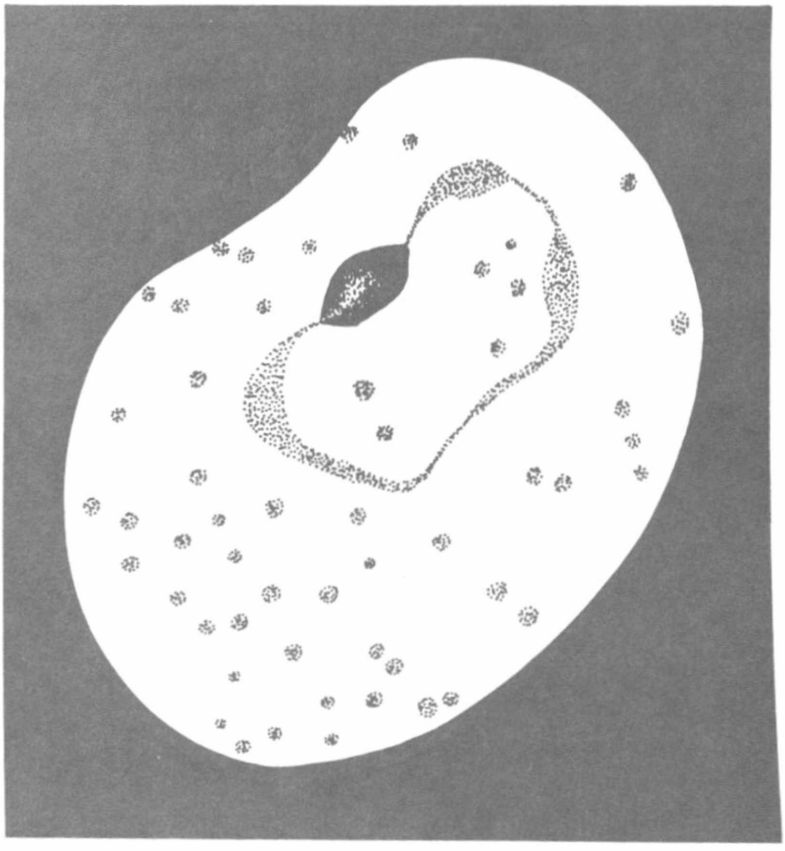
ANNUAL SUMMARY 1989

Issued November 1990

CENTERS FOR DISEASE CONTROL

MALARIA

SURVEILLANCE



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES • Public Health Service • Centers for Disease Control

CDC
CENTERS FOR DISEASE CONTROL

PREFACE

This report summarizes information received from state health departments, medical departments of the Armed Forces, and other sources. It is intended primarily for those responsible for disease control activities. Before quoting this report, contact the original investigator for confirmation and interpretation.

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

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Guidelines for the prevention of malaria in travelers are published in HHS Publication No. (CDC) 90-8280, *Health Information for International Travel 1990*. This booklet also provides information about countries and, where applicable, areas within each country where malaria risk exists. Also listed are areas of the world where chloroquine-resistant strains of *P. falciparum* are known to exist. The booklet is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

SUGGESTED CITATION

Centers for Disease Control: Malaria Surveillance Annual Summary 1989

Issued November 1990

I. SUMMARY

A total of 1,102 cases of malaria with onset of illness in 1989 in the United States and its territories were reported to the Centers for Disease Control (CDC). This compares with 1,023 cases in 1988, an increase of 8%.

The number of reported cases with onset in the United States occurred in the following groups:

U.S. military personnel 35
U.S. civilians 591
Foreign civilians 476

Plasmodium vivax was the parasite identified in 48% of the 1,102 cases, and *P. falciparum* was identified in 41%. *P. malariae* and *P. ovale* were reported in 3% and 2% of the cases, respectively. The species was not determined in the other 6%.

Five of the 1,102 persons acquired the infection in the United States.

Four deaths attributed to malaria were reported for 1989, compared with 6 for 1988.

II. TERMINOLOGY

This report uses terminology derived from the recommendations of the World Health Organization (WHO)(1). Definitions of the following terms are included for reference.

A. Autochthonous

1. Indigenous—malaria acquired by mosquito transmission in an area where malaria occurs regularly.

2. Introduced—malaria acquired by mosquito transmission from an imported case in an area where malaria does not occur regularly.

B. Imported

Malaria acquired outside a specific area (the United States and its territories in this report).

C. Induced

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

D. Relapsing

Renewed manifestation (of clinical symptoms and/or parasitemia) of malarial infection that is separated from previous manifestations of the same infection by an interval greater than those due to the normal periodicity of the paroxysms.

E. Cryptic

An isolated case of malaria ascertained by appropriate epidemiologic investigation not to be associated with secondary cases.

III. GENERAL SURVEILLANCE

This section covers 4 topics: the incidence of malaria, the *Plasmodium* species involved, the area in which infection was acquired and in which the onset of illness occurred, and the interval between the patient's arrival in the United States and the onset of clinical symptoms.

A. Incidence

A total of 1,102 malaria cases with onset of illness in 1989 in the United States were reported to the Division of Parasitic Diseases, Center for Infectious Diseases, Centers for Disease Control (CDC), compared with 1,023 cases in 1988. In 1989, 5 of the 1,102 patients acquired the infection in the United States.

Table 1. All primary malaria cases* in civilians and U.S. military personnel with onset of illness in the United States, 1966-1989

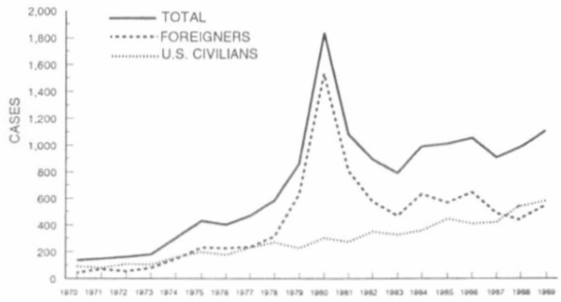
Year	Military Personnel	U.S. Civilians	Foreign Civilians	Unknown	Total
1966	621	89	32	22	764
1967	2,699	92	51	15	2,857
1968	2,567	82	49	0	2,698
1969	3,914	90	47	11	4,062
1970	4,096	90	44	17	4,247
1971	2,975	79	69	57	3,180
1972	454	106	54	0	614
1973	41	103	78	0	222
1974	21	158	144	0	323
1975	17	199	232	0	448
1976	5	178	227	5	415
1977	11	233	237	0	481
1978	31	270	315	0	616
1979	11	229	634	3	877
1980	26	303	1,534	1	1,864
1981	21	273	809	0	1,103
1982	8	348	574	0	930
1983	10	325	468	0	803
1984	24	360	632	0	1,016
1985	31	446	568	0	1,045
1986	35	410	646	0	1,091
1987	23	421	488	0	932
1988	33	550	440	0	1,023
1989	35	591	476	0	1,102

* A "case" is defined as: 1) a person's first attack of malaria in the United States, regardless of whether or not he/she had experienced previous attacks of malaria while outside the country and 2) a positive peripheral blood smear examined in the local or state health department laboratory. A subsequent attack in the same person caused by a different *Plasmodium* species is counted as an additional case. A repeated attack in the same person in this country caused by the same species is not considered an additional case.

Table 2

	1988		1989	
Species	Total	Percent	Total	Percent
P. vivax	437	42.7	532	48.3
P. falciparum	465	45.5	448	40.7
P. malariae	34	3.3	36	3.3
P. ovale	17	1.7	17	1.5
Mixed	4	0.4	1	0.1
Undetermined	66	6.4	68	6.2
TOTAL	1,023	100.0	1,102	100.0

Fig. 1 Cases of Malaria in U.S. Civilians and Foreigners, United States,* 1970-1989



* Includes Puerto Rico, the Virgin Islands, and Guam

Only 35 cases occurred in U.S. military personnel. Civilians have accounted for most of the cases each year since 1973 (Table 1). The number of malaria cases in U.S. civilians increased from 550 in 1988 to 591 in 1989, exceeding, for the second consecutive year since 1974, the number of cases among foreign civilians. (Figure 1). Malaria in foreign civilians increased from 440 reported cases in 1988 to 476 in 1989, an increase of 8%.

B. Plasmodium Species

The *Plasmodium* species was identified in 1,034 (93.8%) of the 1,102 cases. In 1989, *P. vivax* was identified in blood from 48% of the infected persons and *P. falciparum* in blood from 41% (Table 2).

C. Area of Acquisition and of Onset of Illness

The area in which each of the 1,102 patients acquired the infection is listed in Table 3. From 1988 to 1989, cases imported from Central America increased 47.5% and from India, 47.1%. Importation of malaria from Africa did not increase, halting the upward trend observed since 1978.

The geographic distribution of malaria cases within the United States is shown in Figure 2 by the state in which the patient first developed clinical symptoms of malaria.

Fig. 2 Malaria cases with onset in the United States, by state, 1989

Table 3. Malaria cases by distribution of *Plasmodium* species and area of acquisition, United States, 1989

Area of Acquisition	Vivax	Falciparum	Malariae	Ovale	Mixed	Unknown	Total
AFRICA	**52**	**382**	**16**	**13**	**0**	**35**	**498**
Africa, East*	5	19	0	0	0	1	25
Africa, West*	1	18	1	0	0	2	22
Africa, Central*	0	1	0	0	0	0	1
Africa, Unspecified*	7	28	1	0	0	3	39
Angola	0	0	1	0	0	0	1
Burkina Faso	1	2	0	0	0	0	3
Cameroon	0	9	0	0	0	1	10
Central African Rep.	0	8	0	0	0	1	9
Chad	0	1	0	0	0	0	1
Congo	0	1	0	0	0	0	1
Egypt	1	0	0	0	0	0	1
Equatorial Guinea	0	2	0	0	0	0	2
Ethiopia	7	2	0	1	0	2	12
Gabon	0	6	0	0	0	1	7
Gambia	0	1	0	0	0	0	1
Ghana	2	28	2	1	0	5	38
Ivory Coast	0	10	0	0	0	0	10
Kenya	8	37	0	4	0	3	52
Liberia	5	30	1	2	0	3	41
Madagascar	1	6	0	0	0	2	9
Malawi	0	2	0	0	0	0	2
Mali	0	1	0	0	0	0	1
Niger	1	1	0	0	0	0	2
Nigeria	7	121	5	3	0	7	143
Senegal	0	2	0	0	0	0	2
Sierra Leone	1	16	1	0	0	0	18
Somalia	0	1	0	0	0	0	1
South Africa	0	2	0	0	0	0	2
Sudan	2	4	1	0	0	0	7
Tanzania	0	4	0	0	0	2	6
Togo	0	4	0	0	0	0	4
Uganda	0	4	0	2	0	1	7
Zaire	0	9	2	0	0	1	12
Zambia	1	2	0	0	0	0	3
Zimbabwe	1	1	0	0	0	0	2
ASIA	**207**	**44**	**11**	**2**	**0**	**16**	**280**
Asia, Southeast*	12	2	0	0	0	3	17
Afghanistan	4	0	0	0	0	0	4
Burma	1	0	0	0	0	1	1
Cambodia	1	1	0	0	0	0	2
India	135	23	6	2	0	9	175
Indonesia	15	5	1	0	0	1	22
Pakistan	16	1	1	0	0	2	20
Philippines	14	2	1	0	0	1	18
Sri Lanka	0	0	1	0	0	0	1
Thailand	7	9	1	0	0	0	17
Turkey	1	0	0	0	0	0	1
Viet Nam	1	0	0	0	0	0	1
Yemen	0	1	0	0	0	0	1
CENTRAL AMERICA AND CARIBBEAN	**107**	**14**	**7**	**0**	**0**	**2**	**130**
Central Amer. Unspec.*	11	0	0	0	0	0	11
Belize	3	0	0	0	0	1	4
Costa Rica	1	0	0	0	0	0	1
Dominican Republic	1	0	0	0	0	0	1
El Salvador	16	1	1	0	0	0	18
Guatemala	24	0	2	0	0	0	26
Haiti	2	10	0	0	0	0	12
Honduras	16	3	2	0	0	0	21
Nicaragua	33	0	2	0	0	0	35
Panama	0	0	0	0	0	1	1
NORTH AMERICA	**131**	**3**	**2**	**2**	**0**	**9**	**147**
Mexico	126	3	2	2	0	9	142
United States	5	0	0	0	0	0	5
SOUTH AMERICA	**10**	**1**	**0**	**0**	**0**	**2**	**13**
South America, Unspec.*	1	0	0	0	0	0	1
Brazil	1	0	0	0	0	0	1
Colombia	1	0	0	0	0	0	1
Ecuador	3	0	0	0	0	1	4
French Guyana	0	1	0	0	0	0	1
Guyana	1	0	0	0	0	1	2
Peru	1	0	0	0	0	0	1
Venezuela	2	0	0	0	0	0	2
OCEANIA	**19**	**2**	**0**	**0**	**1**	**4**	**26**
Papua New Guinea	19	2	0	0	1	4	26
UNKNOWN	**6**	**2**	**0**	**0**	**0**	**0**	**8**
TOTAL	**532**	**448**	**36**	**17**	**1**	**68**	**1102**

*Country unspecified.

D. Interval Between Arrival and Illness

The interval between the date of arrival in the United States and the date of onset of illness was known for 526 of the patients for which the infecting *Plasmodium* species was also identified. Clinical malaria developed within 1 month after the patient's arrival in 89.3% of the *P. falciparum* cases and in 30.2% of the *P. vivax* cases (Table 4). Only 6 (1.1%) of the 526 patients became ill 1 year or more after their arrival in the United States.

IV. IMPORTED MALARIA IN MILITARY PERSONNEL

Thirty-five cases of imported malaria in U.S. military personnel were reported for 1989. The Army accounted for 19 cases, the Navy for 4, the Air Force for 1, and the Marine Corps for 11 cases.

V. IMPORTED MALARIA IN CIVILIANS

Of the 1,062 imported malaria cases in civilians, 586 (55%) were in U.S. citizens, whereas 476 (45%) were in citizens of other countries (Table 5).

Table 4. Imported malaria cases by interval between date of entry and onset of illness and by *Plasmodium* species, United States, 1989

Interval (in months)	*Vivax*	(%)	*Falciparum*	(%)	*Malariae*	(%)	*Ovale*	(%)	Total	(%)
< 1	81	(30.2)	208	(89.3)	6	(37.5)	1	(12.5)	296	(56.3)
1-2	67	(25.0)	18	(7.7)	5	(31.3)	4	(50.0)	94	(17.9)
3-5	57	(21.3)	3	(1.3)	2	(12.5)	0	(0.0)	62	(11.8)
6-11	58	(21.6)	4	(1.7)	3	(18.7)	3	(37.5)	68	(12.9)
12	5	(1.9)	0	(0.0)	0	(15.8)	1	(12.5)	6	(1.1)
TOTAL	268	(100.0)	233	(100.0)	16	(100.0)	9	(100.0)	526	(100.0)

Table 5. Imported malaria cases in civilians, by area of acquisition, United States, 1989

	United States		Foreign		Total	
Area of Acquisition	Cases	Percent	Cases	Percent	Cases	Percent
Africa	348	59.4	130	30.6	478	45.0
Asia	120	20.5	147	30.8	267	25.1
Central America	29	5.0	87	18.2	116	10.9
Caribbean	7	1.2	6	1.3	13	1.2
Mexico	45	7.7	97	20.5	142	13.4
South America	10	1.7	2	0.4	72	1.1
Oceania	24	4.1	2	0.4	26	2.4
Unknown	3	0.5	5	1.1	8	0.8
TOTAL	586	100.0	476	100.0	1062	100.0

A. U.S. Civilians

Of the 586 cases in U.S. civilians, 348 (59%) were acquired in Africa, and 120 (21%) were acquired in Asia (Table 5).

From 1981 through 1988, imported malaria caused by *P. falciparum* in U.S. civilians infected in Africa increased each year. This trend was halted in 1989, when 269 such infections were reported, a decline of 8.2% over 1988, when 293 such cases were reported. Imported *P. falciparum* infections acquired by U.S. civilians in East Africa (mainly Kenya) declined from 92 in 1988 to 59 in 1989. In contrast, such infections acquired in West Africa increased from 143 in 1988 to 156 in 1989 (mainly Nigeria and Liberia).

The largest percentage of U.S. civilians had traveled to visit friends and relatives (Table 6).

Table 6. Imported malaria cases in U.S. civilians, by category, United States, 1989

Category	Cases	Percent
Tourist	84	14.3
Business representative	63	10.8
Government employee	4	0.7
Missionary	81	13.8
Peace Corps	10	1.7
Seamen/aircrew	2	0.3
Teacher/student	26	4.4
Visiting friends/relatives	175	29.9
Other	17	2.9
Unknown	124	21.2
TOTAL	586	100.0

B. Foreign Civilians

Of the 476 cases in foreign civilians, only 147 (31%) were acquired in Asia; infections acquired in India declined markedly from 149 in 1988 to 103 in 1989 (55%). Infections acquired in Mexico increased 62%, from 60 cases in 1988 to 97 in 1989.

VI. MALARIA ACQUIRED IN THE UNITED STATES

A. Congenital Malaria

Case 1—On June 12, 1989, a blood smear of a 25-day-old infant showed *P. vivax* parasites. The infant was treated with chloroquine and primaquine and had an uneventful recovery. The mother had moved to California from her native Mexico 2 months before the delivery. She had had an undiagnosed febrile illness in Mexico. Blood smears in June 1989 were negative.

(Reported by N. Rha, M.D., Tulare, M. MacLean, M.D., Tulare County Health Department and R.R. Roberto, M.D., California Department of Health Services, Berkeley, California.)

B. Induced Malaria

Case 1— A 39-year-old female resident of Rhode Island had been admitted for treatment of melanoma. In addition to chemotherapy, she received 4 units of blood on August 30 and 2 units on September 19. She developed fever episodes, and on September 22 *P. vivax* parasites were identified on a blood smear. She was treated with chloroquine and primaquine. On October 14 she again experienced febrile episodes, and a blood film was found to contain *Plasmodium* parasites. She was then treated with quinine and pyrimethamine-sulfadoxine on the assumption of chloroquine-resistant *P. falciparum* infection. She had an uneventful recovery from her malaria infection.

Her foreign travel was limited to a 2-week trip to Aruba in 1987. She had no history of malaria or IV drug use.

One of the donors from whom she received blood was from a West African

country and had returned to his native country at the time of the investigation. A blood sample of this donor was sent to a laboratory, but no parasites were found. Because the blood was discarded, serologic testing could not be done. The other 5 donors had no history of unexplained fever episodes, malaria, or foreign travel.

(Reported by D. Mikolich, M.D., Providence, R. Yanke, M.D., Rhode Island Blood Bank, and the Division of Disease Control, State Department of Health, Providence, Rhode Island.)

C. Introduced Malaria

Three episodes of mosquito-transmitted *P. vivax* malaria were identified in California in 1989. Two of these episodes occurred in San Diego County, the other in Kings County.

Episode 1—On July 28, 1989, a 52-year-old banker who resides in a new development in Rancho Santa Fe had onset of malaria symptoms confirmed 1 week later as *P. vivax*. He had no history of foreign travel, blood transfusions, or IV drug use. On August 10, a migrant worker (MW) living in an isolated canyon near the junction of the San Diego River and Lusardi Creek, about 1 mile from the home of the local resident, was diagnosed with *P. vivax* infection. On August 11, the San Diego County Health Department confirmed *P. vivax* in 3 of 40 screened MWs living in the same encampment. The 4 MW cases had onsets of illness between July 27 and August 7. All denied transfusions, IV drug use, or previous malaria. On the night of August 10, 5 light traps placed at the encampment yielded 27 *Anopheles hermsi*. Control measures included larviciding and adulticiding of mosquitoes, and chloroquine prophylaxis for MWs living in the area.

Episode 2—On August 22, 1989, a 32-year-old engineer who resides in Rancho Penasquitoes (6 miles southeast of episode 1, above) had onset of chills and fever; *P. vivax* infection was confirmed 1 week later. He had no history of foreign travel, blood transfusions, or IV drug use. On August 31, 36 *An. hermsi* were collected in 8 light traps within 1 mile of his house. Earlier, on July 7 and 30, 2 MWs from Mexico had onsets of malaria-like illnesses that were confirmed as *P. vivax* infections when they came to medical attention on July 24 and August 1, respectively. Prior to their illness, these MWs had been living in a small unprotected encampment in Penasquitoes with a group that dispersed in July. At the time of his onset of illness, the MW who became ill on July 30 was living in a lean-to within 1 mile of the local resident case. Control measures included larviciding and adulticiding *An. hermsi* habitats.

Episode 3—On September 9, 1989, a 37-year-old teacher from Hanford had onset of fever, chills, and headache, but her illness was not diagnosed as *P. vivax* infection until September 14. Her only foreign travel in the previous 4 years had been a 1-day visit to Tijuana, Mexico. She had no history of blood transfusions or IV drug use. Entomologic investigations around her residence, her school, and her parents' home in nearby Reedley showed no evidence of *Anopheles* habitats or activity. She was most likely exposed at a family birthday outing held at a county park within 1 mile of Kings River on the afternoon of August 19. She recalls being bitten on her legs before leaving the park. She also remembers seeing large numbers of Hispanic MWs encamped near the park, which is flanked by

peach and plum orchards and grape vineyards. None of the 15 other persons who attended the party became ill. Light traps set out in the Burris Park-Kings River area on September 28 yielded 30 *An. punctipennis* and 1 *An. freeborni*. Retrospective and active surveillance for other possible cases of malaria in Kings County during 1989 did not detect any other cases.

(Reported by S. Hunt, D. Maher, M. Ginsberg, M.D., M. Mizrahi, M.S., M. Thompson, Dr.P.H., D. Ramras, M.D., San Diego County Health Department; S. Minkin, M.D., Kings County Health Department; and R.R. Roberto, M.D., California Department of Health Services, Berkeley, California.)

Comment: The episodes of mosquito-transmitted vivax malaria since 1968 (particularly in San Diego County) have features in common which include 1) remotely located encampments, 2) inadequate shelters for MWs residing in areas with *Anopheles* mosquito vectors capable of transmitting malaria, and 3) the reluctance of MWs to seek medical care because of limited access and concerns about being identified as undocumented aliens. Once a parasitemic individual introduces malaria into such settings, these factors allow substantial transmission of malaria to evolve before outbreak foci can be identified and control measures instituted. Medical personnel should be aware that introduced malaria may affect migrant workers. When cases are identified, health care workers should obtain the patient's date of arrival in the United States and a complete history of recent travel, past malaria infection, and intravenous drug use or blood transfusion. A cluster of malaria cases should prompt an immediate and aggressive investigation to determine whether local transmission has occurred.

VII. MALARIA DEATHS

Four deaths due to malaria were reported.

Case 1—A 52-year-old resident of New York City returned on October 20, 1989, from a business trip to Liberia. He did not take malaria prophylaxis. On October 24 he was admitted for treatment of blood slide-confirmed infection with *P. falciparum* malaria. He received 1500 mg chloroquine and left the hospital against medical advice. On October 31 he saw a physician because of fever and malaise. He received antibiotics for the flu. On November 2 he became lethargic and was readmitted. He had a 28% parasitemia with *P. falciparum* and was treated with quinine. He developed renal failure and was started on IV quinidine and given a 10-unit blood exchange transfusion. On November 4, his renal failure increased; he became comatose and developed adult respiratory distress syndrome and disseminated intravascular coagulation. On November 6 the parasitemia was 6%. He died on November 6.

(Reported by D. Marriott, M.D., New York City.)

Case 2—A 16-month-old girl was brought to the emergency room of a hospital in Bolivar, Missouri, on October 1, 1989, with a 2-week history of fevers and increasing lethargy. Her hematocrit was 3.0. *Plasmodium* parasites were identified in the peripheral blood, but the child died before treatment could be instituted. The patient was born in Nigeria and had arrived in this country 2 weeks before her death.

(Reported by L. Harris, M.D., Bolivar, and the Missouri Division of Health, Jefferson City, Missouri.)

Case 3—A 12-year-old female resident of New Jersey returned on July 17, 1989, from a 2-week safari in Kenya during which she used weekly chloroquine prophylaxis. On July 18 she developed fever and chills and sought medical attention the following day. Blood cultures were obtained. On July 22 or 23 she again sought medical attention but did not mention her travel to Africa. On July 24 she was admitted to a hospital in New York City with dehydration, hepatosplenomegaly, and a hematocrit of 32. Blood slide examination revealed a *P. falciparum* infection of low density (less than 1%). Nine hours after admission, therapy was initiated with quinine, pyrimethamine, and sulfadiazine. Three hours later the patient became hypotensive, had poor peripheral perfusion, and died. Postmortem examination revealed 3 liters of blood in the abdomen and a splenic tear.

(Reported by P. La Russa, M.D., New York City.)

Case 4—A 21-year-old female resident of South Carolina returned on July 20, 1989, from a 5-month trip to Liberia as an exchange student. She used weekly chloroquine prophylaxis. On August 15, she sought medical attention with a 3-day history of fever. Blood smear examination indicated the presence of *P. falciparum* parasites. The patient was in good condition and was to be treated at home with quinine and tetracycline. Later that day she became hypotensive and lapsed into a coma. During transfer to a hospital, she became progressively hypotensive and died. Autopsy revealed splenic rupture.

(Reported by D. Potts, M.D., Greenville, and the South Carolina State Department of Health and Environmental Control, Columbia, South Carolina.)

VIII. MICROSCOPIC DIAGNOSIS OF MALARIA

Early diagnosis of malaria requires that physicians include malaria in the differential diagnosis and take a comprehensive travel history from every patient with a fever of unknown origin. Once malaria is suspected, a Giemsa-stained smear of peripheral blood should be examined for parasites. Since the accuracy of diagnosis depends on the quality of the blood film, the following guide is offered for the proper preparation of thick and thin blood smears.

1. Manufacturers' "precleaned" slides are not considered clean enough for use in malaria diagnosis. Before using them, wash the slides in mild detergent, rinse them thoroughly in warm running water and then in distilled water, and dip them in ethyl alcohol (90%-95%). Then, wipe the slides dry with a lintless cloth or tissue for immediate use, or store them in 95% alcohol until needed.

2. Clean the patient's finger with alcohol and wipe the finger dry with a clean cloth or gauze.

3. Puncture the finger with the blood lancet and allow a large globule of blood to form.

4. Place the cleaned surface of the slide against the drop of blood and, with a quick circular motion, make a film the size of a dime in one-third of the area of the slide. Ordinary newsprint should be barely legible through such a wet drop (Figure 3). (Excessive mixing or stirring with a second slide leads to distortion of blood cells and parasites.)

5. Wipe the finger dry and gently squeeze a *small* drop of blood from the puncture. Place the drop at the middle of the same slide (Figure 4).

6. Apply a clean "spreader" slide to the edge of the small drop at a 45o angle and allow the blood to extend about two thirds of the distance to the back of the slide. Then, keeping even contact, push the spreader forward along the slide. This will produce an even layer of red blood cells with a "feathering" at the lower edge (Figure 5).

7. While the thick blood film dries (minimum of 6 hours at room temperature), keep the slide flat and protected from dust and insects.

8. Label the slide in the upper part of the thin film with the date and the name or initials of the patient, as illustrated (Figure 5).

Note: For rapid diagnosis, make the thick and thin films on separate slides. Air dry the thin film, fix it with methyl alcohol, and stain it immediately. If no parasites are found on the thin film, wait until the thick film is dry and examine it for organisms not detected on the thin preparation.

ACKNOWLEDGMENT

The annual Centers for Disease Control Malaria Surveillance Report is based on information provided in individual case reports. The excellent support given to 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.

REFERENCES

1. World Health Organization. Terminology of malaria and of malaria eradication, 1963. World Health Organization, Geneva, p 32.

2. Brunetti R, Fritz RF, Hollister HC. An outbreak of malaria in California, 1952-1953. *Am J Trop Med Hyg* 1953;3:779-788.

3. Centers for Disease Control. Plasmodium vivax malaria—San Diego County, California, 1986. *MMWR* 1986;35:679-681.

Fig. 3

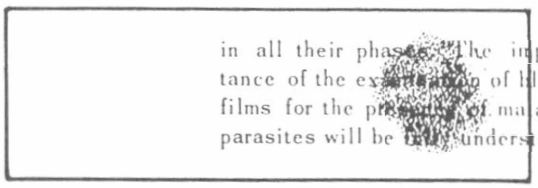


Fig. 4

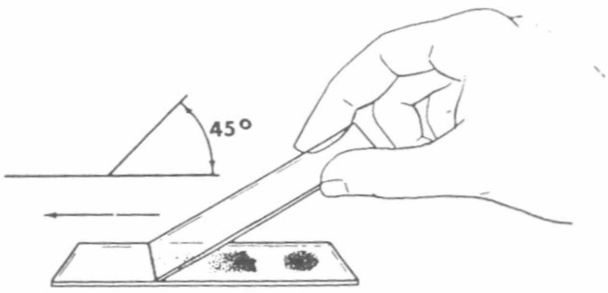
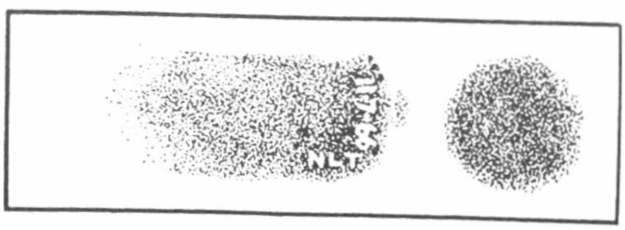


Fig. 5



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