

# MALARIA

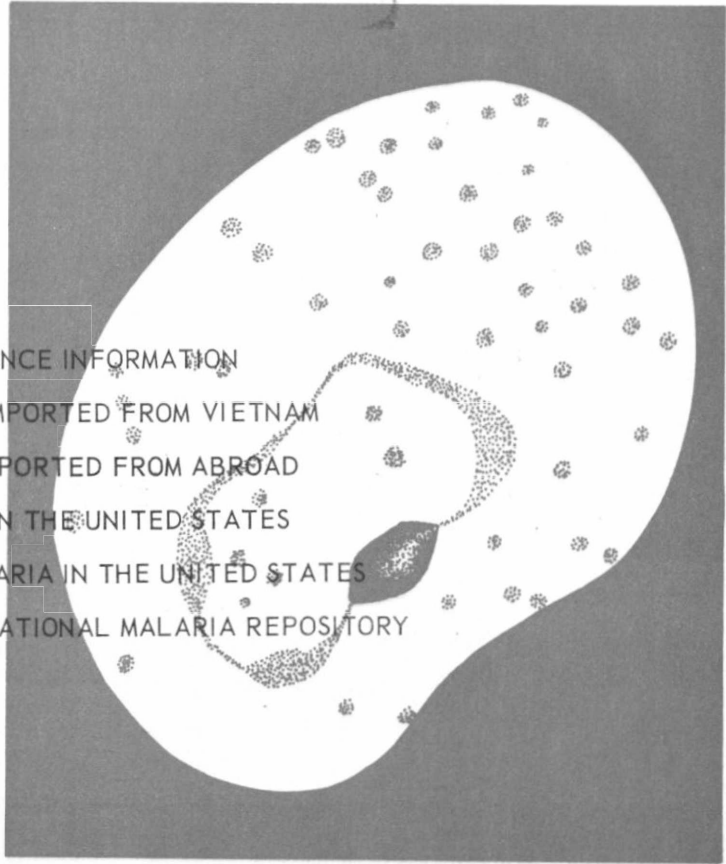
## SURVEILLANCE

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# 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.

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## MALARIA SURVEILLANCE 1969

### I. SUMMARY

In 1969, 3,806 cases of malaria were reported in the United States. This represents a 41.7 percent increase over the 2,686 cases reported in 1968. This increase was due entirely to a greater number of military cases imported from Vietnam. In 1969, 95.2 percent of all cases reported in the United States were acquired in Vietnam. As in previous years imported Plasmodium vivax infections were more common than imported P. falciparum infections (79.2 vs. 14.4 percent).

Army personnel accounted for 77.1 percent of all Vietnam-acquired infections in 1969. The total number of Army cases (2,796) represented a 30.3 percent increase over 1968. This increase in Army cases was due to the increase of Army personnel returning from Vietnam for the attack rate in Army returnees remained relatively constant. The Marines, however, with 19.2 percent of Vietnam-acquired malaria infections in 1969 experienced a 262.6 percent rise in malaria cases compared with 1968. This increase in Marine cases could not be attributed solely to improved reporting or increased numbers of returnees.

Despite the increase in malaria activity, there were no introductions of malaria reported during 1969. Of the five cases acquired in the United States, four were induced by blood transfusion. The fifth case is cryptic in origin.

There were nine malaria fatalities, all due to P. falciparum. Only four of the fatal cases had served with the military in Vietnam. Of the five civilian deaths, four occurred in Americans who had recently returned from Africa. The fifth fatality had received multiple blood transfusions. Serologic studies indicated that the probable source of his infection was an asymptomatic veteran who had returned from Vietnam 1 year earlier.

## II. TERMINOLOGY

The terminology used in this report is derived from the recommendations of the World Health Organization.<sup>1,2</sup> 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, 1969, and March 10, 1970, 3,806 cases\* of malaria with the onset of illness during 1969 in the United States and Puerto Rico were reported to the Parasitic Diseases Branch of the National Communicable Disease Center. This compares with 2,686 cases recorded in 1968, and represents the largest annual number of malaria cases recorded in the United States since 1951 when 5,600 were reported. In addition to the 3,806 first attacks of malaria in the United States, reports were received on 233 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. Reported attacks 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, NCDC.

Malaria in military personnel (including recently discharged veterans) was responsible for the 41.7 percent increase in reported cases of malaria during 1969. Military cases rose from 2,557 (1968) to 3,679 (1969), and comprised 96.4 percent of all cases diagnosed in this country (Table I). All but 53 of these cases were acquired in Vietnam. Despite the increasing speed and popularity of international travel, reports of malaria in civilians has remained rather constant over the past 7 years (Figure 1).

Table I  
 Military and Civilian Cases of Malaria  
 United States 1959-1969\*

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**	620	144	764
1967**	2697	159	2856
1968**	2557	129	2686
1969	3679	127	3806

\*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.

Five of the 127 civilian cases of malaria reported in 1969 acquired their infections in the United States. Blood transfusion induced malaria occurred on four occasions and one case is still considered cryptic in origin. In two of the induced cases, a Vietnam veteran was identified as the most probable source of the infection. The clinical details of these five cases are presented in Section VI.

There was no significant change in the ratios of cases caused by any Plasmodium species between 1968 and 1969. P. vivax accounted for 79.2 percent of infections, while P. falciparum was diagnosed in 14.4 percent (Table II). Of the 90 mixed infections, 84 were caused by coexistent P. vivax and P. falciparum.

Table II  
Cases of Malaria by Plasmodium Species  
United States, 1969

Species	Total	Percent
<u>P. vivax</u>	3014	79.2
<u>P. falciparum</u>	548	14.4
<u>P. malariae</u>	40	1.0
<u>P. ovale</u>	10	0.3
Mixed Infections	90	2.4
Undetermined	104	2.7
Total	3806	100.0

The country of most likely origin of the 3,806 cases of malaria reported in 1969 is shown in Table III. Vietnam was listed as the source of 3,629 imported cases of malaria. Only three of these cases were in non-military personnel. Vietnam returnees, therefore, accounted for 95.2 percent of all malaria cases in 1969. Malaria in military personnel returning from Vietnam is the subject of Section IV. In 1968, only two cases of malaria had been reported from Mexico, however, Mexico was the source of 12 cases of malaria during 1969, the highest total for any country other than Vietnam.

Table III

Cases of Malaria by Distribution of Plasmodium Species and Area of Acquisition  
United States, 1969\*

	<u>vivax</u>	<u>falciparum</u>	<u>malariae</u>	<u>ovale</u>	<u>Mixed</u>	<u>Unknown</u>	<u>Total</u>
AFRICA	15	28	2	6	-	7	58
Africa**	5	6	-	2	-	1	14
West Africa**	2	7	-	1	-	3	13
East Africa**	1	1	-	-	-	-	2
Congo	-	1	-	-	-	-	1
Ethiopia	2	-	-	1	-	-	3
Ghana	-	4	-	1	-	-	5
Kenya	-	4	2	-	-	1	7
Liberia	-	5	-	-	-	1	6
Nigeria	3	-	-	-	-	1	4
Sierra Leone	1	-	-	1	-	-	2
Uganda	1	-	-	-	-	-	1
ASIA	2957	503	30	4	89	90	3673
Asia**	1	1	-	-	-	-	2
Southeast Asia**	3	2	-	-	-	-	5
India	4	-	-	-	-	-	4
Iran	1	-	-	-	-	-	1
Korea	7	1	-	-	-	-	8
New Guinea	5	-	-	-	-	-	5
Okinawa	-	1	-	-	-	-	1
Pakistan	9	-	-	-	-	-	9
Philippines	2	2	1	-	-	-	5
Thailand	4	-	-	-	-	-	4
Vietnam	2921	496	29	4	89	90	3629
CENTRAL AMERICA AND CARIBBEAN	9	4	-	-	-	2	15
Caribbean**	3	-	-	-	-	-	3
Canal Zone	-	3	-	-	-	-	3
El Salvador	1	1	-	-	-	-	2
Honduras	1	-	-	-	-	1	2
Nicaragua	3	-	-	-	-	-	3
Panama	1	-	-	-	-	1	2
EUROPE	-	-	1	-	-	-	1

Table III continued next page

Table III (continued)

	<u>vivax</u>	<u>falciparum</u>	<u>malariae</u>	<u>ovale</u>	<u>Mixed</u>	<u>Unknown</u>	<u>Total</u>
NORTH AMERICA	10	3	4	-	-	-	17
Mexico	8	-	4	-	-	-	12
United States	2	3	-	-	-	-	5
SOUTH AMERICA	1	1	-	-	-	-	2
South America**	1	-	-	-	-	-	1
Colombia	-	1	-	-	-	-	1
UNKNOWN	22	9	3	-	1	5	40
TOTAL	3014	548	40	10	90	104	3806

\*Onset of illness in the United States and Puerto Rico

\*\*Country Unspecified

A history of previous malaria while abroad was obtained in 1,220 of the 3,439 imported cases (35.4 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 (36.4 vs. 24.7 percent).

The geographic distribution of the 1969 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, Texas, North Carolina, Georgia, Kansas, and Hawaii is due to the location of major military centers, particularly Army bases, within their borders.

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 who returned from Vietnam in the preceding quarter.

Clinical malaria developed within 30 days of arrival in the United States in 69.6 percent of falciparum and 19.9 percent of vivax infections for which both the exact date of arrival and the date of onset are known (Table IV). This fact is of particular importance because Vietnam veterans are routinely given one month's leave 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. Six months after entering this country, 99.4 percent of patients with falciparum malaria and 90.2 percent of those with vivax malaria reported during 1969 had developed clinical symptoms. Only 40 patients with vivax malaria (1.4 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 during 1969 was 14 months for falciparum malaria and 30 months for vivax malaria.



Table IV

Malaria Cases by Interval Between Onset of Illness and Date of Entry Into the United States,  
and by Plasmodium Species, United States, 1969

Interval (in months)	<u>Plasmodium</u> Species									
	Vivax	(%)	Falciparum	(%)	Malariae	(%)	Ovale	(%)	All Cases	(%)
<1	550	(19.9)	327	(69.6)	15	(44.1)	2	(25.0)	894	(27.2)
1-2	1277	(46.1)	116	(24.7)	12	(35.3)	3	(37.5)	1408	(42.9)
3-5	669	(24.2)	24	(5.1)	4	(11.8)	3	(37.5)	700	(21.3)
6-11	232	(8.4)	1	(0.2)	3	(8.8)	-	-	236	(7.2)
≥12	40	(1.4)	2	(0.4)	-	-	-	-	42	(1.3)
ALL CASES	2768	(100.0)	470	(100.0)	34	(100.0)	8	(100.0)	3280	(100.0)

Of the 3,806 cases reported in 1969, 73.0 percent were initially treated in military hospitals; 18.7 percent received care in a Veterans Administration hospital (Table V). 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 fact that more than 20 percent of Army personnel have left the Service by the time they develop malaria suggests that the above figures underestimate the extent to which civilian physicians encounter cases of malaria.

Table V  
Malaria Cases by Type of Initial Hospital Admission  
United States, 1969

<u>Type of Hospital</u>	<u>Number of Patients</u>	<u>Percent</u>
Military	2781	73.0
Veterans Administration	713	18.7
Civilian	210	5.5
Public Health Service	27	0.7
Other	10	0.3
Not Specified	19	0.5
Not Hospitalized	46	1.2
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TOTAL	3806	100.0

Nine deaths, all due to *P. falciparum*, occurred in the 548 cases of falciparum malaria reported in 1969 (case fatality rate = 1.6 percent). These cases are discussed in detail in Section VII. Intravascular hemolysis was the most frequent complication reported by physicians (14.9 percent) on patients for whom the information was recorded. Cerebral malaria occurred in 10 cases (2.4 percent), renal failure in 4 (1.0 percent), and pulmonary edema in 3 (0.7 percent). These last three complications were associated with fatality rates of 50, 75, and 100 percent respectively. However, the more thorough investigation of fatal cases may have caused bias in the complication-fatality rates in this small series of cases.

#### IV. MILITARY MALARIA IMPORTED FROM VIETNAM

Three thousand, six hundred and seventy-nine military cases of malaria were reported during 1969, and 3,626 of these (98.7 percent) were imported from Vietnam (Table VI). P. vivax was the etiologic agent in 2,918 of the Vietnam military cases (80.4 percent), P. falciparum in 496 cases (13.7 percent) and P. malariae in 29 cases (0.8 percent). Four cases of P. ovale malaria acquired in Vietnam were reported.\* This is an interesting finding because P. ovale is generally thought to be confined to tropical Africa and the Western Pacific.<sup>3</sup> Mixed Plasmodium infections occurred in 89 cases (2.4 percent) and the Plasmodium species could not be identified in 90 cases (2.5 percent).

Army personnel accounted for 77.1 percent of the military malaria cases from Vietnam, and Marines accounted for 19.2 percent. Navy and Air Force personnel rarely contracted the disease (Table VI). Imported cases of malaria from Vietnam were greater than the 1968 figures by 30.3 percent in Army returnees and by 262.6 percent in Marine returnees. The increase among Army personnel is due to increased troop withdrawals in 1969 since the attack rate for malaria remained at the same level in 1969 as 1968.<sup>4</sup> The Marines, however, experienced a dramatic increase in malaria which cannot be explained by improved reporting, increased numbers of returnees, or a change in the 8-week chloroquine-primaquine regimen used as terminal chemoprophylaxis on return to the United States.

Table VI

Malaria in Military Returnees from Vietnam by Branch of Service, U.S.A., 1969

<u>Branch of Service</u>	<u>Number of Cases</u>	<u>Percent of Cases</u>	<u>Percent Increase 1968-1969</u>
Army	2796	77.1	+ 30.3
Marines	696	19.2	+ 262.6
Navy	17	0.5	- 5.6
Air Force	9	0.2	+ 80.0
Unknown	108	3.0	+ 38.4
TOTALS	3626	100.0	+ 44.4

The relapse rates in patients with vivax malaria imported from Vietnam during the years 1966-1969 is given in Table VII. Since relapse of vivax infections is unusual after 3 years, the 1966 figures may now be presumed to be complete whereas there may be additions to the figures for 1967-1969. Nevertheless, there is a diminishing rate of relapse for each successive year which we believe will persist despite the receipt of additional reports. This is probably due to the more thorough use of primaquine in Army hospitals in the past few years.<sup>5</sup>

\*Species identification of the four P. ovale cases from Vietnam was confirmed by the National Malaria Repository.

The relapse rate in military cases from Vietnam with falciparum infections was 1.4 percent in 1969 (7 of 496 infections) compared to 1.2 percent in 1968, 6.8 percent in 1967, and 8.5 percent in 1966. The decline in the rate of falciparum relapses since 1967 may be the result of the development of more effective chemotherapeutic regimens for the treatment of chloroquine-resistant strains of P. falciparum.

Table VII

Relapse Rates of Military Cases of Vivax Malaria Imported from Vietnam, U.S.A., 1966-1969

Year	Number of Primary Attacks	Percent of Patients with Relapses				
		First	Second	Third	Fourth	Fifth
1966	350	29.4	8.7	1.4	0.0	0.0
1967	2197	18.4	3.4	0.8	0.1	0.0
1968	2059	7.8	0.8	0.2	0.1	0.0
1969	2918	4.4	0.2	0.0	0.0	0.0

#### V. CIVILIAN MALARIA IMPORTED FROM ABROAD

In contrast to the increase in military cases, the number of civilian cases of malaria has remained at the same level for several years. The age and sex distribution of the 127 civilian malaria cases is presented in Table VIII. United States citizens accounted for 83 of the 127 (65.3 percent) and the remaining 44 cases occurred in citizens of other countries (Table IX). College students and teachers traveling abroad contracted more malaria than tourists. The Peace Corps reported six cases of malaria in volunteers in 1969 and six in 1968, compared with 25 in 1967 and 44 in 1966. Thirteen seamen (only one of whom was an American citizen) developed malaria in 1969 and comprised the largest group of foreign nationals with imported malaria.

Table VIII

Civilian Malaria Cases by Age and Sex  
United States, 1969

<u>Age Group</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Percent</u>
0-9	3	4	7	5.5
10-19	5	5	10	7.9
20-29	32	10	42	33.1
30-39	21	7	28	22.0
40-49	12	3	15	11.8
50-59	5	3	8	6.3
60-69	3	2	5	3.9
70+	2	1	3	2.4
Unknown	9	-	9	7.1
TOTAL	92	35	127	100.0

Table IX

Imported Civilian Malaria Cases by Occupation and Nationality  
United States, 1969

<u>Occupation</u>	<u>U. S. Citizen</u>	<u>Foreign Visitor</u>	<u>Total</u>	<u>Percent</u>
Tourist	17	0	17	(13.4)
Businessman	5	0	5	(3.9)
Government representative	9	2	11	(8.7)
Missionary	7	0	7	(5.5)
Peace Corps	6	0	6	(4.7)
Seaman	1	12	13	(10.2)
College Student or Teacher	19	11	30	(23.6)
Other	6	10	16	(12.6)
Unknown	13	9	22	(17.3)
TOTAL	83	44	127	(100.0)

## VI. MALARIA ACQUIRED IN THE UNITED STATES

Despite the increase in imported malaria in the United States, no introductions of malaria were recognized in this country in 1969. Of the five cases of malaria acquired in the United States, four were induced by blood transfusion. The fifth case is still considered cryptic in origin.

### A. Induced Malaria

#### Case 1

On March 10, 1969, a 64-year-old diabetic white man developed melena and was admitted to a hospital where he received 10 units of whole blood before undergoing resection of a bleeding gastric ulcer. He was discharged 2 weeks later but was readmitted on April 7 with fever, jaundice, and anemia. A peripheral blood smear taken on April 10 contained large numbers of trophozoites and gametocytes, as well as occasional schizonts of P. falciparum. Quinine, pyrimethamine, and sulfadiazine therapy cleared the asexual parasitemia; however, hemolytic anemia and azotemia appeared; the patient became obtunded and died on April 22. Autopsy showed cerebral edema, centrilobular necrosis with malarial pigment in the liver, and bile casts in the kidney.

Of the 10 blood donors, nine were located. Eight donors were considered unlikely sources of infection based on epidemiologic considerations. The ninth donor was a veteran who returned from Southeast Asia in March 1968 but denied ever having clinical symptoms of malaria. This man's serum had a 1:256 indirect fluorescent antibody titer against P. falciparum.

(Reported by Drs. C. C. Wany, S. W. De Ramos, and H. B. Shookhoff, Division of Tropical Diseases, and Dr. V. F. Guinee, Director, Bureau of Preventable Diseases, New York City Health Department.)

#### Case 2

On March 26, 1969, a 50-year-old white man with calcific mitral stenosis and pulmonary hypertension underwent open-heart surgery for replacement of the mitral valve. During the procedure he required 11 units of whole blood, 14 units of plasma, and 8 units of platelets. On April 4 he developed fever, shaking chills, and mild leukopenia, and on April 5 P. falciparum ring forms were identified in the peripheral blood. He recovered after receiving standard doses of chloroquine.

The plasma and platelet donors and 9 of the 11 whole blood donors could not be implicated as sources of infection based on epidemiologic considerations. Of the two remaining whole blood donors, one woman had visited the Middle East in 1966 and the other was a Ghanaian citizen who entered the United States in January 1969. To date, efforts to obtain peripheral blood smears and sera from these two individuals have been unsuccessful.

(Reported by Drs. C. C. Wang, S. W. De Ramos, and H. B. Shookhoff, Division of Tropical Diseases, and Dr. V. F. Guinee, Director, Bureau of Preventable Diseases, New York City Health Department.)

### Case 3

On August 8, 1969, P. vivax parasites were found in sections of an open lung biopsy specimen taken from a 38-year-old man with chronic myelocytic leukemia who was hospitalized in New York City. The lung biopsy was performed because of recurring fever of obscure etiology and diffuse, non-specific radiologic changes in the lung fields. The patient was treated with standard doses of chloroquine and made an uneventful recovery from his malaria. The patient, a Korean War veteran, had not traveled outside the U.S. since 1954 and had no history of previous malaria-like illness. The diagnosis of leukemia was made in 1964, and the patient did fairly well until February 1969. Between that date and August 1969, because of blastic crises, he received several courses of antineoplastic agents, 20 units of whole blood or packed cells, 99 units of fresh white cells and 84 units of platelets. Many peripheral blood smears were available for review, and malarial parasites were seen only in a blood specimen taken on August 6, 1969.

All donors of whole blood, packed red cells, and all blood products given in the 6-week period before the patient's onset of symptoms were contacted. None gave a history of recent travel to a malarious area. There was only one whole blood donor during this 6-week period and he gave a history of having had malaria in 1952 while with the military in Korea. Although this man had an indirect fluorescent antibody (IFA) titer of 1:16 to P. malariae, the IFA titer against P. vivax was negative. This man's peripheral blood smear was also negative. The source of the recipient's P. vivax infection is therefore uncertain.

(Reported by Howard B. Shookhoff, M.D., Chief, Tropical Medical Division, and Vincent F. Guinee, Director, Bureau of Preventable Diseases, New York City Health Dept., and an EIS Officer.)

### Case 4

On November 7, 1969, a 38-year-old man experienced a severe hemorrhage from a gastric ulcer. He was hospitalized and during the next 5 days received 11 units of blood. On November 12 he underwent subtotal gastrectomy for resection of his ulcer, and during the operation was given two more units of whole blood. On November 29, he developed fever and chills, and P. falciparum parasites were seen on peripheral blood smears. The patient was treated with chloroquine and quinine and made a complete clinical recovery but relapsed on January 15. He was then treated with quinine and sulfa drugs and has subsequently remained well. He had been in the United States Army and had served in Germany and France. He denied prior unexplained episodes of fever or the use of commonly shared syringes.

All 13 units of blood had been supplied by a blood bank in Buffalo, New York. The donors were interviewed, and a serum sample for malarial indirect fluorescent antibody titers was obtained from each donor. A 24-year-old man was the only donor with positive serologic tests. The indirect fluorescent antibody titers were: P. falciparum 1:256, P. ovale 1:64, P. vivax 1:16, and P. malariae 1:16. Parasites could not be detected in peripheral blood smears obtained on several occasions.

This donor denied travel outside the United States at the time he donated blood. However, when he was subsequently interviewed, he admitted service with the Army

in Vietnam from June 1968 to June 1969. He stated that while in Vietnam he had a brief febrile illness but he was told that it was not malaria.

(Reported by J. R. Hall, M.D., Meadville City Hospital, Pennsylvania; I. Fred Gratch, M.D., Epidemiologist, Division of Communicable Diseases, Pennsylvania Department of Health; Michel A. Ibrahim, M.D., Epidemiologist, Erie County Health Department, New York; and James O. Culver, M.D., Director, Bureau of Epidemiology, New York State Department of Health.)

## B. Cryptic Malaria

### Case 5

In October 1967, a 56-year-old registered nurse had a radical mastectomy performed in Gainesboro, Tennessee, and received two units of blood during the procedure. A second mastectomy was performed in July 1969, and a single unit of blood was given at this time. On October 13, 1969, the woman developed a temperature of 104° F., shaking chills, and vomiting. The fever was intermittent without any distinctive pattern. The hospital laboratory noticed unusual intra-erythrocytic structures and forwarded peripheral blood smears to the State Health Department where the diagnosis of malaria was made. These slides were reviewed by the National Malaria Repository, NCDC, and rare Plasmodium ring forms were seen on one thick smear. The species could not be identified and malaria parasites were not seen on subsequent blood smears.

Chloroquine therapy was started on November 8, 1969, 3 weeks after the onset of symptoms. Because the patient's fever continued for 20 days, despite the administration of chloroquine throughout this period, quinine therapy was substituted and continued for 11 days. The patient became afebrile.

Malarial transmission occurred in the Gainesboro, Tennessee area before World War II. The patient had lived in this region her entire life and had never traveled outside the United States. In 1934 her family physician made the diagnosis of "malaria" and administered quinine. The patient's son also contracted "malaria" in 1948 while living with the family.

All three blood donors were 32 years of age or younger and natives of Tennessee. At the time they donated the suspected units of blood, none had served in the military or traveled overseas. One of the 1967 donors subsequently joined the Army and served in Vietnam. Peripheral blood smears and malarial IFA and IHA tests for the patient and the two non-military donors were negative for malaria in late December 1969. The third donor was located serving in the Army in Hawaii and specimens drawn in March 1970 were negative. Malaria had not been diagnosed in any other individual in the Gainesboro area in 1969. A review of the admission records of the community hospital and the workbook of its hematology laboratory confirmed this fact. The patient in her nursing duties had never cared for a patient with malaria and she denied the use of illicit parenteral drugs.

There are many unusual features in this case of malaria. Firstly, the mode of acquisition is unclear. There has not been indigenous malaria in the Gainesboro, Tennessee area for many years and no imported cases were recognized during 1969. None of the blood donors had evidence of prior malaria and the incubation period is longer than expected for transfusion malaria. Secondly,



the patient's prolonged fever did not have a distinctive pattern. Furthermore, her fever did not respond to prolonged doses of chloroquine. It did respond to quinine, but this may have been fortuitous, since the benign nature of her illness made it highly doubtful that she had a chloroquine resistant P. falciparum infection. Thirdly, she had no IFA or IHA malaria antibodies, although her neoplastic disease may have impaired her serologic response. Despite these features which make the diagnosis of malaria dubious, her peripheral blood smear definitely contained rare Plasmodium of undetermined species. Thus, this case is cryptic in both its epidemiologic and clinical aspect. It is conceivable that her parasitemia was a relapse of a P. malariae infection from her malaria attack in 1934, and that her present febrile illness was primarily due to her neoplastic disease.

(Reported by E. M. Dudley, M.D., Gainesboro, Tennessee; J. Howard Barrick, Ph.D., Director, Division of Laboratories; W. H. Armes, Jr., M.D., M.P.H., Deputy Commissioner; Eugene Fowinkle, M.D., M.P.H., Commissioner, Tennessee Department of Public Health; and an EIS officer).

## VII. DEATHS DUE TO MALARIA IN THE UNITED STATES

Nine cases of fatal malaria, all due to P. falciparum, occurred in the United States and were reported to NCDC in 1969. In 1968, six fatal were reported.<sup>6</sup> Although military personnel accounted for 95 percent of the malaria cases diagnosed in this country in 1969, only four of the nine fatalities were Vietnam veterans. The five civilian fatalities occurred in four American citizens who acquired their infection in Africa, and in one patient with transfusion-induced malaria in which one of the donors had served in Vietnam (see Case 1, Section VI).

Four of the five civilians who died from P. falciparum infection had not taken the recommended chemoprophylactic regimen of chloroquine.

One civilian did not consult a physician before he died; the diagnosis of malaria was made in two other civilians and one serviceman at autopsy. The eight patients who sought medical attention experienced a delay of 1 to 11 days (mean 5.3 days) before the diagnosis of malaria was established. On at least two occasions (Case 6 and 7), a review of antemortem blood smears showed malaria parasites which had not been recognized while the patient was alive. These malaria deaths emphasize the need for malaria chemosuppression during visits to malarious areas and the need for physicians to consider the diagnosis of malaria in febrile patients with a history of recent travel or transfusions.

### Case 1

Case 1, a fatal case of falciparum malaria, is described under Induced Malaria, Section VI.

### Case 2

A fatal case of P. falciparum malaria was reported from Hartford, Connecticut, in a 60-year-old woman. On March 7, 1969, the woman developed weakness, nausea, vomiting, and diarrhea which were controlled with paregoric. However, on March 9, her temperature reached 103° F. On March 10, she felt

weak but was afebrile and able to go shopping. On March 12, she again developed fever, diarrhea, and malaise, and her husband noted some disorientation. She was seen by her physician, who found no neurologic abnormalities but noted a temperature of 102° F. and mild dehydration; he prescribed a tetracycline. The woman had a history of carcinoma of the rectum 9 years previously treated by colostomy and abdominal-perineal colonic resection. On March 12 the physician first learned that the patient and her husband had toured in Kenya and Tanzania from February 4, through 24, 1969, and had returned to the United States on February 25. They had not taken malaria chemoprophylaxis.

On March 13, the patient became dyspneic and extremely weak; she continued vomiting. At her physician's insistence, she agreed to hospitalization. When she arrived at the hospital that evening, she was comatose and cyanotic. Malaria was suspected, and a 10-20 percent parasitemia with young trophozoites of P. falciparum was detected on her blood smear. She died before therapy could be instituted.

On postmortem examination, malaria parasites were found in red cells throughout the body. The liver and spleen were severely congested and the spleen extremely friable. The heart and kidneys were normal. The lungs showed only mild congestion.

(Reported by Hugh B. Friend, M.D., and Eduardo Tolosa, M.D., Hartford, Connecticut; and James C. Hart, M.D., Director, Division of Preventable Diseases, Connecticut State Department of Health.)

### Case 3

About May 13, 1969, a 41-year-old horticultural consultant developed fever and chills while visiting relatives in Southfield, Michigan. Because of the man's religious convictions, he did not seek medical attention. The patient died on May 20, and an autopsy was performed at the request of the medical examiner. The heart blood and red cells within the capillaries of all the tissues examined contained numerous ring forms of P. falciparum. No gametocytes could be identified.

For the past 6 years the patient, his wife, and two children had lived in Johannesburg, South Africa. While there, he had made several business trips to Angola. On April 27, 1969, the entire family flew to Angola and spent 6 days there before arriving in Michigan on May 11 via Lisbon and Boston. The wife stated that her husband had been in excellent health prior to his terminal illness. No member of the family had ever taken malaria chemoprophylaxis. The other three family members have remained asymptomatic despite their refusal to accept chloroquine therapy.

(Reported by Bernard D. Berman, M.D., Director, Oakland County Department of Health, and George H. Agate, M.D., Chief, Division of Epidemiology, Michigan Department of Public Health.)

#### Case 4

During the flight home from Vietnam, on May 28, 1969, a 20-year-old serviceman developed fever and chills followed by dry cough, nausea, vomiting, and mild diarrhea. Four days later, he visited his family physician who elicited a history of a dog bite 5 weeks earlier, for which the patient had already received 14 daily doses of duck embryo rabies vaccine. Because the present symptoms were consistent with an upper respiratory infection, he was given penicillin and told to return if he did not improve.

He continued to feel ill, but was not seen by the physician until June 8, when his family found him semicomatose on the bathroom floor and brought him to the hospital. The admission temperature was 105° F., and there was meningismus and right upper quadrant tenderness. The admission peripheral blood smear contained numerous *P. falciparum* ring forms. The hematocrit was 25 percent, white cell count 25,000/mm<sup>3</sup>, a bilirubin 8.2 mg percent, BUN 78 mg percent, blood pH 7.10, sodium 134 meq/l, potassium 6.0 meq/l, chloride 95 meq/l, and CO<sub>2</sub> 18.4 meq/l. The cerebrospinal fluid pressure and protein were elevated. Following consultation with an Army hospital, the patient was started on parenteral chloroquine and sulfisoxazole, but he steadily deteriorated.

Arrangements were made to air-evacuate the patient from Chattanooga to Walter Reed Army Hospital on June 10. Enroute, the flight surgeon controlled an episode of ventricular tachycardia with intravenous CaCl<sub>2</sub>. On arrival, the hematocrit was 12.5 percent, white cell count 50,000/mm<sup>3</sup>, bilirubin 5.0 mg percent, BUN 236 mg percent, and the creatinine 4.0 mg percent. The prothrombin time was 40.5 seconds, and further evaluation revealed severe depression of clotting factors II, V, VII, IX, and X. The parasite count was in excess of 400,000/mm<sup>3</sup> of blood. Carefully monitored intravenous quinine, hemodialysis, steroids, and fresh frozen plasma were followed by a decrease in parasite count to under 1,000/mm<sup>3</sup> and correction of the metabolic disturbances. During the early hours of June 14, however, acute pulmonary edema developed; there was no response to therapy, and the patient died.

The autopsy showed bronchopneumonia, intra-alveolar hemorrhage, hemoglobin pigment and casts, as well as tubular necrosis in the kidney, and diffuse petechial brain hemorrhages. Although no parasitized red blood cells could be identified in the capillaries, malaria pigment was present throughout the body.

(Reported by John C. Ellis, M.D., Tri-County Hospital, Ft. Oglethorpe, Georgia; Cecil B. Tucker, M.D., Director, Bureau of Preventable Health Services, Tennessee Department of Public Health; Edmund C. Tramont, Captain, MC, Walter Reed Army Hospital; and William E. Long, M.D., Chief, Epidemiology Division, District of Columbia Department of Public Health.)

#### Case 5

On September 4, 1969, a 22-year-old Vietnam veteran returned to the United States and stopped taking malarial suppressives. On September 14, he had a temperature of 105° F. and a chill. When symptoms recurred on the following day, he was admitted to a local hospital in Mississippi where the presence of rales suggested the diagnosis of pneumonia. He was treated with antibiotics for 3 days, but his condition gradually deteriorated. On September 18, he was flown to a military hospital.

At the time of transfer he was semicomatose, responsive only to deep pain, dehydrated, and oliguric. A diagnosis of malaria was confirmed by peripheral blood smears which demonstrated a high percentage of red blood cells parasitized by P. falciparum trophozoites. Intravenous quinine and supportive measures which included hemodialysis and assisted ventilation were instituted, but the patient's condition continued to deteriorate, and he died on September 22. The autopsy revealed petechial hemorrhages of the brain, consistent with cerebral malaria, as well as extensive bilateral pulmonary hemorrhage and evidence of acute renal insufficiency.

(Reported by Durwood L. Blakey, M.D., Director, Division of Preventable Disease Control, Mississippi State Board of Health; Captain William F. Hallahan, MC, USAF, Columbus Air Force Base, Mississippi; Major James H. Knepshield, MC, USA, Chief, Renal Dialysis Service, Walter Reed Army Hospital; and an EIS officer.)

### Case 6

A 76-year-old woman returned to her home in Pennsylvania on October 10, 1969, after a 1-month safari in East Africa. She did not take malaria chemosuppressives. Upon returning home she was weak and confused, and on the tenth day after return, she suddenly lost consciousness while walking, and was admitted to a local hospital.

Physical examination at the time of admission revealed an elderly, febrile, woman with multiple abrasions on the arms and legs and several cracked teeth. No evidence of head injury was found but she was lethargic, and weakness of the right arm and leg was present. A lumbar puncture was performed; the opening pressure was 200 mm of H<sub>2</sub>O and the cerebrospinal fluid was normal. Blood sugar and electrolytes were normal; the SGOT was 51 units, BUN 30 mg percent, and creatinine 2.0 mg percent.

The initial clinical impression was fever of undetermined origin and organic brain syndrome. During the first 3 days of hospitalization, she received ampicillin and digoxin. The patient exhibited daily spiking fever to 103° F., intermittent tachycardia, and marked restlessness. On the second hospital day radiologic examination showed bilateral haziness of the right and left costophrenic angles, suggesting multiple septic pulmonary emboli or pulmonary edema. On the third day of hospitalization she suddenly became hypotensive and oliguric, for which intravenous corticosteroids and mannitol were given. Scleral icterus was noted at that time. The patient remained hypotensive and died on the following day.

At autopsy, marked pulmonary and cerebral congestion, splenomegaly, and possible massive liver necrosis were found on gross examination. Malarial pigment was found in microscopic examination of the spleen, liver, and bone marrow. In addition, the liver architecture was disorganized, and the cells appeared swollen. Capillaries, venules, and arterioles seen in brain sections were completely occluded by agglutinated erythrocytes. The lumina of many cerebral vessels, particularly the capillaries, were outlined by granular, black malarial pigment.

The finding of malarial pigment in frozen sections of the liver prompted the re-examination of an antemortem peripheral blood smear. A very heavy infection with trophozoites of P. falciparum was seen, and some cells contained several parasites each.

(Reported by Perry Dornstein, M.D., Adjunct, Department of Medicine, and the Department of Pathology, Albert Einstein Medical Center, Northern Division, Philadelphia; and Walter Schrack, M.D., State Epidemiologist, Pennsylvania.)

#### Case 7

A 50-year-old man, who had traveled frequently in Africa and Southeast Asia, returned to the United States on October 28, 1969, after a 14-day government sponsored trip to West Africa. On arrival in Africa, he had received 2.5 cc of intramuscular gammaglobulin. It is not known whether the patient took malarial chemosuppressives while in Africa. He complained of feeling ill on his return, and on the following day consulted his physician, who prescribed antibiotics. On November 4, he was admitted to a civilian hospital in Virginia with spiking non-periodic temperature elevations to 105° F. and jaundice. Liver function tests were abnormal, and the tentative diagnosis of infectious hepatitis was made; he was given supportive intravenous fluids. No improvement was noted, and the patient died suddenly on November 10. Pulmonary edema, bilateral hydrothorax, early hepatic necrosis, and extensive malarial pigmentation were present at autopsy. A review of peripheral blood smears obtained 3 days before death showed P. falciparum trophozoites.

(Reported by H. E. Gillespie, M.D., Acting Epidemiologist, Virginia State Department of Health, and an EIS Officer.)

#### Case 8

On November 7, 1969, a 21-year-old serviceman returned to the United States from Vietnam on emergency leave to attend his father's funeral. He had brought no malarial suppressive drugs with him. Three days later, he experienced an episode of fever, chills, and anorexia. On November 18, he consulted a physician because of persistence of these symptoms, was told he had "flu," and was sent home. Two days later, he consulted a second physician who told the patient that malaria was a possibility, but the patient refused both a blood test and hospitalization.

On November 21, he was admitted to a civilian hospital with fever, chills, tachycardia, and restlessness and was treated with penicillin, digitalis aspirin, and diazepam. Three days later, a peripheral smear showed a very heavy infection with P. falciparum, and therapy was begun with oral quinine and chloroquine. Intravenous quinine, whole blood transfusions, and sedatives were started on November 26 because the patient developed hypotensive episodes, a hematocrit of 22 percent, and neurologic abnormalities which included altered states of consciousness and pathologic reflexes. He died suddenly on November 27.

Postmortem examination of the brain showed multiple septic infarcts, malarial pigment, and edema. The spleen contained malarial pigment and red blood cells with malarial parasites. There was bilateral acute pulmonary edema.

(Reported by H. Grant Skinner, M.D., Director, Bureau of Preventable Diseases, Wisconsin State Division of Health.)

## Case 9

On December 6, 1969, a 22-year-old serviceman returned to Detroit, Michigan, on emergency leave from Vietnam because of his father's illness. On arrival he complained of fever, chills, and backache, and on December 8, saw his family physician who made the diagnosis of infectious hepatitis on the basis of the presenting symptoms, jaundice, pruritis, and a skin rash.

The patient was advised to continue his weekly malaria chemosuppressive therapy, which he did, and he was given a penicillin injection. Household contacts received gammaglobulin. On December 14, the man died suddenly at home. An autopsy revealed severe hepatic necrosis secondary to acute malaria. The capillaries of the brain, liver, lung, heart and other organs were plugged with red blood cells which were heavily parasitized by P. falciparum. There was no evidence of concomitant infectious hepatitis.

(Reported by Willard R. Lenz, M.D., Director, Division of Epidemiology, Detroit Department of Health.)

## VIII. REPORT FROM THE NATIONAL MALARIA REPOSITORY - 1969

The presence of Plasmodium species or agreement that there were no parasites present was confirmed by the National Malaria Repository in blood films from 1,546 of the 1,573 cases (98.3 percent) submitted in 1969. Malaria organisms could not be found in blood films from 26 cases (1.6 percent) submitted as having parasites present. The slide from one case (0.6 percent) was judged to be unsatisfactory for adequate parasitologic diagnosis. Two specimens were submitted as negative, but parasites were found at NCDC. It should be noted that in 104 cases (6.6 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 X) and species diagnosis (Table XI) of malaria smears examined by the Repository are shown below. Totals for the calendar year 1968 are included for comparison.

Table X

Origin of Positive Slides for Malaria Submitted to the  
National Malaria Repository, 1968 and 1969

	ORIGIN							Cumulative
	Army	Navy	VA Hosp.	Air Force	Health Depts. (State, County, City)	PHS Hosp.	Others - Hospitals Clinics, Physicians etc.	
Cumulative total positive 1969	630	34	516	78	44	19	111	1432
Cumulative total positive 1968	730	28	349	31	46	29	71	1344

Table XI

Species of Malaria Identified by National Malaria Repository  
1968 and 1969

Species	Cumulative Total 1969	Cumulative Total 1968
<u>P. vivax</u>	1163	1135
<u>P. falciparum</u>	231	154
<u>P. malariae</u>	13	17
<u>P. ovale</u>	11	13
<u>Plasmodium sp.</u>	14	25
Negative	139	145
Unsatisfactory	1	5
Total examined	1572	1494
Cumulative positive	1432	1344

Figure 1 MILITARY AND CIVILIAN CASES OF MALARIA, UNITED STATES 1959 - 1969

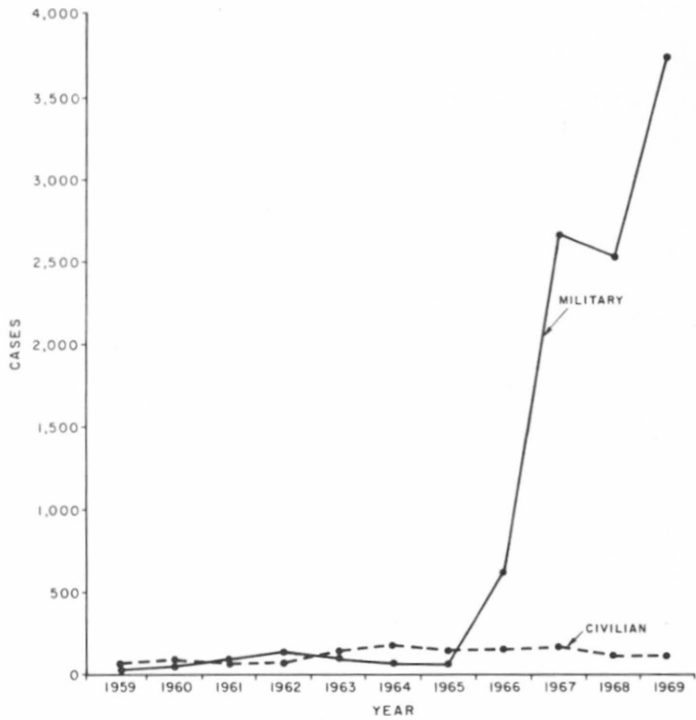
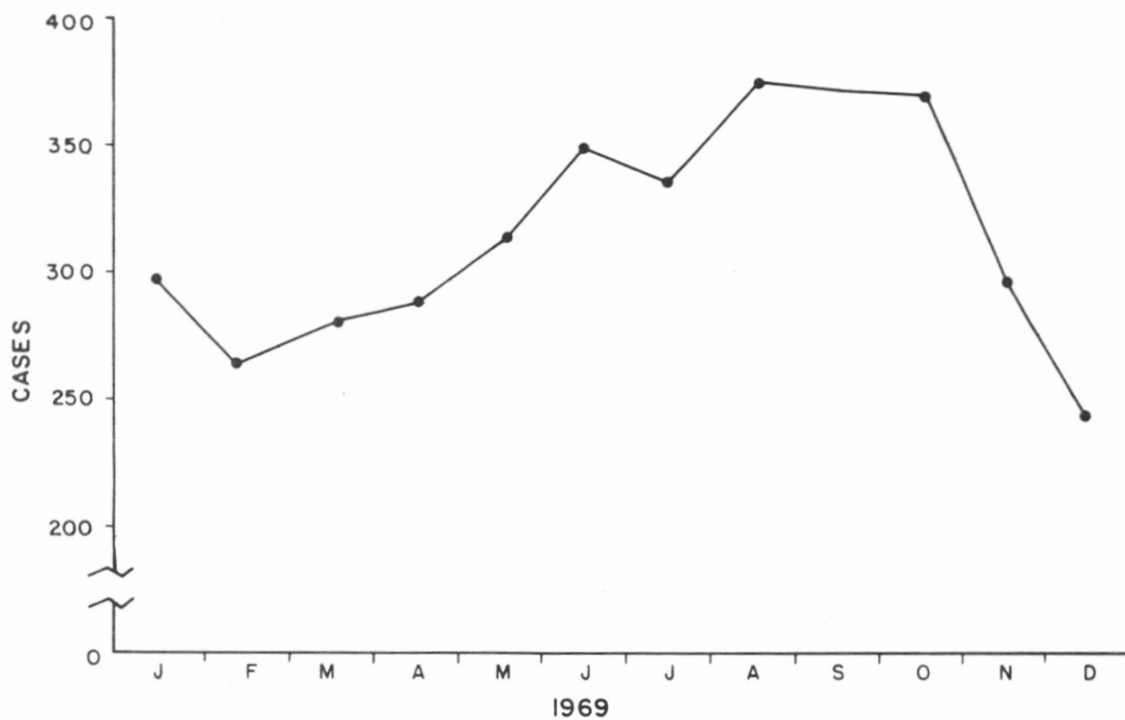


FIGURE 2 GEOGRAPHIC DISTRIBUTION OF MALARIA CASES WITH ONSET IN UNITED STATES, 1969





*FIGURE 3*  
MALARIA CASES BY MONTH OF ONSET,  
UNITED STATES, 1969



### VIII. ACKNOWLEDGMENT

The Malaria Surveillance Report, prepared annually at the National Communicable Disease Center, is based on information provided in individual reports. The excellent support given to the malaria surveillance program 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, 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 PHS 4.80 (NCDC). 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. Lysenko AJ, Beljaer AE: An Analysis of the geographical distribution of Plasmodium ovale. Bull WHO 40:383-394, 1969
4. Department of the Army: Telephone and written communications, 1970
5. Fisher GU, Gordon MP, Lobel HO, et al: Malaria in soldiers returning from Vietnam. Epidemiologic, therapeutic, and clinical studies. Amer J Trop Med, 19:27-39, 1970
6. Dover AS, Western KA: Fatalities due to malaria in the United States. J Infect Dis 121:573-574, 1970

## 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 epidemiological 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.

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