1971 ANNUAL REPORT
JUNE 1972

CENTER FOR DISEASE CONTROL

MALARIA

SURVEILLANCE

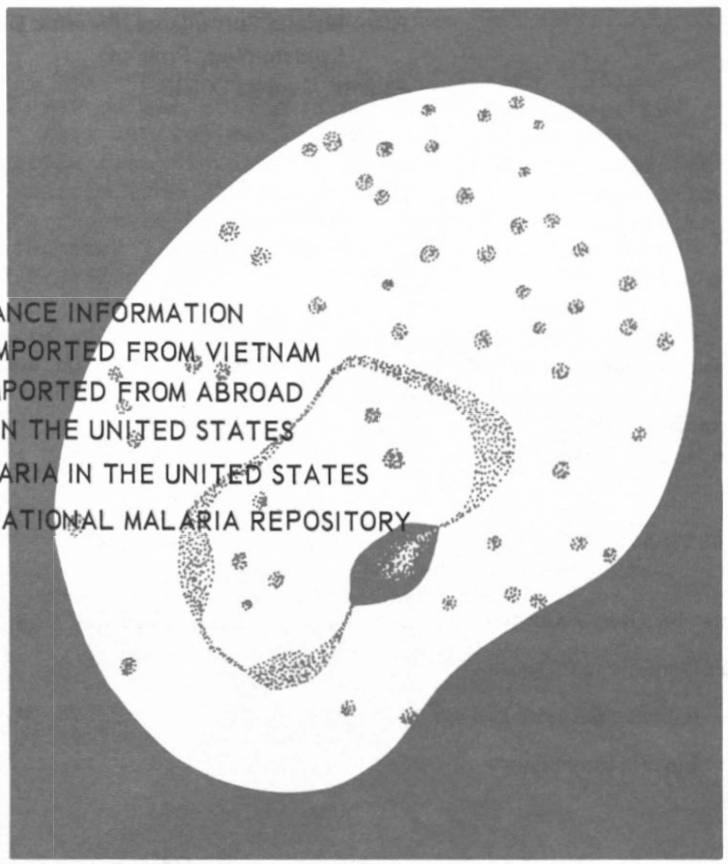


TABLE OF CONTENTS

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

PREFACE

This report summarizes information received from State Health Departments, Medical Departments of the Armed Forces, and other pertinent sources. It is intended primarily for the use of those with responsibility for disease control activities. Anyone desiring to quote this report should contact the original investigator for confirmation and interpretation.

Contributions to the Surveillance Report are most welcome. Please address them to:

Center for Disease Control
Attn: Malaria Surveillance, Parasitic Diseases
Epidemiology Program
Atlanta, Georgia 30333

Center for Disease Control ..... David J. Sencer, M.D., Director

Epidemiology Program ..... Philip S. Brachman, M.D., Director

Parasitic Diseases Branch ..... Myron G. Schultz, D.V.M., M.D., Chief

Malaria Surveillance ..... Peter D. Walzer, M.D.
Donald J. Krogstad, M.D.
Mrs. Stella S. Sanford

Collaborators

Laboratory Division

Helminthology and Protozoology Unit ..... George R. Healy, Ph.D., Chief

National Malaria Repository ..... Neva N. Gleason, M.S., Supervisor
Margaret Welch, M.T. (ASCP)

Fluorescent Antibody Laboratory ..... Alex J. Sulzer, Ph.D., Chief
Marianna Wilson, B.S.

Computer Systems Branch ..... Charles P. Tyson

MALARIA SURVEILLANCE 1971

I. SUMMARY

In 1971, 3,047 cases of malaria were reported in the United States. This represents a 23.8 percent decrease as compared with the 3,997 cases reported for a similar period in 1970. This decline was due entirely to decreasing numbers of military cases imported from Vietnam. Army personnel accounted for 84.1 percent of the military malaria from Vietnam and Marines 7.5 percent. In 1971, 92.8 percent of all cases reported in the United States were acquired in Vietnam. As in prior years, imported Plasmodium vivax infections were more common than P. falciparum (82.8 percent vs. 11.0 percent).

There were 191 civilian cases of malaria, as compared with 125 cases for 1970. This increase was primarily due to the 57 cases acquired in the USA, the highest total since at least 1953. Of the 57 cases, 46 were needle induced, nine were acquired through blood transfusion, one through accidental needle prick, and one was classified as cryptic. P. vivax was the species in 53 of the cases acquired in the USA.

There were eight malaria deaths. Five were due to P. falciparum: two occurred in tourists who visited malarious areas; two were in Vietnam veterans; one fatality occurred in a seaman whose ship was en route from West Africa to Puerto Rico and his illness may have been complicated by the illicit use of narcotics. One person died of P. vivax acquired through blood transfusion; he had had a prior splemectomy and myocardial infarction. Two persons died from apparently ruptured spleens: in one case P. vivax was found, but in the other cases the species of Plasmodium could not be identified.

DHEW Publication No. (HSM) 72-8152

II. TERMINOLOGY

The terminology used in this report is derived from the recommendations of the World Health Organization.[1,2] The definitions of the following terms are included for reference purposes.

1. Autochthonous

   a. Indigenous - malaria acquired by mosquito transmission in an area where malaria is a regular occurrence.

   b. Introduced - malaria acquired by mosquito transmission from an imported case in an area where malaria is not a regular occurrence.

2. Imported

   Malaria acquired outside of a specific area (the United States and Puerto Rico in this report).

3. Induced

   Malaria acquired through artificial means, i.e., blood transfusion, common syringes, or malariotherapy.

4. Relapsing

   Renewal of clinical activity occurring after an interval from the primary attack greater than that due merely to periodicity.

5. Cryptic

   An isolated case of malaria not associated with secondary cases as determined through appropriate epidemiological investigation.

III. GENERAL SURVEILLANCE INFORMATION

Between January 1, 1971 and February 29, 1972, 3,047 cases* of malaria with onset of illness during 1971 in the United States and Puerto Rico were reported to the Parasitic Diseases Branch of the Center for Disease Control. This compares with 3,997 cases reported for a similar period with onset of illness in 1970 and represents a 23.8 percent decrease. In addition to the 3,047 first attacks, reports were also received on 131 individuals who developed one or more relapses of malaria caused by the same species as their first attack.

*A "case" is defined as an individual's first attack of malaria in the United States, regardless of whether or not he had experienced previous attacks of malaria while outside the country. A subsequent attack in the same individual caused by a different Plasmodium species is counted as an additional case. Repeat attacks in this country caused by the same species are considered relapses, not additional cases. All cases included in this report were diagnosed as malaria on the basis of a positive peripheral blood smear examined in a local or state laboratory. Doubtful cases were referred to the National Malaria Repository, CDC.

The decrease in reported cases was due entirely to the decrease of malaria in military personnel (including recently discharged veterans) [Figure 1]. Military cases declined from 3,872 (1970) to 2,856 (1971) and comprised 93.7 percent of all cases diagnosed in this country (Table 1). All but 37 of these cases were acquired in Vietnam.

Figure 1

MILITARY AND CIVILIAN CASES OF MALARIA, UNITED STATES 1959 - 1971

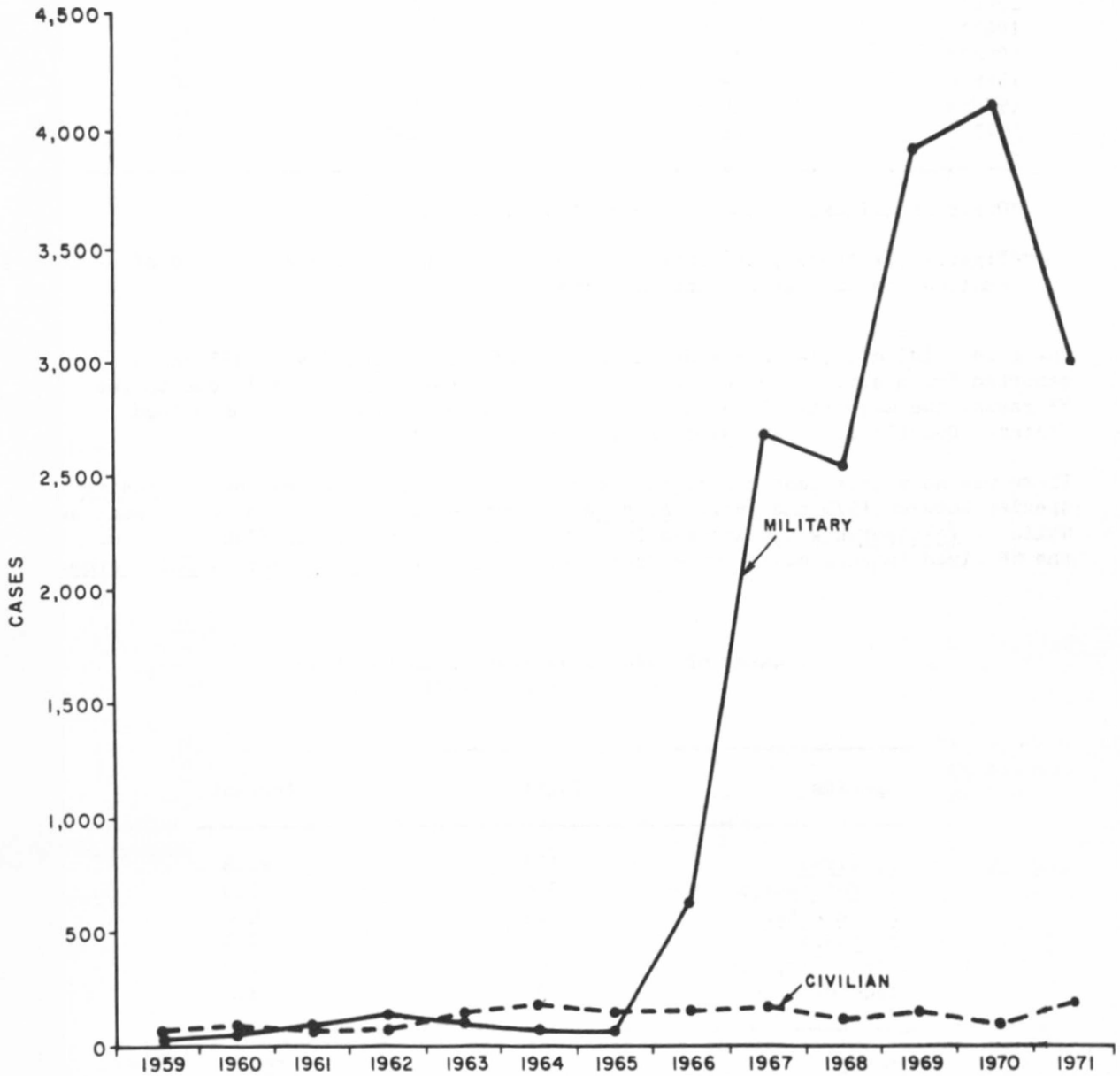


Table 1

Military and Civilian Cases of Malaria
United States, 1959-1971*

Year	Military	Civilian	Total
1959	12	38	50
1960	21	41	62
1961	45	37	82
1962	75	40	115
1963	58	90	148
1964	52	119	171
1965	51	105	156
1966**	621	143	764
1967**	2699	158	2857
1968**	2567	131	2698
1969**	3914	145	4059
1970**	4088	151	4239
1971	2856	191	3047

*Onset of illness in the United States and Puerto Rico

**Figures for these years have been updated to include cases reported after the publication of previous annual summaries.

There were 191 civilian cases of malaria in 1971 as compared with 125 cases reported for a similar period in 1970. This increase was primarily due to the 57 cases, the majority of which were needle-induced, acquired in the United States. Details of these cases are presented in Section VI.

There was no significant change in the ratios of cases caused by any Plasmodium species between 1970 and 1971. P. vivax accounted for 82.8 percent of infections, while P. falciparum was diagnosed in 11.0 percent of infections (Table 2). Of the 68 mixed infections, 66 were caused by coexistent P. vivax and P. falciparum.

Table 2

Cases of Malaria by Plasmodium Species
United States, 1971

Species	Total	Percent
P. vivax	2,523	82.8
P. falciparum	336	11.0
P. malariae	14	0.4
P. ovale	9	0.3
Mixed Infections	68	2.3
Undetermined	97	3.2
TOTAL	3,047	100.0

The country of origin of the 3,047 cases of malaria in 1971 is shown in Table 3. Vietnam was listed as the source of 2,827 imported cases of malaria. Only eight of these cases were in non-military personnel. Vietnam returnees, therefore, accounted for 92.5 percent of all malaria cases in 1971. Malaria in military personnel returning from Vietnam is the subject of Section IV. Aside from Vietnam, the largest number of cases were imported from Nigeria (17) and Nicaragua (13). Mexico accounted for 10 cases, in contrast to 19 cases in 1970.

Table 3

Cases of Malaria by Distribution of Plasmodium Species and Area of Acquisition
United States, 1971*

	vivax	falciparum	malariae	ovale	Mixed	Unknown	Total
AFRICA	18	22	2	7	2	8	59
Africa**	6	6	2	2	-	3	19
West Africa**	-	3	-	-	-	-	3
East Africa**	1	-	-	-	-	-	1
Chad	-	1	-	-	-	-	1
Congo	-	-	-	-	1	-	1
Ethiopia	3	-	-	-	-	1	4
Ghana	1	4	-	1	-	-	6
Kenya	1	-	-	-	-	-	1
Liberia	1	1	-	1	-	-	3
Morocco	1	-	-	-	-	-	1
Nigeria	4	7	-	3	-	3	17
Sierra Leone	-	-	-	-	-	1	1
Uganda	-	-	-	-	1	-	1
ASIA	2,414	302	8	2	66	82	2,874
Asia**	4	-	1	-	-	1	6
Southeast Asia**	9	2	-	1	-	2	14
India	7	1	2	-	-	-	10
Korea	1	-	-	-	-	-	1
Malaya	2	-	-	-	-	-	2
New Guinea	3	1	-	-	-	-	4
Pakistan	8	-	-	-	-	-	8
Philippines	1	-	-	-	-	-	1
Thailand	1	-	-	-	-	-	1
Vietnam	2,378	298	5	1	66	79	2,827
CENTRAL AMERICA AND CARIBBEAN	16	2	1	-	-	2	21
Central America*	1	-	-	-	-	-	1
El Salvador	3	-	1	-	-	1	5
Honduras	2	-	-	-	-	-	2
Nicaragua	10	2	-	-	-	1	13
EUROPE	-	-	-	-	-	-	-
MIDDLE EAST	1	-	-	-	-	-	1
Iran	1	-	-	-	-	-	1

Table III continued next page

Table 3 (continued)

	vivax	falciparum	malariae	ovale	Mixed	Unknown	Total
NORTH AMERICA	62	3	2	-	-	-	67
Mexico	9	1	-	-	-	-	10
United States	53	2	2	-	-	-	57
SOUTH AMERICA	3	3	1	-	-	1	8
South America**	2	-	-	-	-	1	3
Brazil	1	-	-	-	-	-	1
Colombia	-	3	1	-	-	-	4
UNKNOWN	9	4	-	-	-	4	17
TOTAL	2,523	336	14	9	68	97	3,047

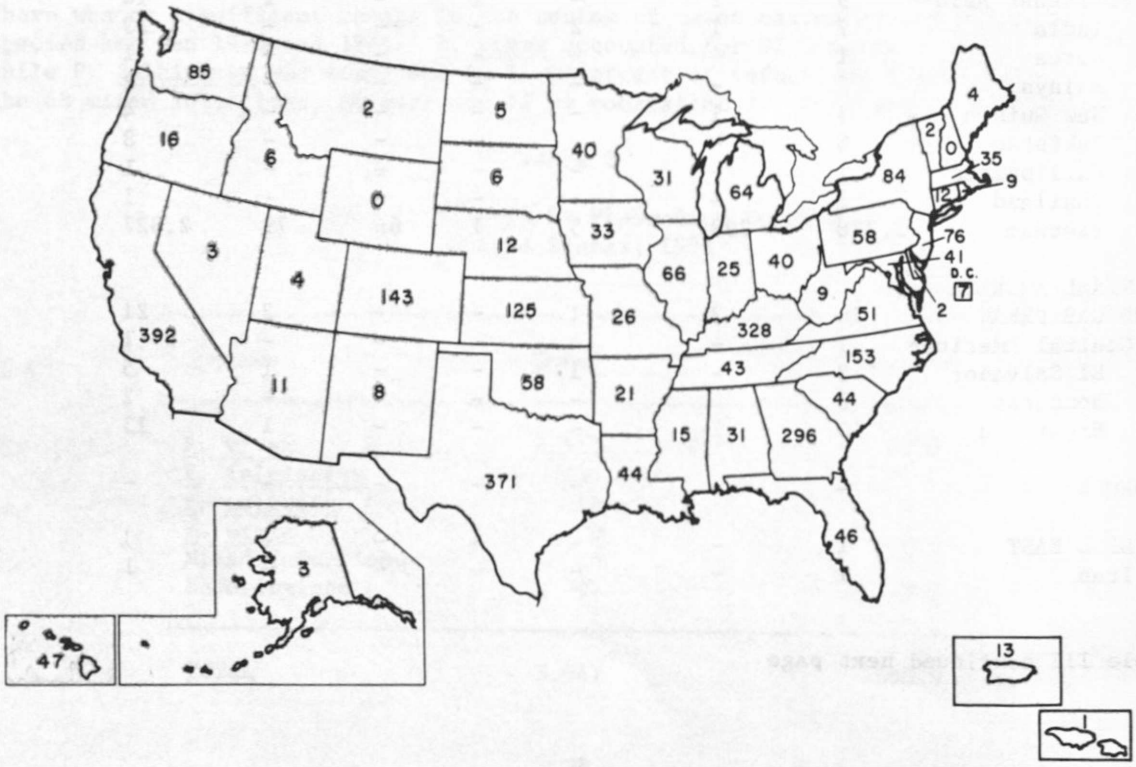
*Onset of illness in the United States and Puerto Rico

**Country Unspecified

A history of previous malaria while abroad was obtained in 1,027 of the 2,870 imported cases (35.8 percent) in which this information was recorded. Patients with vivax malaria were more likely to give a history of prior malaria than patients with falciparum malaria (36.3 vs. 31.2 percent).

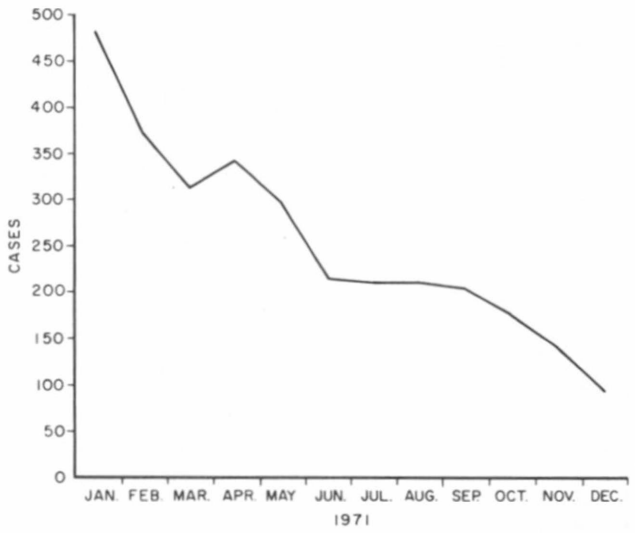
The geographic distribution of the 1971 cases of malaria within the United States is shown in Figure 2 by the State in which the patient first developed clinical symptoms of malaria. The disproportionate number of cases in California, Colorado, Georgia, Kansas, North Carolina, and Texas is due to the location of major military centers, particularly Army bases in these states.

Figure 2 GEOGRAPHIC DISTRIBUTION OF MALARIA CASES WITH ONSET IN UNITED STATES, 1971



The seasonal distribution of malaria cases (Figure 3) has shown no distinctive pattern in recent years, and is primarily determined by the number of troops that returned from Vietnam each month.

Figure 3 MALARIA CASES, BY MONTH OF ONSET, UNITED STATES, 1971



As in previous years, clinical malaria developed within 30 days of arrival in the United States in 63.0 percent of falciparum and 18.6 percent of vivax infections for which both the exact date of arrival and the date of onset are known (Table 4). This fact is of particular importance because Vietnam veterans are commonly given 1 month's leave or discharged from military service as soon as they return home. As a result, they are more likely to be seen by a civilian physician who may not be as familiar with malaria as a military or Veterans Administration physician.

Within 6 months after entering this country, 95.4 percent of patients with falciparum malaria and 87.1 percent of those with vivax malaria developed clinical symptoms. Only 24 patients with vivax malaria (1.1 percent) became ill more than 1 year after their last possible exposure to malaria abroad. The longest interval between entry into the United States and clinical illness in 1971 was 16 months for falciparum malaria and 33 months for vivax malaria.

Of the 3,047 cases reported in 1971, 69.5 percent were initially treated in military hospitals; and 18.9 percent received care in a Veterans Administration hospital (Table 5). The Armed Forces and the Veterans Administration have made complete malaria reporting a major responsibility of their hospital staffs. Reporting by civilian physicians, on the other hand, is largely a matter of individual initiative, even though malaria is a reportable disease in every state. The above figures probably underestimate the extent to which civilian physicians encounter cases of malaria.

Table 4

Malaria Cases by Interval Between Date of Entry Into the United States and Onset of Illness, and by *Plasmodium* Species, United States, 1971

Interval (in months)	*Plasmodium* species								All Cases	
	Vivax	(%)	Falciparum	(%)	Malariae	(%)	Ovale	(%)		(%)
<1	414	(18.6)	177	(63.0)	1	(12.5)	1	(14.3)	593	(23.6)
1-2	925	(41.6)	73	(26.0)	1	(12.5)	1	(14.3)	1000	(39.7)
3-5	597	(26.9)	18	(6.4)	2	(25.0)	3	(42.8)	620	(24.6)
6-11	263	(11.8)	11	(3.9)	4	(50.0)	2	(28.6)	280	(11.1)
≥12	24	(1.1)	2	(0.7)	-	-	-	-	26	(1.0)
ALL CASES	2223	(100.0)	281	(100.0)	8	(100.0)	7	(100.0)	2519	(100.0)

Table 5
Malaria Cases by Type of Initial Hospital Admission
United States, 1971

Type of Hospital	Number of Patients	Percent
Military	2,116	69.5
Veterans Administration	576	18.9
Civilian	261	8.6
Public Health Service	16	0.5
Other	15	0.5
Not Specified	1	0.0
Not Hospitalized	62	2.0
TOTAL	3,047	100.0

Eight deaths were reported. In previous years all malaria fatalities were due to P. falciparum and its complications, and the deaths usually occurred in non-military hospitals. However, the malaria deaths in 1971 were caused by more than one Plasmodium species and involved a variety of circumstances. Five deaths were due to P. falciparum (case fatality rate = 0.1 percent): two of these deaths occurred in tourists who visited malarious areas other than Vietnam; two were in Vietnam veterans; and one fatality occurred in a seaman whose ship was en route from West Africa to Puerto Rico and his illness may have been complicated by the illicit use of narcotics. One person died of P. vivax malaria acquired through blood transfusion; he had had a prior splenectomy and myocardial infarction. Two patients died from apparently spontaneously ruptured spleens: in one case P. vivax was found, but in the other the species of Plasmodium could not be identified.

Intravascular hemolysis was the most frequent complication of falciparum malaria reported by physicians on patients for whom the information was recorded. Cerebral malaria occurred in one case and renal failure in two cases. However, the true incidence of these complications is not known because the reporting of clinical course of non-fatal cases is far less complete than for the fatalities.

IV. MILITARY MALARIA IMPORTED FROM VIETNAM

Two thousand, eight hundred and fifty-six military cases of malaria were reported for 1971, and 2,819 of these (98.7 percent) were imported from Vietnam (Table 6). P. vivax was the etiologic agent in 2,372 of the Vietnam military cases (84.1 percent), P. falciparum in 297 cases (10.5 percent), P. malariae in 5 cases (0.2 percent), and P. ovale in one case. Mixed Plasmodium infections occurred in 65 cases (2.3 percent), and the Plasmodium species could not be identified in 79 cases (2.8 percent).

Army personnel accounted for 84.1 percent of the military malaria cases from Vietnam, and Marines accounted for 7.5 percent. Navy and Air Force personnel rarely contracted the disease (Table 6). There were 2,370 Army cases among 219,468 returnees[3] in 1971 for an attack rate of 108 per 10,000 returnees which is slightly higher than the rate of 106 per 10,000 for 1970. Terminal chemoprophylaxis for malaria was changed from the 8-week chloroquine-primaquine regimen to a single 600 mg (base) dose of chloroquine and 14-day course of 15 mg (base) primaquine, however, this change did not occur until the end of 1971, so it had little bearing on 1971 malaria figures.

Table 6

Malaria in Military Returnees from Vietnam by Branch of Service, U.S.A., 1971

Branch of Service	Number of Cases	Percent of Cases	Percent Change 1970-1971
Army	2,370	84.1	-25.5
Marines	213	7.5	-49.0
Navy	8	0.3	-55.6
Air Force	5	0.2	-37.5
Unknown	223	7.9	+ 4.2
TOTAL	2,819	100.0	-26.6

The relapse rates in patients with vivax malaria imported from Vietnam during the years 1966-1971 are given in Table 7. Since relapse of vivax infections is unusual after 3 years, the 1966-1968 figures may now be presumed to be complete, whereas, there may be additions to the figures for 1969-1971. The relapse rate declined from 1966 to 1969 (probably because of the more thorough use of primaquine in military hospitals) but increased in 1970.

Table 7

Relapse Rates of Military Cases of Vivax Malaria Imported from Vietnam, U.S.A., 1966-1971

Year	Number of Primary Attacks	Percent of Patients with Relapses				
		First	Second	Third	Fourth	Fifth
1966	350	29.4	8.6	1.4	0.0	0.0
1967	2,198	18.5	3.4	0.8	0.1	0.0
1968	2,062	7.9	0.9	0.2	0.1	0.0
1969	3,090	7.1	0.6	0.1	0.0	0.0
1970	3,302	8.3	1.0	0.2	0.0	0.0
1971	2,372	5.0	0.5	0.0	0.0	0.0

The recrudescence rate in military cases from Vietnam with falciparum infections was 2.0 percent in 1971 (6 of 297 infections) compared with 4.4 percent in 1970, and 1.8 percent in 1969.

V. CIVILIAN MALARIA IMPORTED FROM ABROAD

While there has been a distant increase in the total number of civilian malaria cases for 1971, the number of imported civilian cases has remained relatively constant for the past 8 years. The age and sex distribution of the 191 civilian cases is presented in Table 8, and as in previous years, shows a male predominance. United States citizens accounted for 70 of the 134 imported civilian cases of malaria (Table 9). College students and teachers constituted the largest occupational group among U.S. citizens and foreign visitors.

Table 8

Civilian Malaria Cases by Age and Sex
United States, 1971

Age Group	Male	Female	Total	Percent
0-9	3	8	11	5.7
10-19	20	12	32	16.8
20-29	73	19	92	48.2
30-39	14	5	19	9.9
40-49	14	4	18	9.4
50-59	3	1	4	2.1
60-69	4	3	7	3.7
70+	2	1	3	1.6
Unknown	5	0	5	2.6
TOTAL	138	53	191	100.0

Table 9

Imported Civilian Malaria Cases by Occupation and Nationality
United States, 1971

Occupation	U.S. Citizen	Foreign Visitor	Total	Percent
Tourist	15	-	15	11.2
Businessman	5	3	8	6.0
Government representative	3	2	5	3.7
Missionary	3	3	6	4.5
Peace Corps	5	-	5	3.7
Seaman	1	8	9	6.7
College Student or Teacher	25	23	48	35.8
Other	5	17	22	16.5
Unknown	8	8	16	11.9
TOTAL	70	64	134	100.0

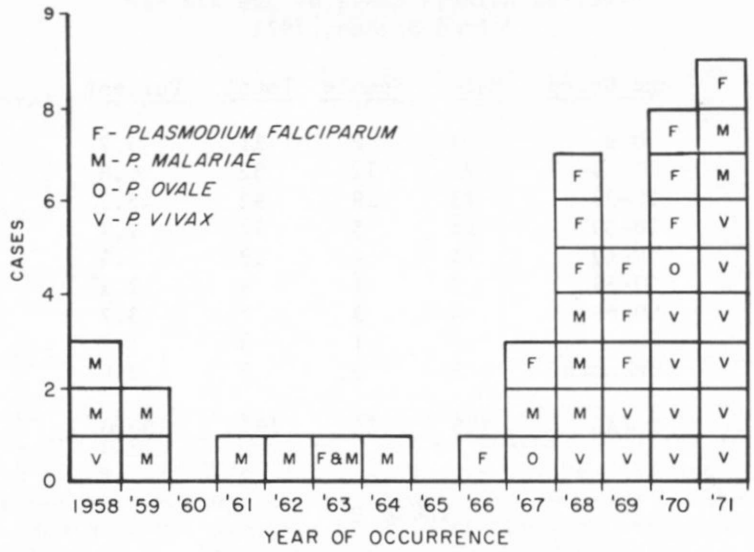
VI. MALARIA ACQUIRED IN THE UNITED STATES

Fifty-seven persons acquired malaria infections within the United States, the highest annual number since at least 1953. The vast majority of cases (53) were due to *P. vivax*: two were due to *P. falciparum*; two were due to *P. malariae*.

Vivax malaria in a 17-year-old girl from south-central Texas has been classified as a cryptic case (Case 1), although it was suspected of being introduced. She lived only about 50 miles from the site where two introduced cases of vivax malaria occurred in 1970.

Nine cases (Cases 2-10) of transfusion-induced malaria occurred in 1971, one more than in 1970, and the largest number in over 15 years (Figure 4). Six of the cases were due to *P. vivax*, two due to *P. malariae*, and one due to *P. falciparum*. Vietnam veterans were the implicated blood donors in at least seven instances.

Figure 4 TRANSFUSION MALARIA CASES, UNITED STATES, 1958-1971



Needle-induced malaria among parenteral drug users accounted for 46 cases (Cases 11-56). The largest outbreak occurred in California from November 1970 to April 1971, and involved a total of 47 confirmed cases, all P. vivax; 42 of them became ill in 1971, so the five persons with onset in 1970 are not included in the 1971 surveillance figures. Seven additional persons in this outbreak had positive malaria antibody titers by the indirect fluorescent antibody (IFA) technique. Four other needle-induced vivax malaria cases occurred in California, North Carolina, and Illinois. In each instance, the probable source of infection was a returning Vietnam veteran.

An additional case of induced malaria (Case 57) occurred when a medical student accidentally pricked himself with a needle after drawing blood from a patient with falciparum malaria.

A. Cryptic Malaria

Case 1

On July 20, 1971, a 17-year-old white female entered a Castroville, Texas hospital with a history of daily chills and fever since July 11. Peripheral blood smears on July 23 demonstrated P. vivax. She was treated with chloroquine and primaquine and recovered.

Epidemiologic investigation revealed that the patient lived in Lytle, Texas (population 1,300) located 10 miles south of Castroville and 15-20 miles southwest of San Antonio. She had been at her home in Lytle from the end of school in May until June 5, then spent 2 days in Corpus Christi. From June 7 to 25, she worked at a religious summer camp near Aquilla, Texas (population 2,000), located 40 miles northwest of Austin. She returned home to Lytle from June 25 to July 2, visited Corpus Christi on July 5, then returned to the camp near Aquilla where she stayed until she was hospitalized.

The patient had ample exposure to mosquitoes both at her home in Lytle and at the camp near Aquilla. She denied the use of parenteral drugs on repeated

occasions, and no evidence of the use of such drugs was found on physical examination. Her only travel outside the United States had been a trip to Mexico from June 19 to July 7, 1970; she visited Mexico City and Acapulco, did not venture from well traveled roads frequented by tourists, and almost always slept indoors. She did not take malaria chemoprophylaxis and never had symptoms suggestive of malaria prior to the onset of her illness on July 11.

Case detection activities conducted within a 1-mile radius of the patient's home in Lytle and of the camp near Aquilla failed to uncover a source for the infection by history, thick and thin blood smears, or serology although Vietnam veterans and Mexican laborers were found. Nor were any secondary malaria cases found by the same methods.

Entomologic studies indicated that Anopheles pseudopunctipennis was the predominant mosquito species found in the vicinity of the patient's home in Lytle, although dissection of 39 A. pseudopunctipennis failed to reveal malaria parasites. In contrast, A. punctipennis was the only anopheline found at the camp near Aquilla, but it was outnumbered by Psorophora, Culex and Aedes.

Judging from extensive interviews with the patient, her family, friends, and physical examination, it is very unlikely that she used parenteral drugs. Since less than 2 percent of imported vivax malaria cases reported to CDC (and virtually none of the cases acquired in Mexico) have incubation periods of ≥12 months, and since her brief trip to Mexico involved at best limited exposure to mosquitoes, it is also unlikely that her malaria was imported. Thus, she probably represents a case of introduced malaria. Two cases of introduced malaria occurred in an area of south-central Texas about 50 miles from the patient's home in 1970; Mexican laborers were the source, and A. pseudopunctipennis was the vector. Based on the usual incubation period for P. vivax (14 days, 9-18 days in 95 percent of cases) and entomologic data (A. pseudopunctipennis is a proven vector of malaria under natural field conditions), the patient probably acquired her infection at home in Lytle.

However, in the absence of a known source of infection, and of secondary cases, this case has been classified as cryptic malaria. (Reported by the Texas State Department of Health and the Parasitic Diseases Branch, Epidemiology Program, CDC.)

B. Transfusion Induced Malaria

Cases 2-10

On December 23 and 25, 1970, a newborn infant underwent exchange transfusions at a New York City hospital due to hyperbilirubinemia associated with erythroblastosis fetalis. After the second transfusion, the patient's hematocrit was 46.5 percent, and she was discharged from the hospital. On February 10, 1971, at 7 weeks of age, she was readmitted to the hospital due to persistent anemia and a temperature spike of 102.6°F. On admission, the hematocrit was 17 percent, and she received 100 cc of packed red blood cells. She was discharged the next day. Review of the peripheral blood smear prepared at the time of the second admission, however, before the additional transfusion was given, showed P. vivax parasites. The patient was recalled to the hospital and treated with chloroquine phosphate. She subsequently made an uneventful recovery.

The two units of blood administered in December were obtained from a blood collection agency in Fayetteville, North Carolina. One of the donors was a 26-year-old serviceman at Ft. Bragg, North Carolina. He denied having had malaria or a malaria-like

illness, traveling outside the United States, and sharing needles and syringes. His peripheral blood smear was negative for malaria parasites, and his serum, when tested by the indirect fluorescent antibody (IFA) test for malaria, gave an end-point dilution titer of 1:16 against P. falciparum antigen and was negative against P. vivax and P. malariae antigens. The second blood donor could not be located.

(Reported by Aaran A. Altar, Director of Blood Bank, Maimonides Medical Center, Brooklyn, New York; Kevin Cahill, M.D., Director, Tropical Disease Center, New York City; Howard B. Shookhoff, M.D., Chief, Tropical Medicine Division, Vincent F. Guinee, M.D., Director, Bureau of Preventable Diseases, New York City Health Department; the Laboratory Division, CDC; and an EIS Officer.)

Case 3

On January 14, 1971, one unit of whole blood was administered to a 19-year-old girl at a military hospital in Texas to replace acute blood loss after severe injuries suffered in an automobile accident. Her condition subsequently improved, and she was discharged from the hospital. On January 31, however, she had onset of fever and chills and was readmitted to the hospital on February 3. On admission, a peripheral blood smear revealed parasites of P. vivax. The patient made an uneventful recovery following treatment with chloroquine phosphate.

The blood had been donated on January 8 by a 24-year-old serviceman who had returned from Vietnam in January 1969. He had not experienced malaria either while overseas or after his return to the United States. While in Vietnam and twice after his return, however, he had experienced self-limited episodes of fever and chills. He said he had taken the prescribed chloroquine-primaquine combination weekly, both while in Vietnam and for 8 weeks after his return. He denied any subsequent travel outside the United States, receipt of blood or blood products, and the use of common syringes. In February 1971, although he was asymptomatic, Plasmodium species parasites were seen on a peripheral blood smear. His serum, when tested by IFA, gave an end-point dilution titer of 1:16 against P. vivax antigen only.

(Reported by Col. Gerald Champlin, M.C., U.S. Darnall Army Hospital, Fort Hood, Texas; John A. Armstrong, M.D., attending physician, Dallas Veterans Hospital, Texas; James T. Wheeler, M.D., Director, Community Blood and Plasma Services, Dallas, Texas; R. F. Sowell, Jr., M.D., Medical Consultant; M. S. Dickerson, M.D., Chief, Communicable Disease Services, Texas State Department of Health; Capt. James McNair, M.C., Preventive Medicine Officer, Ft. Benning, Georgia; the Laboratory Division, CDC; and an EIS Officer.)

Case 4

On January 28, 1971, a 45-year-old man received five units of whole blood while undergoing open heart surgery in a veterans hospital in Texas. After surgery, he had persistent fever, weakness, and anemia. On February 20, P. falciparum parasites were seen on a peripheral blood smear, and the patient was treated with quinine, pyrimethamine, and a sulfonamide.

The patient gave no history of malaria, recent foreign travel, or use of shared syringes. Three of the five units of blood were obtained locally, and the donors gave no history of either malaria or recent foreign travel. The other two units were obtained by a blood collection agency in Columbus, Georgia, from two servicemen stationed at Ft. Benning, Georgia. One of the donors, a 20-year-old man, had served with the Army in Vietnam from September 1970 and had donated blood only once, in January 1971. He denied having had malaria or malaria-like illnesses either while in Vietnam or after his return to the United States. His peri

peripheral blood smear was negative for malaria parasites, but his serum, when tested with the IFA test for malaria, gave end-point dilution titers of 1:1,024 against P. falciparum antigen and 1:256 against P. vivax and P. malariae antigens. The other serviceman had never traveled outside the United States, and his blood tests were negative.

(Reported by the same persons who reported Case 3.)

Case 5

On March 23, 1971, a 43-year-old man in a Washington, D.C., hospital received three units of whole blood to replace losses from gastrointestinal bleeding. He was discharged soon afterwards. On April 10, however, he experienced the onset of intermittent chills and fever, accompanied by weakness; he was readmitted to the hospital on April 24. On admission, P. vivax parasites were seen on a peripheral blood smear. He was treated with chloroquine-phosphate and made an uneventful recovery.

The patient denied any foreign travel, previous history of malaria, and the use of shared syringes. All three units of blood were collected on March 23 from servicemen stationed at Ft. Meade, Maryland. Only one of them had ever traveled outside the United States. This serviceman had recently returned from Vietnam, but efforts to locate him have been unsuccessful.

(Reported by Harold J. Kaplan, M.D., Medical Resident, Washington Hospital Center, William E. Long, M.D., Chief, Epidemiology Division, Health Services Administration, Washington, D.C.; Capt. Robert J. Master, MC, Preventive Medicine Officer, Ft. Meade, Maryland; Howard J. Garber, M.D., Chief, Division of Communicable Diseases, Maryland State Department of Public Health.)

Case 6

On July 21, 1971, a 52-year-old truck driver underwent coronary artery by-pass surgery in a Gainesville Florida hospital; he subsequently received 14 units of blood. He did well postoperatively and was discharged on August 2.

On August 8, the patient had onset of fever and chills occurring every other day; he was hospitalized on August 22. Physical examination revealed a temperature of 104°F. and hepatosplenomegaly. The hematocrit was 30, and the white blood cell count was 8,600/mm^3. A peripheral blood smear demonstrated P. vivax parasitemia. Treatment with chloroquine and primaquine resulted in prompt recovery.

The patient had no previous history of malaria, recent travel to malarious areas, or parenteral drug use. Eleven of the 14 blood donors were civilians without prior history of malaria or travel to endemic areas; peripheral blood smears from five of these persons and serum samples from seven tested by IFA technique were negative for malaria.

The other three donors were soldiers stationed in Georgia; they had donated blood at a nearby commercial blood bank. Two of these had not been to Vietnam; one denied having had malaria or using parenteral drugs. He had a negative IFA test for malaria. The other man was lost to follow-up. The third soldier had been treated for malaria when serving in Vietnam from January to November 1970. Thick and thin peripheral blood smears were negative for malaria, but his serum showed IFA titers of 1:1,024 to P. vivax, 1:256 to P. malariae, and 1:64 to P. falciparum.

(Reported by Baiba Ausinsch, M.D., Department of Anesthesiology, University of Florida Hospital, Gainesville, Florida; Ralph B. Hogan, M.D., Administrator, Epidemiology Section, Florida Division of Health; and an EIS officer.)

Case 7

On September 26, 1971, coronary artery by-pass surgery was performed on a 46-year-old man in Denver, Colorado. From September 26 to 29, he received 11 units of blood. On October 6, he had onset of recurrent chills and fever. A peripheral blood smear obtained on October 28 demonstrated infection with P. malariae. The patient was treated with chloroquine and primaquine and recovered.

Epidemiologic investigation revealed that the patient had never previously had malaria, traveled outside the United States, or used parenteral drugs. Of the 11 donors, one had served in the Philippines in World War II. He denied having had malaria but did admit to having had several undiagnosed febrile illnesses in the past 3-4 years. This man had donated blood on several previous occasions, apparently without incident. Thick and thin blood smears were negative for malaria parasites. His serum, however, when tested for malaria antibodies by the IFA technique, gave the following end-point dilution titers: P. malariae 1:1,024, P. vivax 1:1,024, and P. falciparum 1:256.

(Reported by Jordan Gulinson, M.D., private physician, Denver, Colorado; C. S. Mollohan, M.D., Chief, Office of Epidemiology, Colorado State Department of Health; and an EIS Officer.)

Case 8

On September 25, 1971, a 55-year-old Cuban-born accountant, was admitted to a Memphis, Tennessee hospital with a laceration of his right arm. He received three units of blood and underwent a tendon repair procedure. He was discharged on September 30.

The patient was readmitted on October 11 with acute hemolytic anemia. He was afebrile except for a temperature of 100°F. on the first day of his hospitalization. Extensive hematologic studies could not determine the etiology of the anemia. He received steroids and three units of blood. The steroids were discontinued before his discharge on October 20.

On November 4, the patient was again hospitalized with fever and chills. Physical examination showed a temperature of 102°F. and hepatomegaly. Laboratory studies revealed a hematocrit of 22, and acute hemolysis was again confirmed. He received steroids and two units of blood. His hospital course was marked by daily temperature up to 106°F. which dropped to below 97°F. between peaks. On November 7, he had a cardiac arrest but was successfully resuscitated. A blood smear obtained on November 9 revealed heavy infection with malaria parasites which were initially identified as P. falciparum. Intravenous quinine sulfate was started immediately. The patient had another cardiac arrest on November 11 and died shortly thereafter.

The patient's blood smears were reviewed at CDC, where the parasites were identified as P. vivax. Malaria antibody titers of the patient's serum by IFA showed P. vivax 1:1,024, P. falciparum 1:256, and P. malariae 1:256.

The patient had immigrated to the United States in 1959 and had not traveled outside this country since then. He had never had malaria or used parenteral drugs. As a child, he received a gunshot wound which necessitated a splenectomy. In 1969, he suffered a myocardial infarction but had otherwise been in good health until October 1971.

In the course of his three hospital stays, the patient had received eight units of blood. Seven of the donors denied having had malaria, traveling to malarious areas, or using parenteral drugs. Examination of thick and thin peripheral blood smears and serum tested by the IFA technique from six of these persons were negative for malaria.

The eighth donor, a 26-year-old man, had served in the Army in Vietnam from approximately February 1969 to February 1970. He had donated blood on several other occasions since his return. He was treated by a private physician for malaria of unknown type in March 1970 and again at two Veterans Administration hospitals for two episodes of P. vivax infection in June and September 1970. Peripheral blood smears obtained from one of these hospitals were examined at CDC; P. vivax parasites were identified. He denied the use of parenteral drugs. Although thick and thin blood smears obtained at the time of the epidemiologic investigation were negative for malaria parasites, serum tested by the IFA technique gave titers of 1:1,024 to P. vivax, 1:256 to P. malariae, and 1:64 to P. falciparum. The patient had received this donor's blood on October 14, approximately 2 weeks before the onset of fever.

(Reported by Robert H. Hutcheson, Jr., M.D., State Epidemiologist, Tennessee State Department of Health; Robert C. Rendtorff, M.D., Director, Communicable Diseases, Shelby County Health Department, Memphis, Tennessee; and an EIS officer.)

Case 9

On September 20, 1971, a 43-year-old man entered a Houston, Texas, hospital for an exploratory laparotomy. A diagnosis of fibrosarcoma of the spleen was made and a splenectomy was performed. He was transfused four units of blood on September 26 and 27 and was discharged from the hospital on October 6.

He was hospitalized on November 5 for recurrent chills and fever. Peripheral blood smears demonstrated P. malariae infection. He was treated with chloroquine and primaquine and recovered, but died in February 1971 of his malignancy.

Epidemiologic investigation revealed that two of the four donors had donated blood at a commercial blood bank adjacent to a military base in Texas. One of these men could not be located. The other had returned to the United States from duty in Vietnam in June 1968. Peripheral blood smears were negative for malaria but his serum gave the following end-point dilution titers when tested by the IFA technique: P. vivax 1:16, P. falciparum 1:256, P. malariae 1:256.

(Reported by Robert MacLean, M.D., Director, Communicable Disease Division, Houston City Health Department, Texas; M. S. Dickerson, M.D., Chief; Rugel F. Sowell, M.D., Medical Consultant, Communicable Disease Services, Texas State Department of Health; James Wheeler, M.D., Medical Director, Community Blood and Plasma Service, Inc., Dallas Texas; and two EIS officers.)

Case 10

On October 26, 1971, a 74-year-old woman underwent a total hip replacement in a Houston Texas hospital. During the operation she received two units of blood,

and on October 30, she received a third unit of blood. On November 8, she developed fever and P. vivax was demonstrated on peripheral blood smear on November 11. She was treated with hydroxychloroquine and recovered.

Of the three donors, one had no known history of malaria or foreign travel and had given 17 units of blood over the past 6 years without sequelae. The second donor had no history of malaria or travel and peripheral blood smear and serum by IFA were negative for malaria. The third donor returned from Vietnam in late October 1971 and donated blood at the same commercial blood bank that had been implicated in Case 9. He has been lost to follow-up.

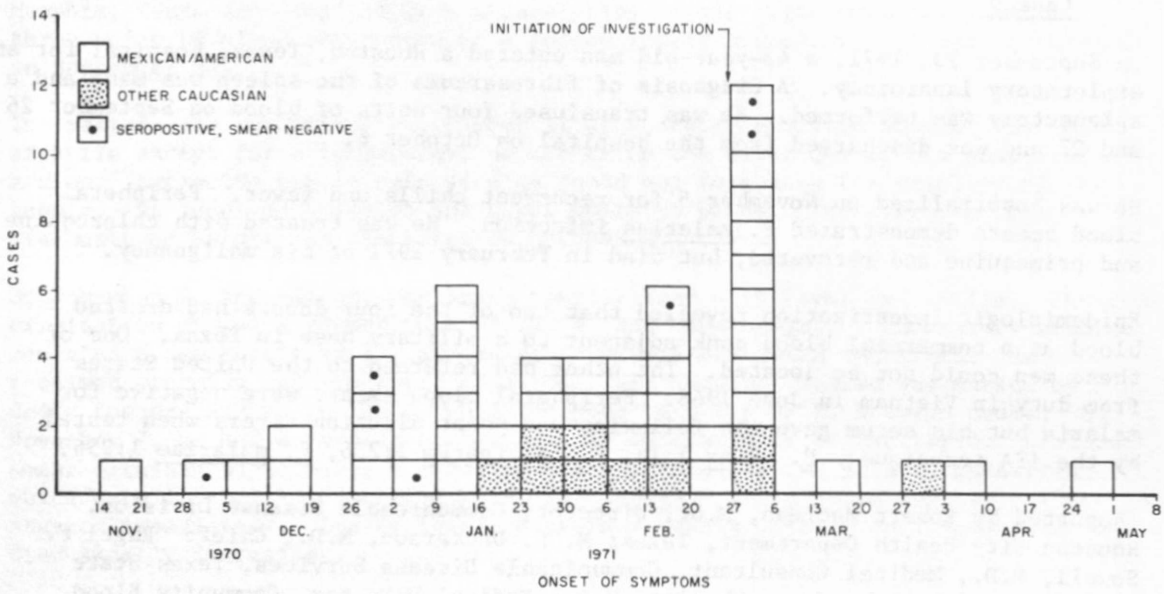
(Reported by same persons who reported Case 9.)

C. Needle-Induced Malaria

Cases 11-52

Between November 1970 and April 1971, an epidemic of 47 cases of P. vivax malaria occurred among users of intravenous heroin in Kern County, California (Figure 5). (Forty-two persons became ill during 1971; the five persons with onset of illness in 1970 are not counted in the 1971 surveillance figures.) All cases gave a history of sharing injection equipment with at least one other malaria patient. Thirty-seven patients were Mexican Americans; 44 were male; the average age was 21 years old. Seven other persons (index case not included) gave histories of recent illness compatible with malaria and had positive indirect fluorescent antibody (IFA) tests for malaria, although their peripheral blood smears were negative.

Figure 5
CASES OF INDUCED MALARIA, BY WEEK OF ONSET, CALIFORNIA, NOVEMBER 1970-APRIL 1971



A 25-year-old male was identified as the probable index case. He had had malaria while serving in Vietnam but had neither been adequately treated, nor taken his prescribed terminal malaria chemoprophylaxis upon return to the United States in August 1970. Although he was asymptomatic and his peripheral blood smear was negative for malaria, his serum gave the following titers by IFA: P. vivax 1:256, P. falciparum 1:64, P. malariae 1:16. He admitted sharing needles with the first eight persons who became ill in the epidemic.

An epidemiologic investigation was initiated on February 26, 1971. A special clinic was established on March 2 by the Kern County Health Department to interview suspect cases and all contacts, to obtain thick and thin peripheral blood smears, and to administer presumptive treatment with chloroquine phosphate (i.e., 2.5 grams total dose over 3 days, with the initial dose of 1.0 gram being given in the presence of health personnel.) Through the clinic 330 contacts were identified and treated with chloroquine. Few malaria cases occurred after the first week of March and none occurred after the last week of April.

(Reported by Owen A. Kearns, M.D., Health Officer, Kern County Health Department; Robert W. Huntington, M.D., Medical Director, Kern County General Hospital, Bakersfield, California; Ronald R. Roberto, M.D., Epidemiologist, Lois Ann Shearer, R.N., Nurse-Epidemiologist and James Chin, M.D., Chief, Bureau of Communicable Disease Control, California Department of Public Health; and three EIS officers.)

Cases 53 and 54

On February 18, 1971, a 20-year-old serviceman at Ft. Bragg, North Carolina, experienced the onset of fever, chills, and headache. Because these symptoms persisted, he entered a military hospital on February 25. At that time, P. vivax was seen on a peripheral blood smear. On March 1, his 18-year-old roommate also experienced the onset of fever and chills. He entered a military outpatient clinic, and P. vivax was seen in his blood smear.

Neither patient had ever traveled outside the United States or received blood transfusions; however, both admitted to occasionally using heroin intravenously. They frequently shared injection equipment between themselves and with another roommate, a 21-year-old serviceman who had returned from Vietnam in January 1970. This latter soldier had been treated for malaria while in Vietnam. After his return, he experienced many attacks of a malaria-like illness characterized by fever and chills, but he did not seek medical attention. He reported that he rarely took the prescribed chloroquine-primaquine tablets while in Vietnam and did not take any after his return to the United States. Several peripheral blood smears examined in mid-March were negative for malaria parasites. His serum, however, when tested by IFA technique for malaria, gave end-point dilution titers of 1:256 against P. vivax, 1:64 against P. falciparum, and 1:16 against P. malariae antigens.

Twenty-four needle-sharing contacts were identified by the patients and the suspect index case. Nineteen of these were interviewed and received presumptive treatment with chloroquine phosphate. Blood samples were drawn for preparation of thick and thin smears and IFA testing; all results were negative. No other cases of malaria associated with this outbreak have been reported.

(Reported by Capt. Robert M. Giller, MC, Assistant Chief, Preventive Medicine Officer; Lt. Col. Raphael DiNapoli, MC, Chief, Preventive Medicine Activity, Division of Meddac, Ft. Bragg, North Carolina and an EIS officer.)

Case 55

On March 19, 1971, a 37-year-old man was admitted to a Chicago hospital due to blunt trauma to the head and abdomen. On admission, his temperature was 102°F. Rales and ronchi were heard on chest examination, and he received penicillin, but the fever persisted. The patient said he had been a prisoner of war in Korea

in 1953 and had been addicted to heroin since then. The initial cultures of blood, urine, and sputum specimens as well as peripheral blood smears were negative for malaria parasites. On March 26, however, P. vivax parasites were seen on a repeat peripheral blood smear. The patient made an uneventful recovery after treatment with chloroquine phosphate.

The patient had not traveled outside the United States recently nor received blood transfusions. He said he had not recently shared his injection equipment, however, he did name two contacts. Neither contact could be located. No other cases of needle-induced malaria have been reported in the Chicago area since that time.

(Reported by David Baldwin, M.D., attending physician, Rush-Presbyterian-St. Luke's Hospital; Olga Brolnitsky, M.D., Chief Epidemiologist; Murray C. Brown, M.D., Commissioner, Chicago Board of Health; and an EIS officer.)

Case 56

On June 9, 1971, a 17-year-old girl was hospitalized in Los Angeles County, California, with a 4-day history of severe headache, earache, and fever. Two days later, P. vivax parasites were seen on a peripheral blood smear. She subsequently made an uneventful recovery.

The patient had no previous history of malaria, blood transfusions, or foreign travel. Six weeks earlier, however, the patient had attended a party where illicit parenteral drugs and injection equipment were shared. Although she denied actual participation, she did admit that she may have "scratched" herself with the needle. Epidemiologic investigation revealed that a close acquaintance of the patient had returned from Vietnam a few days prior to attending the party. He alledgedly had malaria and had used heroin regularly in Vietnam; he was treated with unknown medications for a febrile illness shortly after the party. Subsequent peripheral smears demonstrated P. vivax.

Although none of the other six people at the party had symptoms of malaria or positive blood smears, two persons had IFA titers of 1:64 to P. vivax. All persons attending the party were treated with chloroquine; the Vietnam veteran also received primaquine.

(Reported by Charles W. Rasmussen, M.D., private physician, Pasadena, California; Robert Murray, Epidemiology Analyst; Ichiro Kamei, M.D., Chief, Acute Communicable Disease Control, Los Angeles County Health Department; Rae Lindsay, M.D., Health Officer, Sutter-Yuba County Health Department; Mary Clark, M.D., Deputy Director of Public Health, Santa Clara County Health Department; Ronald R. Roberto, M.D., Medical Epidemiologist, Bureau of Communicable Disease Control, California State Department of Public Health.)

D. Accidentally Induced Malaria

Case 57

On October 18, 1971, a 24-year-old medical student in Birmingham, Alabama accidentally stuck himself with a needle after drawing arterial blood for the determination of blood gases from a patient with falciparum malaria. Eight days later, he had onset of a sore throat, myalgia, and fatigue. He was seen in the student health clinic and started on penicillin. On October 31, he became febrile and experienced chills and drenching sweats. On November 3,

he was admitted to a hospital after ring forms consistent with P. falciparum (50,000 parasites/mm^3.) were found in his peripheral blood smears.

On admission, he was alert and had a temperature of 101°F., pulse 120/minute, respirations 16/minute, and blood pressure 100/60. His tonsils were enlarged bilaterally. Physical examination was normal except for a palpable, tender spleen that extended 3 1/2 cm below the left costal margin.

The patient was started on intravenous quinine, oral pyrimethamine, and sulfadiazine. He became afebrile the following day. On November 6, he experienced a few conjunctival petechiae and a skin rash, and the sulfadiazine was discontinued. He continued to respond to treatment and was discharged on November 14.

(Reported by Richard H. Esham, M.D., Chief, Medical Resident; Thomas W. Sheehy, M.D., Professor of Medicine; Patrick Walker, medical student, University of Alabama School of Medicine, Birmingham, Alabama; and Frederick S. Wolf, M.D., Director, Bureau of Preventable Disease, Alabama State Department of Health.)

VII. DEATHS DUE TO MALARIA IN THE UNITED STATES

Case 1

On October 4, 1971, a 31-year-old soldier stationed in Vietnam became ill with fever and chills, followed by lower back pain 3 days later. While in Vietnam, he had taken chloroquine and primaquine tablets regularly and dapsone intermittently. On October 8, he became weak, lethargic, anorexic, and suffered a mild, constant headache. He was discharged and returned to the United States on October 12. He was admitted to a hospital in Birmingham, Alabama, 2 days later.

On admission, the patient had a rectal temperature of 103°F, pulse 90/minute, respirations 18/minute, and blood pressure 100/70. He was alert, in no acute distress, and had icteric conjunctiva, clear lungs, and normal heart sounds. Liver dullness measured 13 cm, and the spleen was palpable 3 cm below the left costal margin. The peripheral blood smear contained red blood cells with ring forms tentatively identified as P. vivax. He was started on chlorquine phosphate orally. Three days later, he was still febrile and was becoming progressively lethargic. Infection with P. falciparum (250,000 parasites/c.mm.) was confirmed shortly thereafter.

Treatment with parenteral quinine and oral pyrimethamine was started. Within 3 days, a peripheral blood smear was clear of malarial parasites. The patient's condition continued to deteriorate, however, and he lapsed into coma. Spinal fluid studies were normal. Bilateral bronchopneumonia developed on October 18. His condition became progressively worse, and he was unresponsive to broad spectrum antibiotic therapy. On October 20, the patient experienced respiratory distress followed by cardiac arrest. He died shortly thereafter.

(Reported by same people who reported Case 57.)

Case 2

Case 2, a fatal case of vivax malaria, is described under Transfusion **Induced Malaria, Section VI, Case 8.**

Case 3

On January 9, 1971, a 59-year-old American who had been working as a heavy equipment operator in West Irian, Indonesian New Guinea, arrived in Yuba City, California. Because he felt ill, he consulted a physician who admitted him to a local hospital that same day. On admission, he complained of fever, chills, headache, and diarrhea associated with cramps of approximately 10 days duration. On physical examination, he was lethargic, disoriented, and icteric. The differential diagnosis included malaria, gall bladder disease, cholera, trypanosomiasis, amebiasis, and acute flu syndrome. Since he was disoriented on admission, it is not known whether he had taken any chemosuppressive for malaria.

The initial blood smear was negative for malaria. Other laboratory results included: hemoglobulin 15.3 gm percent, white blood cell count 4,900/mm^3, bilirubin 1.8 mg percent, direct 0.5 mg percent, SGOT 32 units, BUN 49 mg percent, and uric acid 7.5 mg percent; the urine showed many granular casts. Direct Coombs' test was negative, and febrile agglutinins reacted at 1:320 against paratyphoid A antigen and 1:40 against both paratyphoid B and typhoid H.

A chest X-ray showed elevation of the right diaphragm, an electrocardiogram indicated an intraventricular conduction defect, and cholecystography revealed an enlarged gall bladder with diminished function.

Although the patient's blood smears remained negative for malaria parasites, antimalarial treatment was initiated late on January 12; he first received amodiaquine, then chloroquine, quinine, and pyrimethamine. On the following day, trophozoites and gametocytes of P. falciparum were seen on a peripheral blood smear. The patient's temperature rose to 105°F., his urine appeared black, and he died suddenly.

Postmortem examination revealed congestion of small vessels of all organs and of the red blood cells within the vessels. There was heavy deposition of malaria pigment in the brain, lungs, liver, and kidneys, and a peripheral blood smear revealed very heavy parasitization with all stages of P. falciparum.

(Reported by Walter Bozak, M.D.: Charles E. Clement, M.D., attending physicians; Lee A. Skaggs, M.D., Pathologist, Rideout Hospital, Yuba City, California; Rae Lindsay, M.D., Health Officer, Sutter-Yuba County Health Department, California; Ronald R. Roberto, M.D., Medical Epidemiologist, Infectious Disease Element; and James Chin, M.D., Chief, Communicable Disease Division, California State Health Department.)

Case 4

On April 12, 1971, a 21-year-old Vietnam veteran with a 4-day history of fever and chills consulted a private physician in Whittier, California. The physician prescribed tetracycline for an apparent urinary tract infection. On April 16, the patient became unconscious and was hospitalized with marked diaphoresis and in shock.

On admission, his hemoglobin was 10.8 gm percent, which later dropped to 2.9 gm percent. Three hours after admission, P. falciparum parasites were seen on a peripheral blood smear. When free blood was found on abdominal puncture, an exploratory laparotomy was performed and his spleen was removed. The spleen had several tears in the capsule and weighed 732 grams. Three hours later, he was operated on again to tie off a weeping splenic stump. The patient required 19 units of blood. He was then started on quinine therapy. On April 19, he

became unresponsive and anuric, with bilateral papilledema. One burr hole was made on suspicion of subdural hematoma; none was found. In spite of therapy, he died on April 22. The cause of death was reported as cerebral malaria.

The patient had returned from Vietnam and been discharged from the Army 18 days before his hospital admission. His friends reported that he had had malaria while in Vietnam and had been taking his malaria pills as recommended. They admitted to much partying after the patient's return, but denied any use of intravenous drugs with the patient or each other.

(Reported by Ichiro Kamei, M.D., Chief of Acute Communicable Disease; Gerald B. Heidbreder, M.D., Health Officer, Los Angeles County Health Department; Ronald R. Roberto, M.D., Medical Epidemiologist, Bureau of Communicable Disease Control, State of California Department of Public Health; and an EIS officer.)

Case 5

On September 1, 1971, a 42-year-old art teacher from Baltimore, Maryland, who was visiting in San Juan, Puerto Rico, consulted a local physician for fever, chills, myalgia, headache, and malaise. Her illness was diagnosed as grippe, and no specific therapy was given. She returned to the physician on September 4 with more severe symptoms and was admitted to a private hospital.

On admission, the patient had a fever and was jaundiced. She became comatose the following day and passed scanty amounts of dark urine. Examination of a peripheral blood smear revealed heavy parasitemia with P. falciparum. Treatment was started with parenteral chloroquine and quinine, as well as heparin and parenteral corticosteroids.

Because of continued coma and oliguria, the patient was transferred to another hospital in San Juan on September 7. Treatment with quinine and chloroquine was continued and pyrimethamine and transfusions with packed red blood cells were also given. By September 10, she was awake, and no parasites were seen on a peripheral blood smear. She remained anemic and icteric, however, with persistently elevated blood urea nitrogen and creatinine in the presence of large daily urine outputs. Because of suspected disseminated intravascular coagulation, she continued to receive heparin. On September 12-13, the patient underwent peritoneal dialysis for 24 hours. She subsequently appeared well clinically, but was found dead in bed on September 14. The cause of death by gross anatomical examination was massive intra-abdominal hemorrhage.

The patient had been in Tangiers, Morrocco, during the early part of August and had later spent 6 days (August 15-21) in Liberia and Ghana, West Africa. She then passed through New York City on August 21 and stopped in Baltimore on August 22-24 on her way to San Juan. It is not known whether she had ever taken antimalarial chemoprophylaxis. She had no history of previous malaria, parenteral drug use, or recent blood transfusions.

(Reported by Alan Rapoport, M.D., private physician, San Juan, Puerto Rico; Lisandro Montalvo-Sanchez, M.D., medical resident, University of Puerto Rico Medical Center, San Juan; Luis Mainardi, M.D., Chief, Communicable Disease Section, Puerto Rico Department of Health; an EIP officer, and an EIS officer.)

Case 6

On November 30, 1971, a 16-year-old Spanish crew member aboard a Lebanese cargo ship which was docked in Las Palmas, Canary Islands, complained of muscle aches after loading tuna. The following day, he had onset of a temperature of 104°F. and diffuse myalgia. He was seen by a local physician who diagnosed influenza and prescribed penicillin, vitamins, and an anti-catarrhal.

Over the next 4 days, as the ship was heading for Puerto Rico, the patient was restless, ate and slept poorly, and experienced deliriums and frequent high fevers; however, the myalgia and the height of his fevers gradually diminished. By December 6, the patient's condition had improved, and he appeared ready to go back to work. He was last seen at 9:00 a.m. on December 7. Two hours later, he was found lying dead on the bathroom floor.

The body was sealed in an unrefrigerated box until the ship arrived in San Juan, Puerto Rico. At autopsy on December 11, there was no jaundice, petechiae, rash, needle marks, or signs of trauma. Other findings, however, included a large congested spleen (550 grams) and pulmonary edema. The brain was unremarkable on gross examination; microscopic examination could not be performed due to severe postmortem changes. Thick blood smears demonstrated heavy P. falciparum parasitemia.

The ship had been in Ghana, West Africa, between November 3 and 17 and in Senegal, West Africa, between November 22 and 26. All but two of the 18 officials and crew had been ashore in Ghana, including the patient. On November 4, as the officers and crew received yellow fever vaccinations along with local residents, one officer noted that the same needle was used on several persons. None of the crew had received malaria prophylaxis.

While in Puerto Rico, the crew members were interviewed and tested for malaria. None of them reported being ill with fever at the time of the patient's illness. Histories, thick blood smears, and serum indirect hemagglutination tests were negative for malaria. No one had needle marks, and each denied illicit drug use except for marijuana. They were started on chloroquine chemoprophylaxis. According to the crew members, the patient had not been as an illicit drug user and had taken only prescribed medicines at the time of his illness. Pills found in his personal belongings contained no opiates on toxicologic analysis. A pain pill containing codeine, however, was frequently passed among the crew members. A portion of codeine is metabolized to morphine in the body, and the patient's bile fluid did contain morphine.

(Reported by Sydney Kaye, M.Sc., Ph.D.; Marino Sorvill, M.D., Institute of Legal Medicine, University of Puerto Rico School of Medicine, Rio Piedras, Puerto Rico; the Foreign Quarantine Program, CDC; and EIP officer, and an EIS officer.)

Case 7

On October 7, 1971, a 22-year-old white male entered an Arkansas hospital in shock with a 2-hour history of sudden, excruciating low back pain. He had been well until two days prior to admission when he experienced headache, nausea, vomiting, weakness, chills and fever; his symptoms abated on October 6 but recurred on the day of admission.

On physical examination he was dyspneic, cold, cyanotic, and had no discerniable pulse or blood pressure. Blood count included hemoglobulin 10.9 gm percent, hematocrit 33, WBC 7,300/mm^3 with normal differential. Resuscitation efforts

were unsuccessful and he died 30 minutes after admission.

Postmortem examination revealed massive hemoperitoneum (2000 cc) secondary to spontaneous rupture of the spleen. The spleen was enlarged (weighing approximately 250 grams) and showed extensive subcapsular hemorrhage. Microscopically there was congestion and malaria pigment. Postmortem peripheral blood smears demonstrated P. vivax. The liver was slightly enlarged, but otherwise unremarkable.

Epidemiologic investigation revealed that the patient had served in Vietnam for about 1 year, returning to the United States in September 1970. He had had several episodes of malaria while in Vietnam and did not take the prescribed malaria chemoprophylaxis upon return to the United States.

Beginning in November 1970, he suffered recurrent attacks of nausea, vomiting, chills and fever. The cause of these episodes was never determined. He was usually treated with antibiotics, although he received a course of amodiaquine on one occasion because of the possibility of malaria. His last such episode was in early September 1971, for which he had been hospitalized for 8 days.

During the month prior to his demise he had apparently been in good health. Careful history indicated no undue straining or trauma to his abdomen.

(Reported by Annette V. Landrum, M.D., Director of Ft. Smith Medical Laboratory, Ft. Smith, Arkansas; John A. Harrel, M.D., Director of Communicable Diseases and Acting Director of the State Board of Health, Little Rock, Arkansas, and an EIS officer.)

Case 8

A 27-year-old white male was pronounced dead upon arrival at an Ohio hospital on June 9, 1971. Postmortem examination by the county coroner indicated the cause of death was a ruptured spleen and peripheral blood smears demonstrated Plasmodium sp. There was no evidence of recent trauma to the abdomen.

The patient had served in Vietnam from September 1969 to October 1970. Little is known about his history since his return to the United States other than he was an itinerant laborer. Efforts to obtain further data were unsuccessful.

(Reported by the Ohio State Health Department and Parasitic Disease Branch, Epidemiology Program, CDC.)

VIII. REPORT FROM THE NATIONAL MALARIA REPOSITORY - 1971

The presence of Plasmodium species or agreement that there were no parasites present was confirmed by the National Malaria Repository in blood films from 1,264 of the 1,267 cases (99.8 percent) submitted in 1971. Malaria organisms could not be found in blood films from two persons submitted as having parasites present. One specimen was submitted as negative, but parasites were found at CDC. It should be noted that in 52 cases (4.1 percent) the National Malaria Repository determined that a different species was present than that identified by the laboratory of origin.

Tables illustrating the origin (Table 10) and species diagnosis (Table 11) of malaria smears examined by the Repository are shown below. Totals for the calendar year 1970 are included for comparison.

Table 10

Origin of Positive Slides for Malaria Submitted to the National Malaria Repository, 1970-71

	ORIGIN							
	Army	Navy	VA Hosp.	Air Force	Health Dept. (State, County, City)	PHS Hosp.	Others Hospitals Clinics, Physicians etc.	Cumulative
Cumulative total positive 1971	131	28	422	58	91	46	96	872
Cumulative total positive 1970	199	53	716	92	98	17	131	1306

Table 11

Species of Malaria Identified by National Malaria Repository 1970 and 1971

Species	Cumulative Total 1971	Cumulative Total 1970
P. vivax	737	1,073
P. falciparum	109	216
P. malariae	8	6
P. ovale	7	5
Plasmodium sp.	10	6
Negative	395	225
Unsatisfactory	1	0
Total examined	1,267	1,531
Cumulative positive	872	1,306

IX. ACKNOWLEDGMENT

The Malaria Surveillance Report, prepared annually at the Center for Disease Control, is based on information provided in individual reports. The excellent support given to the malaria surveillance by State and local health departments and personnel of the Preventive Medicine Services of the U.S. Army, Navy, and Air Force is greatly appreciated.

Thorough and comprehensive evaluation of all cases of malaria reported in the United States constitutes the most effective approach to preventing re-establishment of malaria transmission subsequent to importation.

All cases of malaria, whether first attacks or relapses, regardless of where they are acquired, should be promptly reported to the appropriate health department. Clinical and epidemiological information on each case should be provided on the Malaria Case Surveillance Report Form 4.80 (CDC). Extra copies of this form are available on request. Every effort should be made to obtain pretreatment thick and thin blood films for each case. These films may be submitted with the Surveillance Form.

REFERENCES

1. Terminology of Malaria and of Malaria Eradication. Geneva, World Health Organization, 1963, p 32

2. WHO Expert Committee on Malaria - Tenth Report. WHO Techn Rep Ser No. 272, p 34

3. Unpublished data, Office of the Surgeon General, Department of the Army, 1972

STATE EPIDEMIOLOGISTS

Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, interpretation and transmission of data and epidemiologic information from their individual States, the State epidemiologists perform a most vital role. Their major contributions to the evolution of this report are gratefully acknowledged.

Alabama	Frederick S. Wolf, M.D.
Alaska	Donald K. Freedman, M.D.
Arizona	Philip M. Hotchkiss, D.V.M.
Arkansas	John A. Harrel, Jr., M.D.
California	James Chin, M.D.
Colorado	C. S. Mollohan, M.D.
Connecticut	James C. Hart, M.D.
Delaware	Floyd I. Hudson, M.D.
District of Columbia	William E. Long, M.D.
Florida	Ralph B. Hogan, M.D.
Georgia	John E. McCroan, Ph.D.
Hawaii	Harry L. Boyett, M.D.
Idaho	John A. Mather, M.D.
Illinois	Franklin D. Yoder, M.D. (Acting)
Indiana	Charles L. Barrett, M.D.
Iowa	Arnold M. Reeve, M.D.
Kansas	Don E. Wilcox, M.D.
Kentucky	Calixto Hernandez, M.D.
Louisiana	Charles T. Caraway, D.V.M.
Maine	Timothy R. Townsend, M.D. (Acting)
Maryland	John D. Stafford, M.D. (Acting)
Massachusetts	Nicholas J. Fiumara, M.D.
Michigan	Norman S. Hayner, M.D.
Minnesota	D. S. Fleming, M.D.
Mississippi	Durward L. Blakey, M.D.
Missouri	H. Denny Donnell, Jr., M.D.
Montana	Michael H. Goloff, M.D. (Acting)
Nebraska	Henry D. Smith, M.D.
Nevada	William M. Edwards, M.D.
New Hampshire	Vladas Kaupas, M.D.
New Jersey	Ronald Altman, M.D.
New Mexico	Nancy C. McCaig, M.D.
New York State	Alan R. Hinman, M.D.
New York City	Pascal J. Imperato, M.D.
North Carolina	Martin P. Hines, D.V.M.
North Dakota	Kenneth Mosser
Ohio	John H. Ackerman, M.D.
Oklahoma	Stanley Ferguson, Ph.D.
Oregon	Samuel Osgood, M.D.
Pennsylvania	W. D. Schrack, Jr., M.D.
Puerto Rico	Luis Mainardi, M.D.
Rhode Island	David L. Starbuck, M.D. (Acting)
South Carolina	Donald H. Robinson, M.D.
South Dakota	Robert H. Hayes, M.D.
Tennessee	Robert H. Hutcheson, Jr., M.D.
Texas	M. S. Dickerson, M.D.
Utah	Taira Fukushima, M.D.
Vermont	Geoffrey Smith, M.D.
Virginia	H. E. Gillespie, M.D.
Washington	Byron J. Francis, M.D.
West Virginia	N. H. Dyer, M.D.
Wisconsin	H. Grant Skinner, M.D.
Wyoming	Herman S. Parish, M.D.

☆ U. S. G.P.O.: 1972 – 745-353/1586 Region No. 4

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
CENTER FOR DISEASE CONTROL
ATLANTA, GEORGIA 30333

OFFICIAL BUSINESS

DHEW Publication No. (HSM) 72-8152