Surveillance of Mumps in the United States As Background for Use of Vaccine

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MUMPS is a common infectious disease, particularly among children. Although the illness is not usually severe, considerable morbidity and loss of time from school occur because of the large numbers affected. In addition, a number of complications may ensue. Meningeal involvement is the most common complication, but central nervous system disease with residua is rare. However, orchitis, which occurs in approximately 20 percent of postpubertal males with clinical mumps, is a significant complication. The symptomatic involvement of other organs occurs less frequently.

The loss of productive time because of uncomplicated mumps as well as the morbidity associated with meningitis and orchitis are reasonable justification for mumps prevention. In the past, the use of hyperimmune globulin and inactivated vaccines has proved to be less than optimal in both effectiveness and duration of protection.

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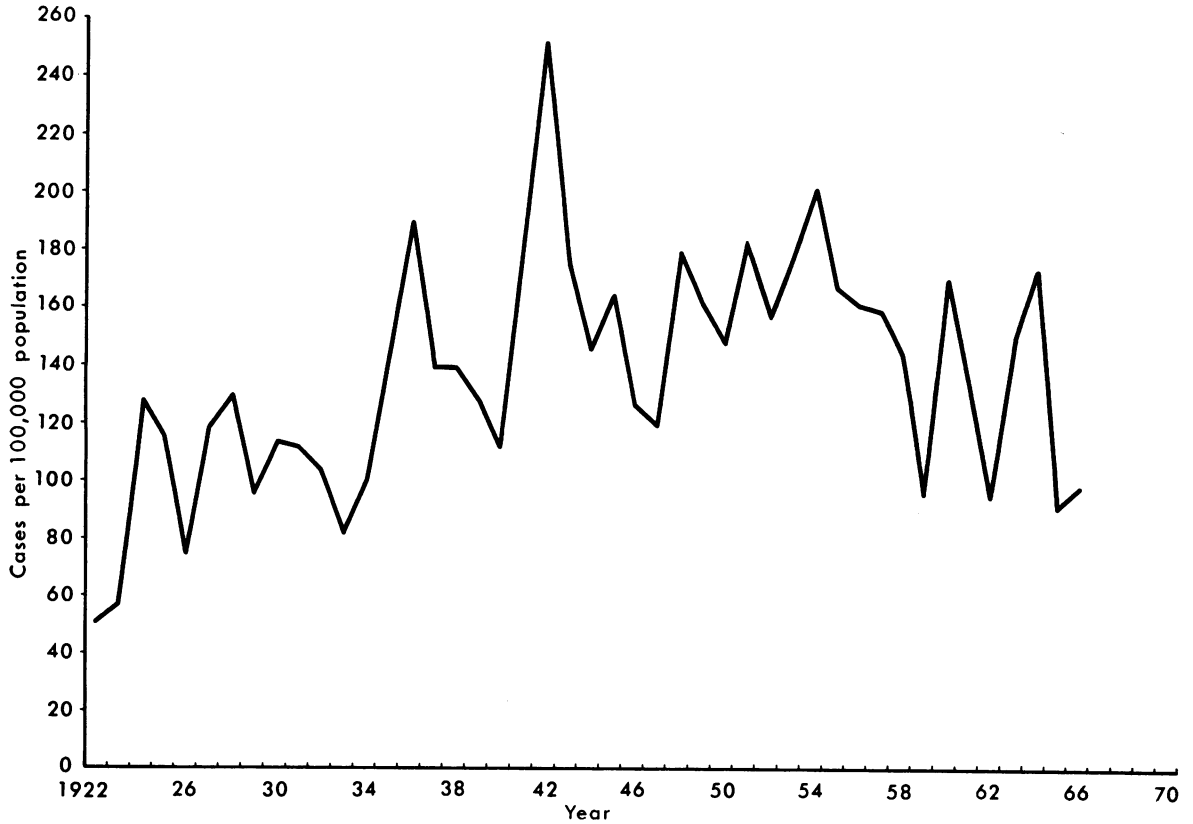
A live attenuated mumps virus vaccine, developed recently, appears to be both safe and effective (*1–3*). No adverse reactions, including fever, have been observed among the more than 6,000 susceptible persons who have received this mumps vaccine. Although antibodies have developed in more than 95 percent of the vaccinees, knowledge regarding the duration of immunity is not yet available. Currently, studies of natural challenge and antibody levels indicate a durable immunity beyond 1 year.

The availability of the live attenuated mumps virus vaccine demands a rationale for its use. Since recommendations for the use of a vaccine must relate to the epidemiologic characteristics of the disease, this paper presents a review of the available surveillance data for mumps in the United States.

Source of Data

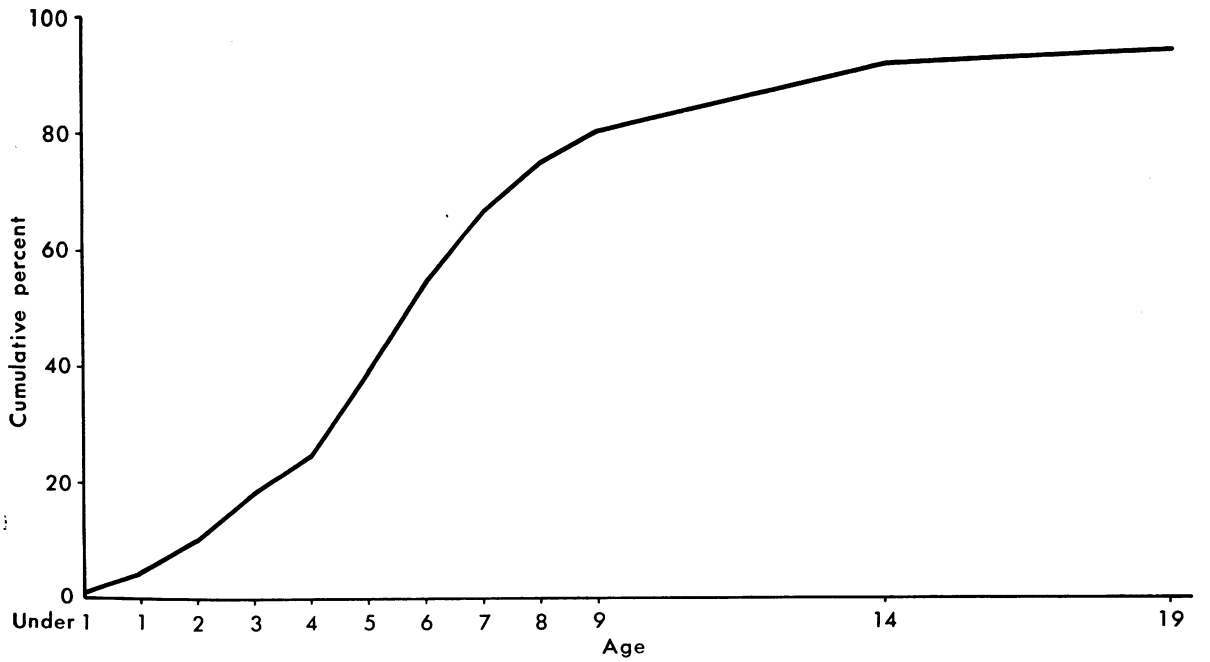
Mumps was placed on the list of nationally notifiable diseases in 1922; however, it was removed from this list in 1950. Nevertheless, many States have elected to continue reporting mumps, and this report includes data that have been voluntarily reported by State health departments to the National Communicable Disease Center, Public Health Service. The additional information characterizing mumps and mumps encephalitis by age, sex, and date of onset was specifically solicited from selected State and municipal health departments where

Figure 1. Reported cases of mumps per 100,000 population, United States, 1922–66



NOTE: Data for 1922–50 are from all States; during 1951–66 only 34–40 States reported mumps cases.

Figure 2. Reported cases of mumps in selected areas,[1] cumulative percentage by age, 1960–64



[1] Los Angeles County (excluding Los Angeles city), New York City, and Milwaukee and Madison, Wis.

Table 1. Reported cases of mumps by age, from selected areas,[1] 1960–64

Age (years)	Number of cases	Percent of cases	Cumulative percent
0–4	19, 427	24. 64	24. 64
Under 1	793	1. 01	1. 01
1	2, 587	3. 28	4. 29
2	4, 479	5. 68	9. 97
3	5, 332	6. 76	16. 73
4	6, 236	7. 91	24. 64
5–9	44, 328	56. 21	80. 85
5	11, 128	14. 11	38. 75
6	12, 723	16. 13	54. 88
7	9, 314	11. 81	66. 69
8	6, 785	8. 60	75. 29
9	4, 378	5. 55	80. 85
10–14	8, 573	10. 87	91. 72
15–19	1, 825	2. 32	94. 04
20 and over	4, 703	5. 96	100. 00
Total	78, 856	100. 00	

[1] Los Angeles County (excluding Los Angeles City), New York City, and Milwaukee and Madison, Wis.

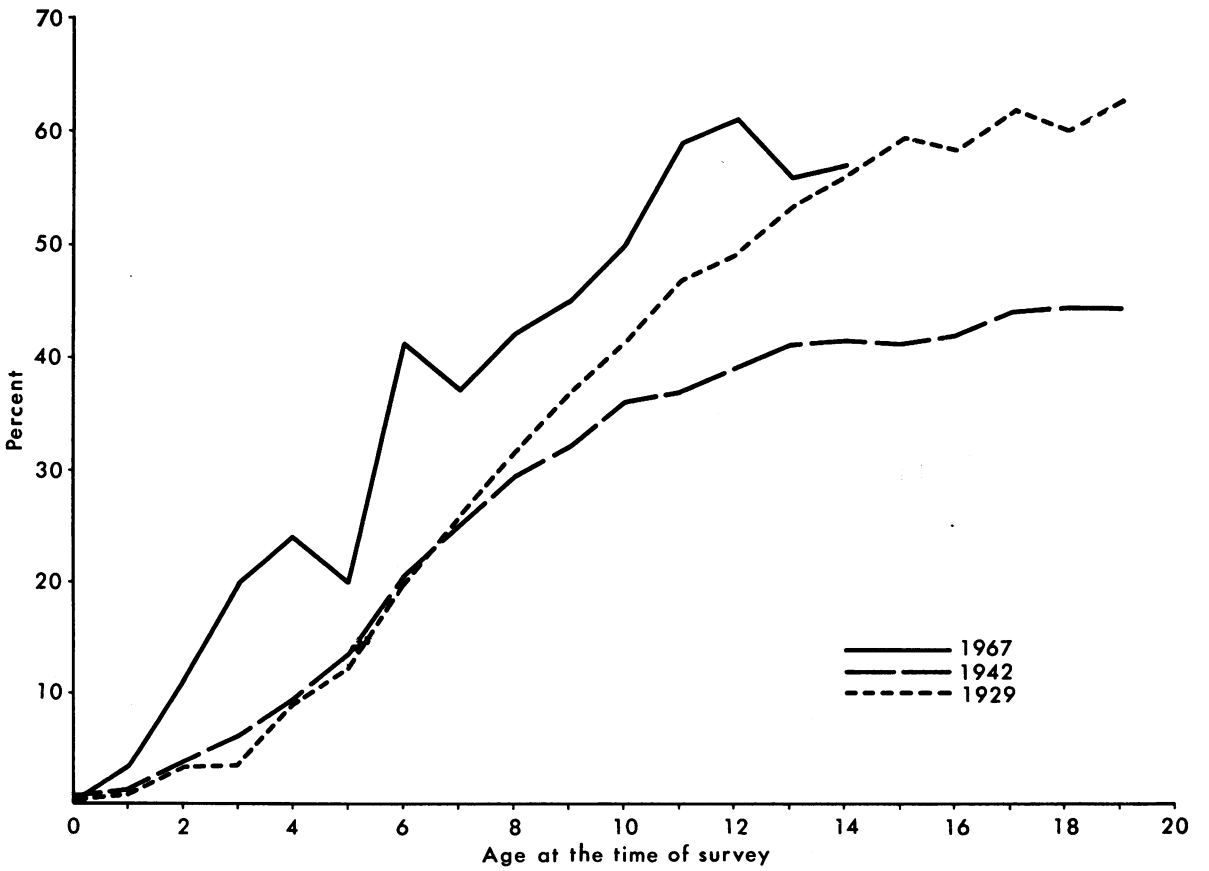
mumps and mumps encephalitis have been consistently reported during the past decade.

At present, considerable variability exists in both the quality and nature of the mumps morbidity data available from States which are reporting mumps. Also, the number of States reporting varies from year to year. Furthermore, the analysis of supplemental data from selected areas may introduce additional bias. For these reasons, the surveillance data presented are limited and must be interpreted accordingly.

Reported Mumps

The yearly incidence of mumps in the United States from 1922 to 1966 is presented in figure 1. Though considerable fluctuation occurred in the yearly rates, no cyclic or repetitive pattern is obvious. Examination of reported cases from smaller areas, such as States or major cities,

Figure 3. Percentage of persons with history of mumps, by age (data from three surveys)



SOURCES: 1967, unpublished data from National Communicable Disease Center; 1942, reference 5; 1929, reference 4.

reveals similar fluctuations without any consistent pattern of cyclic activity.

The age distribution of mumps patients during 1960–64 in four selected areas is shown in table 1 and figure 2. Children under 15 years of age accounted for 92 percent of the cases; more than half were in the age group 5–9 years. Nevertheless, a significant number of persons over age 15 also were affected.

Table 2. Age and sex distribution of patients with reported cases of mumps encephalitis, from selected areas,[1] 1962–66

Age group (years)	Male	Female	Total
0–4	287	95	382
5–9	525	200	725
10–14	180	63	243
15–19	55	32	87
20–29	57	60	117
30–39	43	48	91
40 and over	32	23	55
Total	1, 179	521	1, 700

[1] New York City, Florida, Rhode Island, Washington, Illinois (excluding Chicago), and California.

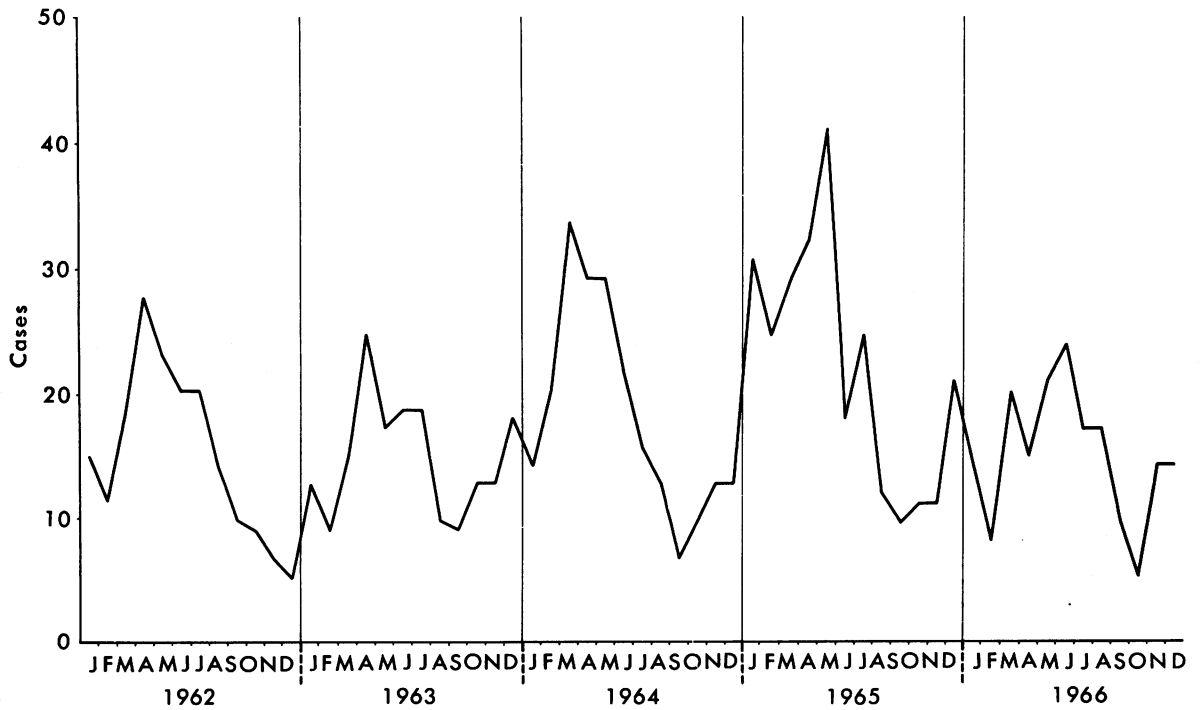
The results of three surveys to determine the percentage of persons with a history of mumps are shown in figure 3. Two of the surveys were conducted by Collins and Shannon (*4, 5*) in a number of areas and one by epidemic intelligence service officers in Atlanta (unpublished data, Statistical Section, Epidemiology Program, National Communicable Disease Center, 1967). These surveys reveal a steady increase in the percentage of persons with a history of clinical mumps through age 15.

According to available reports of mumps patients by sex for a 5-year period from Madison, Wis., Los Angeles County, and New York City, approximately 54 percent of the 43,000 reported cases were in males. This slight preponderance in males occurred in all age groups.

Reported Complications of Mumps

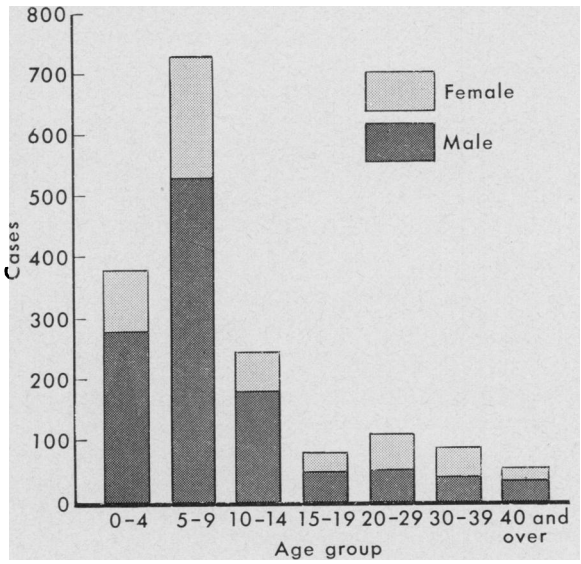
Regarding complications of mumps, data are available only for mumps encephalitis. The term mumps encephalitis, as defined for reporting purposes, includes all forms of postmumps central nervous system disease. Although no quantitative estimate is available, it is likely that

Figure 4. Reported cases of mumps encephalitis from selected areas,[1] by month of onset, 1962–66



[1] California, Washington, Illinois (excluding Chicago), and New York City.

Figure 5. Reported cases of mumps encephalitis from selected areas,[1] by age group and sex, 1962–66



[1] New York City, Florida, Rhode Island, Washington, Illinois (excluding Chicago), and California.

Table 3. Ratio of reported cases of mumps encephalitis to mumps, from 24 States reporting both diseases, 1960–66

Year	Number postmumps encephalitis cases [1]	Number mumps cases [2]	Mumps encephalitis per 1,000 mumps cases
1966	344	104, 183	3. 30
1965	380	93, 897	4. 05
1964	688	176, 538	3. 90
1963	450	152, 482	2. 95
1962	190	92, 018	2. 06
1961	254	132, 021	1. 92
1960	373	167, 336	2. 23

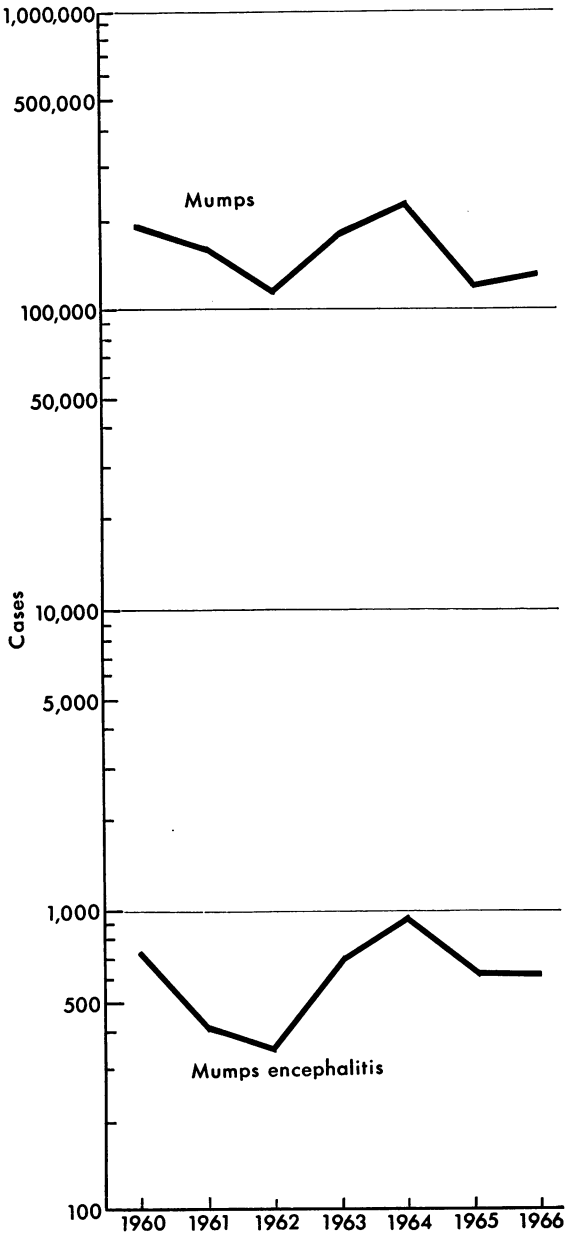
[1] Data from annual summaries of Encephalitis Surveillance Reports, NCDC.
[2] Data from annual supplements to Morbidity and Mortality Weekly Reports, NCDC.

most of the reported mumps encephalitis cases are, in fact, cases of aseptic meningitis without clinically demonstrable nervous tissue involvement. Furthermore, each year more than 50 percent of reported cases of primary encephalitis are classified as etiology not known. The proportion of these cases with unrecognized or unreported mumps association is difficult to ascertain.

The reported cases of mumps encephalitis from several areas are shown by month of onset in figure 4. The peak occurrence of mumps encephalitis in April and May is similar to that for mumps itself.

The sex distribution of patients with mumps

Figure 6. All reported cases of mumps and mumps encephalitis, 1960–66



SOURCE: Data from the National Communicable Disease Center: annual summaries of Encephalitis Surveillance Reports and annual supplements to the Morbidity and Mortality Weekly Reports.

encephalitis (table 2, fig. 5) reveals a striking predominance of mumps encephalitis in males. Of 1,700 reported cases, 1,179 or 69 percent were in males. This figure is markedly higher than the 54 percent male predominance in reported mumps cases. In addition, the age distribution shows a larger proportion of cases of encephalitis among older persons; 35 percent of reported encephalitis cases were in persons 10 years of age or older in contrast to 20 percent for clinical mumps (table 2, fig. 5).

Table 3 represents an attempt to relate the number of reported cases of mumps to the number of cases of mumps encephalitis. These data must be evaluated with some caution. In addition to the poor quality of reporting, there may be added bias because only cases from States reporting both diseases are tabulated. Nevertheless, the frequency of reported cases of mumps encephalitis and mumps can be compared. Over a 7-year period, the number of mumps encephalitis cases varied between 190 and 688 per year. The number of mumps cases reported per year during this period also varied widely, from a low of 92,018 cases to a high of 176,538 cases. Approximately two to four cases of mumps encephalitis were reported for every 1,000 cases of mumps. The parallel pattern shown in figure 6 for all reporting areas suggests a relatively constant relationship between reported mumps and mumps encephalitis.

Summary

The incidence of mumps varies considerably from year to year without any apparent cyclic pattern. The highest incidence occurs during the early school years; however, cases continue into adulthood. Slightly more than 50 percent of reported cases are in males. Mumps encephalitis is reported with a frequency of two to four per 1,000 reported cases of mumps. Approximately 70 percent of the encephalitis cases occur in males.

These data as well as published reports on the incidence and morbidity of other complications of mumps will form the basis of recommendations for vaccine use. Improved and more meaningful surveillance information is essential to further delineate the epidemiology of mumps in the United States, to provide the most meaningful evaluation of vaccine effectiveness, and to provide the rationale for future recommendations for vaccine use.

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