ANNUAL SUMMARY 1977
Issued December 1979

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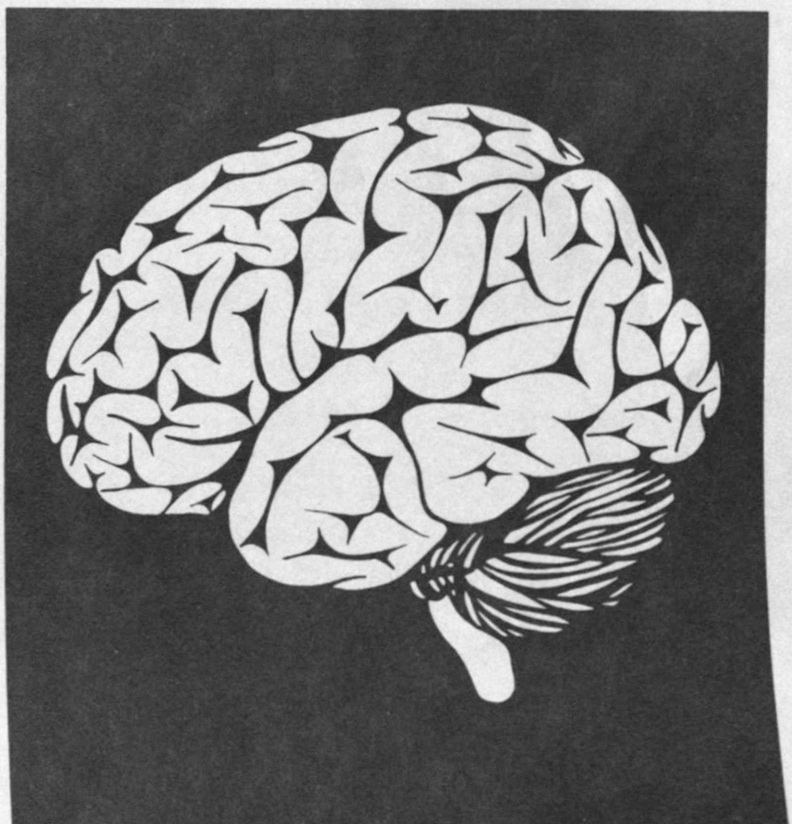

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PREFACE

Summarized in this report is information received from state health departments, university investigators, virology laboratories, and other pertinent sources, domestic and foreign. This summary 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. Send them to:

Center for Disease Control
Attention: Neurotropic Diseases
Viral Diseases Division
Bureau of Epidemiology
Atlanta, Georgia 30333

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Center for Disease Control: Encephalitis Surveillance Annual Summary 1977, Issued December 1979

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I. SUMMARY

In 1977 a total of 1,536 cases of encephalitis, resulting in 171 deaths, were reported to the Center for Disease Control. This total is 16% less than the 1976 total and 29% less than the average total for the preceding 5 years. The average for the preceding 5 years was increased by the 4,308 case total of 1975, a major epidemic year for St. Louis encephalitis activity. Of the 9 geographic divisions in the United States, the East North Central had the most cases (467), but the highest attack rate was associated with the East South Central. Cases were reported to have occurred in all states except Maine, Nevada, Oregon, Vermont, and Wyoming. In 1977, as in each year except 1975, the majority of cases (70%) were of indeterminate etiology. Of the other cases with known etiology, the majority (52%) were associated with arboviral infection, including St. Louis encephalitis (132 cases), California (65 cases), western equine (41 cases), and eastern equine (1 case); the next largest group consisted of cases associated with childhood infections (26%), including chickenpox (43 cases), mumps (43 cases), measles (32 cases), and rubella (1 case). Sixty-three cases associated with herpes simplex infection accounted for 14% of the cases with an established etiology. The other cases of determined etiology, accounting for less than 10%, included 17 cases involving enterovirus infection, 14 with herpes zoster, 5 with respiratory virus infections, and 3 with infectious mononucleosis.

II. METHODS AND DEFINITIONS

This summary was compiled from data submitted to CDC from all state health departments. Only cases clinically classified as having an encephalitic component (i.e., encephalitis, meningo-encephalitis) were included, regardless of etiology. For each of these cases, information was requested on patient's age, sex, and county of residence, the date of onset and outcome of the illness, pertinent laboratory results, and etiologic evaluation when available. In general, cases were classified according to the degree of etiologic information available. Cases considered to be laboratory-confirmed were associated either with the isolation of a virus from an appropriate site--usually the central nervous system (CNS)--or with diagnostic serologic results, usually involving at least a 4-fold difference in titer between acute- and convalescent-phase paired sera. Presumptive cases included those with enterovirus isolates from non-central nervous system sites without supporting serologic evidence, and cases with serologic evidence not meeting the criteria for a confirmed case. Except for presumptive arboviral infections which were tabulated with other cases of documented arboviral etiology, all presumptive cases were included in the indeterminate category. Similarly, cases with documented evidence for more than 1 etiology (complex) and those cases with either inconclusive or no evidence for a specific etiology were included in the indeterminate category. The physician's clinical diagnosis was accepted as documented evidence for specific etiologies where clinical diagnosis was feasible--for example, childhood exanthems or herpes zoster.

III. EPIDEMIOLOGY AND MORBIDITY TRENDS

In 1977 there were 460 cases, resulting in 53 deaths, with sufficient evidence to document a specific infectious etiology (Table 1). More than half the total (32%) involved arboviral encephalitis, and the major arboviral encephalitides were St. Louis encephalitis (SLE) (55%), California encephalitis (CE) (27%), and western equine encephalitis (WEE) (17%). Encephalitis cases following childhood infections (measles, mumps, chickenpox, rubella) accounted for 119 cases, about a quarter (26%) of those with determined etiology. Encephalitis cases following measles (43) were nearly as numerous as they had been in the preceding year (44) when more cases were reported than had been since 1971, reflecting the recognition of widespread outbreaks of measles infection. Fatal encephalitis cases differed markedly in their etiologic pattern. The fatality rate for encephalitis cases associated with herpes simplex and zoster were 47% and 50%, respectively. Although herpes infections accounted for only 17% of known cases, they were associated with 60% of all fatal cases with determined etiology. In

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contrast, cases associated with arboviral and childhood infections represented 78% of those with determined etiology but only 36% of those ending fatally.

TABLE 1
Cases of Encephalitis and Deaths, by Etiology, United States, 1977

Category and Etiology	Cases Number		Cases % of Total	Deaths Number		Deaths % of Total	Death/Case Ratio (%)
Arboviral	239		15.6	10		5.8	4.2
Western equine		41			0		
Eastern equine		1			1		
St. Louis		132			9		
California		65			0		
Enteroviral	17		1.1	1		0.6	5.9
Associated with Childhood Infections	119		7.7	9		5.3	7.6
Measles		32			5		
Mumps		43			3		
Chickenpox		43			1		
Rubella		1			0		
Associated with Respiratory Illness	5		0.3	0		0	0
Parainfluenza		1			0		
Adenovirus		1			0		
M. pneumoniae		1			0		
Respiratory syncytial virus		1			0		
Influenza A		1			0		
Associated with Other Known Etiologies	80		5.2	33		19.3	41.3
Herpes simplex		63			25		
Herpes zoster		14			7		
Infectious mononucleosis		3			1		
Indeterminate	1,076		70.1	118		69.0	11.0
Complex		0			0		
Inconclusive		50			10		
Unknown etiology		1,026			108		
Total	1,536		100	171		100	11.1

There were 1,076 cases included in the indeterminate category: 1,026 with no indication of evidence for a specific etiology, and 50 with inconclusive evidence (23 with an enterovirus demonstrated from an anatomical site not in the CNS, and 27 other viral agents associated with either presumptive serologic evidence or isolation from a peripheral anatomic site).

Although the total number of arboviral cases reported for 1977 continued the declining trend that has followed the extraordinary epidemic activity in 1975, 1977 was a year of substantial epidemic arboviral encephalitis activity, as shown in Table 2. With the exception of 1975 and 1976, the total of 239 cases of arboviral encephalitis for 1977 is the highest total reported since 1966. A major contribution to the arboviral total for 1977 resulted from the late-season outbreak of SLE in Florida detailed in the special report section of this report (Section IV). Only 17 cases of encephalitis were considered associated with a confirmed enteroviral etiology. Nevertheless, enteroviral infections are a likely cause of many of the cases of indeterminate etiology in the summer season, and enteroviral cases are probably the most under-reported because of the difficulty of laboratory confirmation and the relative mildness of most cases. Cases associated with childhood infections continued the secular decline that began in 1966; the total of 119 cases is the lowest annual total recorded since the encephalitis surveillance system began in 1960.

Table 2
Cases of Encephalitis, By Year and Etiologic Group, 1960-1977

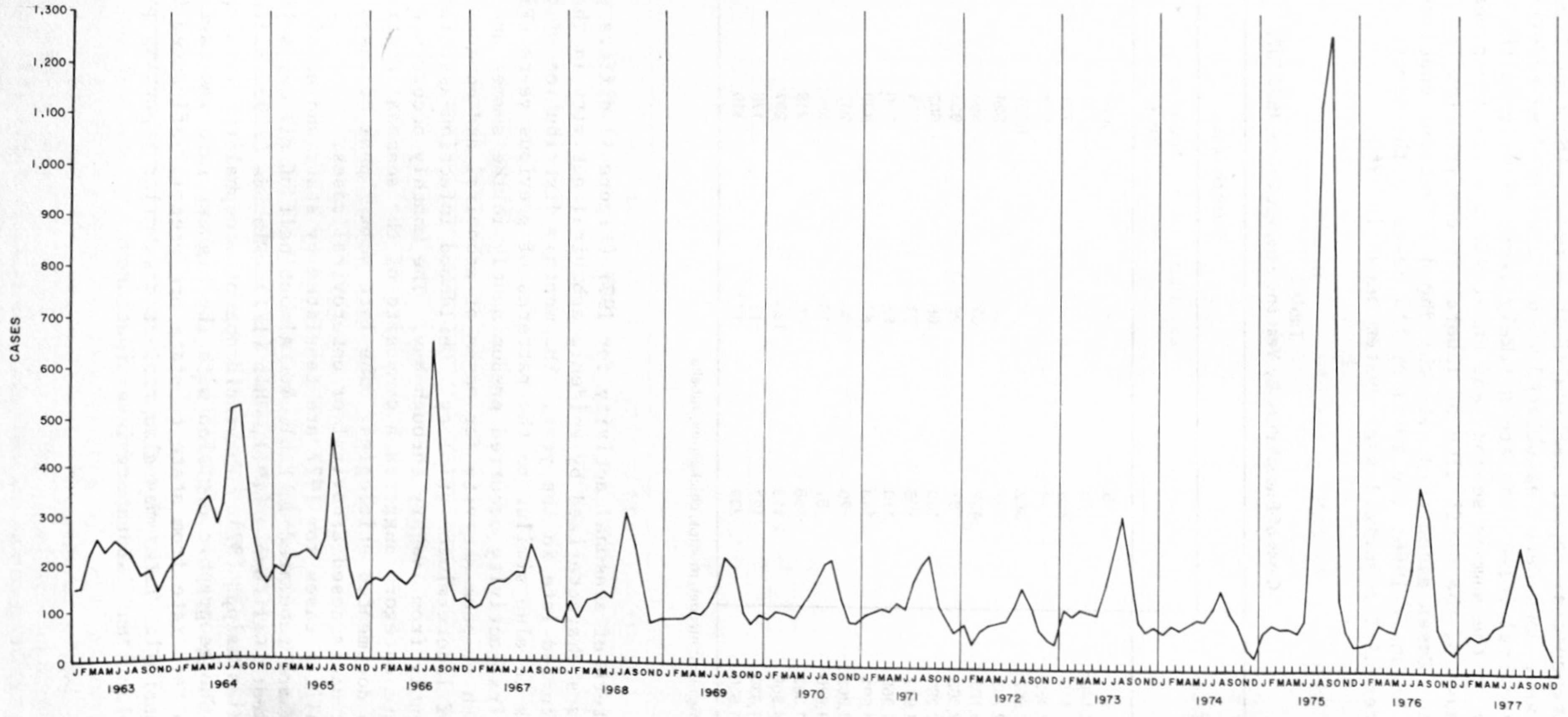
Year	Total	Etiologic Group				
		Arboviral	Enteroviral	Associated with CI*	Other Known	Indeterminate
1960	2,553	45	–	1,094	79	1,335
1961	2,140	70	–	753	111	1,206
1962	2,410	270	–	771	83	1,286
1963	2,362	76	–	994	200	1,092
1964	3,587	582	–	1,397	188	1,420
1965	2,703	297	–	924	57	1,425
1966	3,102	438	37	963	172	1,492
1967	2,368	83	26	995	46	1,218
1968	2,283	130	66	502	75	1,510
1969	1,917	108	31	304	56	1,418
1970	1,950	110	52	370	58	1,360
1971	1,891	148	45	439	80	1,179
1972	1,302	70	30	243	61	898
1973	1,970	91	13	354	62	1,450
1974	1,382	108	48	218	50	958
1975	4,308	2,113	136	237	113	1,709
1976	1,830	427	13	176	90	1,124
1977	1,536	239	17	119	85	1,076

*CI – Childhood infections: measles, mumps, chickenpox, rubella

The pattern of seasonal activity for 1977 (Figure 1) differs somewhat from that of other years characterized by epidemic arboviral activity in that the Florida SLE activity occurred late in the year. The monthly distribution of cases for other etiologic groups is also similar to the patterns of previous years (Figure 2). Arboviral and enteroviral activity occurred predominantly in the summer and early fall; August was the month of peak activity for cases of arboviral and enteroviral encephalitis and for those of indeterminate etiology. Childhood infection-associated cases occurred more frequently from January through May. The monthly occurrence of cases in the indeterminate category suggests a composite of the seasonal distribution of cases associated with documented etiologies. The late summer peak of cases with unknown etiology may reflect undiagnosed arboviral or enteroviral cases.

Encephalitis cases for 1977 are tabulated by state and etiologic group in Table 3; fatal cases are tabulated in Table 4. Almost half of all cases (49%) were reported from 6 states: California (191), Ohio (171), Florida (109), Illinois (108), Indiana (93), and Mississippi (87). The incidence of encephalitis is displayed by state in Figure 3. The geographic division with the highest rate was East South Central. Variations in attack rate from state to state are greatly influenced by epidemic patterns; however, dissimilar rates may also reflect dissimilar reporting practices and emphases on epidemiologic and laboratory investigations.

Fig. 1 REPORTED CASES OF ENCEPHALITIS, BY MONTH OF ONSET, UNITED STATES, 1963-1977



g. 2 REPORTED CASES OF ENCEPHALITIS, BY MONTH OF ONSET AND ETIOLOGIC GROUP, UNITED STATES, 1977

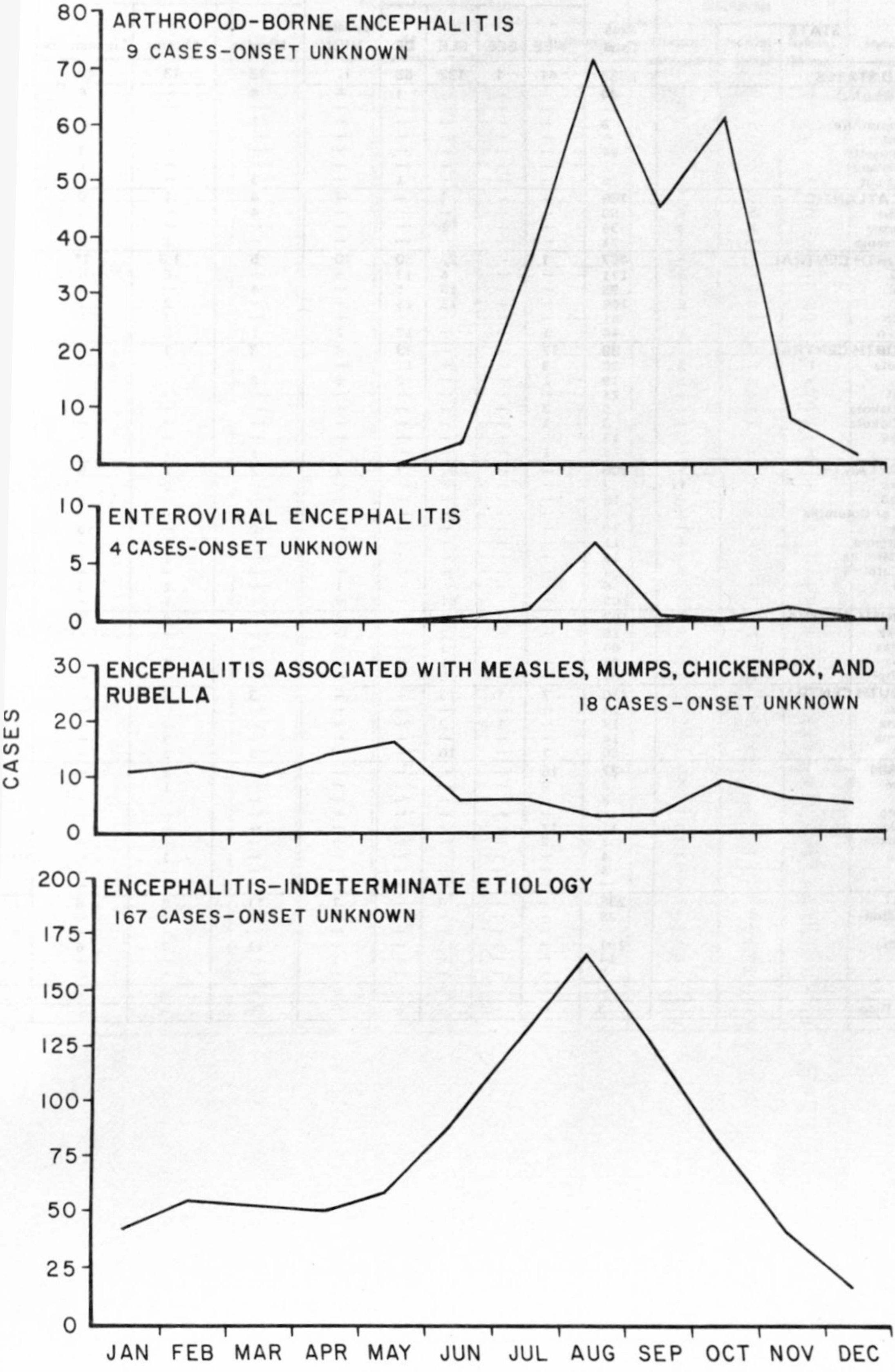


TABLE 3
REPORTED CASES OF ENCEPHALITIS, BY STATE AND ETIOLOGY, 1977

STATE	Area Total	Arthropod-borne				Entero-Viral	Associated with Childhood Infections			
		WEE	EEE	SLE	CE		Measles	Mumps	Chickenpox	Rubella
UNITED STATES	**1,536**	**41**	**1**	**132**	**65**	**17**	**32**	**43**	**43**	**1**
NEW ENGLAND	**44**	—	—	—	**1**	—	**4**	—	**4**	—
Maine	—	—	—	—	—	—	—	—	—	—
New Hampshire	3	—	—	—	—	—	1	—	—	—
Vermont	—	—	—	—	—	—	—	—	—	—
Massachusetts	24	—	—	—	—	—	—	—	3	—
Rhode Island	1	—	—	—	—	—	—	—	1	—
Connecticut	16	—	—	—	1	—	3	—	—	—
MIDDLE ATLANTIC	**168**	—	—	**1**	—	—	**4**	**1**	**9**	—
New York	58	—	—	—	—	—	4	—	6	—
New Jersey	39	—	—	1	—	—	—	—	1	—
Pennsylvania	71	—	—	—	—	—	—	1	2	—
EAST NORTH CENTRAL	**467**	**1**	—	**27**	**50**	**10**	**5**	**13**	**11**	**1**
Ohio	171	—	—	4	13	8	—	6	4	—
Indiana	93	—	—	10	5	—	4	—	2	—
Illinois	108	—	—	13	15	—	—	2	2	1
Michigan	51	—	—	—	—	—	—	3	2	—
Wisconsin	44	1	—	—	17	2	1	2	1	—
WEST NORTH CENTRAL	**89**	**17**	—	—	**13**	**4**	**3**	**1**	—	—
Minnesota	20	9	—	—	11	—	—	—	—	—
Iowa	19	1	—	—	2	3	2	—	—	—
Missouri	16	—	—	—	—	—	—	—	—	—
North Dakota	5	3	—	—	—	—	—	—	—	—
South Dakota	3	3	—	—	—	—	—	—	—	—
Nebraska	13	—	—	—	—	—	—	—	—	—
Kansas	13	1	—	—	—	1	1	1	—	—
SOUTH ATLANTIC	**200**	—	—	**81**	**1**	**2**	**2**	**7**	**9**	—
Delaware	7	—	—	—	—	—	—	2	—	—
Maryland	16	—	—	—	—	—	—	—	2	—
District of Columbia	1	—	—	—	—	—	—	—	—	—
Virginia	30	—	—	—	—	—	2	—	3	—
West Virginia	11	—	—	—	—	—	—	1	—	—
North Carolina	16	—	—	—	1	1	—	1	1	—
South Carolina	4	—	—	—	—	—	—	—	—	—
Georgia	6	—	—	—	—	1	—	2	3	—
Florida	109	—	—	81	—	—	—	1	—	—
EAST SOUTH CENTRAL	**193**	—	—	**9**	—	—	—	**4**	**4**	—
Kentucky	16	—	—	2	—	—	—	—	—	—
Tennessee	65	—	—	1	—	—	—	—	—	—
Alabama	25	—	—	1	—	—	—	4	4	—
Mississippi	87	—	—	5	—	—	—	—	—	—
WEST SOUTH CENTRAL	**110**	**7**	**1**	**13**	—	—	**3**	**6**	—	—
Arkansas	14	—	—	—	—	—	—	—	—	—
Louisiana	17	—	1	3	—	—	—	—	—	—
Oklahoma	14	—	—	—	—	—	—	3	—	—
Texas	65	7	—	10	—	—	3	3	—	—
MOUNTAIN	**27**	**16**	—	—	—	—	—	**2**	—	—
Montana	3	2	—	—	—	—	—	1	—	—
Idaho	3	—	—	—	—	—	—	—	—	—
Wyoming	—	—	—	—	—	—	—	—	—	—
Colorado	11	11	—	—	—	—	—	—	—	—
New Mexico	3	3	—	—	—	—	—	—	—	—
Arizona	4	—	—	—	—	—	—	1	—	—
Utah	3	—	—	—	—	—	—	—	—	—
Nevada	—	—	—	—	—	—	—	—	—	—
PACIFIC	**235**	—	—	**1**	—	**1**	**11**	**9**	**6**	—
Washington	28	—	—	—	—	—	—	2	—	—
Oregon	—	—	—	—	—	—	—	—	—	—
California	191	—	—	1	—	—	11	7	6	—
Alaska	14	—	—	—	—	1	—	—	—	—
Hawaii	2	—	—	—	—	—	—	—	—	—
Guam	—	—	—	—	—	—	—	—	—	—
Puerto Rico	3	—	—	—	—	—	—	—	—	—

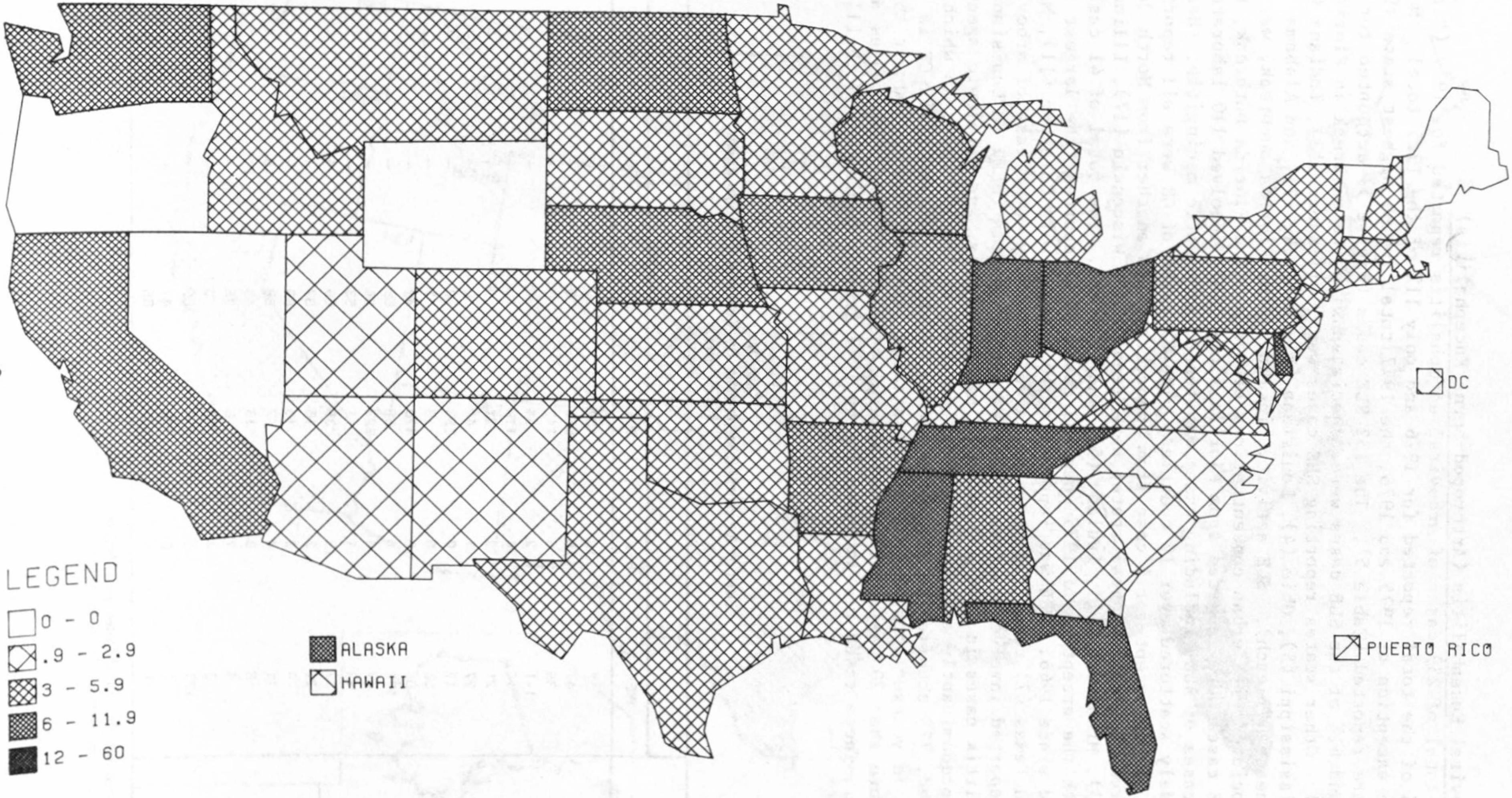
TABLE 3 – Continued
REPORTED CASES OF ENCEPHALITIS, BY STATE AND ETIOLOGY, 1977

STATE	Associated with Respiratory Infection					Other Known Etiologies			
	Para-influ.	Adeno-virus	M. pneumo.	RSV	Influenza A	Herpes simplex	Herpes zoster	Infect. Mono.	Indeter-minate
UNITED STATES	**1**	**1**	**1**	**1**	**1**	**63**	**14**	**3**	**1,076**
NEW ENGLAND	–	–	**1**	–	–	**2**	–	–	**32**
Maine	–	–	–	–	–	–	–	–	–
New Hampshire	–	–	–	–	–	–	–	–	2
Vermont	–	–	–	–	–	–	–	–	–
Massachusetts	–	–	–	–	–	–	–	–	21
Rhode Island	–	–	–	–	–	–	–	–	–
Connecticut	–	–	1	–	–	2	–	–	9
MIDDLE ATLANTIC	–	–	–	–	–	**9**	**5**	**2**	**137**
New York	–	–	–	–	–	6	4	1	37
New Jersey	–	–	–	–	–	1	–	–	36
Pennsylvania	–	–	–	–	–	2	1	1	64
EAST NORTH CENTRAL	–	–	–	–	–	**15**	–	–	**334**
Ohio	–	–	–	–	–	1	–	–	135
Indiana	–	–	–	–	–	3	–	–	69
Illinois	–	–	–	–	–	–	–	–	75
Michigan	–	–	–	–	–	4	–	–	42
Wisconsin	–	–	–	–	–	7	–	–	13
WEST NORTH CENTRAL	–	–	–	–	–	**3**	–	**1**	**47**
Minnesota	–	–	–	–	–	–	–	–	–
Iowa	–	–	–	–	–	–	–	–	11
Missouri	–	–	–	–	–	–	–	–	16
North Dakota	–	–	–	–	–	–	–	–	2
South Dakota	–	–	–	–	–	–	–	–	–
Nebraska	–	–	–	–	–	–	–	1	12
Kansas	–	–	–	–	–	3	–	–	6
SOUTH ATLANTIC	–	–	–	–	–	**11**	**2**	–	**85**
Delaware	–	–	–	–	–	–	–	–	5
Maryland	–	–	–	–	–	1	–	–	13
District of Columbia	–	–	–	–	–	–	–	–	1
Virginia	–	–	–	–	–	1	1	–	23
West Virginia	–	–	–	–	–	–	–	–	10
North Carolina	–	–	–	–	–	1	–	–	11
South Carolina	–	–	–	–	–	–	–	–	4
Georgia	–	–	–	–	–	–	–	–	–
Florida	–	–	–	–	–	8	1	–	18
EAST SOUTH CENTRAL	–	–	–	–	–	–	**1**	–	**175**
Kentucky	–	–	–	–	–	–	–	–	14
Tennessee	–	–	–	–	–	–	–	–	64
Alabama	–	–	–	–	–	–	1	–	15
Mississippi	–	–	–	–	–	–	–	–	82
WEST SOUTH CENTRAL	–	–	–	–	–	**1**	–	–	**79**
Arkansas	–	–	–	–	–	–	–	–	14
Louisiana	–	–	–	–	–	1	–	–	12
Oklahoma	–	–	–	–	–	–	–	–	11
Texas	–	–	–	–	–	–	–	–	42
MOUNTAIN	–	–	–	–	–	**3**	–	–	**6**
Montana	–	–	–	–	–	–	–	–	–
Idaho	–	–	–	–	–	–	–	–	3
Wyoming	–	–	–	–	–	–	–	–	–
Colorado	–	–	–	–	–	–	–	–	–
New Mexico	–	–	–	–	–	–	–	–	–
Arizona	–	–	–	–	–	1	–	–	2
Utah	–	–	–	–	–	2	–	–	1
Nevada	–	–	–	–	–	–	–	–	–
PACIFIC	**1**	**1**	–	**1**	**1**	**19**	**6**	–	**178**
Washington	–	–	–	–	–	–	1	–	25
Oregon	–	–	–	–	–	–	–	–	–
California	1	1	–	1	1	19	5	–	138
Alaska	–	–	–	–	–	–	–	–	13
Hawaii	–	–	–	–	–	–	–	–	2
Guam	–	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–	3

TABLE 4
REPORTED ENCEPHALITIS DEATHS, BY STATE AND ETIOLOGY, 1977

STATE	Area Total	Arbo-viral	Entero-viral	Associated with Childhood Infections: Measles	Mumps	Chicken-pox	Herpes simplex	Herpes zoster	Infect. Mono.	Indeter-minate
UNITED STATES	171	10	1	5	3	1	25	7	1	118
NEW ENGLAND	4	—	—	1	—	—	1	—	—	2
Maine	—	—	—	—	—	—	—	—	—	—
New Hampshire	—	—	—	—	—	—	—	—	—	—
Vermont	—	—	—	—	—	—	—	—	—	—
Massachusetts	2	—	—	—	—	—	—	—	—	2
Rhode Island	—	—	—	—	—	—	—	—	—	—
Connecticut	2	—	—	1	—	—	1	—	—	—
MIDDLE ATLANTIC	15	—	—	—	—	—	2	—	1	12
New York	9	—	—	—	—	—	1	—	—	8
New Jersey	2	—	—	—	—	—	—	—	—	2
Pennsylvania	4	—	—	—	—	—	1	—	1	2
EAST NORTH CENTRAL	19	2	—	1	—	1	2	—	—	13
Ohio	2	1	—	—	—	—	—	—	—	1
Indiana	5	—	—	—	—	1	1	—	—	3
Illinois	7	1	—	—	—	—	—	—	—	6
Michigan	2	—	—	—	—	—	—	—	—	2
Wisconsin	3	—	—	1	—	—	1	—	—	1
WEST NORTH CENTRAL	13	—	—	—	—	—	2	—	—	11
Minnesota	—	—	—	—	—	—	—	—	—	—
Iowa	—	—	—	—	—	—	—	—	—	—
Missouri	6	—	—	—	—	—	—	—	—	6
North Dakota	—	—	—	—	—	—	—	—	—	—
South Dakota	—	—	—	—	—	—	—	—	—	—
Nebraska	—	—	—	—	—	—	—	—	—	—
Kansas	7	—	—	—	—	—	2	—	—	5
SOUTH ATLANTIC	18	7	1	—	1	—	2	1	—	6
Delaware	—	—	—	—	—	—	—	—	—	—
Maryland	1	—	—	—	—	—	—	—	—	1
District of Columbia	—	—	—	—	—	—	—	—	—	—
Virginia	3	—	—	—	—	—	—	1	—	2
West Virginia	1	—	—	—	—	—	—	—	—	1
North Carolina	3	—	—	—	1	—	1	—	—	1
South Carolina	1	—	—	—	—	—	—	—	—	1
Georgia	1	—	1	—	—	—	—	—	—	—
Florida	8	7	—	—	—	—	1	—	—	—
EAST SOUTH CENTRAL	10	—	—	—	—	—	—	—	—	10
Kentucky	—	—	—	—	—	—	—	—	—	—
Tennessee	9	—	—	—	—	—	—	—	—	9
Alabama	—	—	—	—	—	—	—	—	—	—
Mississippi	1	—	—	—	—	—	—	—	—	1
WEST SOUTH CENTRAL	28	1	—	1	—	—	1	—	—	25
Arkansas	6	—	—	—	—	—	—	—	—	6
Louisiana	7	1	—	—	—	—	1	—	—	5
Oklahoma	1	—	—	—	—	—	—	—	—	1
Texas	14	—	—	1	—	—	—	—	—	13
MOUNTAIN	4	—	—	—	—	—	2	—	—	2
Montana	—	—	—	—	—	—	—	—	—	—
Idaho	2	—	—	—	—	—	—	—	—	2
Wyoming	—	—	—	—	—	—	—	—	—	—
Colorado	—	—	—	—	—	—	—	—	—	—
New Mexico	—	—	—	—	—	—	—	—	—	—
Arizona	—	—	—	—	—	—	—	—	—	—
Utah	2	—	—	—	—	—	2	—	—	—
Nevada	—	—	—	—	—	—	—	—	—	—
PACIFIC	60	—	—	2	2	—	13	6	—	37
Washington	6	—	—	—	—	—	—	1	—	5
Oregon	—	—	—	—	—	—	—	—	—	—
California	54	—	—	2	2	—	13	5	—	32
Alaska	—	—	—	—	—	—	—	—	—	—
Hawaii	—	—	—	—	—	—	—	—	—	—
Guam	—	—	—	—	—	—	—	—	—	—
Puerto Rico	—	—	—	—	—	—	—	—	—	—

Fig. 3 CASES OF ENCEPHALITIS PER 1,000,000 POPULATION, UNITED STATES, 1977



A. Arboviral Encephalitis (Arthropod-borne Encephalitis)

The total of 239 cases of arboviral encephalitis reported for 1977 (Figure 4) is only 57% of the total reported for 1976 and only 11% of the 1975 total. Nevertheless, with the exception of 1975 and 1976, the 1977 total is the highest since 1966, when 438 cases were reported (Table 5). The 132 SLE cases (Figure 5) accounted for 55% of the total, and 61% of the SLE cases were associated with the outbreak in Florida (see Section IV). Other states reporting SLE cases were: Illinois (13), Indiana (10), Texas (10), Mississippi (5), Ohio (4), Louisiana (3), Kentucky (2), and Alabama, New Jersey, and Tennessee (1 each). SLE activity, including the Florida outbreak, was generally not associated with urban concentrations of cases. The Florida outbreak, the first time SLE cases were reported from Florida since 1962, involved 110 laboratory-documented cases of SLE, including cases manifested as aseptic meningitis; these cases were widely scattered over 19 counties. The 65 cases of CE were all reported by North Central states except for 1 case from Connecticut and another from North Carolina. Cases from the North Central states were reported by Wisconsin (17), Illinois (15), Ohio (13), Minnesota (11), Indiana (5), and Iowa (2). The total of 41 cases of WEE was, with the exception of 1975 when 133 cases were reported, the largest total reported since 1966. WEE was reported by 10 states, with Colorado (11), Minnesota (9), and Texas (7) reporting the most cases. The only other case of arboviral encephalitis reported involved eastern equine encephalomyelitis (EEE) in Louisiana. Arboviral encephalitis cases in 1977 are shown by age group, sex, and etiologic agent in Table 6. SLE is predominantly a disease of older persons; of the 132 cases in which age was specified, 72% occurred in persons 40 years or older. In contrast, CE is recognized largely in younger persons; 85% of these cases involved persons younger than 20 years old. More than 20 cases of SLE and several cases of CE were reported as aseptic meningitis. These cases are included in the 1977 Aseptic Meningitis Surveillance Report.

Table 5
Cases of Arboviral Encephalitis, By Year and Etiologic Agent
1955–1977

Year	Etiology						Total
	WEE	EEE	SLE	CE	VEE	Pow	
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**
1965	172	8	58	59	–	–	297
1966	47	4	323	64	–	–	438
1967	18	1	11	53	–	–	83
1968	17	12	35	66	1	–	131
1969	21	3	16	67	1	–	108
1970	4	2	15	89	–	–	110
1971	11	4	57	58	19	1	150
1972	8	0	13	46	2*	1	70
1973	4	7	5	75	–	–	91
1974	2	4	72	30	–	–	108
1975	133	3	1,815	160	–	2	2,113
1976	1	0	379	47	–	–	427
1977	41	1	132	65	–	–	239

*Imported into the United States from Mexico
**Includes 1 case attributed to tensaw virus

Fig. 4 CASES OF ARBOVIRAL E

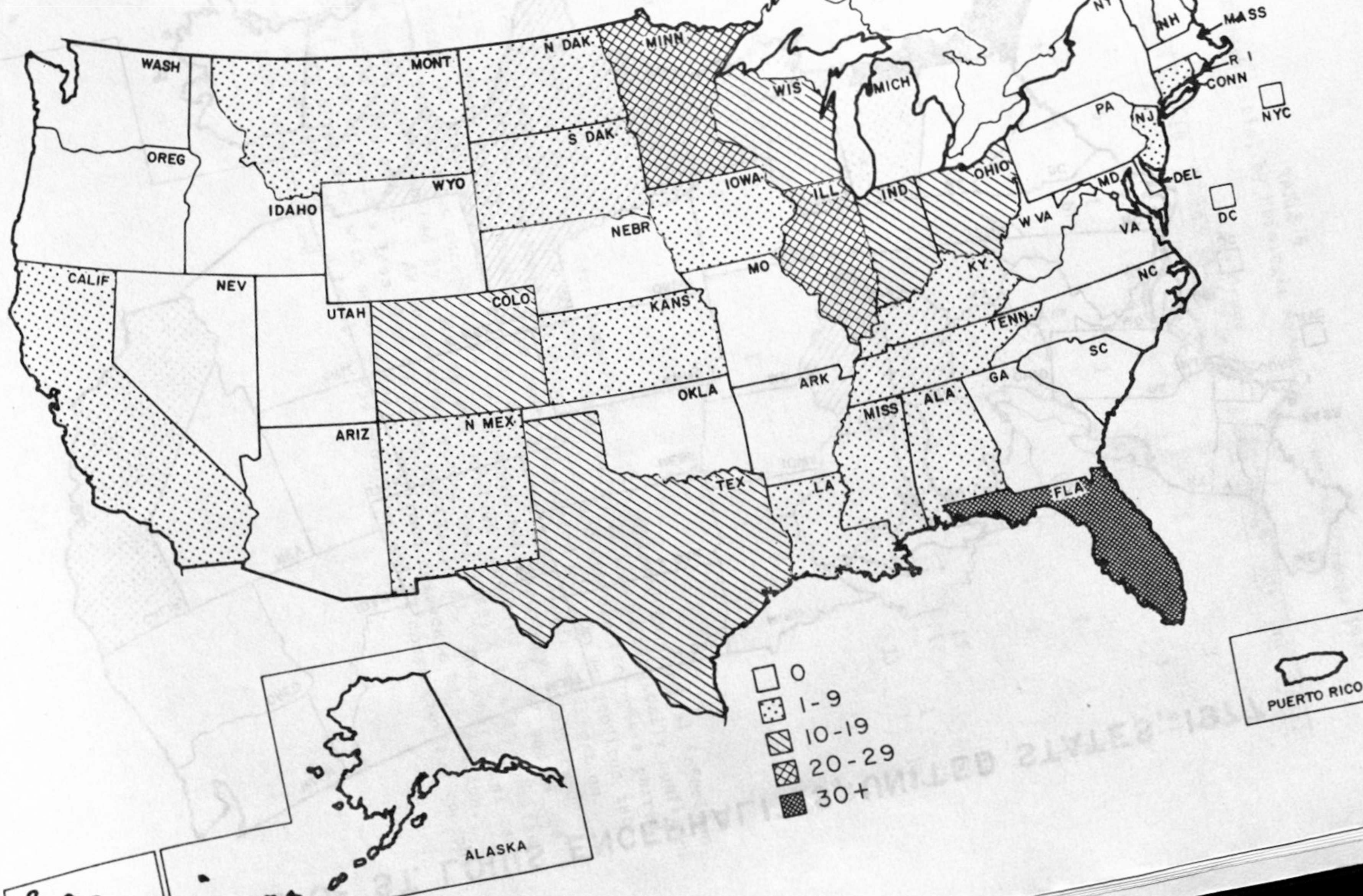


Fig. 5 CASES OF ST. LOUIS

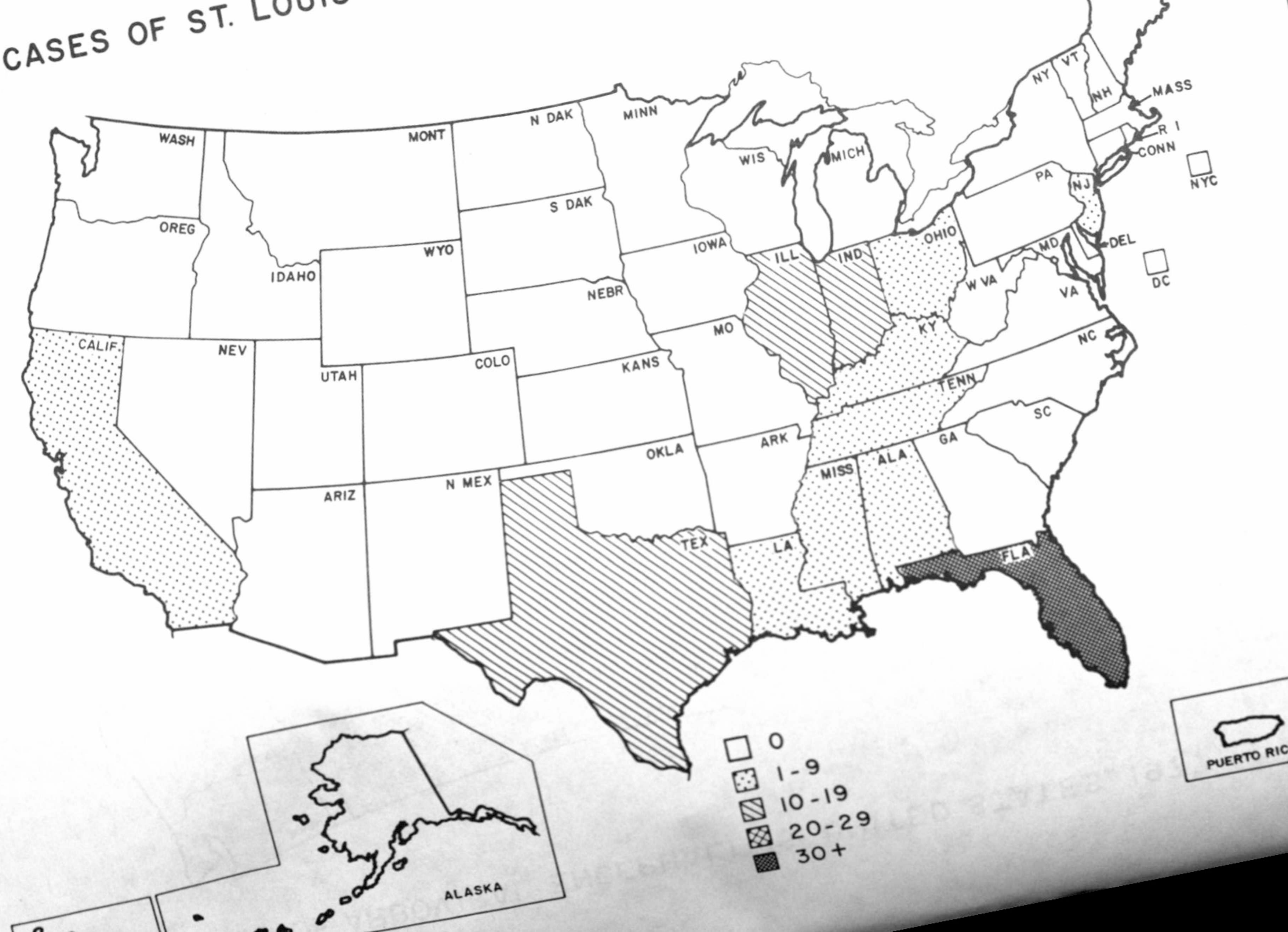


TABLE 6

Cases of Arboviral Encephalitis, by Etiologic Agent, Sex, and Age Group, 1977

Agent & Sex	Age Group <1	1-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70+	Unk	Total
WEE													
Male	1	4	4	3	6	5	1	3	1	1		3	32
Female	1		2			1			3		2		9
Total	2	4	6	3	6	6	1	3	4	1	2	3	41
EEE													
Male											1		1
Female													0
Total											1		1
SLE													
Male		1	6		5	5	3	8	5	14	15		62
Female				2	1	6	7	3	10	21	18		68
Unknown										1		1	2
Total		1	6	2	6	11	10	11	15	36	33	1	132
CE													
Male	2	6	21	6	2		1		1				39
Female	1	6	11	6	1	1							26
Total	3	12	32	12	3	1	1		1				65

B. Enteroviral Encephalitis

Only 17 cases of encephalitis were associated with confirmed enteroviral infection, i.e., an enterovirus was isolated from some CNS location or was serologically confirmed by a diagnostic rise in appropriately collected acute- and convalescent-phase paired sera (Table 7). There were 23 presumptive cases associated with an enterovirus isolated from throat or stool specimens without accompanying serologic confirmation. These cases were tabulated as encephalitis of indeterminate etiology. Confirmed enterovirus cases were reported by 7 states and involved echovirus 6, 9, and 14 and coxsackievirus A9, B3, and B5. As in previous years, most cases (all with specified age for 1977) were in persons less than 40 years old (Table 8). The only fatal case involved a Georgia resident with serologically confirmed coxsackie B3 infection. In the 10-year period 1968-1977, a total of 859 echovirus and 87 coxsackievirus encephalitis cases have been reported.

TABLE 7
Cases of Encephalitis Associated with a Confirmed Enteroviral Infection, by Virus Type and State, 1977

Virus Type	Alaska	Georgia	Iowa	Kansas	N. Carolina	Ohio	Wisconsin	Total
Coxsackie								
A9	1			1				2
B3		1				1		2
B5					1			1
Unknown			1					1
Echovirus								
6						7	1	8
9			2					2
14							1	1
Total	1	1	3	1	1	8	2	17

TABLE 8
Cases of Enteroviral Encephalitis, by Sex and Age Group, 1977

	Age Group												
Sex	<1	1-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70+	Unk	Total
Male		3	1	3		1						2	10
Female	1		1	1		2	1					1	7
Total	1	3	2	4		3	1					3	17

C. Encephalitis Associated with Childhood Infections

The 1977 total of 119 cases of encephalitis associated with childhood infections was the lowest annual total in United States records. The secular decline of cases associated with childhood infections has followed the decline in the national incidence of measles, mumps, and rubella infections that began with the effective vaccination against these diseases (Tables 9 and 10). Five of the 32 cases of reported measles encephalitis resulted in death. Although the 32 case total is lower than the 44 cases reported for 1976, it is markedly higher than the totals reported for 1974 and 1975. The increase in reported cases following measles for 1976 and 1977 may be associated with scattered outbreaks of measles and with closer surveillance resulting from increased interest. Mumps encephalitis was reported from a total of 18 states; 3 cases were fatal. There is no vaccine approved to prevent chickenpox infection, and the number of chickenpox-associated encephalitis cases has not declined to the extent that the number associated with vaccine-preventable childhood exanthems has. Only 1 of the 43 cases of encephalitis following chickenpox infection was fatal. One case of encephalitis was associated with rubella infection, reflecting the relatively small number of rubella cases and the consistently low rate of encephalitic involvement. In the 10-year period 1968-1977, the following totals of encephalitis cases associated with childhood infections have been reported: mumps, 2,030; chickenpox, 605; measles, 321; and rubella, 26.

Table 9
Encephalitis Cases and Deaths Associated with Childhood Infections, By Year and Type of Infection, United States 1963-1977

Year	Measles			Mumps			Chickenpox			Rubella		
	No. of Cases	No. of Deaths	Death/Case Ratio (%)	No. of Cases	No. of Deaths	Death/Case Ratio (%)	No. of Cases	No. of Deaths	Death/Case Ratio (%)	No. of Cases	No. of Deaths	Death/Case Ratio (%)
1963	239	30	12.6	671	6	0.9	84	21	25.0	–	–	–
1964	300	46	15.3	932	18	1.9	106	32	30.2	–	–	–
1965	171	21	12.3	634	4	0.6	112	29	25.9	–	–	–
1966	219	29	13.2	628	10	1.6	106	29	27.4	–	–	–
1967	62	6	9.7	849	8	0.9	77	24	31.2	–	–	–
1968	19	1	5.3	408	2	0.5	69	17	24.6	–	–	–
1969	35	5	14.3	218	5	2.3	48	12	25.0	–	–	–
1970	27	2	7.4	288	5	1.7	46	15	32.6	–	–	–
1971	69	10	14.5	310	5	1.6	54	13	24.1	–	–	–
1972	26	6	23.1	163	0	0	52	18	34.6	–	–	–
1973	37	8	21.6	214	3	1.4	102	14	13.7	–	–	–
1974	14	2	14.3	149	2	1.3	54	10	18.5	–	–	–
1975	17	5	29.4	166	4	2.4	54	12	22.2	–	–	–
1976	44	6	13.6	71	2	2.8	59	6	10.2	2	0	0
1977	32	5	15.6	43	3	7.0	43	1	2.3	1	0	0
Total	1,311	182	13.9	5,744	77	1.3	1,066	253	23.7	3	0	0

Table 10
Cases of Childhood Infections and Number of Cases Associated with Encephalitis, By Year and Type of Infection, United States, 1960-1977

Year	Measles			Mumps			Rubella			Chickenpox		
	No. of Cases	No. of Cases Assoc. with Encephalitis	Rate Per 100,000 Cases	No. of Cases	No. of Cases Assoc. with Encephalitis	Rate Per 100,000 Cases	No. of Cases	No. of Cases Assoc. with Encephalitis	Rate Per 100,000 Cases	No. of Cases	No. of Cases Assoc. with Encephalitis	Rate Per 100,000 Cases
1960	441,703	299	67.7	*	700	–	*	0	–	*	0	–
1961	423,919	276	65.1	*	400	–	*	0	–	*	0	–
1962	481,530	337	70.0	*	385	–	*	0	–	*	0	–
1963	385,156	239	62.1	*	671	–	*	0	–	*	0	–
1964	458,083	300	65.5	*	932	–	*	59	–	*	0	–
1965	261,904	171	65.3	*	634	–	*	7	–	*	0	–
1966	204,136	219	107.3	*	628	–	46,975	10	21.3	*	0	–
1967	67,705	62	98.9	*	849	–	46,888	7	14.9	*	0	–
1968	22,231	19	84.0	152,209	408	268.0	49,371	6	12.2	*	0	–
1969	25,826	35	135.5	90,918	218	239.8	57,686	3	5.2	*	0	–
1970	47,251	27	57.0	104,953	288	274.4	56,552	7	12.4	*	0	–
1971	75,290	69	91.6	124,939	310	248.1	45,086	3	6.7	*	0	–
1972	32,275	26	83.4	74,215	163	219.6	25,507	2	7.8	164,114	52	31.7
1973	26,690	37	138.6	69,612	214	307.4	27,804	1	3.6	182,927	102	55.8
1974	22,094	14	63.4	59,128	149	252.0	11,917	1	8.4	141,495	54	38.2
1975	24,374	17	69.7	59,647	166	278.3	16,652	0	0.0	154,248	54	35.0
1976	41,126	44	107.0	38,492	71	184.5	12,491	2	16.0	183,990	59	32.1
1977	57,345	32	55.8	21,436	43	200.6	20,395	1	4.9	188,396	43	22.8

*National reporting of mumps began in 1968, rubella in 1966, and chickenpox in 1972.

Encephalitis cases caused by childhood infections occurred primarily in the younger age groups (Table 11). Of those cases for which age-specific data are available, most occurred in persons younger than 20 years old: 88% of the cases associated with chickenpox, 93% associated with measles, and 81% associated with mumps. The numbers of reported cases of childhood infection-associated encephalitis were too small to allow representative observations regarding sex distribution.

TABLE 11
Encephalitis Cases Associated with Childhood Infections,
by Etiology, Sex, and Age Group, United States, 1977

Etiology and Sex	Age Group											
	<1	1-4	5-90	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70+	Unk	Total
Measles													
Male	1	1	4	5	2	1							14
Female		5	4	4	4	1							18
Total	1	6	8	9	6	2							32
Mumps													
Male		2	5	7	2			2		1			19
Female		3	10	2	1	2	1	1	1				21
Unknown				1								2	3
Total		5	15	10	3	2	1	3	1	1		2	43
Chickenpox													
Male	2	4	12	3		1							22
Female	1	6	12	1								1	21
Total	3	10	24	4		1						1	43
Rubella													
Male													0
Female					1								1
Total					1								1

D. <u>Encephalitis with Other Documented Etiology</u>

The other 85 cases of encephalitis with documented etiology are shown by age group, sex, and etiologic agent in Table 12. Herpes simplex encephalitis accounted for 74% of these cases and 25 (76%) of the 33 associated fatalities, with a case-fatality ratio of 40%. Herpes simplex cases occurred in persons of all ages and were not associated with any recognized outbreaks or particular season. The 14 herpes zoster cases were associated with a 50% case-fatality ratio, the highest for any etiologic group. Six of the 14 zoster cases involved patients aged 70 or older. The other cases of encephalitis with a determined etiology involved infectious mononucleosis (3), adenovirus (1), parainfluenza (1), respiratory syncytial virus (1), and <u>Mycoplasma pneumoniae</u> (1).

TABLE 12

Cases of Encephalitis with Other Known Etiology, by Etiologic Agent, Sex, and Age Group, United States, 1977

Etiology	Sex	<1	1-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70+	Unk	Total
		Age Group												
Para-influenza	Male													0
	Female		1											1
Adenovirus	Male													0
	Female		1											1
Respiratory syncytial virus	Male													0
	Female						1							1
Influenza A	Male													0
	Female			1										1
H. simplex	Male	2	2		4	2	6	2	4	6	4	3	1	36
	Female	3		1		3	4	4	2	3	6	1		27
H. zoster	Male		1	1							1	4		7
	Female								2	2	1	2		7
Infectious mono.	Male					1								2
	Female					1								1
M. pneumoniae	Male				1									1
	Female													0

E. Encephalitis of Indeterminate Etiology

The 1,076 cases of indeterminate etiology represent 70% of all encephalitis cases reported for 1977. Cases of unknown etiology have represented the majority of reported cases every year except for 1975, when arboviral cases were in the majority. Encephalitis cases of indeterminate etiology and associated deaths are shown by age group and sex in Table 13. Cases involved males (55%) somewhat more frequently than females, but no single age group predominated. The fatality rate was higher for persons less than 1 year of age or 40 years of age or older; the highest rate (39%) involved persons 60 or older. Although cases of indeterminate etiology occurred through 1977, the incidence peaked in late summer about the same time that cases of arboviral and enteroviral etiology peaked.

TABLE 13

Encephalitis Cases and Deaths with Indeterminate Etiology, by Sex and Age Group, United States, 1977

	<1	1-4	5-9	10-14	15-19	20-29	30-39	40-49	50-59	60-69	70+	Unk	Total
	Age Group												
Cases													
Male	39	67	96	80	57	78	37	27	35	27	23	16	582
Female	24	59	52	66	52	87	33	27	26	25	24	10	485
Unknown		3					1			1		4	9
Total	63	129	148	146	109	165	71	54	61	53	47	30	1,076
Deaths													
Male	3	4	3	7	4	8	2	6	9	11	8		65
Female	4	3	4	5	1	6	3	1	6	10	10		53
Total	7	7	7	12	5	14	5	7	15	21	18		118
Death Rate (%)	11.1	5.4	4.7	8.2	4.6	8.5	7.0	13.0	24.6	39.6	38.3	0	11.0

IV. SPECIAL REPORT

Outbreak of St. Louis Encephalitis in Florida

No St. Louis encephalitis (SLE) had been reported from Florida since 1962, when an outbreak occurred in the urban counties of Pinellas, Hillsborough, Manatee, and Sarasota, located on the west coast of Florida. The 1962 outbreak culminated a period of extensive SLE activity marked by outbreaks in the Tampa Bay area in 1959 and 1960. Except for some scattered cases in animals, no SLE had been detected in Florida from 1963 through 1976.

By October 25, 1977, approximately 20 SLE cases had been diagnosed in Florida. An investigation team consisting of epidemiologists and ecologists from the Florida State Department of Health and Rehabilitative Services, assisted by CDC workers, began to search for SLE in humans and animals in late October. The investigation team established a surveillance program for clinical cases of SLE throughout Florida, with emphasis on the central and southern counties where cases had been reported. The infection control nurse, nurse epidemiologist, or chief of the infection control board for each hospital was instructed to report cases of encephalitis, aseptic meningitis, or febrile headache to the county health department once a week. The county, in turn, notified the state of all suspected cases of SLE. Mosquito abatement programs, which were already in effect, were intensified in affected areas. The person in the hospital responsible for reporting cases also encouraged the collection and shipment of proper serologic specimens to the state laboratory so that the diagnosis of SLE could be confirmed or ruled out.

In the counties reporting cases of SLE, hospital records were examined to detect possible additional cases. All cases were categorized as confirmed or presumptive SLE based on laboratory testing.

From August 8 through December 5, 1977, 110 laboratory-presumptive or laboratory-confirmed cases were reported from central and south Florida (Figure 6). In 65 instances the clinical syndrome of encephalitis was documented; in the other 45 cases the illness was less severe (e.g., aseptic meningitis), or the clinical status was not available. The 69 confirmed and 41 presumptive cases, which reached a peak the week of October 21, were reported from 19 counties (Figure 7). The highest attack rates occurred in central Florida counties that had not reported human cases of SLE in the 1962 outbreak.

The attack rate for the area outside standard metropolitan statistical areas (SMSAs) was 5.10 per 100,000 population, and the attack rate within SMSAs was 1.25 per 100,000 ($p < .001$). The attack rates both for rural areas outside SMSAs (3.8) and for other urban areas outside SMSAs (5.8) were significantly higher than the attack rate for central cities within SMSAs (1.2).

In this outbreak cases did not appear to spread from a central focus as they did in the outbreak of 1962; instead they occurred in the counties involved concurrently, with no evidence of spread from 1 area to another.

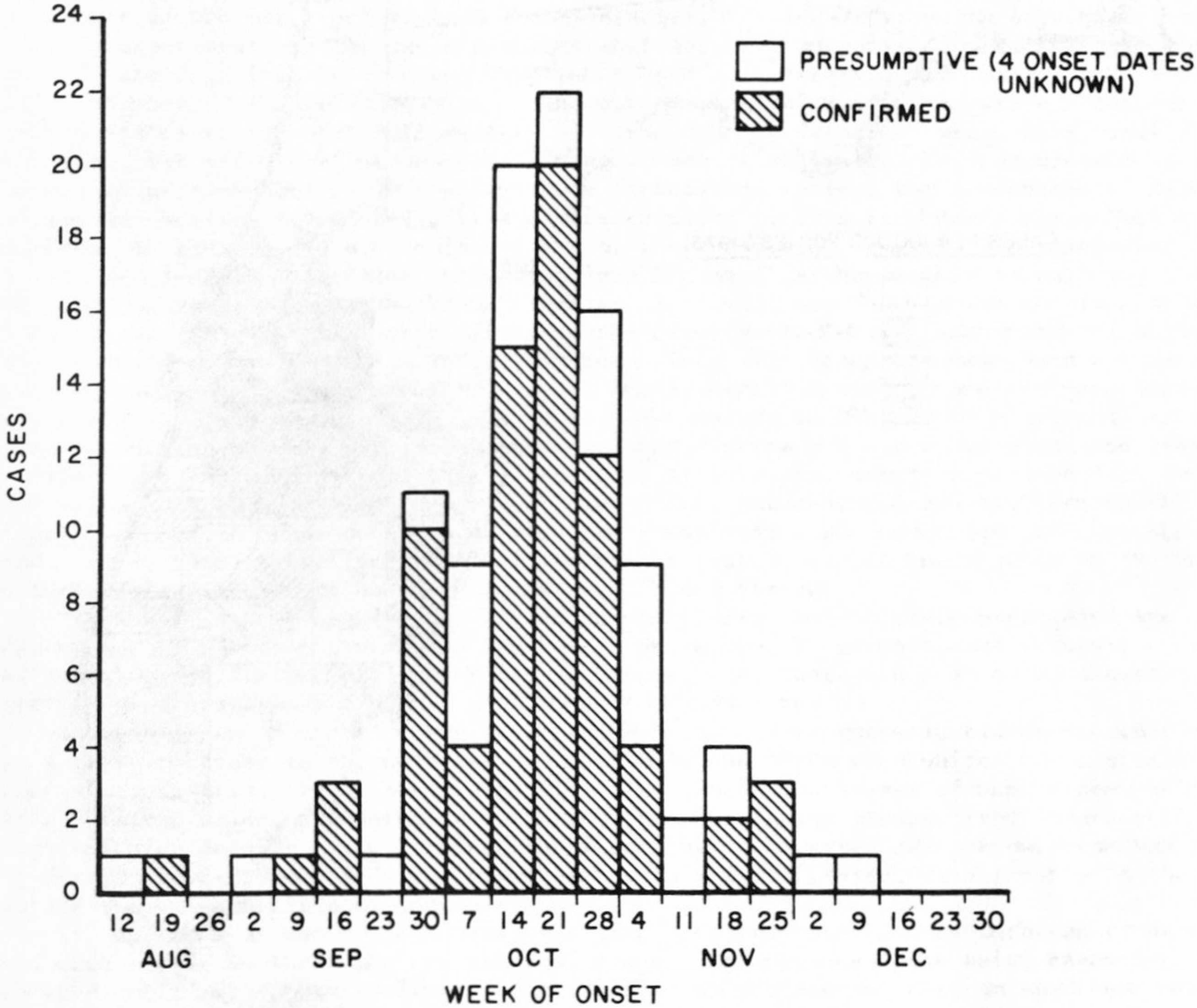
Analysis of age distribution revealed that overall there was a significant correlation between advancing age and clinical attack rate; however, the rate for persons aged 15-24 was somewhat higher than the rate for those aged 35-44, and approximately the same as for the age group 55-64. The overall high rate in the age group 15-24 was attributable to the elevated attack rate in males aged 15-24 (3.46 cases/100,000).

Limited occupational data were available on cases in this outbreak. Fifty-four percent of the persons aged 15-24 had outdoor occupations or avocations, but only 16% of other age groups had outdoor occupations or avocations; this was statistically significant ($p < .05$). In addition, all patients with SLE in the 15- to-24-year age group with a history of work or recreation outdoors resided in noncentral city areas, and all but 1 in non-SMSA areas.

No significant difference occurred in attack rates by race. This is in contrast to the Florida outbreak in the early 1960s when the attack rate for whites was significantly higher than the rate for blacks.

Fig. 6

ST. LOUIS ENCEPHALITIS CASES, BY WEEK OF ONSET, FLORIDA, 1977*



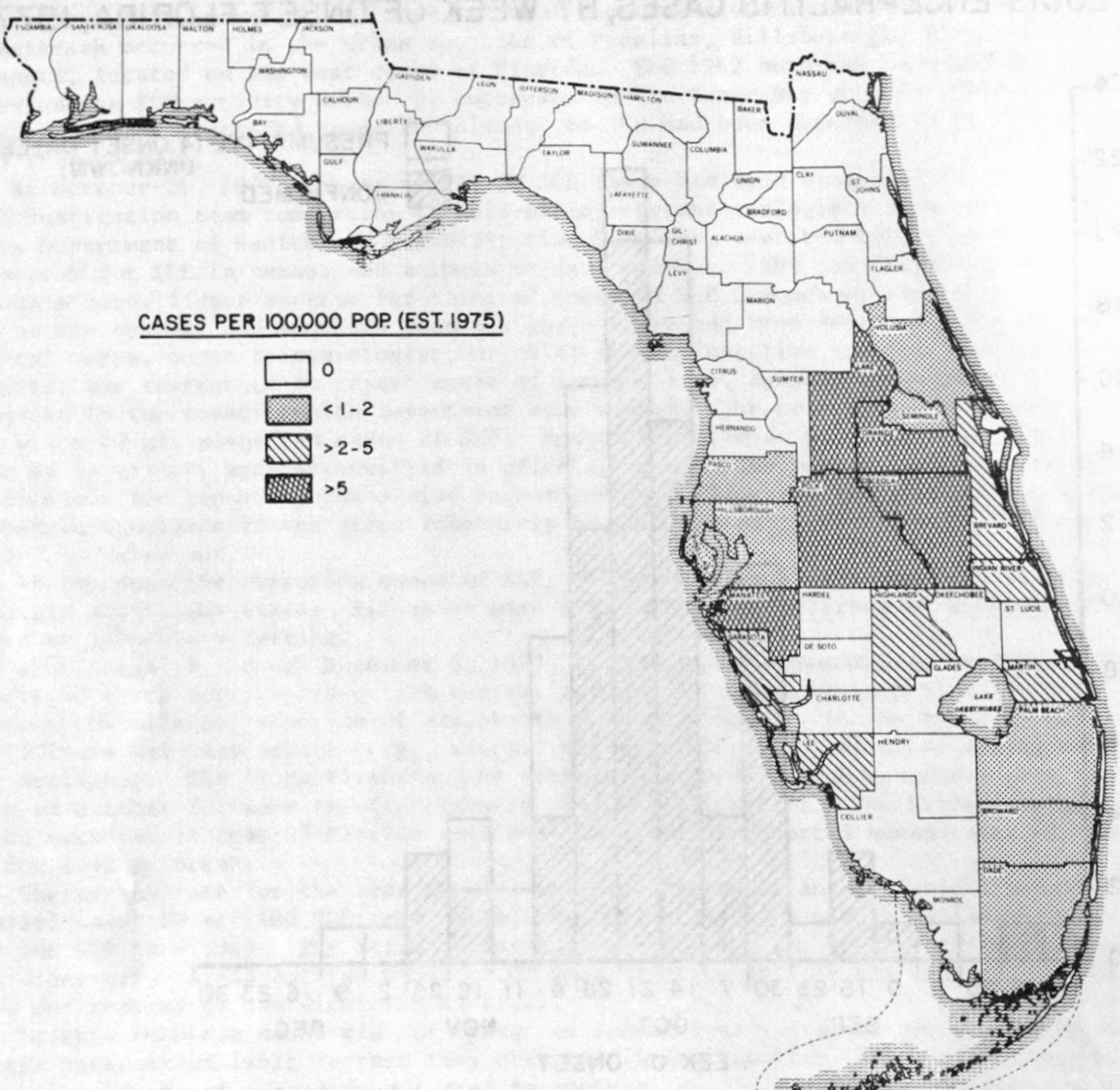
*NO CASES JAN.-JULY

As seen in other outbreaks of SLE, the severity of clinical presentation was age-dependent. A significant correlation of .76 was present between advancing age and clinical encephalitis. A significant negative correlation of -.84 was present between aseptic meningitis and advancing age. No correlation was found between age and febrile headache; however, the numbers were too small to be adequately evaluated.

The case-fatality ratio for this outbreak was 7.2%, far below the case-fatality ratio in 1962 of 19.2%. It may have been related to the greater number of young people seen in this outbreak, to lower virulence, or to higher case ascertainment. The trend of age-specific case-fatality ratios was typical for SLE, and all persons who died were over age 55.

Fig. 7

ST. LOUIS ENCEPHALITIS CASES, BY COUNTY, FLORIDA, 1977



The extent and type of control effort was dependent on resources of individual counties. When a county was notified of a case of SLE, control emphasis was switched to adulticiding for Culex nigripalpus, and efforts were made to educate the population regarding the best methods for avoiding contact with mosquitoes: wearing long-sleeved garments, using mosquito repellent, and avoiding outdoor activity at dusk.

In 1977 changes in control efforts were made in Florida when a county was notified that a human case of SLE had occurred there. Since documentation of cases required laboratory confirmation, counties received this information late in the outbreak. In the 5-county area of Polk, Pinellas, Hillsborough, Manatee, and Sarasota, for example, the first case in the 1977 outbreak was not reported until October 27, although the clinical onset had occurred in early October. In 74% of the cases clinical onset had occurred before October 27. Of the 11 persons who had onset after October 27, only 1 had onset of clinical symptoms later than November 2, and all onsets occurred within the estimated 2-week incubation period for SLE, i.e., between October 27 and November 10. Thus, if the decrease in cases had been due to control methods, it would mean that immediately upon notification of SLE cases, the counties in this area were able to prevent the occurrence of additional infections through aggressive mosquito control. This appears highly unlikely.

This outbreak of SLE presents several features that distinguish it from typical outbreaks of SLE described east of the Mississippi (1-3). Previous reports have described outbreaks in the eastern states that were urban-centered, with the epidemic period extending from June through September, and an increasing clinical attack rate being associated with advancing age. The epidemiology of SLE in the western part of the United States is somewhat different (4,5): the vector, *Culex tarsalis*, is a rural mosquito, SLE affects males more than females, and clinical attack rates are often higher in persons aged 20-30 years. These factors may reflect the occupational exposure of persons working around the irrigated fields where *C. tarsalis* breeds (5). The outbreak in Florida did not follow either of these patterns exactly. The epidemic period was late in the season, extending into December. Although this is unusual, it has occurred previously in outbreaks in Florida. A significant feature was the lack of an urban focus. Attack rates were lowest in the heavily populated urban areas and highest in the small towns of rural, central Florida. This difference may have been due to the vector involved. *Culex pipiens* mosquitoes are primarily urban and are the responsible vectors for SLE in eastern outbreaks (6,7). The vector in Florida is historically, and in this outbreak, the semitropical species *Culex nigripalpus*, found in rural and urban surroundings (8). Moreover, it is interesting to note that urban birds used for surveillance had a very low conversion rate to SLE, but sentinel and backyard chicken flocks located in areas outside the city had relatively high conversion rates to SLE. Indirectly, this may reflect the activity of the vector, and it corresponds to the nonurban distribution of human cases seen in this outbreak.

The significantly higher attack rate in males aged 15-24 closely paralleled the experience of SLE in the west and may have been related to occupational exposure. Although we had limited data on patients' occupations, there did seem to be a higher percentage of persons aged 15-24 with outdoor occupations.

No significant difference was noted between the attack rates in blacks and whites. This is in contrast to the outbreak in Florida in the 1960s when whites had a significantly higher attack rate than blacks (1). In previous outbreaks of SLE, race-specific attack rates varied, depending on whether or not the racial groups lived in areas of high mosquito density (9,10). Since the distribution of cases in this outbreak was different from that of 1962, one might expect to see a different relationship in the SLE attack rates between blacks and whites.

It appears that control measures were initiated too late in this outbreak to have had much effect on the number of clinical cases. In instances like this, cases are not defined until laboratory-confirmed, particularly when acute-phase serum specimens are not being tested independently of convalescent-phase specimens and control measures are not instituted until 3-4 weeks into the outbreak, a time when the number of cases may have peaked and may be diminishing spontaneously.

After the outbreak, many of the techniques developed to monitor mosquito, animal, and human infection with SLE and other arboviruses were incorporated into a statewide plan for arboviral surveillance and control. The procedures now in operation give promise of ensuring the most rapid and effective control if another arboviral outbreak should develop.

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The State Epidemiologists are the key to all disease surveillance activities and their contributions to this report are gratefully acknowledged. In addition, valuable contributions are made by State Laboratory Directors.

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*Dual Assignment

11/30/79