

Poliomyelitis in the United States, 1957

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POLIOMYELITIS reported in the United States during 1957 reached the lowest level since 1942. A total of 5,485 cases were reported to the National Office of Vital Statistics, Public Health Service, a rate of 3.2 per 100,000 population. Of these cases, 2,499 were reported as paralytic, and 2,826 nonparalytic. The paralytic status was unspecified for the remaining 160 cases.

Table 1 presents total national poliomyelitis incidence rates from 1935 through 1957 as reported to NOVS. Although wide annual variations occurred, the incidence of poliomyelitis remained high from 1948 through 1955. During 1956, half as many cases occurred as during the previous year, while in 1957, reported cases were only one-fifth of the 1955 figures.

Seasonal Distribution

Variability in seasonal distribution patterns as well as in annual poliomyelitis incidence in recent years is further apparent from figure 1, which presents the seasonal curve of weekly reports to NOVS for the years 1942, 1947, and 1952 through 1957.

For paralytic poliomyelitis alone, as shown in figure 2, the seasonal rise in 1957 was gradual, and peak incidence was not reached until

the end of September (39th week), much later than the late August peaks reached in 1955 and 1956. Data specifying paralytic status, prior to 1955, are not available on a nationwide scale.

During 1957 the seasonal distribution curve for paralytic poliomyelitis differed considerably from nonparalytic poliomyelitis. Cases reported in the poliomyelitis surveillance program during 1957 by week of onset are presented in figure 3. Whereas nonparalytic disease reached a sharp, seasonal peak in early August, paralytic poliomyelitis rose gradually to a minor peak in early August and subsequently remained at a plateau, not reaching maximum weekly incidence until almost 2 months later. The proportion of paralytic cases among reported poliomyelitis cases was notably lower in all regions of the country during July and August as compared with the remainder of the year.

Morbidity Reporting

In recent years increasingly widespread application of virus diagnostic tissue-culture techniques has permitted study of numerous outbreaks of nonparalytic aseptic meningitis. It is now well documented that many agents of the ECHO and Coxsackie groups are capable of producing an illness clinically indistinguishable from aseptic meningitis caused by the poliovirus. On rare occasions these agents have also been associated with paralytic disease.

During 1957, large outbreaks of illness with aseptic meningitis syndrome due to nonpoliomyelitis enteroviruses were recorded in many States, including Wisconsin, Minnesota, Michi-

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Data Collection

Basic functions of the National Poliomyelitis Surveillance Program are the continual collection of data on the safety and efficacy of poliomyelitis vaccine and the study of the epidemiological trends of poliomyelitis in the United States. Established in April 1955 at the Communicable Disease Center of the Public Health Service, the program is based on participation by local and State health departments, the National Office of Vital Statistics, diagnostic and research laboratories, the National Foundation for Infantile Paralysis, and others with responsibility and interest in the field of poliomyelitis and poliomyelitis-like diseases. Mimeographed Poliomyelitis Surveillance Reports are issued regularly, reviewing data reported in the program. In addition to these periodic reports, reviews of information recorded in 1955 and 1956 have been presented (1-4).

During 1957, 47 States, the District of Columbia, and three Territories participated with the Poliomyelitis Surveillance Unit in studying data, including age, race, sex, date of onset of symptoms, paralytic status, and vaccination status of reported poliomyelitis cases. The present report reviews poliomyelitis incidence during 1957 and summarizes the epidemiological patterns in that year in comparison with 1955 and 1956.

gan, Ohio, North Carolina, Virginia, and Tennessee. These included communitywide epidemics of febrile illnesses often with aseptic meningitis symptoms or skin rash, or both, associated with ECHO-9 virus.

With reported poliomyelitis at a low level, individual case diagnosis has become more important. During the year, a relatively low percentage of cases were paralytic. This percentage was lowest in July and August, the period during which the aseptic meningitis epidemics were occurring. A proportion of the cases reported as nonparalytic poliomyelitis during this time are felt to have been caused by the ECHO and Coxsackie viruses. Included in this group are endemic aseptic menin-

gitis cases, as well as early cases from aseptic meningitis outbreaks later demonstrated epidemiologically and virologically to be due to other than polioviruses.

Routine practices in the morbidity reporting of such cases vary. While a number of non-poliomyelitis aseptic meningitis cases were included in routine morbidity reports as nonparalytic poliomyelitis, data recorded in the epidemiological reports to the Poliomyelitis Surveillance Unit were refined in some States by subtraction of cases from known aseptic meningitis outbreaks initially reported as nonparalytic poliomyelitis.

Distribution

Geographic

In contrast with recent years, no large outbreaks of paralytic poliomyelitis occurred during 1957 in the United States. Table 2 presents poliomyelitis cases reported in the poliomyelitis surveillance program by State and region during 1956 and 1957 and estimated attack rates by paralytic status. The generally low incidence of paralytic disease in all regions is apparent. Highest attack rates for 1957 were reported in the southeastern, south central, and southwestern regions, where paralytic rates were 1.8, 2.9, and 2.0 per 100,000,

For cover of tables see p. 842

Table 1. Total national poliomyelitis incidence, 1935-57

Year	Cases	Rate per 100,000	Year	Cases	Rate per 100,000
1935---	10, 839	8. 5	1947---	10, 734	7. 5
1936---	4, 523	3. 5	1948---	27, 902	19. 1
1937---	9, 511	7. 4	1949---	42, 173	28. 4
1938---	1, 705	1. 3	1950---	33, 300	22. 0
1939---	7, 339	5. 6	1951---	23, 386	18. 6
1940---	9, 826	7. 5	1952---	57, 879	36. 9
1941---	9, 086	6. 8	1953---	35, 592	22. 5
1942---	4, 033	3. 0	1954---	38, 476	23. 9
1943---	11, 540	9. 3	1955---	28, 985	17. 6
1944---	16, 935	14. 7	1956---	15, 140	9. 0
1945---	12, 101	10. 3	1957---	5, 485	3. 2
1946---	25, 196	18. 4			

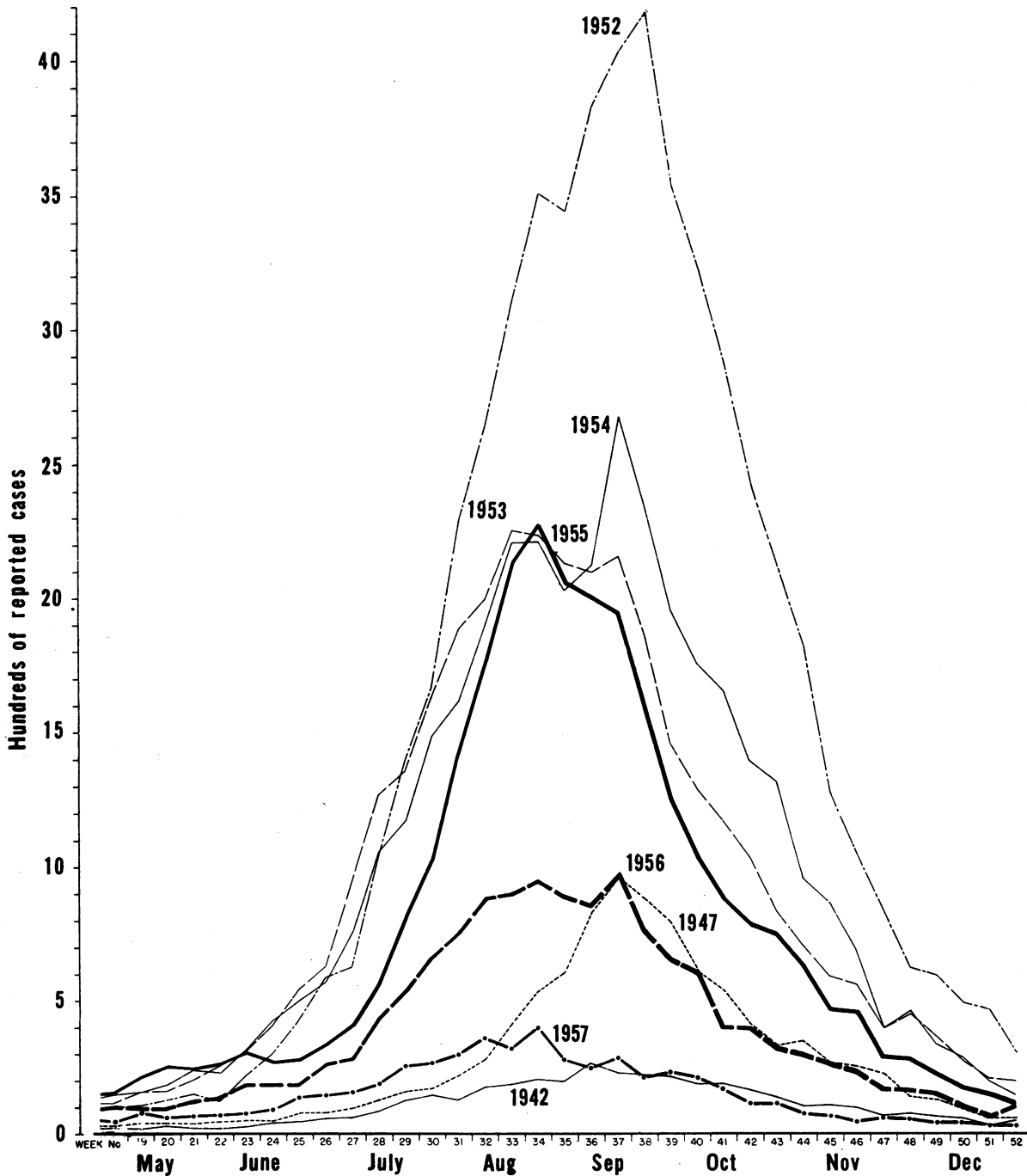
SOURCES: For 1935-1949, The Notifiable Diseases, Annual Reports, Public Health Service, 1935-49; for 1950-57, National Office of Vital Statistics, Weekly Morbidity and Mortality Report, vol. 6, No. 53, Oct. 29, 1958. Population estimates are from the Bureau of the Census.

respectively. Only Texas and the District of Columbia reported more than 3 paralytic cases per 100,000, whereas in 1956 this rate was exceeded in 27 States.

Age

During the past 5 years there has been a progressive rise in the proportion of paralytic cases among preschool children. As shown in

Figure 1. Poliomyelitis incidence in the United States, 1942, 1947, 1952-57.¹



¹Provisional data from the National Office of Vital Statistics, Public Health Service.

table 3, 44 percent of paralytic cases reported in the 1957 poliomyelitis surveillance program were in children under 5 years of age, compared with 42 percent in 1956, 32 percent in 1955, and 29 percent in 1952. This concentration of paralytic poliomyelitis in the preschool age group was observed throughout the Nation, although the tendency was more marked in southern regions.

In figure 4, age-specific attack rates for paralytic poliomyelitis in the United States during 1955, 1956, and 1957 are plotted on a logarithmic scale. During 1957, as in 1956, the highest age-specific rates occurred at 1 year of age, with a rapid decline thereafter to relatively stable rates beyond age 10. This pattern is in contrast with the experience during the previous 20 years (5), when attack rates in this country generally tended to remain high throughout the first decade.

The remarkable trough in paralytic poliomyelitis attack rates among children 7 and 8 years in 1955 has persisted in this cohort through 1956 (then 8 and 9 years of age) and

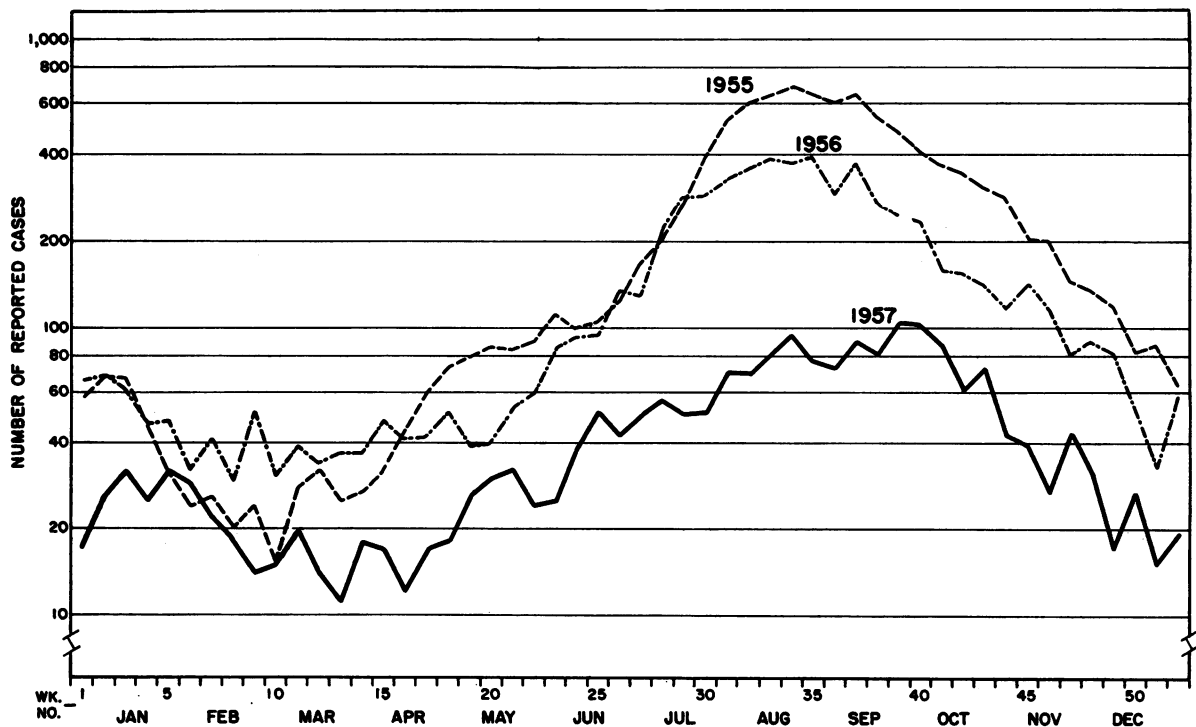
1957 when the lowest rates were among the 9- and 10-year-olds (fig. 4).

For nonparalytic poliomyelitis, in contrast with paralytic, the age distribution during 1957 was not appreciably changed from the pattern of 1952, 1955, and 1956 (table 3). The largest proportion of cases appeared in the 5- to 9-year age group, and the estimated age-specific attack rates for nonparalytic disease peaked approximately at ages 3 through 7.

Sex

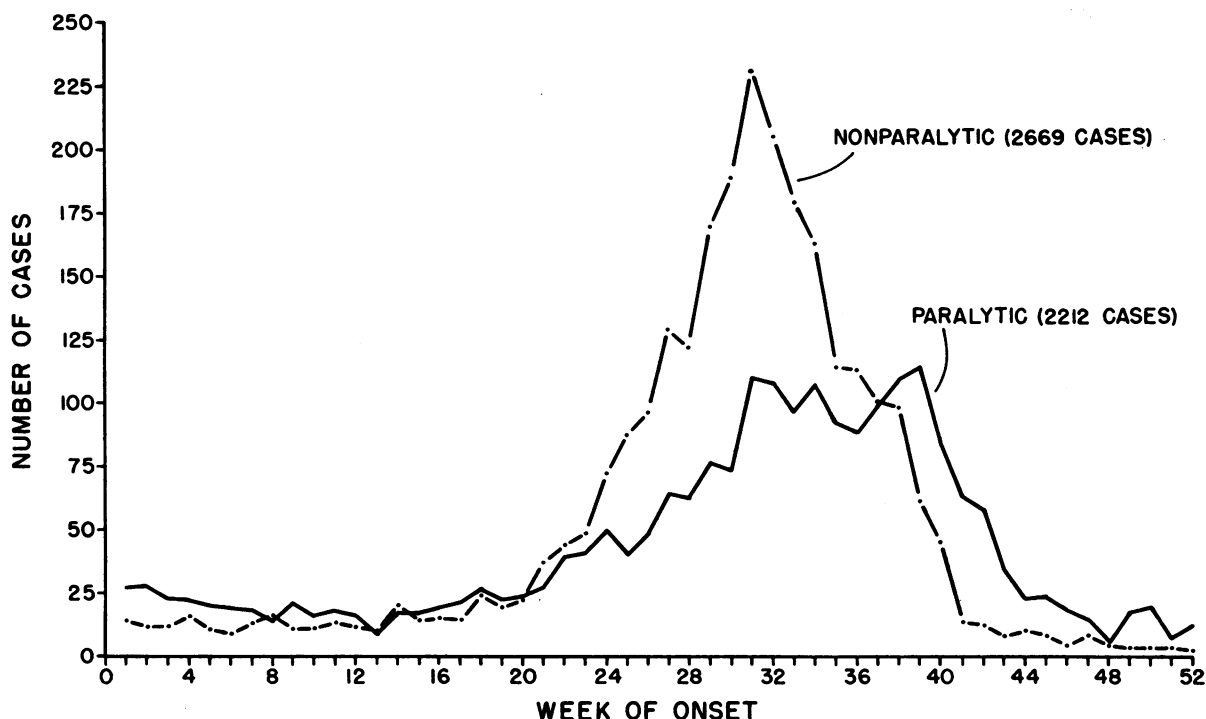
During 1957, just as in 1956 and in previous years, total poliomyelitis incidence in males exceeded that in females. In recent years, however, incidence in young adult females has tended to exceed that in males (3, 5). This pattern was seen in 1956 (4), when more cases occurred in females than in males at age 12 and ages 20 to 24. During 1957 the cases in females outnumbered the cases in males throughout the 20- to 40-year age group (table 4), but when corrections are made for the fact that the female population exceeds the male population

Figure 2. Paralytic poliomyelitis incidence in the United States, 1955-57.¹



¹ Data from the National Office of Vital Statistics, Public Health Service.

Figure 3. Seasonal incidence of poliomyelitis in the United States, 1957.¹



¹ Cases reported to the Poliomyelitis Surveillance Unit, Communicable Disease Center, Public Health Service.

in this age group, these differences are not so prominent.

Racial

Current age-specific attack rates cannot be derived by race since nationwide population estimates by race and age are not available beyond the 1950 census and since reporting of poliomyelitis by race is not a uniform practice.

Nevertheless, data from southern States and from several urban areas suggest that paralytic poliomyelitis attack rates in Negro populations are increasing both absolutely and relative to the rates in whites. Estimation of paralytic poliomyelitis attack rates by race in southern States in 1955 revealed the rate among whites to be 1.8 times that among nonwhites, while in 1957 the rate among whites was only 0.75 times that for nonwhites (6).

In the 1956 Chicago epidemic attack rates for paralytic poliomyelitis among Negroes were almost eight times those in whites (7, 8). During 1957, the only large city with any concentration of poliomyelitis was Washington, D.C., where the paralytic attack rate in nonwhites was four

times as high as in whites. In 1956 and 1957, study of 14 additional urban areas reveals that 6 of these 14 experienced a similar increase in paralytic rates among nonwhites, in contrast with patterns of previous years. These areas were Philadelphia, Richmond, Norfolk, New York, Baltimore, and Atlanta.

Vaccination History

Evidence suggesting poliomyelitis vaccine effectiveness in the prevention of paralytic disease continued to accumulate during 1957. Table 5 presents by age group the proportion vaccinated of paralytic and nonparalytic cases reported during 1957 in the poliomyelitis surveillance program from 47 States and the District of Columbia. Since much of the nonparalytic illness was caused by nonpolioviruses against which the vaccine is ineffectual, it was expected that the proportion vaccinated among nonparalytics would be higher than among paralytics. This higher incidence among nonparalytics was observed in all age groups. An

Table 2. Poliomyelitis cases reported in 1956 and 1957 by State and paralytic status

State and region	1956					1957				
	Cases ¹			Rates ²		Cases ¹			Rates ²	
	Para-lytic	Non-para-lytic	Unspec-ified	Para-lytic	Non-para-lytic	Para-lytic	Non-para-lytic	Unspec-ified	Para-lytic	Non-para-lytic
United States	7, 911	6, 555	674	4. 7	3. 9	2, 499	2, 826	160	1. 5	1. 7
Northeast	684	680	66	1. 6	1. 6	192	213		. 5	. 5
Maine.....	14	6		1. 6	. 7	4	4		. 4	. 4
New Hampshire.....	3	12	1	. 5	2. 1	1	10		. 1	1. 3
Vermont.....	12	10		3. 2	2. 7	4	1		1. 1	. 3
Massachusetts.....	48	52		1. 0	1. 1	11	14		. 2	. 3
Rhode Island.....	2	7		. 2	. 8					
Connecticut.....	30	53		1. 3	2. 4	13	25		. 6	1. 1
New York.....	384	369	1	2. 4	2. 3	107	89		. 7	. 6
New Jersey.....	91	111		1. 7	2. 1	29	52		. 5	. 9
Pennsylvania.....	100	60	64	. 9	. 5	23	18		. 2	. 2
North Central	2, 669	2, 827	267	5. 4	5. 7	713	1, 021	23	1. 4	2. 0
Ohio.....	313	262	3	3. 4	2. 9	122	101	6	1. 3	1. 1
Indiana.....	234	176		5. 3	4. 0	87	73		1. 9	1. 6
Illinois.....	1, 148	792	17	12. 2	8. 4	161	145	1	1. 7	1. 5
Michigan.....	308	348		4. 1	4. 6	121	377		1. 6	4. 8
Wisconsin.....	263	270	5	7. 0	7. 2	35	73		. 9	1. 9
Minnesota.....	78	87		2. 4	2. 7	34	32		1. 0	1. 0
Iowa.....	45	491	44	1. 7	18. 2	21	57		. 8	2. 0
Missouri.....	191	220	3	4. 5	5. 2	60	62		1. 4	1. 5
North Dakota.....	13	27	1	2. 0	4. 1	7	7	3	1. 1	1. 1
South Dakota.....	8	28	1	1. 2	4. 0	18	14	10	2. 6	2. 0
Nebraska.....	58	126	8	4. 1	8. 9	29	45	3	2. 0	3. 1
Kansas.....			185			18	35		. 8	1. 6
Northwest	295	239	18	4. 9	4. 0	66	41	12	1. 1	. 7
Montana.....	38	17		6. 0	2. 7	5	5	2	. 8	. 8
Wyoming.....	18	17	1	5. 6	5. 3	7	5		2. 2	1. 6
Idaho.....	63	31	16	10. 1	5. 0	6	7	10	. 9	1. 1
Washington.....	98	93	1	3. 7	3. 5	19	3		. 7	. 1
Oregon.....	78	81		4. 5	4. 7	29	21		1. 6	1. 2
Southeast	997	849	98	3. 0	2. 5	621	506	71	1. 8	1. 5
Delaware.....	11	18		2. 7	4. 5	1	4		. 2	. 9
Maryland.....	90	23		3. 2	. 8	33	7		1. 1	. 2
District of Columbia.....	7	4		. 8	. 5	66	9		7. 9	1. 1
Virginia.....	151	86		4. 1	2. 4	69	38		1. 8	1. 0
West Virginia.....	60	48	5	3. 0	2. 4	39	18		2. 0	. 9
North Carolina.....	179	136		4. 0	3. 1	52	181		1. 2	4. 0
South Carolina.....	46	67		2. 0	2. 8	66	41	21	2. 8	1. 7
Georgia.....	101	85	1	2. 7	2. 3	71	10	12	1. 9	. 3
Florida.....	103	169	92	2. 7	4. 5	39	57	38	1. 0	1. 4
Kentucky.....	84	112		2. 8	3. 7	68	39		2. 2	1. 3
Tennessee.....	103	60		3. 0	1. 7	68	92		2. 0	2. 7
Alabama.....	62	41		2. 0	1. 3	49	10		1. 6	. 3
South Central	1, 573	1, 010	120	8. 7	5. 6	533	603	21	2. 9	3. 3
Mississippi.....	184	75	35	8. 7	3. 5	30	38	15	1. 4	1. 7
Arkansas.....	146	76		8. 0	4. 2	25	25		1. 4	1. 4
Louisiana.....	414	194		13. 8	6. 5	74	95		2. 4	3. 1
Oklahoma.....	93	94	33	4. 1	4. 2	35	80	6	1. 5	3. 5
Texas.....	736	571	52	8. 2	6. 4	369	365		4. 0	4. 0
Southwest	1, 703	950	105	9. 5	5. 3	374	442	33	2. 0	2. 4
Colorado.....	87	68	3	5. 4	4. 2	26	22	1	1. 6	1. 3
New Mexico.....	37	21	26	4. 5	2. 6	19	10	21	2. 3	1. 2
Arizona.....	65	61	1	6. 1	5. 8	22	18		1. 9	1. 6
Utah.....	145	24	58	17. 9	3. 0	12	10	11	1. 4	1. 2
Nevada.....	13	6	17	5. 3	2. 4	1	3		. 4	1. 1
California.....	1, 356	770		10. 1	5. 7	294	379		2. 1	2. 7
Alaska.....	7	2	2	3. 3	1. 0	3	1		1. 5	
Hawaii.....	45	17		7. 7	2. 9	9	1		1. 5	. 2
Puerto Rico.....	48	6		2. 1	. 3	40	4		1. 8	. 2

¹ Source: National Office of Vital Statistics, Morbidity and Mortality Weekly Report, vol. 5, No. 53, Oct. 23, 1957, and vol. 6, No. 53, Oct. 29, 1958.

² Rates per 100,000 population based on population estimates by the Bureau of the Census.

Table 3. Percentage distribution of paralytic and nonparalytic poliomyelitis cases by age group¹ 1952,² 1955,² 1956,³ and 1957⁴

Age group, in years	Paralytic				Nonparalytic			
	1952	1955	1956	1957	1952	1955	1956	1957
0-4.....	29	32	42	44	21	19	21	17
5-9.....	25	21	16	18	31	29	26	28
10-14.....	13	12	11	9	16	17	16	16
15-19.....		7	7	6		8	10	11
20-29.....	33	16	15	13	31	16	18	18
30 and over.....		11	9	10		9	9	10
Total percent.....	100	99	100	100	99	98	100	100
Total cases.....	13, 552	9, 564	7, 399	2, 262	8, 321	8, 775	6, 269	2, 698

¹ Based on data reported to Poliomyelitis Surveillance Unit in the age distribution analysis. Cases in which paralytic status was not specified are excluded.

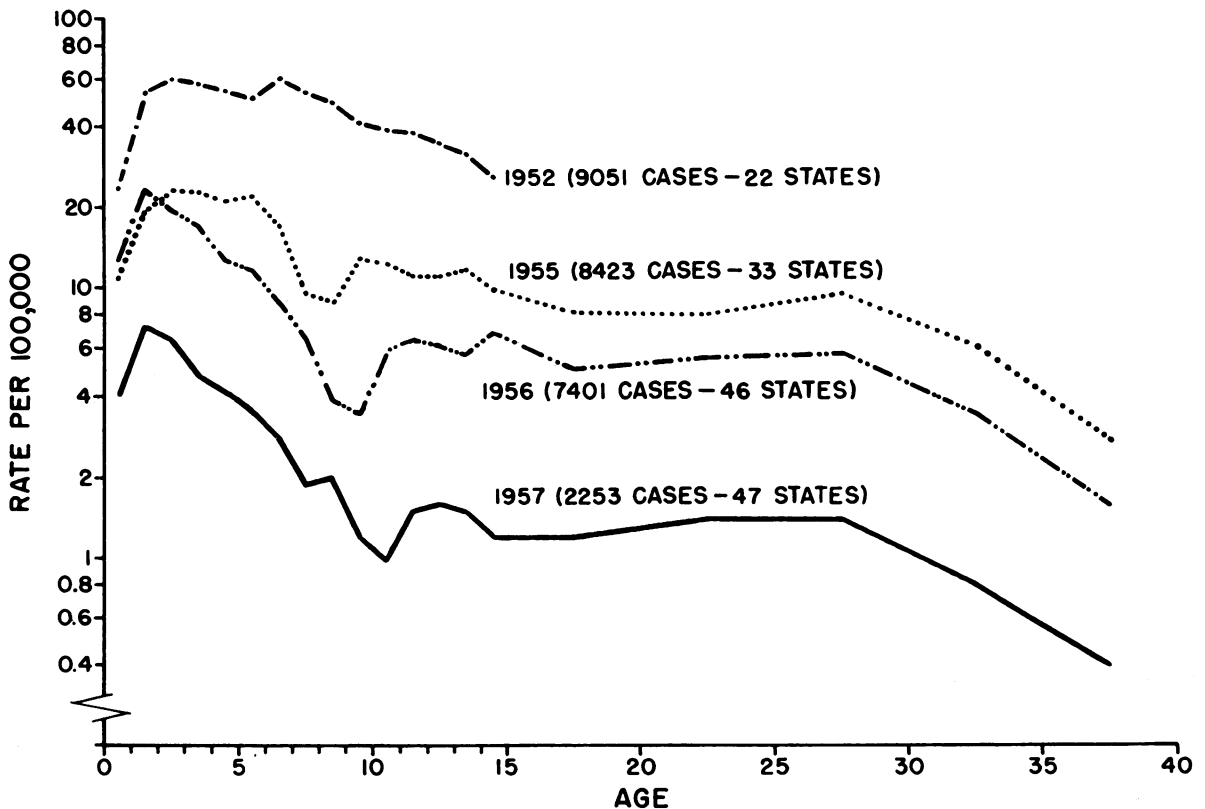
² 1952 data from 22 States and District of Columbia and 1955 data from 33 States and District of Columbia

previously presented in reference 3.

³ 1956 data from 45 States and District of Columbia, reference 4.

⁴ 1957 data from 47 States and District of Columbia.

Figure 4. Age-specific attack rates for paralytic poliomyelitis in the United States, 1952 and 1955-57.¹



¹ Cases reported to the Poliomyelitis Surveillance Unit, Communicable Disease Center, Public Health Service.

Table 4. Paralytic poliomyelitis cases in the United States in 1957, showing age distribution by sex ¹

Age group, in years	Males	Females
0-4	581	424
5-9	233	171
10-14	118	80
15-19	79	56
20-24	65	78
25-29	74	76
30-34	48	49
35-39	24	27
40 and over	42	26
Unknown	1	1
Total	1, 265	989

¹ Cases in which sex was unknown were omitted.

SOURCE: Data reported to Poliomyelitis Surveillance Unit from 47 States and the District of Columbia.

overall total of 54 percent of nonparalytic cases had received some vaccine as compared with 30 percent of paralytic cases.

The ability of the vaccine to modify the clinical characteristics of the disease is indicated in the correlation which exists between number of doses received and absence of paralysis. Whereas 56 percent of all nonvaccinated poliomyelitis cases were paralytic, only 25 percent of all triply vaccinated cases were reported paralytic.

Data obtained in August and November of 1957 for the Poliomyelitis Vaccine Activity Unit by NOVS through a supplement to the Census Bureau's Current Population Survey permitted an estimate of the vaccination status

of the United States population by age group. This analysis was under the direction of Dr. Monroe Sirken, chief, Actuarial Analysis Section, National Office of Vital Statistics. Using as numerators the vaccination history of cases of paralytic poliomyelitis reported by age groups in the poliomyelitis surveillance program and as denominators the above United States population estimates by age group and vaccination status, rough calculations of paralytic poliomyelitis attack rates were derived in vaccinated and unvaccinated populations. The estimated paralytic poliomyelitis rates were lower in the triply vaccinated than in the unvaccinated population (table 6). The percentage reduction ranged from 90 percent in the 0-4 year age group to 54 percent in the 20-29 year age group.

Such estimates represent uncontrolled comparisons of ratios rather than measured attack rates in controlled populations, and as such are subject to many potential errors. Such factors as variations in the vaccine status in different areas, ages, and population groups, and variations in the actual exposure to virus in individual groups should be taken into account in analyzing effectiveness of vaccine. Various studies are in progress at the present time to evaluate vaccine effectiveness in more controlled population subgroups.

Triply Vaccinated Cases

Cases occurring in triply vaccinated persons during 1957 included 207 paralytic, 588 nonparalytic, and 1 unspecified case. Of these, lab-

Table 5. Paralytic and nonparalytic poliomyelitis in the United States in 1957, by age group and vaccination history ¹

Age group, in years	Paralytic			Nonparalytic		
	Total cases	One or more doses	Percent vaccinated	Total cases	One or more doses	Percent vaccinated
0-4	970	246	25	434	212	49
5-9	394	198	50	742	550	74
10-14	198	93	47	417	311	75
15-19	132	37	28	293	125	43
20 and over	492	84	17	733	221	30
Total	2, 186	658	30	2, 619	1, 419	54

¹ Omitting cases in which vaccination status or age was not reported.

SOURCE: Data reported to Poliomyelitis Surveillance Unit from 47 States and the District of Columbia.

Table 6. Paralytic poliomyelitis cases¹ in the United States, 1957, attack rates among triply vaccinated and nonvaccinated persons, and estimates of vaccine effectiveness²

Age group, in years	Paralytic cases		Attack rates		Percent effectiveness
	Not vaccinated	3+ doses	Not vaccinated	3+ doses	
0-4	724	59	92.8	9.6	90
5-9	196	88	56.5	9.2	84
10-19	200	45	23.6	4.4	81
20-29	232	12	16.0	7.4	54
30-39	115	2	6.4	1.3	79
Total	1,467	206	28.2	7.1	75

¹ Cases reported to the Poliomyelitis Surveillance Unit.

² Population estimates of triply vaccinated and nonvaccinated persons provided by Dr. Monroe Sirken, chief, Actuarial Analysis Unit, NOVS, Public Health Service.

oratory data were reported on 85 paralytic cases and 171 nonparalytic cases (table 7). Studies were negative in the large majority of these cases; only 19 percent of the paralytic and 15 percent of the nonparalytic cases studied were confirmed as exhibiting current or recent infection with poliovirus, while other viruses were isolated in 10 percent of the paralytic cases and in 20 percent of nonparalytic cases.

Data regarding the extent of paralytic involvement remaining after convalescence were

Table 7. Poliomyelitis cases in triply vaccinated individuals in 1957, as indicated in laboratory studies

Type of disease	Paralytic		Nonparalytic	
	Cases	Percent of total tested	Cases	Percent of total tested
Poliomyelitis 1	6	7	11	6
Poliomyelitis 2			6	4
Poliomyelitis 3	10	12	7	4
Poliomyelitis, type unspecified			1	1
Coxsackie	6	7	15	9
ECHO	1	1	10	6
Unidentified virus	1	1	10	6
Negative	61	72	111	65
Total	85	100	171	101

SOURCE: Data reported to the Poliomyelitis Surveillance Unit from State and local health departments, from research laboratories, and from laboratories of the Virus Diagnostic Unit of the Communicable Disease Center, Public Health Service.

Table 8. Paralytic poliomyelitis cases in triply vaccinated individuals in the United States during 1957, showing severity of residual paralysis as indicated in laboratory studies

Estimated severity	Polio-virus isolated	Cox-sackie isolated	Nega-tive labora-tory results	No labora-tory study	Total
Severe	7	1	15	19	42
Moderate	3	3	10	23	39
Mild	4		21	29	54
Total	14	4	46	71	135

¹ Including one fatality.

SOURCE: Data reported to the Poliomyelitis Surveillance Unit.

submitted by physicians in 135 cases (table 8). Residual paralysis was roughly estimated to be severe in 42 cases, moderate in 39, and mild in 54 cases. Of the severe cases poliovirus infection was confirmed in 7 and laboratory studies were negative in 15.

During 1957 three deaths from poliomyelitis were reported in triply vaccinated persons. Pathological findings were characteristic of acute poliomyelitis in one case from which type 3 poliovirus was isolated. In a second case, pathological findings were suggestive but laboratory studies were negative. The remaining fatal case was not confirmed; postmortem examination was not performed, and no material for virus isolation was available.

Vaccine Distribution

During the period April 1955 through December 1957, a cumulative total of 186.2 million cc. of net bottled poliomyelitis vaccine was distributed for domestic use. This total includes 27.7 million cc. shipped during the period April–December 1955, 70 million in 1956, and 88.2 million in 1957. In addition, 19.2 million cc. were exported during the period August 1956 to December 1957. During 1957, shipments lagged considerably behind releases, and a balance of 33.1 million cc. was cleared by the National Institutes of Health but not shipped by the end of the year. Distribution of vaccine by calendar quarters is presented in figure 5.

Vaccine Safety

Reporting of cases occurring within 30 days of a poliomyelitis vaccine inoculation was less thorough during 1957 than in 1955 and 1956. Analysis of 36 cases in 1957 with complete data revealed no tendency for the onset of illness to group in the 4- to 11-day period following inoculation. Onset of paralysis occurred in the inoculated limb in six cases and in the opposite uninoculated limb in four cases during 1957. No specific vaccine lot was known to be associated with more than three paralytic cases. The 1955 Cutter cases, in contrast, were associated with a small number of specific lots, and paralysis usually began in the inoculated limb 4 to 11 days following vaccination (1).

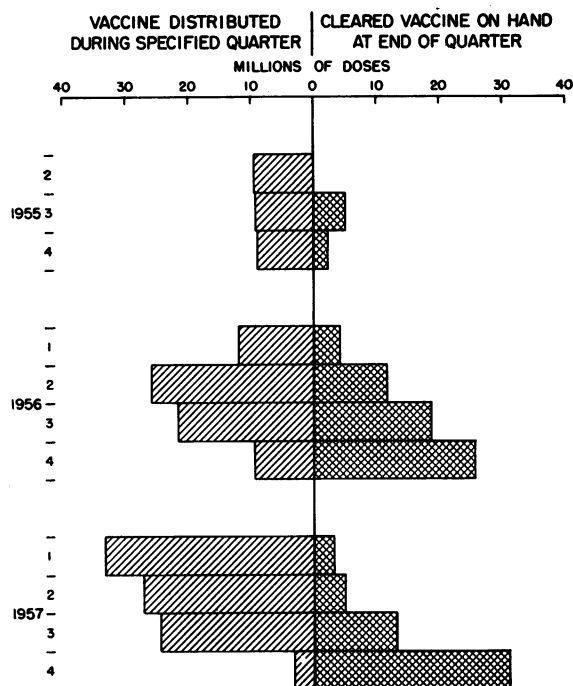
Discussion and Summary

Reported incidence of poliomyelitis in the United States during 1957 reached the lowest level since 1942. There were no major poliomyelitis outbreaks, and attack rates, particularly of paralytic disease, were low in all regions of the country.

Concurrently, during 1957 almost 90 million cc. of poliomyelitis vaccine were shipped in this country, bringing to over 180 million cc. the total vaccine distributed for domestic use since April 1955. More than half of our population has now received at least one dose of vaccine.

The extremely low incidence for paralytic poliomyelitis of 1.5 cases per 100,000 during 1957 is impressive in view of the extensive use of vaccine. However, marked annual variations have characterized poliomyelitis incidence

Figure 5. Poliomyelitis vaccine distribution, 1955–57.¹



¹ Data from Poliomyelitis Vaccine Activity Unit, Bureau of State Services, Public Health Service.

in this country in recent years. Furthermore, response to commercial poliomyelitis vaccine has been variable (9), and vaccinated subjects appear to be readily susceptible to gastrointestinal infection upon natural exposure to poliovirus (10–12). Therefore, it cannot be concluded that the widespread use of vaccine was alone responsible for the low total incidence of the disease during 1957. Final evaluation of the effect of inactivated poliomyelitis vaccine on poliovirus ecology and on total poliomyelitis incidence will require continued study over the next several years.

Changes in epidemiological patterns may nevertheless reflect the size and character of the vaccinated population since the Nation is not uniformly vaccinated. It has, therefore, become of increasing importance to continue detailed study of epidemiological trends of poliomyelitis in this country.

The striking change in age distribution pattern of paralytic disease observed during 1956 continued through 1957, with preschool children accounting for the largest proportion of cases

and with peak age-specific attack rates encountered in 1-year-old infants. Since the preschool ages were less thoroughly vaccinated than older children, it is probable that this change in the relative age distribution is at least in part a result of the vaccination programs. The trough in age-specific attack rates for paralytic poliomyelitis noted in 1955 among 7- and 8-year-olds and again in 1956 among 8- to 9-year-olds has persisted this year among the same cohort, now 9 and 10 years of age. Since this group in particular was thoroughly vaccinated in the school programs of 1955, the persistence of lowest paralytic attack rates in this population for 3 years suggests both effectiveness of the vaccine and duration of the induced immunity over the 3-year period.

Relatively and absolutely increased incidence of paralytic poliomyelitis was encountered during 1956 and 1957 among nonwhite racial groups in the south and in several metropolitan areas throughout the country.

Paralytic poliomyelitis cases tended to occur among unvaccinated individuals during 1957. Examination of vaccination history for paralytic cases in comparison with the estimated vaccination status of the United States population has permitted gross but reasonable estimations of paralytic attack rates in vaccinated and unvaccinated populations. The rate of paralytic disease in the triply vaccinated group was apparently reduced compared with that in unvaccinated populations. Further, a progressively lower incidence was recorded for those who had received 1, 2, or 3 doses of vaccine. These variations in calculations of effectiveness of three doses of vaccine reflect the unequal exposures of populations to virus and differing vaccination status of specific groups. The estimates are useful in determining the range rather than the specific degree of effectiveness.

Poliomyelitis vaccine shipments declined during the latter part of 1957. It is evident that increasingly active immunization programs will be required in order to achieve completion of the requisite three-dose schedule in large segments of the population as yet incompletely

vaccinated. Particular effort will be necessary in groups at relatively increasing risk, including the preschool ages and nonwhite populations.

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