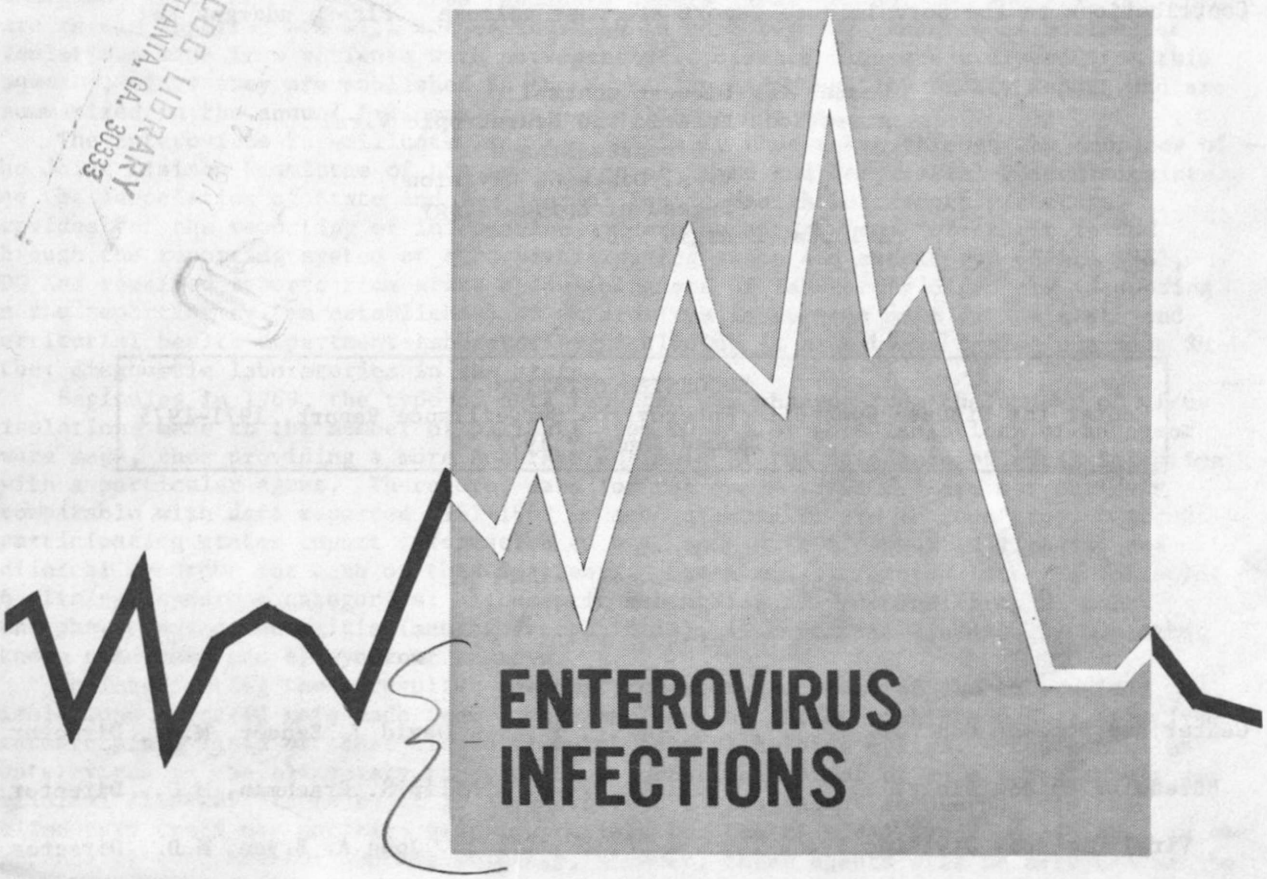
ENTEROVIRUS SURVEILLANCE
1971-1975
Issued January 1977

CENTER FOR DISEASE CONTROL

ENTERIC AND NEUROTROPIC VIRAL DISEASES

SURVEILLANCE



U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL

PREFACE

Summarized in this report is information received from state health departments, university investigators, virology laboratories, and other pertinent sources, both 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. Please address to:

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

SUGGESTED CITATION
Center for Disease Control: Enterovirus Surveillance Report, 1971-1975
Issued January 1977

I. SUMMARY

From 1971 through 1975, the total annual number of enteroviruses isolated per 10 million people in the states and territories that report this information to the Center for Disease Control ranged from 59.8 to 112. Enteroviral infections occurred predominantly in males, and children under 1 year of age were most frequently affected. Peak months of disease onset were July, August, and September.

II. INTRODUCTION

This report, which covers the 5-year period 1971 through 1975, summarizes surveillance data on enteroviruses, 1 of the 3 genera in the Picornaviridae family. (The other 2 genera are rhinovirus and calcivirus.) As shown in Table 1, there are 4 major groups of enteroviruses: poliovirus, coxsackie A, coxsackie B, and echovirus. In addition, there are 4 enterovirus candidate agents (Nos. 68, 69, 70, and 71), but these are rarely reported and will not be included in this report. Reports of poliovirus isolations made from patients with neuroparalytic disease also are excluded from this summary, since they are published in the Morbidity and Mortality Weekly Report and are summarized in the annual Poliomyelitis Surveillance Report.

The Enterovirus Surveillance Program, initially undertaken through the auspices of the Joint Liaison Committee of the Conference of State and Territorial Epidemiologists and the Association of State and Territorial Public Health Laboratory Directors, provides for the reporting of information concerning enterovirus infections to CDC through the reporting system of each participating state and territory. Since 1961, CDC has received reports from state epidemiologists or laboratory directors (depending on the reporting system established) of enterovirus isolations made in the state and territorial health department laboratories, including in some cases isolations made in other diagnostic laboratories in the state.

Beginning in 1969, the type of data reported was changed from the number of virus isolations made to the number of patients from whom 1 or more isolations of an agent were made, thus providing a more accurate estimate of the incidence of viral infection with a particular agent. Therefore, data for the years 1969-1975 are not entirely comparable with data reported 1961-1968 because of this change in reporting. Currently, participating states report information on age, sex, date of onset of illness, and clinical syndrome for each of these patients. Cases are classified into the following 6 clinical syndrome categories: 1) aseptic meningitis, 2) encephalitis, 3) both encephalitis and meningitis (meningoencephalitis), 4) paralytic disease, 5) any other known syndrome, and 6) syndrome unknown.

In interpreting these results, one must remember that most of the enterovirus isolations reported were made from stool specimens or throat washings rather than from cerebrospinal fluid or other tissue from the central nervous system. Presence of an enterovirus in the alimentary tract does not constitute proof of an etiologic role in clinical illness. In fact, it is possible that a viral agent recovered from the alimentary tract may not have been responsible for the clinical syndrome listed. In the absence of evidence for another etiology, however, these agents will be accepted as the probable etiologic agents.

Because of the large number of serotypes and the absence of easily identifiable group-specific antigens, "blind" agent-specific serology usually is not feasible in the diagnosis of a particular clinical syndrome. However, isolation of the common enteroviruses is readily accomplished by using standard tissue culture systems, or infant mouse inoculation for some coxsackie A viruses, and identification is then possible. Thus, this surveillance summary is based on laboratory reports from the states and territories which performed the isolations.

III. EPIDEMIOLOGY OF REPORTED CASES, 1971-1975

Table 2 lists participating states and territories in the years 1971 through 1975. The number of reporting areas ranged from 19 (in 1973 and 1975) to 35 (in 1972). Data accounted for from 57% (in 1975) to 89% (in 1972) of the total United States population.

For purposes of this report, the states have been grouped in 3 zones based on climatic similarities (Figure 1). This was done so that states with both longer and shorter periods of warm weather, the climatic condition under which enterovirus activity is always greatest, could be studied. Data for selected viral agents were computed in 1971, including 5 of the 6 coxsackie B viruses, 28 of the 31 echoviruses, and only 6 of the 23 coxsackie A viruses; therefore, in some tables the 1971 data could not be completely analyzed. In those instances, a notation is made.

In 1971 there were 92.9 total enteroviruses isolated per 10 million persons in those states reporting. In the 4 succeeding years, the total number ranged from 59.8 to 112.0 (Table 3). Such variation correlates well with the presence or absence of epidemics of various agents in those years.

A. Male/Female Ratios

Enterovirus infections were reported consistently more frequently in males than in females (Table 4). The male/female ratio ranged from 1.33 to 1.54 for total non-polio enteroviruses in the 5-year period, but there was a wider range of ratios if the 3 major groups of agents are examined individually.

B. Age

Figure 2 shows the number of isolates of selected epidemic agents per 10 million persons by age, based on 1970 census data. Incidence was clearly age-related, with peak isolation rates occurring in children under 1 year of age. This may imply a higher attack rate in that age range, or it may simply reflect a reporting artifact, since neonatal and infant diseases probably are more alarming to clinicians than diseases found in others. The greater incidence of rashes in children than in adults may also contribute to more attempts to isolate viruses--there simply are more suspected cases of enteroviral infection in children.

It is interesting to note that for 4 of the 5 agents examined (Figure 2), secondary peaks occurred in children in age groups 5-9 or 10-14 and in adults 20-29 years old, suggesting possible age clusters of susceptibles, or--particularly in the latter age group--increased exposure to transmitters of disease. In 1972 coxsackie B5 infections showed no clusters in age groups 5-10, 10-14, or 15-19. One hypothesis to explain this phenomenon might be that many of these children had been in school during the 1967 epidemic of coxsackie B5, and some during the 1961 epidemic. Close school contacts probably allowed for better transmission of the agent, and thus students may have acquired greater protective immunity.

The pattern of echovirus type 9, which was epidemic in the years 1971 and 1975, is also of particular interest. In 1971 there was a secondary peak of incidence in the age group 5-9, and in the 1975 epidemic there was a secondary peak in the age group 10-14. Most of the children in the latter age group had been 5-9 years old in the previous epidemic. Why this unexpected pattern occurred is not readily apparent.

C. Geographic Locations

Table 5 shows the number of isolates of the various groups of enteroviruses per 10 million persons in the reporting states by year and climatic zone. Although in 4 of the 5 years more enteroviruses were isolated in zone I, no consistent trends in frequency of isolation by geographic location are otherwise apparent; however, zone I usually provided the most isolates and zone II the least. The differences within each given year may be explained by the different individual states reporting in that year and by their various systems of receiving reports and analyzing specimens. Also, since many states that reported numerous echovirus isolates reported few if any coxsackie A virus isolates, there is a possibility that states differed in their ability to detect certain agents, expecially when more difficult techniques were required such as infant mouse inoculation in searching for certain coxsackie A viruses.

D. Seasonal Pattern

Figures 3-7 document the well-known fact that enteroviral infections occur predominantly in the warmest months. In all 5 years the peak month for disease onset was

either July, August, or September for not only the 3 major groups of enteroviral agents, but also for the various epidemic agents. Coxsackie B disease peaked in August in all 5 years, coxsackie A disease peaked in July or August, and echoviruses peaked in August in 4 of the 5 years, and in September in the other year.

Epidemics that occurred seemed to increase only the total number of isolates, without displacing or distorting the seasonal pattern. In the 5-year period all epidemics occurred in the season that maximum enterovirus activity would be expected to occur in normal or nonepidemic years.

E. Diagnostic Categories

Table 6 summarizes the percentages of persons in each diagnostic category for the total 5-year period for several enteroviral agents. These agents were selected because of their prevalence or their occurrence in epidemic form in the 5-year period. The diagnosis of paralysis was rarely made, and except for the case of echovirus type 3 (which was epidemic in 1971) meningoencephalitis was diagnosed uncommonly.

Table 7 shows the percentage of isolates associated with the various enteroviral agents for each year. In most instances where the diagnostic category percentages differ markedly, the actual number of isolates is small.

Figures 8-10 present isolates by 3 major diagnostic categories and by patient's age group for the years 1972, 1974, and 1975. Although secondary peaks occurred in either the age groups 5-9 or 10-14 for aseptic meningitis and encephalitis, the diagnostic category for other known syndrome does not consistently show this pattern. However, for all 3 years there was a relative secondary peak in the 20- through 29-year-old age group.

F. Epidemic Activity

Tables 8, 9, and 10 show the number of isolates per 10 million persons in the reporting states by year for each of the 63 common enteroviruses. For the purpose of this report, an epidemic is defined as the incidence of a particular agent's isolation in a given year that is more than 3 times greater than would be expected by examining the average number of isolations for the other years. As mentioned earlier, for some of the coxsackie A viruses and 3 of the echoviruses, 1971 data were not available. Agents were not considered to be epidemic in those instances where isolations were so infrequent as to make interpretation unreliable.

Echovirus types 3 and 4 were epidemic in 1971, coxsackie B1 and B5 in 1972, coxsackie A9 in 1973, echovirus type 16 in 1974, and echovirus types 9, 21, and 33 in 1975. In the instances of echovirus types 21 and 33, however, "epidemics" did not so much reflect widespread national occurrence as they reflected several large outbreaks in only a few states. There were no apparent major epidemics in 1973 and 1974. The isolation of only 59.8 enteroviruses per 10 million persons in 1973 was the lowest number recorded for any year in the 5-year period.

Table 1
Enteroviruses and Types

Poliovirus	Coxsackie A	Coxsackie B	Echovirus	Enterovirus
1 - 3	A1 - A22 A24	B1 - B6	1 - 9 11 - 27 29 - 33	68 - 71

Table 2
Reporting States and Territories,
By Year and Climatic Zone, 1971-1975

1971

- Connecticut, Massachusetts, Michigan, Minnesota, Wisconsin
- Illinois, Indiana, Iowa, Kansas, Maryland, Nebraska, New York, New York City, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Virginia, Washington
- Alabama, Arizona, California, Florida, Georgia, Hawaii, Louisiana, Texas

1972

- Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, Vermont, Wisconsin
- Arkansas, Delaware, Illinois, Indiana, Iowa, Kansas, Maryland, New Jersey, New York, North Carolina, Ohio, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Virginia, Washington, West Virginia
- Alabama, Arizona, California, Florida, Georgia, Hawaii, Louisiana, Texas

1973

- Massachusetts, Michigan, Minnesota, Wisconsin
- Illinois, Kansas, Missouri, New Jersey, New York, Ohio, Oregon, South Carolina, Tennessee, Virginia
- Arizona, Florida, Georgia, Louisiana, Texas

1974

- Connecticut, Massachusetts, Michigan, Minnesota, Wisconsin
- Illinois, Kansas, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Tennessee, Utah, Virginia
- Alabama, Arizona, Florida, Louisiana, Texas

1975

- Connecticut, Massachusetts, Michigan, Minnesota, Wisconsin
- Illinois, Kansas, New Jersey, New York, Oregon, Pennsylvania, South Carolina, Tennessee, Virginia
- Alabama, Arizona, Florida, Louisiana, Texas

Table 3
Enterovirus Isolates* in the Reporting States
and Territories, 1971-1975

Enterovirus Group	1971	1972	1973	1974	1975
Echovirus	77.1	44.6	28.4	50.6	86.6
Coxsackievirus	15.8	66.7	31.2	18.5	25.5
Coxsackievirus A	3.9	8.7	16.2	3.7	12.1
Coxsackievirus B	11.9	58.0	15.0	14.8	13.4
Total	92.9	111.5	59.8	69.1	112.0

*Per 10 million persons

Table 4
Sex Ratio* of Patients With Reported
Enteroviral Infections, United States, 1971-1975

Year	Coxsackie A	Coxsackie B	Total Coxsackie	Total Echovirus	To Ente
1971	2.37**	1.23	1.42	1.53	1
1972	1.67	1.62	1.63	1.42	1
1973	1.89	1.41	1.64	1.28	1
1974	1.20**	1.24	1.23	1.37	1
1975	1.70**	1.15	1.38	1.43	1

*No. males to 1 female
**Ratio based on less than 150 isolates

Table 5
Enteroviral Isolates* in Reporting States and Territories,
By Year, Climatic Zone, and Enterovirus Group, 1971-1975

Year	Climatic Zone	Coxsackie A	Coxsackie B	Echovirus	T Enter
1971	I	11.1	23.7	79.1	1
	II	2.3	10.5	64.0	
	III	3.0	8.1	99.2	1
1972	I	11.5	96.1	42.6	1
	II	6.9	51.4	36.5	
	III	10.5	47.0	61.6	1
1973	I	27.4	11.6	39.4	
	II	13.9	18.8	22.3	
	III	13.0	9.0	34.2	
1974	I	3.7	21.9	50.6	
	II	3.5	11.1	39.6	
	III	4.1	16.6	75.3	
1975	I	12.4	16.2	125.1	
	II	13.6	13.6	52.1	
	III	8.6	10.6	126.7	

*Per 10 million persons

Table 6

Average Percentage of Isolates Associated with Selected Virus Types, By Diagnostic Category, United States, 1971-1975

us Type		Aseptic Meningitis	Encephalitis	Meningo-encephalitis	Paralysis	Other Known	Unknown Syndrome
sackie	A9	28	14	2	0	37	18
	B2	28	9	2	0	46	14
	B3	23	4	2	0	54	17
	B4	27	10	2	0	44	16
	B5	42	6	2	0	28	22
ovirus	3	42	9	11	0	30	8
	4	59	11	5	1	14	11
	6	51	6	3	0	28	11
	9	36	14	3	0	33	14
	11	35	7	1	0	42	15
	16	28	4	2	0	58	9
	33	33	12	0	0	36	19

Table 7

Percentage of Isolates Associated with Selected Virus Types, By Diagnostic Category and Year, United States, 1971-1975

Diagnostic Category	Total	1971	1972	1973	1974	1975
A. Coxsackie A9						
Aseptic meningitis	28	22	35	23	60	31
Encephalitis	14	22	18	11	0	15
Meningoencephalitis	2	0	2	2	0	4
Paralysis	0	0	0	1	0	0
Other	37	44	24	50	20	29
Unknown	18	22	21	13	20	21
B. Coxsackie B2						
Aseptic meningitis	28	33	28	29	30	26
Encephalitis	9	9	11	5	4	6
Meningoencephalitis	2	9	1	0	4	0
Paralysis	0	0	0	0	0	0
Other	46	30	45	56	48	56
Unknown	14	19	16	9	15	12
C. Coxsackie B3						
Aseptic meningitis	23	10	26	20	30	27
Encephalitis	4	3	8	4	4	3
Meningoencephalitis	2	0	4	2	4	0
Paralysis	0	0	0	0	0	0
Other	54	73	30	66	48	60
Unknown	17	13	32	9	15	10
D. Coxsackie B4						
Aseptic meningitis	27	26	34	18	29	26
Encephalitis	10	11	9	5	9	13
Meningoencephalitis	2	4	1	2	0	4
Paralysis	0	0	0	0	0	0
Other	44	40	45	68	35	32
Unknown	16	19	11	7	26	24

Table 7 (Continued)
Percentage of Isolates Associated with Selected Virus Types,
By Diagnostic Category and Year, United States, 1971-1975

Diagnostic Category	Total	1971	1972	1973	1974
K. Echo 16					
Aseptic meningitis	28	100	33	67	25
Encephalitis	4	0	0	0	4
Meningoencephalitis	2	0	0	0	2
Paralysis	0	0	0	0	0
Other	57	0	67	33	60
Unknown	9	0	0	0	9
L. Echo 33					
Aseptic meningitis	33	100	100	50	0
Encephalitis	12	1	0	25	0
Meningoencephalitis	0	0	0	0	0
Paralysis	0	0	0	0	0
Other	36	0	0	25	100
Unknown	19	0	0	0	0

Table 8
Coxsackie A Isolates*
in the Reporting States and Territories, 1971-1975

Virus Type	1971**	1972	1973	1974	1975
A1		.1	.1	0	.1
A2		.6	0	.2	.7
A3	.1	0	0	0	0
A4	.6	.4	1.5	.7	1.5
A5	.1	.3	.2	.8	.1
A6		.2	.1	.2	0
A7		.1	.2	.2	.5
A8		.1	.1	0	0
A9	1.1	4.6	11.6†	.4	6.2
A10	.2	.2	.2	.2	.4
A11		0	0	0	0
A12		.1	0	0	0
A13		.2	.3	.1	0
A14		0	0	0	0
A15		0	0	0	0
A16	1.2	1.7	.1	.7	2.6
A17		0	0	0	0
A18		0	0	0	0
A19		0	0	0	0
A20		0	0	0	0
A21		.1	.1	0	0
A22		0	0	0	0
A24		.1	0	0	0
A unspecified	.6	.1	1.7	.1	0
Total	3.9	8.7	16.2	3.7	12.1
Enterovirus Total	92.9	111.5	59.8	69.1	112.0

*Per 10 million persons
**Data incomplete
†Epidemic

Table 9
Coxsackie B Isolates*
in the Reporting States and Territories,

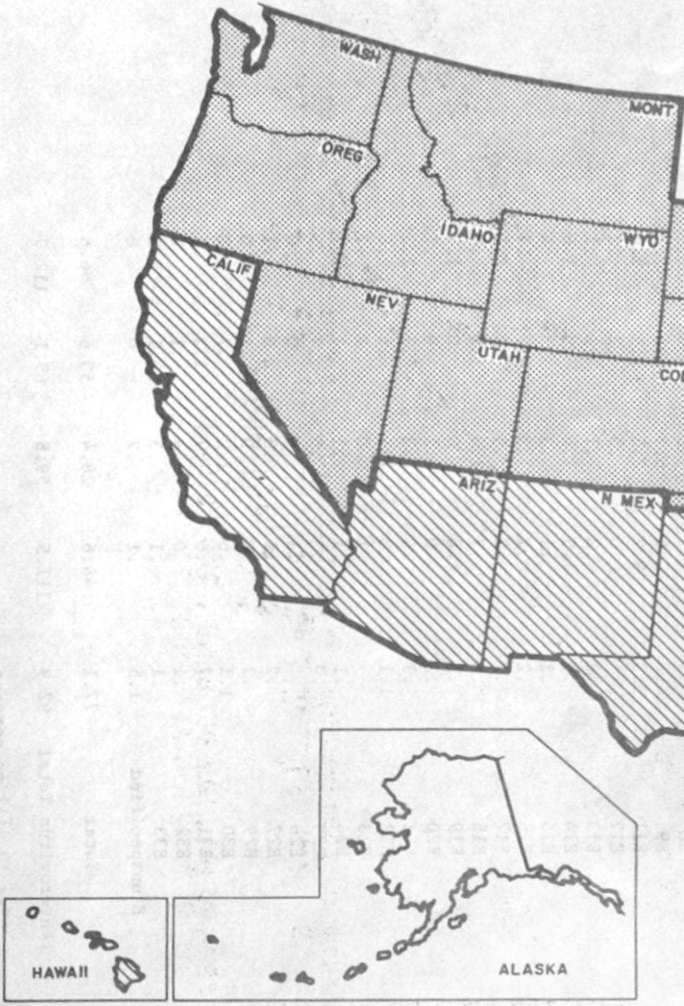
Virus Type	1971**	1972	1973	19
B1	1.2	2.1†	.2	
B2	5.2	4.4	4.5	
B3	1.8	2.9	4.6	
B4	3.1	4.0	4.7	
B5	.4	44.6†	.8	
B6		0	.1	
B unspecified	.1	0	.1	
Total	11.9	58.0	15.0	1
Enterovirus Total	92.9	111.5	59.8	6

*Per 10 million persons
**Data incomplete
†Epidemic

Table 10
Echovirus Isolates*
in the Reporting States and Territories, 19

Virus Type	1971**	1972	1973	1974
E1	.4	.3	.4	.2
E2	.2	1.8	.5	.7
E3	4.1†	1.0	.1	0
E4	29.0†	7.6	1.4	8.4
E5	.4	.4	.5	1.2
E6	3.0	8.4	5.6	6.6
E7	.9	1.4	.7	.2
E8	.3	.2	0	0
E9	26.8	7.6	6.3	6.5
E11	3.3	9.2	2.5	5.9
E12		0	.5	.2
E13	.1	.2	.1	.1
E14	.9	1.9	1.8	.9
E15	.1	.1	.3	.3
E16	.2	.2	.3	14.2
E17	.2	.2	.9	0
E18	.6	.7	1.4	1.2
E19	.5	.6	0	0
E20	.2	0	.1	0
E21	.1	.4	.3	.3
E22	1.1	.8	1.5	.6
E23		.1	0	.2
E24	.1	.1	.1	.1
E25	.9	.3	.5	.7
E26		.1	0	0
E27	.2	.2	.3	0
E29	.1	0	0	.1
E30	1.1	.6	1.2	.7
E31	.7	.6	.7	1.2
E32	.1	0	.4	.1
E33	.1	.1	.3	.1
E unspecified	1.5	.1	.2	0
Total	77.1	44.6	28.4	50.6
Enterovirus Total	92.9	111.5	59.8	69.1

*Per 10 million persons
**Data incomplete
†Epidemic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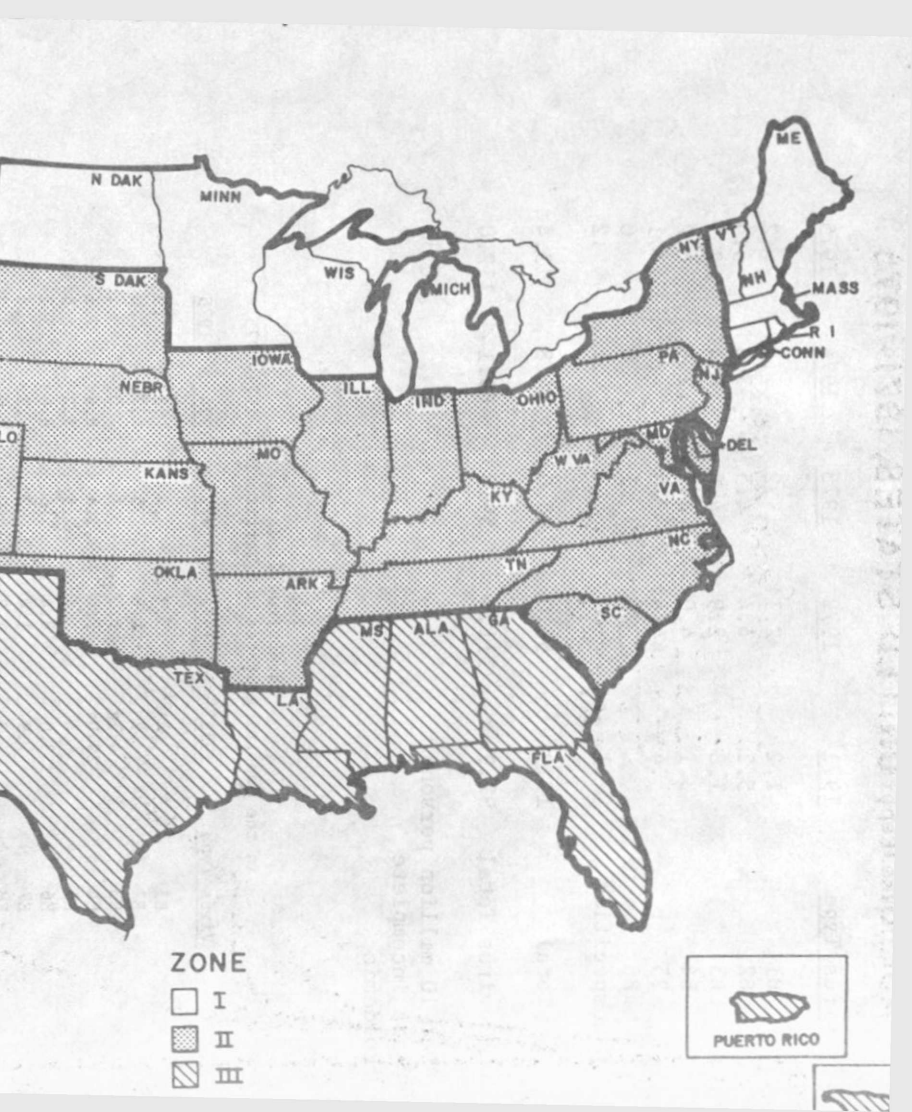
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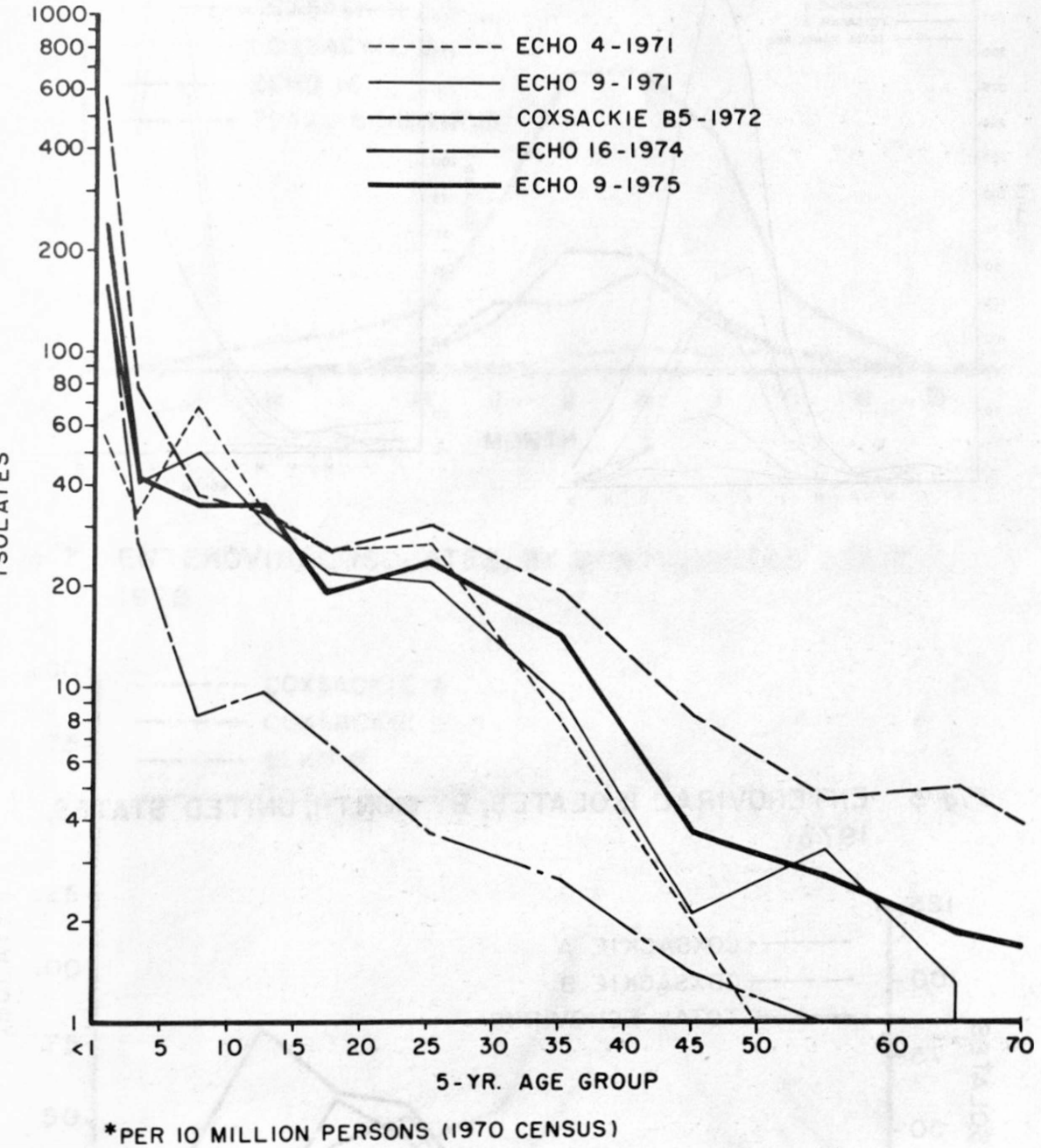
Fig. 2 SELECTED ENTEROVIRAL ISOLATES,* BY PERSON'S AGE GROUP, UNITED STATES, 1971-1975



*PER 10 MILLION PERSONS (1970 CENSUS)

Fig. 3 ENTEROVIRAL ISOLATES, BY MONTH, UNITED STATES, 1971

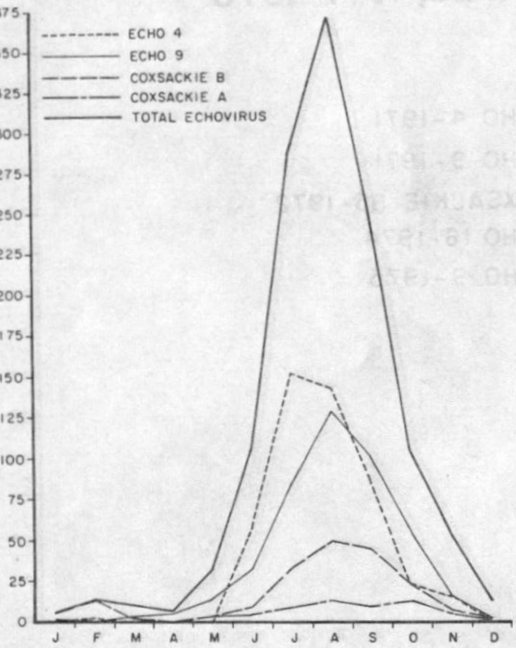


Fig. 4 ENTEROVIRAL ISOLATES, BY MONTH, UNITED STATES, 1972

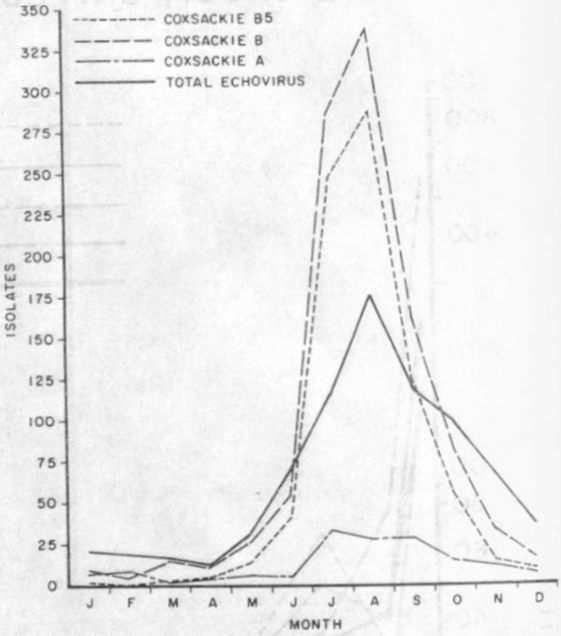
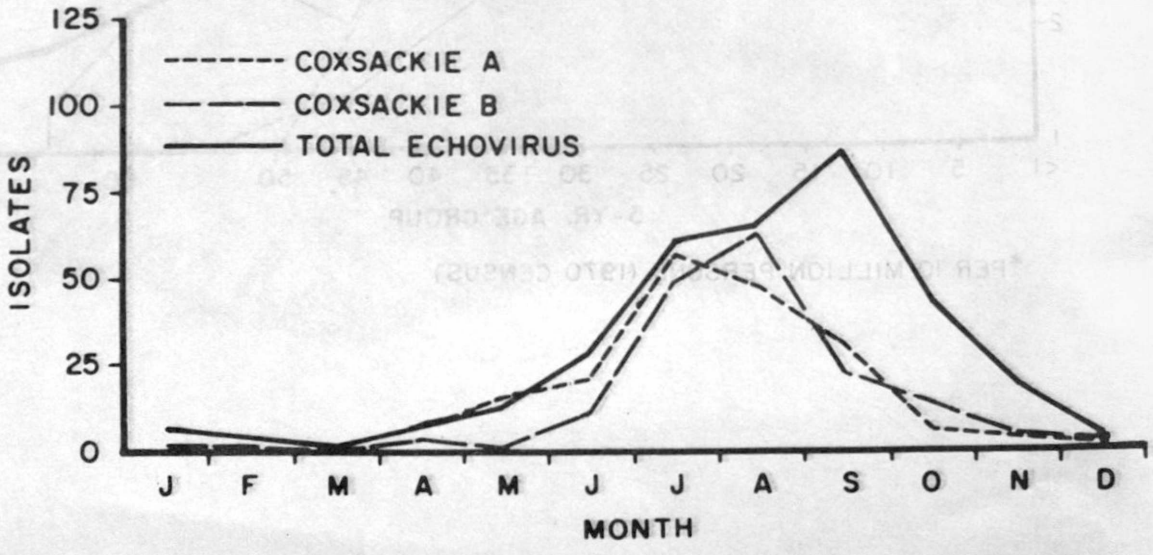
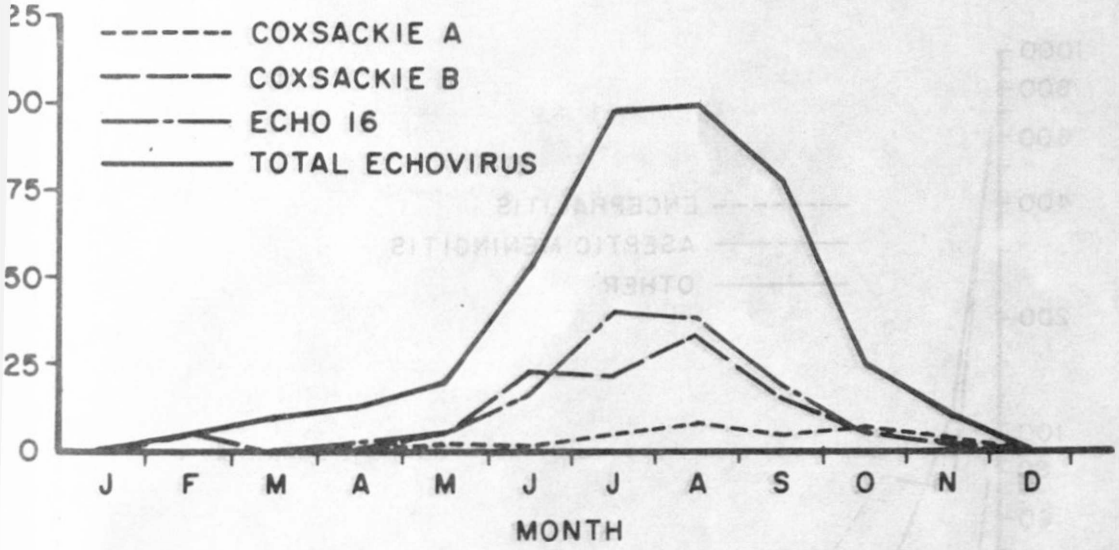


Fig. 5 ENTEROVIRAL ISOLATES, BY MONTH, UNITED STATES, 1973



6 ENTEROVIRAL ISOLATES, BY MONTH, UNITED STATES, 1974



g. 7 ENTEROVIRAL ISOLATES, BY MONTH, UNITED STATES, 1975

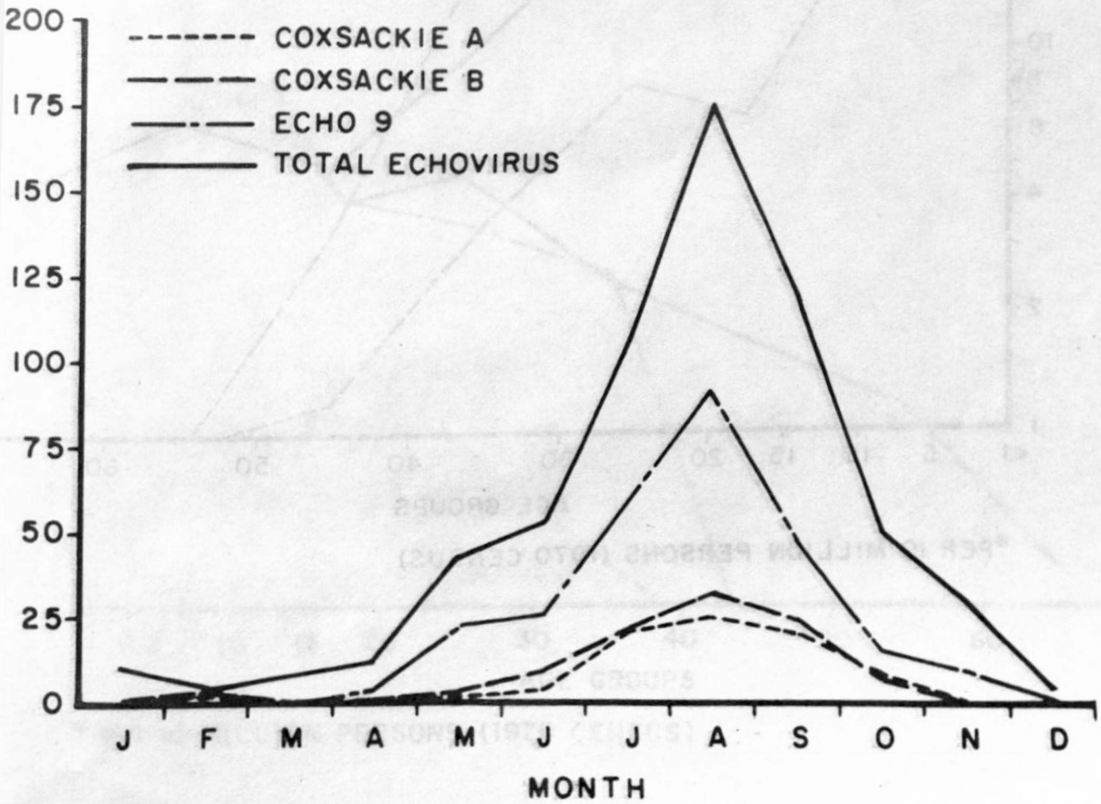
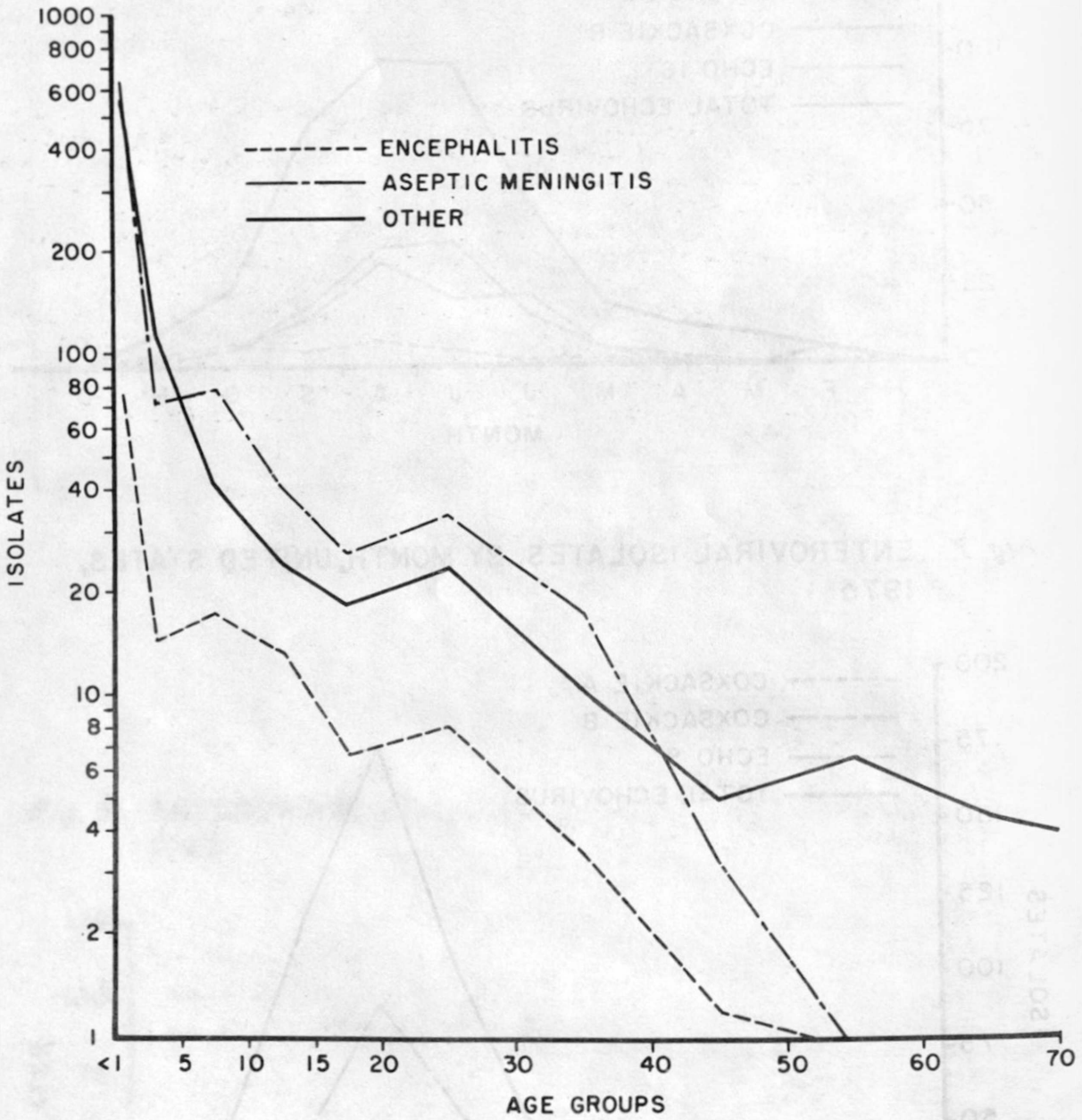
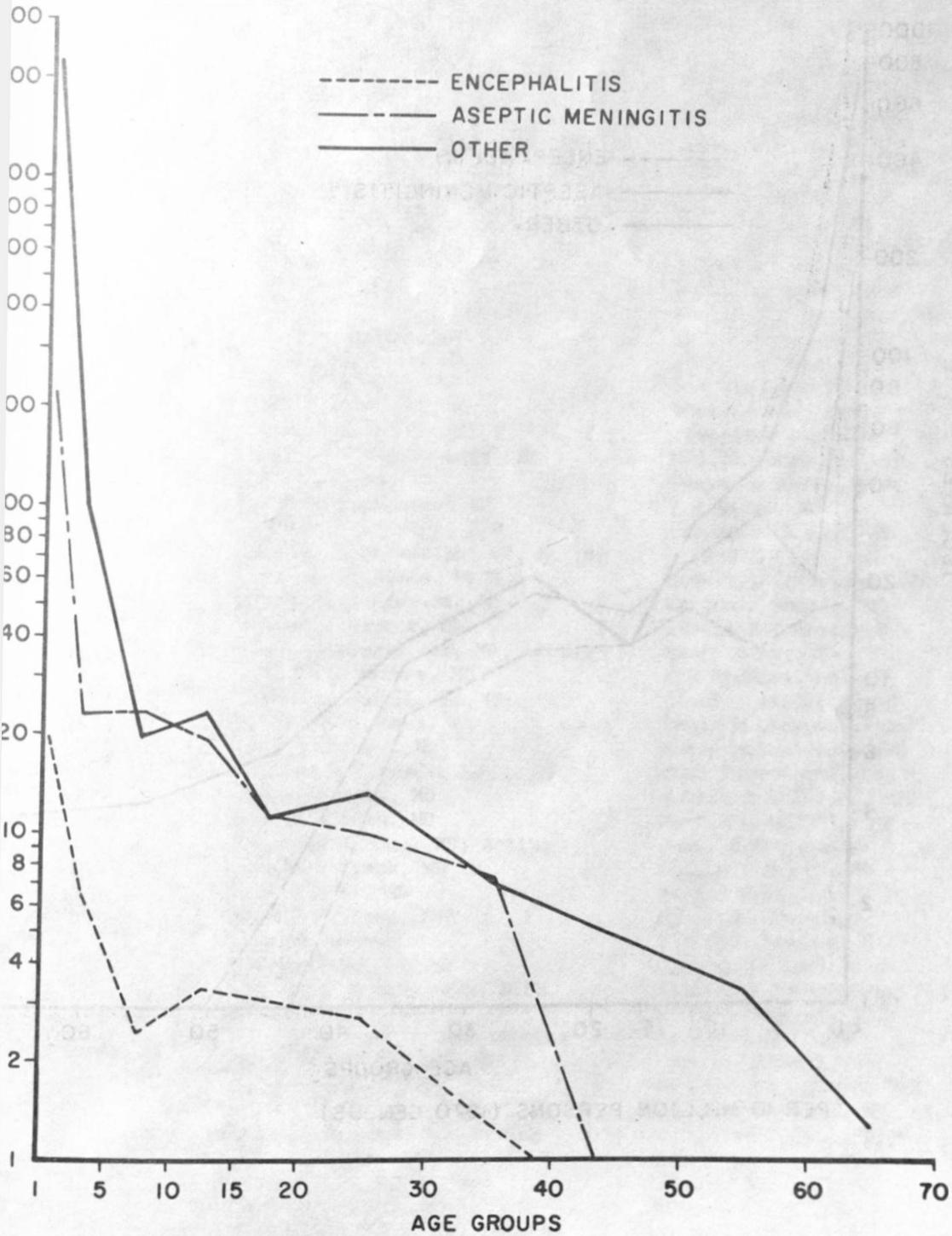


Fig. 8 ENTEROVIRAL ISOLATES,* BY DIAGNOSTIC CATEGORY AND PERSON'S AGE GROUP, UNITED STATES, 1972



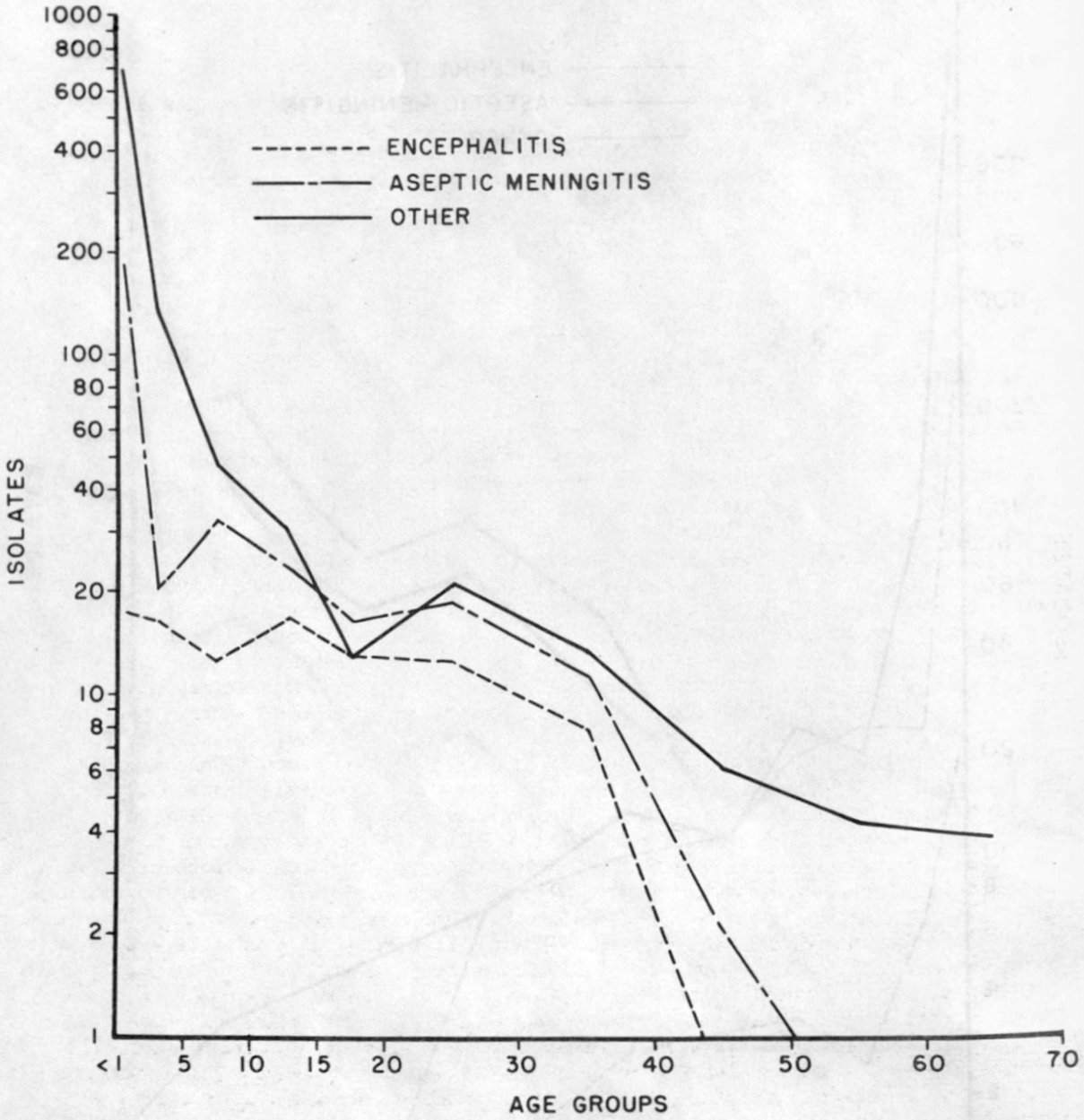
*PER 10 MILLION PERSONS (1970 CENSUS)

9 ENTEROVIRAL ISOLATES*, BY DIAGNOSTIC CATEGORY AND PERSON'S AGE GROUP, UNITED STATES, 1974



*PER 10 MILLION PERSONS (1970 CENSUS)

Fig. 10 ENTEROVIRAL ISOLATES* BY DIAGNOSTIC CATEGORY AND PERSON'S AGE GROUP, UNITED STATES, 1975



*PER 10 MILLION PERSONS (1970 CENSUS)

STATE EPIDEMIOLOGISTS AND STATE LABORATORY DIRECTORS

The State Epidemiologists are the key to all disease surveillance activities. They are responsible for collecting, interpreting, and transmitting data and epidemiologic information from their individual states. Their contributions to this report are gratefully acknowledged. In addition, valuable contributions are made by State Laboratory Directors; we are indebted to them for their valuable support.

STATE	STATE EPIDEMIOLOGIST	STATE LABORATORY DIRECTOR
Alabama	Frederick S Wolf, MD	Thomas S Hosty, PhD
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*Dual assignment

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