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STATUS OF MALARIA PROGRAMS IN THE AMERICAS

XXXVIII REPORT

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INTRODUCTION

Advances in knowledge about the biology and ecology of the parasites that produce malaria and the vectors that transmit it, as well as progress in chemotherapy and immunology, have opened the way for action. However, despite great interest in the development of epidemiology services, the applicative exercises of identifying, measuring, ranking, and stratifying the risk factors for becoming ill or dying of malaria, these procedures are still not routine practice.

Fortunately, the decision-making levels have accepted the following basic principles and converted them into resolutions that currently govern the development of control and technical cooperation programs:

a) Malaria is not uniformly distributed at any given time throughout the area (still known as "the originally malarious area") or within a specific geographical area, much less in a given country.

b) The public and private sectors should enlist and maintain the necessary political will to activate investment and intervention plans that will effectively eliminate the factors that contribute to transmission.

c) Environmental management for the control of malaria vectors, improved housing and living conditions for workers in agriculture and the extractive industries (gold, petroleum, wood, precious stones, etc.), and inclusion of the concept of malaria prevention and control in irrigation, settlement, urbanization, water supply, and liquid waste development projects are sine-qua-non conditions for the permanent interruption of malaria transmission.

d) Health should be promoted by means of cooperation and coordination between the different levels of administration in the public and private sectors involved in integrated actions for the prevention and control of malaria and other mosquito-borne diseases.

e) The planning and implementation of effective interventions should be based on epidemiological knowledge of the situation and on the elimination of risks, paving the way for health protection activities.

f) Prevention activities should be carried out by means of the general and specific social services within the local health systems, applying the principles of local programming, and making optimum use of resources and social participation.

Current World Situation

Around 100 countries or administrative units in the world still have malaria transmission (Map 1). The world's total population of 5,061,000,000 inhabitants may be classified, in terms of the malaria situation, as those in which:

a) Malaria never existed or disappeared without "specific" interventions: 1.371 billion (27%)

b) Malaria has been controlled by means of a program that has maintained its results: 1.617 billion (32%)

c) Transmission was reduced or eliminated but has recrudesced: 1.599 billion (32%).

d) The malaria endemic remains virtually unchanged: 474 million (9%), although interventions have been carried out to control it.

Around 85% of the cases reported to WHO by the Member Countries (excluding Africa) are concentrated in nine countries: Afghanistan, Brazil, China, India, Mexico, Philippines, Sri Lanka, Thailand, and Vietnam. Within these countries, moreover, malaria tends to be clearly focalized. The cases registered in 1988 were as follows:

Countries	Cases	Percentage
Afghanistan	379,000	8.0
Brazil	560,000	11.9
China	134,000	2.8
India	1,780,000	38.0
Mexico	116,000	2.5
Philippines	155,000	3.3
Sri Lanka	380,000	8.0
Thailand	344,000	7.3
Vietnam	150,000	3.2
Others	705,000	15.0
TOTAL	4,703,000	100.0

Mortality from malaria is not fully reported to WHO, but there are some indications that, at least in some areas, infant mortality rates in general, and those specifically due to malaria, are falling. However, a study in Gambia (1987) suggests that almost 25% of the mortality in children 1-4 years of age is attributable to malaria; it was concluded that annual mortality from malaria is 6.3 per 1,000 in children under 1 year of age and 10.7 per 1,000 in children aged 1-4.

Africa

North of the Sahara the number of registered cases fell from 1,467 in 1987 to 1,061 in 1988. In the Sub-Sahara there are judged to be between two and seven million cases per year, but an extrapolation of data from surveys on fever and parasitemia suggests that around 100 million clinical cases may occur annually within an infected population of 260 million people. Botswana, Madagascar, Rwanda, Swaziland, and Zambia have occasional epidemics or exacerbations of endemicity as a result of the seasonal torrential rains, which are almost cyclic.

Southeast Asia

In Bangladesh and Bhutan the number of cases in 1988 dropped to 33,000 and 11,000, respectively. In India, the number of laboratory-confirmed cases increased by 7%, to 1.78 million, but there has been a 45% decline in the territories, and it has been possible to slightly reduce the percentage of P. falciparum infections (34% in 1988).

In Maldives the last case of P. falciparum was registered in 1976, and no autochthonous cases have been recorded since 1984. No anophelines were found in an entomologic survey conducted in 1988 on 86 of the islands.

In Nepal the epidemiological and operational stratification of the malarious areas is bearing fruit; it has been possible to reduce the number of cases from 42,000 in 1985 to 24,000 in 1988.

In Sri Lanka the incidence of 35,000 cases in 1982 (1,500 Pf) rose to 676,000 (183,000 Pf) in 1987. In 1988 only 380,000 (94,000 Pf) were registered, but the number of blood samples examined dropped considerably, from 1.95 million to 1.33 million.

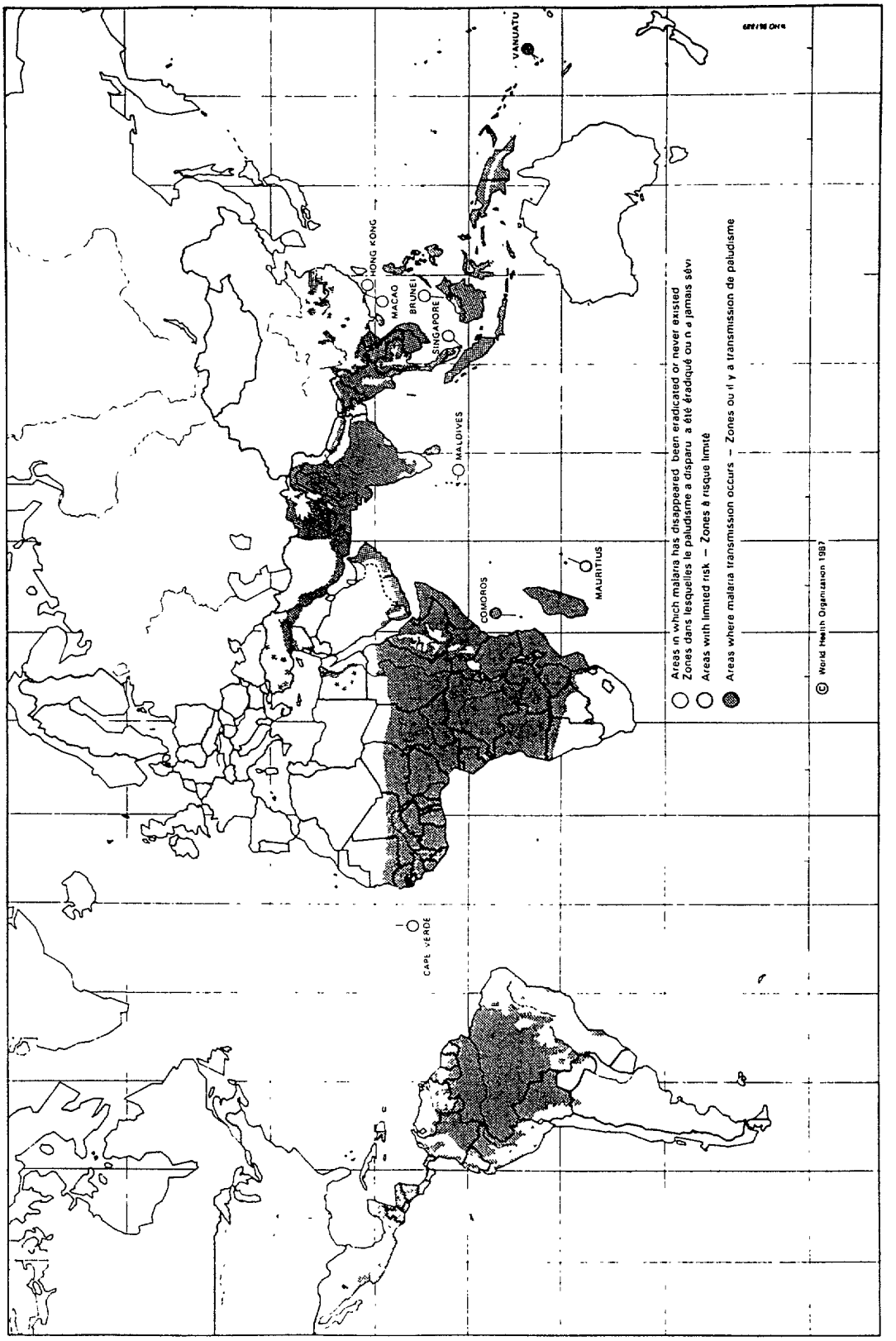
Eastern Asia and Oceania

Malaria is concentrated on the countries listed below, which had the following numbers of cases in 1988:

China	134,000	(Pf 20-30%)
Indonesia	32,000	(Pf 46%)
Philippines	155,000	
Sabah	37,000	
Sarawak	1,000	per year (border)
Solomon Islands	64,000	
Thailand	344,000	(Pf, multiple resistance)

MAP 1

WORLD MALARIA SITUATION



No figures are available for Kampuchea, Laos, Myanmar, Papua New Guinea, Vanuatu, or Vietnam, but it is presumed that the epidemiological situation has not changed significantly.

Europe

Endemic malaria (100% P. vivax is registered particularly in southeastern Turkey as well as elsewhere in this country. The API was reduced from 0.79 per 1,000 population in 1986 to 0.39 in 1987, and apparently it continued to decline in 1988. In the Soviet Union the disease is limited to the Republics of Azerbaijan and Tadjik. In 1987, 338 cases of local transmission were registered. The number of imported cases in Europe continues to increase every year.

The Americas

In 1974, the 21 countries of the Region with active malaria control programs had 269,000 registered cases of this illness, corresponding to an annual parasite incidence of 1.34 per 1,000 population that year. At the end of 1989, 1,099,436 cases of malaria had been confirmed by parasitoscopic examination, for a rate of 2.72 per 1,000 population. The figures for 1989 are shown in Table 1 and Figure 1.

The highest levels of annual parasite incidence were recorded in French Guiana (69.28 cases per 1,000 population), Belize (29.52), and Guyana (20.35). The group of countries at the next lower level comprised Nicaragua (12.28), Honduras (9.22), Guatemala (4.75), and Suriname (4.28).

Brazil (3.92), Haiti (3.64), Bolivia (3.57), and Colombia (3.21) were in third place; at the fourth level were Ecuador (2.22), El Salvador (1.87), Venezuela (through September, 1.61), Peru (1.47), Paraguay (1.26), and Mexico (1.17). In last place were Costa Rica (0.24), the Dominican Republic (0.18), Panama (0.18), and Argentina (0.05) (Table 2).

Brazil accounts for 52.42% of the cases in the Region. Within Brazil, the State of Rondônia has 45% of the cases, and six municipios in that state produce 80% of its cases. Three states alone (Rondônia, Pará, and Maranhao) had four-fifths of Brazil's half million cases. The Amazon River basin, which also encompasses the Andean countries and the Guayanas, accounts for around three-fourths of the malaria in the Western Hemisphere.

P. falciparum infections in the Region have increased significantly, from 19,879 in 1959, or a rate of 0.11 per 1,000 population, to 360,742 in 1989, or a rate of 0.89 per 1,000 population.

Table 1

MALARIOMETRIC RATES OF 21 COUNTRIES OF THE AMERICAS
WITH ACTIVE MALARIA PROGRAMS

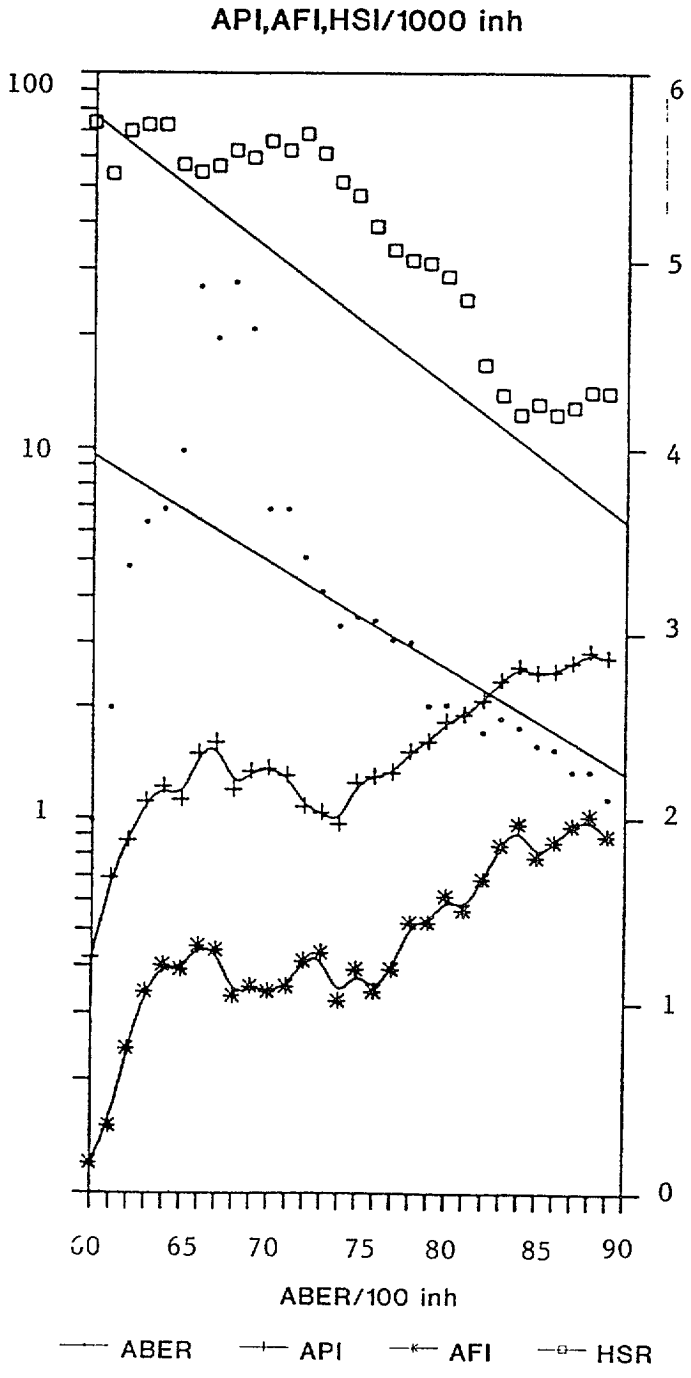
Year	Total population	Blood slides examined						Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	AFI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
1959	183,828	2,531,566	1.38	71,138	0.39	19,879	0.11	13,148,306	71.53
1960	187,910	3,713,353	1.98	79,048	0.42	22,668	0.12	13,726,707	73.05
1961	193,450	5,019,034	2.59	133,161	0.69	28,240	0.15	10,377,938	53.65
1962	199,228	6,703,183	3.36	173,570	0.87	47,909	0.24	13,897,489	69.76
1963	205,312	7,388,147	3.60	225,731	1.10	68,785	0.34	14,901,921	72.58
1964	210,805	7,737,428	3.67	255,130	1.21	85,362	0.40	15,214,265	72.17
1965	216,852	8,635,009	3.98	243,259	1.12	84,161	0.39	12,255,286	56.51
1966	222,574	10,813,817	4.86	332,599	1.49	101,965	0.46	12,037,910	54.08
1967	228,707	10,464,355	4.58	366,346	1.60	101,216	0.44	12,836,614	56.13
1968	235,012	11,473,186	4.88	280,063	1.19	78,373	0.33	14,503,758	61.71
1969	241,596	11,178,193	4.63	320,383	1.33	84,851	0.35	14,260,457	59.03
1970	250,421	9,184,108	3.67	339,825	1.36	86,066	0.34	16,354,814	65.31
1971	257,555	9,449,291	3.67	335,290	1.30	90,027	0.35	15,942,166	61.90
1972	264,718	9,036,489	3.41	284,180	1.07	109,762	0.41	18,095,931	68.36
1973	271,710	8,778,033	3.23	280,044	1.03	116,180	0.43	16,523,538	60.81
1974	279,466	8,500,069	3.04	268,700	0.96	89,411	0.32	14,220,717	50.89
1975	286,403	8,863,987	3.09	356,196	1.24	110,961	0.39	13,428,977	46.89
1976	293,737	9,005,812	3.07	378,651	1.29	101,260	0.34	11,415,514	38.86
1977	301,816	8,929,851	2.96	398,290	1.32	116,238	0.39	10,151,758	33.64
1978	309,522	9,143,761	2.95	468,038	1.51	160,478	0.52	9,813,592	31.71
1979	318,373	8,280,680	2.60	514,110	1.61	166,581	0.52	9,905,425	31.11
1980	328,805	8,576,170	2.61	599,959	1.82	201,260	0.61	9,406,537	28.61
1981	335,343	8,622,478	2.57	635,877	1.90	188,658	0.56	8,275,938	24.68
1982	343,640	8,453,319	2.46	713,878	2.08	235,017	0.68	5,679,929	16.53
1983	353,302	8,969,388	2.54	829,546	2.35	295,253	0.84	4,886,234	13.83
1984	361,070	9,006,858	2.49	929,891	2.58	345,622	0.96	4,417,500	12.23
1985	367,965	8,781,416	2.39	909,162	2.47	285,318	0.78	4,808,740	13.07
1986	379,269	8,992,837	2.37	948,906	2.50	325,437	0.86	4,636,776	12.23
1987	386,239	8,675,128	2.25	1,017,294	2.63	370,811	0.96	4,940,182	12.79
1988	394,720	8,890,281	2.25	1,117,990	2.83	398,601	1.01	5,568,710	14.11
1989	404,267	8,495,307	2.10	1,099,436	2.72	373,199	0.92	5,484,654	13.57

a) Population according to United Nations, Demographic Year Book, in thousands of inhabitants.
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants
h) Number of house sprayings during the year, regardless of cycles and insecticides.
i) HSR = House spraying rate, per 1000 inhabitants.

Sep/19/90 (hs)

FIGURE 1

MALARIOMETRIC RATES IN 21 COUNTRIES, 1960-1989



Malaria Status PAHO/WHO
(FJLA-HS)

Table 2

MALRIOMETRIC RATES, BY GEOGRAPHICAL REGIONS a)

Countries (by geographical sub-regions)	Total population 1989 a)	ABER					API					HSR				
		1985	1986	1987	1988	1989	1985	1986	1987	1988	1989	1985	1986	1987	1988	1989
MEXICO	86,737	1.47	1.53	1.54	1.67	1.71	1.70	1.62	1.24	1.40	1.17	3.52	7.56	11.17	14.68	18.25
CENTRAL AMERICA																
Belize	178	13.07	12.49	13.02	12.88	11.13	17.50	16.64	25.02	21.16	29.52	143.34	218.28	172.49	156.11	137.42
Costa Rica	2,941	4.62	4.27	3.71	3.72	3.69	0.28	0.30	0.32	0.35	0.24	6.78	6.59	4.62	6.53	6.69
El Salvador	5,135	4.15	3.19	4.07	4.25	3.72	9.18	4.18	2.60	1.81	1.87	16.00	8.33	18.42	15.43	15.12
Guatemala	8.935	5.55	5.53	6.06	4.76	3.71	6.90	5.20	6.84	6.06	4.75	62.13	15.82	20.77	26.69	29.18
Honduras	4,982	9.38	9.11	8.30	8.73	7.85	7.73	6.45	4.08	6.16	9.22	32.15	46.79	33.84	30.79	27.02
Nicaragua	3,745	12.99	15.08	12.80	13.53	13.98	4.63	6.00	4.86	9.12	12.28	13.87	22.87	26.72	14.98	28.16
Panama	2,370	16.87	17.44	17.74	17.41	14.28	0.06	0.48	0.53	0.43	0.18	18.71	18.14	12.77	7.91	8.17
CARIBBEAN AREA																
Haiti b)	6,381	4.35	3.89	3.47	0.64	1.00	3.20	2.13	1.97	1.96	3.64	34.38	28.78	37.07	...	32.37
Dominican Rep.	7,018	6.44	6.70	5.83	5.24	4.18	0.13	0.21	0.18	0.16	0.18	...	...	...	7.96	1.96
BRAZIL	147,399	2.55	2.43	2.15	2.34	2.29	2.96	3.20	3.60	3.87	3.92	16.53	15.82	15.04	18.19	15.82
GUIANAS																
French Guiana	90	8.33	7.66	35.77	29.71	39.99	8.64	11.65	25.83	36.23	69.82	...	...	...	...	755.56
Guyana	1,023	5.58	8.73	16.71	18.00	14.04	8.27	16.88	34.52	35.26	20.35	5.22	7.39	10.79	7.92	...
Suriname	398	15.39	13.41	7.61	8.56	5.87	4.42	3.46	5.30	6.86	4.28	21.23	12.61	0.00	1.86	0.44
ANDEAN AREA																
Bolivia	7,113	1.33	1.56	1.72	1.52	1.59	2.23	3.21	3.70	3.22	3.57	8.74	16.79	12.57	12.92	14.01
Colombia	31,210	1.17	1.63	1.45	1.67	1.79	1.95	3.04	3.01	3.30	3.21	9.82	12.36	9.59	7.47	6.85
Ecuador	10,490	3.95	2.86	3.30	3.27	1.38	7.35	5.33	6.40	5.25	2.22	42.76	5.93	6.81	22.96	13.76
Peru	21,790	1.08	0.91	0.73	0.59	...	1.78	1.82	1.89	1.52	1.47	10.22	10.72	9.75	6.95	...
Venezuela c)	19,245	1.59	1.63	1.70	1.85	1.31	0.83	0.81	0.98	2.44	1.61	14.86	14.48	19.69	17.53	12.44
SOUTHERN CONE																
Argentina	31,930	0.08	0.08	0.07	0.06	0.07	0.03	0.06	0.05	0.02	0.05	0.18	0.53	0.49	0.48	0.26
Paraguay	4,157	4.00	2.72	2.49	1.91	2.15	1.39	1.14	0.95	0.71	1.26	17.05	12.35	10.36	9.70	13.29

Aug/27/90 (hs)

ABER = Annual Blood Examination Rate, per 100 inhabitants.
API = Annual Parasite Incidence, per 1000 inhabitants.
HSR = House Spraying Ratem per 1000 inhabitants.

a) Based on the total population of the country, in thousands of inhabitants.

I. CURRENT STATUS OF THE CONTROL PROGRAMS

1. General Information

The programs for malaria prevention and control in the Americas detected and diagnosed approximately 1,101,468 cases in 1989 (Table I.3). Of these, 65.19% were infections; 32.34%, Plasmodium falciparum; and 0.47%, other plasmodia species. Information by species is not available for 2.0% of the cases.

The total number of cases suggests a stabilization of the epidemiological trend observed in the last decade. The year 1989 ended with an annual morbidity rate of 386.30 cases per 100,000 population in the malarious area of the Hemisphere (Table I.4). The apparent improvement in the malaria situation does not have a clear explanation, except possibly the considerable reduction in case detection activities in Ecuador, Panama, and Suriname due to labor, social, and political problems. Table I.5 shows the number of cases by country from 1986 to 1989.

The inversion in the parasite formula might be considered a good sign, corroborating a certain reduction in the flow of susceptible persons to the Amazon area. It might also be an indication of greater social stability among migrants to that region.

In the subregion of Central America, Panama, and Belize, three of the seven countries had a mild improvement in annual parasite incidence (Costa Rica, Guatemala, and Panama), while the other four saw a slight deterioration.

In the seven countries with active transmission in Central America, 1,904,483 blood samples were examined and 148,373 cases were diagnosed. Of the slides examined, 24.83% were obtained through active case-detection (472,874) and 75.17% in passive detection (1,431,609). Examination of the slides obtained through active case-detection only revealed 4,934 cases, or 3.33% of all cases registered. The fact that 96.67% of the cases are detected in passive case-detection suggests that there is better integration of the general health services with those of malaria control in that subregion (see Table I.6).

The estimated population for the Region in 1989 was 715,739,000. Of this total, 285,130,000 live in areas originally considered malarious (39,86%) (Tables I.7 and I.8). The distribution by areas of the Hemisphere is shown in Table I.9.

In the 21 countries that maintain active control programs, the situation has been stabilized, as can be seen in Table I.10, which shows the parasite formula based on the figures reported by each country.

Except for the Island of Hispaniola, where P. falciparum predominates, the countries that have more infections due to this species than P. vivax are ones in which mineral resources are being exploited in a disordered fashion or there are social or political conflicts in jungle areas. Since coverage of traditional vector control activities (household spraying with residual insecticides) has declined in 10 of the 19 countries for which information was received, an absurd direct relationship could be inferred between reduced house spraying rates (HSR) and a smaller proportion of P. falciparum infections. This might be explained by the existence in such countries of an operational stratification in which available resources were concentrated in areas where the prevalence of P. falciparum infections is greatest. However, this does not appear to be the case in French Guiana, where the HSR increased from 29.7 in 1988 to 39.9 in 1989, while 61% of the parasite formula was P. falciparum. This would lead to the possible conclusion that other interventions have been more effective in the proportional reduction of P. falciparum in the parasite formula. However, the use of residual insecticides in the Region has increased, as it can be seen in Table I.11, while the number of sprayings has remained the same (Tables I.12 and I.13).

Apparently there is a threshold in the development process of new living spaces that needs to be raised in order to maintain effective control over malaria transmission. The elements that go to make up this threshold differ as widely as the various ecosystems or elements in the social structures that are part of the system. The threshold is probably determined by level of education, social stability, degree of development of the local health services, and, to a lesser extent, general economic indicators.

The emphasis of malaria control programs on responding to the demand for case detection, diagnosis, and treatment has diminished their potential capacity and priority role in advising the medical care services on correct clinical management of suspected cases at the different levels in the general health services. In addition, they have failed to take responsibility for guiding intersectoral activities in the social areas and for developing economic infrastructure, both of which are fundamental if the countries are to prevent epidemics or the reestablishment of malaria as an endemic disease.

However, the numbers of personnel involved in evaluation are greater than those involved in specific measures to control the vector (Table I.14), which also adds to budgetary expenditures and undermines cost-effectiveness as long as the traditional strategy is insisted upon (Table I.15).

The action strategy that included, for example, active case-finding, parasitoscopic diagnosis, treatment in presence, and epidemiological case surveys was designed to confirm that eradication has been attained and is still used by some of the specialized malaria control programs. This was based on the assumption that malaria could be

made to disappear by emphasizing the interruption of transmission through the vector-parasite relationship, modifying the behavior and dynamics of the human population, and insisting on the elimination of parasitic reservoirs through treatment, without taking into account the indirect risk factors and their influence on every social and ecological situation.

As a result, the national malaria control programs have had little success in the timely detection and treatment of cases or in the detection and prediction of malaria epidemics. This is primarily due to the slow process of taking, diagnosing, recording, and collecting regional data and then consolidating the information in subregional or national centers. This process, which can take weeks or even months, does not favor early detection of an incipient epidemic or the timely application of essential corrective measures. The general health services are usually better prepared to conduct such detection and to ensure that control strategies designed to fit the local situation are effective. On the other hand, there is already knowledge about a number of variables and elements that are indicative of interactions it's which give rise to epidemics, which means that it is possible to design a basic strategy capable of being adapted to changes in the system.

Within the notion of stratification of the malaria problem, it is possible to see the benefits of using some basic control strategies. However, the concept of stratification is difficult to introduce, given that managers of health actions would rather have standardized procedures to implement than general principles for a basic strategy that needs to be adapted to local situations.

In the conception of this strategy it is necessary to define: (a) the determining characteristics of local malaria, primarily those susceptible to control interventions, and (b) indicators for following the relative prevalence of the factors that determine local transmission.

Malaria in Forest or Jungle Areas

In general, the population at risk of contracting malaria is of two types: stable and unstable. The first, when involved in regular agricultural production, is subject to low-incidence P. vivax infection. This malaria is usually controllable by household spraying with residual insecticides, unless the dwellings are seasonal in nature.

The unstable population, engaged in agriculture at the edge of the forest and or in the extraction of natural products inside the jungle, is susceptible to P. falciparum infection. In this group, spraying with insecticides is useless because of the exophylic nature of the vectors, which are protected by the moisture and shade of the forest. Traditionally, the control strategy in this situation has been mass chemotherapy. However, this is more difficult in border areas where illegal commercial activity and/or political insurrection hamper the population's access to health services. In these cases, the most

rational approach to prevention and control is to educate the social groups involved to use self-protection measures such as mosquito nets impregnated with insecticides and environmental or personal repellents, reinforcing the effectiveness of the antimalarial drugs.

Drug consumption by country (Tables I.16 and I.17) does not show any substantial increase, although this might be the result of sectorial distribution of chemotherapy, which would suggest that specific control programs still play a curative role.

For the selection of adequate control measures, it is necessary to quantify the different risk factors for becoming ill or dying from malaria and to determine the different interactions between them. Only then will it be possible to define the intervention mechanisms that can be implemented at the local level and which are capable of modifying them.

If the Region's malaria situation is viewed from the perspective of implementation of the primary health care strategy, it can be said that all the countries are in a position to reorient their programs so that they can carry out the following functions:

a) Develop and maintain an adequate core of experts to advise the public and private sectors in the social area (education and health, for example), on economic infrastructure for study of the malaria problem, and on the planning and implementation of projects leading to malaria control.

b) Design, lead, and direct the training of general health services personnel in malaria detection, clinical treatment, and follow-up, as well as in the surveillance of parasite susceptibility to the antimalarial drugs, and also support the development of effective information systems that will favor decision-making and the implementation of malaria control actions at the local level.

c) Promote the education of communities in appropriate management of the fever, as well as the use of elements for personal protection against the vectors and for protection and sanitary development of the environment.

2. Country Information

The situation by geographical subregion is shown in Maps I.1, 2, 3, and 4 and the respective tables. The table that appears with Map I.1 includes the countries that do not have any evidence of malaria transmission. Of these, Canada, Cuba, and the United States are under constant threat of reestablishment of transmission in view of the growing number of imported cases, diagnosed, and treated in the absence of epidemiological surveillance systems. As a result, epidemics could occur.

MALARIOMETRIC RATES - ARGENTINA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	20,476	21,868	0.11	1,094	0.05	-	1,094	-	0.00	0.05	57,995	2.83
1960	20,611	96,629	0.47	2,039	0.10	7	2,032	-	0.00	0.10	173,008	8.39
	20,930	137,859	0.66	4,541	0.22	4	4,537	-	0.00	0.22	152,725	7.30
	21,245	152,151	0.72	4,708	0.22	-	4,705	3	0.00	0.22	136,994	6.45
	21,558	157,410	0.73	845	0.04	-	843	2	0.00	0.04	101,369	4.70
	21,868	181,722	0.83	554	0.03	-	554	-	0.00	0.03	84,402	3.86
1965	22,179	182,881	0.82	254	0.01	-	249	5	0.00	0.01	78,664	3.55
	22,488	211,281	0.94	411	0.02	-	410	1	0.00	0.02	117,704	5.23
	22,800	259,335	1.14	1,620	0.07	1	1,618	1	0.00	0.07	142,013	6.23
	23,113	240,859	1.04	579	0.03	-	579	-	0.00	0.03	138,248	5.98
	23,428	159,178	0.68	247	0.01	-	247	-	0.00	0.01	101,738	4.34
1970	23,748	95,410	0.40	86	0.00	-	86	-	0.00	0.00	50,000	2.11
	24,068	99,695	0.41	518	0.02	-	517	1	0.00	0.02	7,368	0.31
	24,392	99,806	0.41	359	0.01	-	359	-	0.00	0.01	36,048	1.48
	24,820	92,241	0.37	805	0.03	-	805	-	0.00	0.03	-	0.00
	25,620	71,168	0.28	171	0.01	-	171	-	0.00	0.01	35,156	1.37
1975	26,050	52,015	0.20	100	0.00	-	100	-	0.00	0.00	27,105	1.04
	26,480	47,610	0.18	70	0.00	1	69	-	0.00	0.00	18,951	0.72
	26,910	46,841	0.17	463	0.02	-	463	-	0.00	0.02	18,330	0.68
	27,350	39,922	0.15	325	0.01	-	325	-	0.00	0.01	17,918	0.66
	27,789	48,945	0.18	936	0.03	1	935	-	0.00	0.03	15,440	0.56
1980	28,237	35,501	0.13	341	0.01	-	341	-	0.00	0.01	11,960	0.42
	28,694	31,431	0.11	323	0.01	-	323	-	0.00	0.01	9,005	0.31
	29,157	27,803	0.10	567	0.02	1	566	-	0.00	0.02	11,393	0.39
	29,625	27,020	0.09	535	0.02	1	534	-	0.00	0.02	8,057	0.27
	30,094	24,943	0.08	437	0.01	-	436	1	0.00	0.01	6,199	0.21
1985	30,331	23,611	0.08	774	0.03	3	770	1	0.00	0.03	5,374	0.18
	30,737	26,345	0.09	2,000	0.07	1	1,999	-	0.00	0.07	16,381	0.53
	31,138	20,419	0.07	1,521	0.05	-	1,521	-	0.00	0.07	15,312	0.49
	31,536	20,028	0.06	666	0.02	-	664	2	0.00	0.03	15,262	0.48
1989	31,930	21,080	0.07	1,620	0.05	-	1,620	-	0.00	0.08	8,165	0.26

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
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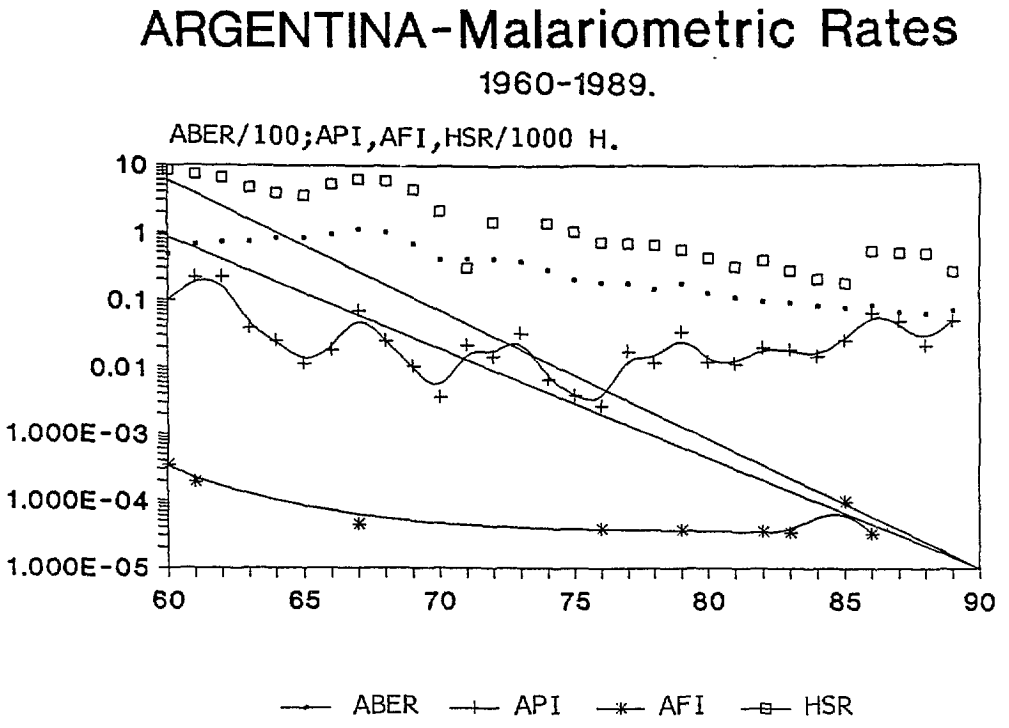

STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Malaria in Argentina continues to be restricted to the northern region along the border with Bolivia. The registration of 1,620 cases (all P. vivax) indicates an increase over the 666 cases reported in 1988. However, the number of slides examined (21,080) in 1988 was almost the same as the figure for 1989 (21,080). The HSR declined from 0.48 in 1988 to 0.26 in 1989.

Malaria Control in International Border Areas

The intercountry cooperation agreements with Bolivia and Paraguay have been strengthened through the ongoing exchange of information, resources, and training activities.

MALARIOMETRIC RATES - BELIZE

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	88	11,307	12.85	1,019	11.58	712	211	96	8.09	2.40	22,526	255.98
1960	91	13,307	14.62	196	2.15	55	138	3	0.60	1.52	31,008	340.75
	93	12,355	13.28	23	0.25	1	22	-	0.01	0.24	31,410	337.74
	95	14,556	15.32	20	0.21	-	20	-	0.00	0.21	32,566	342.80
	99	13,085	13.22	17	0.17	-	17	-	0.00	0.17	-	0.00
	103	11,826	11.48	35	0.34	-	35	-	0.00	0.34	-	0.00
1965	107	10,787	10.08	206	1.93	188	18	-	1.76	0.17	-	0.00
	111	13,920	12.54	552	4.97	260	292	-	2.34	2.63	-	0.00
	115	14,773	12.85	375	3.26	170	205	-	1.48	1.78	15,820	137.57
	116	12,271	10.58	39	0.34	1	38	-	0.01	0.33	16,095	138.75
	120	12,194	10.16	28	0.23	-	28	-	0.00	0.23	19,593	163.28
1970	120	15,522	12.94	33	0.28	-	33	-	0.00	0.28	19,215	160.13
	124	15,703	12.66	33	0.27	3	30	-	0.02	0.24	20,132	162.35
	128	19,835	15.50	86	0.67	-	86	-	0.00	0.67	22,298	174.20
	132	24,414	18.50	99	0.75	-	99	-	0.00	0.75	23,080	174.85
	136	23,100	16.99	96	0.71	-	96	-	0.00	0.71	15,890	116.84
1975	140	19,116	13.65	90	0.64	-	90	-	0.00	0.64	12,379	88.42
	140	23,513	16.80	199	1.42	-	199	-	0.00	1.42	11,752	83.94
	140	39,151	27.97	894	6.39	-	894	-	0.00	6.39	13,300	95.00
	140	30,818	22.01	1,218	8.70	2	1,216	-	0.01	8.69	17,768	126.91
	142	20,952	14.75	1,391	9.80	13	1,378	-	0.09	9.70	11,399	80.27
1980	145	23,925	16.50	1,529	10.54	34	1,495	-	0.23	10.31	16,835	116.10
	149	46,460	31.18	2,041	13.70	41	2,000	-	0.28	13.42	13,353	89.62
	152	31,945	21.02	3,868	25.45	191	3,677	-	1.26	24.19	15,954	104.96
	156	31,889	20.44	4,595	29.46	634	3,961	-	4.06	25.39	8,046	51.58
	159	31,146	19.59	4,117	25.89	521	3,596	-	3.28	22.62	28,228	177.53
1985	163	20,905	12.83	2,800	17.18	97	2,703	-	0.60	16.58	22,935	140.71
	167	20,859	12.49	2,779	16.64	136	2,643	-	0.81	15.83	36,452	218.28
*	170	22,139	13.02	3,258	19.16	243	3,004	6	1.43	17.67	29,324	172.49
	174	22,403	12.88	2,725	15.66	95	2,617	13	0.55	15.04	27,163	156.11
1989	178	19,806	11.13	3,285	18.46	95	2,617	13	0.53	14.70	27,163	152.60

a) Estimated population, in thousands of inhabitants. (hs)
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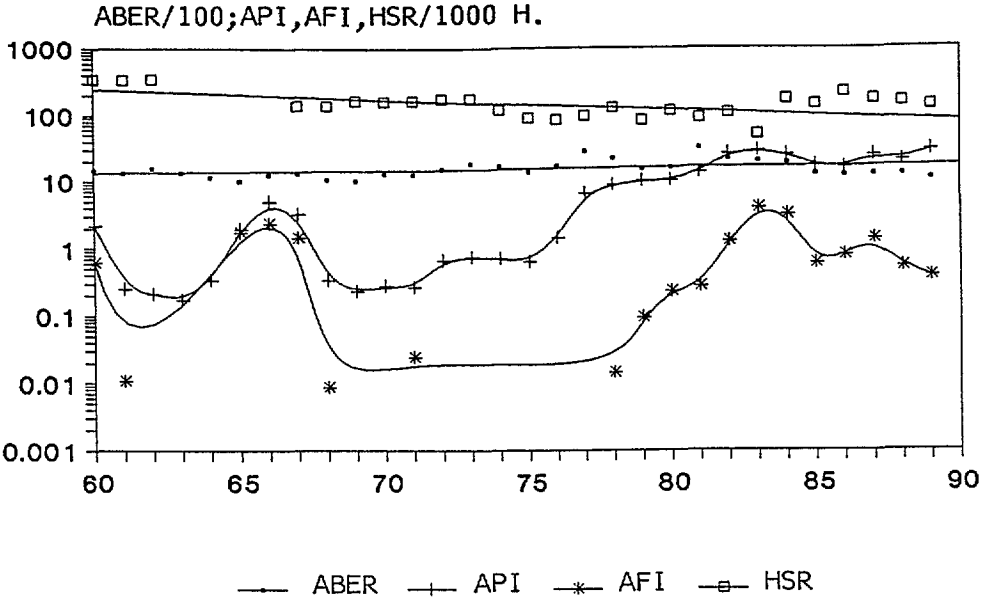
BELIZE Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Belize reported 3,285 cases of malaria in 1989, 97.7% of them P. vivax infections. For the exposed population in the malarious areas only, the API has been 18.46 per 1,000 population.

Transmission has been concentrated in the Cayo District on the Guatemalan border, with 40% of the cases, and the Toledo District, with 21% of the cases.

Malaria transmission in Belize is linked to the migration of seasonal workers from Guatemala, El Salvador, and Honduras to harvest bananas and citric fruit.

Despite the fact that in the areas along the Guatemalan and Mexican borders spraying has been applied in households and at the breeding sites near the dwellings for a complete cycle period, followed by spraying at sites that repeatedly tested positive, the HSR was reduced to 137.42 houses sprayed per 1,000 population.

Detection and treatment activities have been carried out to a great extent by voluntary collaborators and the general health services, which diagnosed 20.7% of the 12,907 samples as positive. Active case-finding was responsible for diagnosing only 8.8% of the 6,899 samples examined.

MALARIOMETRIC RATES - BOLIVIA

Year	Total population	Blood slides examined								Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	3,616	83,762	2.32	1,970	0.54	243	1,419	308	0.07	0.39	286,827	79.32
1960	3,825	87,775	2.29	893	0.23	143	621	129	0.04	0.16	301,995	78.95
	3,920	153,008	3.90	796	0.20	58	725	13	0.01	0.18	262,670	67.01
	4,019	177,528	4.42	1,110	0.28	378	721	11	0.09	0.18	188,193	46.83
	4,121	173,019	4.20	2,345	0.57	910	1,435	-	0.22	0.35	67,510	16.38
	4,226	155,540	3.68	3,454	0.82	497	2,955	2	0.12	0.70	59,669	14.12
1965	4,334	270,754	6.25	941	0.22	138	801	2	0.03	0.18	40,991	9.46
	4,446	260,145	5.85	1,373	0.31	214	1,159	-	0.05	0.26	53,591	12.05
	4,561	214,537	4.70	1,442	0.32	200	1,242	-	0.04	0.27	54,987	12.06
	4,680	187,635	4.01	1,998	0.43	472	1,526	-	0.10	0.33	53,214	11.37
	4,770	185,299	3.88	4,425	0.93	891	3,534	-	0.19	0.74	29,035	6.09
1970	4,931	167,265	3.39	6,862	1.39	651	6,211	-	0.13	1.26	17,797	3.61
	5,063	158,786	3.14	8,080	1.60	699	7,381	-	0.14	1.46	58,251	11.51
	5,195	132,750	2.56	4,275	0.82	364	3,911	-	0.07	0.75	77,492	14.92
	5,331	118,417	2.22	7,696	1.44	640	7,056	-	0.12	1.32	84,406	15.83
	5,470	114,805	2.10	4,936	0.90	349	4,586	1	0.06	0.84	86,477	15.81
1975	4,890	133,605	2.73	6,615	1.35	711	5,903	1	0.15	1.21	19,867	4.06
	5,030	124,101	2.47	6,714	1.33	1,383	5,331	-	0.27	1.06	52,055	10.35
	5,150	118,002	2.29	10,106	1.96	1,211	8,895	-	0.24	1.73	75,191	14.60
	5,300	124,082	2.34	10,897	2.06	1,042	9,855	-	0.20	1.86	88,449	16.69
	5,450	110,235	2.02	14,873	2.73	710	14,163	-	0.13	2.60	98,409	18.06
1980	5,600	143,648	2.57	16,619	2.97	432	16,187	-	0.08	2.89	122,018	21.79
	5,755	176,235	3.06	9,774	1.70	496	9,278	-	0.09	1.61	154,572	26.86
	5,916	166,124	2.81	6,699	1.13	885	5,814	-	0.15	0.98	122,384	20.69
	6,080	151,187	2.49	14,441	2.38	1,713	12,728	-	0.28	2.09	89,551	14.73
	6,249	99,003	1.58	16,338	2.61	1,218	15,120	-	0.19	2.42	56,145	8.98
1985	6,428	85,378	1.33	14,354	2.23	890	13,454	-	0.14	2.09	56,205	8.74
	6,547	101,878	1.56	20,993	3.21	1,674	19,319	9	0.26	2.95	109,926	16.79
	6,730	115,512	1.72	24,891	3.70	1,512	23,379	-	0.22	3.47	84,588	12.57
	6,918	104,888	1.52	22,258	3.22	1,494	20,764	-	0.22	3.00	89,348	12.92
1989	7,113	112,770	1.59	25,367	3.57	1,363	24,004	-	0.19	3.37	99,640	14.01

a) Estimated population, in thousands of inhabitants. (hs)
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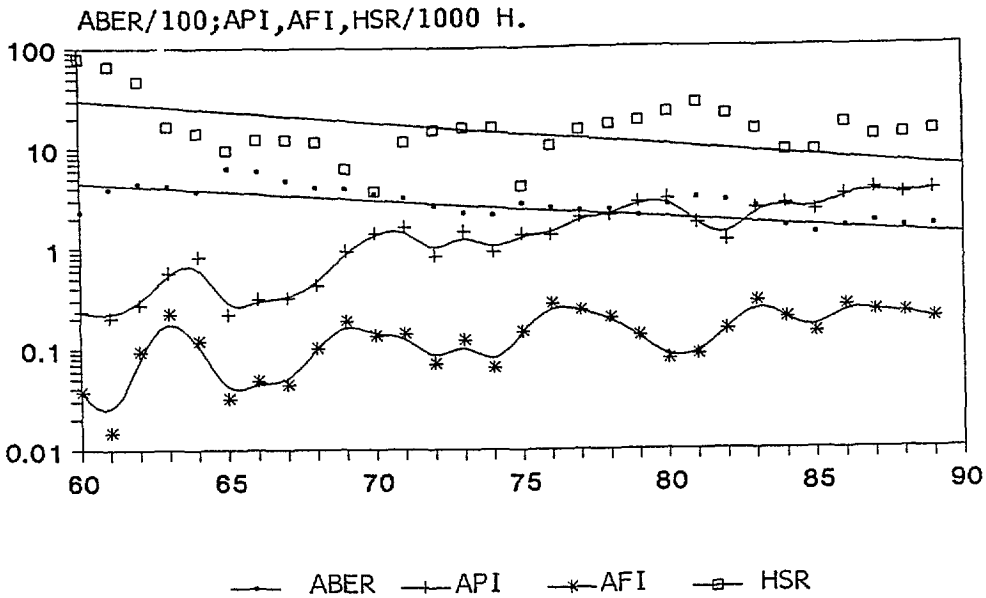
BOLIVIA-Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Malaria in Bolivia showed a slight increase in 1989. The API rose from 3.22 in 1988 to 3.57 in 1989. The departments of Tarija, Pando, Chuquisaca, and Beni (Guayamerín and Riberalta) had the highest APIs, with 21.6, 20.5, 11.8, and 10.5, respectively. A total of 112,770 blood samples were taken, or 7% more than during the previous year. The PSI was 22.5% and the ABER was 4.4, both slightly higher than in the previous year.

In passive case-finding the health services took 16,712 samples, or 14.8% of the total, with a positivity of 42.9%. The voluntary collaborators took 25,000 samples, or 22.2% of the total, with a positivity of 41%. In active case-finding, 71,058 samples were taken, or 63% of the total, with a positivity of barely 11.4%. Since active case-finding is more expensive and less effective, there needs to be better integration of the health services and greater community participation in prevention and control activities.

Causes Contributing to the Persistence of Malaria

The causal factors in the high rate of malaria transmission in northern Bolivia (Beni and Pando) are:

- Influx of miners from Brazil since 1982, as well as mining population coming from gold areas in La Paz Department and the interior of the country.

- P. falciparum, which predominates in the northern region, causes 28.3% of all malaria cases reported in Pando Department. In Beni it represents 34.3% of the cases. P. falciparum is apparently resistant to the 4-aminoquinelines and to Fansidar in Pando Department and in Vaca Diez Province, Beni.

- The principal vector is An. darlingi ; to date no resistance to the insecticides has been observed. Although household spraying is done every four months in the region, this measure is not sufficient to change the situation in the precarious mining settlements. Occasionally there is also peridomiciliary spraying.

The factors that may be facilitating the transmission of malaria in the departments of Chuquisaca and Tarija are related to:

- Migration of the rural population in search of jobs on rice plantations and in other agricultural activities. This is an internal migration toward northern Argentina.

- P. vivax is the only parasite in the region. These two departments reported 12,403 cases in 1989, comprising 51.7% of the total number of reported cases caused by this species.

- The principal vector, Anopheles pseudopunctipennis, continues to be susceptible to the insecticides. However, the spraying cycles are periodically interrupted.

In general, throughout the country health services coverage comes down to the demand. The average number of person/year medical visits provided by the Ministry of Health was 0.4 in urban areas and 0.06 in rural areas. Social Security provides 1.8 medical visits per person/year. Of the Ministry of Health's 10,967 employees, 8,119 (74%) are located in urban areas and only 2,848 (26%) in rural areas. On the other hand, the creation of "Popular Health Committees," an outgrowth of community participation, has resulted in extended coverage in terms of vaccinations as well as the control of diarrhea and acute respiratory infections, and it has also made significant contributions to malaria control in some areas.

Household spraying activities have not changed since the 1960's. Coverage is static; the HSR is 13.49, and two annual DDT cycles are performed.

The health services collaborate only through case-finding, i.e. the passive taking of slides from fever patients, and the rate of this passive surveillance ranges between 0.6 and 9.3 annually. On the other hand, active surveillance conducted by the malaria control program is only of 28% in the areas of Chuquisaca and Tarija, which generate more than 50% of the P. vivax cases.

Malaria Control in International Border Areas

During 1989 three border meetings were held. The first was with Peru, in the city of Cobija, Pando Department (Bolivia). Information on the malaria situation in the border area of Madre de Dios-Peru, Pando-Bolivia, and Acre-Brazil was reviewed and evaluated. In biweekly meetings with Brazil, in the city of Guayamerín (Bolivia) and Guajaramirim (Brazil), professional and technical personnel are discussing adjustments to the surveillance programs. And with Argentina, in the city of Tarija (Bolivia), a meeting was held on the subjects of Chagas' disease, vector control, and malaria with a view to analyzing progress in the agreement between the two countries on programming and operational and technical cooperation.

Decentralization

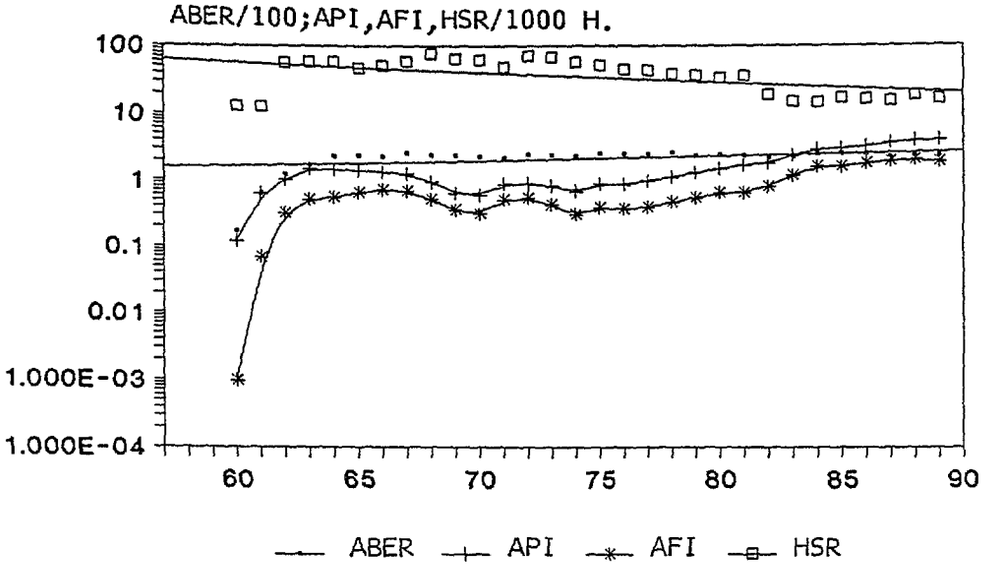
The process of integrating malaria control into the health infrastructure is still in the phase of physical integration at the central level. Hierarchically, it comes under the responsibility of the National Bureau of Epidemiology. So far, functional integration with the health services has not occurred, and political decision and critical and institutional analysis are still needed.

MALARIOMETRIC RATES - BRAZIL

Year	Total population	Blood slides examined							Sprayings			
		Number	ABER	Positive	API	P.falc. & Assoc.	Other P.vivax species		AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	67,711											
1960	69,720	114,622	0.16	8,297	0.12	66	8,230	1	0.00	0.00	873,746	12.53
	71,868	438,707	0.61	44,188	0.61	4,883	39,300	5	0.07	0.55	881,920	12.27
	74,096	884,434	1.19	72,060	0.97	22,910	49,142	8	0.31	0.66	4,081,914	55.09
	76,526	1,245,674	1.63	111,417	1.46	37,929	73,388	100	0.50	0.96	4,419,463	57.75
	78,730	1,775,864	2.26	111,278	1.41	42,041	69,180	57	0.53	0.88	4,481,579	56.92
1965	81,006	1,874,955	2.31	110,306	1.36	51,273	58,925	108	0.63	0.73	3,757,685	46.39
	82,930	1,854,939	2.24	108,630	1.31	57,728	50,654	248	0.70	0.61	4,222,505	50.92
	85,240	2,151,470	2.52	102,842	1.21	57,266	45,348	228	0.67	0.53	5,006,241	58.73
	87,620	2,081,679	2.38	81,324	0.93	44,289	36,799	236	0.51	0.42	6,584,083	75.14
	90,070	2,139,885	2.38	56,951	0.63	31,346	25,454	151	0.35	0.28	5,725,743	63.57
1970	92,520	2,030,459	2.19	54,644	0.59	28,557	25,935	152	0.31	0.28	5,642,025	60.98
	95,170	2,012,625	2.11	80,293	0.84	46,605	33,597	91	0.49	0.35	4,462,581	46.89
	97,850	2,291,682	2.34	85,325	0.87	51,420	33,845	60	0.53	0.35	6,826,559	69.77
	99,920	2,329,563	2.33	79,161	0.79	42,002	37,107	52	0.42	0.37	6,724,621	67.30
	102,400	2,271,691	2.22	66,481	0.65	29,997	36,393	91	0.29	0.36	5,761,532	56.26
1975	104,940	2,617,755	2.49	88,630	0.84	39,572	49,020	38	0.38	0.47	5,282,378	50.34
	107,540	2,600,871	2.42	89,765	0.83	38,397	51,331	37	0.36	0.48	4,648,871	43.23
	110,210	2,638,765	2.39	104,436	0.95	42,027	62,381	28	0.38	0.57	4,643,422	42.13
	112,920	2,825,890	2.50	121,577	1.08	51,568	69,983	26	0.46	0.62	4,191,780	37.12
	115,740	2,691,966	2.33	147,630	1.28	60,916	86,693	21	0.53	0.75	4,180,295	36.12
1980	121,270	2,838,643	2.34	176,237	1.45	75,920	100,302	15	0.63	0.83	4,016,014	33.12
	124,020	2,839,488	2.29	205,544	1.66	77,779	119,431	2	0.63	0.96	4,382,444	35.34
	126,806	2,672,904	2.11	221,939	1.75	98,999	122,934	6	0.78	0.97	2,334,628	18.41
	129,660	2,881,660	2.22	297,687	2.30	147,504	150,169	14	1.14	1.16	1,900,883	14.66
	132,590	3,277,492	2.47	378,257	2.85	206,414	171,836	7	1.56	1.30	1,888,740	14.24
1985	135,563	3,452,943	2.55	401,304	2.96	214,193	187,706	5	1.58	1.38	2,241,251	16.53
	138,502	3,363,962	2.43	443,627	3.20	243,761	199,857	9	1.76	1.44	2,190,413	15.82
	141,459	3,034,540	2.15	508,864	3.60	270,458	238,403	3	1.91	1.69	2,127,939	15.04
	144,427	3,373,283	2.34	559,535	3.87	287,786	271,784	1	1.99	1.88	2,626,667	18.19
1989	147,399	3,368,564	2.29	577,520	3.92	275,674	301,841	5	1.87	2.05	2,332,347	15.82

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fiels examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

BRAZIL- Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Brazil occupies a vast geographical area reaching from 3° N to 34° S longitude and from 35° to 74° W latitude. Its surface covers 8,511,965 km^2, of which 6,889,045 km^2 were originally classified as malarious, and of these, more than 5 million km^2 are within the Amazon region. This area has a great diversity of geoecological environments.

The country's estimated population was 150,087,503 in 1989, of which 65,239,021 (44.5%) are considered to live in originally malarious areas. Of this latter group, 42,449,555, or 65.1%, live in areas where malaria transmission has been interrupted. The rest of the 22,789,466 malarious-area inhabitants (34.9%) live in places where transmission continues.

A total of 577,520 cases of malaria were registered in 1989, of which 271,268 were caused by P. falciparum, 301,841 by P. vivax, and 5% by P. malariae. These cases made for an API of 3.78 per 1,000 population, calculated on the basis of the entire national population. If the API had been calculated on the basis of the population at risk in the malarious areas, the figure for 1989 would have been 15.54. In 1989 the parasite formula reversed in favor P. vivax, whereas P. falciparum had prevailed from 1984 to 1988.

Of the three macroregions into which the country can be divided, the one with the highest rate of transmission is the Amazon region, which in turn is divided into nine states or territories: Acre, Amapá, Amazonas, Maranhao, Mato Grosso, Pará, Rondônia, Roraima, and Tocantins (formerly the northern part of Goiás). This region is a humid tropical jungle area, with abundant rains, high temperatures, and altitudes generally near sea level. The states of the Amazon region are responsible for 97% of the malaria cases. The principal vector species is Anopheles darlingi, but recently malaria parasites have been isolated in other anopheline species. In the northern coastal region of the country, An. aquasalis has also been indicated as a vector.

The three states responsible for the highest rates of malaria transmission in the Amazon region in 1989 were Rondônia (45%), Pará (21%), and Mato Grosso (11%).

The increase of malaria in Roraima is due to the introduction of approximately 50,000 garimpeiros (miners) in malarious areas in the territory of the Yanomami Indians. The increase in the state of Amazonas is due in part to a resurgence of transmission in the city of Manaus and the surrounding municipios. The increase in the states of Mato Grosso and Amapá is also due to mining and the uncontrolled influx of garimpeiros.

In 1989 Paraná was among the states with the highest rates of transmission, owing to an epidemic outbreak on the outskirts of the city of Foz de Iguaçú. This outbreak extended to the neighboring cities of Puerto Stroessner (Paraguay) and Iguazú (Argentina). The main cause of the outbreak was an increase in An. darlingi in the area and the arrival of persons infected with malaria who had migrated from states in the Amazon region.

The rest of the country can be divided into two regions, in which there is little malaria transmission. The northeast includes the states of Alagoas, Bahia, Ceará, Paraíba, Pernambuco, Piauí, Rio Grande do Norte, and Sergipe. This is arid or semiarid land on the northeast coast. It is also characterized by high temperatures and long periods of drought.

The southern region of the country comprises the states of Espírito Santo, Goiás, Mato Grosso do Sul, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, Sao Paulo, and the Federal District. This is the most developed region of the country and its climate is temperate. In some localized areas there have been outbreaks such as the one that occurred in Foz de Iguaçú, Paraná, in early 1989.

Causes of Malaria Transmission

The states responsible for most of the malaria cases, particularly in the Amazon region, attribute the increased number to the existence in those areas of two "great frontiers."

The first frontier is mining, with the presence of the garimpeiros, who enter remote areas of the Amazon region in search of gold, cassiterite, and other minerals. Most of the garimpeiros live in precarious conditions, under makeshift roofs and without walls. The predominant form of malaria in these settlements, or garimpos, is P. falciparum, as it is in Caldeirao, Jirau, Penha, and Sovaco da Velha--all in the state of Rondônia. Control activities in these areas are quite limited. Because of the difficult access, they are carried out primarily with small airplanes. The cost of living in these localities is very high. However, despite the access problems, the migration spreads out over vast areas, since the garimpeiros are continuously moving from one place to another. These people live in open garimpos, over which there is no government control. In the closed garimpos, such as the Serra Pelada in Pará, there is government control, and for this reason malaria has never been a serious problem.

Mining disrupts the ecological balance. It tends to destroy the jungle, since large land areas get cleared and small watercourses are shifted or dammed up with earthworks. The heavy rainfall in the region contributes to the formation and maintenance of breeding sites and helps to spread them over time. The use of mercury to separate the gold has polluted the rivers, to the extent that the fish are now contaminated and cannot be eaten. Direct mercury poisoning of the garimpeiros is also a serious problem.

The second frontier that adds to malaria transmission in the Amazon region is agriculture, which predominates in the states of Acre and Ronônia. Here tenant farmers settle on lands that are often inaccessible during the rainy season, and they spend most of their time during the first years clearing their lots and planting subsistence crops. They spend little time and effort on the construction of houses, living instead in shelters with only partial walls or none at all.

The state which unquestionably had the most problems was Rondônia; it is responsible for more than 41% of all the cases in the country. The annual parasite incidence (API) per 1,000 population in the 22 municipios of Rondônia during the last five years is shown in Table Brazil-1. The instability of the annual parasite incidence can be noted in the different municipios of Rondonia over the last five years, which is primarily attributable to the high degree of mobility among the region's inhabitants and to the continuous flow of people from one place to another.

Although Pará has an API of 22.6, one of the lowest in the Amazon region, this state is a classic example of the need to incorporate risk-based stratification into malaria control activities. In this state there are municipios with an API of almost 700 per 1,000 population and

BRAZIL - 1

MALARIOMETRIC INCIDENCE IN THE MUNICIPALITIES OF RONDONIA's STATE, BRAZIL

Annual Parasite Incidence (API) p/1.000 h.

Municipality	1985	1986	1987	1988	1989
Ariquemis	435,73	379,01	542,87	617,0	463,2
Porto Velho	125,52	109,21	122,93	176,6	123,3
Jaru	282,56	164,18	184,60	192,4	156,1
Ouro Preto	102,00	48,45	63,33	106,4	101,8
Machadinho	-	-	-	256,6	553,2
Ji-Paraná	131,09	120,56	98,76	110,0	88,29
Costa Marques	242,38	585,05	650,88	483,9	236,5
Sao Miguel	-	-	-	-	-
Rolim de Moura	104,59	118,37	119,46	92,03	73,17
Vila Nova	-	-	-	-	-
Alvorada D'Oeste	-	-	292,04	364,8	219,3
Pimenta Bueno	46,93	51,15	51,49	44,85	46,05
Guajara Mirim	141,02	122,70	88,12	141,1	49,54
Cerejeiras	100,68	137,65	96,29	85,98	62,58
Nova Brasilandia	-	-	-	200,6	106,6
Cacoal	66,21	51,23	40,43	38,82	23,44
Colorado D'Oeste	30,49	34,44	22,41	19,22	32,59
Vilhena	25,37	103,24	79,33	78,67	42,56
Alta Floresta	-	-	44,35	122,4	54,88
Presidente Medice	464,43	152,91	90,38	63,03	32,74
Espigao D'Oeste	63,41	24,57	23,63	19,83	23,64
Santa Luzia	-	-	9,22	44,75	26,85

others that have as many as 26,747 cases in the year. At the same time, there are four municipios in the state in which no malaria transmission has been recorded.

The migration of tenant farmers and miners is also believed to contribute to the occurrence and resurgence of malaria in other regions of the country where transmission had been interrupted.

In some cases, urban transmission still is a serious problem in the Amazon region. In some places, such as Porto Velho, the capital of Rondônia, it has been possible to reduce the rate of urban transmission. On the other hand, in the city of Manaus, where urban transmission had been interrupted in 1974, it became reestablished with the expansion of the city. An example of the rate of urban transmission in the region of Manaus is shown in Table Brazil-2, where it is clear that transmission in the municipios of Manaus and its environs is responsible for almost 50% of the cases in the entire state.

Epidemic outbreaks, such as the one that occurred in the region of Foz de Iguaçú, Paraná, are attributable to the gradual increase in the An. darlingi vector populations over the years. Transmission had not been noted in the area until 1986. During this same period the total number of imported cases came to more than 2,000. One of the concerns is that the movement of workers in November, December, and January--months that climatically favor malaria transmission--may exacerbate the malaria problem in the state of Paraná.

BRAZIL-2

REGISTERED NUMBER OF CASES IN MANAUS AND NEIGHBORING MUNICIPALITIES DISTRIBUTION BY MUNICIPALITY

Municipality	Blood Slides Examined	Blood Slides Positive	Plasmodium falciparum	Plasmodium vivax
Manaus	27,541	8,724	2,014	6,710
Autazes	5,656	2,821	1,431	1,390
Manacaparu	4,046	1,568	107	1,461
Careiro	3,255	1,119	306	813
Iranduba	2,926	1,330	109	1,221
Novo Airao	1,072	534	117	417
Presidente Figuereido	828	142	22	120
O t h e r Municipalities	116,455	18,631	6,013	12,618
Total country	161,779	34,869	10,119	24,750

Malaria Control in International Border Areas

Brazil has borders with ten countries, the majority of them in malarious regions. Many of the border areas are unprotected, since they are inhabited by indigenous tribes that cross back and forth unrestrictedly between the two countries. An example of this, as it relates to the malaria problem, is the area of northern Roraima where garimpos have been established. This land is a Yanomami Indian reservation. Garimpeiros, as well as the indigenous population, have been traveling from Venezuela to Brazil and vice versa without any restrictions whatsoever.

On the border between the state of Mato Grosso do Sul and Paraguay there has continued to be residual transmission in some of the communities of Amambay Indians, who live on both sides of the border, and active foci occasionally appear.

In the focus around Foz de Iguaçú in western Paraná, household spraying was conducted in a six-kilometer area starting at Lake Itaipu, although complete coverage was not achieved. Elimination of the problem in the region of Foz de Iguaçú is feasible but will depend on coordination with the social sectors involved, since there is transmission on both sides of the lake and it is an area in which social regulation is needed.

There are several international agreements that govern common activities in border areas. These are:

1. The Southern Cone Pact

The countries that initially formed this pact are Argentina, Chile, Paraguay, and Uruguay, and in recent years Bolivia and Brazil have joined as well. Malaria is endemic only in Paraguay, Bolivia, Brazil, and a small area of northern Argentina. At the last meeting, held in 1988, it was agreed to continue carrying out joint programs to address mutual problems, including malaria. At other technical meetings it has been recommended that exchange activities be stepped up in the areas of human resources, research, epidemiological surveillance, documentation, and the acquisition and provision of supplies, materials, and equipment, with a view to attaining effective and lasting control of such diseases as malaria.

2. Amazonian Cooperation Treaty

At the First Meeting of Presidents of the countries of the Amazon region, held in Manaus in 1989, the authorities made a commitment to develop the Amazon region; to safeguard the environment and its cultural, economic, and ecological heritage; and to protect the health of the Amazonian populations. Several meetings have been held within this framework to update the diagnosis of the border situation in priority areas, antimalaria activities being one of them. There has also been

discussion of the organization and operation of the health system, with emphasis on activities involving prevention and control, research, and manpower development. There have been similar meetings with the rest of the Amazon countries.

Decentralization

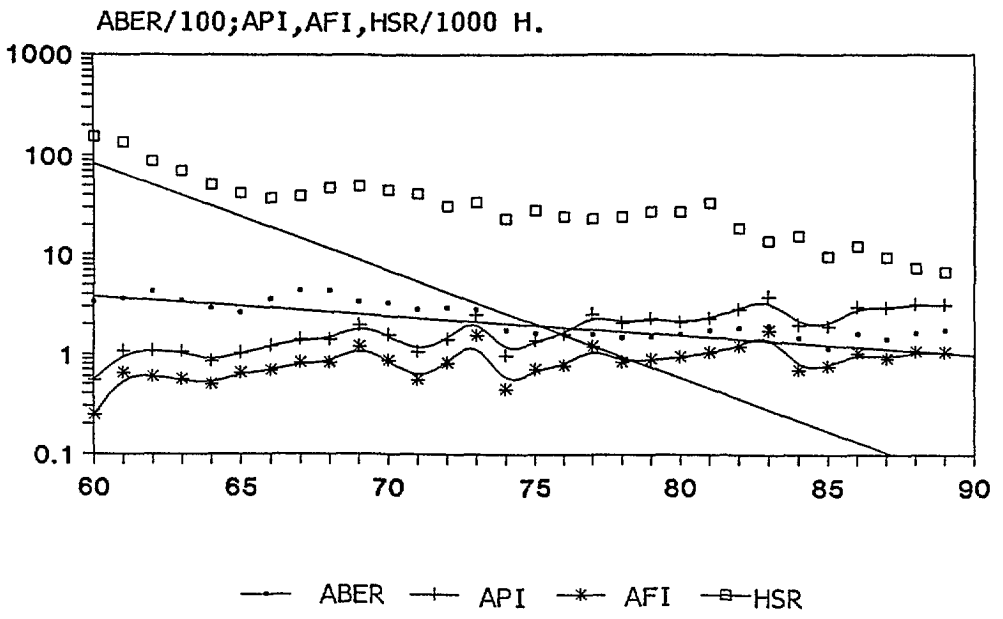
Efforts to decentralize the health system have taken forms, depending on the capacity of the different states and municipios to absorb the activities. In the states where the health systems are more developed, many of the activities have already been transferred, while in a number of others (most of the malarious states) the transition has been slower. Decentralization will be stressed, and will be nearer completion in 1990, thanks to establishment of the National Health Foundation, which is charged with integrating control activities into the health services.

MALARIOMETRIC RATES - COLOMBIA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	14,938	329,288	2.20	4,172	0.28	1,195	2,942	35	0.08	0.20	2,357,627	157.83
1960	15,416	509,920	3.31	8,426	0.55	3,758	4,642	26	0.24	0.30	2,358,989	153.02
	15,908	570,160	3.58	16,974	1.07	10,235	6,694	45	0.64	0.42	2,127,057	133.71
	16,417	697,245	4.25	17,497	1.07	9,718	7,745	34	0.59	0.47	1,431,774	87.21
	16,941	577,406	3.41	17,898	1.06	9,375	8,499	24	0.55	0.50	1,163,280	68.67
	17,485	499,523	2.86	14,729	0.84	8,648	6,058	23	0.49	0.35	871,294	49.83
1965	17,996	470,708	2.62	18,277	1.02	11,593	6,668	16	0.64	0.37	744,002	41.34
	18,468	655,897	3.55	22,135	1.20	12,512	9,610	13	0.68	0.52	677,228	36.67
	18,956	827,511	4.37	26,633	1.40	15,626	10,944	63	0.82	0.58	741,895	39.14
	19,462	858,857	4.41	27,333	1.40	15,964	11,344	25	0.82	0.58	916,892	47.11
	19,984	676,866	3.39	39,435	1.97	24,092	15,326	17	1.21	0.77	980,578	49.07
1970	20,527	685,412	3.34	32,272	1.57	17,975	14,280	17	0.88	0.70	922,943	44.96
	21,088	604,773	2.87	22,402	1.06	11,722	10,675	5	0.56	0.51	873,910	41.44
	21,668	646,399	2.98	30,997	1.43	17,709	13,282	6	0.82	0.61	671,412	30.99
	22,343	631,563	2.83	56,494	2.53	34,635	21,855	4	1.55	0.98	754,124	33.75
	22,981	404,120	1.76	22,406	0.97	10,275	12,127	4	0.45	0.53	533,332	23.21
1975	23,644	385,691	1.63	32,690	1.38	16,880	16,880	10	0.71	0.71	663,863	28.08
	24,333	386,897	1.59	39,022	1.60	18,827	20,185	10	0.77	0.83	589,367	24.22
	25,048	401,621	1.60	63,888	2.55	30,344	33,496	48	1.21	1.34	573,765	22.91
	25,645	381,978	1.49	53,412	2.08	21,741	31,600	71	0.85	1.23	618,052	24.10
	26,360	401,005	1.52	60,957	2.31	23,621	37,267	69	0.90	1.41	714,348	27.10
1980	27,093	436,275	1.61	57,346	2.12	25,658	31,663	25	0.95	1.17	738,538	27.26
	26,360	463,864	1.76	60,972	2.31	27,909	33,047	16	1.06	1.25	872,088	33.08
	27,190	505,220	1.86	78,601	2.89	32,916	45,650	35	1.21	1.68	506,585	18.63
	27,515	535,962	1.95	105,360	3.83	47,957	57,362	41	1.74	2.08	380,043	13.81
	27,515	407,627	1.48	55,268	2.01	19,411	35,776	81	0.71	1.30	429,845	15.62
1985	28,625	334,062	1.17	55,791	1.95	21,921	34,291	86	0.77	1.20	280,988	9.82
	29,325	477,503	1.63	89,251	3.04	30,526	58,612	113	1.04	2.00	362,410	12.36
	29,943	434,646	1.45	90,014	3.01	27,749	62,250	15	0.93	2.08	287,152	9.59
	30,566	510,526	1.67	100,850	3.30	33,106	67,689	55	1.08	2.21	228,323	7.47
1989	31,210	557,129	1.79	100,286	3.21	33,540	66,691	55	1.07	2.14	213,854	6.85

a) Estimatated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

COLOMBIA - Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

In Colombia, a total of 100,286 malaria cases were registered during 1989, or slightly less than the 100,860 detected in 1988. The highest rate of transmission was in the attack-phase area, which had 96.4% of the cases and 95.4% of the localities with transmission. In terms of API, this area has been divided into three risk levels, as follows:

* Municipios with between 0.5 and 10.0 API, considered to be at medium risk;

* Municipios with over 10.0 API, classified as being at high risk.

* Municipios with less than 0.5 API, considered to be at low risk.

The map in Chapter V (Figure V.7) shows a primary stratification of the areas according to malaria risk level. It is intended to review risk levels during 1990 in order to better adapt them to the stratification process.

Six regions in Colombia have been identified as having the highest rates of transmission (Table V.4).

The 72,650 malaria cases in these six regions represent 72.4% of the total recorded in the entire country during 1989. These cases were detected in 91 municipios of the regions, among which 31 municipios were responsible for 57,414, or 79.0%, of the cases in the regions, and 57.4% of the total for the entire country.

Characteristics of the Six Regions with Persistent Malaria Transmission

The Middle Magdalena includes part of the municipios of Santander, Norte de Santander, Boyacá, Antioquia, El Cesar, and Bolivar. The region corresponds to the Caribbean plain, a subregion, and the Momposina depression, which includes the lower and part of the middle Magdalena River and its tributaries. It has an area 17,312 km^2, and the population for 1989 was estimated at 373,157. It is a floodplain with several marshes, where rice-growing, livestock-raising, and oil-prospecting are the main economic activities. An. darlingi and An. albimanus are the two principal vectors.

The El Sarare region is distingushed by its three major rivers: the Arauca, the Meta, and the Cinaruco--all tributaries of the Orinoco. Part of this territory borders on Venezuela. Average annual precipitation is estimated at 1,258 mm. The area is 4,582 km^2, and the 1989 population was estimated at 91,678 inhabitants. The most important municipio in this region is Arauca, where economic activity centers around livestock-raising. An. albimanus is the principal vector.

The El Catatumbo region includes only a small part of the department of Norte de Santander, where the Catatumbo River is located. Other important rivers are the Zulia, Sardinata, Táchira, Intermedio, and Pamplonita, whose waters are part of the Lake Maracaibo basin. The average annual temperature is 27.8°C and precipitation is 763 mm per year. The area is 2,775 km^2, and the population for 1989 was estimated at 82,047 inhabitants. The principal economic activity is oil-prospecting, although there is also cultivation of coffee, sugarcane, tobacco, cacao, and plantain, as well as livestock-raising. The principal vector is An. nuñeztovari.

The Uraba region corresponds to the lower Cauca and comprises the departments of Antioquia, Chocó, and Córdoba. El Chocó has both Atlantic and Pacific coasts, while Antioquia and Córdoba are on the Caribbean. The Region's average annual precipitation is 1,475 mm and its average annual temperature is 27.5°C. The main rivers are the San Juan, Atrato, Cauca, and Magdalena. The area is 24,033 km^2, and the 1989 population was estimated at 377,314 inhabitants. The economy is based on mining, lumbering, and agriculture--particularly such crops as sugarcane, coffee, rice, cacao, and tobacco. The three main malaria vectors have been identified as An. darlingi, An. nuñeztovari and An. nuñeztovari.

The Amazon region includes part of Putumayo Intendancy, El Caquetá Department, and the commissaries of El Amazonas, El Vaupés, and El Guainía, extending from the Guaviare to the Amazon and from the Cordillera Oriental to Brazil. Its area is 200,063 km^2, and it has an estimated population of 477,245, equivalent to 2.38 inhabitants (1989) per square kilometer. Average annual temperature is 29°C and average annual precipitation is 3,250 mm. There are several rivers and lakes, the most prominent being the Amazonas, Putumayo, Caquetá, Guaviare, Vaupés, Meta, and Orinoco rivers and the Zancudo and Guacamayo lakes. The region is undergoing intense settlement. Economic activity is minimal and is based on agriculture, a little livestock-raising, trade, and very limited forestry. The principal vector is An. darlingi, and it is suspected that An. evansae may also be involved in transmission.

The Pacific coast region includes the departments of Chocó, Valle del Cauca, Cauca, and Nariño on the Pacific coast. The region is flat and has a humid climate, with an annual average temperature of 27.0°; rain is continuous, with an annual precipitation of 3,644 mm.

This region has an area 56,894 km^2, and the population is estimated at 763,967, equivalent to 13.4 inhabitants per square kilometer. On the Pacific slope the principal rivers are the Patía, Mira, and Iscuandé, while on the Amazon slope they are the Guamués, Patascoy, and Rumiyaco. The people make their living from fishing, plantain- and rice-growing, lumbering, and mining. An. nuñeztovari has been identified as the principal vector, with An. neivai suspected of being a second transmitter.

Causes Contributing to Malaria Transmission

The causes contributing to malaria transmission in the six regions described above are closely related to the risk factors that are present. These are outlined in general terms in Table V.6.

Decentralization

The health services at the sectional level, including hospitals, health posts, and other medical services, examined 286,530 blood samples, representing 51.4% of the total samples taken by the entire epidemiological assessment system. That number of samples does not include 224,861 that were taken and examined by the Antioquia Health Service (SSSA). Although information on the number of treatments is only available from the SSSA, it is presumed that each patient cared for was given curative treatment.

The information provided by the SSSA shows that 82,364 treatments were administered, using six different methods. The SSSA also reported 16 deaths attributed to malaria. The regulations corresponding to Law 10 of 10 January 1990, which restructures the Ministry of Health, provides for antimalaria actions to be carried out by the health services at the sectional level.

Malaria Control in International Border Areas

a) With Peru: Under the Civilian-Naval Plan of Action, the navies of Colombia and Peru continued to make periodic visits to the border population in villages on the banks of the Putumayo and Amazon rivers.

b) With Ecuador: There is a Health Cooperation Agreement between the Ministries of Health of Colombia and Ecuador for the development of an Malaria Emergency Control Plan for the Border Area. Under this Agreement, a meeting was held in 1989 at Ibarra, Ecuador, to evaluate fulfillment of the Plan of Action which had been drawn up for the purpose of programming activities for that year.

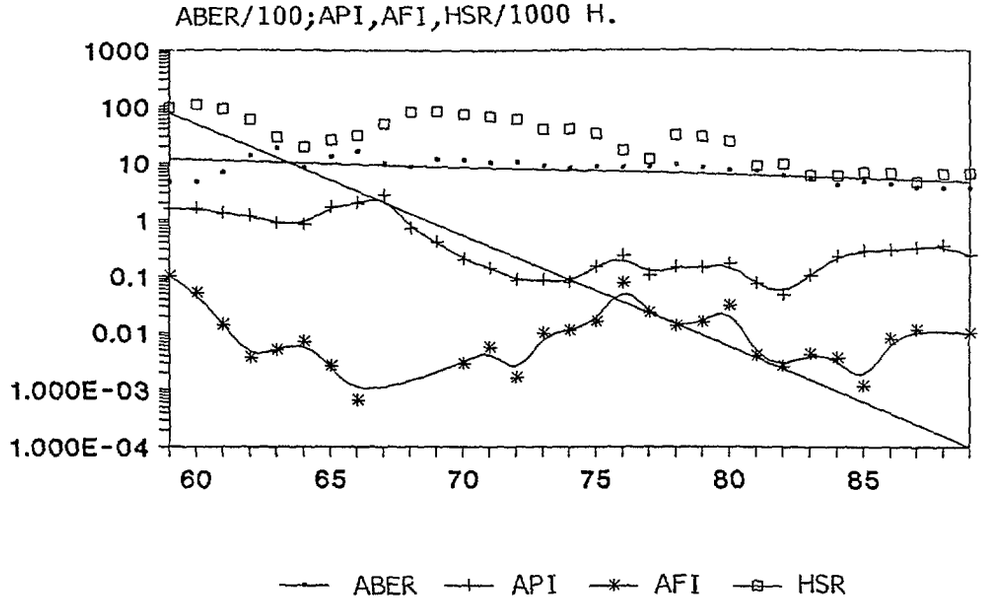
c) With Venezuela: Malaria control program personnel in the border areas met regularly from 1950 to 1983. Beginning that year, although they continued to get together to prepare joint plans of action for the timely application of malaria control measures, the meetings became less regular owing to lack of interest. Since December 1989 there has been renewed interest in this type of meeting, which analyzes the epidemiological status of other endemic diseases as well as malaria.

MALARIOMETRIC RATES - COSTA RICA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	1,200	55,524	4.63	1,899	1.58	121	1,775	3	0.10	1.48	112,162	93.47
1960	1,254	57,603	4.59	2,000	1.59	64	1,936	-	0.05	1.54	131,942	105.22
	1,298	87,889	6.77	1,673	1.29	18	1,655	-	0.01	1.28	115,513	88.99
	1,343	183,642	13.67	1,583	1.18	5	1,577	1	0.00	1.17	78,386	58.37
	1,391	257,850	18.54	1,228	0.88	7	1,221	-	0.01	0.88	39,456	28.37
	1,439	123,285	8.57	1,212	0.84	10	1,202	-	0.01	0.84	28,088	19.52
1965	1,490	197,751	13.27	2,563	1.72	4	2,559	-	0.00	1.72	38,049	25.54
	1,541	250,135	16.23	3,047	1.98	1	3,046	-	0.00	1.98	47,683	30.94
	1,590	164,109	10.32	4,443	2.79	0	4,443	-	0.00	2.79	78,646	49.46
	1,634	142,029	8.69	1,191	0.73	0	1,191	-	0.00	0.73	132,618	81.16
	1,685	202,362	12.01	688	0.41	0	688	-	0.00	0.41	138,241	82.04
1970	1,727	195,484	11.32	350	0.20	5	344	1	0.00	0.20	125,344	72.58
	1,798	185,011	10.29	257	0.14	10	247	-	0.01	0.14	116,907	65.02
	1,843	191,152	10.37	159	0.09	3	156	-	0.00	0.08	110,578	60.00
	1,873	166,355	8.88	161	0.09	18	143	-	0.01	0.08	74,048	39.53
	1,922	154,656	8.05	152	0.08	21	131	-	0.01	0.07	75,629	39.35
1975	1,965	166,814	8.49	290	0.15	31	259	-	0.02	0.13	62,454	31.78
	2,010	171,753	8.54	473	0.24	155	318	-	0.08	0.16	33,194	16.51
	2,070	175,973	8.50	217	0.10	47	170	-	0.02	0.08	24,083	11.63
	2,120	202,284	9.54	307	0.14	28	285	-	0.01	0.13	64,545	30.45
	2,170	176,219	8.12	308	0.14	33	274	-	0.02	0.13	61,800	28.48
1980	2,245	166,894	7.43	376	0.17	69	307	-	0.03	0.14	53,205	23.70
	2,271	162,861	7.17	168	0.07	9	159	-	0.00	0.07	19,868	8.75
	2,324	139,019	5.98	110	0.05	6	104	-	0.00	0.04	21,821	9.39
	2,380	120,116	5.05	245	0.10	10	235	-	0.00	0.10	14,155	5.95
	2,509	103,987	4.14	569	0.23	9	560	-	0.00	0.22	14,994	5.98
1985	2,628	121,456	4.62	734	0.28	3	731	-	0.00	0.28	17,814	6.78
	2,666	113,720	4.27	790	0.30	21	768	-	0.01	0.29	17,559	6.59
	2,791	103,456	3.71	883	0.32	32	851	-	0.01	0.30	12,899	4.62
	2,866	106,611	3.72	1,016	0.35	27	989	-	0.01	0.35	18,725	6.53
1989	2,941	108,614	3.69	699	0.24	31	668	-	0.01	0.23	19,664	6.69

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

Costa Rica- Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

The malaria situation in Costa Rica has responded favorably following the stabilization of migrant and refugee groups in the border areas, where social control measures and decentralization of the health care services have been stepped up.

During 1989, 108,614 blood samples were examined, of which 699 turned out to be positive for P. vivax and 31 for P. falciparum.

Epidemiological analysis indicates that the provinces most affected were Limón, with 322 cases; Alajuela, with 140; and San José Fuera de Area, with 113. Taken together, these positive cases represent 82.2% of the total for the country. They are the result of epidemic outbreaks in the cantons of Talamanca and Central in Limón and Los Chiles and San Carlos in Alajuela. There were also outbreaks in La Cruz, Guanacaste. A total of 185 were classified as having been imported from abroad--177 from Nicaragua, two from Panama and Colombia, and one each from El Salvador, Honduras, Guatemala, and Africa.

By the end of 1989, malaria transmission was successfully under control in 79% of the territory in the consolidation phase, where 701,495 people live. Notwithstanding the dispersion of the cases, for the country as a whole the figures were substantially reduced (30%): the 1,016 cases in 1988 dropped to 699 in 1989. Autochthonous cases also declined by 5% relative to imported ones. Annual parasite incidence declined from 1.3 per 1,000 population to 0.9 per 1,000. These favorable conditions are attributable in large degree to the fact that additional personnel were taken on, a measure thanks to which it was possible to serve areas that were difficult to reach because of their geographical location.

Causes Contributing to Malaria Transmission

As in previous years, most of the malaria foci appeared in places where there are several problems that come together--e.g. resistance of the vector to insecticides, internal migration, an influx of population from neighboring countries for political reasons, and internal displacement of persons without documents. Another contributing factor has been the demand, throughout the year, for resources and services due to the increase and dispersion of malaria cases throughout the national territory, particularly in the Huetar Norte and Huetar Atlántica regions.

Decentralization

The following strategies have been suggested for development of the Program's activities: adaptation of structures from the Malaria Program based on general guidelines from the Ministry of Health and on operational needs and geographical and epidemiological stratification of the different areas. This has made it possible to take optimum advantage of human, financial, and material resources. In addition, the epidemiological surveillance system, aimed at high-risk groups, has been strengthened. This has consisted basically of timely detection and treatment of positive cases and delimitation of epidemic foci. Some of these actions were carried out by incorporating them into the Basic Technical Councils (local health systems). Community participation was also promoted by holding workshops in the different regions, with excellent results. With the support of the PAHO/AID Subregional Project, supplementary activities were stepped up, such as: training, exchange of information, and adaptation of the information systems. Activity also has begun in the area around the border between Nicaragua and Costa Rica under the auspices of the project financed by the governments of Sweden and of Finland.

MALARIOMETRIC RATES - ECUADOR

Year	Total population	Blood slides examined: Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Sprayings: Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	4,330	98,977	2.29	5,887	1.36	2,313	3,571	3	0.53	0.82	440,477	101.73
1960	4,358	119,562	2.74	9,084	2.08	3,158	5,906	20	0.72	1.36	349,331	80.16
	4,501	213,169	4.74	9,733	2.16	1,489	8,243	1	0.33	1.83	806,254	179.13
	4,655	269,004	5.78	5,531	1.19	658	4,868	5	0.14	1.05	856,598	184.02
	4,814	286,453	5.95	3,857	0.80	237	3,599	21	0.05	0.75	773,026	160.58
	4,979	314,700	6.32	4,628	0.93	264	4,363	1	0.05	0.88	720,136	144.63
1965	5,150	340,127	6.60	4,179	0.81	203	3,976	-	0.04	0.77	645,198	125.28
	5,326	311,821	5.85	4,976	0.93	406	4,570	-	0.08	0.86	194,823	36.58
	5,400	289,660	5.36	10,756	1.99	956	9,809	-	0.18	1.82	14,832	2.75
	5,580	350,183	6.28	37,043	6.64	4,196	32,835	12	0.75	5.88	307,305	55.07
	5,770	421,650	7.31	50,957	8.83	4,317	46,634	6	0.75	8.08	680,266	117.90
1970	5,960	360,879	6.06	28,375	4.76	2,828	25,539	8	0.47	4.29	745,376	125.06
	6,170	283,114	4.59	9,171	1.49	909	8,261	1	0.15	1.34	643,967	104.37
	6,380	321,611	5.04	6,707	1.05	727	5,982	-	0.11	0.94	611,398	95.83
	6,600	374,151	5.67	6,810	1.03	1,014	5,796	-	0.15	0.88	464,693	70.41
	6,830	314,685	4.61	5,481	0.80	1,003	4,470	8	0.15	0.65	366,261	53.63
1975	7,060	306,917	4.35	6,555	0.93	1,235	5,319	1	0.17	0.75	409,442	57.99
	7,190	313,053	4.35	10,974	1.53	1,945	9,020	9	0.27	1.25	267,971	37.27
	7,556	307,540	4.07	11,275	1.49	2,612	8,662	1	0.35	1.15	449,096	59.44
	7,570	303,139	4.00	9,815	1.30	2,205	7,609	1	0.29	1.01	416,546	55.03
	7,760	285,597	3.68	8,207	1.06	2,648	5,559	-	0.34	0.72	488,113	62.90
1980	8,354	367,129	4.39	8,748	1.05	2,755	5,993	-	0.33	0.72	222,997	26.69
	8,644	357,855	4.14	12,745	1.47	3,427	9,318	-	0.40	1.08	189,742	21.95
	8,945	384,792	4.30	14,633	1.64	3,126	11,507	-	0.35	1.29	30,206	3.38
	9,250	453,067	4.90	51,606	5.58	16,515	35,091	-	1.79	3.79	100,230	10.84
	9,569	408,465	4.27	78,599	8.21	15,637	62,962	-	1.63	6.58	266,068	27.81
1985	9,378	370,998	3.96	68,989	7.36	11,998	57,061	-	1.28	6.08	401,160	42.78
	9,647	275,865	2.86	51,430	5.33	11,985	39,445	-	1.24	4.09	57,253	5.93
	9,922	327,653	3.30	63,503	6.40	17,849	45,654	-	1.80	4.60	67,571	6.81
	10,203	333,918	3.27	53,607	5.25	13,561	40,046	-	1.33	3.92	234,233	22.96
1989	10,490	144,851	1.38	23,274	2.22	6,569	16,705	-	0.63	1.59	144,346	13.76

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
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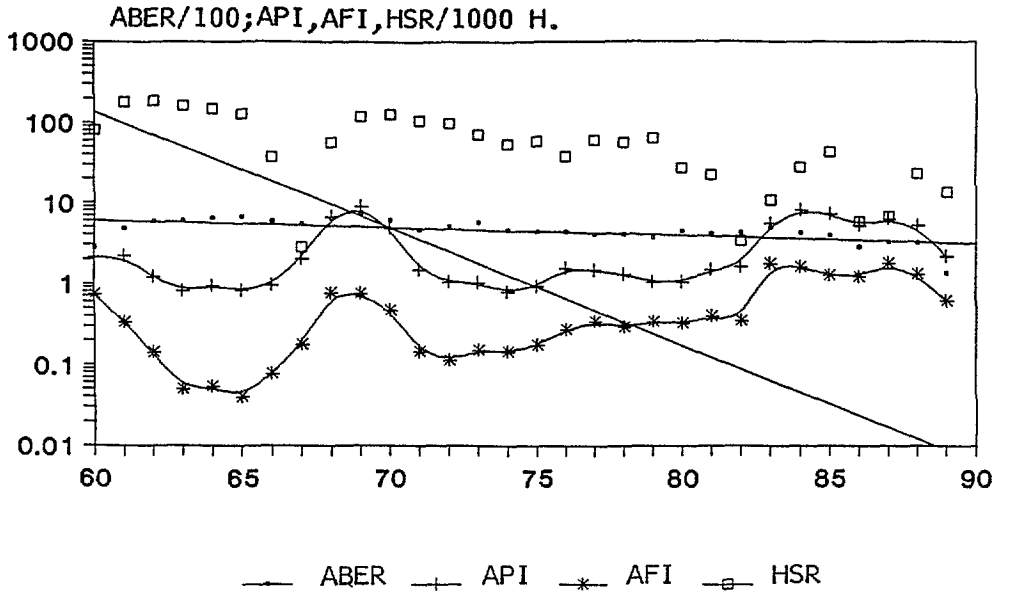

STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In Ecuador, malaria continues to be a public health problem and is one of the principal causes of morbidity. During 1989 a total of 144,851 blood samples were analyzed and 23,274 cases were detected, of which 6,559 were P. falciparum infections (28.4%). The smaller number of cases reflected the reduced number of samples taken because of a strike by program personnel.

The total population estimated for the country in 1989 was 10,490,249 inhabitants, of which 6,082,575 are at risk for becoming ill or dying from malaria, in an area 175,444 km^2.

In 1989, six provinces were identified as having a higher rate of malaria transmission (Table V.12).

The highest annual parasite incidence for 1989 was observed in the new province of Sucumbíos, with 45.5 per 1,000 population, followed by the provinces of Los Ríos, Esmeraldas, and Napo, with 16.9, 12.2, and 11.8, respectively.

Since 1989, the province with the highest rate of malaria transmission has been Sucumbíos, with an incidence of 4,533.0 per 100,000 population, surpassing Esmeraldas, which up until 1988 was reporting 50% of the malaria cases in the country. Next in frequency are Los Ríos Province and Napo Province, with 1,695.6 and 1,184.1 cases per 100,000 population, respectively.

Causes Contributing to Malaria Transmission

These causes are related to the administrative and managerial aspects of the program. The economic crisis has caused financial support to be inopportune, late, and insufficient. Strikes have paralyzed the program for months at a time, resulting in an annual malaria coverage of 40% at most. In 1989 the malaria program was on strike for six months, which means that the decline in incidence is artificial. The budget for 1989 was S/ 1,200 million, equivalent to US$ 1,500,000, and the new collective bargaining agreement for malaria personnel called for an increase of US$ 500,000, as a result of which one-third of the field operations were left without funds.

Circulation of the parasite is concentrated in five provinces which have 84% of all the reported cases in the country. More than 90% of the cases of P. falciparum in Esmeraldas show resistance to chloroquine grade R-I.

Health services coverage in Ecuador is reduced to meeting the demand, except for vaccinations which, because of the different strategies used, have attained more than 80% coverage in the under-5 age group. The group under 1 year of age has no more than 60% coverage. In the case of malaria, household spraying was suspended for lack of DDT.

Malaria Control in International Border Areas

Activities are conducted along the borders with neighboring countries. A Health Cooperation Agreement, described below, was signed between the Ministries of Health of Colombia and Ecuador for the purpose of developing an emergency plan for malaria control in their border areas.

The areas near the Colombia border are considered to be at high risk for vector-borne diseases and infant mortality, with low socioeconomic development, high migration, insufficient basic health resources, and inadequate epidemiological knowledge. This motivated the incorporation of measures to control malaria, yellow fever, dengue, Chagas' disease, and other priority problems in the Region into the local health services, with the objective of reducing morbidity and mortality from malaria and other vector-borne diseases in the provinces of Esmeraldas, Napo, Putumayo, and Nariño. In addition, an Ecuador-Colombia border health plan of action prepared at La Cocha-Nariño with the participation of PAHO/WHO and the Hipólito Unanue Agreement is being carried out.

On the Ecuador-Peru border a preparatory meeting was held in El Oro Province, Ecuador. Bilateral activity has already begun for the control and surveillance of malaria, Aedes aegypti, and plague.

Decentralization

The process of integrating the activities to control malaria and other vector-borne diseases began with passage of the decree calling for a switch from an eradication strategy to one of disease control. The local health services and hospitals are now also responsible for the diagnosis and treatment of malaria cases, and a national commission has been appointed to plan and coordinate malaria control activities with those of the health services.

MALARIOMETRIC RATRICOS - EL SALVADOR

Year	Total population	Blood Muestras de sangre examinadas								Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	Other P.vivax species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g) (h)	(i)	(j)	(k)	(l)
	2,386	71,259	2.99	17,521	7.34	4,051	13,430 -	1.70	5.63	556,360	233.18
1960	2,454	76,287	3.11	10,066	4.10	2,959	7,064 1	1.21	2.88	581,562	236.99
	2,527	127,293	5.04	12,563	4.97	2,960	9,594 4	1.17	3.80	749,266	296.50
	2,627	194,069	7.39	15,433	5.87	2,557	12,873 4	0.97	4.90	389,910	148.42
	2,721	238,791	8.78	17,846	6.56	1,879	15,962 5	0.69	5.87	436,369	160.37
	2,824	350,843	12.42	25,827	9.15	2,661	23,195 1	0.94	8.21	240,295	85.09
1965	2,928	506,442	17.30	34,070	11.64	2,186	31,884 -	0.75	10.89	6,393	2.18
	3,037	530,357	17.46	68,562	22.58	10,703	57,859 -	3.52	19.05	302,112	99.48
	3,151	535,494	16.99	82,960	26.33	7,227	75,734 -	2.29	24.03	372,167	118.11
	3,266	805,311	24.66	35,831	10.97	1,025	34,808 -	0.31	10.66	693,150	212.23
	3,390	858,916	25.34	25,299	7.46	1,994	23,344 -	0.59	6.89	681,157	200.93
1970	3,534	572,373	16.20	45,436	12.86	4,286	41,234 -	1.21	11.67	749,747	212.15
	3,647	414,331	11.36	46,858	12.85	3,235	43,623 1	0.89	11.96	227,668	62.43
	3,668	394,935	10.77	38,335	10.45	3,059	35,276 -	0.83	9.62	720,592	196.45
	3,771	393,110	10.42	35,095	9.31	7,286	27,809 -	1.93	7.37	258,027	68.42
	3,887	478,553	12.31	66,691	17.16	13,133	53,558 -	3.38	13.78	276,703	71.19
1975	4,007	538,909	13.45	83,100	20.74	16,816	66,284 -	4.20	16.54	319,126	79.64
	4,123	533,610	12.94	83,290	20.20	13,820	69,470 -	3.35	16.85	294,620	71.46
	4,250	471,109	11.08	32,243	7.59	2,934	29,300 -	0.69	6.89	302,401	71.15
	4,353	507,237	11.65	56,533	12.99	8,634	47,899 -	1.98	11.00	10,000	2.30
	4,440	434,475	9.79	75,657	17.04	13,391	62,266 -	3.02	14.02	88,092	19.84
1980	4,525	425,264	9.40	95,835	21.18	15,782	80,053 -	3.49	17.69	-	0.00
	4,527	367,447	8.12	93,187	20.58	10,878	82,309 -	2.40	18.18	21,600	4.77
	4,598	351,426	7.64	86,202	18.75	10,263	75,939 -	2.23	16.52	54,000	11.74
	4,668	306,648	6.57	65,377	14.01	9,696	55,681 -	2.08	11.93	-	0.00
	4,738	270,156	5.70	66,874	14.11	11,172	55,292 -	2.36	11.67	65,873	13.90
1985	4,767	201,177	4.22	44,473	9.33	4,373	40,100 -	0.92	8.41	77,497	16.26
	4,840	182,622	3.77	23,953	4.95	2,395	21,558 -	0.49	4.45	47,684	9.85
	4,927	200,654	4.07	12,834	2.60	598	12,236 -	0.12	2.48	90,766	18.42
	5,026	213,518	4.25	9,095	1.81	230	8,975 -	0.05	1.79	77,529	15.43
1989	5,135	190,995	3.72	9,605	1.87	40	9,565 -	0.01	1.86	77,631	15.12

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
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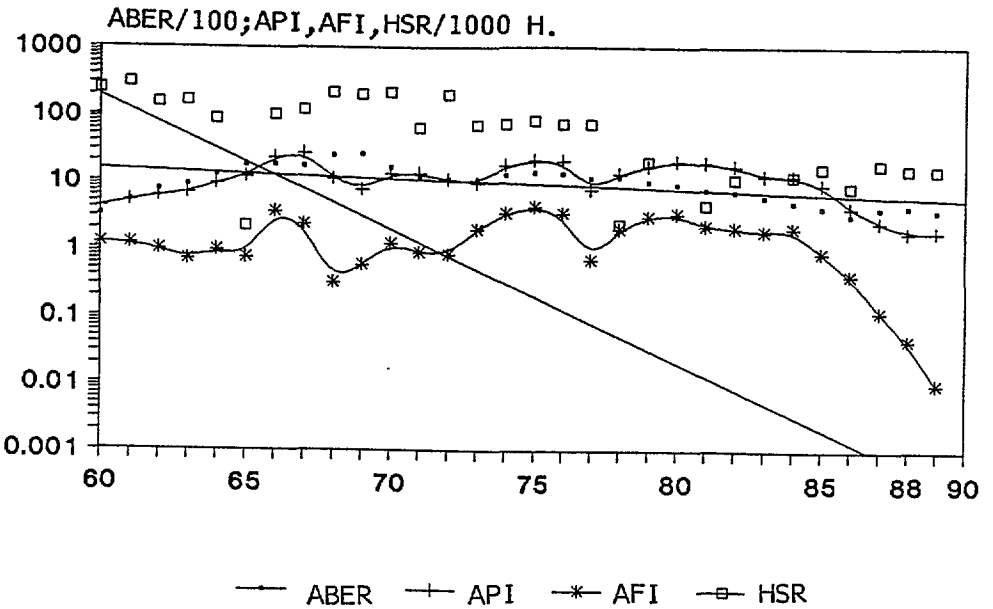
EL SALVADOR- Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In El Salvador, 9,605 cases of malaria were registered in 1989, representing a 5.6% increase over 1988. Of these, 99.6% were from P. vivax. Malaria transmission appears to be scattered throughout the country, since 36% of the localities have reported cases. Still, it can be considered that the epidemiological situation continues to be favorable despite the conflict going on in the country, which grew worse in November and December. During those months, malaria incidence increased slightly over the previous year; 45% of the year's reported cases occurred in the last quarter of 1989. However, cases attributable to P. falciparum continued to decline, as is shown in the table of malariometric rates. Failure to apply insecticides on a timely basis in the third spraying cycle, as well as a shortage of drugs, also contributed to the increase in cases.

During 1989, emphasis was placed on malaria training for health services personnel, and engineering works were completed for the drainage and cleanup of Ticuiziapa Lagoon, located in the coastal area of the country.

MALARIOMETRIC RATES - GUATEMALA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	3,695	108,047	2.92	7,894	2.14	1,548	6,346	-	0.42	1.72	631,998	171.04
1960	3,810	129,742	3.41	3,387	0.89	417	2,969	1	0.11	0.78	697,557	183.09
	3,928	218,628	5.57	4,083	1.04	780	3,298	5	0.20	0.84	756,185	192.51
	4,051	323,373	7.98	5,996	1.48	1,601	4,375	20	0.40	1.08	606,853	149.80
	4,185	348,866	8.34	15,116	3.61	5,557	9,522	37	1.33	2.28	427,022	102.04
	4,305	289,058	6.71	20,401	4.74	5,003	15,358	40	1.16	3.57	411,234	95.52
1965	4,438	380,562	8.58	14,472	3.26	2,313	12,157	2	0.52	2.74	393,924	88.76
	4,565	376,439	8.25	22,045	4.83	3,230	18,812	3	0.71	4.12	278,804	61.07
	4,698	439,186	9.35	19,684	4.19	1,377	18,306	1	0.29	3.90	752,620	160.20
	4,837	492,940	10.19	10,407	2.15	364	10,043	-	0.08	2.08	858,960	177.58
	4,966	521,336	10.50	10,494	2.11	209	10,284	1	0.04	2.07	687,708	138.48
1970	5,270	449,706	8.53	11,044	2.10	83	10,961	-	0.02	2.08	648,392	123.03
	5,420	332,531	6.14	8,280	1.53	34	8,245	1	0.01	1.52	476,143	87.85
	5,580	345,156	6.19	7,750	1.39	4	7,746	-	0.00	1.39	584,258	104.71
	5,740	386,026	6.73	6,182	1.08	3	6,179	-	0.00	1.08	674,310	117.48
	6,050	421,240	6.96	4,030	0.67	25	4,005	-	0.00	0.66	583,575	96.46
1975	6,240	418,749	6.71	4,979	0.80	100	4,879	-	0.02	0.78	518,531	83.10
	6,430	435,097	6.77	9,616	1.50	320	9,296	-	0.05	1.45	557,844	86.76
	6,630	472,297	7.12	34,907	5.27	2,159	32,748	-	0.33	4.94	0	0.00
	6,840	463,794	6.78	59,755	8.74	5,234	54,521	-	0.77	7.97	504,664	73.78
	7,046	440,712	6.25	69,039	9.80	6,631	62,408	-	0.94	8.86	605,403	85.92
1980	6,917	456,784	6.60	62,657	9.06	4,361	58,296	-	0.63	8.43	840,518	121.51
	7,113	475,777	6.69	67,994	9.56	5,718	62,276	-	0.80	8.76	407,716	57.32
	7,315	468,430	6.40	77,375	10.58	7,841	69,534	-	1.07	9.51	805,968	110.18
	7,524	442,745	5.88	64,024	8.51	4,356	59,668	-	0.58	7.93	695,933	92.50
	7,740	526,694	6.80	74,132	9.58	6,535	67,597	-	0.84	8.73	132,682	17.14
1985	7,963	441,757	5.55	54,958	6.90	3,125	51,833	-	0.39	6.51	494,653	62.12
	8,194	473,403	5.78	42,609	5.20	1,425	41,184	-	0.17	5.03	129,627	15.82
	8,433	511,445	6.06	57,662	6.84	2,804	54,858	-	0.33	6.51	175,161	20.77
	8,680	413,216	4.76	52,561	6.06	2,165	50,396	-	0.25	5.81	231,676	26.69
1989	8,935	331,675	3.71	42,453	4.75	1,155	41,298	-	0.13	4.62	260,681	29.18

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
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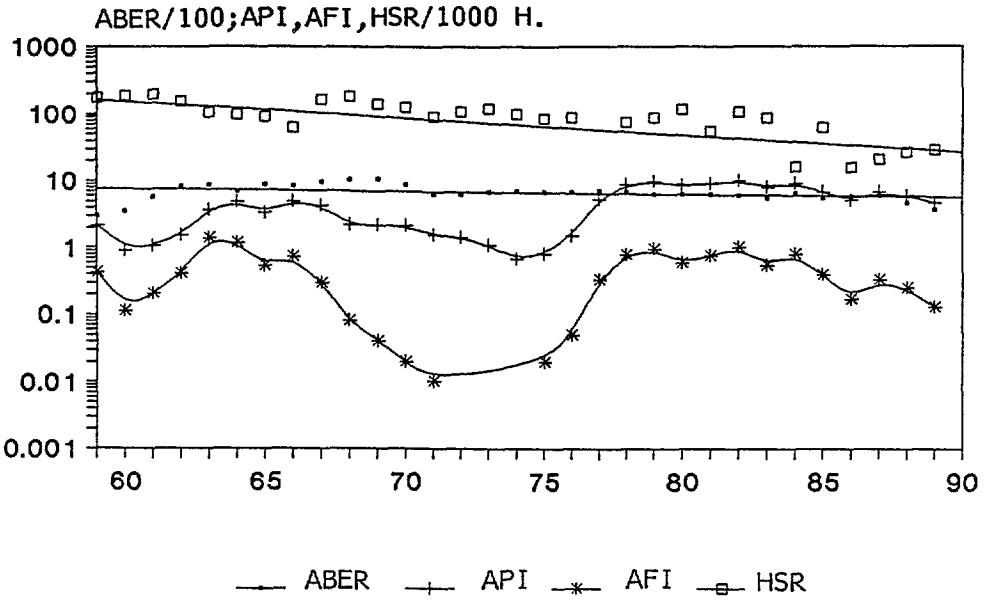
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

GUATEMALA-Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In Guatemala, the information system was revamped and data processing was computerized. As a result, the figures are not yet final. The register shows 42,453 malaria cases for 1989, of which 1,084 were due to P. falciparum (2.5%), 71 were associated infections, and the rest were due to P. vivax, still the predominant species. The downward trend observed the previous year was maintained, with a 27% reduction in cases.

The malaria rate per 1,000 population was 12.4, or slightly less than that for 1988 (12.72). The positive slide index was 12.8, also very similar to the previous year.

Malaria incidence relative to the different ecological areas was as follows: the northern area continued to have the highest positivity, accounting for 57.8% of all cases. Next came the southern area, with 23.4%, and finally the eastern central area, with 18.8%. It should be noted that some of the cases occurred in areas previously considered to be malaria-free.

The Malaria Program succeeded in protecting 17% of the exposed population through household spraying, but the campaign against the larvae only reached 2.3% of the inhabitants of the endemic area. In both cases, resources were concentrated on priority localities, according to their epidemiological stratification.

Of the principal factors limiting control of the endemic disease, the first and foremost is increased vector resistance. The marked resistance to fenitrothion in the southern area has extended significantly to the east central area and even some parts of the northern area. Resistance to deltamethrin along the Pacific coast (southern area) has reached critical levels.

Other problems are: lack of funds for critical budget items (per diem, supplies for the examination and reporting of samples, parts for spraying equipment), difficulties in budget execution, changes in the pattern of labor management, major problems with vehicles, and political and social disorder in several of the areas.

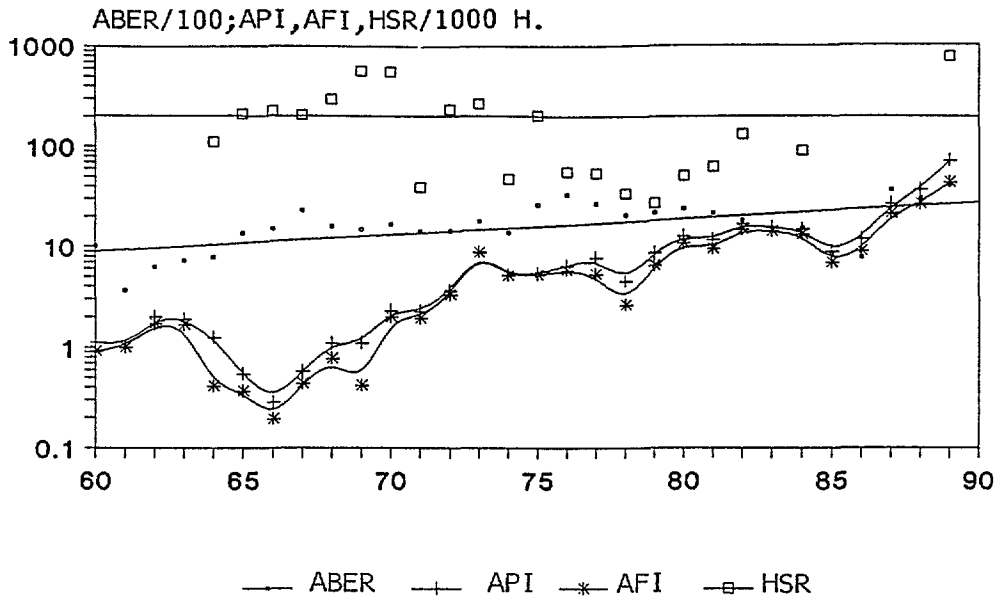
MALARIOMETRIC RATES - FRENCH GUIANA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	31											
1960	33	3,343	10.13	37	1.12	30	6	1	0.91	0.18	-	-
	33	1,197	3.63	33	1.00	33	-	-	1.00	0.00	-	-
	35	2,183	6.24	70	2.00	60	10	-	1.71	0.29	-	-
	37	2,648	7.16	70	1.89	61	9	-	1.65	0.24	-	-
	39	3,025	7.76	48	1.23	16	32	-	0.41	0.82	4,298	110.21
1965	41	5,424	13.23	22	0.54	15	7	-	0.37	0.17	8,564	208.88
	42	6,180	14.71	12	0.29	8	4	-	0.19	0.10	9,432	224.57
	44	9,811	22.30	25	0.57	19	6	-	0.43	0.14	8,926	202.86
	46	7,132	15.50	50	1.09	35	14	1	0.76	0.30	13,464	292.70
	48	7,000	14.58	52	1.08	20	32	-	0.42	0.67	26,861	559.60
1970	51	8,237	16.15	117	2.29	101	16	-	1.98	0.31	27,967	548.37
	52	7,176	13.80	116	2.23	100	16	-	1.92	0.31	1,996	38.38
	54	7,597	14.07	192	3.56	178	14	-	3.30	0.26	12,361	228.91
	56	9,739	17.39	484	8.64	477	7	-	8.52	0.13	14,650	261.61
	68	9,153	13.46	351	5.16	343	8	-	5.04	0.12	3,160	46.47
1975	60	15,250	25.42	319	5.32	308	11	-	5.13	0.18	12,020	200.33
	62	19,854	32.02	394	6.35	354	40	-	5.71	0.65	3,400	54.84
	64	16,908	26.42	488	7.63	333	146	9	5.20	2.28	3,400	53.13
	60	12,147	20.25	266	4.43	156	102	8	2.60	1.70	2,000	33.33
	70	15,114	21.59	604	8.63	446	157	1	6.37	2.24	1,876	26.80
1980	69	15,462	22.41	831	12.04	700	131	-	10.14	1.90	3,315	48.04
	72	14,249	19.79	769	10.68	627	142	-	8.71	1.97	4,074	56.58
	74	12,319	16.65	1,143	15.45	997	145	1	13.47	1.96	8,925	120.61
	77	10,391	13.49	1,051	13.65	964	87	-	12.52	1.13		0.00
	80	10,587	13.23	1,021	12.76	919	102	-	11.49	1.28	6,240	78.00
1985	82	6,664	8.13	691	8.43	540	142	-	6.59	1.73	...	...
(*)	84	6,436	7.66	979	11.65	738	241	-	8.79	2.87	...	...
(*)	86	30,761	35.77	2,221	25.83	1,798	423	-	20.91	4.92	...	...
(*)	88	26,145	29.71	3,188	36.23	2,284	904	-	25.95	10.27	...	...
1989	90	35,993	39.99	6,284	69.82	3,831	2,391	-	42.57	26.57	68,000	755.56

(hs)

a) Estimated population, in thousands of inhabitants.
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.
* Provisional information.

FRENCH GUIANA - Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

In French Guiana, the areas of greatest malaria transmission are the basins of the Maroni River on the western border and the Oiapoque on the eastern border.

The Maroni River region, inhabited almost entirely by isolated populations, had an API of 555.5 in 1989, 92% being P. falciparum. P. vivax has been detected only among the indigenous population near the Caribbean and around the sources of the river.

On the banks of the Oyapoque River, where the API was 658.8, 54.4% of the cases were P. vivax. In the rest of the country, malaria transmission has been limited. The imported cases have been shown to come primarily from the state of Pará in Brazil. Around Cayenne alone, 1,658 imported cases have been diagnosed and treated.

Principal Factors Contributing to Transmission

In all the transmission areas, jungle An. darlingi is considered to be the only vector. Cross-border circulation of the native population, the people's reluctance to accept residual spraying with DDT, difficulties in accessing widely scattered localities, and resistance to

the 4-aminoquinolines have contributed to the persistence of transmission. However, the epidemiological surveillance declined when an insurrection occurred in the interior of Suriname and operations on that side of the border were suspended.

On the eastern border, the influx of workers, called garimpeiros, is a continuous source of infection. Many of these immigrants request medical services at the health centers in the interior and on the coastal area as they look for work around Cayenne, where some epidemics have originated.

Control Activities in the Border Regions

Along the border between French Guiana and Suriname the constant movement of the native population does not permit timely follow-up of cases, resulting in inefficient detection and treatment.

On the border with Brazil there is no regulation to provide for the screening of Brazilian emigrants who cross over from Pará (many of them clandestinely) and turn up later in the more populated areas on the coast.

Health Services Integration

The Departmental Service responsible for the parasitoscopic diagnosis of malaria, epidemiological research, and vector control measures has teams on the coast in Cayenne, Tomate, Kourou, Sinnamary, St. Laurent, and Maná; in the Maroni River region in Atapatou, Gran Santi, and Maripasoula; and in the Ogapoke River region at St. George. All cases are referred and then treated by the medical services in the health centers or hospitals or by private physicians.

MALARIOMETRIC RATES - GUYANA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	550	3,754	0.68	176	0.32	63	100	13	0.11	0.18	...	...
1960	565	3,674	0.65	263	0.47	184	67	12	0.33	0.12	...	...
	585	16,889	2.89	231	0.39	58	168	5	0.10	0.29	15,107	25.82
	600	35,446	5.91	446	0.74	266	180	-	0.44	0.30	23,808	39.68
	617	32,255	5.23	476	0.77	418	58	-	0.68	0.09	12,231	19.82
	630	55,185	8.76	225	0.36	192	33	-	0.30	0.05	13,072	20.75
1965	643	61,507	9.57	28	0.04	26	2	-	0.04	0.00	11,121	17.30
	659	53,669	8.14	910	1.38	16	894	-	0.02	1.36	8,618	13.08
	674	34,163	5.07	175	0.26	145	29	1	0.22	0.04	9,242	13.71
	686	55,217	8.05	61	0.09	27	34	-	0.04	0.05	12,508	18.23
	694	70,121	10.10	25	0.04	13	12	-	0.02	0.02	5,477	7.89
1970	710	63,623	8.96	18	0.03	9	9	-	0.01	0.01	2,883	4.06
	725	65,967	9.10	27	0.04	17	9	1	0.02	0.01	3,049	4.21
	741	59,931	8.09	266	0.36	147	119	-	0.20	0.16	4,770	6.44
	758	56,420	7.44	42	0.06	4	38	-	0.01	0.05	9,343	12.33
	774	42,549	5.50	72	0.09	67	5	-	0.09	0.01	2,676	3.46
1975	780	55,758	7.15	1,116	1.43	854	262	-	1.09	0.34	5,137	6.59
	790	102,815	13.01	4,642	5.88	2,456	2,186	-	3.11	2.77	11,479	14.53
	810	121,075	14.95	1,563	1.93	640	923	-	0.79	1.14	4,364	5.39
	820	137,114	16.72	927	1.13	293	633	1	0.36	0.77	13,578	16.56
	850	107,232	12.62	2,294	2.70	564	1,730	-	0.66	2.04	6,974	8.20
1980	870	139,433	16.03	3,202	3.68	380	2,822	-	0.44	3.24	8,602	9.89
	880	110,993	12.61	2,065	2.35	620	1,443	2	0.70	1.64	7,025	7.98
	900	87,525	9.73	1,700	1.89	451	1,249	-	0.50	1.39	5,905	6.56
	918	59,940	6.53	2,102	2.29	188	1,912	2	0.20	2.08	5,777	6.29
	935	29,207	3.12	3,017	3.23	431	2,585	1	0.46	2.76	1,257	1.34
1985	953	53,276	5.59	7,900	8.29	2,336	5,564	-	2.45	5.84	4,982	5.23
	971	84,763	8.73	16,388	16.88	9,336	7,052	-	9.61	0.08	7,179	7.39
	989	165,230	16.71	34,142	34.52	22,638	11,504	-	22.89	0.07	10,668	10.79
	1,006	181,067	18.00	35,470	35.26	24,327	11,143	-	24.18	0.06	7,965	7.92
1989	1,023	143,599	14.04	20,822	20.35	12,390	8,432	-	12.11	0.06	4,490	4.39

a) Estimated population, in thousands of inhabitants. (hs)
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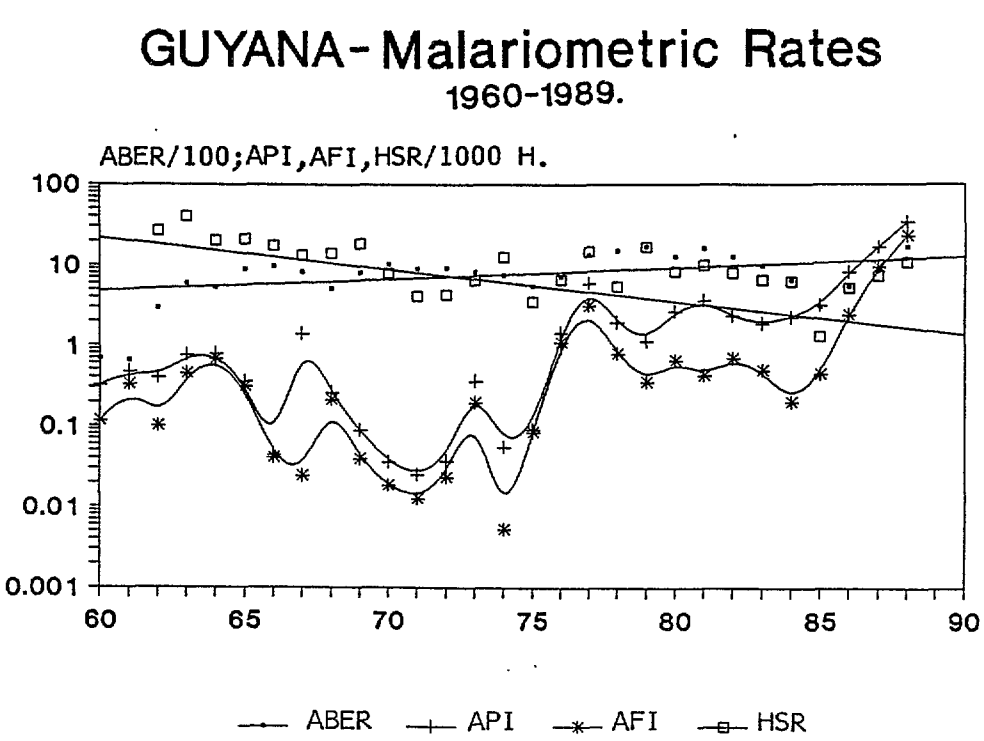


STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

Areas of Greatest Transmission

In Guyana, most of the malaria cases were registered in five of the ten administrative regions of the country, as follows:

Region	Population	Slides examined	Positive slides	API
I	18,875	44,299	7,833	415
II	12,317	18,546	1,786	145
VII-VIII	24,010	33,052	4,682	195
IX	15,629	20,155	2,583	162
Others	676,271	27,489	3,989	5.9
TOTAL	747,102	143,601	20,822	27.9

The highest API was in Region I, on the Venezuela border, where 38% of all the registered cases originated.

In Region IV, which includes Georgetown, the capital of the country, more than 3,000 cases have been registered, or 15% of all the cases in

the country. However, the great majority of these are cases imported from Regions VII and VIII (75%), from Region X (10%), and from Region I (9.0%). These cases occurred primarily among migrant gold and diamond miners. The principal vector in the regions of the interior is An. darlingi; in the coastal area, transmission is attributed to An. aquasalis.

Factors Contributing to Transmission

Prospectors for gold and diamonds in the jungle areas of the interior come from the coastal area and have notably influenced the malaria situation in Guayana during the last decade.

As a result of this activity, several camps have been established on the banks of rivers, placing the miners in intimate contact with An. darlingi. The lack of sprayable surfaces in the houses, resistance to the use of mosquito nets, and extreme difficulty of access to these localities by the health services for the detection, diagnosis, and treatment of cases, make this group of susceptible persons highly vulnerable to infection. Diagnosis and treatment is usually delayed, since it is performed during periodic visits to the Atlantic coast, in areas in which 90% of the population lives or when the miners leave their camps in search of medical care. The situation is aggravated by a 25% treatment failure rate, probably due to resistance of the plasmodium to the antimalarial drugs and to the interruption of treatment.

Joint Activities on the Borders

The agreement signed between Venezuela and Guyana has facilitated routine operations, permitting both programs to make control visits to remote localities in the border area, during which they conduct diagnosis, treatment, spraying with residual insecticides, and the promotion of individual protective measures to reduce the incidence of infection.

Along the Guyana-Brazil border, migratory movements are more restricted and commercial in nature. The joint project to build a connecting road between Brazil and Guyana could have serious implications because it will facilitate access to the jungle regions of Guyana, between Lethem and Georgetown, greatly increasing the incidence of malaria. There is an agreement between the malaria control programs of Brazil and Guyana for the exchange of information, but operative collaboration is minimal.

Case Detection and Treatment

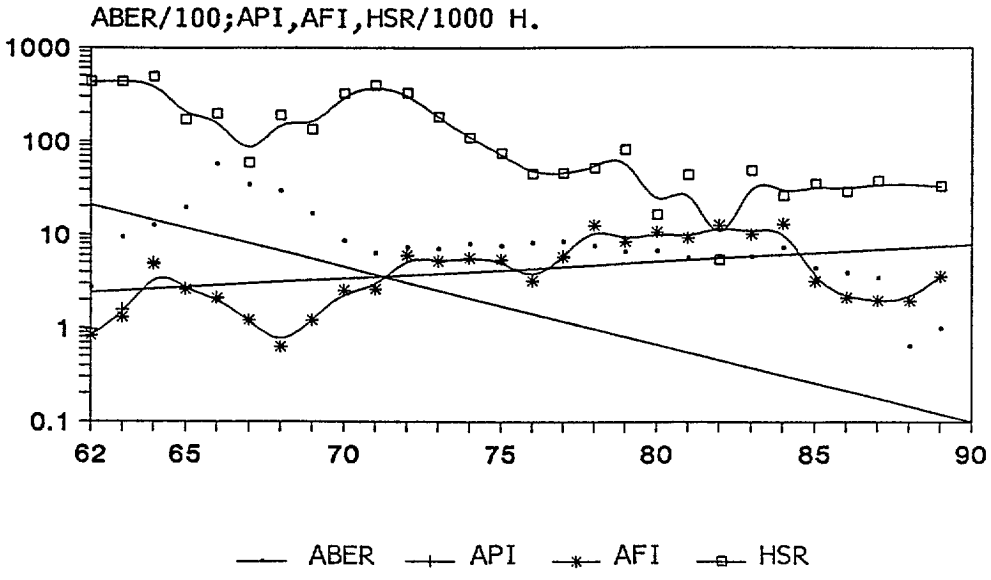
Wherever the primary health care system has infrastructure and provides coverage, malaria diagnosis and treatment is handled by the general health services. Where there is no coverage by the general health services, active case-finding and all measures against the vector are carried out by the special malaria service.

MALARIOMETRIC RATES - HAITI

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	Other P.vivax species		AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
1960	3,991	...	...	...	...	...	...	...	...	...	...	...
	4,067	...	...	...	...	...	...	...	...	...	...	...
	4,145	111,142	2.68	4,033	0.97	3,441	20	572	0.83	0.00	1,792,395	432.42
	4,226	386,657	9.15	6,662	1.58	5,464	12	1,186	1.29	0.00	1,817,027	429.96
	3,850	473,297	12.29	19,170	4.98	18,422	24	724	4.78	0.01	1,883,520	489.23
1965	3,910	752,284	19.24	10,304	2.64	9,997	20	287	2.56	0.01	664,572	169.97
	3,970	2,239,469	56.41	8,378	2.11	8,208	35	138	2.07	0.01	772,513	194.59
	4,030	1,343,796	33.34	4,871	1.21	4,840	3	28	1.20	0.00	233,513	57.94
	4,100	1,173,905	28.63	2,562	0.62	2,556	3	3	0.62	0.00	760.385	185.46
	4,160	686,167	16.49	5,005	1.20	4,999	1	5	1.20	0.00	549,869	132.18
1970	4,235	357,366	8.44	10,658	2.52	10,654	-	4	2.52	-	1,354,700	319.88
	4,315	270,695	6.27	11,347	2.63	11,345	2	-	2.63	0.00	1,697,187	393.32
	4,368	313,368	7.17	25,961	5.94	25,961	-	-	5.94	-	1,411,027	323.04
	4,440	309,482	6.97	22,858	5.15	22,857	-	1	5.15	-	801,247	180.46
	4,514	357,546	7.92	25,441	5.64	25,441	-	-	5.64	-	487,658	108.03
1975	4,584	346,934	7.57	24,733	5.40	24,732	1	-	5.40	-	337,874	73.71
	4,668	380,184	8.14	15,087	3.23	15,078	7	2	3.23	0.00	205,767	44.08
	4,749	400,024	8.42	27,679	5.83	27,646	28	5	5.82	0.01	213,796	45.02
	4,833	365,202	7.56	60,472	12.51	60,471	1	-	12.51	0.00	247,095	51.13
	4,919	321,456	6.53	41,252	8.39	41,252	-	-	8.39	-	396,595	80.63
1980	5,413	333,157	6.15	53,478	9.88	53,478	-	-	9.88	-	80,244	14.82
	5,509	283,978	5.15	46,703	8.48	46,703	-	-	8.48	-	219,512	39.85
	5,616	303,118	5.40	65,354	11.64	65,354	-	-	11.64	-	27,683	4.93
	5,723	308,075	5.38	53,954	9.43	53,954	-	-	9.43	-	253,177	44.24
	5,830	385,400	6.61	69,863	11.98	69,862	1	-	11.98	0.00	138,174	23.70
1985	5,922	226,887	3.83	16,662	2.81	16,662	-	-	2.81	-	179,230	30.27
	6,032	262,582	4.35	14,363	2.38	14,363	-	-	2.38	-	194,512	32.25
	6,146	212,989	3.47	12,134	1.97	12,120	14	-	1.97	0.00	227,813	37.07
(*)	6,263	40,321	0.64	12,306	1.96	12,306	-	-	1.96	0.00	0	0.00
1989	6,381	63,528	1.00	23,231	3.64	23,231	-	-	3.64	0.00	206,541	32.37

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.
* La informacion de 1988 es provisional e incompleta.

HAITI - Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In March 1988, at a time of financial crisis, the Government of Haiti closed the NMES and discharged all field workers and administrative personnel. The institution's property was conveyed to the Ministry of Health. Since then, financial difficulties and political instability have impeded the systematic reorganization of malaria control measures for the whole country. The last complete official epidemiological report prepared by the NMES was that of 1987.

Table V.8 presents the data available by locality for 1979. In 1980 a first version of the stratification scheme was developed on the basis of API performance.

Unfortunately, no complete epidemiological information is available on the current status of malaria in the country. However, given the absence of control measures, there are strong signs that incidence of the disease is on the increase, especially in the principal foci identified during the stratification process and in all areas where there are conditions favorable for transmission. Since 1988 the only source of epidemiological information on malaria has been the health institutions. In that year they reported 40,321 slides examined and 12,306 cases of P. falciparum, with a PSI of 30.5%. In 1989 there were 23,231 cases registered, all due to P. falciparum.

As of 1986, four species of Anopheles had been registered in the country: An. albimanus, An. crucians, An. grabhami, and An. vestitipenis. In 1986 a new species, An. pseudopunctipennis, was discovered in a coastal area south of Port-au-Prince. The distribution and capacity of the vector have still not been established. The principal malaria vector in Haiti is An. albimanus.

The complete information for 1989 is as follows:

Public health regions	Slides examined	Slides positive	PSI
North	13,875	3,737	26.9
Transversal	24,075	10,139	42.1
West	15,812	6,458	40.8
South	9,766	2,897	29.7
COUNTRY TOTAL	63,528	23,231	36.6

2. Control Strategy

After the NMES was abolished as an institution, the Government adopted the policy to integrate malaria control into the general health services following the guidelines of the primary health care strategy (PHC). To implement this policy, it created a technical unit (Unit of Vector-borne Disease Control), which will be responsible for giving technical support to the health services during the integration process. Since the NMES was abolished two years ago, no systematic campaign activities against the vectors or parasites have been carried out, only such emergency measures as household spraying and the distribution of antimalarial drugs in late 1988 and early 1989 after Hurricane Gilbert. The only measure currently being carried out against malaria is the distribution of antimalarial drugs in the health centers, dispensaries, and hospitals. In this effort, 3,000,000 tablets of chloroquine 150 mg base and 500,000 tablets of primaquine 15 mg base were distributed to public and private (NGO) health institutions as part of a UNDP/PAHO/WHO project. Information is not available regarding any evaluation of the coverage or impact of this measure on malaria incidence of and/or mortality.

Malaria Control in Border Areas

At present no special measures are being implemented in border areas. The program for technical cooperation with the Dominican Republic ended when the NMES was closed down.

Integration of Malaria Control into the Health Services

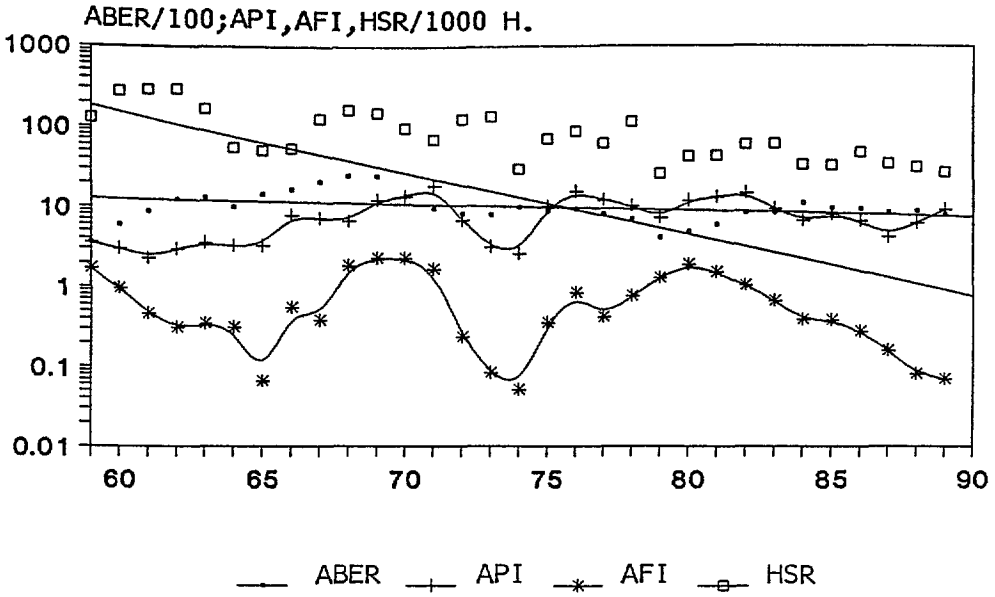
Integration of the malaria campaign into the health services has been part of official health policy since 1988. Although to date there is no concrete plan for implementing this policy, malaria patients have begun to be treated in the health centers as a part of the routine activities. The Government has submitted a cooperation plan to UNDP to obtain the funds needed in order to implement integration. The plan is in the final approval stage and will be executed by PAHO/WHO. If the proposal is approved, the authorities will be receiving US$ 1,000,000 over a four-year period for training and supplies.

MALARIOMETRIC RATES - HONDURAS

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	Other P.vivax species		AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	1,880	66,391	3.53	6,675	3.55	3,170	3,504	1	1.69	1.86	236,963	126.04
1960	1,849	109,677	5.93	5,517	2.98	1,737	3,780	-	0.94	2.04	496,758	268.66
	1,910	164,965	8.64	4,334	2.27	861	3,472	1	0.45	1.82	543,766	284.69
	1,973	239,655	12.15	5,750	2.91	597	5,153	-	0.30	2.61	575,450	291.66
	2,040	264,131	12.95	7,077	3.47	688	6,389	-	0.34	3.13	336,144	164.78
	2,109	207,000	9.82	6,673	3.16	641	6,032	-	0.30	2.86	115,153	54.60
1965	2,181	310,301	14.23	6,952	3.19	141	6,811	-	0.06	3.12	109,162	50.05
	2,256	360,760	15.99	17,127	7.59	1,204	15,923	-	0.53	7.06	118,142	52.37
	2,333	465,598	19.96	16,144	6.92	872	15,272	-	0.37	6.55	288,253	123.55
	2,413	584,696	24.23	15,666	6.49	4,281	11,385	-	1.77	4.72	382,068	158.34
	2,495	591,544	23.71	29,584	11.86	5,528	24,056	-	2.22	9.64	360,416	144.46
1970	2,640	357,436	13.54	34,537	13.08	5,875	28,662	-	2.23	10.86	248,440	94.11
	2,720	255,773	9.40	48,586	17.86	4,444	44,142	-	1.63	16.23	184,027	67.66
	2,810	226,578	8.06	18,651	6.64	652	17,999	-	0.23	6.41	340,011	121.00
	2,900	226,231	7.80	8,862	3.06	239	8,621	2	0.08	2.97	376,655	129.88
	2,990	287,842	9.63	7,503	2.51	150	7,353	-	0.05	2.46	86,626	28.97
1975	3,090	266,923	8.64	30,289	9.80	1,078	29,210	1	0.35	9.45	213,792	69.19
	3,200	295,128	9.22	48,804	15.25	2,603	46,201	-	0.81	14.44	276,375	86.37
	3,320	264,233	7.96	39,414	11.87	1,355	38,059	-	0.41	11.46	202,920	61.12
	3,439	236,650	6.88	34,554	10.05	2,539	32,013	2	0.74	9.31	389,642	113.30
	3,564	143,485	4.03	25,297	7.10	4,505	20,792	-	1.26	5.83	90,500	25.39
1980	3,691	175,591	4.76	43,009	11.65	6,789	36,220	-	1.84	9.81	154,362	41.82
	3,821	221,822	5.81	49,377	12.92	5,667	43,710	-	1.48	11.44	160,536	42.01
	3,955	322,802	8.16	57,482	14.53	4,019	53,463	-	1.02	13.52	233,702	59.09
	4,090	336,879	8.24	37,536	9.18	2,640	34,896	-	0.65	8.53	243,669	59.58
	4,232	452,184	10.68	27,332	6.46	1,589	25,743	-	0.38	6.08	138,174	32.65
1985	4,383	410,720	9.37	33,828	7.72	1,616	32,212	-	0.37	7.35	140,793	32.12
	4,531	411,150	9.07	29,130	6.43	1,238	27,892	-	0.27	6.16	211,214	46.62
	4,680	388,509	8.30	19,095	4.08	743	18,352	-	0.16	3.92	158,386	33.84
	4,830	421,474	8.73	29,737	6.16	405	29,332	-	0.08	6.07	148,736	30.79
1989	4,982	391,250	7.85	45,922	9.22	367	45,555	-	0.07	9.14	134,593	27.02

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

HONDURAS- Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

Honduras had a total of 45,922 malaria cases in 1989, representing a 54.4% increase over 1988. This is perhaps due to diminished coverage, as reflected in the decline in the annual blood examination rate (ABER) from 8.73 to 7.85 per 100 population from 1988 to 1989.

Of these cases, 99.2% were due to P. vivax. The areas of San Pedro Sula (Region III), La Ceiba (Region VI), and Choluteca (Region IV) had 89% of all the cases registered in 1989.

Factors Contributing to the Persistence of Transmission

Densely populated areas in El Progreso and Santa Cruz de Yojoa, lowlands with a hot, humid climate propitious for high densities of anophelines, are making for intense malaria transmission in this region. Inadequate care of malaria patients in the health centers (only the first 10 suspected cases are diagnosed) is adding to the problem. Furthermore, the construction of the El Cajón hydroelectric dam and the Santa Barbara-Santa Cruz highway has brought heavy circulation/migration of workers, increasing the number of individuals susceptible to infection

without at the same time increasing coverage by the health protection services. In the eastern region, in the Aguan River valley, a large number of subsistence farmers live in conditions of precarious health protection with difficult access to general health services.

In the southern region (Choluteca), on the Gulf of Fonseca, traditional rice and sugarcane production creates the conditions for a high proliferation of anopheline vectors, which, together with the seasonal migration of day laborers, provides optimum conditions for local transmission.

The agreement between Honduras and Nicaragua to reduce malaria transmission in the border area (PAHO/ASDI) carried out its first stage, which involved the distribution of recently received materials and equipment (1989).

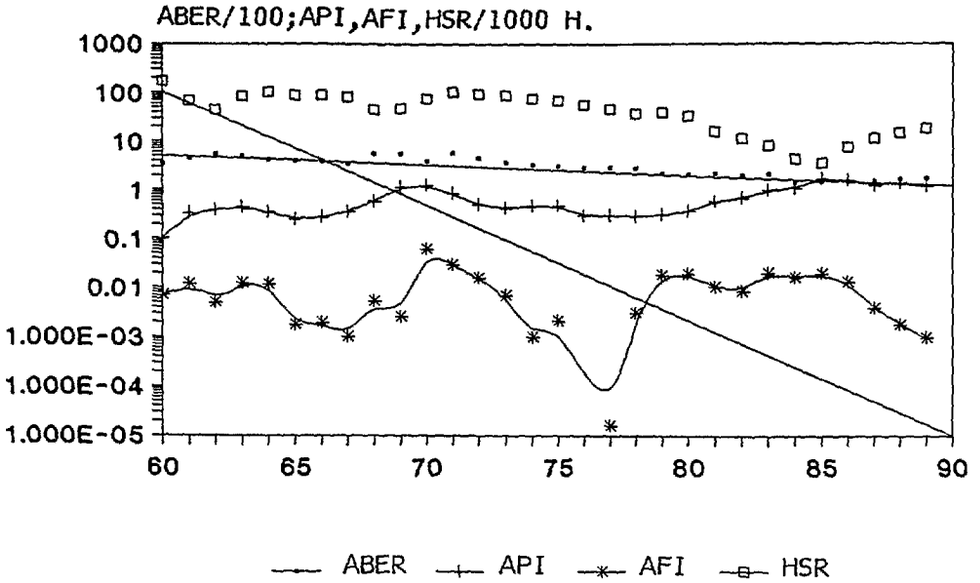
MALARIOMETRIC RATES - MEXICO

Year	Total population	Blood slides examined								Sprayings		
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	34,851	821,598	2.36	3,202	0.09	443	2,705	54	0.01	0.08	6,560,183	188.24
1960	34,994	1,212,770	3.47	3,569	0.10	245	3,251	73	0.01	0.09	5,918,572	169.13
	36,158	1,574,267	4.35	11,849	0.33	428	11,287	134	0.01	0.31	2,434,790	67.34
	37,367	1,967,392	5.27	14,279	0.38	182	14,027	70	0.00	0.38	1,608,147	43.04
	38,623	1,832,551	4.74	16,741	0.43	462	16,215	64	0.01	0.42	3,182,640	82.40
	39,928	1,595,323	4.00	13,405	0.34	454	12,929	22	0.01	0.32	4,068,291	101.89
1965	41,284	1,595,503	3.86	10,113	0.24	70	10,033	10	0.00	0.24	3,580,140	86.72
	42,694	1,572,042	3.68	11,212	0.26	80	11,121	11	0.00	0.26	3,714,522	87.00
	44,161	1,471,843	3.33	15,163	0.34	44	15,110	9	0.00	0.34	3,515,375	79.60
	45,686	2,406,837	5.27	26,040	0.57	236	25,669	135	0.01	0.56	1,973,112	43.19
	47,274	2,524,060	5.34	52,126	1.10	119	51,958	119	0.00	1.10	2,136,772	45.20
1970	50,695	1,889,877	3.73	61,158	1.21	3,026	58,083	49	0.06	1.15	3,666,055	72.32
	52,452	2,859,253	5.45	42,978	0.82	1,501	41,432	45	0.03	0.79	5,350,655	102.01
	54,273	2,329,667	4.29	26,216	0.48	852	25,324	40	0.02	0.47	4,965,198	91.49
	56,161	1,959,139	3.49	23,176	0.41	393	22,760	23	0.01	0.41	4,836,154	86.11
	58,118	1,822,307	3.14	26,800	0.46	57	26,718	25	0.00	0.46	4,293,265	73.87
1975	60,145	1,805,782	3.00	27,925	0.46	126	27,784	15	0.00	0.46	4,053,426	67.39
	61,800	1,749,778	2.83	18,153	0.29	-	18,139	14	0.00	0.29	3,397,260	54.97
	63,820	1,804,367	2.83	18,851	0.30	1	18,842	8	0.00	0.30	2,817,470	44.15
	65,840	1,845,554	2.80	19,080	0.29	200	18,865	15	0.00	0.29	2,354,162	35.76
	67,420	1,446,946	2.15	20,983	0.31	1,208	19,760	15	0.02	0.29	2,609,171	38.70
1980	69,350	1,467,695	2.12	25,734	0.37	1,329	24,402	3	0.02	0.35	2,298,366	33.14
	71,193	1,593,697	2.24	42,104	0.59	762	41,336	6	0.01	0.58	1,141,083	16.03
	73,011	1,440,806	1.97	49,993	0.68	637	49,242	114	0.01	0.67	828,311	11.35
	75,103	1,595,180	2.12	75,029	1.00	1,554	73,472	3	0.02	0.98	613,268	8.17
	77,123	1,093,953	1.42	85,501	1.11	1,283	84,214	4	0.02	1.09	338,538	4.39
1985	78,733	1,014,397	1.29	116,016	1.47	1,058	114,957	1	0.01	1.46	278,628	3.54
	80,971	1,217,848	1.50	130,915	1.62	1,107	129,808	-	0.01	1.60	617,830	7.63
	83,040	1,232,005	1.48	99,578	1.20	320	99,257	1	0.00	1.20	1,107,614	13.34
(m)	84,884	1,385,626	1.63	116,238	1.37	152	116,086	-	0.00	1.37	1,219,319	14.36
1989 *	86,737	1,484,565	1.71	101,241	1.17	85	101,127	-	0.00	1.17	1,583,090	18.25

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.
m) Estimated figures.
* In 1989 29 cases without diagnostic specie are included.

MEXICO- Malariometric Rates

1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In 1989, Mexico reported 101,241 cases of malaria, or a reduction of 12.9% relative to the number registered in 1988. In some of the the priority states--Veracruz, Campeche, and Tabasco on the Gulf coast and Chiapas and Sinaloa on Pacific coast--the drop was sizable. In Guerrero the number of cases did not change substantially, but in the states of Quintana Roo, Nayarit, and Colima there were sizable increases (14.3%, 21.1% and 24.2%, respectively). Of the non-priority states, only Jalisco showed a significant increase (26.1%).

The number of positive localities in the country (an indicator of spread) also declined by nearly 10%, following the same trend as in the number of cases at the state level. The priority states that showed increasee in the number of positive localities were, in order of importance, Quintana Roo (28.3%), Colima (25.3%), Nayarit (11.0%), Guerrero (5.9%), and Michoacán (3.0%).

Among the non-priority states, Jalisco was also the only one that had a significant increase (28.1%) in the number of positive localities. The case averages by locality for 1989 were not significantly different from those seen in 1988 (6.48 and 6.75, respectively) for either the priority states or the non-priority states. On balance, it would appear that the measures applied had been successful for maintaining effective control throughout the country.

The states of Chiapas, Guerrero, Oaxaca, Michoacán, and Sinaloa together contributed more than 78% of the total number of malaria cases registered during 1989. These states are all on the Pacific coast, which consistently reports the largest numbers of cases. Except on the coastal plain of Chiapas (where the recognized vector is Anopheles albimanus), the predominant vector is An. pseudopunctipennis.

The epidemiological surveillance effort, roughly measured by the number of blood samples examined (BSE), increased 7.1%, given that in 1989 a total of 98,939 more samples were examined than in 1988. However, the country's positive slide index (PSI) dropped from 8.39% in 1988 to 6.82% in 1989, for a decline of 13%. In the state of Guerrero an increase in BSE coupled with a reduction in PSI indicates that the rise in number of cases detected is largely the result of intensive case-finding during 1989 and probably represents little change in the intensity of transmission. On the other hand, in Michoacán, Nayarit, Quintan Roo, Colima, and Jalisco there was no appreciable change in BSE, whereas both the PSI and number of cases increased, which suggests an increase in transmission.

Information on morbidity by municipios and on control measures taken, provided by the states, permits a more thorough analysis of what has happened. For example, in 1988 and 1989 more than 50% of the cases and positive localities in the state of Nayarit were from three municipios (Nayar, Yesca, and Huajicori) in the Sierra Jurisdiction in the western Sierra Madre. The number of localities involved did not increase in the same proportion as the cases. This situation, together with the data provided, suggest that there has been an epidemic in the area since 1987. The control measures that have been implemented (spraying with DDT, collective and radical treatment with antimalarial drugs, and antilarval spraying) were carried out again at practically the same level as the year before, when there was a similar situation. Chiapas, on the other hand, is just the opposite case, with a trend toward improvement in the last two years. Around 50% of the cases are limited to 15 of the state's 109 municipios. In the municipio of Ocosingo, one that has been most affected in the last decade, the decline in incidence was nearly 50%. This municipio represents a model of primary care actions undertaken by voluntary collaborators in the community, including household spraying with insecticides and drug treatment, both collective and for radical cure. The strategy is now showing results after several years of effort. In this state, two different insecticides have been applied: bendiocarb in areas of recognized vector resistance to DDT, and DDT itself where there is no resistance to it. The coverage levels reached in 1989 were better by almost 10% relative to those achieved in 1988. Finally, Oaxaca represents an intermediate situation, in which, although there has been a reduction in the number of cases, the improvement has been limited to the area of the Papaloapan River basin. In the coastal region, morbidity actually increased, particularly in the municipios of Pochutla, Puerto Escondido, Pinotepa Nacional, and Juquila. In the first of these regions, DDT was the principal strategy used, and in the second the insecticide was either fenitrothion or bendiocarb.

The number of malaria cases caused by P. falciparum in 1989 declined by 44% relative to the previous year. This number, 85, represented barely 0.08% of the total number of cases registered in the country. Chiapas continues to be the state with the largest number of cases due to this species (more than 60%). However, an increase is noted in cases reported from Tabasco, which may suggest active transmission. In Chiapas, the Lacandona Jungle is the area that has had the most outbreaks due to P. falciparum . Heavy traffic with Tabasco would help to account for the introduction of cases in this state. The sporadic appearance of cases in Quintana Roo and Guerrero might be due to cases imported from Chiapas. The receptivity of these regions makes it necessary to keep a close watch on cases due to P. falciparum .

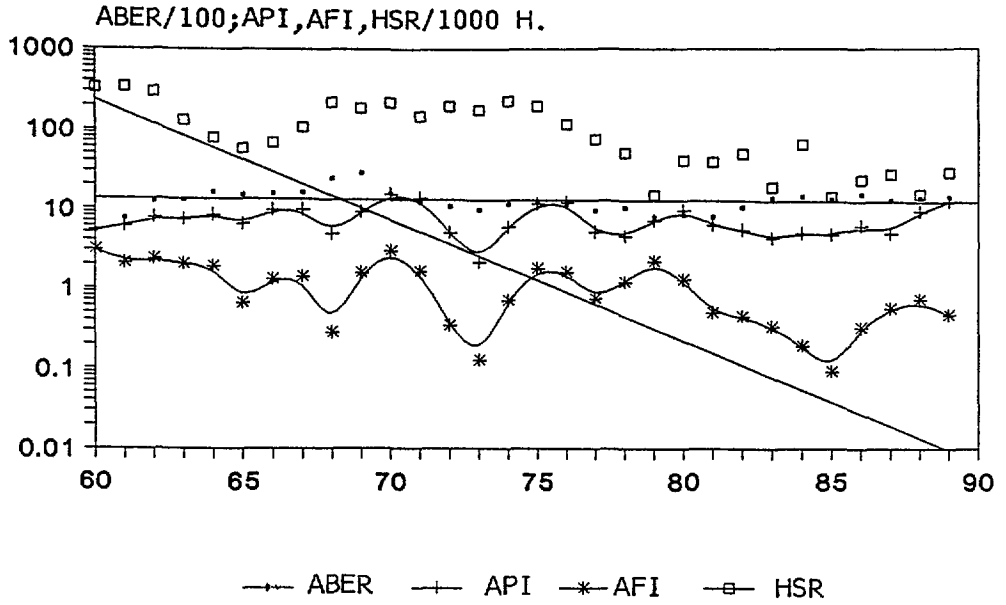
The country's overall morbidity for 1989 was 153.86 cases per 100,000 population, which, compared with the figure of 159.24 for 1988, represents a reduction of 3.4%. Although the states of Chiapas, Guerrero, Oaxaca, Michoacán, and Sinaloa report the largest number of cases and tend to be the ones with the biggest problem, the morbidity rates put a different light on the situation. For example, Quintana Roo, which ranks only ninth in frequency of cases, is actually fourth in epidemiological importance. This indicator has the problem that it fails to reflect the population exposed (in the denominator). In states that have large cities (without malaria transmission), the value of the rates is diluted and loses proportion. It is necessary to make an additional effort to estimate the population at risk more appropriately. Rates calculated in this way will make it possible to stratify the problem and to orient control efforts more rationally.

MALARIOMETRIC RATES - NICARAGUA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	1,370	38,965	2.84	1,907	1.39	649	1,258	-	0.47	0.92	425,575	310.64
1960	1,411	74,074	5.25	7,528	5.34	4,217	3,311	-	2.99	2.35	460,554	326.40
	1,453	109,283	7.52	8,722	6.00	3,001	5,721	-	2.07	3.94	490,912	337.86
	1,496	181,727	12.15	11,359	7.59	3,454	7,904	1	2.31	5.28	435,155	290.88
	1,541	194,087	12.59	11,155	7.24	3,034	8,121	-	1.97	5.27	197,715	128.30
	1,579	247,611	15.68	13,016	8.24	2,908	10,108	-	1.84	6.40	122,046	77.29
1965	1,619	238,467	14.73	10,275	6.35	1,039	9,236	-	0.64	5.70	91,614	56.59
	1,660	254,497	15.33	15,647	9.43	2,128	13,519	-	1.28	8.14	109,931	66.22
	1,701	269,395	15.84	16,321	9.59	2,353	13,968	-	1.38	8.21	177,422	104.30
	1,744	411,544	23.60	8,250	4.73	479	7,771	-	0.27	4.46	374,418	214.69
	1,788	498,119	27.86	16,050	8.98	2,732	13,318	-	1.53	7.45	322,777	180.52
1970	1,833	281,386	15.35	27,260	14.87	5,348	21,912	-	2.92	11.95	390,083	212.81
	1,889	223,098	11.81	25,303	13.39	3,041	22,262	-	1.61	11.79	269,794	142.82
	1,954	208,232	10.66	9,595	4.91	666	8,929	-	0.34	4.57	376,056	192.45
	2,015	191,361	9.50	4,246	2.11	251	3,989	6	0.12	1.98	348,622	173.01
	2,084	233,941	11.23	12,167	5.84	1,452	10,715	-	0.70	5.14	463,391	222.36
1975	2,155	259,675	12.05	24,692	11.46	3,798	20,894	-	1.76	9.70	408,839	189.72
	2,240	250,582	11.19	26,228	11.71	3,513	22,715	-	1.57	10.14	253,158	113.02
	2,312	215,093	9.30	11,584	5.01	1,671	9,913	-	0.72	4.29	167,367	72.39
	2,410	243,450	10.10	10,633	4.41	2,798	7,835	-	1.16	3.25	118,468	49.16
	2,644	203,475	7.70	18,418	6.97	5,669	12,749	-	2.14	4.82	37,887	14.33
1980	2,732	222,427	8.14	25,465	9.32	3,424	22,041	-	1.25	8.07	108,157	39.59
	2,860	223,473	7.81	17,434	6.10	1,396	16,038	-	0.49	5.61	107,362	37.54
	2,955	300,001	10.15	15,601	5.28	1,291	14,310	-	0.44	4.84	142,931	48.37
	3,100	412,858	13.32	12,907	4.16	1,018	11,889	-	0.33	3.84	56,271	18.15
	3,234	451,943	13.97	15,702	4.86	615	15,087	-	0.19	4.67	205,494	63.54
1985	3,272	424,681	12.98	15,130	4.62	298	14,840	-	0.09	0.03	45,356	13.86
	3,385	510,289	15.08	20,308	6.00	1,096	19,212	-	0.32	0.04	77,423	22.87
	3,502	448,314	12.80	17,011	4.86	1,928	15,083	-	0.55	0.03	93,573	26.72
	3,622	490,145	13.53	33,047	9.12	2,575	30,472	-	0.71	0.06	54,267	14.98
1989	3,745	523,700	13.98	45,982	12.28	1,720	44,262	-	0.46	0.08	54,267	14.49

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

NICARAGUA-Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In Nicaragua, a total of 45,982 malaria cases were registered in 1989, representing an increase of 39.1% relative to 1988. Of these cases, 96.3% were diagnosed as P. vivax.

This situation of increased morbidity is even more serious when it is contrasted with the mild increase in detection coverage based on the annual blood examination rate (ABER), which went from 13.53 in 1988 to 13.98 in 1989. This situation is accompanied by a significant increase in the household spraying index, which went from 14.98 per 1,000 population in 1988 to 28.16 in 1989.

On the other hand, the integration of the specific antimalaria activities into the general health services is evidenced by the detection of 97.7% of the cases in 90% of the blood samples examined in 1989, with a positivity index of 9.55%, compared with a positivity index of 1.9% in 53,304 blood samples taken in the course of active case-finding. It may be assumed that the factors that cause the malaria transmission in Nicaragua are related to the general socioeconomic deterioration of the country, which have not been altered by the high level of care coverage (ABER=13.98) and protection through house sprayings (HSR=28.16) that has been implemented throughout the national territory.

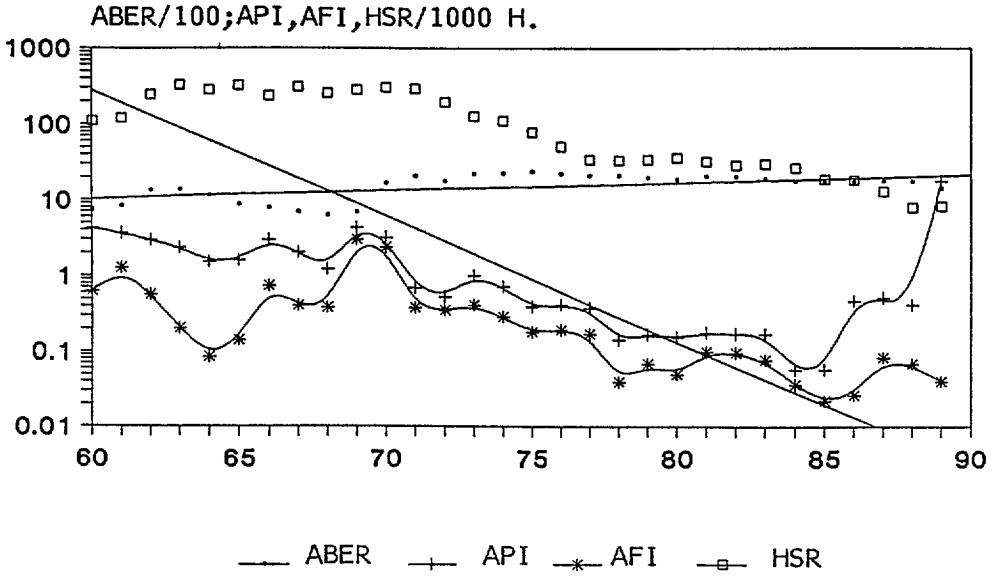
MALARIOMETRIC RATES - PANAMA

Year	Total population	Blood slides examined								Sprayings		
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	1,031	80,471	7.81	5,066	4.91	583	4,481	2	0.57	4.35	142,848	138.55
1960	1,062	77,141	7.26	4,464	4.20	670	3,793	1	0.63	3.57	115,948	109.18
	1,094	88,961	8.13	3,911	3.57	1,378	2,531	2	1.26	2.31	128,200	117.18
	1,130	145,012	12.83	3,249	2.88	631	2,618	-	0.56	2.32	271,260	240.05
	1,167	152,898	13.10	2,670	2.29	236	2,433	1	0.20	2.08	373,953	320.44
	1,205	131,634	10.92	1,804	1.50	101	1,703	-	0.08	1.41	331,795	275.35
1965	1,234	102,996	8.35	1,929	1.56	172	1,757	-	0.14	1.42	383,552	310.82
	1,272	97,525	7.67	3,664	2.88	906	2,757	1	0.71	2.17	292,251	229.76
	1,311	88,612	6.76	2,646	2.02	527	2,119	-	0.40	1.62	392,532	299.41
	1,351	83,211	6.16	1,625	1.20	512	1,113	-	0.38	0.82	333,764	247.05
	1,392	94,596	6.80	5,937	4.27	4,104	1,833	-	2.95	1.32	379,549	272.66
1970	1,460	237,477	16.27	4,584	3.14	3,405	1,179	-	2.33	0.81	429,829	294.40
	1,500	301,030	20.07	1,041	0.69	573	467	1	0.38	0.31	427,499	285.00
	1,550	269,098	17.36	819	0.53	543	276	-	0.35	0.18	293,971	189.66
	1,590	344,315	21.66	1,595	1.00	651	944	-	0.41	0.59	197,897	124.46
	1,660	368,820	22.22	1,184	0.71	481	703	-	0.29	0.42	180,910	108.98
1975	1,700	394,995	23.24	666	0.39	307	359	-	0.18	0.21	130,241	76.61
	1,750	384,941	22.00	727	0.42	337	390	-	0.19	0.22	86,915	49.67
	1,790	377,059	21.06	674	0.38	308	365	1	0.17	0.20	60,340	33.71
	1,840	382,942	20.81	263	0.14	73	190	-	0.04	0.10	60,954	33.13
	1,880	369,775	19.67	316	0.17	129	187	-	0.07	0.10	64,250	34.18
1980	1,954	360,172	18.43	304	0.16	97	207	-	0.05	0.11	69,954	35.80
	1,905	387,276	20.33	340	0.18	189	151	-	0.10	0.08	60,330	31.67
	1,953	392,458	20.10	334	0.17	186	148	-	0.10	0.08	55,737	28.54
	2,002	380,135	18.99	341	0.17	154	187	-	0.08	0.09	59,328	29.63
	2,134	373,072	17.48	125	0.06	78	47	-	0.04	0.02	56,516	26.48
1985	2,181	367,839	16.87	126	0.06	48	78	-	0.02	0.04	40,802	18.71
	2,227	388,485	17.44	1,060	0.48	59	1,001	-	0.03	0.45	40,392	18.14
	2,274	403,305	17.74	1,195	0.53	189	1,006	-	0.08	0.44	29,046	12.77
	2,322	404,320	17.41	1,000	0.43	161	839	-	0.07	0.36	18,367	7.91
1989	2,370	338,473	14.28	427	0.18	84	343	-	0.04	0.14	19,361	8.17

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

PANAMA- Malariometric Rates

1960-1989.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

In Panama, a total of 427 malaria cases were registered in 1989. Of these, 84 were due to P. falciparum and 343 to P. vivax. There was a 57.3% reduction in the number of cases compared with the figure for 1988. This, together with a decline in care coverage, as seen in the 65,847 fewer blood samples examined relative to 1988, suggests the possibility of underregistration, accentuated by a 48.4% reduction in the number of active reporting posts compared with those reporting the previous year. Of the total cases, 20% were classified as imported; of these, 65.43% were imported from Colombia to the transmission area and 19.7% to malaria-free regions. Cases were also registered coming from Costa Rica (8.6%) and India (6.2%).

Panama's originally malarious area occupies 92.3% of the national territory and has 96.3% of the population.

Malaria transmission persists in the province of Darién, the San Blas comarca, and eastern Panama (Bayano region). Taken together, these areas correspond to 32.3% of the national territory and have 3.4% of the country's population, for a density of 3.5 inhabitants per square kilometer. There are 96 case-generating localities, representing 0.98% of all localities.

The San Blas comarca is a thin strip along the Atlantic coast running from Colón Province to the Colombian border and is inhabited by the Kuna Indians. The principal outbreaks have been in Wala, Morti, Alto Chucunaque, Gran Playón, and Puerto Obaldía. In 1989, this region contributed 12.9% of the cases.

Darién, next to the Colombian border on the Pacific slope, rises to 1,000 meters above sea level and has two large and persistent malaria foci. Jaqué-Darién, with an area 1,183 kilometers square, and Puerto Pina, 313 kilometers square, are the principal case-generating nuclei, accounting for 50.8% of the national total. This region is populated by the Chocoes racial group.

Eastern Panama, with 31.3% of the cases coming mainly from Alto Bayano, is also located on the Pacific slope and is traversed by the Pan American Highway. It is inhabited by Kunas, Chocoes, and settlers from malaria-free provinces in the country's interior.

Causes Contributing to the Persistence of Malaria

The persistence of malaria can be traced to the following situations:

a. San Blas comarca

- Close commercial, political, and tribal contacts between the Kuna Indians and Colombian indigenous groups in Caño Caimán on the Urabá Gulf.
- Frequent visits by non-indigenous Colombian merchants without any migration control (imported cases).
- Intervention measures not carried through and not undertaken on a timely basis either for cultural reasons (the Kunas) or for lack of resources (NMES).

b. Darién Province

- Migration from Juradó, Colombia (Pacific coast).
- Treatments not completed owing to mobility of the population.
- Insufficient intervention measures.
- Asymptomatic carriers.

c. Eastern Panama (Alto Bayano)

- Uncontrolled colonization by highly susceptible populations from malaria-free regions.

- Culture shock between the traditional medicine of the Kunas and the control methods used by the NMES.

- Relocation of indigenous Kuna populations owing to construction of the Bayano hydroelectric plant and the resulting ecological changes.

- Movements of indigenous population between San Blas and Colombia (Gulf of Urabá).

The border agreements with Colombia have been inoperative since 1985, when the Panamanian political crisis began. With Costa Rica there is good coordination of all border health activities, both on the Pacific and on the Atlantic coasts.

Control Activities

Household spraying with fenitrothion and propoxur continues to be the only interevention measures being taken to control the disease. In 1989, coverage with spraying came to only 7% of the programmed target.

The disease is being controlled with chloroquine-primaquine medication for P. vivax cases and fanasil for P. falciparum .

The intervention measures have not any impact on transmission. Strategies are currently being implemented with a view to controlling the principal risk factors identified through epidemiological study of cases, socioeconomic study of malaria-related factors (Project AMR/89-3682-3), and research on the biology and ecology of Anopheles albimanus supported by a PAHO/AID agreement.

Integration

In 1987, following a political decision, steps were taken to move toward an integrated health system, which calls for the decentralizion of malaria diagnosis and treatment to the local health systems. In all the regions of the country, workshops have been held on malaria epidemiology for physicians and nurses and on microscopy for regional laboratory workers, so that the process is now in place in the remote provinces on the Costa Rican and Colombian borders. There has been some epidemiological surveillance in the malaria-free areas, but with only limited results, given the frequent turnover of health sector personnel. The process is being hampered by lack of resources on the part of both the NMES and the SIS.

MALARIOMETRIC RATES - PARAGUAY

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	1,728	11,379	0.66	641	0.37	1	640	-	0.00	0.37	161,261	93.32
1960	1,751	47,045	2.69	1,165	0.67	5	1,159	1	0.00	0.66	171,086	97.71
	1,801	27,995	1.55	1,528	0.85	9	1,519	-	0.00	0.84	56,656	31.46
	1,850	48,184	2.60	5,756	3.11	313	5,443	-	0.17	2.94	0	0.00
	1,910	92,806	4.86	3,443	1.80	313	3,130	-	0.16	1.64	0	0.00
	1,969	103,169	5.24	8,851	4.50	961	7,889	1	0.49	4.01	0	0.00
1965	2,030	82,848	4.08	6,732	3.32	115	6,616	1	0.06	3.26	5,709	2.81
	2,070	131,293	6.34	33,026	15.95	717	32,309	-	0.35	15.61	6,993	3.38
	2,130	164,444	7.72	50,304	23.62	6,636	43,668	-	3.12	20.50	1,519	0.71
	2,180	113,770	5.22	20,743	9.52	794	19,949	-	0.36	9.15	138,627	63.59
	2,240	129,509	5.78	10,307	4.60	1,591	8,716	-	0.71	3.89	625,145	279.08
1970	2,300	157,587	6.85	1,429	0.62	155	1,274	-	0.07	0.55	600,198	260.96
	2,360	169,448	7.18	423	0.18	194	229	-	0.08	0.10	513,048	217.39
	2,430	185,659	7.64	94	0.04	11	83	-	0.00	0.03	374,865	154.27
	2,500	145,879	5.84	41	0.02	2	39	-	0.00	0.02	189,875	75.95
	2,600	124,803	4.80	101	0.04	6	95	-	0.00	0.04	156,857	60.33
1975	2,690	125,132	4.65	217	0.08	11	206	-	0.00	0.08	127,295	47.32
	2,780	152,410	5.48	140	0.05	46	94	-	0.02	0.03	144,286	51.90
	2,870	85,613	2.98	156	0.05	11	145	-	0.00	0.05	120,511	41.99
	2,970	63,070	2.12	156	0.05	37	119	-	0.01	0.04	68,169	22.95
	3,070	57,225	1.86	116	0.04	46	70	-	0.01	0.02	86,845	28.29
1980	3,168	93,899	2.96	140	0.04	23	117	-	0.01	0.04	78,576	24.80
	3,268	101,979	3.12	73	0.02	4	69	-	0.00	0.02	91,664	28.05
	3,370	94,348	2.80	66	0.02	19	47	-	0.01	0.01	51,793	15.37
	3,470	84,630	2.44	49	0.01	10	39	-	0.00	0.01	45,656	13.16
	3,577	107,662	3.01	554	0.15	19	535	-	0.01	0.15	66,354	18.55
1985	3,693	131,196	3.55	4,568	1.24	19	4,549	-	0.01	1.23	55,989	15.16
	3,808	102,912	2.70	4,329	1.14	10	4,319	-	0.00	1.13	46,813	12.29
	3,923	97,532	2.49	3,741	0.95	73	3,667	1	0.02	0.93	40,632	10.36
	4,040	77,081	1.91	2,884	0.71	24	2,859	1	0.01	0.71	39,202	9.70
1989	4,157	89,263	2.15	5,247	1.26	18	5,229	-	0.00	1.26	55,249	13.29

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
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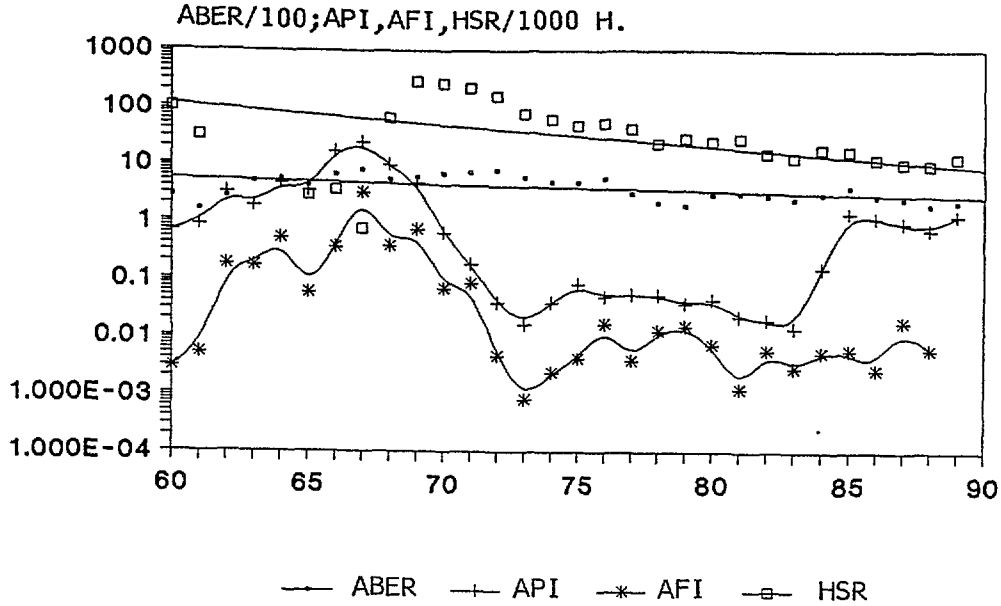
PARAGUAY- Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

The number of malaria cases in Paraguay has again increased 82% relative to the previous year. The problem continues to be concentrated in the area of the Itaipu Dam.

The departments affected by malaria are: Alto Paraná, Canindeyú, Caaguazú, San Pedro, and Amambay. Alto Paraná has the highest positivity index, with 90% of the cases in the entire the country. These five departments had 98.5% of the malaria cases reported.

Within Alto Paraná, the Hernandarias district has the highest incidence, with 50.4% of all cases. This area presents certain operational difficulties which stand in the way of more effective surveillance. To address this problem, two new sectors have been created, each with infrastructure corresponding to the local area's needs, for rapid and effective case diagnosis to keep the problem from spreading to other regions.

Activities during 1989 were not carried out as planned, including household spraying with DDT, epidemiological surveillance, treatment and follow-up of cases, and some entomological studies.

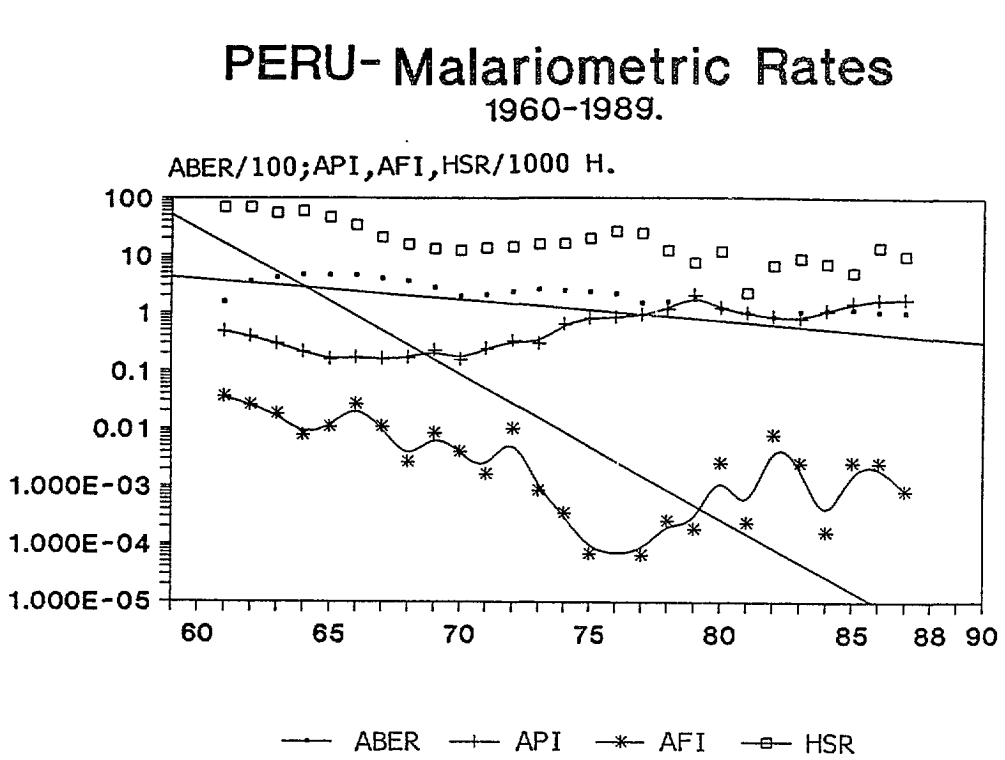
Of the 5,247 cases reported, 99.6% were caused by P. vivax.

The binational agreement between Paraguay and Brazil concerning the area of the Itaipú Dam continues in effect. Traffic between the two countries in this area has gotten worse, and it continues to contribute the largest number of reported cases in the country.

MALARIOMETRICS RATES - PERU

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	9,741	149,791	1.54	4,658	0.48	342	4,265	51	0.04	0.44	669,140	68.69
1960	10,022	349,780	3.49	3,906	0.39	256	3,560	90	0.03	0.36	682,491	68.10
	10,322	417,528	4.05	3,056	0.30	185	2,805	66	0.02	0.27	559,042	54.16
	10,630	470,639	4.43	2,216	0.21	82	2,052	82	0.01	0.19	627,527	59.03
	10,947	490,568	4.48	1,747	0.16	116	1,484	147	0.01	0.14	500,218	45.69
	11,272	502,744	4.46	1,934	0.17	302	1,538	94	0.03	0.14	379,184	33.64
1965	11,607	452,097	3.90	1,877	0.16	126	1,664	87	0.01	0.14	240,003	20.68
	11,952	424,993	3.56	2,049	0.17	32	1,915	102	0.00	0.16	186,109	15.57
	12,307	341,937	2.78	2,772	0.23	105	2,591	76	0.01	0.21	162,433	13.20
	12,675	247,116	1.95	2,010	0.16	52	1,911	47	0.00	0.15	153,893	12.14
	13,055	263,344	2.02	3,168	0.24	22	3,105	41	0.00	0.24	173,975	13.33
1970	13,447	310,237	2.31	4,494	0.33	135	4,282	77	0.01	0.32	188,723	14.03
	13,830	354,765	2.57	4,128	0.30	12	4,092	24	0.00	0.30	218,566	15.80
	14,220	341,084	2.40	9,270	0.65	5	9,236	29	0.00	0.65	229,605	16.15
	14,630	339,566	2.32	12,033	0.82	1	12,007	25	0.00	0.82	285,606	19.52
	14,750	317,522	2.15	12,485	0.85	0	12,485	-	0.00	0.85	383,405	25.99
1975	15,160	225,114	1.48	14,338	0.95	1	14,324	13	0.00	0.94	366,828	24.20
	15,570	243,675	1.57	18,462	1.19	4	18,448	10	0.00	1.18	187,410	12.04
	15,990	275,827	1.72	32,410	2.03	3	32,385	22	0.00	2.03	120,235	7.52
	16,410	201,489	1.23	20,376	1.24	43	20,312	21	0.00	1.24	192,877	11.75
	16,850	174,565	1.04	17,127	1.02	4	17,117	6	0.00	1.02	37,997	2.26
1980	17,300	150,407	0.87	14,982	0.87	138	14,805	39	0.01	0.86	117,684	6.80
	17,750	189,164	1.07	14,812	0.83	47	14,752	13	0.00	0.83	156,963	8.84
	18,230	211,100	1.16	20,483	1.12	3	20,480	-	0.00	1.12	132,393	7.26
	18,710	224,650	1.20	28,563	1.53	51	28,511	1	0.00	1.52	95,441	5.10
	19,204	214,213	1.12	33,724	1.76	51	33,655	18	0.00	1.75	269,129	14.01
1985	19,698	213,487	1.08	35,026	1.78	17	35,009	-	0.00	1.78	201,473	10.23
	20,208	184,636	0.91	36,866	1.82	68	36,783	15	0.00	1.82	216,665	10.72
	20,727	151,276	0.73	39,136	1.89	12	39,122	2	0.00	1.89	202,160	9.75
	21,254	125,430	0.59	32,359	1.52	0	32,211	148	0.00	1.52	147,695	6.95
1989	21,790	...	0.00	32,114	1.47	65	32,049	-	0.00	1.47	...	...

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Peru's total estimated population in 1989 was 21,791,500, of whom 7,200,000 are at risk of becoming ill or dying from malaria in an area 850,000 km^2.

a) A total of 32,114 malaria cases were reported in 1989, or 245 fewer than in 1988.

b) The incidence for 1988 was 529.2 per 100,000 population, and for 1989 it was 446.0.

c) P. vivax represents 99.8% of the registered cases and P. falciparum , 0.2%.

Table V.13 shows the high-risk departments in 1989.

The highest incidence is in the departments of Junín, Ayacucho, and Madre de Dios, with 5,388.1, 2,690.0, and 1,873.7 per 100,000 population, respectively. The first two have intense agricultural activity, along with social violence, and the third has gold-mining activities.

Causes of Malaria Transmission

Use of the stratification process and the API as a tracer indicator has made it possible to identify high-, medium-, and low-risk areas, which are indicated in Figure V.12.

The causal factors in high-risk areas may be summed up basically as those variables that are dependent on man, the parasite, the vector, and the environment, as follows:

Anthropogenic aspects

- Shifting of the susceptible population from the highlands to the Amazon tropics.
- Social factors and intense drug traffic in the five departments.
- Violence and guerrilla activities which have interrupted malaria control operations.
- An illiteracy rate of more than 70% in the adult rural population.
- Gold-mining in Madre de Dios Department.
- Intense agricultural activity. Rice cultivation has increased malaria transmission, especially in the departments of San Martín and Junín.
- In all five of the high-risk departments, people are brought from the highlands to work as agricultural laborers and these workers take the parasite back to their places of origin.

Parasitological aspects

- P. vivax has a prevalence of 99.18% in the country.
- Small foci of P. falciparum have been detected recently in the area near the Ecuador border, and these strains are resistant to chloroquine.
- In the eastern region bordering on Brazil strains of P. falciparum were detected in December 1989 which were resistant to pyremethamine and sulfadoxine.

Entomological aspects

- The principal vectors are An. pseudopunctipennis on the Pacific coast and inter-Andean valleys, and An. darlingi, An. rangeli, and An. oswaldoi in the eastern Amazon region.
- The field tests carried out in 1989 continue to confirm anopheline susceptibility to DDT.

1. **Health services coverage is reduced to responding to the demand and does not reach more than 20% of the population.**

The Malaria Control Program has been decentralized since 1973 and is implemented by each of the 28 public health units. To date, owing to lack of political decision, this process has not been accompanied by financial deconcentration.

The Malaria Control Program's annual budget of 40 million "intis" covers only 15% of the national programming.

Supervision from the central level is insufficient because of financial limitations.

Centralization of the budget means little or no participation by the health services.

The constant turnover of human resources at all levels is not followed up by an ongoing training process.

There is no budgetary programming for malaria control at the level of the departments.

There has been no assessment of the process of integrating malaria into the local health services.

2. **Malaria Control in International Border Areas**

During the 1989 there were two border meetings:

a) With Ecuador, in April, at Tumbes, Peru. The meeting focused on the preparatory phase and on diagnosis of the situation in areas on the Peru-Ecuador border. This baseline will make it possible to measure the impact of malaria control and surveillance at the next meeting, to be held in 1990.

b) With Brazil, in April of 1989 at Iquitos, Loreto Department, Peru. The results were:

- Review of the current status of malaria control in the areas along the Peru-Brazil border.

- Programming of the border area for surveillance and control of malaria and dengue. Binational cooperation in cases of emergency.

3. The process of integrating malaria detection and treatment is being managed by the general health services only in cases of epidemic outbreaks, but this is being done in coordination and collaboration with the central and regional malaria levels.

The local health service investigates and controls the malaria cases that occur within a radius of 5 km from the focus.

There is reluctance on the part of health personnel to carry out regular malaria surveillance and control.

The health services do not report on their local malaria activities.

Physical integration at the central level has not been accompanied by functional integration.

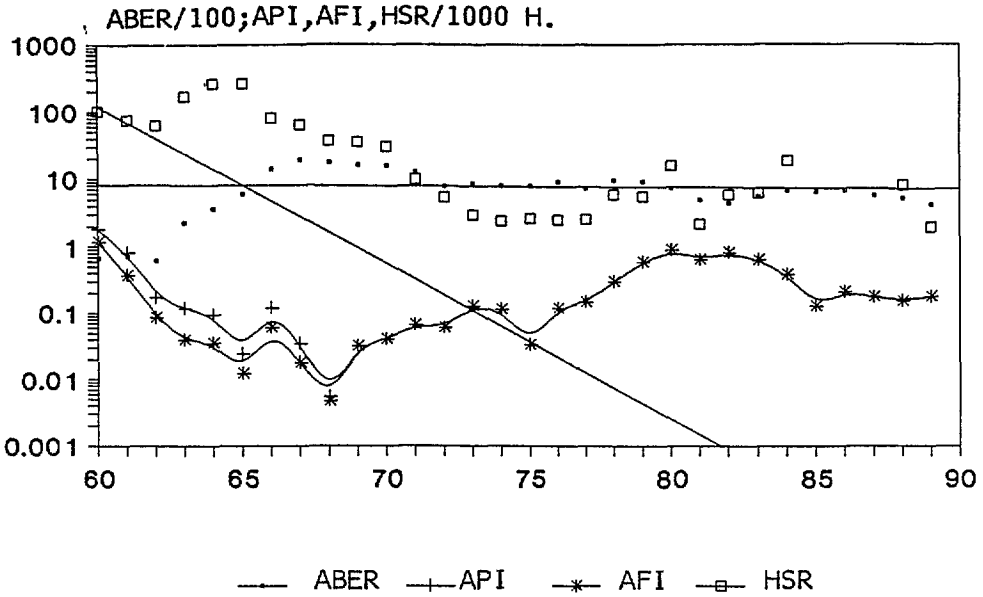
The physical and functional integration of activities for vector control, malaria, dengue, yellow fever, leishmaniasis, plague, and exanthematous typhus is being considered within the new concept of decentralization and political and administrative regionalization of the country.

MALARIOMETRIC RATES - DOMINICAN REPUBLIC

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	2,927	28,721	0.98	3,743	1.28	1,976	1,767	-	0.68	0.60	393,896	134.57
1960	3,038	20,337	0.67	5,540	1.82	3,591	1,949	-	1.18	0.64	309,716	101.95
	3,128	21,946	0.70	2,523	0.81	1,165	1,358	-	0.37	0.43	231,127	73.89
	3,220	19,742	0.61	548	0.17	277	271	-	0.09	0.08	201,109	62.46
	3,315	73,352	2.21	386	0.12	130	256	-	0.04	0.08	549,554	165.78
	3,412	121,211	3.55	321	0.09	120	201	-	0.04	0.06	891,727	261.35
1965	3,513	205,836	5.86	84	0.02	43	41	-	0.01	0.01	911,536	259.48
	3,616	505,130	13.97	429	0.12	216	213	-	0.06	0.06	288,765	79.86
	3,723	702,520	18.87	127	0.03	66	61	-	0.02	0.02	234,656	63.03
	3,833	655,202	17.09	21	0.01	18	3	-	0.00	0.00	140,220	36.58
	3,946	629,695	15.96	124	0.03	123	1	-	0.03	0.00	136,189	34.51
1970	4,062	628,221	15.47	161	0.04	161	-	-	0.04	0.00	120,812	29.74
	4,182	514,596	12.31	277	0.07	276	1	-	0.07	0.00	41,059	9.82
	4,305	329,394	7.65	261	0.06	261	-	-	0.06	0.00	23,078	5.36
	4,480	374,880	8.37	569	0.13	569	-	-	0.13	0.00	12,793	2.86
	4,610	360,782	7.83	520	0.11	520	-	-	0.11	0.00	10,825	2.35
1975	4,750	374,478	7.88	159	0.03	159	-	-	0.03	0.00	12,301	2.59
	4,890	436,068	8.92	586	0.12	585	1	-	0.12	0.00	11,992	2.45
	5,030	364,800	7.25	745	0.15	745	-	-	0.15	0.00	12,788	2.54
	5,170	489,095	9.46	1,531	0.30	1,531	-	-	0.30	0.00	29,965	5.80
	5,300	478,832	9.03	3,080	0.58	3,080	-	-	0.58	0.00	28,647	5.41
1980	5,440	390,770	7.18	4,780	0.88	4,779	1	-	0.88	0.00	84,501	15.53
	5,581	273,498	4.90	3,596	0.64	3,596	-	-	0.64	0.00	11,868	2.13
	5,744	251,542	4.38	4,654	0.81	4,653	1	-	0.81	0.00	33,206	5.78
	5,960	321,589	5.40	3,801	0.64	3,801	-	-	0.64	0.00	37,048	6.22
	6,101	413,416	6.78	2,370	0.39	2,370	-	-	0.39	0.00	113,717	18.64
1985	6,414	404,575	6.31	816	0.13	815	1	-	0.13	0.00	-	-
	6,566	427,694	6.51	1,360	0.21	1,359	-	-	0.21	0.00	-	-
	6,716	391,345	5.83	1,206	0.18	1,204	2	-	0.18	0.00	-	-
	6,867	360,101	5.24	1,072	0.16	1,064	8	-	0.15	0.00	54,670	7.96
1989	7,018	293,093	4.18	1,275	0.18	1,243	32	-	0.18	0.00	13,788	1.96

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.

DOMINICAN R. - Malariometric Rates
1960-1989.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

In the Dominican Republic, there were 1,275 reported cases of malaria during the year in a population at risk of 6,969,827 which occupies 47,562 km2 and represents 99.4% of the total population and 98.2% of the national territory. The annual parasite incidence in 1989 was 0.18 per 1,000 population, while in 1988 it was 0.16. However, active malaria transmission is occurring in 22 of the 30 provinces into which the country is divided. Of these 22 provinces, 10 of them had 90.6% of the cases registered in 1989.

A total of 293,093 blood samples were collected and examined during the year, and 467,831 households were visited. A total of 1,275 cases of malaria were reported, of which 64% (816 cases) were autochthonous and the rest were imported (430 cases from Haiti and 29 from Venezuela). Of the slides examined, 82.8% (242,727) were the result of active case-finding, and 831 cases (65.2%) were detected. The rest of the slides and cases were the result of passive detection. Of all the cases, 97.2% were caused by P. falciparum and 2.5% by P. vivax (all imported), while the rest (two cases, also imported) were mixed infections. In the entire country, five fatal cases were confirmed, all in hospitalized patients between the ages of 14 and 26, with the male sex predominating (four cases).

The Dominican Republic's malaria program has a vertical structure, with national coverage, through which it carries out most of the passive case-findings.

The program has concentrated its epidemiological surveillance effort on the area near the Haitian border, with activities concentrated in four areas in particular, where the ABER is 39.5 and 25.5% of the cases are detected. However, epidemics have also been detected in the provinces of Barahona and Bahoruco, which, together with the large number of cases diagnosed in Pedernales, San Cristóbal, and Peravia, bears out the high cost of lack of participation by the general health services in epidemiological surveillance, detection, and treatment of malaria cases.

MALARIOMETRIC RATES - SURINAME

Year	Total population	Blood slides examined								Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	P.vivax	Other species	AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	275	46,687	16.98	2,703	9.83	2,343	30	330	8.52	0.11	92,468	336.25
1960	290	45,396	15.65	997	3.44	912	3	82	3.14	0.00	72,444	249.81
	299	36,424	12.18	646	2.16	596	50	-	1.99	0.00	35,338	118.19
	308	37,819	12.28	716	2.32	693	-	23	2.25	0.00	19,381	62.93
	308	67,696	21.98	1,882	6.11	1,845	10	27	5.99	0.00	25,079	81.43
	328	76,555	23.34	1,681	5.13	1,650	5	26	5.03	0.00	17,598	53.65
1965	338	47,744	14.13	4,311	12.75	4,282	7	22	12.67	0.00	21,791	64.47
	348	35,785	10.28	2,933	8.43	2,878	11	44	8.27	0.00	24,519	70.46
	359	25,479	7.10	1,786	4.97	1,766	1	19	4.92	0.00	9,596	26.73
	370	35,339	9.55	1,555	4.20	1,541	2	12	4.16	0.00	15,282	41.30
	381	38,194	10.02	741	1.94	734	1	6	1.93	0.00	6,892	18.09
1970	371	48,702	13.13	1,019	2.75	1,009	10	-	2.72	0.00	6,519	17.57
	370	52,306	14.14	1,546	4.18	1,545	-	1	4.18	0.00	4,423	11.95
	370	59,600	16.11	800	2.16	753	47	-	2.04	0.00	487	1.32
	370	59,448	16.07	1,948	5.26	1,925	23	-	5.20	0.00	2,565	6.93
	370	80,239	21.69	3,984	10.77	3,982	2	-	10.76	0.00	10,096	27.29
1975	360	79,327	22.04	2,741	7.61	2,740	1	-	7.61	0.00	9,335	25.93
	350	79,564	22.73	537	1.53	419	118	-	1.20	0.00	4,033	11.52
	360	67,501	18.75	993	2.76	945	48	-	2.63	0.00	2,379	6.61
	370	61,358	16.58	876	2.37	858	16	2	2.32	0.00	1,243	3.36
	360	80,060	22.24	903	2.51	786	116	1	2.18	0.00	2,198	6.11
1980	355	91,141	25.67	4,445	12.52	4,250	195	-	11.97	0.00	3,611	10.17
	357	61,880	17.33	2,479	6.94	2,228	251	-	6.24	0.00	3,384	9.48
	360	53,257	14.79	2,805	7.79	2,519	286	-	7.00	0.01	17,191	47.75
	365	58,538	16.04	1,943	5.32	1,604	339	-	4.39	0.01	98,761	270.58
	370	66,609	18.00	3,849	10.40	3,665	184	-	9.91	0.00	15,488	41.86
1985	375	56,953	15.19	1,635	4.36	1,380	255	-	3.68	0.00	7,855	20.95
	380	50,969	13.41	1,316	3.46	1,002	314	-	2.64	0.01	4,790	12.61
	386	29,368	7.61	2,044	5.30	1,678	366	-	4.35	0.01	-	0.00
	392	33,564	8.56	2,691	6.86	2,296	395	-	5.86	0.01	729	1.86
1989*	398	23,364	5.87	1,704	4.28	1,585	119	-	3.98	0.01	176	0.44

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fims examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
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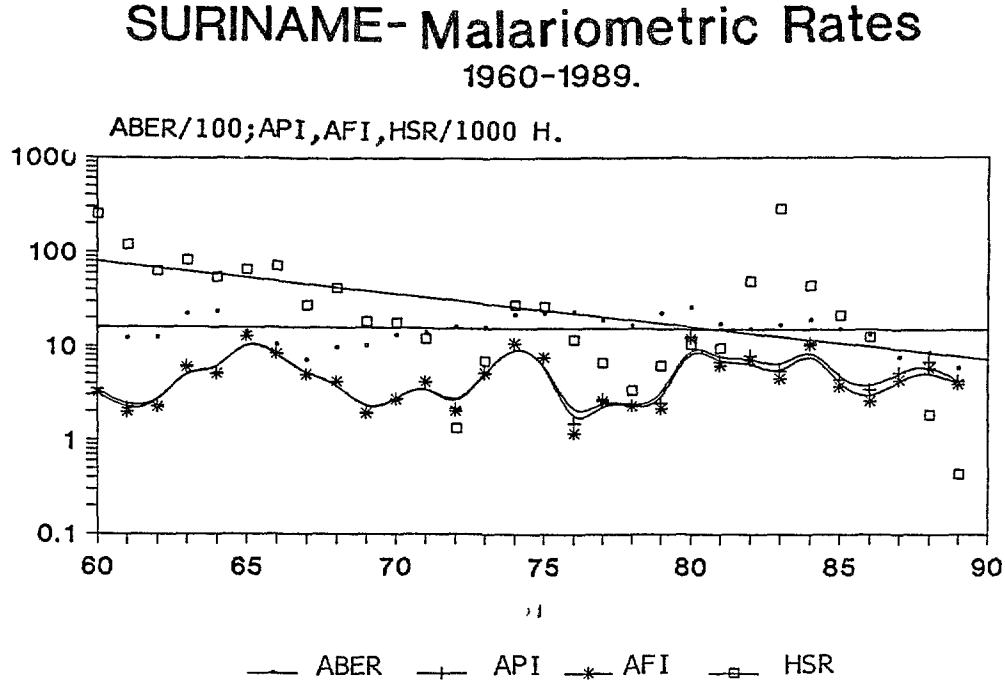
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.
* Emergency spraying only.



STATUS OF MALARIA PAHO/WHO
(FJLA/HS)

Suriname reported 1,704 cases of malaria, representing a reduction of 36.7%. However, case detection coverage was low, since the number of blood samples examined was 30.4% less. The figures therefore reflect difficulties in coverage by the services more than an improvement in the epidemiological situation. Epidemics have been traced to all the major river basins through cases detected in Paramaribo among immigrants from the interior. The high rate of population movement has given rise to small epidemics in localities on the coast.

Causes of Malaria Transmission

Table V.9 shows the principal risk factors bearing on the transmission of malaria.

The internal problem of guerrilla activities, with the consequent social unrest and impact on the effectiveness of health services coverage, have resulted in rapid deterioration of the epidemiological status of malaria in terms of its incidence and geographic spread. In addition to the country's traditional problems, including difficult

access by remote populations, there is high reluctance to spraying, resistance of P. falciparum to the antimalarial drugs, and intense border traffic.

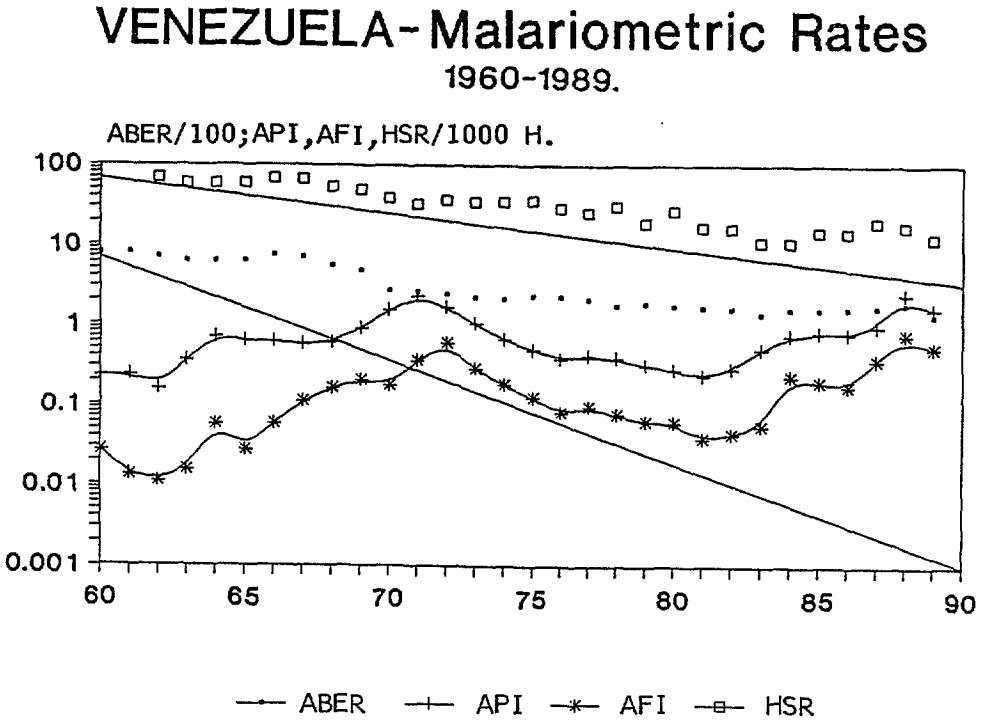
Control Activities in Border Areas

Along the border with French Guiana, detection activities and the treatment of cases are done through the general health services in Stoelmanseiland, but specific activities to control transmission have not been carried out since 1986. Bilateral commissions between Suriname and Brazil and Suriname and Guyana are meeting and exchanging information on various health matters.

MALARIOMETRIC RATES - VENEZUELA

Year	Total population	Blood slides examined									Sprayings	
		Number	ABER	Positive	API	P.falc. & Assoc.	Other P.vivax species		AFI	AVI	Number of sprayings	HSR
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
	7,086	503,777	7.11	911	0.13	126	762	23	0.02	0.11		
1960	7,365	564,669	7.67	1,674	0.23	194	1,468	12	0.03	0.20		
	7,627	600,511	7.87	1,754	0.23	98	1,630	26	0.01	0.21		
	7,926	548,240	6.92	1,210	0.15	86	1,107	17	0.01	0.14	540,069	68.14
	8,225	499,944	6.08	2,853	0.35	124	2,707	22	0.02	0.33	479,865	58.34
	8,525	518,313	6.08	5,884	0.69	471	5,406	7	0.06	0.63	490,884	57.58
1965	8,824	545,035	6.18	5,364	0.61	237	5,100	27	0.03	0.58	522,616	59.23
	9,123	667,540	7.32	5,481	0.60	518	4,916	47	0.06	0.54	611,665	67.05
	9,423	650,682	6.91	5,257	0.56	1,020	4,215	22	0.11	0.45	623,926	66.21
	9,620	527,453	5.48	5,735	0.60	1,531	4,144	60	0.16	0.43	505,452	52.54
	9,940	468,158	4.71	8,740	0.88	2,017	6,652	71	0.20	0.67	492,476	49.54
1970	10,280	271,449	2.64	15,288	1.49	1,803	13,465	20	0.18	1.31	397,766	38.69
	10,612	268,615	2.53	23,626	2.23	3,762	19,860	4	0.35	1.87	343,936	32.41
	10,939	262,955	2.40	18,062	1.65	6,447	11,608	7	0.59	1.06	403,867	36.92
	11,280	245,733	2.18	11,687	1.04	3,213	8,470	4	0.28	0.75	390,822	34.65
	11,632	240,547	2.07	7,648	0.66	2,109	5,535	4	0.18	0.48	407,293	35.01
1975	11,993	275,048	2.29	5,952	0.50	1,502	4,448	2	0.13	0.37	436,744	36.42
	12,361	274,308	2.22	4,768	0.39	1,017	3,747	4	0.08	0.30	358,814	29.03
	12,737	266,052	2.09	5,304	0.42	1,246	4,047	11	0.10	0.32	326,600	25.64
	13,122	226,546	1.73	5,065	0.39	1,025	4,032	8	0.08	0.31	405,717	30.92
	14,550	272,409	1.87	4,722	0.32	928	3,789	5	0.06	0.26	279,186	19.19
1980	15,024	241,953	1.61	3,901	0.26	862	3,035	4	0.06	0.20	377,080	25.10
	15,487	239,051	1.54	3,377	0.22	562	2,801	14	0.04	0.18	241,749	15.61
	15,944	236,380	1.48	4,269	0.27	660	3,591	18	0.04	0.23	239,213	15.00
	16,397	226,229	1.38	8,400	0.51	929	7,465	6	0.06	0.46	180,940	11.03
	16,853	259,099	1.54	12,242	0.73	3,823	8,416	3	0.23	0.50	179,645	10.66
1985	17,317	276,020	1.59	14,305	0.83	3,447	10,854	4	0.20	0.63	257,598	14.88
	17,790	289,504	1.63	14,361	0.81	3,139	11,221	1	0.18	0.63	257,688	14.48
	18,270	311,055	1.70	17,988	0.98	6,851	11,137	-	0.37	0.61	359,731	19.69
	18,756	346,616	1.85	45,827	2.44	14,579	31,233	15	0.78	1.67	328,827	17.53
1989 *	19,245	253,042	1.31	31,078	1.61	10,138	20,937	3	0.53	1.09	239,315	12.44

a) Estimated population, in thousands of inhabitants. (hs)
b) Number thick blood fimls examined during the year.
c) ABER = Annual Blood Examination Rate, per 100 inhabitants.
d) Number of positive slides, i.e.,showing Plasmodium in at least 100 microscopic fields.
e) API = Annual Parasite Incidence, per 1000 inhabitantes.
f) Number of slides showing P. falciparum and other associated plasmodia.
g) Number of slides showing P. vivax.
h) Number of slides showing P. malariae and/or P. ovale.
i) AFI = Annual P. falciparum Incidence during the year, per 1000 inhabitants.
j) AVI = Annual P. vivax Incidence during the year, per 1000 inhabitants.
k) Number of house sprayings during the year, regardless of cycles and insecticides.
l) HSR = House spraying rate, per 1000 inhabitants.
* Informacion hasta septiembre.



STATUS OF MALARIA PAHO/WHO

(FJLA/HS)

Venezuela registered more cases in 1989 than in 1988, for a 19% increase, which was accompanied by an increase of 28.3% in the budget allocated specifically for the national malaria control program.

Malaria transmission in Venezuela is divided into geographical regions with high rates of transmission (Figure V.8)--namely: (a) the southern region, corresponding mainly to Bolívar State; (b) the western region, which borders on Colombia; and (c) the eastern region around Sucre State.

Bolivar State had 61% of all the cases registered in the country during 1989; the municipio of El Dorado had more than 80% of all the cases in the entire state. This is the wealthiest region of the country in terms of gold and diamonds. There are other highly malarious areas in the municipios along the Orinoco River and also in Santa Elena, a locality on the Brazilian border.

Thirteen percent of all the cases in the country are from the western region. The municipios that border on Colombia had the highest number of cases.

Nineteen percent of the country's reported cases were from the eastern region, where the municipios located on the gulfs of Cariaco and Paria had the highest transmission.

The percentage distribution of malaria cases in Venezuela in 1989 is shown graphically in Figure V.9.

Causes of Malaria Transmission

Bolívar State has a mining population of more than 50,000, the majority of whom live in the municipio of El Dorado. This unstable population, with its disorganized settlements, is disrupting the ecological balance and is considered the prime cause of transmission. In addition, commercial exchange between the miners and the local cities has produced a resurgence of malaria in the latter. This explanation can also be invoked in the case of the municipios located along the Orinoco and those in Santa Elena on the Brazilian border, where there are also mines. With the entry of garimpeiros from Brazil, other border municipios have also had increases in transmission. It is important to mention that the vector in this region is Anopheles darlingi.

In the western region near the Colombian border, the principal cause of high transmission appears to be the migration between Colombia and Venezuela to work in the agricultural fields and engage in trade. This happens, in particular, between Cúcuta (Colombia) and San Cristóbal (Táchira State, Venezuela) and between Puerto Carreño (Colombia) and Puerto Ayacucho (Amazonas Fed. Terr., Venezuela). Transmission has declined in this region in recent years, probably because of reduced migration from Colombia to Venezuela owing to the country's current unfavorable economic situation. There is also evidence that some cases come from Bolívar State, which has shown increased local transmission. Graphs are not available on this subject.

In the northern states of Apure, Barinas, and Táchira the principal malaria vector is Anopheles nuñeztovari, which is refractory to household spraying with insecticides. This is apparently due to the fact that the mosquito does not rest on indoor walls. It is therefore difficult to control malaria using traditional methods.

In the eastern region, mainly in the state of Sucre, the critical economic situation has caused many workers to look elsewhere for jobs, with heavy migration to Bolívar State, especially to the mines and agricultural fields. At the same time, the river trading route through the Orinoco delta has been a source of malaria resurgence in this region. The principal vector in the eastern region is Anopheles aquasalis (=emilianus), which is also refractory to the classical methods of household spraying and therefore difficult to control.

Control Activities in Border Areas and Border Treaties

Throughout the country, control activities consist basically of periodic application of insecticides through household spraying. In cases of emergency, space-spraying is also done. In the border areas in the eastern and western areas of Venezuela, household spraying is done every three or four months with fenitrothion. The number of malaria cases in the eastern area increased from 4,995 at 5,513 in the two last years. Patients diagnosed with malaria due to P. vivax are treated with primaquine and chloroquine. For cases due to P. falciparum , fansidar, amodiaquine, and quinine are used.

In Bolívar State, household spraying with DDT is applied every six or 12 months, but because of the increase in unstable settlements of miners and new cases of malaria, the classical malaria control operations have not been adequate. For this reason, a cooperation agreement was signed in 1989 between the Ministry of Health and Social Welfare, the Bolívar State Government, and the Venezuelan Guayana Corporation to carry out a joint program that will make it possible to improve malaria control in the state. As a result, operations and sanitary facilities have been improved, equipment has been increased, and a plan has been undertaken to reduce malaria incidence based on stratification techniques. It is still too early to evaluate this joint effort and determine whether it has made an impact.

The only bilateral treaty or border cooperation agreement is the one between the Governments of Venezuela and Guyana, signed in November 1988, which establishes, in principle, a cooperation agreement to combat malaria in areas of mutual epidemiological interest. So far, two technical meetings have been held, and cooperation has already begun. Control measures have been discussed and standardized, agreements have been produced to evaluate antimalarial drugs and insecticides, and training programs have been carried out. This agreement is conceived as a long-term plan that will make it possible to set up bases for mutual cooperation and malaria control in areas of common interest. However, it is still too early to judge the impact.

II. PROBLEMS IN THE DEVELOPMENT OF CONTROL PROGRAMS

The problems faced in malaria control have been divided into two broad groups: technical and administrative.

The technical problems involve the bio-environmental elements that intervene in transmission of the disease--that is, the malaria parasite or causative agent, the anopheline mosquito vector, man in his dual capacity of parasite reservoir and susceptible host, and the environment in which the biological elements interact and produce transmission of the disease. The administrative problems are related to the functional capability of the responsible institutions to plan and carry out control measures; basically, they have to do with the availability of human resources, timeliness in the allocation of financial resources, and administrative and managerial capability.

1. Technical problems

1.1 Malaria control, especially in the last three decades, has been based almost exclusively on household application of residual insecticides for control of the adult anopheline vector, on presumptive treatment of suspected cases of malaria, and on curative treatment of patients verified by parasitoscopic diagnosis. These actions were effective when the malaria campaign was being carried out in areas where there was a stable population with predictable migration habits and in an ecological environment that could be modified by social development, which made it difficult for the mosquito vectors to adapt. However, interventions against the vector and the parasite have given rise to reactions in both cases, producing vector resistance to insecticides and P. falciparum resistance to the antimalarial drugs, which now represent two of the technical problems in malaria control (Table II.18).

In addition to the foregoing problems there are also those caused by man or related to his attitudes and practices.

While technical problems associated with the vector and the parasite have kept control measures from producing their hoped-for effect, it is the problems of social origin that are most frequent, most notable, least studied, and, because of their complex origin, most difficult to manage and find solutions for.

1.2 The effectiveness of household application of residual insecticides for malaria control depends on whether the malarious area to be protected has the right combination of factors, such as physiological susceptibility of the vector to the insecticide used, susceptibility of vector behavior in terms of indoor eating and resting habits, and feasibility of applying the insecticide on the walls and interior surfaces of dwellings. This last factor is

necessary in order for the insecticide to have prolonged action over time through its residual effect. DDT is the most widely used insecticide, both because it is the most economical in terms of price and because it has a significant residual effect.

The absence of one or more of the factors listed leads to problems in the control of malaria with insecticides.

The physiological resistance of anophelines to the insecticides used for their control has been one of the technical problems most frequently blamed for shortcomings in malaria control. Its role varies with the intensity and extent of resistance (Table II.18).

Resistant behavior of anophelines vis-à-vis insecticides also has been an obstacle that has reduced the effectiveness of some of the insecticides in malaria control. This may be because the anophelines avoid contact with the insecticide, because it is applied before or after they have fed indoors, or because by natural habit some of the anophelines tend to feed and/or rest out-of-doors.

Countries such as Mexico, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Colombia, Ecuador, and Venezuela have encountered resistance on the part of one or more of its anopheline vectors to one or several of the insecticides used for control, and/or they have found anophelines with eating and resting habits that do not bring them into contact with the insecticides applied indoors.

These biological and ethological adaptations of anophelines may be the consequence of extensive utilization of pesticides in the environment (agriculture), or perhaps the result of natural selection of anopheline populations that avoid contact with the residual insecticide.

It frequently happens in endemic regions, especially in rural or jungle areas of developing countries, that there are no walls on which the insecticide can be applied. The advantage of having walls is that the insecticide's residual effect poisons the anophelines that come in contact with it when they rest on the sprayed surfaces, and this intervention interrupts the transmission of malaria. The detailed identification of the areas in question, and the exact quantification of the frequency with which the lack of walls occurs, has not been taken into account in the planning of spraying operations, yet this measure constitutes the principal intervention to control the disease. As a result, insufficient application of insecticide owing to the lack of complete surfaces leads to failure to produce the hoped-for effect. Even though this problem has been identified, sometimes the spraying is continued instead of looking for and applying alternative interventions that are effective in such situations.

1.3 Resistance of P. falciparum to chloroquine was first seen between 1961 and 1964 in Brazil, Colombia, Guyana, and Venezuela. Subsequent studies carried out in several countries have verified the widespread presence of P. falciparum strains that are resistant not only to chloroquine but also to amodiaquine and to pyrimethamine in combination with long-acting sulfa drugs.

The geographical distribution of resistance, especially the proportional distribution of the different degrees of resistance, varies in the countries where P. falciparum exists.

The presence of P. falciparum infections resistant to one or several of the antimalarial drugs has been observed in varying degrees of intensity in Bolivia, Brazil, Colombia, Ecuador, Guyana, French Guiana, Panama, Suriname, and Venezuela.

In countries such as Haiti and the Dominican Republic, despite the absolute prevalence of P. falciparum infections, no resistance has been found up to now.

In Mexico, the countries of Central America, Panama, and Belize, P. falciparum infections are less frequent than in the rest of the countries and no resistance has been described up to now.

P. falciparum has a higher relative prevalence in the jungle border areas, where the population is very mobile owing to agricultural expansion or mining activities. These areas also have a greater frequency of infections with P. falciparum strains that are resistant to antimalarial drugs. The mobility factor favors greater man-vector contact in a numerous population in which some are carriers of the parasite and others are susceptible to infection. The sudden increase in the parasite population gives rise to epidemic outbreaks with high rates of morbidity and mortality. In these areas, the absence of social control, together with limited health service coverage and therefore scarce resources for the early diagnosis and timely treatment of infections, adds to the frequency of serious infections and the risk of dying from malaria.

1.4 The malaria control problems associated with social factors are multiple and have varying origin.

The difficulties that stand in the way of their solution are impressive and complex, because the actions depend more on the health sector itself than almost any other sector of national development. However, the solutions proposed for minimizing the harmful effect of such problems on the health of the population, particularly in the case of malaria control, correspond basically to the health sector because it has the epidemiological instruments to identify and assess the risk of illness or death from such causes, and, as a result, they can propose the intersectoral interventions that will be appropriate for reducing or eliminating the causal factors.

Herein lies the purpose of the integrated epidemiological risk approach that has been adopted for malaria control, as well as the value of the epidemiological stratification of the malaria problem that is offered as a strategy for achieving this objective. Once the risk factors for malaria have been assessed and the necessary interventions have been selected to control them, while at the same time the different national sectors related to execution of the corresponding interventions are identified, it will be up to the health sector to assume the responsibility of obtaining intersectoral participation and coordinating its implementation.

Some of the socioeconomic situations that relate to vector-borne diseases, including malaria, are the following:

a. National development is demanding that new lands be cultivated, that lines of communication be extended to the jungle areas undergoing agricultural expansion, that the extraction of natural resources be increased, that new areas for employment be explored, that hydroelectric dams be built, etc.

   Such activities lead to situations that present high risks for malaria, such as: internal migrations corresponding to the planting and harvesting seasons; penetration of settlers and their families, usually in jungle areas where disease vectors abound; construction of precarious temporary dwellings without even minimum protection facilities, which place the residents at a disadvantage relative to the vectors' assault; and lack of basic infrastructure in terms of not only health and sanitation but also education and political and administrative authority, which leaves the population in these conditions completely to their own devices. There are also risks that stem from inadequate use of water resources in flood-based irrigation systems, as with rice and banana crops, poorly built dams and irrigation canals that turn into anopheline breeding sites, and waters that become stagnant after long periods of rain and overflowing rivers.

   The situations mentioned are very often foreseeable, either because they are the product of an official or private national, regional, or local development project or program, or because they follow the seasonal crop or rain cycles that are known in the region.

   The problem for malaria control in such circumstances lies, first, in identifying interventions that are appropriate to each risk situation and assessing its impact on transmission; and second, in coordinating with the responsible health agencies and those concerned with malaria risk-producing situations during the planning or programming phases in order to report, discuss, and guarantee sectoral participation in the different execution stages of projects at such times as it may become necessary to introduce control interventions.

1.5 The Amazon Basin. This American macroregion brings together the special geographical and ecological characteristics described, which make for the particular epidemiological situations that are linked to the development of its social and economic infrastructure. This ecological macrosystem includes extensive areas of Brazil, Bolivia, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname, and Venezuela.

Actions for infrastructure development through various projects such as road-building, colonization, agriculture and livestock-raising, and utilization and extraction of natural resources create various situations that increase the risk of illness or death from malaria. The Amazon Basin produces nearly three-fourths of all the malaria cases registered annually in the American Hemisphere, as well as 95% of the cases of P. falciparum, with a percentage of infections that are resistant to chloroquine. These circumstances indicate the need to plan and implement development activities in the areas indicated, taking into account the risks of illness or death from malaria and ensuring that the process is adapted to local situations, strengthened by the use of existing multisectoral resources, and based on community participation (Table II.18).

2. **Administrative situations that hamper malaria control**

2.1 The technical problem of vectors resistance to insecticides, even though it may be solved through the use of alternative insecticides, can sometimes become an administrative problem because of the financial resources needed in order to meet the high cost of the substitute insecticides and their application. The residual effect of the substitute insecticides is not as great as that of DDT, and they need to be applied more frequently.

2.2 Early diagnosis and adequate and timely treatment of malaria infection, as well as epidemiological surveillance to avoid recurrence of the disease in areas where transmission has been interrupted, are activities that should be carried out daily by all the institutions in the health sector. Despite the consensus regarding this need, there is still the problem in the countries that the health authorities expect such fundamental prevention and control actions to be carried out almost exclusively by the specialized malaria services without any participation by the general health services. Thus, the problem of inadequate diagnosis and treatment of patients and the lack of other epidemiological surveillance actions for prevention and control arises from a lack of administrative decision.

2.3 Some of the personnel in the general public health services, which vary in number and category in each country, are not adequately informed and familiarized with malaria prevention and control activities because of the segregation of services that has existed in the past. In order to incorporate epidemiological surveillance

actions for malaria into the general health activities, it is necessary to update the knowledge of such personnel and train them for comprehensive performance in their public health activities. The problem that has been identified in malaria prevention and control, as well as the lack of intrasectoral participation and integration, is administrative, inasmuch as it refers to the need for manpower training and the integration of functions.

2.4 The methodology originally designed to eradicate malaria is still being used in many countries, although the name of the eradication services has been changed and the current objective is no longer eradication but rather control of the disease. The continued use of some of the practices from the eradication strategy that are not necessary for control (e.g. active case-finding, comprehensive coverage with spraying in areas without transmission or in areas with dwellings without walls, radical treatment, epidemiological investigation of all cases, etc.), takes up resources that could be redistributed and utilized effectively in integrated control at the local level based on the epidemiological risk approach, which would yield a cost benefit. The presumption exists that in some countries, once cost-effectiveness and cost-benefit analyses have been carried out, current resources, which are considered insufficient, would be adequate for carrying out more efficient and effective control. The malaria control problems in this area could be solved by improving administrative management.

2.5 Malaria programs are currently focused on designing prevention and control interventions which can be carried out in an integrated manner with intersectoral participation within the context of the primary health care strategies. However, there are some difficulties in implementing this strategy, such as inadequate health services infrastructure for efficient local health systems, frequent financing shortages that affect the national health systems, insufficient human resources of the quality and training level needed for communicable disease surveillance and control, lack of integrated statistical information systems that are capable of producing reliable and timely data for decision-making at the local level, lack of sufficient locally available resources for early diagnosis, and lack of essential drugs for timely treatment of the local forms of the disease.

3. Generation of knowledge

There are still gaps in our knowledge about the dynamics of malaria transmission and appropriate interventions for reducing or eliminating the risks of contracting the disease, although there has been renewed interest in multidisciplinary research on malaria.

One of the major problems for malaria control is the lack of sufficient knowledge about effective ways to protect man when he invades the natural ecosystems of the vector and the parasite and alters these systems with his agricultural and mining practices, disrupting the local biological equilibrium and thereby placing himself at a disadvantage and at serious risk of illness or death from malaria without being able to implement effective measures in his defense.

From all this it may be deduced that there is still need to expand research, both basic and operational. The aim of the first is to contribute to knowledge about the natural history of the current endemic disease through the use of molecular biology to characterize the plasmodia, the vectors, and pathogenesis, so that resources can be developed for protection against them. The aim of the second is to help solve the problems of ecological imbalance resulting from contemporary socioeconomic development and to generate techniques and methods for individual and collective protection both in areas where the malaria situation has gotten worse because of agricultural and mining practices and in areas where social development has made it possible to devise intersectoral strategies for demographic management, social protection, and maintenance of the ecological balance.

4. In summarizing this chapter, it is appropriate to cite the XXXVII Report on the Status of Malaria Programs in the Americas, presented in 1989, because the reasons behind the situation have not changed: malaria transmission has a common origin in various biological, environmental, social, economic, political, and administrative factors. Actions aimed at the prevention and control of these factors should be directed toward eliminating or minimizing the risks therefrom and should be carried out with the participation of the corresponding national sectors. The endemic disease affects different human groups with varying intensity in different ecological environments within a single country, which means that the groups at risk should be stratified and different interventions carried out, as appropriate, in each local malaria situation. Since it is not feasible to attain the goal of short-term eradication simultaneously throughout the malarious area, integrated control and with realistic goals is the alternative that makes it possible to diversify and to supplement prevention and control measures based on the local malaria situation, using all the available resources, among which local health systems, intersectoral cooperation, and community participation are fundamental.

5. Table 23 gives a summary of the malaria control problems that have been identified by the countries.

III. ADVANCES IN MALARIA RESEARCH

This chapter summarizes only a small part of the studies done in or outside the Region by researchers from the Americas. There information was selected because of its actual or potential importance for the prevention and control programs. Unfortunately still there is a relative lack of interest to carry out research on the social and the epidemiological aspects of the problem.

Funds for malaria research from countries of the region or funds from International agencies for research in the region are shown in the table on the following page.

1. Epidemiology

Imported malaria is becoming an important subject in the Region. In countries like Canada and the USA the finding of patients with resistant strains of P. falciparum has had stressed the need for availability of new therapeutic schemes (see Section V). In other countries, imported malaria had began to be considered. Such is the case in Trinidad and Tobago, in which it was recently determined the number of imported cases of malaria which entered the country from 1968 to 1986. A total of 84 cases of imported malaria was detected; in 44 the agent was Plasmodium falcparum, in 25 P. vivax, in 11 P. malariae, in one P. ovale, and three were mixed. The monthly incidence of malaria showed that July and August accounted for 41% of all imported malaria cases. Most malaria cases were diagnosed among male patients (74.3%) whereas the most significant age group contracting malaria was 20-29 years. Twenty-seven percent of the persons contracting malaria were Trinidadians, while tourists, seamen and contract officers accounted for 21%. The African continent was responsible for 60%, India 25% and South America 12% of the imported malaria cases diagnosed and treated in Trinidad. Trinidadians of Africa and East Indian descent accounted for 78% of all imported malaria cases. The need to maintain port surveillance was further emphasized. (1)

Results on the epidemiological situation in relation to Malaria in French Guyana were also reported last year. Before 1949 malaria was highly prevalent in the whole territory of French Guiana. When malaria control based on house-spraying and drug prophylaxis was implemented in the 1950's the disease sharply dropped below 20 cases per year. Since 1976 despite vector control operations, malaria is on the rise again. In 1987, 3,269 cases have been notified giving an incidence of 37.6 per thousand for the whole country population only four deaths were recorded. All the age groups were concerned but the transmission was restricted to some foci along the Oyapock river (prevalence rate 25%), along the Maroni river (prevalence 2.3%) and in a few places of the coastal area. The main cities remain malaria free. In vivo resistance to chloroquine was observed in 22% of the cases which could be cleared by amodiaquine or quinine. (2)

FUNDS FROM COUNTRY AND INTERNATIONAL AGENCIES FOR MALARIA RESEARCH
IN THE AMERICAN REGION, 1985-1989 *

Agency	1985	1986	1987	1988	1989
International Development Research Center, Canada	38,433	---	---	364,157	53,831 x,a)
Board on Science and Technology for International Development, Institute of Medicine/National Academy of Sciences, USA	244,176	228,900	187,604	97,012	44,132 x,b)
National Institute of Allergy and Infectious Disease, National Institutes of Health, USA	5,708,000	5,993,424	6,122,927	6,803,213	7,842,896 +,c)
Agency for International Development, USA	12,500,000	9,900,000	12,000,000	10,000,000	8,500,339 +.c)
USA Army and USA Navy	5,220,000	5,225,000	6,176,000	5,973,000	7,685,000 +,e)
Pan American Health Organization World Health Organization (PAHO/WHO)	334,500	488,125	741,400	998,803	454,000 x)
Special Programme for Research and Training in Tropical Diseases UNDP/World Bank/WHO (TDR)	1,756,432	1,364,449	1,446,211	1,746,119	2,120,128 x)
Brazil **	---	250,000	759,248	50,000	532,930
Colombia **	---	25,000	80,000	---	---
Mexico **	---	50,000	270,000	339,337	812,528

* In USA dollars, except otherwise indicated.
x) Calendar year, 1989. +) Fiscal year, Oct 1988-Oct.1989.
a) Canadian Dollars. Project in Perú.
b) Field Research on mosquitoes done in Colombia, Mexico and Venezuela.
c) Funds for institutions in the USA.
d) Most of the funds for Institutions in the USA
e) Most of the funds for Institutions in the USA. Funds are also allocated to projects in other countries, including Brazil, Mexico and Peru.
** Funds converted into USA dollars, according to the average official exchange rate for the year.

The distribution of malaria in foci inhabited by quite different ethnic groups calls for specific studies. Along the Oyapock on the Brasilian border and along the Litani on the Surinam border, incidence among American Indians and Creoles ranges from 300 and 900 per thousand; Plasmodium falciparum accounts for 65% and P. vivax for 35%. Along the middle and lower Maroni on the Surinam border, the Boni and Ndjukas Negroes move freely through the frontier. Since the civil strife, Surinamese used to attend health centres of French Guyana. Therefore it is difficult to find the sources of contamination and the incidence among French Guyana citizens; P. falciparum is the only parasite recorded in this focus. In 1987 a small outbreak mainly due to P. vivax, occurred in a Lao refuges village in the hinterland. The coastal foci harbour large communities of Haitian and Brazilian immigrants. The vector is Anopheles darlingi and up to now there is no evidence that other species could be involved. The rise of malaria despite of control measures involves several factors: the house spraying is no more accepted by a large percentage of house holders and the alternative larviciding has only limited efficacy; the houses of American Indians have no walls to be sprayed; there is a continuous introduction of parasites by migrants. It has been said that vectors have change their behaviour toward exophily but such a statement has not yet been supported by evidence. All these factors should be taken in account to improve malaria control. (2)

A sero-epidemiological study of malaria, with special emphasis on Plasmodium brasilianum/P. malariae, was conducted on 4 Indian tribes living in the Amazon Basin of northern Brazil; the Arara, the Parakana, the Asurini, and the Metuktire. The incidence of malaria, as determined by blood films, was very low in all tribes. Parasitemia levels in most individuals were less than 0.02%, determination of the plasmodial species was not feasible. High levels of antibodies to both blood stages and sporozoites were detected for P. brasilianum/P. malariae, P. falciparum and P. vivax. The anti-sporozoite antibody response against all 3 plasmodial species was age related. All of the Metuktire adults and almost 90% of the Asurini adults had anti-sporozoite antibodies against P. brasilianum/P. malariae. The presence of P. brasilianum was confirmed in the indigenous monkeys by blood films and serology. This suggested that the monkeys, which are often kept as pets, serve as reservoir host. Anopheles darlingi mosquitoes, infected with P. brasilianum/P. malariae, were found in the study area. (3)

The effects of prolonged low-intensity warfare on the community-based malaria control efforts was described in Nicaragua. In this country, post 1979 malaria control programme is based on community participation by means of health education and in mosquito breeding site drainage, expanded case finding, and increased availability of chemotherapy. Mosquito resistance and increasing costs have forced a reduction in the use of residual insecticides. The number of reported malaria cases in the country fell from 25,465 in 1980 to 15,702 in 1984, while the ratio of blood smears total population increased from 86 to 137 per 1000 people. Malaria incidence in the eight states of the country under heaviest military attack in the current war was compared to

incidence in the eight states least affected by the war. In the war zone there was a 17% excess in cases from August 1983-April 1985 above a 1974-82 baseline average, while there was a 62% decline in the number of cases in the non-war zone. (4)

2. Social and Economic Research*

A recently completed study in Colombia, has provided insight into the perceptions, problems and coping strategies of families in La Tola, Colombia with respect to malaria, as well as the costs borne by them.

La Tola, a community of about 2,000 population on the Pacific Coast, is located on a river bank and lacks easy access to the rest of the country. It is very poor, the river is contaminated and it suffers from extreme humidity. Malaria is a serious problem in the area, both P. vivax and P. falciparum. For example, in a blood survey in July 1987, of the 48 positive cases of malaria, 55% were P. vivax and 45% P. falciparum.

Community participation in local activities was, however, impressive and has been responsible for a relatively advanced educational, social and health services in the area. The community was also intricately involved in the facilitation of the research project, implying that the results of this research will be of considerable interest to community members, and will hopefully be utilized to improve the situation.

The study design was complex and involved a large number of questionnaires to various family members such as patients, care-givers, and replacements of sick members, and key community members. A combination of questionnaires, time-use charts, consumption charts and community cards provided detailed information on people's activities which were important for the calculation of time lost due to illness and substitution effects. In-depth observational and anthropological data was also collected.

The most important findings were that people are concerned about health as a fundamental part of overall wellbeing and self-sufficiency. Their conceptions of malaria combined a mixture of modern and traditional beliefs, some correct, some incorrect. The large majority (75%) had suffered from malaria and had been incapacitated for an average of eight days, and reported significant time and income lost as a result of their illness.

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* Kindly prepared by Dr. C. Vlasoff, Secretary Steering Committee on Socioeconomic Research. UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR).

The study found that, on average, families spent Ps. 711 on direct monetary costs associated with each case of malaria. This corresponds to slightly less than one day's wages at minimum wage rates. Diagnosis and drugs were freely provided by the malaria control service, but the costs of each case to the malaria service was, on average, Ps. 400, raising the cost per patient to Ps. 1111. Overall household lossses are still, of course, higher, because of time lost for foregone activities such as production, education and household maintenance.

Women were almost exclusively the care-takers for malaria patients, and even when they were ill they hesitated to admit it because it was felt that this indicated weakness of her part and a failure to fulfill her expected role. Women, it was found, generally did not take care of themselves adequatedly and tended to put off treatment until the disease had progressed to more severe dimensions, and then became more ill and took longer to recover.

Interestingly, community perceptions of the disease were found to be very accurate. For example, community members stated that the most affected groups were children and young people, and that malaria was higher in the urban area of La Tola than in the surrounding areas. Prevalence data confirmed these results. This finding, in combination with the strong community commitment, leads one to conclude that the potential for greater involvement of community members in preventive and control activities may be considerable.

3. Diagnosis

The standard method for malaria diagnosis is the detection of parasites by examination of thick stained blood films. This method is sensitive (limits of detection are 10-20 parasites/ul blood) when performed by a skilled microscopist, but labor intensive. On the other hand, serological methods, are easiest to perform but are unable to distinguish between active and previous infections and in general are useful only for certain epidemiological studies.

A variety of DNA probes have been developed which are able to detect Plasmodium falciparum DNA in infected blood. The sensitivity and specificity of one of this DNA probe have now been extensively field tested in comparison with those of conventional microscopic examination of blood films from 1179 patients. Using improved techniques, sensitivity of the DNA probe was 89% when compared to microscopy. It was concluded that the DNA probe method compares favorable with conventional microscopy in detecting parasite densities as low as 25 parasites per microliter of blood. A significant advantage of the DNA probe method is that it utilizes a standardized procedure which can simultaneously and reproducibly analize a large number of samples without opportunity for significant reader bias. (5)

Another DNA probe for P. falciparum was tested in the field to compare its sensitivity and specificity with that of light microscopy.

In 2 studies in Thailand, 1,397 patients were tested. Microscope slides were prepared in a standard fashion and examined by clinical techniciansand expert microscopists. The DNA probe method compares favorably in sensitivity with routine microscopy, detecting parasite densities as low as 40 parasites/microliters blood in the first study and, after modifications, 20-25 parasites/microliters blood in the second. Modifications included the elimination of salt from the lysis buffer, increasing the pH of the lysis buffer, and use of nylon based hybridization membranes instead of nitrocellulose. The DNA probe method offers the advantage of a standardized procedure that can be used in a batchwise fashion on a large number of samples (6). Not so good results were found when probes were used for early diagnosis of malaria. Using blood from volunteers with sporozoite induced malaria, a comparison was made on the sensitivity and specificity of Giemsa stained thick film examination, in vitro culture, and 4 different DNA probes for detecting parasitemia. Between 9 and 13 days after sporozoite inoculation, patent parasitemia (4-550 parasites/ul) was detected by thick film examination of 0.5 ul blood in 7 volunteers. Cultures of 1 ml blood obtained 7 days after sporozoite inoculation were positive in all volunteers who eventually developed patent prasitemia. The DNA hybridization probes detected parasites in only 5-28% of smear -or culture- positive samples. (7)

A system for the sensitive and accurate diagnosis of all four species of malaria parasite that are pathogenic in man has been also reported. It involves hybridization of oligonucleotides complementary to species-specific regions of the RNA of the parasite small ribosomal subunit followed by autoradiography. The method retains its specificity even under conditions of very low stringency similar to those that will occur in field diagnosis. Direct application of treated blood to nylon is possible and consistently results in the detection of fewer than 10 parasites by autoradiography in overnight exposure. The target rRNA is stable even in dehydrated cells (8). Although this method is promising, its application to field condition still needs to be developed further.

In the last few years, a number of different recombinant and synthetic peptides consisting of the repetitive sequence of the Plasmodium falciparum circumsporozoite protein (NANP)n have been produced and used to develop immunoassays for the detection of antibodies against P. falciparum sporozoites in human sera. A comparative study of three enzime-linked immunosorbent assays (ELISA) that employed different (NANP)n pepetides (the synthetic pepetides (NANP)3 and (NANP)40 as well as the recombinant peptides R32tet32 and R32LR) was carried out using serum samples from individuals who were living in different endemic malaria areas. The results obtained for these peptide-based ELISAs were compared with those obtained for an immunofluorescence assay (IFA) that used glutaraldehyde-fixed sporozoites. All the methods tested exhibited 100% specificity on sera from persons not exposed to malaria, good reproducibility (coefficients of variation ranged from 3% to 15% for peptide-based ELISAs), and good sensitivity. Reproducibility and sensitivity were lower for the IFA than for the peptide-based ELISAs, perhaps because of the subjective element in the interpretation of the

results which is inherent to the IFA method. ELISAs based on peptides that contain a higher number of (NANP) repeats, i.e., (NANP)40 andR32tet32 or R32LR, gave results which correlated better with each other than with those obtained with the ELISA that employed a shorter (NANP)3 peptide. (NANP)n-based ELISAs are relatively simple and inexpensive methods for the detection of anti-P. falciparum sporozoite antibodies and can readily be used in epidemiological research in the field. (9)

An enzime-linked immunosorbent assay (ELISA) for circulating IgG mouse antibody to Plasmodium falciparum circumsporozoite (CS) protein was modified for use with human sera from an area endemic for malaria and from individuals never exposed to malaria. The results for the detection of anti-CS IgG correlated well with those of sporozoite immunofluorescence antibody assays. Modification of the ELISA method allowed for the simultaneous detection of anti-CS IgG and IgM antibody on a single serum sample in the same well of the microtitration plate in dried whole-blood samples collected on filter-paper. The assay has been used to monitor human antibody levels in a phase-1 malaria vaccine trial and in longitudinal studies of malaria transmission in Thailand and Kenya. (10)

Encouraging reports were made on previous years on the use of a rapid diagnostic test for malaria based on acridine orange staining of centrifuged parasites in a microhaematocrit tube ("QBC" tube). It has been proposed as a device that promises to replace the well established procedures for diagnosing malaria in clinical practice. The method is simple, sensitive, and rapid. Species of malaria can be discriminated and intensity of parasitemia measured (11). Now this test was compared with the thick blood smear in 12 volunteers experimentally infected with Plasmodium falciparum, 408 residents of a malaria endemic area, and 180 hospital patients with suspected malaria. In the experimentally infected volunteers, the QBC tube test and the thick blood smear were comparable and the QBC tube could detect as few as 4 parasites/microliter blood. When used for mass screening in the field study, the test had a sensitivity of 70% for the diagnosis of malaria compared with 92% for a single thick blood smear. However, when used for the diagnose of malaria in hospital patients, the test detected as few as 3 parasites/microliter in 91 of 92 patients with asexual parasitaemia. For the three studies, the QBC tube was highly specific (98.4%), indicating malaria in only 8 of 487 subjects with negative blood films. The species of parasites was correctly identified in 77% of specimens. Processing the QBC tube was easier and much more rapid than was processing a thick blood smear, taking only 5 min. for centrifugation and 5 min. for examination. The QBC tube is not a substitute for the blood smear, but its speed and easeness of use make it an important new tool for the diagnosis of malaria. (12)

4. Immunology

Actual knowledge on the immunology of malaria suggest that protective immunity against malaria is induced by vaccination of hosts with irradiation-attenuated sporozoites. This immunity is mediated in

part by neutralizing antibodies that are directed mainly against the repeat domain of the circumsporozoite protein. Early experiments showed, however, that B-cell-depleted mice that are immunized with sporozoites can resist challenge, indicating that T-cell effector mechanisms may also have a role in protection. This idea was supported by the recent observation that protective immunity also requires T-cells expressing the CD8 antigen (CD8+ T cells) whose target is probably the developing liver-stage parasites. Moreover, an oral Salmonella based vaccine that expresses the circumsporozoite protein is able to protect against murine malaria in the absence of antibodies. It was also reported the identification of an epitope contained within amino acids 249-260 of the Plasmodium berghei circumsporozoite protein, which is recognized by H-2kd-restricted cytotoxic T cells. Passive transfer into mice of cytotoxic-T-cell clones that recognize this epitope conferred a high degree of protection against challenge. These results provide the first direct evidence that CD8+ T cells, that are specific for a defined epitope, can confer protection against a parasitic infection **(13)**. Although the above findings allow for an insight on resistance mechanisms on experimental malaria. Corroboration in the role of T cells, to identify vaccine relevant T cell epitopes on the circumsporozoite (CS) protein of Plasmodium falciparum is still needed.

The lymphocyte proliferative responses to 10 CS protein derived peptides were studied in 28 adults and correlated with resistance to malaria. Eight peptides, six of which were not overlapping, induced proliferation of lymphocytes from one to five volunteers, suggesting either genetic restriction of response to each of the T epitopes, or dominance of some T sites on the immunizing sporozoites. The 28 volunteers were radically cured of malaria and during the next 126 days 25 of the 28 were reinfected. Resistance to malaria was not correlated with antibodies to malaria, but was significantly correlated with lymphocyte responses to CS protein residues 361-380 and 371-390. Among the 25 volunteers who became re-infected with malaria, lymphocytes from only two responded to a peptide including residues 361-380 of the P. falciparum CS protein, and only one to peptide 371-390. In contrast, lymphocytes from all three volunteers who did not became infected responded to peptide 361-380, and lymphocytes from two of the three protected responded to peptide 371-390. The significant correlation between proliferation to some of the peptides and resistance to malaria suggest that at least one epitope within these overlapping peptides is involved in a protective cellular immune response. The data support inclusion of these residues in future CS protein vaccines **(14)**. Onother study indicated that a T cell clone obtained from a human volunteer immunized with Plasmodium falciparum sporozoites specifically recognized the native circumsporozoite (CS) antigen expressed on P. falciparum sporozoites, as well as bacteria -and yeast- derived recombinant falciparum CS proteins. The response of these CD4+ CD8- cells was species-specific, since the clones did not proliferate or secrete gamma interferon when challenged with sporozoites or recombinant CS proteins of other human, simian, or rodent malarias. The epitope recognized by the sporozoite-specific human T cell clones mapped to the 5' repeat region of the CS protein and was contained in the NANPNVDPNANP sequence. **(15)**

Studies on the relevance of polyclonal B cell activation (PBA) associated with malaria in the development of specific anti-sporozoite immunity were made in Brazil. For this purpose it was used a reverse haemolytic plaque assay and an immunoradiometric assay employing the synthetic peptide (NANP)3, the main epitope of the circumsporozoite (CS) protein of Plasmodium falciparum. The degree of activation of IgG and IgM secreting cells and the level of anti-sporozoite antibodies in 95 subjects with malaria and 21 non-infected individuals was assesed. A positive correlation was observed between the anti -(NANP)3 antibody levels and the number of past attacks of malaria but not between the former and the age of individuals or the number of months of residence in the endemic region. Individuals with high numbers of IgG or IgM secreting cells (SC) had lower levels of anti -(NANP)3 antibodies; those with levels of antibodies above the mean for malaria-infected individuals had lower numbers of IgGSC and higher haematocrit and haemoglobin values. These data show the existence of a negative relationship between malaria-induced PBA and anti-sporozoite immunity. It is suggested that either PBA blocks the development of anti-sporozoite immunity or, alternatively, the latter protects individuals against malaria and malaria-associated PBA. (16)

Studies on possible immunizing candidates to prevent malaria continue to be high priority in the Region. Immunization with a synthetic peptide which is representative of part of the repeating region of Plasmodium falciparum circumsporozoite protein resulted in an immunity which allowed vaccines to retard the development of patent malaria as compared to nonimmunized controls. Analysis of infection dynamics showed that immunity could be attributed to either neutralization of about 92% of inoculated sporozoites, delayed development of the majority of parasites, or a combination of neutralization and delayed development. In spite of this impresive antiplasmodial capacity, all volunteers after being bitten by infected mosquitoes developed malaria, and seven of eight developed parasitemia between 6.5 and 7.0 days after infective mosquito bites. (17)

Research was also done to examine whether prior immunity against a carrier protein modulates the serological response to injected peptide haptens attached to the same carrier in man. Baseline tetanus antitoxin levels in volunteers who received a malaria sporozoite peptide-tetanus toxoid conjugate vaccine were compared with post-vaccination IgM and IgG antibody titres against the sporozoite antigen. In tetanus-vaccinated North American recipients of low doses of conjugate vaccine there were significantdose-dependent negative correlations between these variables, which suggests that epitopic suppression may occur in man. In contrast, Venezuelans living in non-malarious areas and mosty naive to tetanus toxoid showed a notabe IgM response to the sporozoite antigen. The findings indicate that epitopic suppression and immune enhancement occur in man, and that the specific immunological responses to conjugated peptide vaccines may be difficult to predict. (18)

When antibodies to sexual stage surface and intracellular antigens of Plasmodium falciparum were studied in human sera from an area where

intense transmission of P. falciparum, as well as the less prevalent P. malariae and P. vivax occurs, a prominent 27-kD sexual stage-specific intracellular protein was recognized in proportion to the general antibody response to gamete proteins. The response to the gamete surface proteins, however, was quite unrepresentative of the general antibody response to the intracellular gamete proteins. No antibodies were detected against pfs25, a 21-kD protein expressed on zygotes and ookinetes of P. falciparum and known to be a sensitive target of malaria transmission-blocking antibodies. The antibody response to two other target antigens of transmission-blocking antibodies on the surface of gametes of P. falciparum, a 230- and a 48- and 45-kD protein doublet, was too variable and independent of the response to the internal protein antigens. Several possibilities may account for the variable response to these gamete surface antigens in individuals with otherwise good antibody responses to internal sexual stage proteins. It may be possible that there is MHC restriction of the immune response to the gamete surface antigens in the human population. This interpretation accords well with evidence for MHC-restricted immune response to the same P. falciparum gamete surface antigens shown in studies on mice. (19)

A mathematical model was defined to estimate the degree of in vivo activity against Plasmodium falciparum sporozoites expressed by volunteers vaccinated with a synthetic peptide comprising the immunodominant epitope of the circumsporozoite protein. Relative to the course of infection in non-immunized controls, infections in vaccinated volunteers corresponded to the neutralization or delay of development of greater than 99% of challenge sporozoites. (20)

Trials in squirrel monkeys of 2 recombinant Plasmodium vivax malaria vaccine candidates based on the circumsporozoite (CS) protein were reported. One recombinant (NS181V20), produced in Escherichia coli, contains the repeat region of the CS protein. The other (vivax-1) recombinant is yeast-derived and contains the entire repeat domain and part of the surrounding N-terminal and C-terminal regions. Both antigens were administered with alum and muramyl tripeptide as adjuvants. No formulation caused toxic side effects. Both antigens, when administered with alum, induced high levels of sporozoite antibodies in all animals. Another group of animals was immunized with irradiated sporozoites alone. Upon challenge, a few immunized animals did not develop detectable parasitemia and others developed parasitemia only after a prolonged prepatent period. Monkeys immunized with irradiated sporozoites had higher levels of antibody but not increased protection. There was no correlation between protection and either antibody level or the in vitro proliferation of lymphocytes in response to the antigens. This is the first time P. vivax sporozoite vaccines have been tested in monkeys with a subsequent sporozoite challenge. (21)

Taking into account that recent developments in immunology and molecular biology indicate that vaccines against malaria are on the horizon, guidelines addressed to national health authorities, in particular to those of malaria-endemic countries interested in the potential use of P. falciparum asexual blood-stage vaccines for the

control of malaria, and to scientists interested in the development and field evaluation of such vaccines were published. This guidelines may help public health officials to make decisions about malaria vaccine trials to be conducted in their countries, including not only field (Phase III) trials, but also the required earlier clinical trials. (22)

5. Chemotherapy and Drug Resistance

During the past decade the incidence of Plasmodium falciparum malaria in the United States has increased 10-fold. Treatment may be delayed because the therapy recommended for severe or complicated disease, intravenous quinine dihydrochloride, is available only from the Centers for Disease Control. Because of this drawback other drugs were tested in several patients with severe or complicated P. falciparum malaria. Five patients were treated with a continuous infusion of quinidine gluconate, 10 with an exchange transfusion in addition to the continuous infusion of quinidine gluconate, and 2 with intermittently adminstered intravenous quinine dihydrochloride and an exchange transfusion. All 16 patients with P. falciparum malaria (1 patient had only P. vivax malaria) had hyperparasitemia at the time of diagnosis (6 to 54 percent of the erythrocytes infected, median: 13 percent). Three patients with marked hyperparasitemia (54, 38, and 30 percent) and multiple other indicators of a poor prognosis, including advanced age, died. The 13 patients who completed their courses of quinidine with or without exchange transfusion presented a parasitemia level of 1.1 percent or less in 28 to 72 hours (mean, 44.4 hours) after the start of therapy. Side effects of quinidine treatment were observed in only two patients, one of whom had a serum quinidine concentration above the toxic level. It was concluded that the continuous infusion of quinidine gluconate is well tolerated alone and with exchange transfusion, and is effective in the treatment of severe and complicated malaria. (23)

Forty cases of imported malaria were reviewed and management principles discussed in Canada. All 15 cases of Plasmodium falciparum malaria were acquired in Africa, 5 of which were probably chloroquine-resistant. Most cases of Plasmodium vivax (80%) were acquired on the Indian subcontinent, including 2 cases of congenital malaria. Six children developed P. falciparum malaria despite chemoprophylaxis. All children had a history of fever, usually with other influenza-like symptoms. Two thirds had splenomegaly, and one third were afebrile on admission. Thrombocytopenia (70%) and anemia (70%) were often present. Forty five percent received previous wrong diagnosis and treatment. Quinine or quinidine with either Fansidar or clindamycin were used to treat P. falciparum malaria. Clindamycin may be more effective if given for 7 instead of 3 days. There were no deaths orresidual complications. As the prevalence and severity of drug-resistant P. falciparum spreads, prophylaxis and treatment choices become more difficult. Diagnosis requires a travel history and a high index of suspicion. (24)

The side effects induced by malaria treatment was highlithed in the USA because of a clinical picture shown by a 12 year old boy who developed a phototoxic rash with subsequent progression to

Stevens-Johnson syndrome due to prophylactic ingestion of antimalarials (chloroquine and sulfadoxine - pyrimethamine; Fansidar). The patient recovered from his skin symptoms after 4 weeks during which he received systemic corticosteroids and antibiotics. This unusual combination of two different patterns of adverse cutaneous drug reactions was most probably caused by the sulfonamide component of Fansidar. (25)

Oral treatment with clindamycin (5 mg/kg twice a day, for five consecutive days) was studied in patients with uncomplicated falciparum malaria in Acre, Brazil, an area with multiresistant Plasmodium falciparum. Parasitaemia ranged between 12 and 79560/microliters of blood in the admission. Thirty-five out of 44 patients admitted to the study could be followed up for 28 days. Only two patients showed parasitaemia six days after admission, and no asexual parasites were observed by day seven. Twenty-eight days after admission all patients were cured. Of the nine patients withdrawn from the study, five were lost during follow up and four needed different treatment (quinine 15 mg/kg twice a day, for ten days) because clinical symptoms did not improve within 60 hours after admission. These patients had experienced their first attack by P. falciparum. In individual cases oral clindamycin can be used as an alternative treatment in semi-immune patients with uncomplicated falciparum malaria from an area where multiresistant parasites frequently occur. However, because of the slow response in all cases described here, and the risk of development of resistance, if clindamycin is used alone it cannot be recommended as monotherapy in non-immune patients. (26)

The susceptibility of P. falciparum to different drugs in vivo and in vitro has been commonly reported from Brasil, Colombia, Guayana and Venezuela. A new report from the later country focus on the susceptibilities of 27 Plasmodium falciparum strains to chloroquine and mefloquine obtained in the area of Puerto Ayacucho, Amazonas Federal Territory of Venezuela. Fifty percent of these strains showed chloroquine resistance in vivo. No grade III chloroquine resistance was found. Twenty five percent of the strains were resistant to chloroquine in vitro and 9% were resistant to mefloquine in vitro. Preliminary results suggest that strains resistant to Fansidar may also be found. (27)

Clinical characteristics of patients with falciparum malaria, as well as sensitiviy of Plasmodium falciparum to chloroquine and mefloquine, were investigated in 2 distinct strata within the same geographical area of the Amazon Basin. One stratum was the population living along the road (E), the other were living along the river (R), both near Rio Branco, capital of Acre State, Brazil. The clinical features did not differ between the 2 strata. Although in vitro sensitivity of P. falciparum to mefloquine was observed in both areas, significant differences in chloroquine sensitivity were observed between the 2 strata. Continuous drug pressure over the years in area 'E' and relatively low drug pressure in area 'R' were presumably responsible for these differences. (28)

In Acre, the westernmost state of Brazil in the Amazon region, the sensitivity of Plasmodium falciparum to chloroquine, amodiaquine, mefloquine, quinine and sulfadoxine/pyrimethamine was determined in vitro. The in vitro parasite responses to all antimalarial drugs were determined according to the recommendations of WHO. Of 83 isolates of P. falciparum, all were sensitive to mefloquine and of 87 isolates of P. falciparum, 84 (97%) were sensitive to quinine. In contrast, 65 of 89 (73%) and 70 of 83 (84%) isolates were resistant to amodiaquine and chloroquine, respectively. Sulfadoxine/pyrimethamine resistance was seen in 23 of 25 (92%) cases. These data clearly indicate that in the western part of the Amazon region the 4-aminoquinolines, as well as sulfadoxine/pyrimethamine, can no longer be recommended for the treatment of P. falciparum infections. (29)*

Evidence has been shown in Colombia regarding development of drug resistance on P. vivax. Eleven cases of Plasmodium vivax infection of Colombian origin that relapsed 49-166 days following treatment with chloroquine or amodiaquine (1.5 g in 3 days) plus primaquine (15 mg daily for 14 days) a regimen widely used to effect radical cure of infections with this parasite. Relapses occurred under conditions that precluded reinfection has been described. The fact that most of the relapses occurred within the last two years suggest that P. vivax drug resistance may be developing in Colombia and possibly other regions of South America. (30)

6. Entomology

In order to identify malaria vectors in the Pacific lowlands of Colombia, studies were done in Charambira, a village that has malaria transmission throughout the whole year. During a period of one month, mosquitoes were collected outside the houses in 2 different places in the village. Mosquitoes were captured when they were feeding on human bait (volunteers from the same village). Mosquitoes were studied using the IRMA technique, which is capable of surveying large number of mosquitoes. (31)

Morphological examination of the mosquitoes collected in the study showed 4729 A. neivai, 8 A. albimanus and 7 A. apicumacula. Only 9.9% (472) of the A. Neivai and 0.13% (8) of the A. albimanus were captured during the morning peak of activity (0500-0600 h); the remainder were captured during the evening peak of activity (1800-1900 h). By IRMA, eight A. neivai (0.17%) were infected with P. falciparum and 1 (0.02%) with P. vivax. No specimen of any other species was found to be infected. (31)

These finding are important since the vector control activities of the National Malaria Eradication Service of Colombia are based on DDT spraying of the houses. Such spraying probably has little impact on

*PAHO/WHO does not recommend the assessment of resistance through the in vitro tests only.

mosquitoes, such as A. neivai, which feed and rest outdoors. It is therefore not surprising that there has been an increase of malaria incidence in forest regions of the country which have high rates of immigration. The study emphasizes the usefulness of immunological methods when studying large number of mosquitoes in areas where malaria transmission is low and unstable. (31)

A mosquito survey was carried out in malarious indian settlements in the Xingu National Park, Brazil, by the end of the rainy season, when 27 species were collected. An. darlingi, the most frequent an anthropophilic mosquito, was found infected with P. falciparum and seems to be the principal malaria vector in the area. The other Anophelinae and Culicinae were little frequent or scarce. The local fauna includes vectors of yellow fever and of several other arbovirus. (32)

Research on the biology and ecology of Anopheles albimanus continue to be made on the Pacific coast of Belize, Guatemala, El Salvador, Honduras, Nicaragua and Panama. Control efforts in the Pacific coastal plain has been severely hampered by previous ignorance of fundamental aspects of vector biology and ecology.

This project was built around a regional network that stimulates scientific exchange with regard to malaria control in Central America. The network will provide and opportunity for coordinated research to embrace the diversity of geographic conditions, breeding habitats, and human settlements in the region.

Results up to now confirm some previous findings but also show in some specific localities striking differences with what has been shown in previous studies. An. albimanus continue to be the more abundant vector. However other anophelines not yet identified may be playing also a role in malaria transmission. There are also indications of a close relationship between agricultural practices, social characteristics of the population and the existance of breeding sites for mosquitoes.

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IV. TRAINING

As a result of better registration, it has been possible to improve the follow-up of training activities being carried out in the Region.

1. Graduate-Level Activities in Progress

Ongoing activities continue to be carried out with the support of both PAHO and the TDR Special Program.

1.1 Master's Degree in Epidemiology, Valle University, Cali, Colombia

This program continues, although during 1989 it was not possible to enroll candidates from outside Colombia because of the social instability in the country. For the same reason, some of the modern graduate-level technical training activities in malaria diagnosis were postponed, to be carried out in 1990.

1.2 Master's Degree in Public Health, School of Public Health, FIOCRUZ, Rio de Janeiro, Brazil. Area of Concentration: Epidemiology of Endemic Diseases.

In 1989 the foreign students were financed through fellowships from TDR or PAHO (two each). The national students have been or are being supported by Brazilian specialized agencies or by their sponsoring institutions.

1.3 Master's Degree in Medical Entomology, University of Panama, Panama

The third class of four students completed the course in June and finished their theses in September. The fourth class entered in August and is expected to finish in July 1991. Enrollment is limited to 10 students.

In order to improve the selection of the students for the course, the advisers responsible for evaluating this program suggested that the potential candidates be interviewed in their countries of origin by the respective PAHO/WHO representatives and that they take an examination prepared by the University of Panama. Approval by this institution would be a prerequisite for them to be accepted as students in the Master's program. This should take care of the problem of dropouts, or at least reduce the rate thereof, which has been quite high in the past.

The countries of origin of the 11 students who have completed the Master's degree so far are: Panama (5), Colombia (2), Costa Rica (1), Honduras (1), Guatemala (1), and Venezuela (1). The three students who graduated in the first class are now part on the teaching staff that gives the course.

1.4 Master's Degree in Medical Entomology, School of Biological Sciences, Autonomous University Nuevo León, Monterrey, N.L., Mexico

This program continues to offer a Master's degree designed to meet national needs for specialists in this field. It is hoped, in addition, that the program will attract some students from the Central American countries starting in 1991.

1.5 International Course on Malaria and Environmental Sanitation, School of Malariology and Environmental Sanitation, Maracay, Venezuela

This is a course may have considerable impact in Latin America in view of the ongoing need of the control programs to have professionally trained personnel who can come up with creative solutions to the problems associated with vector-borne diseases through the identification and resolution of risk factors.

The course, in addition to granting a Master's degree to professionals who fulfill its requirements, has offered and continues to offer opportunities to train technical personnel assigned to the programs for vector-borne disease control. There is no doubt that this is one of the courses in Latin America that has had the most experience with vector control activities.

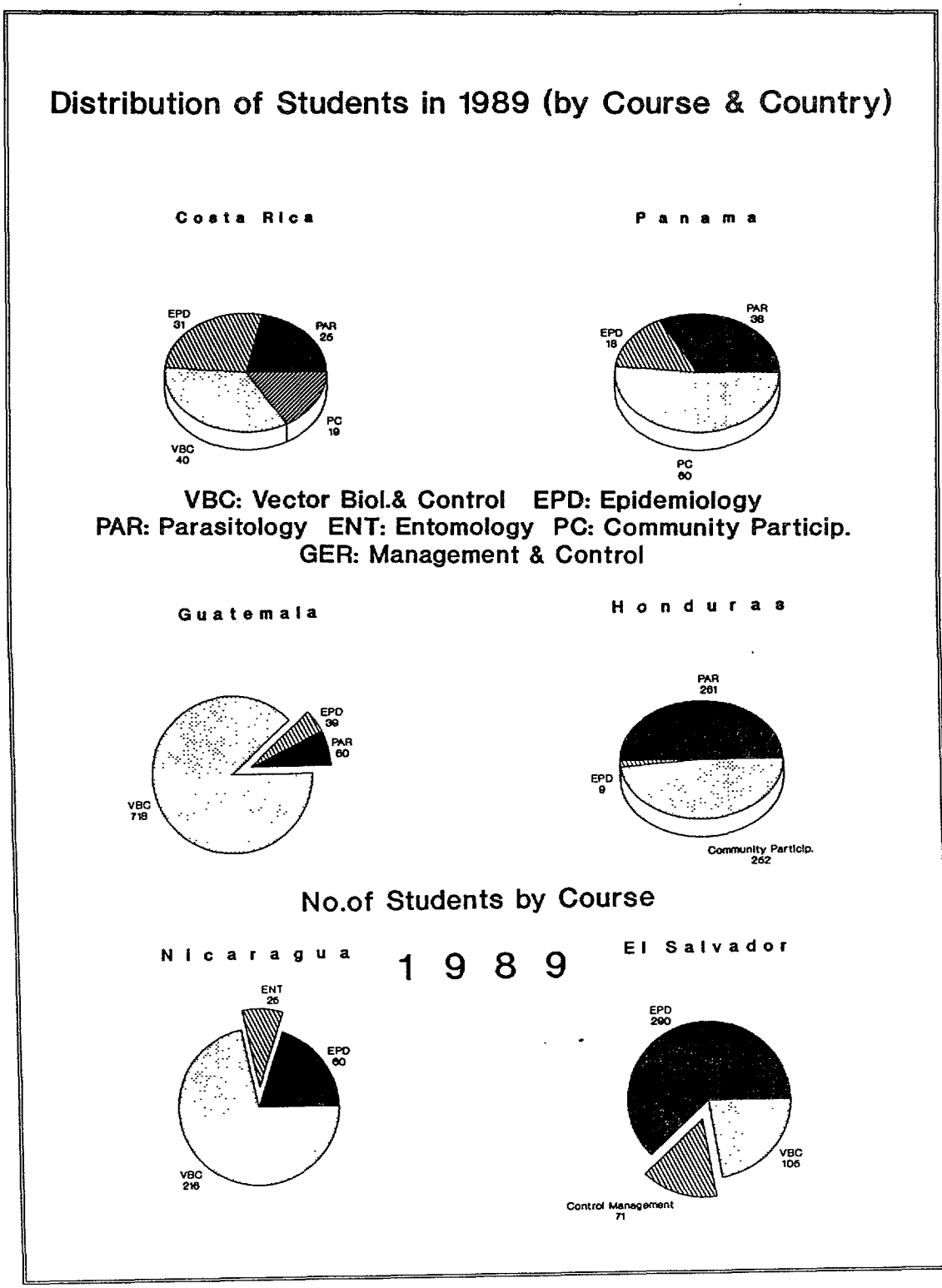
2. Local Training Activities

Figure IV.1 presents, as an example, data from several Central American countries showing that more than 1,000 students attended courses in biology and vector control, entomology, parasitology, management, epidemiology, and community participation.

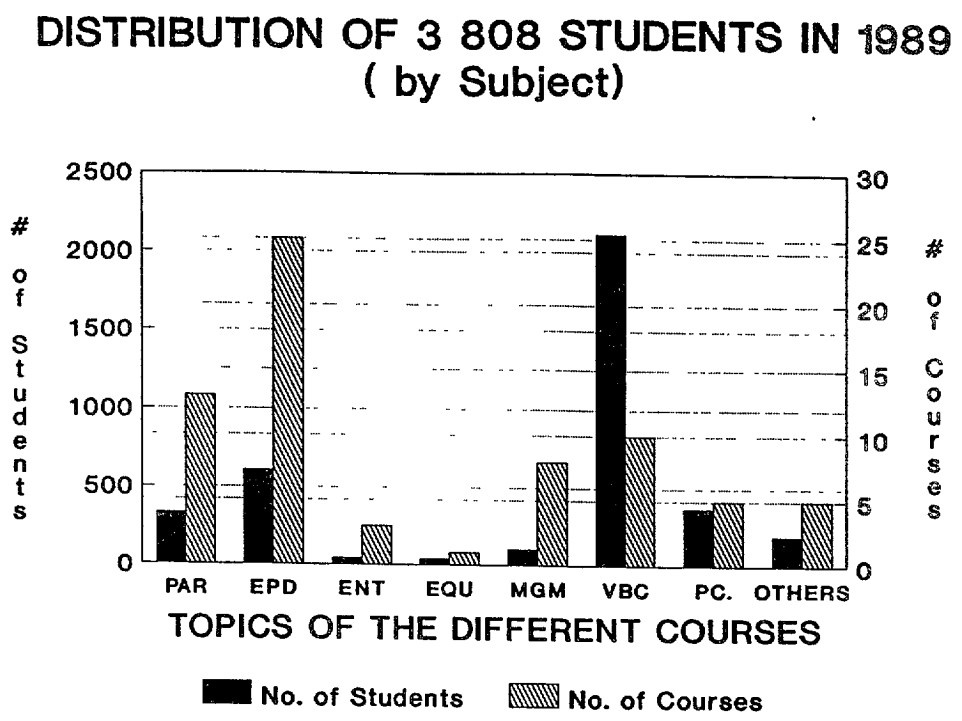
Figure IV.2 gives a partial summary of the activities carried out by the countries by subject area using national resources or funds contributed under the PAHO/USAID agreement. The latter, especially in Central America and Panama.

Figure IV.3 shows what has been done in other countries. It is clear that during 1989 emphasis was placed on activities related to vector biology and control and parasitology, but there were also some activities in epidemiology and a few in entomology, which continues to be a discipline that attracts little interest for an academic career. Table 19 summarizes the information available on the number of courses and the participants in different courses on malaria and/or related topics. Figure IV.4 gives the distribution of fellowships granted by PAHO/WHO in malaria and other related areas during 1989.

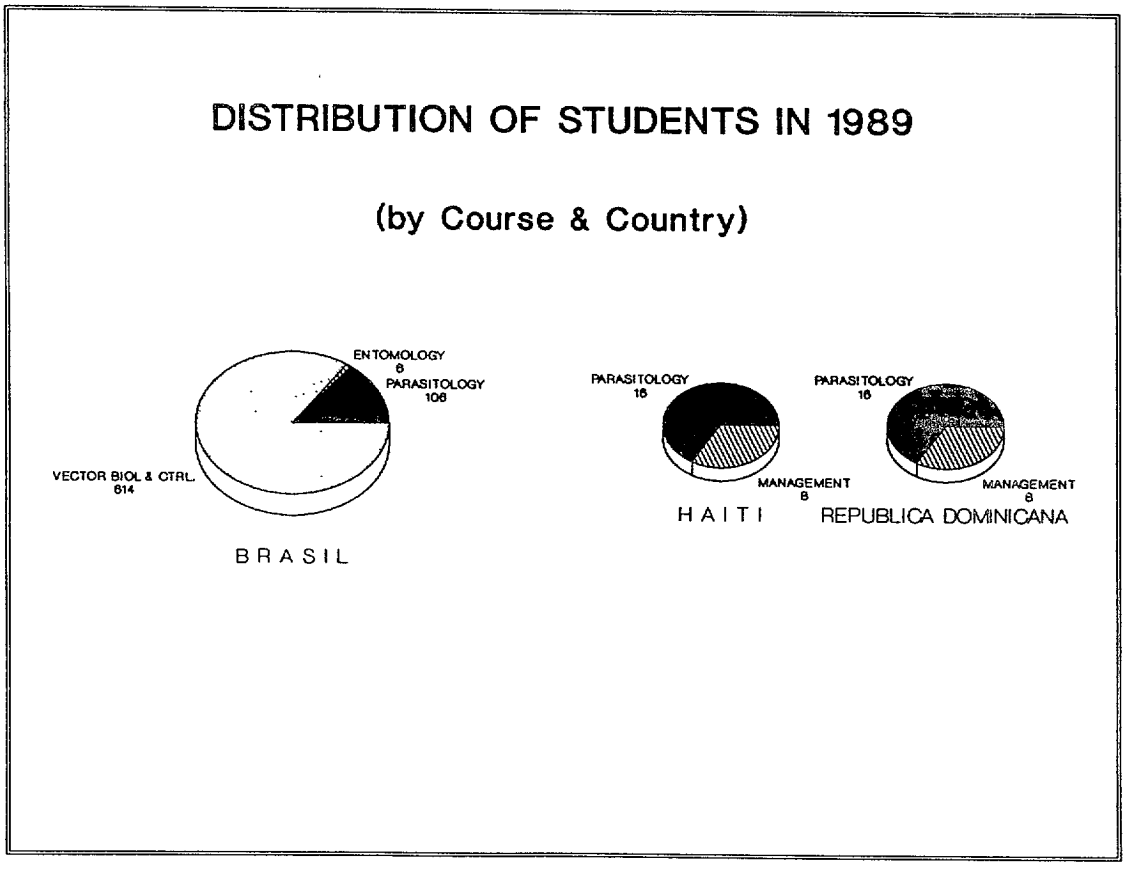
F I G U R E IV-1


Distribution of Students in 1989 (by Course & Country)
Costa Rica
EPD 31
PAR 25
PC 19
VBC 40
Panama
PAR 38
EPD 18
PC 60
VBC: Vector Biol.& Control EPD: Epidemiology
PAR: Parasitology ENT: Entomology PC: Community Particip.
GER: Management & Control
Guatemala
EPD 39
PAR 60
VBC 718
Honduras
PAR 261
EPD 9
Community Particip. 262
No.of Students by Course
1 9 8 9
Nicaragua
ENT 25
EPD 60
VBC 216
El Salvador
EPD 290
VBC 105
Control Management 71

F I G U R E IV-2



F I G U R E IV-3



F I G U R E IV-4

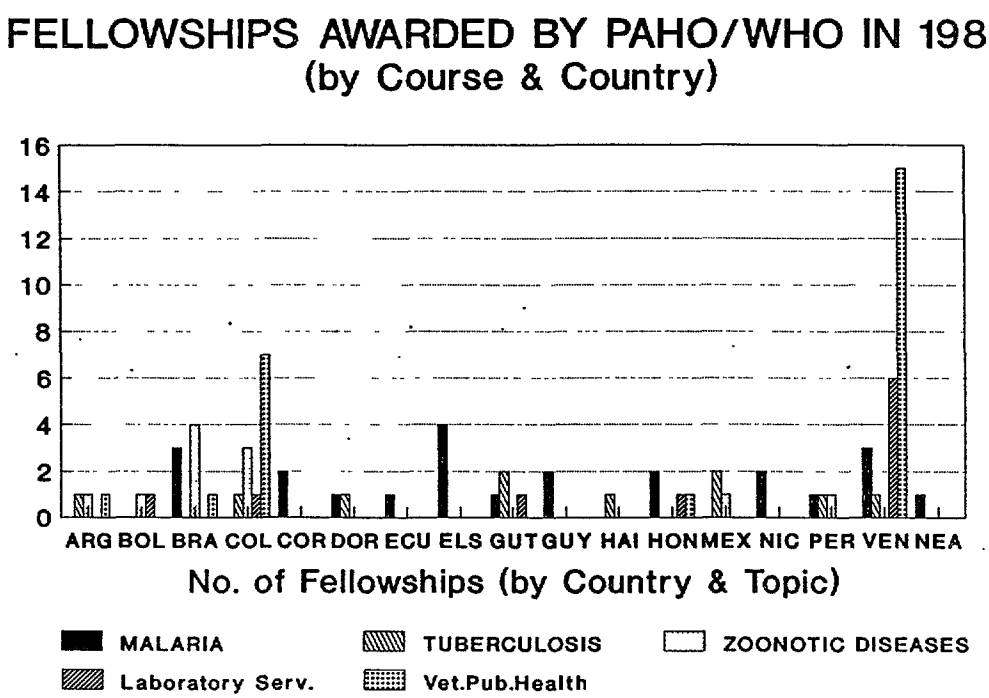

FELLOWSHIPS AWARDED BY PAHO/WHO IN 1989
(by Course & Country)
16
14
12
10
8
6
4
2
0
ARG BOL BRA COL COR DOR ECU ELS GUT GUY HAI HON MEX NIC PER VEN NEA
No. of Fellowships (by Country & Topic)
MALARIA
TUBERCULOSIS
ZOONOTIC DISEASES
Laboratory Serv.
Vet.Pub.Health

Table II-1

TRAINING ACTIVITIES, NATIONAL LEVEL, 1989

Country	TOTAL		Parasit Lab. Microscop.		Malaria epidem.		Ento-mology		Insect. & Equipment handling		Malaria control Managment		Vector control		Collaborator volunt. Part communit.		Other	
	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P
Mexico	7	211	–	–	2	69	1	31	–	–	3	90	1	21	–	–	–	–
Belice	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Costa Rica	4	115	1	25	1	31	–	–	1	40	–	–	–	–	1	19	–	–
El Salvador	14	466	1	71	12	290	–	–	–	–	–	–	1	105	–	–	–	–
Guatemala	6	817	5	60	1	39	–	–	–	–	–	–	(a)	718	–	–	–	–
Honduras	2	261	–	–	1	9	–	–	–	–	–	–	–	–	1	252	–	–
Nicaragua	3	301	–	–	1	60	1	25	–	–	–	–	1	216	–	–	–	–
Panama	6	116	2	38	2	18	–	–	–	–	–	–	–	–	2	60	–	–
Haiti	2	68	1	53	1	15	–	–	–	–	–	–	–	–	–	–	–	–
Rep. Dominicana	3	21	1	13	–	–	–	–	–	–	2	8	–	–	–	–	–	–
Guay. Francesa	0	0	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Guyana	2	39	2	39	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Suriname	0	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Brasil	5	726	1	106	–	–	1	6	–	–	–	–	3	614	–	–	–	–
Bolivia	1	12	–	–	1	12	–	–	–	–	–	–	–	–	–	–	–	–
Colombia	9	276	1	19	2	46	–	–	–	–	1	18	–	–	–	–	5	193 b)
Ecuador	4	305	–	–	–	–	–	–	–	–	1	10	3	295	–	–	–	–
Peru	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Venezuela	2	26	–	–	2	26	–	–	–	–	–	–	–	–	–	–	–	–
Argentina	2	52	1	12	–	–	–	–	–	–	–	–	–	–	1	40	–	–
Paraguay	4	243	–	–	1	62	1	16	–	–	–	–	2	165	–	–	–	–
Total	76	4,055	16	436	27	677	4	78	1	40	7	126	11	2,134	5	371	5	193

C = Number of courses. P = Number of participants.

a) Continuous courses are given the whole year for different level personnel.

b) Includes five courses on development and child survival.

Sep/19/90 (hs)

V. MALARIA STRATIFICATION IN THE REGION OF THE AMERICAS

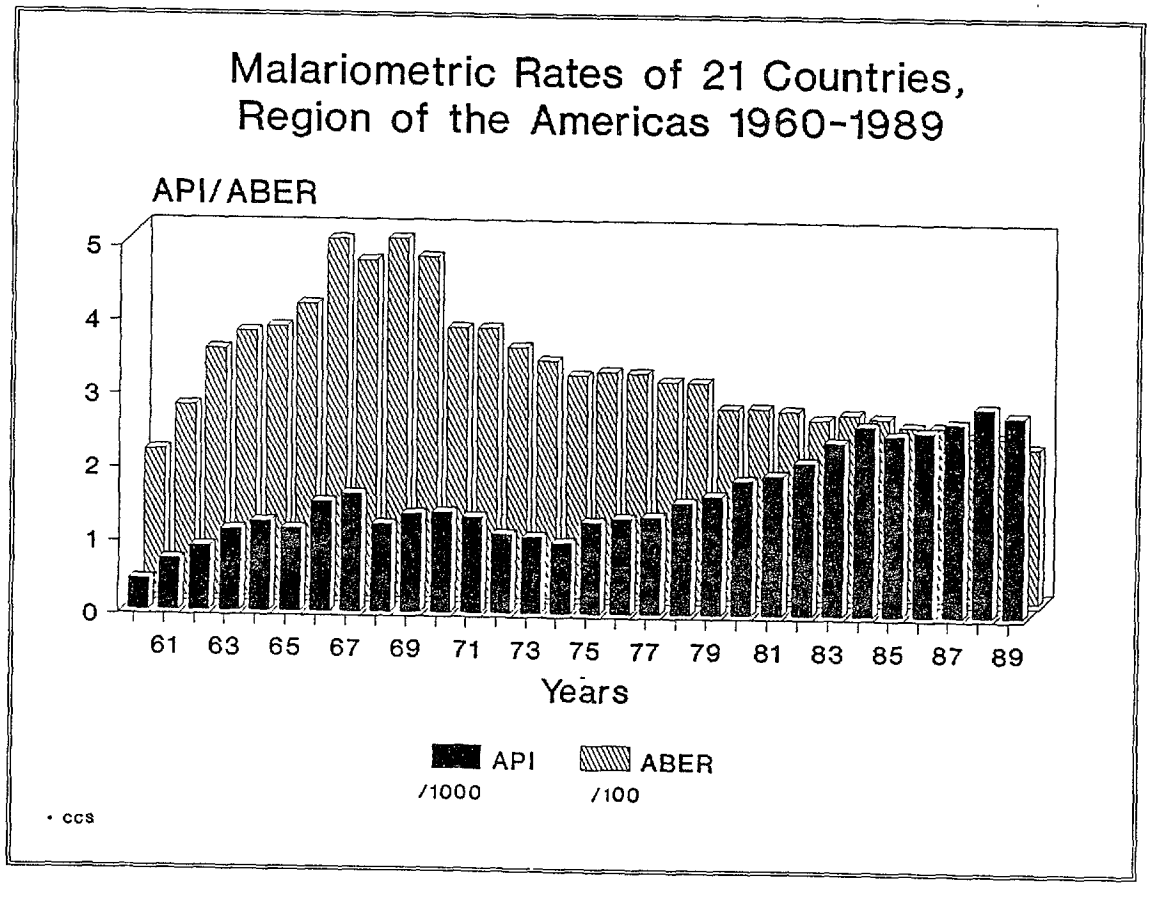
1. Status of Malaria in the 1980's

Malaria had a significant increase in Latin America and the Caribbean during the 1980s, in a trend that continued throughout the decade (Figure V.1). During this period malaria emerged once again as a serious public health problem.

The steady rise in malaria is particularly significant because it paralleled the socioeconomic deterioration that affected the countries of the Region during the decade.

Beginning in 1987, over a million new cases of malaria were reported each year, with the figure reaching 1.1 million in 1989. These numbers reflect the intensification of malaria transmission that took place during the period.

Figure V.1



This resurgence and aggravation of malaria during a time of socio-economic crisis has made it necessary to review and adjust the strategies aimed at malaria prevention and control. The purpose of this chapter is to briefly introduce some of the most important components of the epidemiological methodology that have been incorporated into the strategy of epidemiological stratification for malaria. It also documents the progress of this stratification process in the Region.

2. Epidemiological Stratification of Malaria Risk

Background

In general, the concept of "stratification" and its use in the study of malaria distribution has a long history. Kouznetsov et al. (1986) have reviewed some of the many approaches to classifying malarious areas that have been used over time. These models are summarized in Table V.1. The majority of these stratification schemes have been based on geographical, topographical, and climatological criteria.

Table V.1

List of Typologies Used Previous to Epidemiological Stratification of Malaria.

CRITERIA	INDICATORS	TYPOLOGY	AUTHORS
Climate Topography	Geography (low) Humidity (high) Climate (hot)	Not Defined	Hippocra-tes
Climate	Temperature, Season Cycles.	4 Climatic Zones	Celli,1900 Gill, 1934
Endemicity	Spleen rate in children <9 years	4 Levels Hypo, Meso, Hyper, Holo.	WHO (1951)
Zoogeography	Geography (low) Type of Vector	12 zones	MacDonald (1957)
Season of Transmission, Insecticides.	Duration Trans-mission , Type of Insecticide.	Atlas of: *Tanganyika *Kenya	Malariolo-gists(1956) (1957)

• ccs

A distinctive characteristic of most of these schemes has been their limited utilization in the selection of control strategies in malaria and general health programs.

These stratification models represented an effort to systematize some of the components involved in the process of malaria transmission. However, they did not take into account the most important factors responsible for the levels of malaria endemicity. They gave little weight to social, economic, and biological factors or to the organization of health services as determining factors in the process of malaria transmission.

Instead, these classifications of malarious areas have been based largely on a general pooling of the information available, thus making it impossible to recognize local variations or the factors that specifically contribute to the level and intensity of transmission in the malarious areas.

It should also be pointed out that the various geographical areas classified as malarious in the Region of the Americas are not only very diverse from a geo-ecological, political, and socioeconomic perspective but also differ in terms of the organization of their health services. This diversity of factors has been of considerable relevance in the resurgence of malaria. However, these characteristics have not played a part in the selection of control strategies.

3. Epidemiological Risk Approach and the Malaria Stratification Process in the Region of the Americas

In Latin America, malaria stratification emerged as a strategic approach beginning in 1979 (PAHO-WHO, 1981). In 1985, it was recognized as a strategy for making objective epidemiological diagnoses on which to base the planning of action for malaria prevention and control.

In its early stage in Latin America, malaria stratification was based on schemes and recommendations issued by various consultative groups of the World Health Organization (Orlov and Semashko, 1986; Kouznetsov et al. 1986).

During this stage, the regional control programs recognized stratification as a valuable instrument to be used in the planning of control activities. As a result, the control programs have made better use of available information, stressing the importance both of different malariometric indicators and of their relationship to various geographical and ecological characteristics.

Recently the epidemiological risk approach has been incorporated into the stratification scheme, serving as a basis both for the situational diagnosis and for decisions on intervention strategies. Some of the most important concepts of this approach are detailed below.

4. Basic Concepts of Epidemiological Stratification

Definition of Stratification

In the Region of the Americas, epidemiological stratification in malaria control programs has been defined as a dynamic and ongoing process involving research, diagnosis, analysis, and the interpretation of information which serves as a basis for the comprehensive and methodological classification of geo-ecological areas and population groups according to malaria risk factors.

A risk stratum is an aggregate of individuals and social groups located in well-defined geographical areas that share a similar hierarchy of principal risk factors. Consequently, the measures or interventions undertaken in order to modify them are similar within each stratum.

The main feature of this new strategy is an epidemiological study conducted on specific individuals and social groups of the risk factors that are responsible for the incidence of malaria at the local level. An understanding of the profile of risk factors at the local level assist in the selection of prevention and control measures.

In summary, the purpose of this approach is to establish an epidemiological hierarchy of possible specific measures or interventions that may be used to reduce malaria transmission by eliminating or reducing the underlying risk factors.

Accordingly, on the basis of the local epidemiological situation and its risk factors, an attempt is made to recognize the fundamental characteristics of the malaria problem, based on which specific interventions can then be developed, rather than general control measures.

5. Theoretical Bases for the Epidemiological Stratification of Malaria

A. The main assumption on which the epidemiological approach of malaria stratification is based is the need to recognize the great social inequities that exist in the distribution of the risk of contracting and dying from malaria. The involvement of social factors in the resurgence of malaria transmission in the Region of the Americas has been clear and decisive. Several sections of this document refer to the various components relating to the social determinants of malaria.

B. Malaria transmission is a focalized process that is both complex and dynamic. The frequency and distribution of malaria depends on a combination of several risk factors, which, at the local level,

contribute to the specific configuration of malaria morbidity and mortality and its corresponding risk profile. Failure to take into account the local epidemiological situation and the social and biological forces involved in transmission has prevented traditional control measures from having the expected and programmed impact in several countries of the Region.

C. Epidemiological methodology is flexible, which makes it possible to adjust it to the different socio-epidemiological situations and specific eco-geographies of the countries in the Region.

D. Characterization of the risk factors for the stratification of malaria necessarily involves both the socioeconomic and ecological dimension, as well as the organizational aspects of the health services.

The epidemiological methodology has important advantages in malaria stratification for several reasons, the most important one being that at each risk stratum it addresses the specificity of the transmission process and the risk factors that contribute to it.

This methodology provides basic information for the selection of control strategies that can be integrated into health programs--strategies whose fundamental purpose is not only to reduce the incidence of malaria but to eliminate the specific risk factors for malaria in the areas of concern.

6. Methods for Epidemiological Risk Stratification

Stratification is an integrated diagnosis-intervention-evaluation process that optimizes the decision-making process. It can be summarized in the following steps:

A. Study of annual parasite incidence (API) and its secular trends in recent years, in order to identify priority areas.

B. Identification and measurement of malaria risk factors in priority areas or localities using the epidemiological risk research methodology.

C. Determination of malaria epidemiological risk strata according to a ranking of the most important risk factors.

D. Selection of interventions aimed at reducing or eliminating the most important risk factors at each stratum.

E. Adaptation of the health services for the implementation of actions based on epidemiological risk stratification.

F. Identification of structure, process, and impact indicators, so as to evaluate the effect of each intervention.

G. Execution of specific interventions aimed at reducing or eliminating each risk factor.

H. a. **Measurement of:**

- Reduction in the risk of contracting or dying from malaria. The indicators are the specific rates of incidence and mortality.

- Changes in the risk factors, measured on the basis of relative risk and percentage of attributable population risk.

b. Evaluation of each intervention according to the indicators of structure, process, and impact.

c. Monitoring and adjustment of the process at all stages.

7. Identification of Priority Areas

By studying the annual parasite incidence (API) and its secular trends in recent years, it has been possible to identify those areas in which antimalaria interventions have not been successful.

Based on study of the API and its secular trends, priority areas are defined as those in which an increase is observed in the incidence and/or in which this incidence is of considerable magnitude. Most countries of the Region with active malaria transmission maintain an API register and have identified areas at risk on the basis of this indicator.

8. Study of Risk Factors

Within this approach, and in the context of malaria, a RISK FACTOR is defined as any variable or set of variables that bear direct relation to the incidence of malaria. More broadly, it may be defined as any characteristic, attribute, condition, or circumstance that increases the probability of appearance of, or mortality from, malaria at any given moment.

The risk of becoming infected or sick of malaria implies an increase in the probability of becoming infected or sick as a result of the presence of one or more risk factors.

The risk factors for malaria may be classified in different ways. However, any classification should include ecological, geographical, entomological, social, economic, and demographic factors as well as aspects relating to organization of the health services.

As it has already been pointed out, the epidemiological classification of risk factors has as its objective the identification of those risk factors, from among the probable risk factors, that account for the increase and magnitude of malaria incidence observed in priority areas.

Any classification of risk factors should be based on the recognition of particular determinants that exist within: (a) priority geo-ecological areas, (b) exposed human groups and their living conditions, and (c) the structure and organization of the health services. These considerations are of great importance given that malaria is a local problem, and its characteristics and dimensions may differ from one place to another.

9. Epidemiological Measurement of Risk Factors

Stratification makes use of the three basic epidemiological measurements of risk: absolute risk or incidence, relative risk (RR), and attributable risk (AR).

The API (annual parasite incidence) is used as a proxy indicator of absolute risk. The denominator of this rate refers only to the exposed population in malarious areas. Its objective is to provide information regarding the intensity and extent of malaria in the human groups studied.

Relative risk (RR) estimates the strength of the association between the exposure to each risk factor analyzed and the disease itself. It indicates the risk of developing malaria in the group exposed to the factor under study in relative to the risk found in the group not exposed to that same factor. For malaria, the RR is defined as the ratio of annual parasite incidence (specific API) in the exposed group divided by the API in the group not exposed to the risk factor.

Through calculation of the RR it is possible to select those risk factors which occur most frequently in the transmission of malaria in a given locality or social group. This measurement makes it possible to determine, in the groups studied, the most important risk factors which by being eliminated will reduce the incidence of malaria.

Within this approach, it is of the utmost importance to be able to estimate the percentage of risk of the population's contracting malaria that can be attributed to exposure to a specific risk factor. For malaria, this indicator of risk, called percentage of population attributable risk (%PAR), expresses the proportion of disease in the population under study that is attributable to the factor in question, so that this proportion of malaria risk can be eliminated if this factor is eliminated or controlled.

10. Development of Malaria Risk Strata

The RR and %PAR are the indicators of malaria risk that this approach uses to assess the importance of each risk factor. These indicators make it possible to set up the risk strata and to combine communities and social groups within the strata. These measurements provide the information necessary for ranking the risk factors according to their importance. In this way control programs can target their resources and interventions on the factors that are most prevalent and most strongly associated with the incidence of malaria in the population, so that control measures will have greater impact.

The %PAR indicates the percentage of risk that is due to each factor studied in the population. By extension, it also tells us the impact that the elimination or control of a given factor is expected to have on the incidence of malaria.

In conclusion, within this approach, prevention and control measures are selected on the basis of the hierarchy of risk factors found, according to the magnitude of their %PAR. One of the basic features of this approach is that interventions are aimed directly at the elimination or elimination of risk factors. It is hoped that, by eliminating the specific determinants of malaria, it will be possible to have a direct and lasting impact on the reduction of malaria incidence, which is the ultimate objective of the prevention and control effort.

11. Stratification Process in the Countries of the Region of the Americas.

Current experience shows that the process of malaria stratification in the countries of the Region of the Americas has been neither continuous nor homogeneous. In its early forms it depended to a great extent on the criteria used and the type of information available in each country.

However, toward the end of the 1980s, most countries with malaria transmission had completed their initial stratification schemes based on the trends of the API. This characterization of the epidemiology of malaria has made it possible for the countries to subdivide their malarious areas into "strata" or "priority areas" using as the basic criterion the ranges established from the incidence or prevalence observed. This unification of priority areas represents a first level of analysis and summary of the malariometric information available. In order to continue the process of reducing the complexity of the malaria problem, stratification should adopt an epidemiological perspective in the analysis of local characteristics, recognized as risk factors that account for the increase observed in malaria morbidity.

The criteria used to epidemiologically stratify the local malaria situation should be based on the analysis and recognition of risk factors that determine the frequency and distribution of malaria.

There follows a description of the current status of this process in the countries of the Region based on the information available in 1989.

12. General Characteristics of the Stratification Process

In general, it can be said that in the countries of the Region the malaria epidemiological stratification process had the following characteristics:

A. The epidemiological stratification process in the countries of Latin America and the Caribbean has made it possible to begin to study the different risks of disease and death from malaria as they affect the respective populations, due to the presence of specific attributes or characteristics in individuals and social groups, in the environment, and in the organization of the health services.

B. The trend of the API in 21 countries of the Region shows an increase from 1.7/1.000 in 1980 to 2.72/1.000 in 1989. This average increase DOES NOT REFLECT the real intensification of transmission that has occurred in the malarious areas of the countries in the Americas. Further analysis of this indicator in the interior of the countries, excluding areas and populations without transmission or risk of contracting the disease, gives a more realistic assessment of the malaria problem. For example, in 1989 the API reported for many of the high-risk areas in the different countries was 250 times greater than the above figure for the Region. The API reached levels as high as 694/1.000 and 553/1.000 in some municipios of Brazil, 659/1.000 in French Guiana, and 415/1.000 in Guyana, as can be seen from the tables and respective figures for these countries.

C. Malaria is a disease with focal distribution. Thus, the study of its distribution and the various mechanisms to be selected for its control should always include the local epidemiological profile of its determinants. Generalized and overall control strategies will not work. Although they facilitate the temporal reduction of transmission in particular situations, unless the risk factors that determine it are deactivated or removed, local transmission will reappear, continue, or rapidly increase.

D. The epidemiological mapping of high-risk malaria transmission areas has helped countries to identify their priority human groups and geo-ecological areas. The epidemiological stratification process will make it possible to recognize the principal factors that contribute to malaria morbidity and mortality, the elimination of which will be the objetive of malaria prevention and control programs.

The following paragraphs give a brief summary of the current status of the stratification process and its relationship to the malaria situation as of December 1989 in some of the countries in the Region of the Americas.

The description is not exhaustive, nor does it include all the countries that have malaria transmission. It does, however, illustrate the role that epidemiological methodology plays in the process of malaria stratification.

The chapter also gives the corresponding epidemiological maps for some of the countries described. The maps are designed to show the priority areas and serve as a basis for the second stage of stratification, which will be to study and measure the risk factors at the local level.

BRAZIL

The emerging process of malaria epidemiological stratification in Brazil has done much to reveal the inequity that exists in the distribution and frequency of the disease in this country. Moreover, it has made it possible to understand how important it is for control programs to recognize the specific risk factors that determine the intensity and severity of malaria in the various human groups and areas of the country.

The trend in Brazil's malariometric rates between 1960 and 1989 is shown in Figure V.2. As it can be seen, since 1975 the API in Brazil has risen steadily. In 1983 this trend showed a sharp upturn, despite the fact that the annual blood examination rate (ABER) remained constant. The House Spraying Rate (HSR) showed a downward trend during the 1980s.

The API and the number of cases in Brazil in 1989 are given by high-risk regions in Figure V.3.

The malariometric rates in the states with APIs above 5.0 per 1,000, which represent high-risk areas, are shown in Table V.2.

Figure V.2

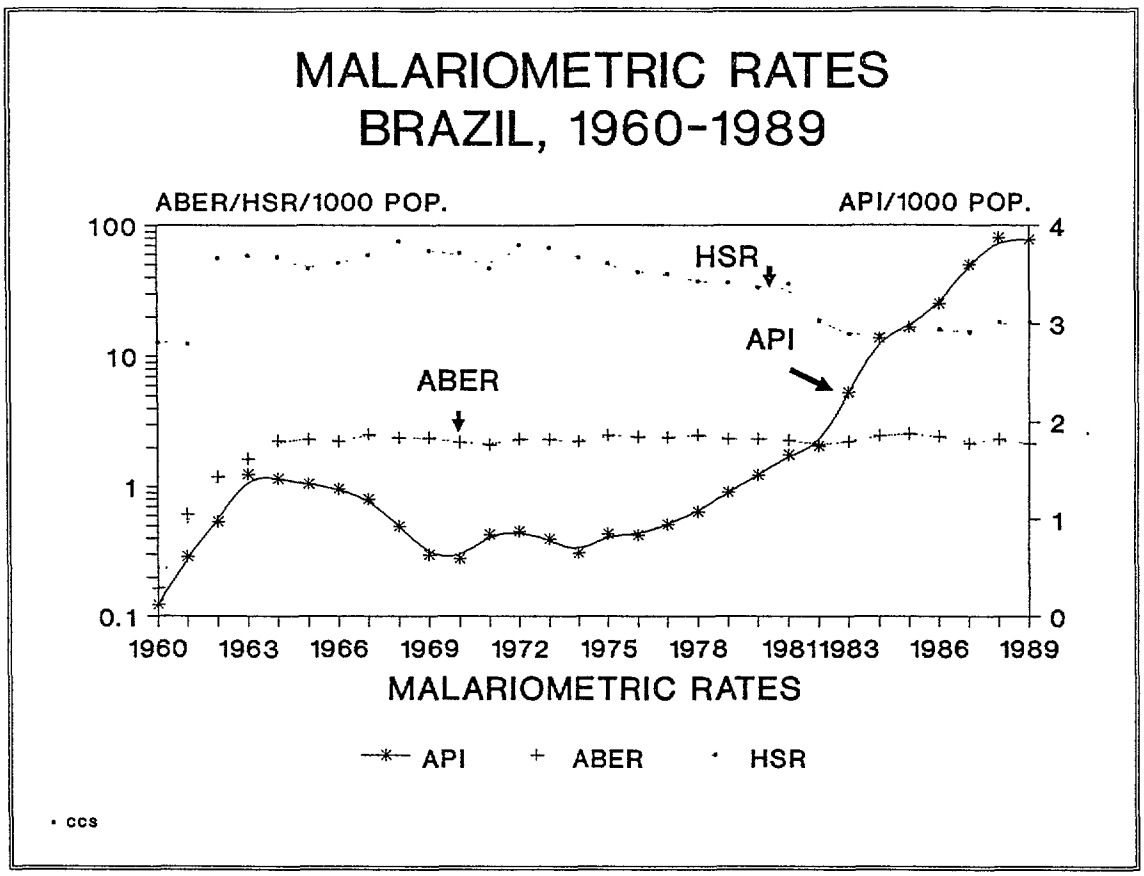
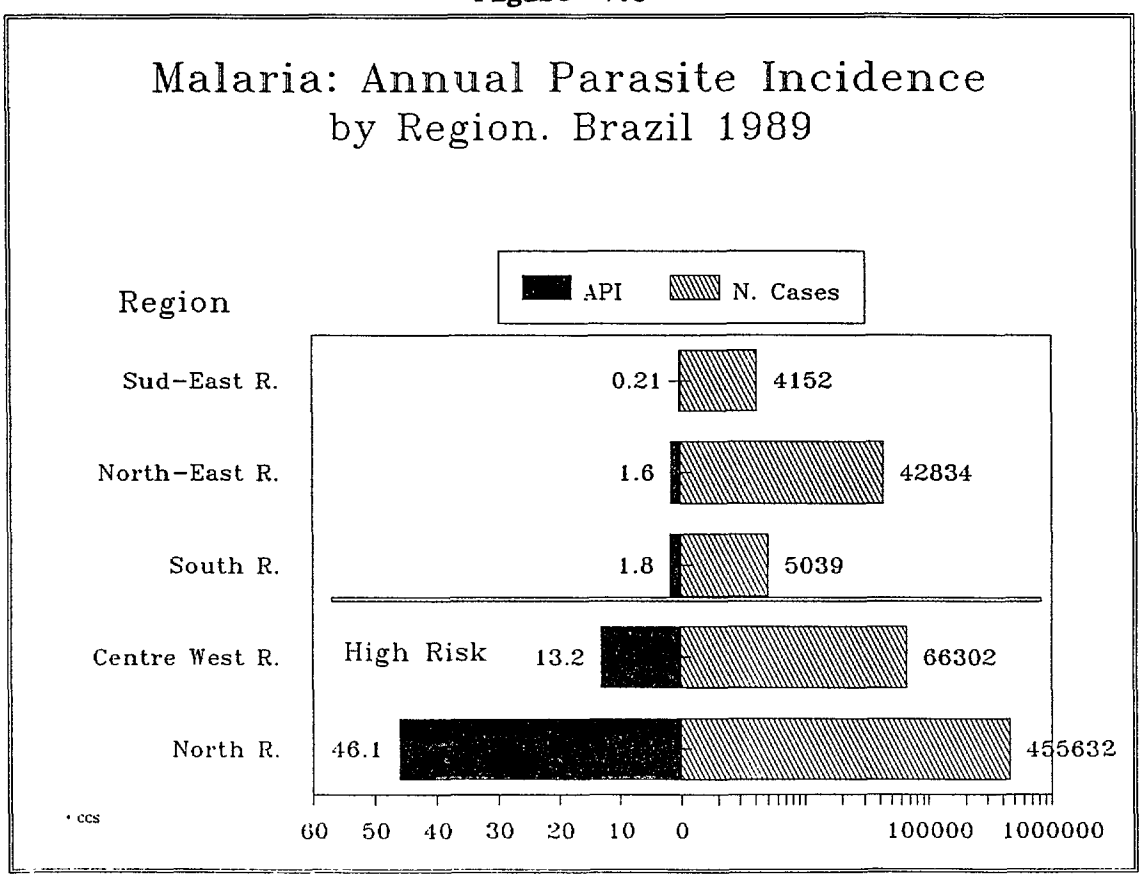


Figure V.3



As it can be seen from these figures, in 1989, Brazil, with 577,520 cases and a total population of 150 million, reported an API of 3.85. This API value does not reflect the intensification of malaria in the areas of transmission. There are considerable variations between the different regions. For example, the southeastern region, with 4,152 cases and an API of 0.21, contrasts with the northern and midwest regions, with 455,632 (API=46.1) and 66,302 (API-13.2), respectively.

Table V.2

Malariometric Rates, 8 States
With APIs > 5.0/1000, Brazil. 1989

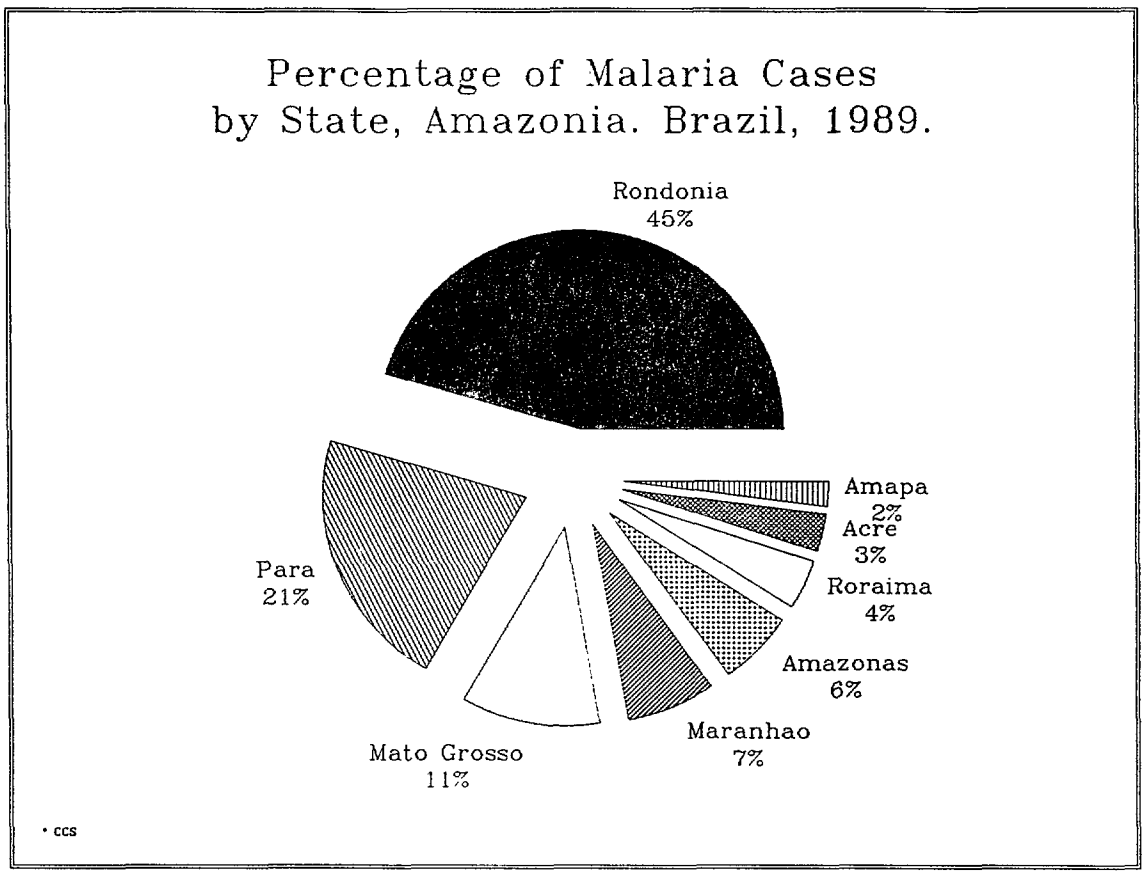
State	API	PBS	ABER
RORAIMA	146.5	29.6	49.6
RONDONIA	128.3	30.7	41.8
AMAPA	43.2	29.3	14.7
ACRE	38.5	23.5	16.4
MATO GROSSO	28.8	31.9	9.0
PARA	22.6	22.8	9.9
AMAZONAS	16.9	21.6	7.8
MARANHAO	7.2	10.0	7.2
TOTAL MALARIOG. AREAS	8.6	17.2	5.0

• CCS

If this indicator is broken down even further, it can be seen that, of the country's 27 states, eight reported APIs of over 7 per 1,000 (Table V.2). The APIs in these states were as follows: Roraima, 146.5; Rondonia, 128.3; Amapá, 43.2; Acre, 38.5; Mato Grosso, 28.8; Pará, 22.6; Amazonas, 16.9; and Maranhao, 7.2.

As it can be seen from Table V.2, the highest transmission rate is basically concentrated in the states of the Amazon region, where 97% of the cases were reported. In this region, three states are responsible for most of the cases: Rondônia, with 45%; Pará, with 21%; and Mato Grosso, with 11% of the total number of cases (Figure V.4).

Figure V.4



A new analysis and a look at the interior of these states bears out the importance of malaria stratification by priority risk areas. Of the 22 municipios that make up the state of Rondonia, eight reported APIs of over 100. Of these eight municipios, three had 254,925 cases of malaria, or 44.6% of all the cases in Brazil (Figures V.5 and V.6). Of the municipios in Rondonia, Machadinho, which was created only two years ago, had an API of 553.2--the highest in the state. (Figure V.5).

Figure V.5

Municipalities with API > 100/1000 Rondonia, Brazil, 1985-1989

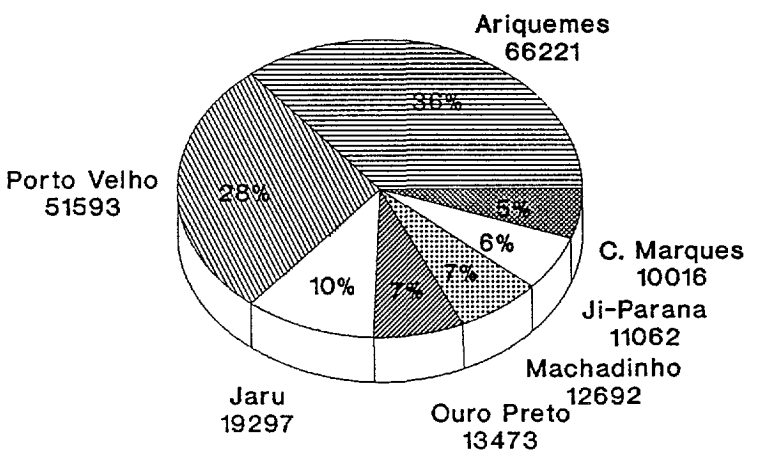
	1985	1986	1987	1988	1989
Machadinho	0	0	0	257	553
Ariquemes	435	379	542	617	463
C. Marques	242	585	650	496	236
A.D'Oeste	0	0	292	363	219
Jaru	282	164	184	192	156
P. Velho	125	109	122	176	123
N. Brasilandia	0	0	0	200	106
Ouro Preto	102	48	63	106	102

Machadinho Ariquemes C. Marques A.D'Oeste
Jaru P. Velho N. Brasiland Ouro Preto

•ccs

Figure V.6

Malaria Case Distribution in Rondonia, by Municipio* with > 10,000 Cases. Brazil, 1989



Rondonia

*Malaria High Risk Municipalities

• ccs

Similarly, a further breakdown of the API shows that, although the state of Pará, with one of the lowest levels of transmission in the Amazon region, reports an API of 22.6, nevertheless one of its municipios has an API of 695.95, one of the highest API levels in the entire country and in the Region.

Table V.3

Malaria Distribution in Municipalities Created in 1989, Pará State, Brazil, 1989.

NEW MUNICIPALITY	POP.	CASES	API	
Ourilandia do Norte	28,552	6,101	213.68	HIGH RISK
Ma. das Barreiras	7,854	1,243	158.26	
Curionopolis	51,461	4,891	95.04	
Pacaja	17,591	1,216	69.13	
Ruropolis	16,089	720	44.75	
Brejo G. do A.	13,775	551	40.00	
Parauapebas	48,383	1,697	35.07	
Geraldo do A.	37,004	1,168	31.56	
Tucuma	27,807	522	18.77	
D. Eliseu	24,480	437	17.85	
B. Jesus do T.	15,021	204	13.58	
Uruara	18,585	122	6.56	
S. Joa de P.	14,571	68	4.67	
Mae do Rio	17,202	43	2.50	
Medicilandia	25,211	60	2.38	
Garrafao Do N.	31,412	32	1.02	
Concordia do P.	16,288	12	0.74	

. ccs

It can also be seen that, of the 104 municipios in Pará, eight reported APIs of over 100 per 1,000. Of these municipios, two were responsible for 40,873 cases. Due to the process of stratification, it has been possible to break down the malariometric information available at the local level, which in turn makes it possible to identify the critical areas of transmission.

It should be pointed out that in 1989 Pará had 17 new population settlements, which reported APIs ranging from 213.7 to 0.74. Of these 17 new municipios, 11 had APIs of over 10 (Table V.3). The social factors discussed below account to a great extent for the behavior of malaria in these new settlements.

In the geographical areas where most of the malaria cases are found, particularly in the Amazon region, there are reports of two large-scale social processes, which have a bearing on the risk of contracting malaria.

The first is an intense and disorganized migration toward remote mining areas in which living and working conditions are extremely precarious and high levels of transmission are found.

The second process, also of a social nature, is the intensified shift of population toward agricultural subsistence areas, with the resulting establishment of settlements whose problems of inaccessibility, inadequate living conditions, and limited health protection have created the fundamental substratum for the persistence and increase of malaria in these areas.

Briefly, it could be said that the first stage in the process of malaria stratification in Brazil has made it possible to observe the enormous differences in the distribution of the disease and to recognize the importance of its local dimension.

The understanding of both the forces and the factors involved in transmission, as well as the actions that can affect them and on which control programs would be based, constitutes the next stage in this process of epidemiological stratification.

COLOMBIA

In recent years the basic malaria stratification effort in Colombia has consisted in identifying and grouping the critical malarious areas, using the corresponding API levels as a basic criterion for selection.

Consequently, based on the APIs found, the areas of malaria transmission in Colombia have been divided into three levels of risk. Figure V.7. shows the mapping of these levels of risk by regions of the country.

Figure V.7

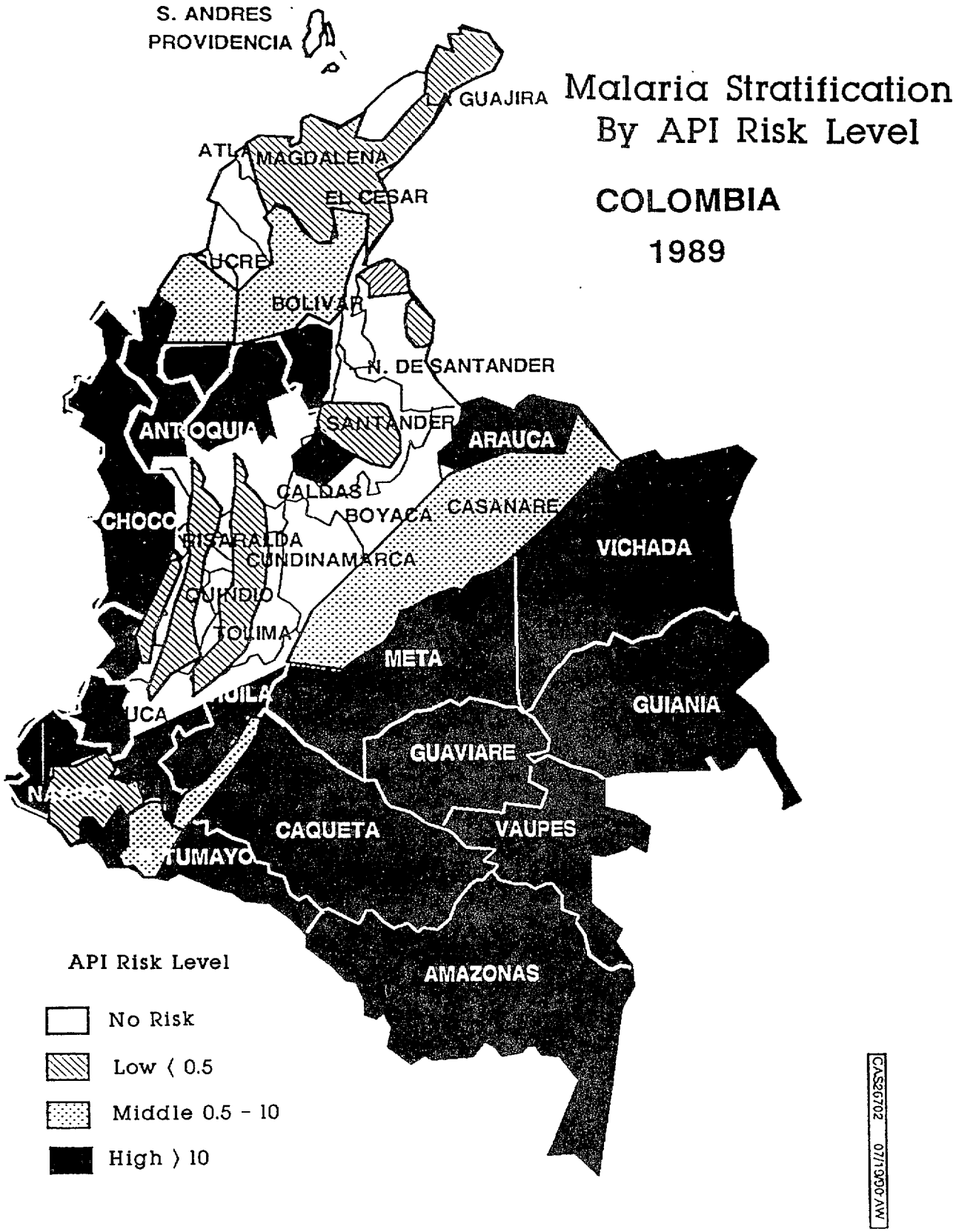

S. ANDRES
PROVIDENCIA
Malaria Stratification
By API Risk Level
COLOMBIA
1989
LA GUAJIRA
ATLANTICO
MAGDALENA
EL CESAR
SUCRE
BOLIVAR
N. DE SANTANDER
ANTIOQUIA
SANTANDER
ARAUCA
CALDAS
BOYACA
CASANARE
CHOCO
RISARALDA
CUNDINAMARCA
VICHADA
QUINDIO
TOLIMA
META
HUILA
GUIANIA
GUAVIARE
CAQUETA
VAUPES
AMAZONAS
API Risk Level
No Risk
Low ⟨ 0.5
Middle 0.5 - 10
High ⟩ 10
CA2G702
07/10/90MW

Table V.4

Malaria High Risk Areas by Region. Colombia. 1989

Regions	Cases	API
1. Uraba-Bajo Cauca	30,550	80.97
2. Amazonas	17,903	37.51
3. Litoral Pacifico	16,074	20.24
4. Sarare	4,608	50.26
5. Magdalena Medio	2,821	7.56
6. Catatumbo	694	8.45
Subtotal of 6 Regions	72,650 (72% of Total)	33.09
Total of Country	100 286 (100%)	3.21

• CCS

Table V.5 A

Municipalities with Higher Malaria Transmission, by Region, Colombia. 1989

REGION	MUNICIPALITY	CASES	% COUNTRY
Uraba-Bajo Cauca	Tierralta	5331	5.33
	Caceres	2931	2.93
	El Bagre	2603	2.60
	P. Libertador	2391	2.39
	Carepa	2072	2.07
	Segovia	1901	1.90
	Caucasia	1653	1.65
	Montelibano	1442	1.44
	Taraza	1383	1.38
	Remedios	1338	1.33
	Nechi	1325	1.32
	Mutata	1185	1.18
	Turbo	1100	1.10
	Valencia	790	0.79
	Zaragoza	650	0.65
	Subtotal	28095	28.09

• CCS

Table V.5 B

Municipalities with Higher Malaria Transmission, by Region, Colombia. 1989

REGION	MUNICIPALITY	CASES	% COUNTRY
Amazonia	El Retorno	4325	4.32
	S. Jose G.	2539	2.53
	Cartagena CH.	1162	1.16
	San Vicente	1102	1.10
	Solano	1064	1.06
	Milan	920	0.92
	Puerto Asis	893	0.82
	Subtotal	12005	12.00
Pacific Coast	Buenaventura	4201	4.20
	Tumaco	3268	3.26
	El Charco	1655	1.65
	Itsmina	1518	1.51
	Bajo Baudo	1022	1.02
	Subtotal	11664	11.66

• ccs

Table V.5 C

Municipalities with Higher Malaria Transmission, by Region, Colombia. 1989

REGION	MUNICIPALITY	CASES	% COUNTRY
Sarare	Saravena	2659	2.65
	Tame	885	0.88
	Arauquita	768	0.76
	Subtotal	4312	4.31
Magdalena Medio	Remedios	1338	1.33
	Subtotal	1338	1.33
Total	Total	57414	57.41

• ccs

The basic unit used in the classification of risk is the municipio. Those municipios that have an API lower than 0.5 are considered to be at low risk. Most municipios in the consolidation phase are at this level. Those municipios that have an API between 0.5 and 10.0 are considered to be at medium risk, and, finally, those that have an API of more than 10.0 are classified as being at high risk.

The 100,286 malaria cases that occurred in Colombia in 1989 were found in 2,103 of the 37,841 localities in the country's malarious areas. Six regions had 72,650 of the cases (Table V.4), or 72% of all cases registered in 1989. These 72,650 cases were detected in 91 municipios. Of these 91 municipios, 32 were responsible for 57,414 cases, which represented 79% of the cases reported in these regions and 57.4% of the total number of cases in the entire country (Tables V.5 A, B, and C).

As it has been shown in the tables and figures for the country, the stratification process in Colombia has made it possible to identify the major areas of malaria focalization, based on varying degrees of risk, which in turn were measured according to the trend in the API.

The most important universal risk factors reported by the Colombian authorities are listed in Table V.6.

Table V.6

Overall risk factors contributing to the persistence of malaria transmission, by area, Colombia, 1989.

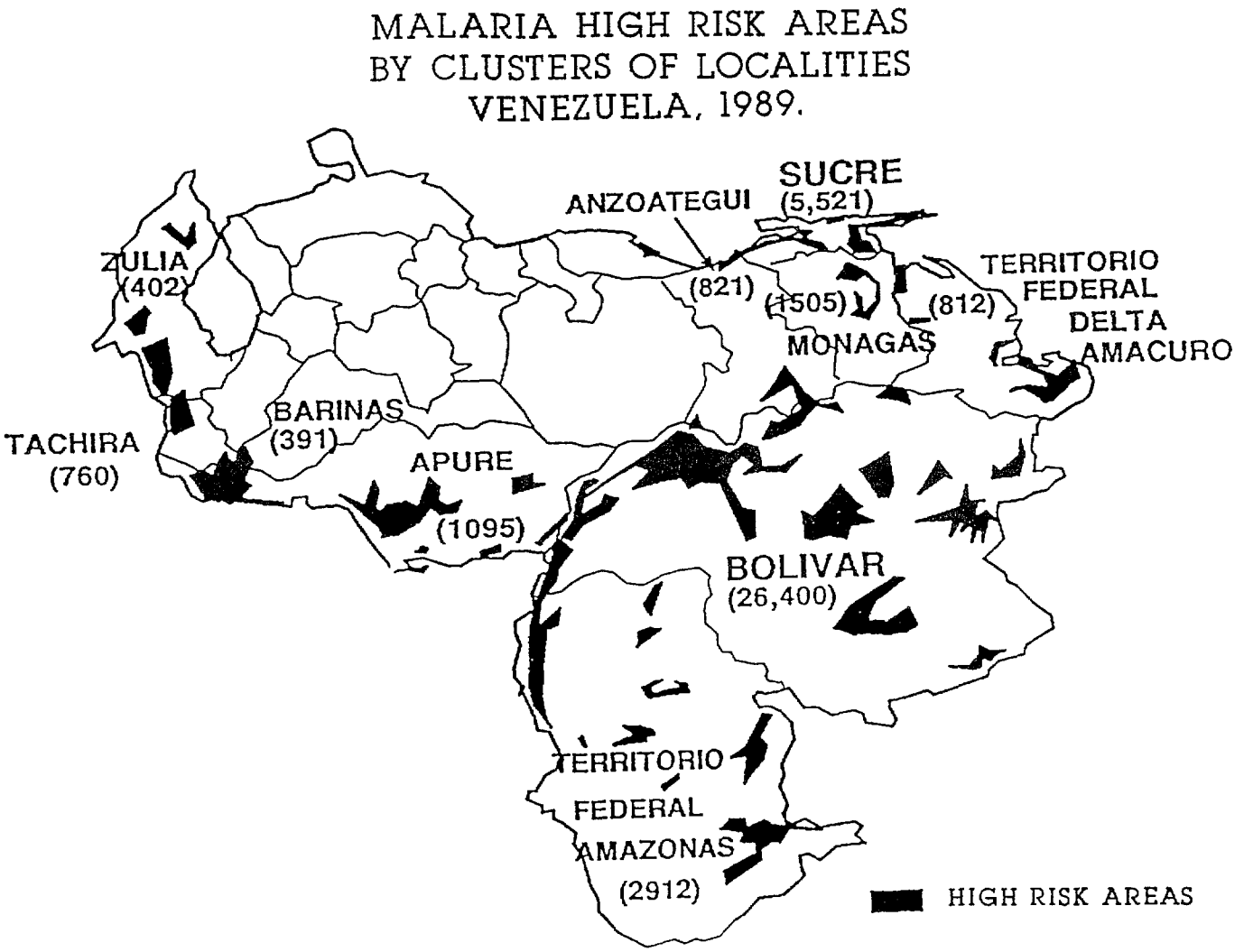
AREA	CASES OF MALARIA	RISK FACTORS
Uraba Bajo Cauca	18,072	Factors associated with social conflict. Lack of resources.
Amazon region	17,903	Factors associated with social conflict. Lack of resources.
Pacific coast	16,074	Technical problems. Lack of resources.
Sarare	4,608	Low coverage with house spraying. Problems of vector behavior.
Middle Magdalena valley	2,821	Low coverage with house spraying. Disruption of public order. Problems of vector and parasite behavior.
Catatumbo	694	Social problems. Precarious housing conditions. Settlement areas. Low coverage with house spraying. Problems of vector behavior.

Due to the complexity of the social risk factors that are involved in the persistence of malaria transmission, control programs should consider the need to facilitate coordinated action among the sectors, including the economic and other social sectors, and they should also make considerable adjustments in their control measures.

VENEZUELA

In Venezuela, 43,369 cases of malaria were reported in 1989. The country's API was 2.25, which was very similar to the API of 1988, i.e. 2.44. As shown in the epidemiological risk map (Figure V.8), Venezuela has three geographical areas with high levels of malaria transmission.

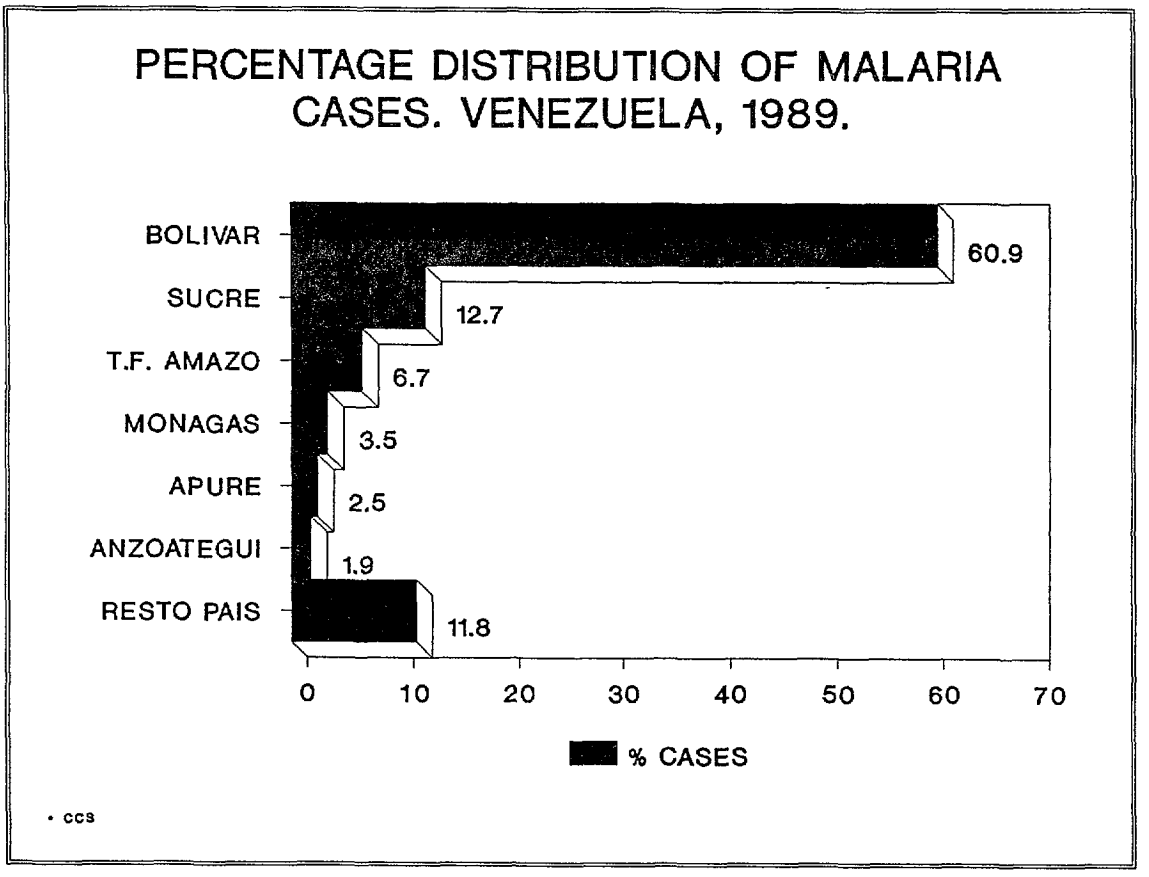
Figure V.8



These areas are located in the southern region, corresponding basically to the state of Bolívar; the western region, including the states of Zulia, Táchira, and Apure and the federal territory of Amazonas; and the eastern region, which centers around the state of Sucre.

Analysis of the malariometric indicators, following the epidemiological stratification approach, reveals that the distribution of malaria morbility is concentrated in the state of Bolívar. 61% of malaria cases in the country are from this state (Figure V.9).

Figure V.9



As in the rest of the countries of the Region of the Americas, malaria in Venezuela has a local pattern of distribution.

Table V.7

High Risk Areas by Number of Malaria Cases, by Departament. Venezuela, 1989

DEPARTMENT	1987	1988	1989
Bolivar	8,887	30,693	26,400
Sucre	2,190	4,938	5,512
T.T Amazonas	1,153	1,297	2,913
Monagas	410	1,295	1,505
Apure	1,098	1,540	1,095
Anzoategui	138	822	821
T.F. Delta A	925	1,042	812
Tachira	1,558	1,169	760
D. Federal*	235	661	665
Carabobo	80	405	565
Guarico	70	338	468
Zulia	294	256	402
Aragua	57	322	400
Barinas	711	556	391
Portuguesa	20	96	161
Lara	18	75	150
Miranda	66	92	93
Merida	56	100	85
N Esparta	6	42	61
Trujillo	7	26	46
Cojedes	1	22	27
Yaracuy	2	26	21
Falcon	6	14	17

This local distribution can be seen clearly in a comparison of the malariometric indicators broken down at the local level. For example, the API of 2.25 reported for the country as a whole and the API of 27.4 reported for Bolívar makes for a risk differential that is 12 times greater in this state.

A more detailed breakdown of the data shows that within the state of Bolívar the municipio of El Dorado reports more than 80% of all the cases in the state.

Additional areas at risk for malaria transmission in the country are located in the eastern region, with 8,650 cases, or 19% of the total. Thirteen percent of the cases (5,561) were found in the western region. The distribution of cases by municipio in these regions is shown in Table V.7.

HAITI

In the last few years, epidemiological information on malaria in Haiti has been limited. As of 1989, 23,231 cases of malaria had been registered, all of them due to P. falciparum.

Of the four health regions into which the country is divided, the Transversal Sanitary Region was responsible for 10,139 cases, or 44% of all the cases registered in 1989. In the Western Region a total of 6,458 cases were registered, while 3,737 and 2,897 cases were found in the Northern and Southern Regions, respectively. These figures do not reflect the true morbidity, however, since the sources of epidemiological information for malaria cases are very limited.

Table V.8

Malaria Stratification, based on API trends, by Locality. Haiti, 1979*

LEVEL OF RISK (API)	No. Localities Total	%	Population Total	%
HIGH RISK (10+)	3401	13.9	948,756	21.6
MEDIUM RISK (5 - 9)	1535	6.3	470,154	10.7
LOW RISK (0.1 - 4)	3345	13.7	237,610	28.2
Negatives	16189	66.1	736,925	39.5
Total	24470	100.0	4393,445	100.0

• CCS

In 1980 an initial malaria stratification scheme was developed in an attempt to determine which were the most important malaria risk areas in the country. The basic criterion used for the selection of these areas, as in other countries, was the trend of the API.

Localities having APIs of 10 or more were considered to be at high risk, while those with APIs between 5 and 9 were regarded as being at medium risk. Low-risk areas were those with APIs ranging from 0.1 to 4. Localities with APIs not corresponding to these three ranges were considered malaria-free (Table V.8).

On the basis of this characterization, 66% of the localities (24,470), which have 39.5% of the country's total population, were declared malaria-free.

A total of 3,401 localities, or 13.9%, with 21.6% of the population, had APIs in excess of 10, thus being at the highest risk for malaria in the country.

At the next level, 6.3% of the localities (1,535), with 10.7% of the population, were considered to be at medium risk, while 13.7% of the localities (3,345), with 28.2% of the population, were found to be at low risk.

Two of the most important risk factors in terms of malaria transmission were the constant internal population migrations and the socioeconomic conditions of these populations.

In terms of the factors related to the organization of health services, it should be pointed out that control measures started to be cut back in 1968. In March 1988, a time of serious financial crisis, the Government terminated the National Malaria Eradication System, discharging all field workers and administrative personnel. Financial constraints and political instability have prevented the systematic reorganization of malaria control activities.

SURINAME

As shown in Table V.9, Suriname has experienced rapid deterioration in its malaria situation over the last few years. This deterioration has been seen in terms of both increased incidence and spread of the disease to other geographical areas.

The following table is a summary of the main risk factors that have had impact on malaria transmission, classified by areas of the country.

Tableo V.9

Factors contributing to malaria transmission, by areas, Suriname, 1989

AREA	RISK FACTORS
INTERIOR	Social conflicts; lack of access by malaria control personnel. Resistance of *P. falciparum* to drugs; remote and scattered population groups.
COASTAL	Migration of refugees from localities in the interior that have epidemics.

Some of the most important factors associated with this deterioration are: internal social conflicts; breakdown of the health services, particularly in the interior where there are areas of intense transmission; suspension of antimalarial activities; and migration of the local population.

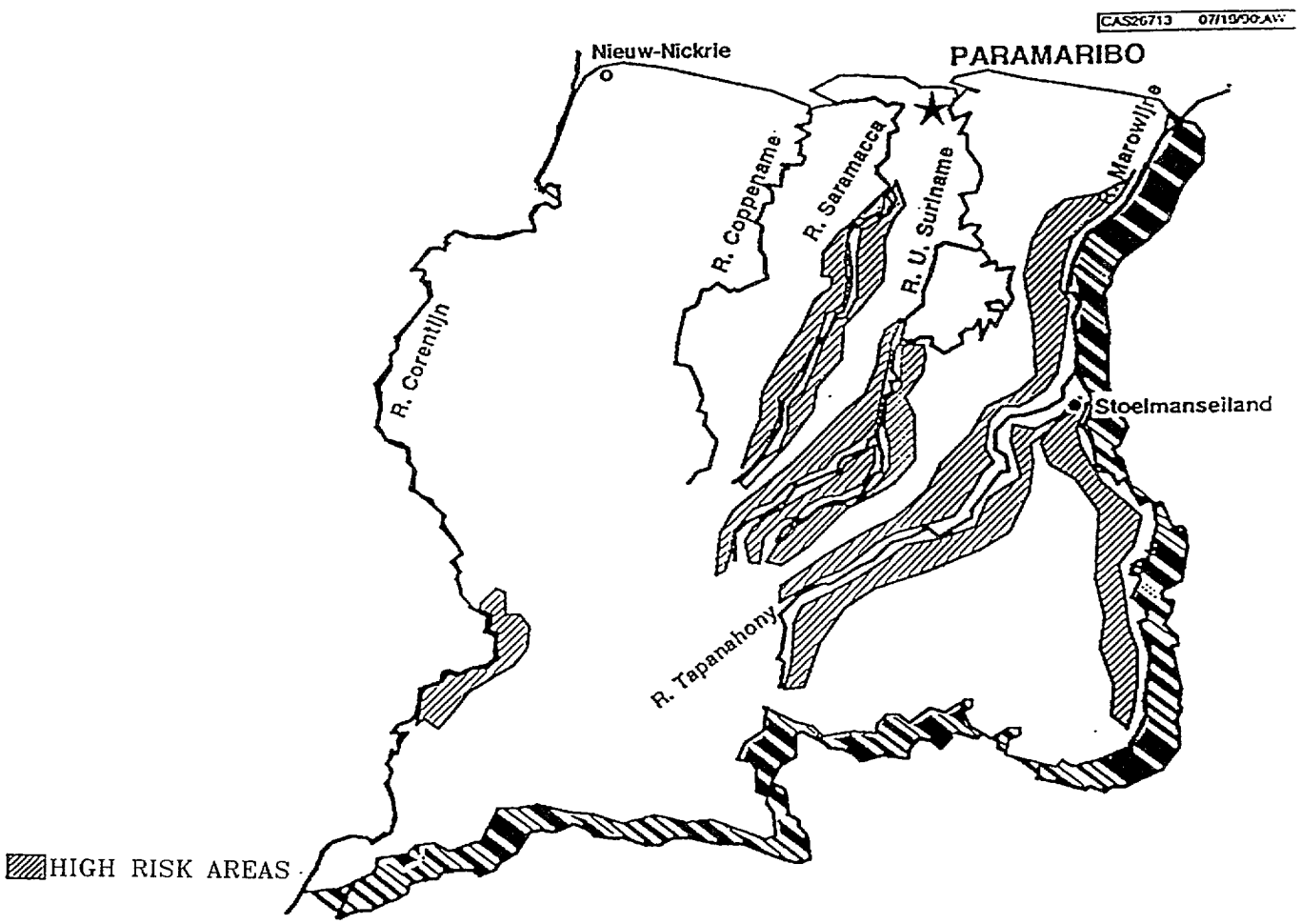
In addition to the above-mentioned factors, others have also played a part in the deterioration of the malaria situation. Among these are the rejection of household spraying by the population, active population movements in border areas, and the widely scattered distribution of the population.

The malaria stratification process in Suriname cannot continue unless consideration is given to the critical sociopolitical situations that the country's population is currently experiencing.

On the other hand, the control programs should pay particular attention to the areas covered by the Marowigne, Alto Suriname, and Saramacca rivers and their tributaries, since, as it can be seen from the malaria risk map (Figure V.10), these are the major high-risk areas in the country.

Figure V.10

MALARIA HIGH RISK AREAS SURINAME, 1989.



BOLIVIA

Bolivia, which had 25,367 cases of malaria in 1989, reported a national API of 3.57. However, the API found in malarious areas was 9.89.

An examination of this malariometric indicator by department shows an API of 21 in the department of Tarija, 19.8 in Pando, 11.8 for Chuquisaca, and 10.5 for Beni (Tables V.10 and 11).

Table V.10

Malariometric Rates in Departments with Malaria High Risk. Bolivia, 1988-89

Department	1988 ABER	1988 NPS	1988 API	1989 ABER	1989 NPS	1989 API
Tarija	10.6	22.2	23.7	8.3	25.9	21.0
Pando	9.3	15.7	14.7	11.2	18.3	19.8
Chuquisaca	7.0	25.8	18.1	9.6	19.1	11.8
Beni	5.4	26.1	14.0	6.1	17.1	10.5
API in Malario-genic Areas			9.3			9.9
All Country	1.5	21.2	3.2	1.6	22.5	3.6

• ccs

Table V.11

Malaria High Risk Areas, Bolivia, 1989

Regions/ High Risk Area	Population Malaric. Area	No. Cases	API
VIII Tarija	216,864	4,554	21.0
V Pando	17,580	348	19.8
III Chuquisaca	255,418	3,014	11.8
I Beni	271,650	2,853	10.5
Totals	761,650	10,769	10.7
All the Country	2563,797	25,367	9.8

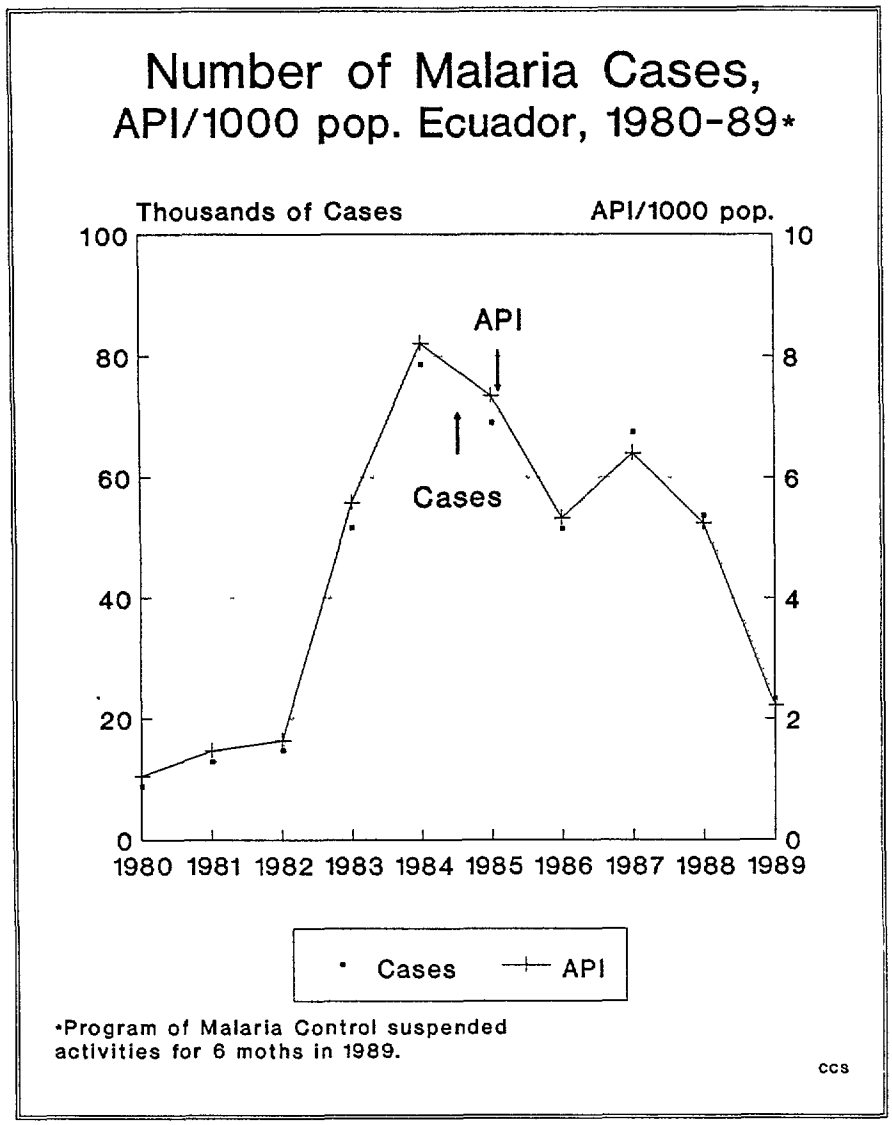
• ccs

Among the risk factors that may assist to explain the mechanisms of malaria transmission are the labor/mining-related migration and the migration to rice-growing areas. These processes are characterized by tremendous mobility and precarious living conditions which have placed the population at high risk of contracting malaria. In addition, the parasite has become drug-resistant in the malarious areas of Beni and Pando. Low coverage by the services and operational problems in the control programs contribute significantly to malaria transmission in the country.

ECUADOR

In Ecuador, 23,274 cases were reported in 1989, with an API of 2.22, a rate that was 2.4 times lower than in 1988. This phenomenon does not necessarily reflect a real decline in malaria, however, since in 1989 labor problems paralyzed the malaria control program for several months, resulting in a coverage of less than 40% for the year (Figure V.11).

Figure V.11



In view of these circumstances, it is safe to say that the API for 1989 significantly underestimates true morbidity from malaria in the country. A breakdown of the above-mentioned API by provinces is shown in Table V.12. The province of Sucumbíos had an API of 45.46; Los Ríos, 16.95; Napo, 11.84; Esmeraldas, 11.84; Manabí, 4.16; and Guayas, 1.38.

Table V.12

Malaria High Risk Areas, Ecuador, 1989

Regions/ High Risk Area	Population Malario. Area	No. Cases	API
Sucumbios	66,931	3,034	45.46
Los Rios	179,817	3,049	16.95
Napo	92,387	1,094	11.84
Esmeraldas	356,273	4,004	12.23
Manabi	1100,329	4,578	4.16
Guavas	2746,530	3,794	1.38
Totals	4542,267	19,553	4.30
Malariogenic Areas	6082,575	23,274	3.82
All Country			2.22

• ccs

Among the main risk factors for transmission are those associated with the country's economic crisis, those linked to management problems within the malaria program, and the limited operating capacity of the health services.

PERU

In Peru the total number of malaria cases reported in 1989 was 32,114, while the overall API for the whole country was 4.46. In the interior the APIs were as much as 12 times higher than the national figure (Table V.13).

Table V.13

Areas of High Risk of Malaria, by Department. Peru, 1989.

Departament High Risk	No. Cases	API
Junin	7,321	53.8
Ayacucho	2,742	26.9
Madre de Dios	890	18.7
San Martin	6,132	15.4
Pasco	376	14.8
Subtotal	17,461	24.6
Total Country	32,114	4.4

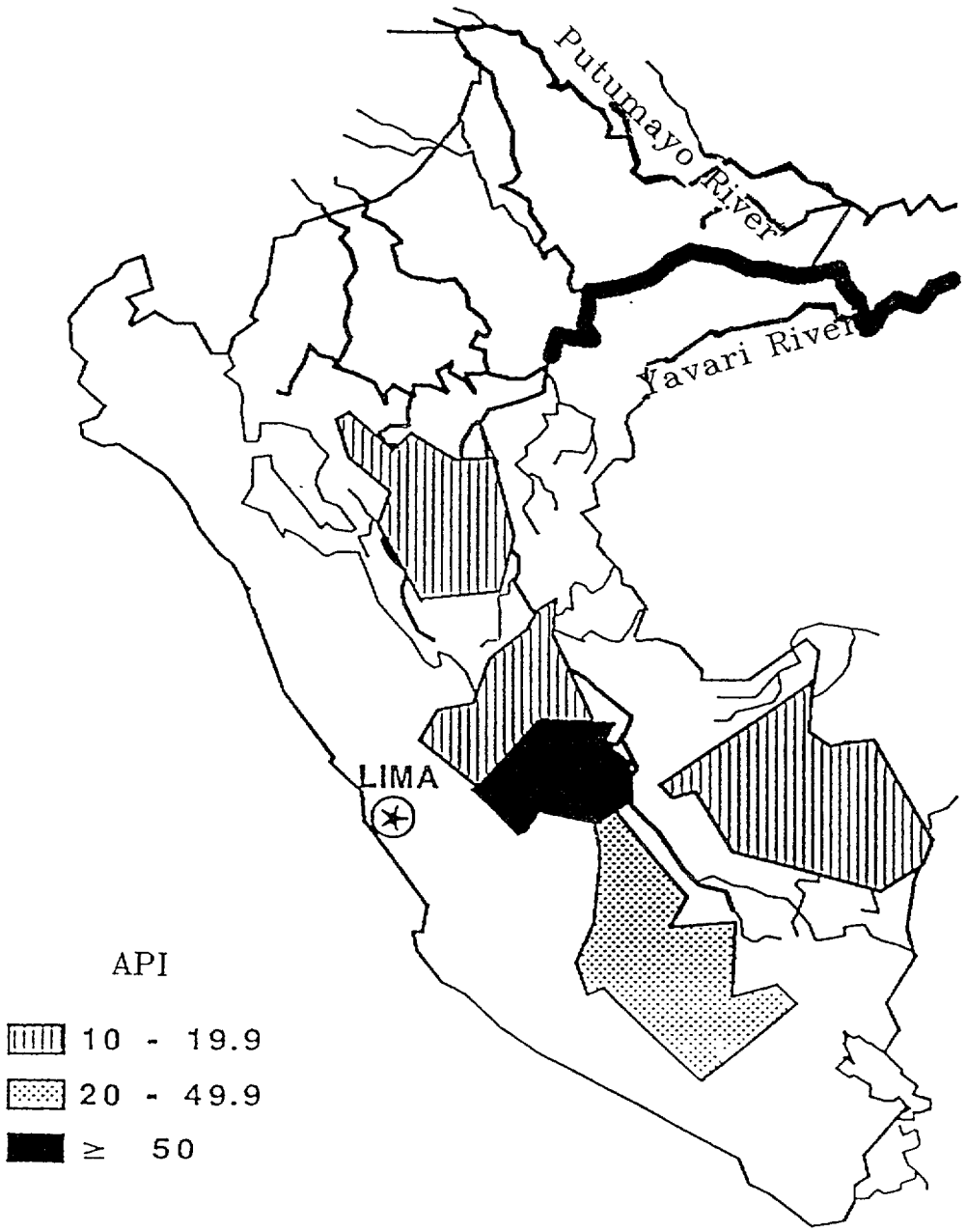
· ccs

For example, the department of Junín, with 7,321 cases, had an API of 53.88, while in the department of Ayacucho it was 26.90; in Madre de Dios, 18.73; in San Martín, 15.43; and in Pasco, 14.83.

The malaria epidemiological map for Peru, showing the distribution of malaria according to these figures, is shown in Figure V.12.

Figure V.12

MALARIA HIGH RISK AREAS
BY API. PERU, 1989.



Based on the API rates, the country's malarious regions have been divided into three areas of risk. High-risk areas are those with APIs of 10 of over, while medium- and low-risk areas have APIs of between 0.5 and 9 and lower than 0.5, respectively.

Two of the main risk factors mentioned as contributing to malaria transmission are those related to the country's critical sociopolitical situation and the serious economic deterioration that is affecting a large proportion of its population.

Also of considerable importance are the social factors associated with violence and drug trafficking, as well as those caused by population movements and internal migrations of workers living in the most precarious of conditions.

13. Involvement of Social Factors in the Malaria Transmission Process in the Countries of the Americas

The economic deterioration and social adjustments that took place in the 1980s in most of the countries in the Region have had a significant impact on the epidemiological profile of health and on the malaria situation.

During this period, the process has been strongly conditioned by the interaction of various economic, sociocultural, political, and bio-environmental factors.

The malaria stratification process has made it possible to recognize the enormous disparities that exist in the distribution of malaria in the Region.

The massive, disorganized mobilization of vulnerable population groups, the increase in new population settlements under precarious social and health conditions, and the breakdown of organizational structures in both the productive and the social sector have generated a severe imbalance in the socioeconomic order of the Region.

This process has resulted in a deterioration of health conditions and in a worsening of the malaria problem in several critical areas in the countries of the Region.

The 1980s saw a significant increase in mass population movements in the endemic countries of Latin America and the Caribbean. These movements occurred as a result of serious economic pressures on the population, triggered in some cases by armed conflict and political instability.

Heavy migrations are being seen in the countries, both internal and from other countries. These population movements have been associated primarily with mining and extraction activities and with the demand for agricultural labor.

In the Amazon region, the existence of new, disorganized poles of colonization without any basic support infrastructure has led to deforestation and to the clandestine destruction of rainforests, caused by both the search for food and the limited availability of agricultural land.

The "resurgence" of mining as an economically important activity has spread throughout several of the Latin American countries.

As a direct result of this phenomenon, there has been a disordered movement of the work force toward highly endemic areas. All these factors have promoted a sustained increase in the already high rates of malaria.

The needed diversification of control measures calls for a comprehensive epidemiological approach that draws on contributions from the social sciences and health services research combined with the progress achieved in basic research, immunology, entomology, and clinical medicine.

The epidemiological risk method is the basis for the application of this comprehensive approach, which allows for stratification of the malaria problem according to levels of risk, taking into account the weight that each factor has in the transmission process.

The use of stratification for assessment of the malaria situation and the planning of control strategies requires the adoption of an epidemiological perspective that takes into account social, economic, and ecological conditions as well as aspects related to organization of the health services in their local dimension.

Malaria stratification provides a rational basis for the planning of control activities. The epidemiological information and the socioeconomic profile of areas of risk are considered to be fundamental elements in the selection of control measures, which are aimed not only to the temporary reduction of malaria transmission but fundamentally to the elimination of the risk factors that perpetuate it.

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NUMBER OF BLOOD SLIDES EXAMINED AND WITH PLASMODIA, BY GEOGRAPHICAL SUB-REGIONS AND BY PHASES OF THE PROGRAMS, 1989

Country (by geographical sub-region) *	T o t a l		Maintenance		Consolidation		Attack phase		Non-malarious areas	
	Blood slides		Blood slides		Blood slides		Blood slides		Blood slides	
	Examined	Positive	Examined	Positive	Exam.	Posit.	Exam	Posit.	Exam.	Posit.
Bahamas a)	5	5	-	-	-	-	-	-	5	5
Barbados a)	1	1	-	-	-	-	-	-	1	1
Bermuda a)	1	1	-	-	-	-	-	-	1	1
Canada a)	195	195	-	-	-	-	-	-	195	195
Cuba	1,028,113	762	1,028,113	762	-	-	-	-	-	-
Chile	0	0	-	-	-	-	-	-	-	-
Dominica	16	0	16	0	-	-	-	-	-	-
United States	1,025	1,025	1,025	1,025	-	-	-	-	-	-
Grenada	119	0	119	0	-	-	-	-	-	-
Guadeloupe	17	4	17	4	-	-	-	-	-	-
Caiman Islands	25	4	-	-	-	-	-	-	25	4
Jamaica	514	2	514	2	-	-	-	-	-	-
Martinique	198	23	198	23	-	-	-	-	-	-
Saint Lucia	...	...	...	...	...	...	...	...	...	...
Trinidad & Tabago	13,522	10	13,522	10	-	-	-	-	-	-
Mexico	1,484,565	101,241	-	-	-	-	1,484,565	101,241	-	-
Belize	19,806	3,285	432	95	6,220	943	13,154	2,247	-	-
Costa Rica	108,614	699	-	-	64,639	437	41,795	121	2,180	141
El Salvador	190,995	9,605	-	-	-	-	190,995	9,605	-	-
Guatemala	331,675	42,453	-	-	-	-	322,339	41,128	9,319	1,325
Honduras	391,250	45,922	-	-	-	-	389,756	45,706	1,494	216
Nicaragua	523,670	45,982	-	-	-	-	523,700	45,982	-	-
Panama	338,473	427	-	-	192,000	390	146,473	37	-	-
Haiti	63,528	23,231	-	-	-	-	63,528	23,231	-	-
Dominican Rep.	293,093	1,275	244,846	1,044	8,862	4	39,373	227	12	0
French Guiana	35,993	6,284	12,850	1,658	8,716	989	14,427	3,637	-	-
Guyana	143,599	20,822	-	-	-	-	116,110	16,833	27,489	3,989
Suriname	23,364	1,704	322	12	437	0	12,535	814	10,070	878
Brazil	3,368,564	577,520	75,717	2,481	539,255	7,046	2,718,705	560,813	34,887	7,180
Bolivia	112,770	25,367	-	-	-	-	112,770	25,367	-	-
Colombia	557,129	100,286	-	-	125,609	3,563	431,520	96,723	-	-
Ecuador	144,851	23,274	-	-	-	-	144,422	23,231	429	43
Peru b)	...	32,114	...	...	...	...	...	...	...	...
Venezuela c)	253,042	31,078	171,500	24,667	-	-	78,593	5,658	2,949	753
Argentina	21,080	1,620	12,122	435	-	-	8,955	1,182	3	3
Paraguay	89,263	5,247	2,925	4	32,588	64	53,508	5,148	242	31
T O T A L	9,539,075	1,101,468	1,564,238	32,222	978,326	13,436	6,907,223	1,008,931	89,301	14,765

* With the exception of countries without transmission. ... Information not available.
a) Information from "weekly Epidemiological Reports. b) Provisional incomplete information.
c) Information up to September.

Sep/7/90 (hs)

Table I-4

MALARIA MORBIDITY IN THE AMERICAS
1958 - 1989

Year	Population (Thousands)		Blood Slides			Morbidity per 100,000 inhabitants	
	Total country	Malariou Area	Examined	Positives	%	Total country	Malarious area
1958	387,276	135,409	1,716,103	56,705	3.30	14.64	41.88
1959	394,606	145,920	2,749,117	75,612	2.75	19.16	51.82
1960	400,500	143,586	3,955,149	79,998	2.02	19.97	55.71
1961	416,008	147,292	5,341,004	99,639	1.87	23.95	67.65
1962	427,919	153,742	7,221,367	177,089	2.45	41.38	115.19
1963	434,950	152,021	7,903,156	227,026	2.87	52.20	149.34
1964	447,666	158,642	8,156,290	254,572	3.12	56.87	160.47
1965	455,527	146,389	9,069,950	241,462	2.66	53.01	164.95
1966	463,649	166,469	11,797,983	333,280	2.82	71.88	200.21
1967	474,868	169,901	11,609,228	369,388	3.18	77.79	217.41
1968	484,664	174,704	12,522,696	282,773	2.26	58.34	161.86
1969	491,483	176,325	12,179,190	323,782	2.66	65.88	183.63
1970	505,819	181,257	9,925,162	344,170	3.47	68.04	189.88
1971	513,544	185,492	10,134,212	338,416	3.34	65.90	182.44
1972	524,774	190,448	9,695,953	284,813	2.94	54.27	149.55
1973	535,109	195,528	9,400,682	280,276	2.98	52.38	143.34
1974	544,865	200,755	8,997,318	269,003	2.99	49.37	134.00
1975	555,676	205,872	9,276,878	356,692	3.84	64.19	173.26
1976	565,249	211,086	9,352,775	379,364	4.06	67.11	179.72
1977	576,942	215,550	9,274,480	398,925	4.30	69.14	185.07
1978	587,704	220,153	9,493,751	468,923	4.94	79.79	213.00
1979	600,263	226,361	8,630,653	515,271	5.97	84.47	227.63
1980	610,021	231,366	8,943,369	602,836	6.74	98.82	260.56
1981	627,375	239,260	9,100,529	629,629	6.92	100.36	263.16
1982	635,954	245,307	8,826,418	715,177	8.10	112.46	291.54
1983	639,212	249,327	9,113,611	830,700	9.11	129.96	333.18
1984	659,535	257,276	9,422,827	931,356	9.88	141.21	362.01
1985	665,777	259,838	9,485,203	910,917	9.60	136.82	350.57
1986	662,983	263,371	10,070,388	950,570	9.44	143.38	360.92
1987 a)	672,941	268,217	9,764,285	1,018,864	10.43	151.40	379.87
1988 a)	703,370	280,758	10,092,472	1,120,040	11.10	159.24	398.93
1989 a)	715,739	285,130	9,539,075	1,101,468	11.55	153.89	386.30

a) The information of some countries is provisional

Aug.21/90 (hs)

Table I-5

MALARIA CASES REGISTERED IN THE REGION OF THE AMERICAS, 1986-1989

Countries (by geographical sub-regions		Population 1988 a) Areas malaricas	1986 Casos registrados	%	1987 Casos registrados	%	1988 Casos registrados	%	1989 Casos registrados	%
Countries without transmission and where Eradication of Malaria has been certified		81,848 b)	1,664	0.18	1,440 c)	0.14	1,908 c)	0.17	2,032 c)	0.18
MEXICO		44,750	131,014	13.78	102,984	10.11	116,238	10.38	101,241	9.19
CAPB	Belize	166	2,779		3,258 c)		2,725 c)		3,285	
	Costa Rica	815	790		883		1,016		699	
	El Salvador	4,624	23,953		12,834		9,095		9,605	
	Guatemala	3,429	42,609		57,662		52,561		42,453	
	Honduras	4,620	29,130		19,095		29,737		45,922	
	Nicaragua	3,745	20,308		17,011		33,047		45,982	
	Panama	2,284	1,060		1,195		1,000		427	
Sub-total		19,683	120,629	12.69	111,938	10.99	129,181	11.53	148,373	13.47
CARIBE	Haiti	5,360	14,363		12,134		12,306 d)		23,231	
	Dominican Rep.	6,970	1,360		1,206		1,072		1,275	
Sub-total		12,330	15,723	1.65	13,340	1.31	13,378	1.19	24,506	2.22
GUIANAS	French Guiana	81	979		3,318 c)		3,188 c)		6,284	
	Guyana	762	16,388		34,142		35,470		20,822 d)	
	Suriname	297	1,316		2,044		2,691		1,704	
Sub-total		1,140	18,683	1.97	39,504	3.88	41,349	3.69	28,810	2.62
BRAZIL		65,239 c)	443,627	46.67	508,864	49.94	559,535 c)	49.96	577,520	52.43
ANDEAN REGION	Bolivia	2,671	20,993		24,891		22,258		25,367	
	Colombia	21,319	89,251		90,014		100,850		100,286	
	Ecuador	6,083	51,430		63,503		53,607		23,274	
	Peru	7,199 c)	36,866		39,136 c)		32,359 c)		32,114 d)	
	Venezuela	15,115	14,365		17,988		45,827		31,078 e)	
Sub-total		52,387	212,905	22.40	235,532	23.12	254,901	22.76	212,119	19.26
SOUTHERN CONE	Argentina	4,220	2,000		1,521		666		1,620	
	Paraguay	3,533	4,329		3,741		2,884		5,247	
Sub-total		7,753	6,329	0.67	5,262	0.52	3,550	0.32	6,867	0.62
TOTAL		285,130	950,574	100.00	1,018,864	100.00	1,120,040	100.00	1,101,468	100.00

a) Population in thousands. b) Total population of these countries is 105,085 inhabitants; including total population of countries which have never been malarious, (see Table and Map I.2). c) Provisional figure.
d) Incomplete provisional figure. e) Information up to September.

Sep.14/90 (hs)

Table I-6

COMPARATIVE RESULTS OF ACTIVE AND PASSIVE CASE DETECTION
UNDER MALARIA PROGRAMS IN THE AMERICAS, 1989

Countries (by geographical sub-region) *	Number of Evaluators	Active case detection			Pasive case detection					TOTAL		
		Blood slides			Product. notific. Posts	Blood slides			Average slides per productive Not. post	Blood slides		
		Examined	Positives	%		Examined	Positives	%		Examined	Positives	%
Bahamas a)	-	-	-	-	-	-	-	-	-	5	5	100.00
Barbados a)	-	-	-	-	-	-	-	-	-	1	1	100.00
Bermuda a)	-	-	-	-	-	-	-	-	-	1	1	100.00
Canada a)	-	-	-	-	-	-	-	-	-	195	195	-
Cuba	-	121,518	...	-	-	907,675	...	-	-	1,028,113	762	0.07
Chile	-	-	-	-	-	-	-	-	-	0	0	0
Dominica	-	-	-	-	-	16	0	-	-	16	0	0
United States	-	-	-	-	-	-	-	-	-	1,025	1,025	100.00
Grenada	-	-	-	-	-	119	0	-	-	119	0	0.00
Guadeloupe	-	17	4	-	-	-	-	-	...	17	4	23.53
Caiman Islands	-	-	-	-	-	25	4	16.00	-	25	4	16.00
Jamaica	-	-	-	-	-	514	2	0.39	-	514	2	
Martinique	-	-	-	-	-	-	-	-	-	198	23	11.62
Saint Lucia	-	-	-	-	-	...	...	...	...	...	...	...
Trinidad & Tobago	-	4,695	0	-	-	8,857	10	0.11	-	13,552	10	0.07
Mexico	...	...	...	...	...	...	...	...	...	1,484,565	101,241	6.82
Belize	12	6,899	611	8.86	311	12,907	2,674	20.72	3.46	19,806	3,285	16.59
Costa Rica	113	101,440	441	0.43	664	7,174	258	3.60	0.90	108,614	699	0.64
El Salvador	120	56,611	539	0.95	2,141	134,384	9,066	6.75	5.23	190,995	9,605	5.03
Guatemala	88	12,257	1,549	12.64	4,165	319,418	40,904	12.81	6.39	331,675	42,453	12.80
Honduras	140	21,144	442	2.09	...	370,106	45,480	12.29	-	391,250	45,922	11.74
Nicaragua	63	53,304	1,043	1.96	...	470,366	44,939	9.55	-	523,670	45,982	8.78
Panama	238	221,219	309	0.14	148	117,254	118	0.10	66.02	338,473	427	0.13
Haiti	...	...	...	...	...	...	...	...	...	63,528	23,231	36.57
Dominican Rep.	...	242,747	831	0.34	...	50,346	444	0.88	...	293,093	1,275	0.44
French Guiana	...	9,670	903	9.34	...	26,323	5,381	20.44	...	35,993	6,284	17.46
Guyana	40	...	...	...	124	143,599	20,822	14.50	96.50	143,599	20,822	14.50
Suriname	45	78	5	6.41	108	23,286	1,699	7.30	17.97	23,364	1,704	7.29
Brazil	...	1,458,899	62,193	4.26	19,986	1,929,665	515,327	26.71	8.05	3,368,564	577,520	17.14
Bolivia	60	71,058	8,079	11.37	...	41,712	17,188	41.21	-	112,770	25,367	22.49
Colombia	337	129,020	13,044	10.11	4,427	428,109	87,242	20.38	8.06	557,129	100,286	18.00
Ecuador	...	19,500	2,501	12.83	...	125,351	20,773	16.57	-	144,851	23,274	16.07
Peru b)	...	...	...	...	...	...	...	...	...	...	32,114	...
Venezuela c)	698	157,236	5,903	3.75	...	95,806	25,175	26.28	-	253,042	31,078	12.28
Argentina	70	11,621	713	6.14	31	9,459	907	9.59	25.43	21,080	1,620	7.69
Paraguay	...	38,745	716	1.85	911	50,518	4,531	8.97	4.62	89,263	5,247	5.88
T o t a l	-	2,737,678	99,826	3.65	-	5,272,989	842,944	15.99	-	9,539,105	1,101,468	11.55

* With exception of countries without transmission. ... Information not available.
a) Information from the Weekly Epidemiological Report. b) Provisional incomplete information. c) Information up to September

Sep.17/90 (hs)

Table I.7

POPULATION OF MALARIOUS AREAS
1958 - 1988
(In thousands)

Year	Number of inhabitants in originally malarious areas					Total Population (In thousands)
	Mainte-nance	Consoli-dation	Attack	Prep. phase or Program not started	Total	
1958	52,866	1,996	46,196	34,351	135,409	387,276
1959	52,856	9,349	56,292	27,423	145,920	394,606
1960	54,363	10,101	53,400	25,722	143,586	400,500
1961	56,979	17,879	39,021	33,413	147,292	416,008
1962	59,299	30,424	49,276	14,743	153,742	427,919
1963	56,546	33,901	31,910	29,664	152,021	434,950
1964	57,414	32,277	34,426	34,525	158,642	447,666
1965	60,975	34,731	38,575	12,108	146,389	455,527
1966	69,760	36,128	43,369	17,212	166,469	463,649
1967	70,720	41,581	44,766	12,834	169,901	474,868
1968	72,441	45,812	56,234	217	174,704	484,664
1969	72,757	46,987	56,375	206	176,325	491,483
1970	80,770	40,518	59,807	162	181,257	505,819
1971	81,306	43,644	60,396	146	185,492	513,544
1972	86,634	42,016	61,645	153	190,448	524,774
1973	87,969	45,535	61,915	109	195,528	535,109
1974	91,527	46,042	63,130	56	200,755	544,865
1975	99,405	44,633	61,834	-	205,872	555,676
1976	101,068	48,813	61,205	-	211,086	565,249
1977	104,567	50,610	60,373	-	215,550	576,942
1978	105,611	59,734	54,808	-	220,153	587,704
1979	113,092	57,280	55,989	-	226,361	600,263
1980	114,620	58,087	58,659	-	231,366	610,021
1981	117,042	59,962	62,256	-	239,260	627,375
1982	118,338	62,028	64,941	-	245,307	635,954
1983	119,175	66,970	63,182	-	249,327	639,212
1984	124,408	68,372	64,496	-	257,276	659,535
1985	124,086	67,092	68,659	-	259,837	665,777
1986	116,143	43,717	103,500	-	263,371	662,983
1987	117,310	42,334	108,633	-	268,277	672,384
1988	124,250	46,048	109,927	-	280,225	703,358
1989	126,441	45,309	113,388	-	285,130	715,739

Sep/17/90 (hs)

Table I-8

STATUS OF MALARIA PROGRAM IN THE AMERICAS, BY POPULATION, 1989

Countries (by geographical sub-region)	Total Population	Population of originally malarious areas							
		Total Mal. area		Maintenance		Consolidation		Attack	
	a)	Total	%	Total	%	Total	%	Total	%
Anguilla	7 b)	-	-	-	-	-	-	-	-
Antigua	85 b)	-	-	-	-	-	-	-	-
Netherland Antilles	191 b)	-	-	-	-	-	-	-	-
Bahamas	257 b)	-	-	-	-	-	-	-	-
Barbados	259 b)	-	-	-	-	-	-	-	-
Bermuda	58 b)	-	-	-	-	-	-	-	-
Canada	24,310 b)	-	-	-	-	-	-	-	-
Cuba	10,501	3,574 b)	34.03	3,574 c)	100.00	-	-	-	-
Chile	12,748	325 b)	2.55	325	100.00	-	-	-	-
Dominica	82	17 b)	20.73	17 c)	100.00	-	-	-	-
United States of Amer.	248,134 b)	70,282 b)	28.32	70,282 c)	100.00	-	-	-	-
Grenada	101 b)	40 b)	39.60	40 c)	100.00	-	-	-	-
Guadalupe	340	333	97.94	333 c)	100.00	-	-	-	-
Cayman Islands	21 b)	-	-	-	-	-	-	-	-
Falkland Islands	2 b)	-	-	-	-	-	-	-	-
Turks and Caicos Islands	8 b)	-	-	-	-	-	-	-	-
Virgin Islands (USA)	111 b)	-	0.00	-	100.00	-	-	-	-
Virgin Islands (UK)	13 b)	-	-	-	-	-	-	-	-
Jamaica	2,483 b)	2,111 b)	85.02	2,111 c)	100.00	-	-	-	-
Martinica	344	215	62.50	215 c)	100.00	-	-	-	-
Montserrat	13 b)	-	-	-	-	-	-		-
Puerto Rico	3,658 b)	3,658 b)	100.00	3,658 c)	100.00	-	-	-	-
St. Kitts-Nevis	49 b)	-	-	-	-	-	-	-	-
St. Peter & Miquelon	6 b)	-	-	-	-	-	-	-	-
St. Vincent	109 b)	-	-	-	-	-	-	-	-
Saint Lucia	135 b)	115 b)	85.19	115 c)	-	-	-	-	-
Trinidad and Tobago	1,263 b)	1,178 b)	93.27	1,178 c)	100.00	-	-	-	-
Uruguay	3,104 b)	-	-	-	-	-	-	-	-
Mexico	86,737 b)	44,750 b)	51.59	-	-	-	-	44,750	100.00
Belize	166	166	100.00	-	-	72	43.37	94	56.63
Costa Rica	2,949	815	27.64	-	-	701	86.01	114	13.99
El Salvador	5,138	4,624	90.00	-	-	-	-	4,624	100.00
Guatemala	8,425	3,429	40.70	-	-	-	-	3,429	100.00
Honduras	4,951	4,620	93.31	-	-	-	-	4,620	100.00
Nicaragua	3,745	3,745	100.00	-	-	-	-	3,745	100.00
Panama	2,370	2,284	96.37	-	-	2,080	91.07	204	8.93
Haiti	6,000	5,360	89.33	-	-	-	-	5,360	100.00
Rep. Dominicana	7,012	6,970	99.40	6,823	97.89	52	0.75	95	1.36
French Guiana	100	81	81.00	49	60.49	27	33.33	13	16.05
Guyana	768	762	99.22	657	86.22	-	-	105	13.78
Suriname	402 b)	297 b)	73.88	263	88.55	6	2.02	28	9.43
Brazil	150,087	65,239	43.47	17,257	26.45	25,192	38.61	22,790	34.93
Bolivia	6,756	2,671	39.54	-	-	-	-	2,671	100.00
Colombia	32,648	21,319	65.30	-	-	15,479	72.61	5,840	27.39
Ecuador	10,490	6,083	57.99	-	-	-	-	6,083	100.00
Peru	21,790 b)	7,199 b)	33.04	-	-	-	-	7,199	100.00
Venezuela	19,245	15,115	78.54	14,463 d)	95.69	-	-	652	4.31
Argentina	33,411	4,220	12.63	4,118	97.58	-	-	102	2.42
Paraguay	4,157	3,533	84.99	963	27.26	1,700	48.12	870	24.62
T o t a l	715,739	285,130	39.84	126,441	44.35	45,309	15.89	113,388	39.77

a) Population in thousands. b) Midyear population estimated by PAHO. c) Pop. living in areas where malaria eradication has been registered by PAHO/WHO. d) Includes an area of 11,425,915 inhabitants where malaria eradication has been registered by PAHO/WHO.

Aug/21/90 (hs)

Table I-9

STATUS OF MALARIA PROGRAM IN THE AMERICAS, BY POPULATION, 1989

Countries (by geographical sub-region)	Total Population	Population of originally malarious areas							
		Total Mal. area		Maintenance		Consolidation		Attack	
	a)	Total	%	Total	%	Total	%	Total	%
Anguilla	7 b)	-	-	-	-	-	-	-	-
Antigua	85 b)	-	-	-	-	-	-	-	-
Netherland Antilles	191 b)	-	-	-	-	-	-	-	-
Bahamas	257 b)	-	-	-	-	-	-	-	-
Barbados	259 b)	-	-	-	-	-	-	-	-
Bermuda	58 b)	-	-	-	-	-	-	-	-
Canada	24,310 b)	-	-	-	-	-	-	-	-
Cuba	10,501	3,574 b)	34.03	3,574 c)	100.00	-	-	-	-
Chile	12,748	325 b)	2.55	325	100.00	-	-	-	-
Dominica	82	17 b)	20.73	17 c)	100.00	-	-	-	-
United States of Amer.	248,134 b)	70,282 b)	28.32	70,282 c)	100.00	-	-	-	-
Grenada	101 b)	40 b)	39.60	40 c)	100.00	-	-	-	-
Guadalupe	340	333	97.94	333 c)	100.00	-	-	-	-
Cayman Islands	21 b)	-	-	-	-	-	-	-	-
Falkland Islands	2 b)	-	-	-	-	-	-	-	-
Turks and Caicos Islands	8 b)	-	-	-	-	-	-	-	-
Virgin Islands (USA)	111 b)	-	0.00	-	100.00	-	-	-	-
Virgin Islands (UK)	13 b)	-	-	-	-	-	-	-	-
Jamaica	2,483 b)	2,111 b)	85.02	2,111 c)	100.00	-	-	-	-
Martinica	344	215	62.50	215 c)	100.00	-	-	-	-
Montserrat	13 b)	-	-	-	-	-	-	-	-
Puerto Rico	3,658 b)	3,658 b)	100.00	3,658 c)	100.00	-	-	-	-
St. Kitts-Nevis	49 b)	-	-	-	-	-	-	-	-
St. Peter & Miquelon	6 b)	-	-	-	-	-	-	-	-
St. Vincent	109 b)	-	-	-	-	-	-	-	-
Saint Lucia	135 b)	115 b)	85.19	115 c)	-	-	-	-	-
Trinidad and Tobago	1,263 b)	1,178 b)	93.27	1,178 c)	100.00	-	-	-	-
Uruguay	3,104 b)	-	-	-	-	-	-	-	-
Mexico	86,737 b)	44,750 b)	51.59	-	-	-	-	44,750	100.00
Belize	166	166	100.00	-	-	72	43.37	94	56.63
Costa Rica	2,949	815	27.64	-	-	701	86.01	114	13.99
El Salvador	5,138	4,624	90.00	-	-	-	-	4,624	100.00
Guatemala	8,425	3,429	40.70	-	-	-	-	3,429	100.00
Honduras	4,951	4,620	93.31	-	-	-	-	4,620	100.00
Nicaragua	3,745	3,745	100.00	-	-	-	-	3,745	100.00
Panama	2,370	2,284	96.37	-	-	2,080	91.07	204	8.93
Haiti	6,000	5,360	89.33	-	-	-	-	5,360	100.00
Rep. Dominicana	7,012	6,970	99.40	6,823	97.89	52	0.75	95	1.36
French Guiana	100	81	81.00	49	60.49	27	33.33	13	16.05
Guyana	768	762	99.22	657	86.22	-	-	105	13.78
Suriname	402 b)	297 b)	73.88	263	88.55	6	2.02	28	9.43
Brazil	150,087	65,239	43.47	17,257	26.45	25,192	38.61	22,790	34.93
Bolivia	6,756	2,671	39.54	-	-	-	-	2,671	100.00
Colombia	32,648	21,319	65.30	-	-	15,479	72.61	5,840	27.39
Ecuador	10,490	6,083	57.99	-	-	-	-	6,083	100.00
Peru	21,790 b)	7,199 b)	33.04	-	-	-	-	7,199	100.00
Venezuela	19,245	15,115	78.54	14,463 d)	95.69	-	-	652	4.31
Argentina	33,411	4,220	12.63	4,118	97.58	-	-	102	2.42
Paraguay	4,157	3,533	84.99	963	27.26	1,700	48.12	870	24.62
T o t a l	715,739	285,130	39.84	126,441	44.35	45,309	15.89	113,388	39.77

a) Population in thousands. b) Midyear population estimated by PAHO. c) Pop. living in areas where malaria eradication has been registered by PAHO/WHO. d) Includes an area of 11,425,915 inhabitants where malaria eradication has been registered by PAHO/WHO.

Aug/21/90 (hs)

Table I-10

EPIDEMIOLOGICAL SITUATION OF 21 COUNTRIES WITH ACTIVE MALARIA PROGRAMS, 1989

Countries (by geographical sub-regions)	Population malarious areas	Blood slides		Species of parasites				Epidemiological Indicators *			
		Examined	Posit.	P. falc.	P. vivax	P.mal.	Mixtas	IAES	ILP	IPA	% de P.falc.
Mexico	44,750	1,484,565	101,241 a)	85	101,127	-	-	3.32	6.82	2.26	0.08
Belize	166	19,806	3,285	70	3,208	7	0	11.93	16.59	19.79	2.13
Costa Rica	815	108,614	699	31	668	-	-	13.33	0.64	0.86	4.43
El Salvador	4,624	190,995	9,605	40	9,565	-	-	4.13	5.03	2.08	0.42
Guatemala	3,429	331,658	42,453	1,084	41,298	-	71	9.67	12.80	12.38	2.55
Honduras	4,620	391,250	45,922	326	45,555	-	41	8.47	11.74	9.94	0.71
Nicaragua	3,745	523,670	45,982	1,681	44,262	-	39	13.98	8.78	12.28	3.66
Panama	2,284	338,473	427	84	343	-	-	14.82	0.13	0.19	19.67
Haiti	5,360	63,528	23,231	23,231	-	-	-	1.19	36.57	4.33	100.00
Dominican Rep.	6,970	293,093	1,275	1,241	32	-	2	4.21	0.44	0.18	97.33
French Guiana	81	35,993	6,284	3,831	2,391	62	-	44.44	17.46	77.58	60.96
Guyana	762	143,599	20,822	12,255	8,432	-	135	18.85	14.50	27.33	58.86
Suriname	297	23,364	1,704	1,583	119	0	2	7.87	7.29	5.74	92.90
Brazil	65,239	3,368,564	577,520	271,268	301,841	5	4,406	5.16	17.14	8.85	46.97
Bolivia	2,671	112,770	25,367	1,349	24,004	-	14	4.22	22.49	9.50	5.32
Colombia	21,319	557,129	100,286	33,405	66,691	55	135	2.61	18.00	4.70	33.31
Ecuador	6,083	144,851	23,274	6,569	16,705	-	-	2.38	16.07	3.83	28.22
Peru b)	7,199 c)	...	32,114	65	32,049	-	-	0.00	...	4.46	0.20
Venezuela d)	15,115	253,042	31,078	9,781	20,937	3	357	1.67	12.28	2.06	31.47
Argentina	4,220	21,080	1,620	-	1,620	-	-	0.50	7.69	0.38	0.00
Paraguay	3,533	89,263	5,247	18	5,229	-	-	2.53	5.88	1.49	0.34
T O T A L	203,282	8,495,307	1,099,436	367,997	726,076	132	5,202	4.18	12.94	5.41	33.47

* ABER = Annual Blood Examination Rate. SPR = Slide Positive Rate. API = Annual Parasite Incidence

P. falc. = Plasmodium falciparum.

P. mal. = Plasmodium malariae

a) Includes 29 cases without diagnostic of specie. b) Provisional incomplete information. c) Estimated.

d) Information up to September.

Sep/17/90 (hs)

Table I-11

INSECTICIDES USED IN MALARIA PROGRAMS, 1989 AND ESTIMATED 1990

Country (by geographical region)	D D T (Kg)				Malation		Propoxur 50% (Kg.)		Fenitrothion 40% (Kg)		O t h
	1989		1990 (Est.)		1989	1990 (Est.)	1989	1990 (Est.)	1989	1990 (Est.)	1989
	100%	75%	100%	75%							
Mexico	22,000	1,041,866	50,525	1,254,925	59,682	117,334	-	-	4,850	-	65,002 a
Belize	8,500	17,000	8,500	7,500	-	-	-	-	- -	-	- -
Costa Rica	-	-	-	-	5,754	12,000	3,509	3,000	-	-	2,370 c)
El Salvador	-	-	-	-	-	-	49,094	13,000	-	-	1,579 d)
Guatemala	-	-	-	-	-	-	18,292	37,000	58,429	200,000	8,219 e)
Honduras	-	-	-	-	-	-	2,451	-	130,980	146,185	-
Nicaragua	-	4,055	-	-	-	-	13,510	30,913	-	-	22,612 f)
Panama	-	185 g)	-	-	-	-	1,044	3,000	4,503	80,000	-
Haiti	-	-	-	-	-	-	-	-	160	-	-
Dominican Rep.	319	4,725	...	...	-	-	-	-	207	-	-
French Guiana	45	105	-	-	187	...	80	...	461	...	1,030 h)
Guyana	-	4,384	-	8,858	-	-	-	-	-	-	-
Suriname	50	...	500	1,500	...	...	...	...	...	...	...
Brazil	82,277	1,331,781	130,000	1,680,000	-	-	-	-	-	-	7,100 i)
Bolivia	-	115,496	-	110,000	-	-	-	-	-	-	-
Colombia	880	103,731	7,000	350,000	-	-	-	-	29,784	40,000	-
Ecuador	72	5,289	-	276,000	103,065	-	-	-	2,345	-	-
Peru	...	...	...	...	...	...	...	...	...	...	...
Venezuela j)	-	77,569	-	113,971	31,035	54,712	-	-	76,955	136,392	65,712 k)
Argentina	20	4,705	1,000	10,000	-	-	-	-	-	-	144 l)
Paraguay	-	24,165	-	107,140	-	-	-	-	-	-	-
T O T A L	114,163	2,735,056	197,525	3,919,894	199,723	184,046		86,913	308,674	602,577	173,768

... Information not available.

a) MEX. Includes in 1990, 3,000 Lt. Temephos 50%, 11,002 Kg. Bendiocarb 80% & 51,000 Lt. Fenthion 2%. b) MEX. Estimations for 1990 are: Temephos 50%, 41,500 Kg. Temephos 1%, 3,539 Kg. Bendiocarb 80%, & 69,755 Lt. Fenthion 2%. c) COR. In 1989, includes 1,200 Lt. Propox 1,170 Lt. Malathion 57%. and for 1990 2,000 Lt. of each. d) ELS. In 1989 includes: 315 kg. Bendiocarb 80%, 600 Gal. Abate emulsion & Permetrin 5%, in 1990 includes: 7,000 Kg. 2,000 & 2,000 respectively. e) GUT. In 1989 includes: 6,459 Kg. Deltametrin 5%, 916 Kg Ac and 844 Kg. Icon 5% and in 1990 includes: 12,000 Kg. Deltametrin 5%. f) NIC. Kg. Deltametrin 2.5%. g) PAN. DDT was used by a privat
h) GFR. Includes 69 Kg. K'otrin, 556 Kg. Temephos, 494 Lt. Temephos & 352 Lt. Malathion 95%. i) BRA. Kg. Icois. j) VEN. Information
k) VEN. In 1989 includes, 26,999 Lt. DDT C.E. 30% and 35,714 Lt. Fenitrothion C.E. and in 1990 includes 46,041 and 41,391 respectively.
l) ARG. Liters of K'otrine 2.5%.

Sep/

Table I-12

SPRAYINGS WITH RESIDUAL INSECTICIDES APPLIED IN 1988 AND 1989

Countries (by geogra- sub-regions)	Hydrochlorides		Organophosphates				Carbamates				Pyrethroides			
	DDT		Malathion		Fenitrothion		Propoxur		Bendiocarb		Deltamethrin		K'otrin	
	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989	1988	1989
Mexico	1,037,835	1,509,022	-	-	a)	3,469	-	-	181,484 a)	74,068	-	-	-	-
Belize	27,163	24,460	-	-	-	-	-	-	-	-	-	-	-	-
Costa Rica	-	-	12,565	10,493	-	-	6,160	9,171	-	-	-	-	-	-
El Salvador	-	-	-	-	-	-	77,529	73,866	-	3,765	-	-	-	-
Guatemala b)	-	-	-	-	148,923 c)	153,401	-	28,507	-	-	82,753	76,043	-	-
Honduras	-	-	-		148,736	134,593 d)	-	(d)	-	-	-	-	-	-
Nicaragua	6,461	-	-	-	-	-	-	-	-	-	-	105,454	47,806	-
Pamama	9,648	804	-	-	6,738	15,665	1,981	2,892	-	-	-	-	-	-
Haiti	-	-	-	-	-	206,541	-	-	-	-	-	-	-	-
Domincan Rep.	54,670	13,788	-	-	-	-	-	-	-	-	-	-	-	-
French Guiana	...	68,000 e)	...	-	...	-	...	-	...	-	...	-	...	-
Guyana	7,965	4,490	-	-	-	-	-	-	-	-	-	-	-	-
Suriname	729	176	-	-	-	-	-	-	-	-	-	-	-	-
Brazil	2,626,667 f)	2,332,347 g)	-	-	-	-	-	-	-	-	-	-	-	-
Bolivia	89,348	94,457	-	213	-	-	-	-	-	-	-	-	-	-
Colombia	199,321	225,721 h)	-	-	22,431	(h)	3,139	-	-	-	-	-	3,432	-
Ecuador	69,826	9,035	150,056	133,144	14,351	2,167	-	-	-	-	-	-	-	-
Peru	147,702	...	-	...	-	...	-	...	-	...	-	...	-	...
Venezuela	191,254 j)	142,201	-	-	135,156	97,114	-	-	-	-	-	-	-	-
Argentina	15,262	8,165 k)	-	-	-	-	-	-	-	-	-	-	-	-
Paraguay	39,202 h)	39,386	-	15,249	-	-	-	-	-	-	-	-	-	-
T O T A L	4,523,053	4,472,052	162,621	159,099	476,335	612,950	88,809	114,436	181,484	77,833	82,753	181,497	51,238	-

... Information not available.

a) MEX. Includes 169,602 houses sprayed with Bendiocarb and Fenitrothion, without specified number. b) GUT. In addition, 2,730 houses were sprayed with Icon, Actellic and Deltamethrin. c) GUT. Includes 448 houses sprayed with Deltamethrin, Fenitrothio and Actellic. d) HON. Includes houses sprayed with Fenitrothion and Propoxur. e) GFR. Houses sprayed with K'otrin and Baytex. f) BRA. Includes houses sprayed with Malathion and pyretroids, without specified number. g) BRA. Includes houses sprayed with DDT, Malathion and Deltametrin. h) COL & PAR Includes houses sprayed with DDT and Fenitrothion. i) VEN. Information up to September. j) VEN. In addition, 2413 houses were sprayed with DDT and Fenitrothion. k) ARG. Includes houses sprayed with DDT and K'otrin.

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Table I-13

NUMBER OF INTRADOMICILIARY SPRAYINGS WITH RESIDUAL INSECTICIDES, 1986-1989

Insecticides	1986		1987		1988		1989	
	Number of countries	Sprayings	Number of countries	Sprayings	Number of countries	Sprayings	Number of countries	Sprayings
DDT	14	3,820,475 a)	12	3,979,995 b)	15	4,523,053 c)	13	4,467,562 d)
FENITROTION	7	482,968 e)	9	640,741 f)	6	476,335 g)	5	612,950 h)
PROPOXUR	5	104,658	5	123,841	4	88,809	4	114,436
MALATION	1	16,703	1	12,899	2	162,621	2	159,099
DELTAMETRINA	2	129,627 i)	3	191,806 i)	1	82,753	2	281,497
BENDIOCARB	1	87,049	1	121,618	1	181,484	2	77,068
CLORFOXIM	-	-	1	5,420	-	-	-	-
K'OTRINA	-	-	-	-	2	51,238	-	-
T O T A L	-	4,641,480		5,070,900	-	5,515,055	-	5,712,612

a) Includes sprayings with DDT, Deltamethrin and Fenitrothion (Col) and with DDT and Fenitrothion (ECU and VEN).
b) Figures of Colombia and Venezuela are included with DDT.
c) In some countries, (BRA, PAR & VEN) sprayings with DDT, Malathion, Pyretrines and K'otrine are included.
d) Includes sprayings with DDT, Fenitrothion and K'otrine (COL) and with DDT and Fenitrothion (ECU & MEX)
e) Figures of 3 countries (COL, ECU & VEN) are included with DDT. f) Figures of 3 countries (COL, ECU & MEX) included with DDT fiure. g) Figures of one country (MEX) is included in DDT figure. h) Houses sprayed with Propoxur included with Fenitrothion. i) (COL) Sprayings with Deltametrin included with DDT.

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Table I-14

PERSONNEL EMPLOYED IN MALARIA PROGRAMS IN THE AMERICAS
1988 and 1989 a)

Category	1988	1989 b)
Engineers	38 c)	37 c)
Spraying Chiefs	567	440
Sector Chiefs	569	641
Squad Chiefs	1,626	1,758
Spraymen	6,529 d)	7,584 d)
Draftsmen	46 c)	44 c)
Medical Officers	122	113
Entomologists	31	31
Assistant entomologists	215	347
Statisticians & Statist. assist.	312	315
Evaluation Inspectors	2,023	2,602
Evaluadores	8,464 d)	7,967 d)
Microscopists	1,373	1,429
Administrators	36	36 a)
Administrative assistants	354	300 a)
Accountans	34	28
Disbursing Officers	33	31
Storekeepers	55	49
Storekeepers' assistants	26	22
Secretaries	207	279
Other	379	365
Transport chiefs, Mechanics and Assistant mechanics	188	179
Drivers	1,066	1,105
Motorboat operators	209	213
Boatmen	163	163
T O T A L	24,665	26,078

a) The administration of some malaria programs is under the national health services.
b) Information from some countries was not available.
c) Engineers and draftsman work in different programs.
d) In some programs this personnel perform larvicide spraying amd do epidemiological work

Sep/14/90 (hs)

Table I-15

NATIONAL AND INTERNATIONAL CONTRIBUTIONS TO MALARIA PROGRAMS, 1988-1989

Countries (by geographic region)	Country expenditures a)			Loans and grants			PAHO/WHO Regular funds	
	1988	1989	1990	1988	1989	1990	1988-89 b)	1990-91 b)
Mexico	...	32,991	44,857	-	-	-	615,100 c)	674,400 c)
Belice	...	...	...	...	...	...	0	38,800 c)
Costa Rica	1,093,333	1,037,500	1,382,730	-	224,051 d)	412,578 d)	0	26,400 c)
El Salvador	1,317,617	1,037,494	...	-	86,860 e)	-	346,600 c)	229,399 c)
Guatemala	3,233,975	4,136,690	2,784,275	-	90,620 e)	-	281,200 c)	356,400 c)
Honduras	2,367,349	2,742,659	...	236,593	213,980 f)	693,733 g)	624,200 c)	52,200 h)
Nicaragua	...	...	...	-	508,152 h)	868,725 d)	140,500 c)	93,700 i)
Panama	432,561	450,561	...	...	...	...	0	36,700 c)
Haiti	77,000	40,000	27,662	...	...	...	550,400 i)	117,800 i)
Rep. Domin.	407,690	582,978	...	...	...	...	210,400 c)	155,500 c)
Brasil	15,658,951	326,218,580	1,075,361	11,041	130,588	419,230	758,000 i)	297,700 i)
G. Francesa	...	...	...	...	...	...	-	-
Guyana	200,829	121,433	166,970	...	...	...	197,800 j)	194,600 c)
Suriname	87,005	82,485	...	...	...	...	41,000 c)	98,400 c)
Bolivia	551,188	7,653	...	...	...	...	461,400 c)	522,400 c)
Colombia	1,857,502	3,500,000	...	...	...	...	370,700 c)	204,500 c)
Ecuador	2,429,184	3,409,090	2,483,870	...	...	...	257,300 c)	380,900 c)
Peru	...	...	...	...	...	...	165,300 c)	70,600 i)
Venezuela	4,040,326	5,639,156	...	...	...	...	194,400 c)	0
Argentina	71,547	406,085	...	...	...	...	2,267,150 c)	335,160 c)
Paraguay	1,452,220	1,846,504	1,643,389	...	...	...	111,700 c)	241,200 c)
Proy. Reg.	-	-	-	2,393,712	2,607,871 l)	875,000 m)	2,013,155 n)	2,489,480 n)
Total	35,278,277	351,291,859	9,609,114	2,641,346	3,862,122	3,269,266	9,606,305	6,616,239

... Information not available.

a) Estimations of the countries; converted into USA dollars, according to official exchange rate of each year.

b) Figures taken from Official Document 226. c) Amount for the Communicable Diseases Program. d) Grant from the Governments of Sweden and Finland for COR/NIC border's Project. e) BID Grant for preparation of proposal on Integrated Malaria Control Programs. f) Grant for $120,000 from the Gov. of Sweden and Finland for HON/NIC border's project and BID Grant for preparation of a proposal on Integrated Malaria Control Programs. g) Grant from the Governments of Sweden and Finland for HON/NIC border's Project. h) Includes Grant for $404,675 from the Gov. of Sweden and Finland and $103,480 from BID's Grant for the preparation of a proposal on Integrated Malaria Control Programs. i) Funds only for Malaria Program. j) Funds for Vector Control. k) Includes $128,570 Grant from the USA Navy Department, $2,165,142 Grant/Agreement PAHO/AID for the CAPB countries and $100,000 FINIDA Grant for Nic. l) Includes $2,108,705 from the PAHO/AID Agreement, $257,412 FINIDA Grant and $241,754 Grant from the US Navy Dept. m) Includes $400,000 from the PAHO/AID Agreement, $225,000 from FINIDA Grant and $250,000 Grant form the USA Navy Dept. n) Includes ICP/MAL and MCP/MAL Projects and 40% of the funds assigned to VBC.

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Table I-16

USE OF ANTIMALARIAL DRUGS IN 1989 AND REQUIREMENTS FOR 1990

Countries (by geographical region)	Chloroquine 150 mg.		Primaquine 15 mg.		Primaquine 05 mg		Chloroquine/Primaquine combined Adult doses		Chloroquine/Primaquine combined Infant doses		Pyrimethamine 25 mg	
	1989 a)	1990 a)	1989 a)	1990 a)	1989 a)	1990 a)	1989 a)	1990 a)	1989 a)	1990	1989 a)	1990
Mexico	8,003.4	7,753.6	3,192.7	3,076.9	2,725.6	2,532.7	1,740.0	1,740.0	304.5	304.5	-	-
Belize	160.0	250.0	75.0	110.0	70.0	110.0	-	-	-	-	-	-
Costa Rica	779.8	1,000.0	78.7	150.0	-	-	2.5	25.0	-	-	-	-
El Salvador	77.6	70.0	22.1	20.0	-	-	1,022.5	3,000.0	603.0	500.0	-	-
Guatemala	1,136.9	6,000.0	177.5	2,000.0	149.6	1,100.0	309.8	1,000.0	137.3	80.0	-	-
Honduras	2,933.6	3,800.0	972.9	2,000.0	1,062.7	2,300.0	1,469.9	800.0	13.5	200.0	-	-
Nicaragua	13,629.4	13,000.0	5,347.5	5,100.0	2,924.4	3,100.0	-	-	-	-	-	-
Panama	156.0 b)	250.0 b)	27.0	100.0	19.0	40.0	209.0	600.0	39.0	45.0	7.0	10.0
Haiti	3,000.0	...	500.0	...	-	-	-	-	-	-	-	-
Dominican Rep.	511.3	671.3	0.7	0.9	-	-	508.9	692.0	0.9	1.2	-	-
French Guiana	10.0	12.0	10.0	12.0	-	-	-	-	-	-	-	-
Guyana	505.0 b)	400.0 b)	565.0	500.0	10.0	20.0	-	-	-	-	-	-
Suriname	29.9 b)	30.0	23.0	25.0	12.0	15.0	-	-	-	-	-	-
Brazil	14,208.5 b)	17,000.0	5,940.2	5,800.0	1,534.6	2,000.0	762.1	1,000.0	389.4	500.0	-	-
Bolivia	1,507.1 b)	1,520.0 b)	720.0	720.0	260.0	260.0	-	-	-	-	21.0	21.0
Colombia	2,418.2 b)	3,000.0 b)	1,262.8	1,000.0	18.7	100.0	89.4	500.0	-	-	239.2	-
Ecuador	821.8	4,334.6	128.3	934.5	63.3	460.3	-	3,106.1	-	1,529.9	-	-
Peru	...	...	...	...	...	...	...	...	...	...	...	...
Venezuela c)	3,058.8 b)	6,473.0 b)	534.1	700.0	174.0	140.0	1,360.3 d)	2,475.0 d)	51.0 d)	86.5 d)	22.0	90.0
Argentina	80.0	150.0	60.0	150.0	50.0	100.0	-	-	-	-	-	-
Paraguay	468.0	1,150.0	130.0	210.0	88.0	42.0	-	480.0	-	100.0	-	-
T O T A L	53,495.3	66,864.5	19,767.5	22,609.3	9,161.9	12,320.0	7,474.4	15,418.1	1,538.6	3,347.1	289.2	121.0

... No information available.
a) Estimated by countries. b) Includes Amodiaquine 150 mg. base. c) Information up to September.
d) Includes Chloroquine/Amodiaquin combined tablets.

Sep/13/90 (hs)

Sep/13/90 (hs)

Table I-16 (Pag. 2)

USE OF ANTIMALARIAL DRUGS IN 1988 AND REQUIREMENTS FOR 1989

Countries (by geographical sub-region)	Sulfadoxine/Pyrimet. Fansidar		Fanasil 500 mg		Mefloquine		Quinine sulfate 500 mg.		Quinine ampoules		Quinine capsules	
	1989	1990 a)	1989	1990 a)	1989	1990	1989	1990 a)	1989	1990 a)	1989	1990 a)
Mexico	-	-	-	-	-	-	-	-	-	-	-	-
Belize	-	-	-	-	-	-	-	-	-	-	-	-
Costa Rica	-	-	146.1	250.0	-	-	-	-	-	-	-	-
El Salvador	-	-	-	-	-	-	-	-	-	-	-	-
Guatemala	-	-	-	-	-	-	-	-	-	-	-	-
Honduras	-	20.0	-	-	-	-	-	-	-	-	-	-
Nicaragua	-	-	-	-	-	-	-	-	-	-	-	-
Panama	-	-	1.0	0.5	-	-	-	-	-	-	-	-
Haiti	-	-	-	-	-	-	-	-	-	-	-	-
Dominican Rep.	-	-	-	-	-	-	-	-	-	-	-	-
French Guiana	-	-	-	-	-	-	-	-	-	-	-	-
Guyana	75.0	100.0	-	-	-	-	200.0	300.0	1.0	0.9	-	-
Suriname	45.0	50.0	-	-	-	-	-	-	-	-	-	-
Brazil b)	728.3	1,000.0	-	-	72.9	100.0	3,339.9	4,100.0	82.8	100.0	-	-
Bolivia	6.0	6.0	9.2	9.2	-	-	27.5	25.0	1.4	1.0	-	-
Colombia	0.5	300.0	165.1	400.0	-	-	4.4	10.0	-	-	14.0	20.0
Ecuador	1.9	20.0	-	-	-	-	-	-	0.4 c)	0.4 c)	-	-
Peru	...	...	...	...	...	...	...	...	...	...	...	...
Venezuela c)	61.5	67.6	-	-	-	-	15.6	17.1	-	-	-	-
Argentina	-	-	-	-	-	-	-	-	-	-	-	-
Paraguay	-	-	-	-	-	-	-	5.0	-	-	-	-
T O T A L	918.2	1,563.6	321.4	659.7	72.9	100.0	3,587.4	4,457.1	85.6	102.3	14.0	20.0

... No available information.

a) Estimated by countries. b) In addition, Brazil used 36,017 Paludil ampoules, 630,003 Tetraciclin capsules and 2,250 dosis of Chloroquine injectable and for 1990 they estimate 50,000, 800,000 and 3,000 respectivel. c) Quinine biclorhydro. d) Venezuela used in 1989, 646 Medikel tabs. and 12 Moticine and for 1990 they estimated 600 and 590 respectively.

Sep/13/90 (hs)

Table I.17

CONSUMPTION OF ANTIMALARIAL DRUGS IN 21 COUNTRIES WITH ACTIVE MALARIA PROGRAMS
1985-1989

Drug		QUANTITIES				
		1985	1986	1987	1988	1989 b)
4-Aminoquinolines:						
Chloroquine (150 mg. base)	Tabs.	44,296,200	29,729,100	49,193,600	38,647,500	51,109,500
Amodiaquine (150 mg. base)	Tabs.	9,943,000	13,356,000	5,057,800	5,439,000	2,385,000
8-Aminoquinolines:						
Primaquine (15 mg. base)	Tabs.	8,375,900	8,756,100	9,656,700	14,734,800	19,767,500
Primaquine (05 mg. base)	Tabs.	3,352,800	5,600,900	4,084,700	7,463,400	9,161,900
Chloroquine/Primaquine (150/15)	Tabs.	8,410,400	7,036,900	9,922,100	5,073,200	7,474,400
Cloroquine/Primaquine (75/7.5)	Tabs.	2,268,700	1,485,600	1,419,000	765,400	1,538,600
Pyrimethamine (25 mg. base)	Tabs.	315,200	392,100	431,400	127,900	289,200
Sulphfadoxine (500 mg. base)	Tabs.	130,671	854,500	202,500	500	3,321,400
Sulphadoxine/Pirimethamine	Tabs.	742,755	1,246,500	2,372,300	2,532,400	918,200
Chloroquine/Pyrimethamine	Tabs.	797,790	13,000	2,000	0	0
Amodiaquine/Primaquine	Tabs.	44,600	655,000	851,500	0	0
Mefloquine	Tabs.	-	13,600	17,500	105,788	630,003
Paludrine	Tabs.	4,000	12,000	-	0	0
Tetracycline	Tabs.	1,666	2,000	-	0	630,003
Lapudrine (20 mg. base)	Tabs.	14,000	10,000	-	0	0
Quinine/Sulphate (200,300 y 500 mg)	Tabs.	532,461	975	242,000	2,472,200	3,587,400
Quinine Dihydrocloride	Tabs.	-	-	-	108,500	14,000
Quinine - Sulphate	Ampoules	11,300	15	22,500	15,100	85,600
Total		79,241,443	69,164,290	83,475,600	77,485,688	100,912,706

a) Kg. Quinine
b) In addition, 2,250 ampoules of Chloroquine were used in 1989

Sep/14/90 (hs)

MAP I.2

COUNTRIES WITH NO EVIDENCE OF TRANSMISSION

Countries or territories	Population 1989 originally malarious area a)	Registered malaria cases 1986	1987	1988	1989
Bahamas	257	2	18 b)	17 b)	5 e)
Barbados	259	3	1 b)	1	1 e)
Bermuda	58	1	-	0	1 e)
Canada	26,310	302	327 b)	184 c)	195
Cuba	3,574	401	290	824	762
Chile	335	2	2	0	0
Dominica	17	1	...	0	0
USA	70,282 a)	920	786	870	1,025
Grenada	40	1	...	...	0
Guadalupe	333	...	...	...	4
Caiman Islands	21	3	2 b)	0	4
Jamaica	2,111 a)	10	6	4	2
Martinica	215	...	...	...	23
Saint Lucia	115 a)	0	3 b)	...	...
Trinidad & T.	1,158	18	5	8	10
T O T A L	105,085	1,664	1,440	1,908	2,032

a) Population estimated by PAHO, for those countries which have never been malarious, the population figure is for the entire country.
b) Information from Weekly Epidemiological reports. c) Information from the "Canada Weekly Report".

Sep/17/90 (hs)

MAP I.3

MEXICO, CENTRAL AMERICA, BELIZE, PANAMA, HAITI AND DOMINICAN REP.

Countries	Population 1989 Originally malarious area a)	Registered Malaria cases			
		1986	1987	1988	1989
Mexico	44,750 b)	131,014	102,984	116,238	101,241
Belize	166	2,779	3,258 c)	2,725	3,285
Costa Rica	815	790	883	1,016	699
El Salvador	4,624	23,953	12,834	9,095	9,605
Guatemala	3,429	42,609	57,662	52,561	42,453
Honduras	4,620	29,130	19,095	29,737	45,922
Nicaragua	3,745	20,308	17,011	33,047	45,982
Panama	2,284	1,060	1,195	1,000	427
Total, CAPB	19,683	120,629	111,938	129,181	148,373
Haiti	5,360	14,363	12,134	12,306 d)	23,231
Dominican Rep.	6,970	1,360	1,206	1,072	1,275
Total, CARIBE	12,330	15,723	13,340	13,378	24,506
TOTAL	32,013	136,352	125,278	142,559	172,879

a) Population in thousands of inhabitants. b) Provisional figures.
c) Incomplete information.

(hs)

MAP I.4

BRAZIL AND GUIANAS

Country	Population 1989 Originally malarious area a)	Registered Malaria Cases			
		1986	1987	1988	1989
Brazil	65,005	443,627	508,864	559,535	577,520
French Guiana	81	979 b)	3,318	3,188	6,284
Guyana	762	16,388	34,142	35,470	20,822 c)
Suriname	296	1,316	2,044	2,691	1,704
Total, Gianas	1,139	18,683	39,504	41,349	28,810
T O T A L	66,144	462,310	548,368	600,884	606,330

a) Population in thousands of inhabitants. b) Provisional figure.
c) Inf. up to November.

MAP I.5

ANDEAN AREA AND SOUTHERN CONE

Country	Population 1989 Originally malarious area a)	Registered cases			
		1986	1987	1988	1989
Bolivia	2,671	20,993	24,891	22,258	25,367
Colombia	21,319	89,251	90,014	100,850	100,286
Ecuador	6,083	51,430	63,503	53,607	23,274
Peru	...	36,866	39,136 b)	32,359 b)	32,114 b)
Venezuela	15,115	14,365	17,988	45,349	31,078 c)
Total Area Andina:	45,188	212,905	235,532	254,423	212,119
Argentina	4,220	2,000	1,521	666	1,620
Paraguay	3,533	4,329	3,741	3,884	5,247
Total Cono Sur	7,753	6,329	5,262	4,550	6,867
T O T A L	52,941	219,234	240,794	258,973	218,986

a) Population in thousand inhabitants. b) Provisional figure.
c) Information up to August.

Table II-18

AREAS WITH TECHNICAL AND ADMINISTRATIVE PROBLEMS IN THE CONTROL OF MALARIA IN THE AMERICAN REGION

Country and areas (by geographical region)	Population of affected areas	Area km2	Insecticide		Number of cases	Principal vectors	Causes of the problem
			Type used	Years of coverage			
Mexico: States of Colima, Chiapas, Chihuahua, Durango, Guerrero, Hidalgo, Jalisco, Mexico, Michoacan, Morelos, Nayarit, Oaxaca, Puebla, Sinaloa y Sonora	44,648,280 (a)	1,097,191 (a)	DDT	32	90,622	A. psudopunct. A. albimanus	Vector resistance to DDT; vectors and human behavior; poor housing; internal and external migration; untimely diagnosis and insufficient treatment of cases.
El Salvador: Pacific coastal zone	924,787	4,819	Propoxur	11	8,412	A. albimanus	Population migrations; poor housing; formations of breeding places in swamps and ponds.
Guatemala: Ecological areas of North, South and East-Central	3,631,810	80,350	Fenit. Propoxur	De 10 a 12	42,453	A. albimanus A. pseudopunct. A. vestitipennis A. darlingi	Population migrations; poor housing; ecological changes.
Honduras: ...	...	...	...	...	...	...	Socio-political problems; difficult access and/or lack of transportation and insufficient funds.
Nicaragua: ...	...	...	...	...	...	...	...
Panama: Darien, Bayano y San Blas	73,644	25,321	Fenit. Propoxur	4 a 6 15	375	A. albimanus A. Punctimacula A. pseudopunct.	Socio-anthropological problems; population movements; administrative and economic difficulties.
Subtotal	49,278,521	1,207,681	-	-	141,862	-	-

... Information not availalble.

Table II.18 (Pag. 2)

AREAS WITH TECHNICAL AND ADMINISTRATIVE PROBLEMS IN THE CONTROL OF MALARIA IN THE AMERICAN REGION

Country and areas (by geographical region)	Population of affected areas	Area km2	Insecticide		Number of cases	Principal vectors	Causes of the problem
			Type used	Years of coverage			
Haiti:							
...	4,000,000	20,000	Fenit.	...	23,231	A. albimanus	Structure problems; administrative and financial
Dominican Republic							
...	...	...	...	...	...	...	...
Guayana Francesa: *						A. darlingi	Problems in the antivector campaing;
...	...	...	...	...	...	A. aquasalis	population movements difficulties
Guyana: *							Socio-economic mining industry,
Regions 1, 2, 7/8 and 9	75,921	146,557	DDT	Mas de 20	16,833	A. darlingi A. aquasalis	operational difficulties, population movements; difficult terrains, suspected drugs' resistance.
Brasil: *							Intense population movements,
Acre, Amapa, Amazonas, Goias, Maranhao, Mato Grosso, Para, Rondonia, Roraima	18,277,397	5,202,940	DDT	22	557,787	A. darlingi	poor housing; P.falciparum resistance and high anophelinic density in the Amazon region; Administrative and personnel problems.
Bolivia: *							Poor housing; migrations; P. falciparum
Riberalta and Guayamerin Federico Roman, Siglo XX, Araras y San Antonio	74,080	35,634	DDT	7 y 30	1,200	A. darlingi	resistance to 4-aminoquinoleines; areas of difficult access; insufficient spraying coverage.
Colombia: *							
Magdalena Medio; Catatumbo; Sarare; Amazonia; Litoral Pacifico; Uraba; Bajo Cauca	2,165,400	305,659	DDT Prop. Malat. Fenit. K'otrina	22 a 30	60,172	A. darlingi A. nuneztovari A. albimanus A. evansae A. neivai	Vector and parasite resistance; poor housing; migrations; colonization; areas without coverage due to social and financial problems. and financial problems.
Sub-total	22,427,398	5,405,131		-	599,051		-

Table II-18 (Pag.3)

AREAS WITH TECHNICAL AND ADMINISTRATIVE PROBLEMS IN THE CONTROL OF MALARIA IN THE AMERICAN REGION

Country and areas (by geographical region)	Population of affected areas	Area km2	Insecticide		Number of cases	Principal vectors	Causes of the problem
			Type used	Years of coverage			
Ecuador: * Provinces Esmeraldas Manabi, Los Rios, Pichincha, Guayas, Napo y Cotopaxi	3,799,591	71,782	DDT Fenit. Malathion	25 3 1 ciclo	19,092	A. albimanus A. punctimacula A. pseudopunct. A. nuneztovari A. trinkae A. rangeli A. oswaldoi	Insufficient spraying coverage; labor problems; ecological factors; P. falc. resistance; areas under agricultural development; oil operations and intense colonization.
Peru: * ...	...	...	...	...	...	...	...
Venezuela: * Areas Occidental y Meridional	651,622	139,603	DDT	42	5,658	A. nuneztovari A. darlingi	Vector exophily, population movements; anthropological problems
Argentina: Tartagal, Oran, Iruya St. Victoria	100,101	11,275	DDT	42	1,182	A.pseudopunct.	Intense internal and external migrations; areas with difficult access climatological and financial problems; areas bordering malarious country.
Paraguay: Special area; Alto Paranà; Dist. Salto del Guairà, Dept. Canindeyù Distrito Yhù (Caaguazù)	314,637	19,445	DDT	27 a 28	4,953	A. darlingi	Residual foci; internal and external migration; formation of breeding places; construction of hydroelectrical dams.
Sub-total	4,551,314	222,660	-	-	25,932	-	-
T o t a l	76,257,233	6,835,472	-	-	766,845	-	-

* Countries with malarious areas in the Amazon basin.