COMMUNICABLE DISEASE CENTER

ENCEPHALITIS

SURVEILLANCE

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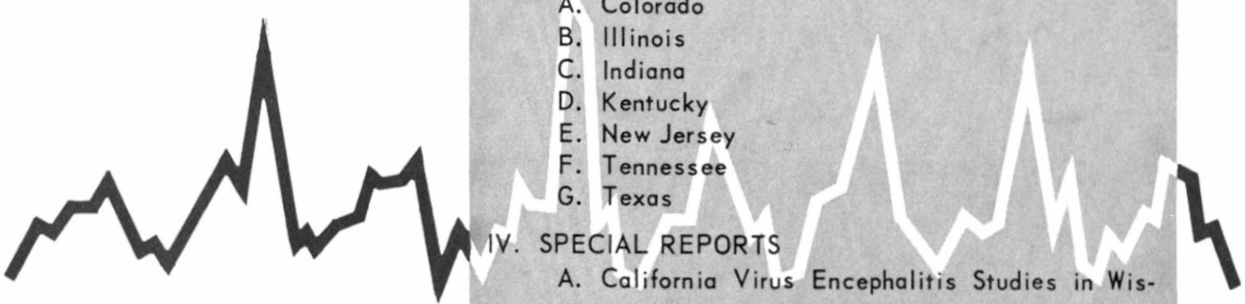

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE / PUBLIC HEALTH SERVICE

PREFACE

Summarized in this report is information received from State Health Departments, university investigators, virology laboratories and other pertinent sources, domestic and foreign. Much of the information is preliminary. 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 to:

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I. SUMMARY

During 1964, a total of 3587 cases of encephalitis, including 337 deaths, was reported to the Encephalitis Surveillance Unit (ESU). This represents the highest total of cases reported to the ESU since it was established in 1955. An increased number of both post-infectious and primary encephalitis cases was reported in 1964 as compared to 1963. Mumps and measles accounted for over three quarters of the 1585 post-infectious encephalitis cases. The widespread rubella epidemics during the winter of 1964 were reflected by a relatively large number (59) of reported post-rubella encephalitis cases. During 1964, 582 cases of arthropod-borne encephalitis were reported. Outbreaks due to St. Louis, Western Equine, and California encephalitis viruses occurred during 1964. Cases of human illness due to Eastern Equine encephalitis virus were reported for the first time in three years. A summary of this material as well as information on virus isolations from non-human species are summarized in Section II.

Detailed reports of the outbreaks of arthropod-borne encephalitis occurring during 1964 are contained in Section III. Major epidemics of St. Louis encephalitis were recorded in Harris County (Houston), Texas, and in Burlington and Camden Counties, New Jersey, (including adjacent areas of Pennsylvania). St. Louis encephalitis outbreaks of smaller size occurred in Indiana, Tennessee, Kentucky, and in two separate areas of Illinois. Outbreaks of mixed infection with both St. Louis encephalitis and Western Equine encephalitis were recognized in the high plains area of Texas and in central Colorado. The first recognized outbreak due to California encephalitis virus was noted in Indiana, in 1964.

A summary of viral encephalitis cases in horses reported to the U.S. Department of Agriculture has been previously included in this report. This will appear as a supplement to the 1964 Encephalitis Surveillance Report in several months.

II. MORBIDITY TRENDS

For the year 1964, a total of 3587 cases of encephalitis, including 337 deaths, was reported. This represents the highest total reported to the Encephalitis Surveillance Unit (ESU) since it was establisned in 1955. The cases of encephalitis reported for 1964 are shown by etiology in Table 1 and classified by State in Table 2 on pages 2 and 3.

Table 1

Cases of Encephalitis
Reported to the Encephalitis Surveillance Unit
United States, 1964

Etiology	Number of Cases		Percent Cases	
Post-infectious Encephalitis		1585		44.2
Mumps	932		26.0	
Measles	300		8.4	
Varicella	106		3.0	
Rubella	59		1.6	
Influenza	14		0.4	
Post Vaccinal	8		0.2	
Other	166		4.6	
Primary Encephalitis		2002		55.8
Arthropod-borne	582		16.2	
Etiology Unknown	1420		39.6	
TOTAL		3587		100.0

Table 2

Reported Cases of Infectious Encephalitis
by State According to Etiology*

State	Total Cases (ESU)	Post-Infectious Encephalitis							Primary Encephalitis	
		Measles	Mumps	Varicella	Influenza	Post Vaccinal	Rubella	Other**	Arthropod-borne	Etiology Unknown
Alabama	1	0	0	0	0	0	0	1	0	0
Alaska	3	0	0	0	0	0	0	0	0	3
Arizona	45 (28)	4 (3)	3 (1)	9 (9)	0	0	0	1 (1)	2	26 (14)
Arkansas	36 (4)	3 (2)	9	1 (1)	2 (1)	0	3	1	0	17
California	602 (65)	86 (10)	294 (10)	32 (6)	0	0	0	21 (4)	12	157 (35)
Colorado	111 (3)	1	20	0	0	0	0	0	37 (3)	53
Connecticut	23 (4)	1	4	1	1	0	3 (1)	1	0	12 (3)
Delaware	2	0	2	0	0	0	0	0	0	0
D. C.	2 (1)	0	1	0	0	0	0	1 (1)	0	0
Florida	190 (14)	21 (1)	137	1	0	0	0	2	4 (2)	25 (11)
Georgia	21 (21)	0	0	0	0	0	0	0	1 (1)	20 (20)
Hawaii	8	0	3	0	0	0	0	0	0	5
Idaho	4	0	0	0	0	0	0	0	0	4
Illinois	207 (8)	27 (1)	104 (4)	4	1	1	7	1	46 (3)	16
Indiana	80 (7)	6	8	1	0	0	0	4	31	30 (7)
Iowa	24	0	3	0	0	0	0	0	0	21
Kansas	85 (2)	0	5	0	0	0	0	2	4	74 (2)
Kentucky	60 (3)	1	1	0	0	0	0	6	24 (1)	28 (2)
Louisiana	22	6	5	2	0	0	0	0	0	9
Maine	8 (7)	2 (1)	0	0	0	0	0	5 (5)	0	1 (1)
Maryland	33 (10)	4	4	1	0	0	0	19 (8)	0	5 (2)
Massachusetts	27	0	10	1	0	0	0	0	0	16
Michigan	76	2	19	0	0	0	0	0	1	54
Minnesota	83 (8)	3	56 (1)	3 (1)	0	1	0	5 (2)	3 (2)	12 (2)
Mississippi	31 (5)	10 (5)	2	0	0	0	0	0	0	19

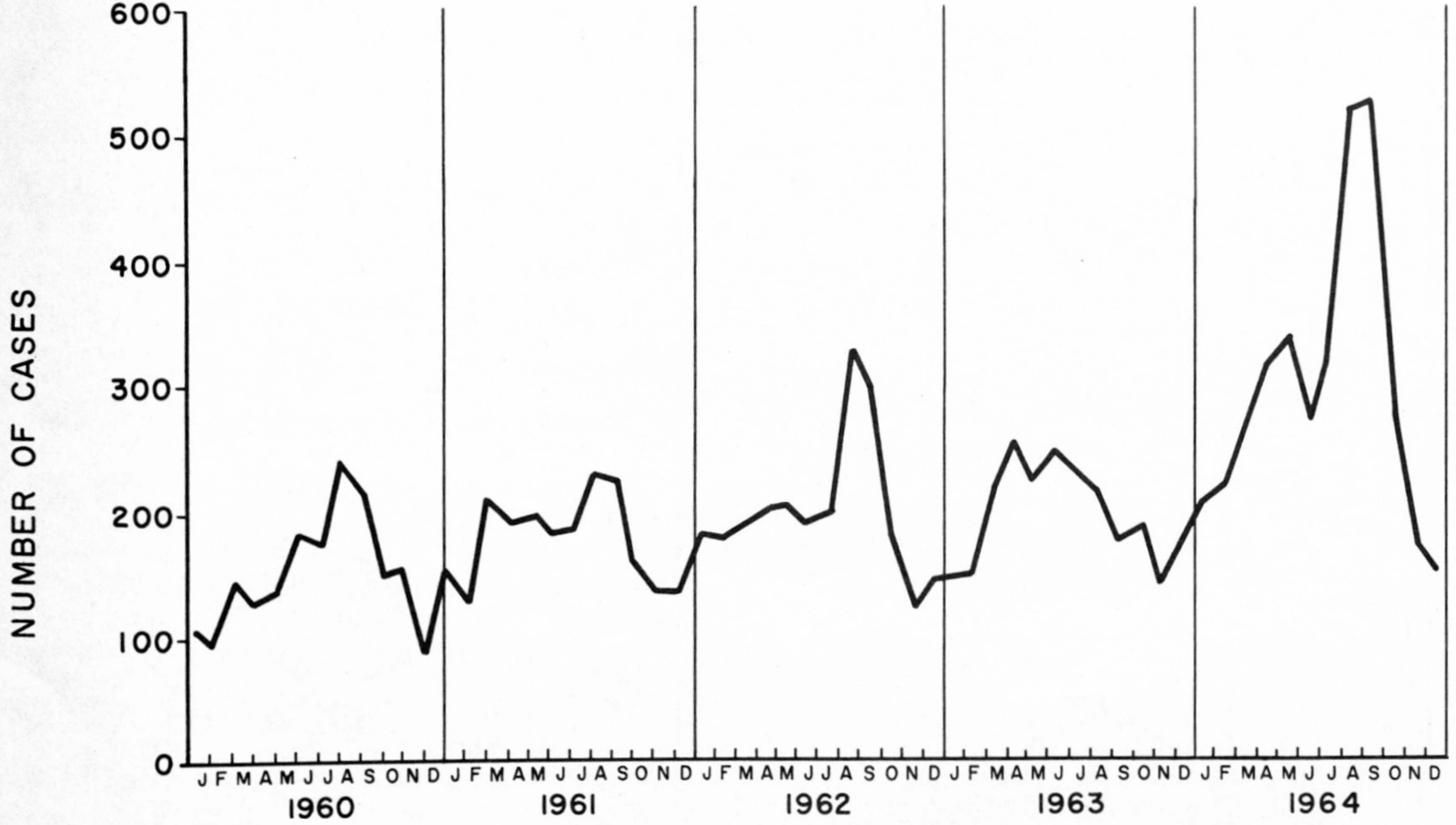
Table 2 (continued)

State	Total Cases (ESU)	Post-Infectious Encephalitis							Primary Encephalitis	
		Measles	Mumps	Varicella	Influenza	Post Vaccinal	Rubella	Other**	Arthropod-borne	Etiology Unknown
Missouri	33 (6)	0	0	0	0	0	0	1	2	30 (6)
Montana	8 (1)	1 (1)	3	0	0	0	0	2	0	2
Nebraska	17	0	1	0	0	0	0	0	5	11
Nevada	0	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0	0	0
New Jersey	237 (9)	16	11	3	0	0	0	0	94 (9)	113
New Mexico	20	0	2	0	0	0	0	0	0	18
New York	333 (9)	36 (3)	37 (1)	13 (3)	0	2 (1)	29	5 (1)	0	211
North Carolina	64 (37)	8 (6)	4	2 (1)	2 (2)	0	0	5 (4)	1	42 (24)
North Dakota	14 (2)	1	2	0	0	0	0	1	5	5 (2)
Ohio	188 (2)	5	23	3	0	1	0	12	26	118 (2)
Oklahoma	11	0	0	0	0	0	0	0	0	11
Oregon	40 (9)	8 (2)	15	1 (1)	4 (1)	1 (1)	0	0	0	11 (4)
Pennsylvania	150 (13)	8	27	9 (2)	1	1	12 (3)	4 (1)	21 (1)	67 (6)
Rhode Island	38	2	21	1	0	0	0	0	0	14
South Carolina	14	0	12	0	0	0	0	0	0	2
South Dakota	11	0	1	0	0	0	0	0	0	10
Tennessee	47 (17)	5 (4)	11 (1)	0	1 (1)	0	5 (5)	2 (2)	6	17 (4)
Texas	370 (29)	8 (1)	8	0	1	0	0	10	252 (28)	91
Utah	20 (1)	1	9	0	0	0	0	10 (1)	0	0
Virginia	83 (21)	11 (3)	20	6 (3)	0	0	0	44 (15)	0	2
Washington	80 (8)	11 (3)	28	10 (5)	1	0	0	0	0	30
West Virginia	11	1	3	0	0	0	0	0	0	7
Wisconsin	7	0	2	0	0	1	0	0	4	0
Wyoming	7	1	2	2	0	0	0	0	1	1
Totals	3587 (337)	300 (46)	932 (18)	106 (32)	14 (5)	8 (2)	59 (9)	166 (45)	582 (50)	1420 (147)
Puerto Rico	12 (3)	5 (2)	1	0	0	0	0	4 (1)	0	2

* Deaths are shown in parenthesis.
** 39 were specified (22.9%).

Figure 1

REPORTED CASES OF ENCEPHALITIS BY MONTH
UNITED STATES, 1960-1964



The definitions employed are those agreed upon at the 1963 Biennial Conference of State and Territorial Epidemiologists as follows:

1. Post-infectious encephalitis, defined as an illness with encephalitic manifestations but with a preexisting diagnosed infection. Post-infectious encephalitis includes those associated with mumps, measles, rubella, vaccinia, etc.

2. Primary encephalitis, defined as an acute febrile illness with encephalitic manifestations as an intrinsic part of the disease. The category will include "ARBO" infections, as well as acute encephalitis of unknown etiology.

The cases reported for the years 1960-64 are shown by month in Figure 1. The previous characteristic pattern of incidence with an increase in April or May followed by a second peak in the late summer and fall again occurred during 1964. The numbers of reported cases by etiology for each month are shown in both Table 3 and Figure 2. The highest incidence of cases of post-infectious encephalitis occurred during the spring, whereas the cases due to the arthropod-borne viruses peaked during August and September. A marked increase in cases of encephalitis with no known etiology also was noted during the same period. Such a pattern has also been observed in previous years of high incidence of arthropod-borne encephalitis. It is likely that at least some of the reported cases of encephalitis with no known etiology may have been unrecognized cases of arthropod-borne encephalitis.

Table 3

Reported Cases of Encephalitis by Month
According to Etiology

Month	Total Cases Reported	Post-Infectious Encephalitis	Primary Encephalitis	
			Arthropod-borne	Unknown Etiology
January	205	137	0	68
February	214	129	0	85
March	265	182	0	83
April	317	228	1	88
May	334	239	0	95
June	263	170	6	87
July	313	143	40	130
August	518	96	280	142
September	522	51	209	262
October	262	55	26	181
November	169	68	1	100
December	146	72	1	73
Unknown	59	15	18	26
TOTAL	3587	1585	582	1420

A. Post-Infectious Encephalitis

Of the 3587 cases of encephalitis reported for 1964, a total of 1585 were classified as post-infectious encephalitis. This represents the largest annual total since 1960, when nationwide reporting of post-infectious encephalitis to the Encephalitis Surveillance Unit was initiated. Of the 1585 cases, 932 were ascribed to mumps, 300 to

Figure 2

REPORTED CASES OF ENCEPHALITIS BY ETIOLOGIC GROUP AND MONTH OF ONSET, 1964

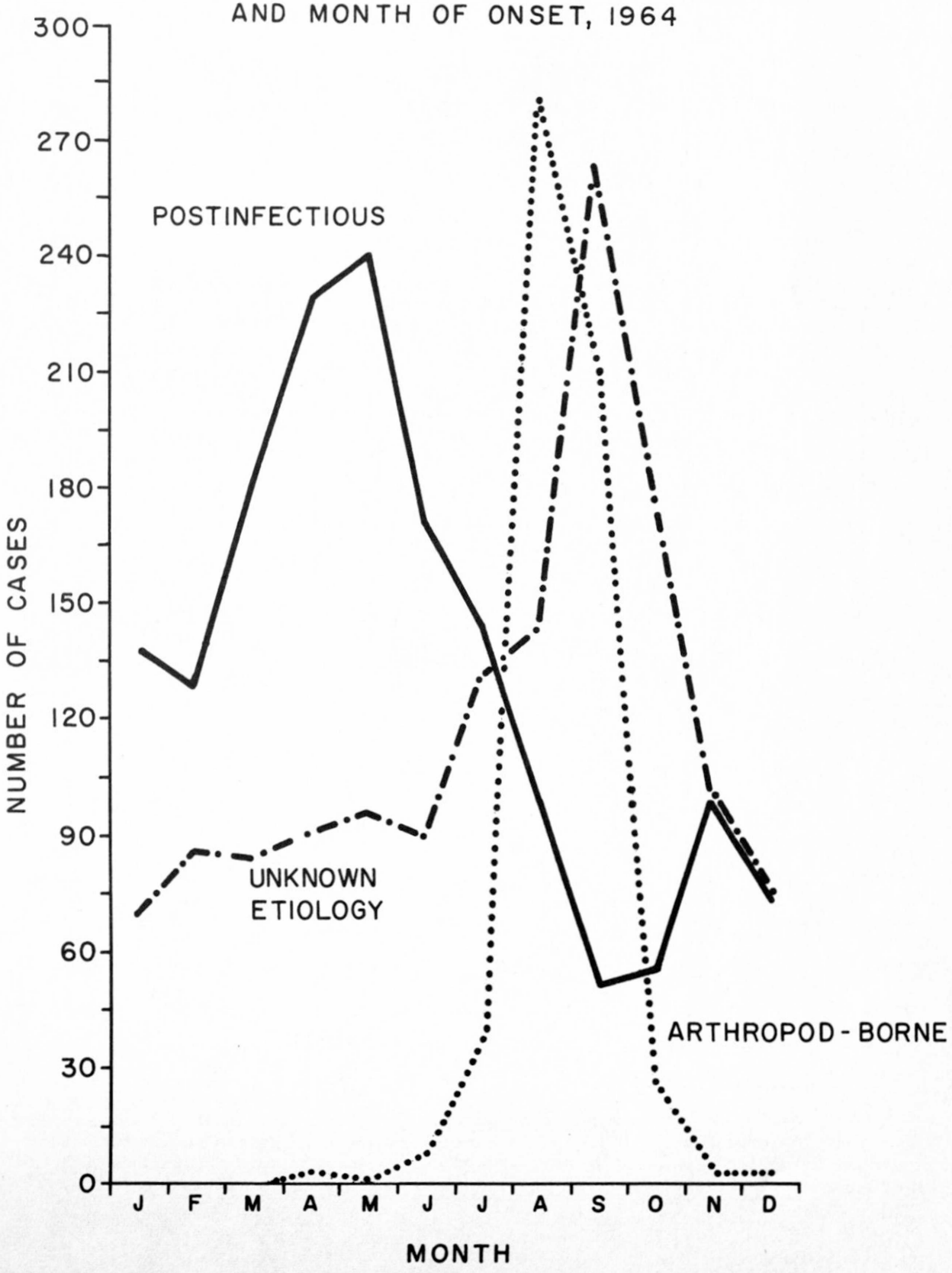
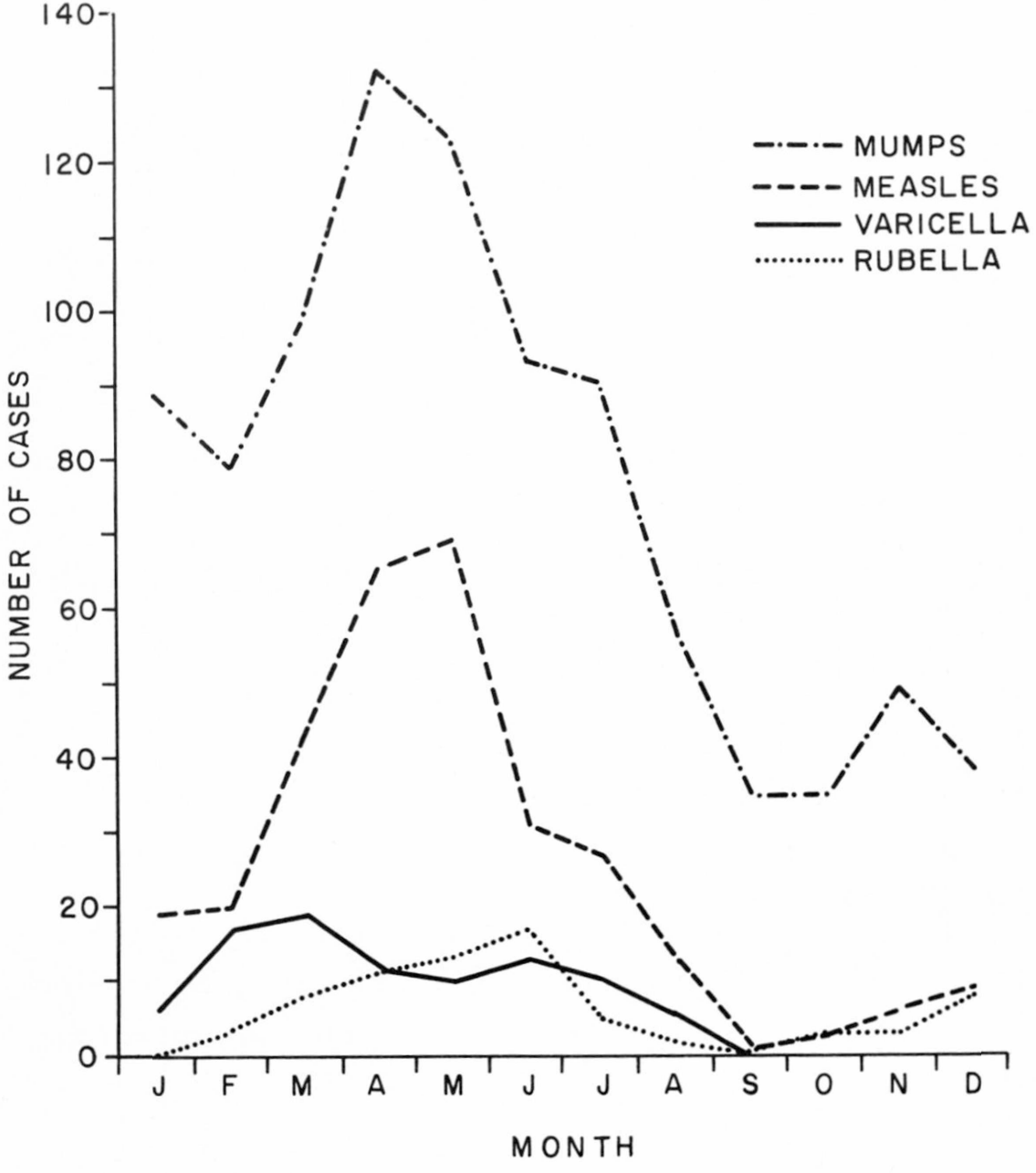


Figure 3

POSTINFECTIOUS ENCEPHALITIS
ASSOCIATED WITH MEASLES, MUMPS, VARICELLA, AND RUBELLA
BY MONTH OF ONSET, 1964



measles, 106 to varicella, 59 to rubella, 14 to influenza and 8 post vaccinal (Table 1). The incidence in 1964 compared to the previous 4 years is presented in Table 4. The monthly incidence of post-infectious encephalitis associated with mumps, measles, varicella and rubella is shown in Figure 3. With the exception of varicella, all demonstrated peak incidence during the second quarter of the year. In addition to those mentioned, a number of other infectious agents were reported to have accounted for cases. Included were: herpes simples (6), herpes zoster (2), lymphocytic choriomeningitis (4), pertussis (1), respiratory syncytial (1), coxsackie B-3 (1), coxsackie B-4 (1), adenovirus type 7 (1), adenovirus unspecified (1), streptococcus faecalis (1), and streptococcus unspecified (1).

Table 4

Cases of Commonly Reported Post-Infectious Encephalitis by Etiology, 1960-1964

	Etiology					
Year	Mumps	Measles	Varicella	Rubella	Influenza	Post Vaccinal
1960	700	299	95	--	24	--
1961	402	276	75	--	8	8
1962	358	337	76	--	40	7
1963	671	239	84	--	30	3
1964	932	300	106	59	14	8

Mumps Encephalitis

Of the 1585 cases of post-infectious encephalitis with known etiology, 932 cases, including 18 deaths, were associated with mumps. Mumps has shown the most frequent etiologic relationship to encephalitis for each of the past 5 years (Table 4). The total of 932 cases of mumps encephalitis reported in 1964 exceeds the 1963 total by more than 250 cases and represents the largest total reported to the ESU since surveillance of encephalitis was begun in 1960. Since mumps is not a nationally reportable disease, it is not known whether the incidence of mumps encephalitis correlates closely with yearly fluctuations in the incidence of mumps. The greatest increase in the incidence of mumps encephalitis during 1964 was reported from California and Florida , where mumps is a reportable disease. As shown in Table 5, the numbers of reported cases of both mumps and mumps encephalitis in these 2 states have increased steadily since 1962; however, the increase for mumps encephalitis is proportionately greater. Whether this is due to progressively better reporting of encephalitis or to a true alteration in the rate of this complication of mumps is not known.

Table 5

Reported Cases of Mumps and Mumps Encephalitis
in California and Florida for 1962-1964

Year	Mumps (No. Cases)	Mumps Encephalitis (No. Cases)
1962		
Calif.*	11,510	69
Fla.**	2,798	16
1963		
Calif.	18,100	186
Fla.	3,603	64
1964		
Calif.	25,119	294
Fla.	5,715	137

* From California Morbidity (Weekly)

** Florida State Board of Health Weekly Report of Common Communicable Disease

Measles Encephalitis

A total of 300 cases of measles encephalitis (46 deaths) was reported for 1964. The number of reported cases of post-infectious encephalitis associated with measles has been relatively constant during the past five years (Table 4), ranging between 239 and 337 cases. Measles is the only nationally reportable disease commonly associated with post-infectious encephalitis. As shown in Table 6, the measles encephalitis rate (per 100,000 measles cases) has remained essentially stable during the past five years.

Table 6

Reported Cases of Measles and Post-Measles
Encephalitis in the U.S. - 1960-1964

	Measles	Measles Encephalitis	Measles Encephalitis Rate per 100,000 Cases
1960	441,703	299	67.7
1961	423,919	276	65.1
1962	481,530	337	70.0
1963	385,156	239	62.1
1964	490,591	300	61.2

Deaths due to measles encephalitis accounted for 46 of the 112 deaths ascribed to cases of post-infectious encephalitis with known etiology.

Varicella Encephalitis

The number of reported cases of post-infectious encephalitis following varicella during the past five years has ranged from a low of 75 cases in 1961 to a high of 106 cases in 1964. In 1964 there were 32 deaths.

Rubella Encephalitis

Of the 1585 reported cases of post-infectious encephalitis with known etiology, 59 cases (9 deaths) were related to rubella. This total reflects the widespread rubella epidemics during the winter of 1964.

Influenza Encephalitis

During the year 1964, the incidence of influenza in the United States was comparatively low. No major epidemic occurred. There were 14 reported cases of influenza encephalitis, including 5 deaths.

Post Vaccinal Encephalitis

Eight cases of post vaccinal encephalitis, including two fatalities, have been reported following smallpox vaccination. No cases following any other vaccines were reported.

B. Arthropod-Borne Encephalitis

Cases of arthropod-borne encephalitis have been classified, as in previous years, into "confirmed" and "presumptive" categories. The definition of these categories is as follows:

"Confirmed Cases" fulfill any one of the following criteria:

1. Isolation of the virus.
2. A fourfold rise in serum antibody titer between acute and convalescent specimens.
3. A fourfold fall in serum antibody titer between acute and convalescent specimens.
4. A single significant titer of 1:8 or greater of complement fixing antibodies, or 1:320 or greater hemagglutination inhibition antibodies, during an epidemic.

"Presumptive Cases" fulfill any one of the following criteria:

1. A single significant titer of complement fixing or hemagglutination inhibiting antibodies, (as is 4 above) in an individual with clinical encephalitis.
2. History of clinical encephalitis in an area of concurrent epidemic, but without laboratory confirmation.
3. Pathological evidence by autopsy of encephalitis during an epidemic.

A total of 582 confirmed or presumptive cases of arthropod-borne encephalitis with onsets of illness in 1964 have been reported. During the 10 year period of reporting to the Encephalitis Surveillance Unit, this total was exceeded only in 1956, when 625 cases of arthropod-borne encephalitis were reported. Of the 582 cases in 1964, St. Louis encephalitis accounted for 470, Western Equine encephalitis for 64, California encephalitis for 42, Eastern Equine encephalitis for 5 and Tensaw virus for one. The number of cases by State are shown in Figure V. A summary of the occurrence of arthropod-borne encephalitis by etiology for the past 10 years is shown in Table 7.

Table 7

Human Cases of Arthropod-Borne Encephalitis Reported to the Encephalitis Surveillance Unit 1955-1964

Year	Etiology				Total
	WE	EE	SLE	Calif.	
1955	37	15	107	0	159
1956	47	15	563	0	625
1957	35	5	147	0	187
1958	141	2	94	0	237
1959	14	36	118	0	168
1960	21	3	21	0	45
1961	27	1	42	0	70
1962	17	0	253	0	270
1963	56	0	19	1	76
1964	64	5	470	42	582*

* One case of encephalitis attributed to Tensaw virus (reported by Indiana) is included in the total.

(1) Reported Cases of Human Illness

St. Louis Encephalitis (SLE)

The 470 laboratory documented cases of St. Louis Encephalitis were reported from 14 States. Major epidemics were recorded in Harris County (Houston), Texas and the Camden-Burlington County area of New Jersey. Epidemics with smaller numbers of cases occurred in Kentucky, Illinois, Indiana, and Tennessee. Outbreaks of mixed infection with both WEE and SLE occurred in central Colorado and the high plains area of Texas. Special reports of the various outbreaks are presented in Section III. The only reported isolation of SLE virus from a human source was from a fatal case in Ohio.

Western Equine Encephalitis (WEE)

The 64 reported cases of Western Equine encephalitis in 1964 were reported from 10 States. Isolations of WEE virus were made from central nervous system tissue from 2 fatal cases in Hale County, Texas, and from the cerebrospinal fluid of one of the same cases.

Of the 64 cases of WEE, 31 occurred in two areas: Hale County, Texas, and central Colorado. Outbreaks of mixed infection with both WEE and SLE were recorded in both areas. Reports of these outbreaks are included in Section III.

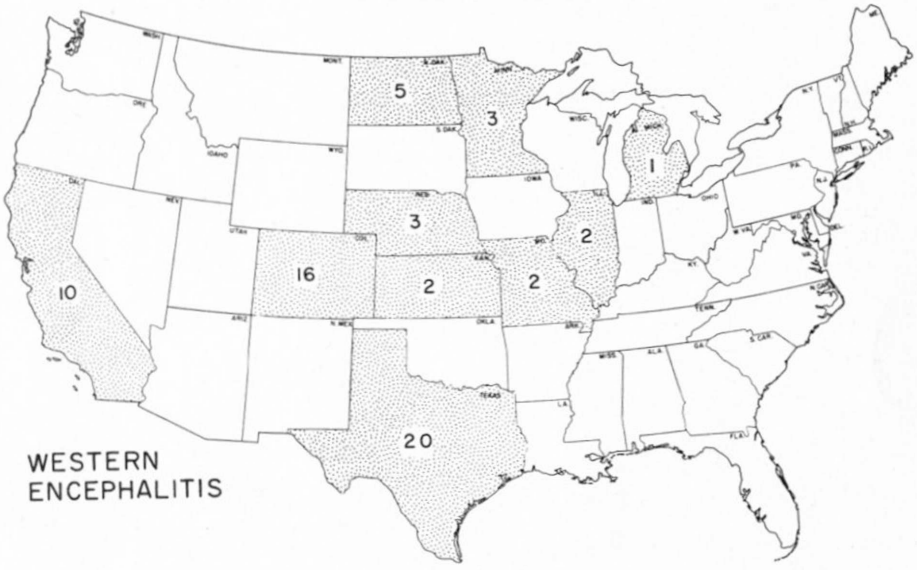
The distribution of cases by age and sex is shown in Table 8. As noted in previous years, Western Equine encephalitis occurred primarily among the younger persons. One third of the cases occurred in the 0-4 age group and 32 cases (50 percent) were less than 15 years of age. Forty of the 64 cases occurred in males. The seasonal incidence of WEE is shown in Table 9. The highest incidence occurred during August and September, when 40 and 18 cases, respectively, developed illness.

California Encephalitis

Forty-two cases of serologically confirmed or presumptive California encephalitis were reported for 1964. The cases were reported from 4 states: Ohio (25), Indiana (12), Wisconsin (4) and North Carolina (1). The 25 cases in Ohio occurred primarily during

Figure 4

HUMAN CASES OF ARTHROPOD-BORNE ENCEPHALITIS
BY STATE, 1964



WESTERN
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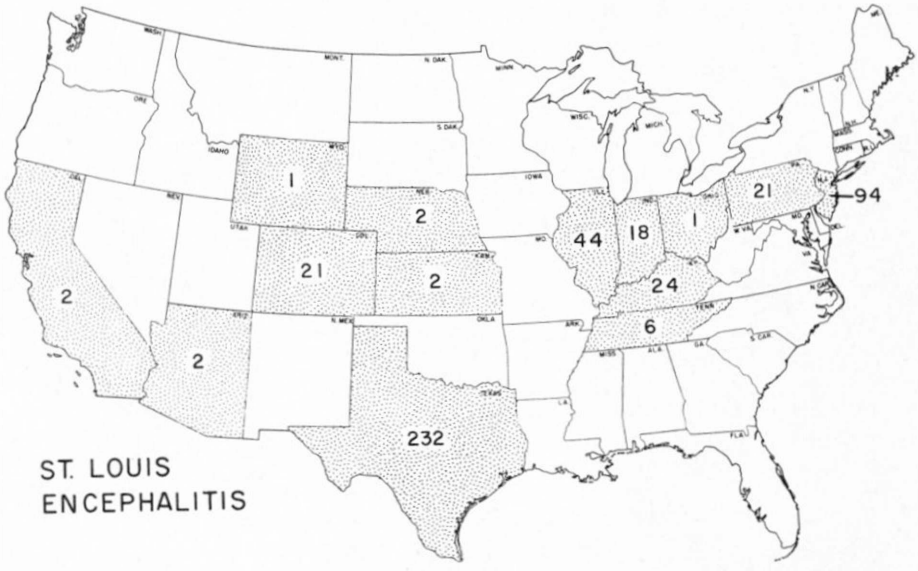
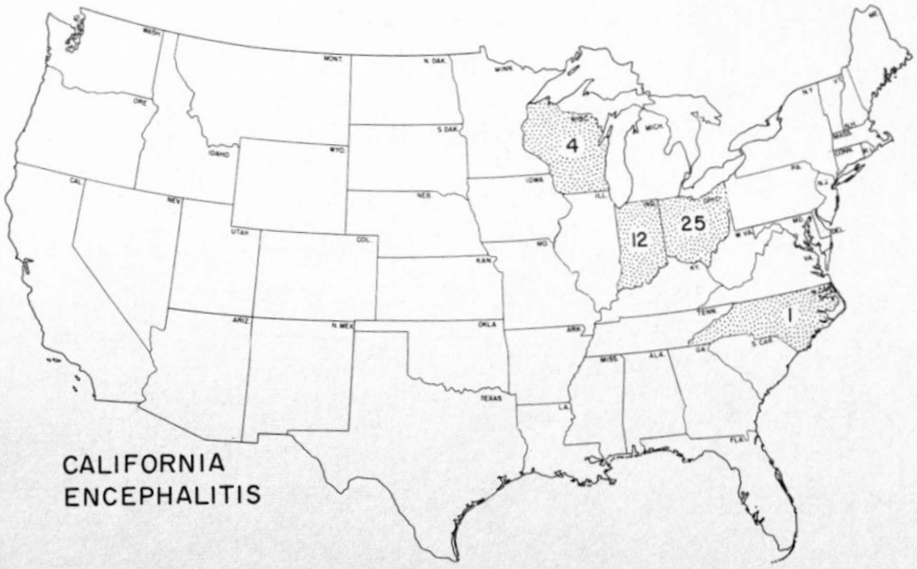


ST. LOUIS
ENCEPHALITIS



CALIFORNIA
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Table 8

Confirmed and Presumptive Human Cases of
Arthropod-Borne Encephalitis by Age and Sex, 1964*

Age Group	SLE			WE			California		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	13	5	18	10	11	21	3	3	6
5-9	14	9	23	3	3	6	12	7	19
10-14	14	8	22	4	1	5	5	4	9
15-19	8	13	21	1	1	2	1	0	1
20-29	24	24	48	3	1	4	1	0	1
30-39	29	31	60	6	0	6	0	0	0
40-49	23	36	59	7	0	7	0	0	0
50-59	24	29	53	1	2	3	0	0	0
60-69	36	40	76	0	2	2	0	0	0
70 & over	38	48	86	2	2	4	0	0	0
Unknown	2	2	4	3	1	4	2	0	2
TOTAL	225	245	470	40	24	64	24	14	42*

* Includes 4 cases with unknown age and sex.

Table 9

Confirmed and Presumptive Human Cases
of Arthropod-Borne Encephalitis by Month, 1964*

Month of Onset of Illness	SLE No. of Cases	WE No. of Cases	EE No. of Cases	California No. of Cases	Total
January	0	0	0	0	0
February	0	0	0	0	0
March	0	0	0	0	0
April	0	1	0	0	1
May	0	0	0	0	0
June	2	0	4	0	6
July	29	4	1	6	40
August	224	40	0	16	280
September	176	18	0	14	208
October	24	1	0	1	26
November	1	0	0	0	1
December	1	0	0	0	1
Unknown	13	0	0	5	18
TOTAL	470	64	5	42	581*

* One case of Tensaw encephalitis reported from Indiana is not included in this table.

August and September; however, there was no obvious geographic clustering (no county reported more than 2 cases). An outbreak of 12 cases in southeastern Indiana is described in Section III. During 1964, the first case to be reported from North Carolina occurred in a 7-year-old Cherokee Indian male who resided on the Cherokee reservation in the western area of the state.

The seasonal incidence of cases of California encephalitis, shown in Table 9, demonstrates a peak incidence during August and September. The distribution of cases by age and sex is shown in Table 8. Of 36 cases with known age, 34 were in children less than 15 years old. The oldest case occurred in a 27-year-old male. A slight male predominance, 24 of the 38 cases reported by sex, was noted.

The 1963 Annual Encephalitis Surveillance Summary presented clinical and laboratory data from the first reported case of human illness due to California encephalitis. The dramatic rise in reported cases in 1964 is in part due to increased efforts by various laboratories to test the sera of previously undiagnosed cases of encephalitis for California encephalitis virus.

Eastern Equine Encephalitis (EEE)

Five cases of Eastern Equine encephalitis, including 3 deaths, were reported in 1964. These represent the first reported cases since 1961. Four cases, including 2 deaths, were reported from 3 separate counties of Florida. One fatal case was reported from Georgia. Eastern Equine encephalitis virus was recovered from central nervous system tissue from all 3 fatal cases.

Tensaw Virus

A case of clinical encephalitis associated with a fourfold rise in hemagglutination inhibition titer to Tensaw virus was reported from Indiana. The case occurred in a 13-year-old female from Kosciusko County who developed illness on September 17, 1964. A rise of hemagglutination antibody titer from 40 to 160 was noted between the acute and convalescent serum specimens.

(2) Non-human Arbovirus Isolations

In addition to the reporting of human cases, the Encephalitis Surveillance Unit attempts to maintain as complete a record as possible on isolations of arboviruses from non-human sources. This information is furnished by various State Health Departments, by individual investigators and by Public Health Service facilities. Persons submitting information on isolations, other than those from State Health Departments, are listed in Appendix B.

A summary of non-human isolates during 1964 is included in Appendix A. Isolations have been listed by the various species according to State. Noteworthy are: (1) the continued isolations of Venezuelan Equine encephalitis virus (VEE) from mosquitoes in south Florida and, (2) the isolation of Eastern encephalitis virus and Western encephalitis virus from a species of fresh water Aedes mosquitoes (Aedes infirmatus).

III. STATE REPORTS

A. Colorado

A total of 37 confirmed cases, including 3 deaths, of arthropod-borne encephalitis were reported from Colorado for 1964. Of these, 21 cases were St. Louis encephalitis and 16 Western Equine encephalitis.

Two-thirds of the confirmed cases occurred in the more populous "eastern slope" counties of Denver, Adams, Larimer and Otero. Both WEE and SLE occurred in all of these counties except Larimer where 6 cases of SLE alone were confirmed.

The earliest cases of both WEE and SLE had onsets of illness in early August. Cases continued over a two month period. Western Equine encephalitis virus and St. Louis encephalitis virus were both recovered from pools of Culex tarsalis during the epidemic period.

(Reported by Dr. Cecil S. Mollohan, Chief of Epidemiology, Colorado State Department of Public Health; Disease Ecology Section, Technology Branch, CDC; and an EIS officer.)

B. Illinois

(1) Hamilton County

An outbreak of 19 serologically documented cases of St. Louis encephalitis, including 2 deaths, was reported from Hamilton County, in southern Illinois, during 1964. The overall attack rate was 190 per 100,000. The epidemic curve is shown in Figure 5 on page 16. Cases occurred over an 11 week period from mid-July until early October with a peak incidence during the last week in August and the first week of September. All cases were in adults, and only 2 cases, both fatal, occurred in persons less than 50 years of age. Of the 19 cases, 11 were in females and 8 were in males. The majority of cases resided within the limits of the town of McLeansboro; however, there was no clustering of cases within the town.

Thus far, 9 SLE isolates have been made from pools of Culex pipiens mosquitoes collected in Hamilton County during the outbreak. In addition, isolates of SLE virus were recovered from 5 birds (see Appendix A) that were trapped and bled during the same period.

(2) Madison County

Eighteen confirmed or presumptive cases of St. Louis encephalitis including one death, and one confirmed case of Western encephalitis were reported from Madison County, Illinois, in 1964. As shown in the histogram on page 16, the first case of SLE became ill during the week ended august 22. The following week there were no cases. However, during September there were 3-5 cases per week. The SLE cases all occurred in adults with the exception of one in a 14-year-old girl. Of the 18 cases, 10 were in females and 8 were in males. The only fatality occurred in an 87-year-old woman who became ill on September 12 and had an eight fold serologic rise in hemagglutination inhibition titer to SLE.

The single case of Western Equine encephalitis occurred in a 14-year-old boy who became ill on September 16 and demonstrated high titers to Western Equine encephalitis.

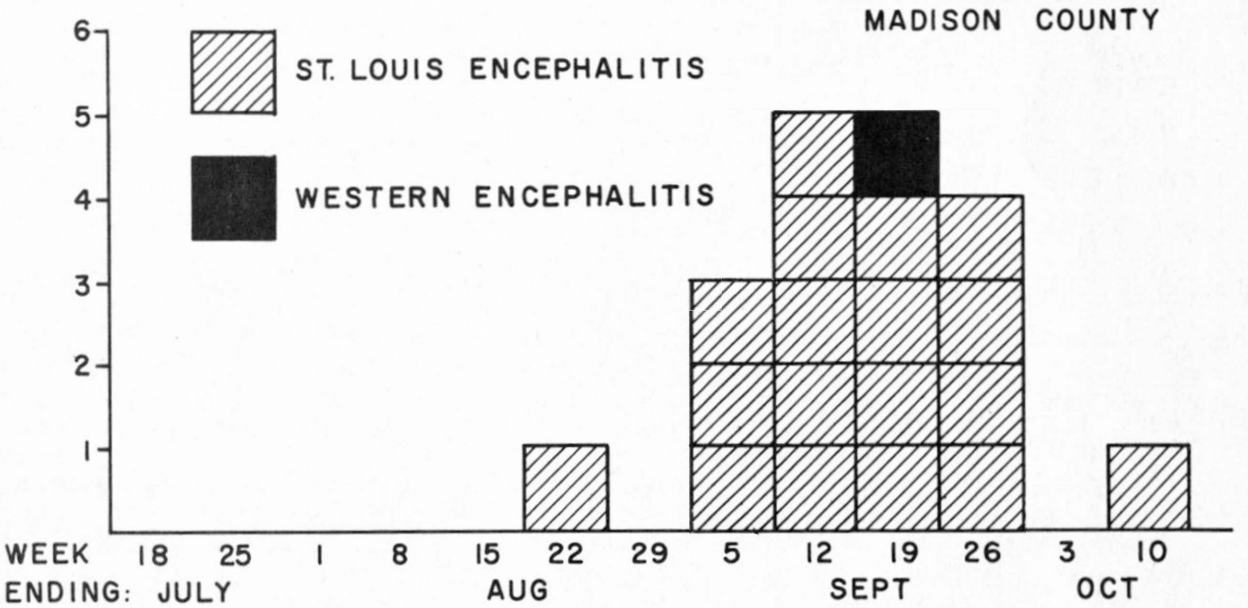
(Reported by Dr. Norman J. Rose, Chief of Epidemiology, Illinois Department of Public Health.)

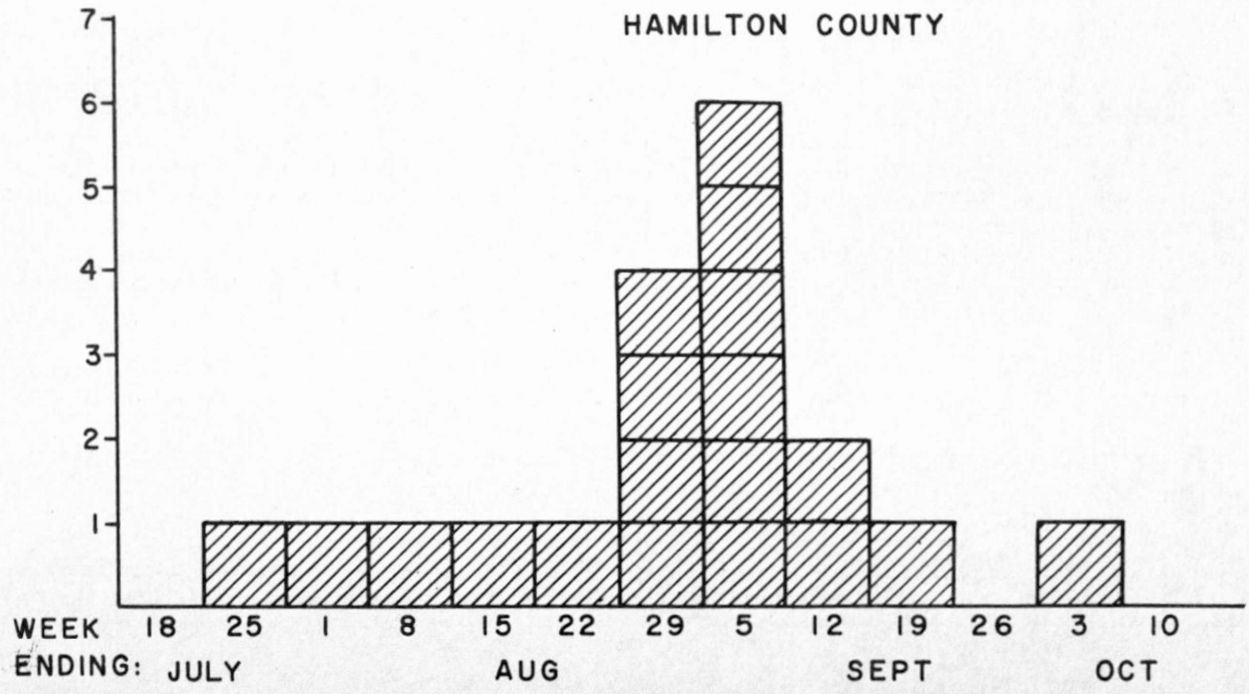
C. Indiana

In southeastern Indiana, there were a number of cases of suspected encephalitis that occurred during August and September. A total of 12 cases were serologically confirmed as California encephalitis and are presented in the line listing shown on page 17.

Figure 5

CONFIRMED CASES OF ARTHROPOD-BORNE ENCEPHALITIS
BY WEEK OF ONSET
MADISON AND HAMILTON COUNTIES, ILLINOIS, 1964





Six of the cases occurred in Ripley County, the remainder were scattered through 3 other counties in southeastern Indiana. The Ripley County cases all occurred during the weeks ended August 29 and September 5. All cases occurred in children between the ages of 4 and 16 years and 11 of the 12 cases were in males. After the cases were identified as California encephalitis, efforts were made to collect mosquitoes; however, the weather had become cold, preventing collection of adequate numbers for study.

Serologic investigation of previously undiagnosed encephalitis cases occurring in the same area of Indiana during the previous 5 years is currently in progress.

Cases of California Virus Encephalitis - Indiana, 1964

Initials	Age	Sex	Confirmed or Presumptive	County	Onset	CF Titer Acute	CF Titer Conv.	Death or Recovery
W.R.	5	M	C	Wayne	8/13	<8	32	R
A.W.	16	M	C	Decatur	9/1	<8	64	R
R.W.	9	M	C	Ripley	8/30	8	64	R
W.M.	7	M	C	Ripley	8/30	<8	128	R
D.B.	11	M	C	Ripley	8/29	<8	32	R
C.F.	4	F	C	Bartholomew	9/7	<8	64	R
Unk.	4	M	C	Monroe	9/16	1:10	1:80	R
J.W.	4	M	C	Bartholomew	9/19	512		R
R.D.	12	M	P	Ripley	9/1	32		R
T.F.	14	M	P	Ripley	9/4	128		R
C.C.	7	M	P	Ripley	9/23	32		R
Unk.	7	M	P	Wayne	9/23	1:160	1:80	R

(Reported by Dr. A. L. Marshall, Jr., Director of Preventive Medicine, State Board of Health, Indianapolis, Indiana and Laboratory Branch, CDC.)

D. Kentucky

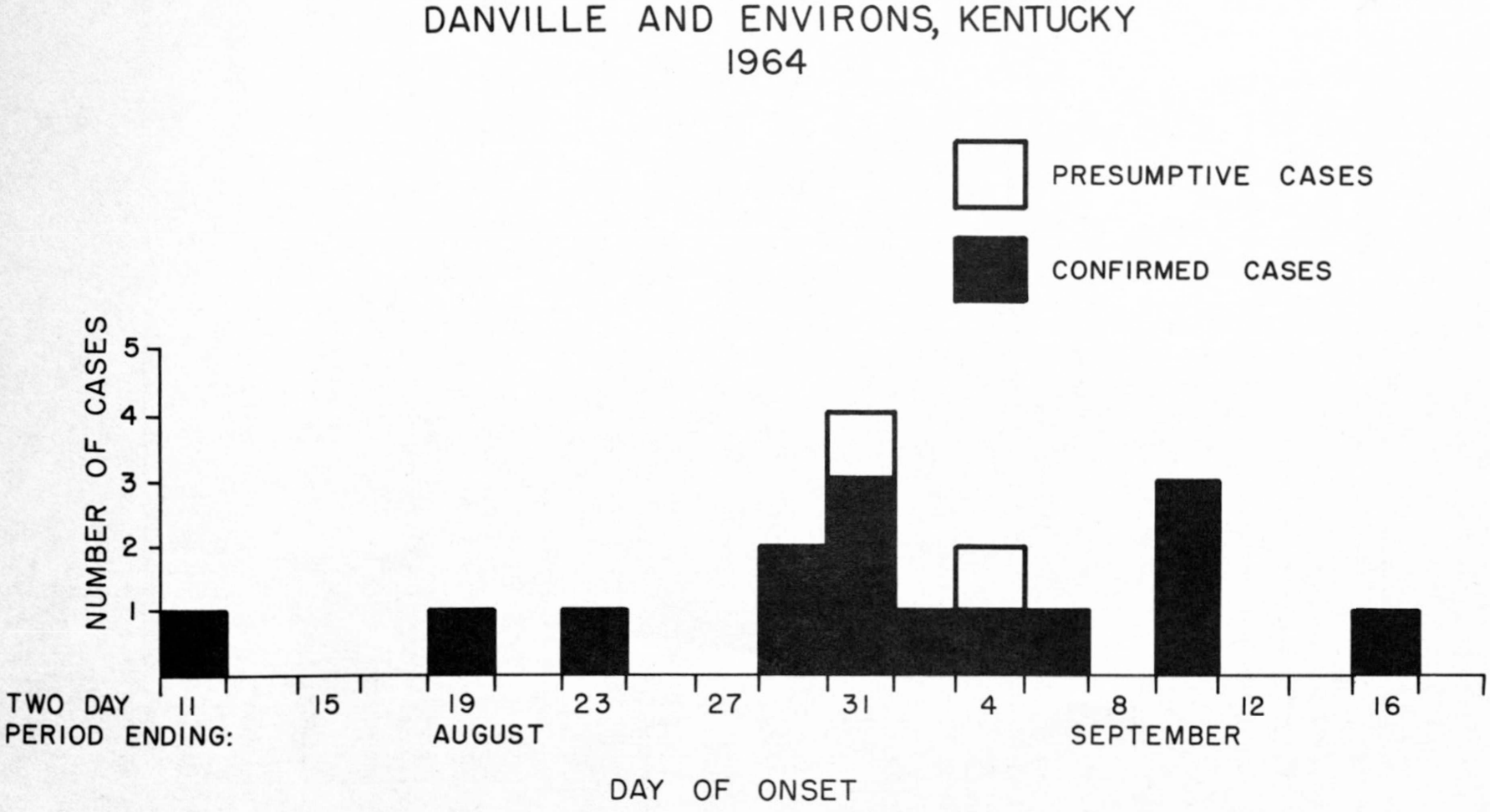
During August and September, there were 16 proved cases of SLE in Danville, Kentucky and environs. This represents an attack rate of 122 per 100,000. In addition, there was one case from an adjacent county but in close proximity to Danville. All cases resided within 10 miles of the Danville city limits. There were no fatalities.

As shown in Figure 6, the earliest case became ill on August 11. Only one case occurred the following week. There then followed a rapid rise in incidence with 10 of the 17 cases developing illness during a 9 day period ending September 5. The epidemic terminated in mid-September.

The attack rate of 122 per 100,000 in the city of Danville was more than twice the rate noted either in the suburbs of Danville (50 per 100,000) or rural Boyle County (43 per 100,000).

Attack rates by age showed a progressive increase with advancing age as shown in the following table. Eleven of the 16 cases were females.

Figure 6


ENCEPHALITIS BY DATE OF ONSET
DANVILLE AND ENVIRONS, KENTUCKY
1964
PRESUMPTIVE CASES
CONFIRMED CASES
NUMBER OF CASES
5
4
3
2
1
TWO DAY PERIOD ENDING:
11
15
19
23
27
31
4
8
12
16
AUGUST
SEPTEMBER
DAY OF ONSET

Boyle County, Kentucky Encephalitis Cases
by Age and Sex

Age Group	Population*			No. of Cases			Attack Rate per 100,000		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-9	1623	1628	3251	0	0	0	0	0	0
10-34	3321	3466	6787	1	3	4	30	87	59
34-64	3523	3836	7359	3	5	8	85	144	109
65+	1127	1387	2514	1	3	4	89	216	159
Total	9594	10,317	19,911	5	11	16	52	107	80

* 1960 Census

Entomologic studies revealed that all of the confirmed cases, with only one exception, resided within 1500 feet of demonstrable mosquito breeding sites. Three isolations of SLE virus were made from pools of Culex pipiens-quinquefasciatus in Danville. Flanders virus, which has never been reported to cause illness, was also isolated from 2 pools of Culex pipiens-quinquefasciatus. A warm dry period closely following frequent rains was thought to be responsible for the appearance of large numbers of Culex pipiens-quinquefasciatus in the Danville area. Ten chicken flocks from scattered parts of Danville were serologically sampled for SLE antibodies. All flocks had at least one chicken with a positive titer. Most flocks averaged between 25 and 60 percent positive. In addition, 241 wild birds were captured and bled. Of these, 35 sera were positive for SLE. One of 6 horse serum specimens obtained from rural Boyle County exhibited a positive group B arbovirus titer.

(Reported by Mr. J. Clifford Todd, State Epidemiologist, Kentucky State Department of Health.)

E. New Jersey

A total of 94 confirmed and presumptive cases of St. Louis encephalitis, including 9 deaths, were reported from Camden and Burlington Counties in New Jersey. The majority of cases occurred in urban areas. Another 21 confirmed or presumptive cases occurred in contiguous areas of Pennsylvania. As shown in Figure 7, the first case in New Jersey became ill during the week ended August 8, and a low incidence persisted throughout August. A sharp rise occurred during early September and the peak was reached during the week ended September 26.

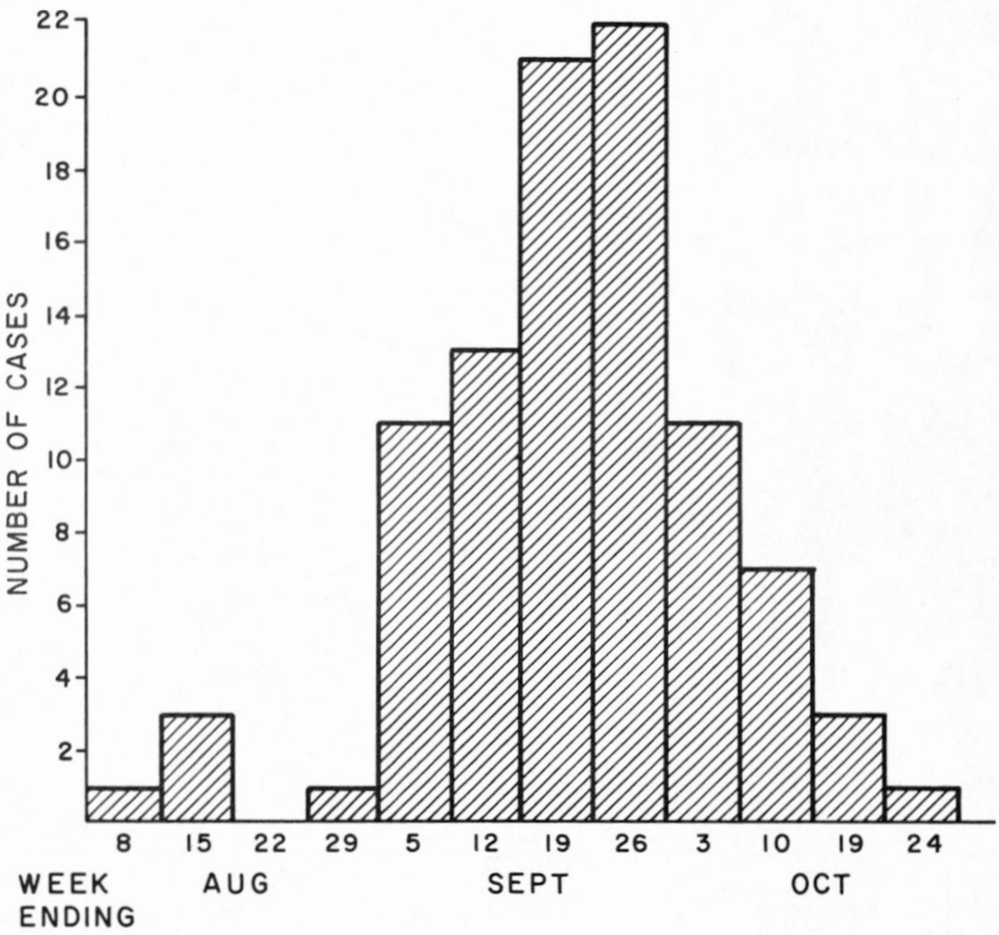
In New Jersey, the overall attack rate for the involved areas was 20.8 per 100,000. As shown in the table on the following page, attack rates increased with advancing age. The highest rate, 67.8 per 100,000, occurred in the age group 65 years and older. The attack rate among females (27 per 100,000) was twice that in males (14 per 100,000). This difference was more striking above the age of 45. Of the 9 fatalities, 7 were females. All deaths occurred in individuals 55 years of age or older.

St. Louis encephalitis virus was isolated from pools of Culex pipiens-quinquefasciatus, the presumed vector. Additional studies of birds and non-avian hosts are in progress.

(Reported by Dr. Wm. J. Dougherty, Director, Division of Preventable Disease Control, New Jersey State Department of Health and Dr. Martin Goldfield, Director, Division of Laboratories, New Jersey State Department of Health.)

Figure 7

ST. LOUIS ENCEPHALITIS BY WEEK OF ONSET
BURLINGTON & CAMDEN COUNTIES, NEW JERSEY, 1964



St. Louis Encephalitis by Age and Sex
Burlington and Camden Counties, New Jersey-1964

Age Group	No. of Cases			Attack Rate per 100,000		
	Male	Female	TOTAL	Male	Female	TOTAL
0-4	1	0	1	3.7	0.0	1.9
5-14	1	1	2	2.3	2.4	2.3
15-24	3	3	6	12.0	10.9	11.4
25-34	3	6	9	10.4	19.5	15.1
35-44	6	8	14	17.7	22.1	20.0
45-54	5	17	22	18.7	63.6	41.2
55-64	4	9	13	21.0	43.2	32.6
65+	8	19	27	46.0	84.0	67.8
TOTAL	31	63	94	14.1	27.1	20.8

F. Tennessee

An outbreak of 5 cases of St. Louis encephalitis (4 confirmed or presumptive) occurred in Memphis, Tennessee with the first case having onset of illness on August 25. Three additional cases developed illness during the next 10 days. The fifth case did not become ill until mid-October. The cases were clustered geographically in the southwestern section of Memphis. All the cases occurred in individuals over 50 years of age. Four of the 5 cases were in Negroes.

Four isolations of SLE virus were made from pools of Culex quinquefasciatus-pipiens mosquitoes collected in Memphis.

A case of serologically confirmed SLE was also reported from Obion County in September 1964 (located 100 miles north of Memphis). Cases of SLE were last reported in Obion County in 1956.

(Reported by Dr. Cecil B. Tucker, Director and Assistant Commissioner, Preventable Diseases, Tennessee Department of Public Health.)

G. Texas

(1) Hale County

A mixed outbreak of St. Louis encephalitis and Western Equine encephalitis occurred in Hale County, Texas, during July and August, 1964. Epidemics of both SLE and WEE have occurred on a number of occasions in recent years in this area. A total of 77 suspected cases of encephalitis were reported. Of these, 19 cases have been confirmed to be Western Equine encephalitis and 6 cases as St. Louis encephalitis. WEE virus was isolated from central nervous system tissue from two fatal cases. In addition, both WEE and SLE have been isolated from pools of Culex tarsalis.

(Reported by Dr. Van C. Tipton, Director, Communicable Disease Control, Texas Department of Health and the Disease Ecology Section, Technology Branch, CDC.)

(2) Harris County (Houston)

A major epidemic of St. Louis encephalitis occurred during the late summer and early fall, 1964, in Harris County (Houston), Texas. A preliminary total of 221 laboratory confirmed or presumptive cases*, including 26 deaths, has been reported. It is anticipated that further cases will be added to the total when laboratory studies have been completed.

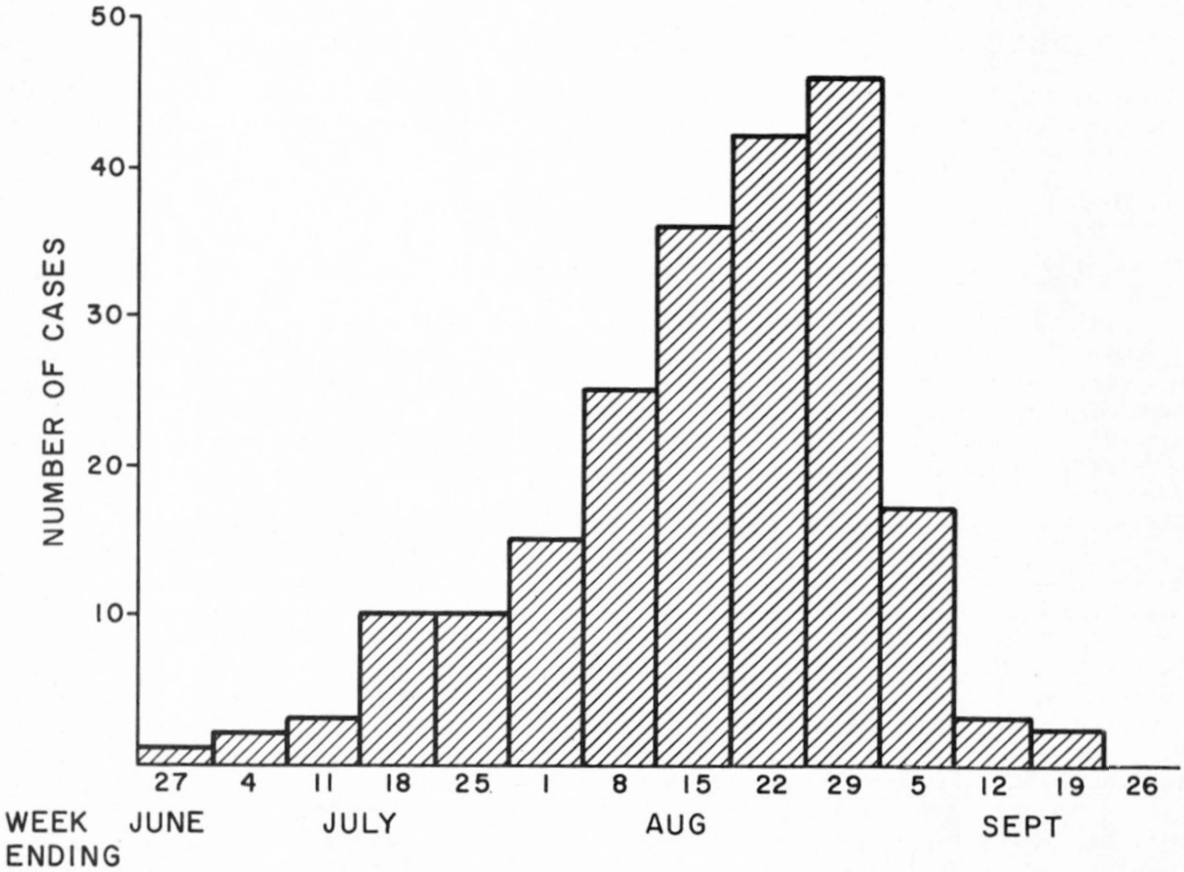
The epidemic curve for the 221 confirmed cases is shown on the following page. The first case became ill on June 25 followed by a steady increase in incidence with a peak having been reached during the week ended August 29, when 46 cases became ill. The epidemic ended in mid-September.

The overall attack rate was 17.8 per 100,000. The distribution of cases by age and sex are shown in the table on page 22. The attack rates increased with advancing age. No significant difference in attack rates between males and females was noted. Geographically, the early cases were clustered in a lower socioeconomic area in the center of Houston. As the epidemic progressed, cases occurred in the more peripheral areas of the city; however, rates remained lower in these peripheral areas throughout the epidemic.

* Because of the presence of group B arbovirus antibodies in many serum specimens from Houston, possibly due to previous dengue, a fourfold rise in hemagglutination antibody alone was not considered as confirmatory of recent SLE infection.

Figure 8

ST. LOUIS ENCEPHALITIS BY WEEK OF ONSET
HARRIS COUNTY, TEXAS, 1964



St. Louis Encephalitis by Age Group and Sex
Harris County, Texas - 1964

Age Group	No. of Cases			Attack Rate per 100,000*		
	Male	Female	TOTAL	Male	Female	TOTAL
0-4	8	4	12	9.9	5.1	7.5
5-9	8	3	11	10.9	4.2	7.6
10-14	12	3	15	20.3	5.2	12.8
15-19	4	10	14	10.0	23.0	16.8
20-29	13	10	23	16.9	11.0	13.7
30-39	14	11	25	14.5	10.9	12.7
40-49	10	15	25	12.8	19.0	15.9
50-59	12	11	23	21.2	19.7	20.5
60-69	21	14	35	69.9	42.5	55.6
70+	19	19	38	116.0	82.1	96.1
TOTAL	121	100	221	19.9	15.8	17.8

* 1960 Census

There were 26 deaths, for a case fatality rate of 11.8 per 100. Of these 26 deaths, 25 occurred in persons over 50 years of age. Many of the fatalities occurred in persons with other illnesses such as hypertension, arteriosclerotic heart disease, and diabetes mellitus.

A total of 75,074 mosquitoes, principally Culex quinquefasciatus were collected in Houston between August 23 and October 17, 1964. Twenty-two isolations of St. Louis encephalitis virus were made from C. quinquefasciatus and one isolation was made from a pool of anopheles quadrimaculatus mosquitoes.

(Reported by Dr. Van C. Tipton, Director, Communicable Disease Control, Texas Department of Health, Dr. J. E. Peavy, Commissioner of Health, Texas Department of Health and a team from the Communicable Disease Center.)

IV. SPECIAL REPORTS

A. California Virus Encephalitis Studies in Wisconsin

Investigations at the Zoonosis Research Laboratory, Wisconsin State Laboratory of Hygiene, have established the activity of California encephalitis virus in causing human illness and widespread subclinical infection in Wisconsin residents. The evidence is based both on serological studies and on the isolation of this virus from a fatal human case. This is the first isolation of California virus from a human source to be reported. The data to date can be summarized as follows:

Serological Survey: A metabolic-inhibition screening test was carried out with five encephalitis antigens on sera from 637 persons engaged in outdoor occupations. This survey revealed 25.9 percent of the group had antibodies to California virus antibodies, 4.2 percent with St. Louis encephalitis antibodies, 0.5 percent with Western Equine encephalitis antibodies and none with antibodies to Eastern Equine encephalitis. Neutralization tests confirmed the presence of specific antibodies to California virus. The presence or absence of antibody was definitely related to the degree of outdoor exposure. Among constant outdoor workers (Indian forest residents, conservation workers), antibody was demonstrated in sera from 41 percent of the 276 studied, whereas only 20 percent of the 129 intermittent outdoor workers (veterinarians, etc.) demonstrated antibodies. The rate for the 232 short term workers (summer forest campers) who were surveyed was 10.8 percent. A sampling of 232 young men at the beginning and end of outdoor exposure in summer forestry camps in 1963 has shown serologic conversion from negative to positive in four instances. No encephalitic illnesses occurred in these four young men.

Relation to Clinical Illness: Hemagglutination-inhibition and mouse neutralization tests for California encephalitis virus have been carried out on serum samples sent to the State Laboratory of Hygiene from 1960-1964 from patients with previously undiagnosed central nervous system infections. Twenty patients demonstrated elevated titers. Paired sera from 13 of these persons showed a fourfold or greater rise in HI antibody titer between the acute and convalescent specimens. Cases occurred each year. The largest number of cases (8) occurred in 1960. Fever, coma, convulsions, stiff neck, vomiting and cerebrospinal fluid pleocytosis were among the symptoms recorded. All of these cases were in children under 12 years of age. Most of them resided in rural areas of western Wisconsin. All illnesses occurred during the months of July, August or September.

Isolation of Virus: With the assistance of Dr. Bernard Kalfayan, Pathologist, Lutheran Hospital, La Crosse, the brain from a four-year-old girl who died from encephalitis in September 1960 was studied further. California virus was isolated in 1964 from the brain which had been stored frozen at 40° since 1960. This was confirmed by Dr. Ralph Anslow, Veterinary Science Department, University of Wisconsin, who reisolated the virus from the original brain tissue in another laboratory. The identity of the isolate as a California group virus was confirmed at the Communicable Disease Center, and by Dr. Wm.

McD. Hammon, School of Public Health, University of Pittsburgh and another member of the same family, a three-year-old boy, was hospitalized in September of 1964 with encephalitis. Paired serum specimens revealed a rise in California antibody titer. Of 9 other members of this family who were sampled in October, 1964, 4 demonstrated evidence of prior infection.

From these studies California encephalitis virus must be regarded as producing widespread infection in certain areas of Wisconsin and infection has been demonstrated to cause an encephalitic illness, and even death.

(Reported by A. S. Evans, M.D., Director, State Laboratory of Hygiene, Laboratory of the Wisconsin State Board of Health, Dr. Wayne Thompson, Chief, Zoonosis Research Laboratory and Dr. Robert W. Hanson, University Veterinary Science Department.)

Editor's Note: Previous reports of California virus activity in California, Montana, and Florida as well as recognized cases of clinical encephalitis due to this virus in Indiana, Ohio and North Carolina during 1964 indicate the widespread activity to this virus. The extent to which this virus causes disease in the United States remains to be accurately defined.

B. Encephalitis Studies in Florida

Investigative activities continue at the Encephalitis Research Center, Tampa, Florida. The following material is from the 1964 Annual Report of the Encephalitis Surveillance Report, Florida State Board of Health.

For the second consecutive year Florida experienced no epidemics of human infection with arthropod-borne viruses. This past year did, however, represent a year of increased activity in the State for Eastern and Western Equine encephalitis viruses which produced severe clinical illness in horses and in man. Infection with these viruses was also detected in both wild and domestic birds, sentinel bird flocks, and in mosquitoes. Such activity is neither new nor unusual for Florida, and has been recognized to occur in irregular cycles for many years. The enlarged staff of arbovirus investigators in the State, most of whom were in the Encephalitis Research Center (ERC) in Tampa, made it possible to study this activity with an intensity and precision that had not previously been possible.

At the ERC, Western encephalitis (WE) virus was recovered from the brain of a sick horse, the first such recovery in Florida and probably east of the Appalachian mountains. Eastern encephalitis (EE) virus was recovered 5 times from moribund horses. Both viruses were isolated repeatedly from Culiseta melanura mosquitoes which have long been incriminated as the vector of these viruses between birds. However, for the first time, the EE and WE viruses were also obtained from a species of fresh water Aedes mosquitoes (Aedes infirmatus). This may prove to be the first identification of a vector carrying this virus from birds to horses or to man. There were 4 confirmed human cases of Eastern encephalitis in the State of Florida in 1964. In 3 of these, laboratory studies at the ERC in Tampa assisted in the diagnosis. One was from Polk County, one from Hillsborough County, and one from Putnam County. Of the 4 cases in the State, 2 were fatal, and the survivors were severely damaged, emphasizing again the serious import of this virus for the human population should an epidemic occur. Activity of EE and WE viruses was readily demonstrated in wild and domestic birds in the Tampa Bay area and in sentinel chicken flocks maintained by the ERC to measure arbovirus transmission to birds.

Again in 1964, as in 1963, there was virtually no evidence of activity of St. Louis encephalitis virus in the entire State of Florida, or in the Tampa Bay area. The negative evidence included observations for clinical disease in man, for inapparent infection in man, virus isolation studies in mosquitoes, and virologic and serologic observations in wild and domestic birds, chickens, wild mammals, amphibians and reptiles. This apparent disappearance of SLE virus was made doubly enigmatic by the fact that

1964 represented the year of the largest St. Louis encephalitis epidemic in the United States, involving the states of Texas, Colorado, Tennessee, Kentucky, Indiana, Illinois, New Jersey and Pennsylvania.

The intensive search for arboviruses by the Encephalitis Research Center did however result in the recovery of a number of other agents. These included arboviruses belonging to the California complex, Tensaw virus, Hart Park virus, and unidentified viral agents recovered from 2 species of ticks and from cotton rats. The public health significance of these other viral agents is as yet undefined. However, early information indicates that the viruses belonging to the California complex may represent a new and significant arboviral cause of human disability and disease, not only in Florida but in a large area of the United States.

(Reported by Dr. James O. Bond, Director, Encephalitis Research Center, Tampa, Florida.)

APPENDIX A

NON-HUMAN ARBOVIRUS ISOLATIONS, 1964
REPORTED TO THE ENCEPHALITIS SURVEILLANCE UNIT

1. Isolations from Mosquitoes

State	Species	Virus Isolated	No. Isolations	Laboratory
Florida	C. nigrigalpus	P. Hart Park	1	2
Florida	C. nigrigalpus	VE	1	1
Florida	A. infirmatus	EE	1	2
Florida	A. infirmatus	WE	2	2
Florida	A. infirmatus	Calif.	1	1
Florida	A. taeniorhynchus	Calif.	3	1
Florida	A. taeniorhynchus	Calif. Complex	7	2
Florida	A. taeniorhynchus	P. Calif. Complex	3	2
Florida	A. atlanticus	Calif. Complex	12	2
Florida	A. atlanticus	P. Calif. Complex	3	2
Florida	C. (Melanoconion) Sp.	VE	6	1
Florida	C. melanura	EE	9	1 & 2
Florida	C. melanura	WE	3	2
Florida	C. melanura	P. Hart Park	5	2
Florida	A. species	Calif. Complex	1	2
Florida	A. species	P. Calif. Complex	1	2
Florida	An. crucians	Tensaw	36	1 & 2
Florida	An. crucians	VE	1	1
Georgia	A. atlanticus	Calif.	20	1
Georgia	An. crucians	EE	1	1
Georgia	An. crucians	Tensaw	25	1
Georgia	C. (Melanoconion) Sp.	EE	1	1
Georgia	Cs. melanura	EE	20	1
Georgia	Cs. melanura	WE	5	1
Georgia	Cs. melanura	Hart Park-like	9	1
Georgia	M. perturbans	EE	7	1
Illinois	C. pipiens	SLE	9	3
Illinois	An. quadrimaculatus	Cache Valley or Tensaw	6	3
Indiana	C. pipiens	SLE	3	1
Kansas	C. tarsalis	WE	1	4
Kentucky	C. pipiens	SLE	3	1
Kentucky	C. pipiens	Hart Park-like	2	1
Maryland	C. melanura	EE	2	7
Maryland	C. melanura	WE	1	7
Maryland	A. taeniorhynchus	Tensaw*	2	7
Mass.	C. melanura	WE	1	5
Tennessee	C. quin-pipiens	SLE	4	1
Tennessee	C. quin-pipiens	Hart Park-like	1	1
Texas	C. tarsalis	Hart Park	1	6
Texas	C. tarsalis	WE	11	6
Texas	A. nigromaculis	WE	1	6
Texas	C. quinquefasciatus	SLE	4	6
Texas	Mixed pool	Hart Park	1	6
Texas	C. quinquefasciatus	SLE	22**	1
Texas	C. quinquefasciatus	Calif.	1	1
Texas	C. quinquefasciatus	Hart Park-like	1	1
Texas	An. quadrimaculatus	SLE	1	1
Texas	An. quadrimaculatus	Bunyamwera	1	1

* Tentative identification.
** Includes 3 isolates made by Texas State Board of Health

2. Isolations from Birds

State	Species	Virus Isolated	No. Isolations	Laboratory
Florida	Pheasant	EE	1	2
Florida	Exposure Chicks	EE	2	2
Florida	Exposure Chicks	WE	2	2
Illinois	House Sparrow	SLE	3	3
Illinois	Catbird	SLE	1	3
Illinois	Chimney Swift	SLE	1	3
Illinois	Red Wing Blackbird	WE	1	3
Mass.	Swamp Sparrow	EE	1	5
Mass.	Swamp Sparrow	WE	1	5
Mass.	Robin	WE	1	5
Mass.	Catbird	WE	1	5

3. Isolations from Mammals

State	Species	Virus Isolated	No. Isolations	Laboratory
Arkansas	Horse	WE	5	1
Florida	Horse	EE	5	2
Florida	Horse	WE	1	2
Georgia	Horse	EE	1	1
Illinois	Horse	WE	2	3
Louisiana	Horse	WE	1	1 & 8
Maryland	Horse	EE	1	10
New Jersey	Hamster	WE	1	9
New Jersey	Cat	WE	2	9
New Jersey	Mouse	WE	1	9
New Jersey	Mouse	EE	1	9
New Jersey	Dog	WE	3	9

(1) Communicable Disease Center, Atlanta, Georgia.
(2) Encephalitis Research Center, Florida State Board of Health, Jacksonville, F
(3) Center for Zoonoses Research, University of Illinois, Urbana, Illinois.
(4) Kansas State Department of Health, Topeka, Kansas.
(5) Massachusetts State Health Department, Division of Laboratories, Boston, Massachusetts.
(6) Texas State Health Department, Division of Laboratories, Austin, Texas.
(7) Department of Viral Diseases, Walter Reed Army Institute of Research, Washington, D.C.
(8) Louisiana State Health Department, New Orleans, Louisiana.
(9) New Jersey State Health Department, Division of Laboratories, Trenton, New Jersey.
(10) Maryland Livestock Sanitary Services Laboratory, University of Maryland, College Park, Maryland.

APPENDIX B

In addition to the State Epidemiologists who contribute much of the material of this report, the Surveillance Section of the Communicable Disease Center wishes to express its grateful appreciation to the following individuals whose data has been frequently quoted in this as well as previous Encephalitis Surveillance Reports.

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Key to all disease surveillance activities are those in each State who serve the function as State epidemiologists. Responsible for the collection, intrepretation 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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