

# Final Report of Poliomyelitis Epidemic in Detroit and Wayne County, 1958

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**E**PIDEMIC poliomyelitis presents serious public health problems both during the acute phase and in the extended convalescent and recovery periods. During the 1958 epidemic in Detroit, the Detroit Health Department effectively mobilized its personnel and facilities to face these problems and has since used the experience gained to prevent their recurrence. A preliminary report of this epidemic was published in 1959 (1). This paper presents the final report of the 1958 poliomyelitis experience in Detroit and Wayne County.

The toll of the 1958 poliomyelitis outbreak was similar to that of prevaccine days: 874 cases of poliomyelitis, 462 nonparalytic and 412 paralytic, were reported in a population of 2,842,000 (fig. 1, table 1). There were 25 deaths (table 2); 177 cases were initially diagnosed as paralytic but on followup were found to have neither residual paralysis nor minor sequelae of poliomyelitis. Those significantly or severely disabled numbered 224; information was not available on 11. Table 3 shows the distribution of residual paralysis.

Few cases were reported prior to mid-July.

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*Data on poliomyelitis patients hospitalized at Herman Kiefer Hospital during the 1958 poliomyelitis epidemic were obtained from Dr. Donald C. Young, director of the communicable disease service. Virus studies were performed by Dr. Gordon C. Brown at the virus laboratory, University of Michigan School of Public Health, Ann Arbor.*

Then the number rose sharply, reaching a peak in mid-September (fig. 2). Cases continued to be reported throughout October, and sporadic cases persisted into November. The central area of Detroit was hardest hit; 91.6 percent of all paralytic cases in the city occurred in that area. Outside Detroit poliomyelitis has usually reached its peak in mid-August.

This was the 13th year of high poliomyelitis incidence for Detroit, and almost its worst—exceeded only by the 1952 incidence, when 748 cases were reported with 41 deaths (table 4). Wayne County had 344 cases in 1952, of which 152 were paralytic; in 1958 there were 225 cases, 66 of them paralytic.

The occurrence of poliomyelitis in epidemic proportions in the nonwhite population of Detroit in 1958 followed the trend of Chicago's experience in 1956 (2). Of the 346 paralytic cases in Detroit, 271 occurred in the nonwhite population (table 1). The specific rate for the nonwhite population was estimated at 57 per 100,000 compared with 5.2 per 100,000 for the white population. Thus, the rate for nonwhites appears to have been more than 10 times the rate for whites. This apparent increase in the proportion of paralytic cases among nonwhites has appeared since the advent of a preventive vaccine.

The incidence of nonparalytic cases was highest in the group aged 5–9 years. Males accounted for 56.1 percent of all cases (table 5). Poliomyelitis was diagnosed in 14 pregnant women. Four of these cases were paralytic. There were no fatalities among them.

In 60 families more than one person was diagnosed as having poliomyelitis in 1958; 44 of these cases were paralytic; none were fatal.

Figure 1. Nonparalytic and paralytic cases of

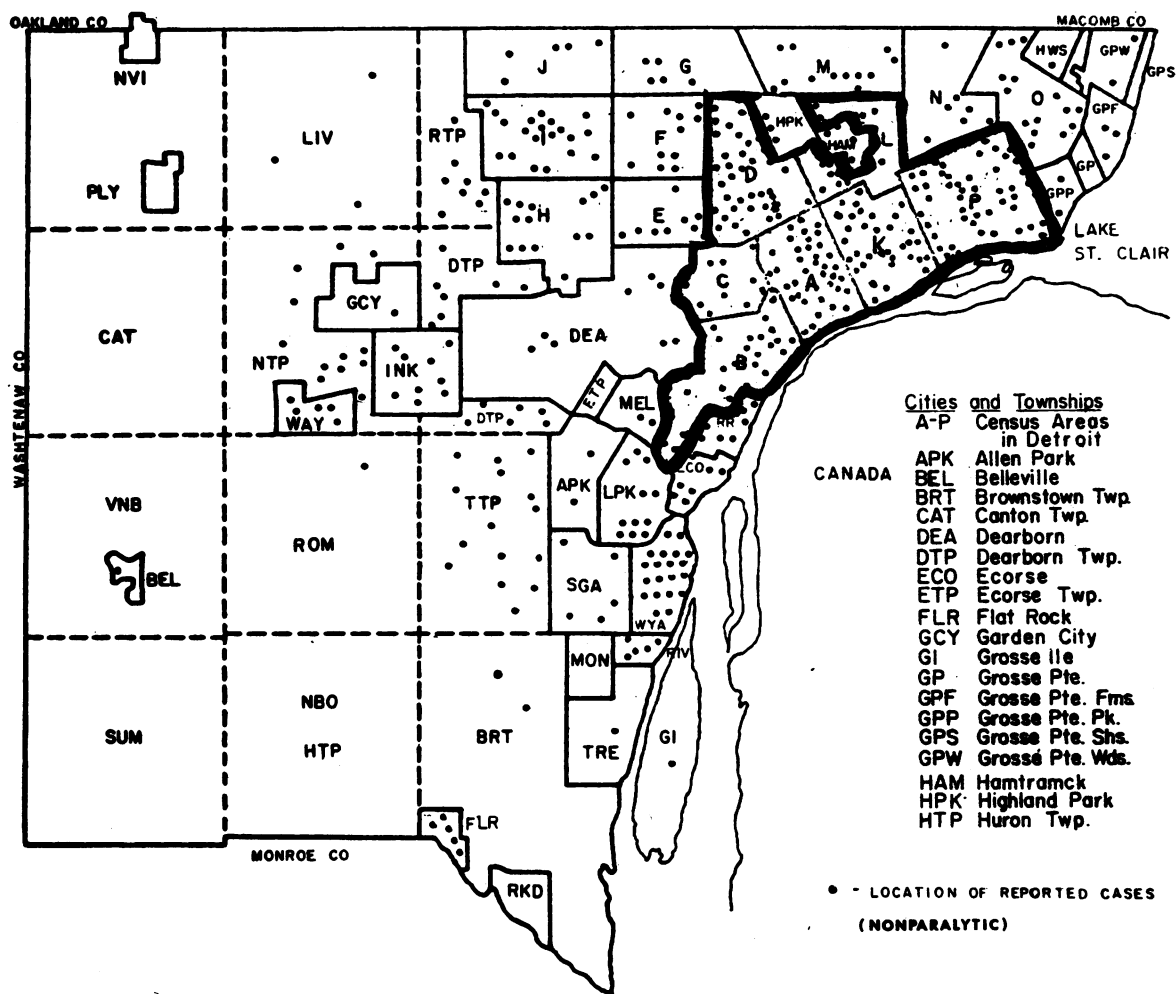
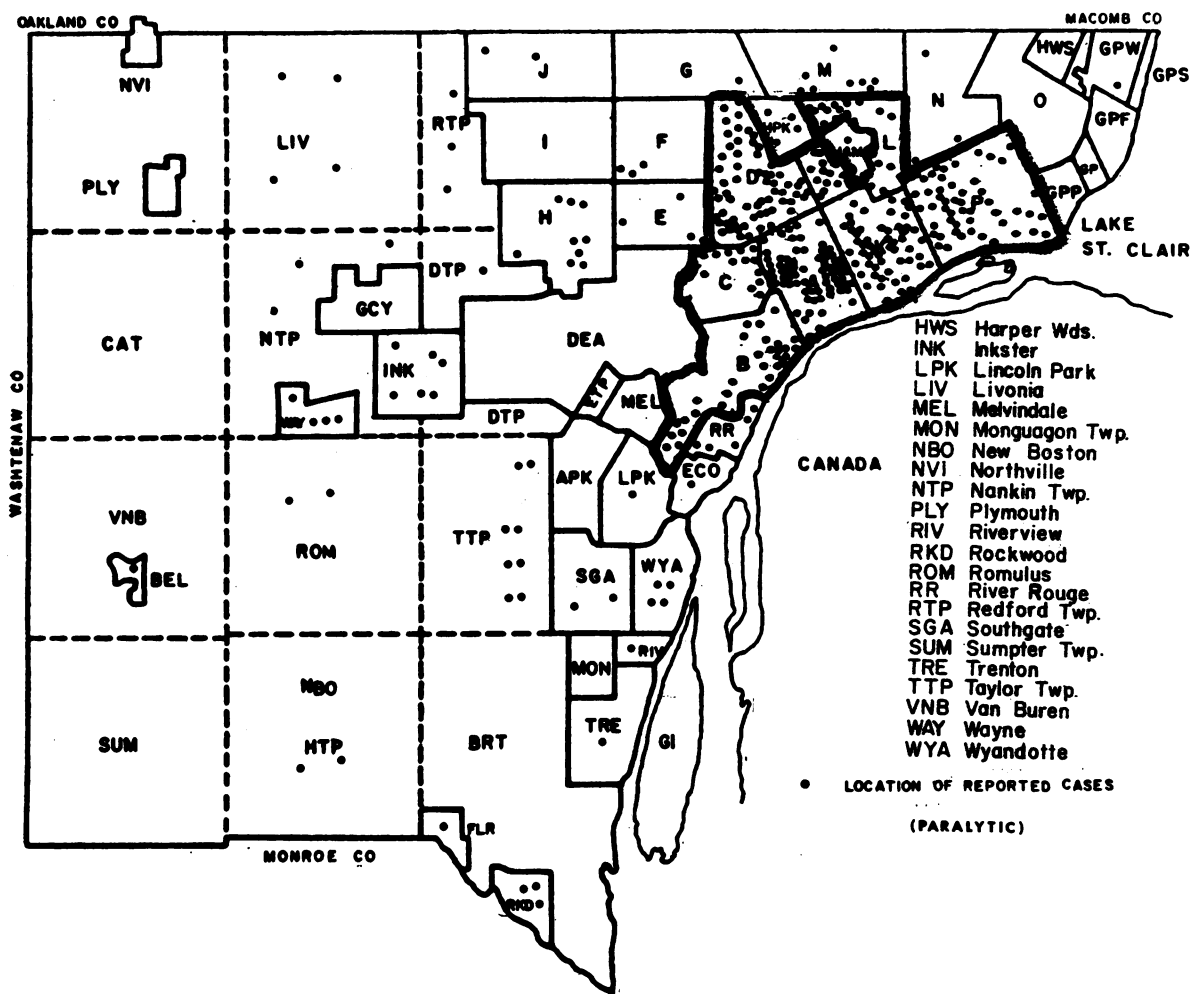


Table 1. Estimated population and number of reported paralytic and nonparalytic poliomyelitis cases in Detroit and Wayne County, Mich., 1958

Area	Estimated population			Poliomyelitis cases						
	Total	White	Non-white	Total reported	Paralytic			Nonparalytic		
					Total	White	Non-white	Total	White	Non-white
Wayne County.....	2, 842, 000	( <sup>1</sup> )	( <sup>1</sup> )	874	412	128	284	462	319	143
Detroit.....	1, 900, 000	1, 420, 000	480, 000	649	346	75	271	303	173	130
Central area.....	1, 094, 000	645, 000	449, 000	521	317	57	260	204	81	123
Outer area.....	806, 000	775, 000	31, 000	128	29	18	11	99	92	7
Remainder of county.....	942, 000	( <sup>1</sup> )	( <sup>1</sup> )	225	66	53	13	159	146	13

<sup>1</sup> Estimate not available.

poliomyelitis reported in Detroit and Wayne County, Mich., 1958



In 1958, children under the age of 5 years accounted for 59.8 percent of Detroit's paralytic poliomyelitis cases (table 6). This percentage was highest in the central area (61.5 percent) and lowest in the outer area (41.3 percent). In the central area 80 percent of the patients with paralytic poliomyelitis were under 10 years of age. The majority of the paralytic cases, 55.8 percent, were in males. Fatalities were nearly three times as frequent in males as in females.

The average age of all patients reported as having poliomyelitis is shown in table 7.

**Area Characteristics**

In this report, Detroit and Wayne County have been divided into three areas, the central

and outer areas of Detroit proper and the remainder of Wayne County (fig. 1).

The central area of Detroit is that portion of the city which is contained in a half circle pivoting about the foot of Woodward Avenue at the Detroit River in downtown Detroit and extending outward for approximately 5 miles. This area is made up of census areas A, B, C, D, K, L, and P. It is an area of low income and low economic status. Housing is for the most part old and population density is high. There are several modern housing developments in the area. Most of the residents are nonwhite. They move frequently within the city and, for the most part, have resided in Detroit less than 10 years. Very few are natives of Detroit, but there are also very few recent in-migrants. Many are unemployed and

**Table 2. Deaths from poliomyelitis in Detroit and Wayne County, Mich., by age, race, sex, and area, 1958**

Age (years)	Total	Race and sex				Area		
		White		Nonwhite		Detroit		Remainder of Wayne County
		Male	Female	Male	Female	Central area	Outer area	
All ages.....	25	5	2	13	5	21	2	2
0-4.....	7	0	0	5	2	7	0	0
5-9.....	2	0	0	0	2	2	0	0
10-14.....	2	1	0	1	0	1	0	1
15-19.....	2	1	0	1	0	2	0	0
20-29.....	3	2	0	1	0	3	0	0
30-39.....	7	1	0	5	1	5	2	0
40 and over.....	2	0	2	0	0	1	0	1

receive some form of public assistance. About 58 percent of Detroit's population lives in the central area, and about 92 percent of the paralytic cases and 67 percent of the nonparalytic were reported from this population. The vaccination rate in the central area was low. Families received an average of 0.71 dose of poliomyelitis vaccine. Among adults, only females had received vaccine, provided by the State during pregnancy.

The outer area of Detroit is made up of census areas E, F, G, H, I, and J in the northwest part of the city and M, N, and O in the northeast part. The outer area has a population of 806,000, about 42 percent of the population of Detroit proper. This is the higher economic portion of the city, although there

are neighborhoods which contain low-income families. Eight percent of the paralytic and 33 percent of the nonparalytic cases were reported from this area. The residents had a much higher vaccination rate than those in the central area. In the northwest part of the city, families with diagnosed poliomyelitis, mostly nonparalytic, had received 2.0 doses per person; children had received an average of 2.2 doses. As in the central area, most adults receiving vaccine were females.

The major portion of Wayne County is outside the city of Detroit, to the west and south. This area includes the cities of Hamtramck and Highland Park, which lie within the city limits of Detroit, as well as some communities along Lake St. Clair, to the east of the city. The county varies from highly industrialized to distinctly rural areas, and from top-level to low-economic residential areas. Only the city of River Rouge, with population characteristics similar to those of central Detroit, approached central Detroit's paralysis rate. The number of reported cases was also high in Wyandotte and Inkster. Dearborn, with a population of 115,000, had no paralytic cases. The vaccination rate in Wayne County was low.

**Table 3. Residual paralysis among reported cases of poliomyelitis in Detroit and Wayne County, Mich., 1958**

Type of poliomyelitis	Total	Detroit	Remainder of Wayne County
Total cases.....	874	649	225
Nonparalytic.....	462	303	159
Paralytic.....	412	346	66
Residual paralysis:			
None.....	69	56	13
Mild.....	113	95	18
Moderate.....	129	111	18
Severe.....	76	61	15
Death.....	25	23	2

### Epidemic Management

Each development of the poliomyelitis epidemic was noted or anticipated. The public was kept informed through close working re-

Figure 2. Poliomyelitis cases reported in Detroit and Wayne County, Mich., by week of onset, 1958

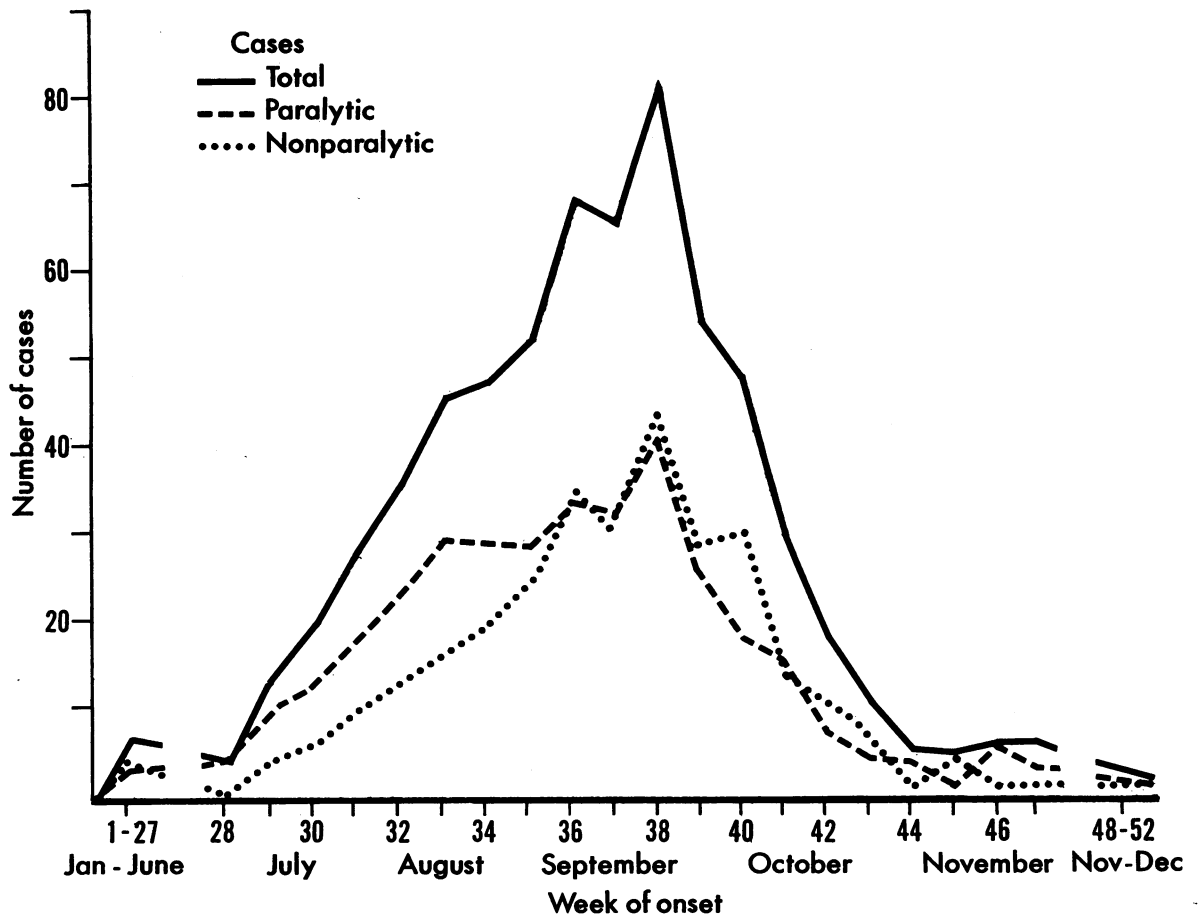


Table 4. Reported cases of poliomyelitis, by population and race, and reported deaths, Detroit, Mich., 1946-58

Year	Population	Reported cases						Deaths	
		Total	Rate per 100,000	White		Nonwhite		Number	Case fatality rate
				Number	Percent	Number	Percent		
1946	1,750,000	315	18.0	239	75.9	76	24.1	27	8.6
1947	1,785,000	219	12.3	188	85.8	31	14.2	6	2.7
1948	1,815,000	192	10.6	174	90.6	18	9.4	6	3.1
1949	1,825,000	553	30.3	521	94.2	32	5.8	27	4.9
1950	1,846,000	400	21.7	367	91.8	33	8.2	27	6.8
1951	1,896,000	371	19.6	311	83.8	60	16.2	11	3.0
1952	1,945,600	748	38.5	665	88.9	83	11.1	41	5.5
1953	1,995,650	559	28.0	503	90.0	56	10.0	25	4.5
1954	2,000,000	549	27.5	462	84.2	87	15.8	25	4.6
1955	1,902,000	249	13.1	200	80.3	49	19.7	2	.8
1956	1,910,000	151	7.9	92	60.9	59	39.1	2	1.3
1957	1,912,000	179	9.4	102	57.0	77	43.0	2	1.1
1958	1,900,000	649	34.2	247	38.1	402	61.9	23	3.5

**Table 5. Reported cases of poliomyelitis in Detroit, Mich., by type of disease,**

Age (years)	Total cases		Type of poliomyelitis				Sex			
			Nonparalytic		Paralytic		Male		Female	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All ages.....	649	100.0	303	47.7	346	53.3	364	56.1	285	43.9
Under 1.....	40	6.2	7	17.5	33	82.5	24	60.0	16	40.0
1-4.....	236	36.4	62	26.3	174	73.7	137	58.1	99	41.9
5-9.....	166	25.6	100	60.2	66	39.8	97	58.4	69	41.6
10-14.....	70	10.8	52	74.3	18	25.7	45	64.3	25	35.7
15-19.....	41	6.3	27	65.9	14	34.1	16	39.0	25	61.0
20-29.....	55	8.5	29	52.7	26	47.3	27	49.1	28	50.9
30-39.....	32	4.9	20	62.5	12	37.5	14	43.8	18	56.2
40 and over.....	9	1.3	6	66.7	3	33.3	4	44.4	5	55.6

relationships with the press, radio, and television. This up-to-the-minute knowledge of the situation was a result of prompt reporting of disease and of early home visits for epidemiological study and followup. Medical histories pointed up the very low rate of vaccination of the victims of the epidemic. The areas hardest hit were noted.

This information was used as a basis for setting up a crash immunization program sponsored by the Wayne County Medical Society, the Detroit and Wayne County Departments of Health, and the National Foundation. The

program was directed primarily at the epidemic area. Poliomyelitis protection clinics were held in churches, schools, recreational centers, and libraries—wherever the public could best be served. A full course of three injections was made available to all, regardless of the patient's ability to pay.

The program, from its beginning in mid-August to the end of the year, resulted in the administration of more than 630,000 injections of poliomyelitis vaccine. On the basis of vaccine sales, it is estimated that about twice this number of doses were given by private physi-

**Table 6. Reported cases of paralytic poliomyelitis in Detroit, Mich., by age, sex, and race, 1958**

Age (years)	Total		Sex				Race			
			Male		Female		White		Nonwhite	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
All ages.....	346	100.0	193	55.8	153	44.2	75	21.7	271	78.3
Under 1.....	33	9.5	21	63.6	12	36.4	5	15.2	28	84.8
1-4.....	174	50.3	97	55.7	77	44.3	23	13.2	151	86.8
5-9.....	66	19.1	34	51.5	32	48.5	16	24.2	50	75.8
10-14.....	18	5.2	11	61.1	7	38.9	7	38.9	11	61.1
15-19.....	14	4.0	5	35.7	9	64.3	4	28.6	10	71.4
20-29.....	26	7.5	17	65.4	9	34.6	14	53.8	12	46.2
30-39.....	12	3.5	7	58.3	5	41.7	3	25.0	9	75.0
40 and over.....	3	.9	1	33.3	2	66.7	3	100.0	0	.0

**age, sex, and race, 1958**

Race					
White			Nonwhite		
Number	Percent of—		Number	Percent of—	
	Age group	Total white cases		Age group	Total non-white cases
248	38.2	100.0	401	61.8	100.0
5	12.5	2.0	35	87.5	8.7
51	21.6	20.6	185	78.4	46.2
69	41.6	27.8	97	58.4	24.2
40	57.1	16.1	30	42.9	7.5
26	63.4	10.5	15	36.6	3.7
34	61.8	13.7	21	38.2	5.2
17	53.1	6.9	15	46.9	3.7
6	66.7	2.4	3	33.3	.8

cians, making a total of about 2 million injections.

In areas of high poliomyelitis incidence, 64.1 percent of the children returning to school in September had been vaccinated; 89.7 percent of the February 1959 entrants claimed such protection. In areas of low poliomyelitis incidence, the corresponding figures were 96.6 percent and 98.2 percent. Poliomyelitis protection is now available at health centers throughout the city on a weekly clinic basis, and an extensive school program has been set up.

About 85 percent of the cases of reported poliomyelitis in Detroit and Wayne County were cared for at Herman Kiefer Hospital, which is under the supervision of the Detroit Health Department. Both routine hospital care and diagnostic screening were the responsibility of the hospital's medical staff. Many cases came to the hospital from outside Detroit and Wayne County. As new admissions of acute poliomyelitis cases exceeded the capacity of the hospital, recently convalescent patients were transferred to other facilities. Routine followup examinations were done for patients 30 or more days after discharge.

**Epidemiology**

In the Detroit epidemic, poliomyelitis sought its victims among the poorly vaccinated. There

was apparently little radial spread of the disease from one region to another in the heavily populated areas. Late in the season a shift to the rural areas of Wayne County was noted.

The number of doses and the date of injection of poliomyelitis vaccine were carefully determined for each reported case of poliomyelitis. In the city of Detroit, 95.1 percent of the patients with paralytic poliomyelitis had fewer than three inoculations of Salk vaccine, and 78.6 percent had no vaccine (table 8). Seventeen with paralytic poliomyelitis had three inoculations; none had four. None of the patients who died had had three inoculations.

A slightly different picture is seen in Wayne County outside Detroit. Here 74.2 percent of the patients with paralysis had received no vaccine, 83.3 percent had received fewer than three injections, and 11 patients, or 16.7 percent, had received three or more injections. One of the fatalities in Wayne County was an 11-year-old boy who had two injections of vaccine in 1955 and a third in 1957. This was confirmed from school records. There were no virus studies on this patient.

To measure the value of poliomyelitis vaccine,

**Table 7. Average age in years of reported cases of poliomyelitis in Detroit, Mich., for 1958, by sex, race, and type of disease**

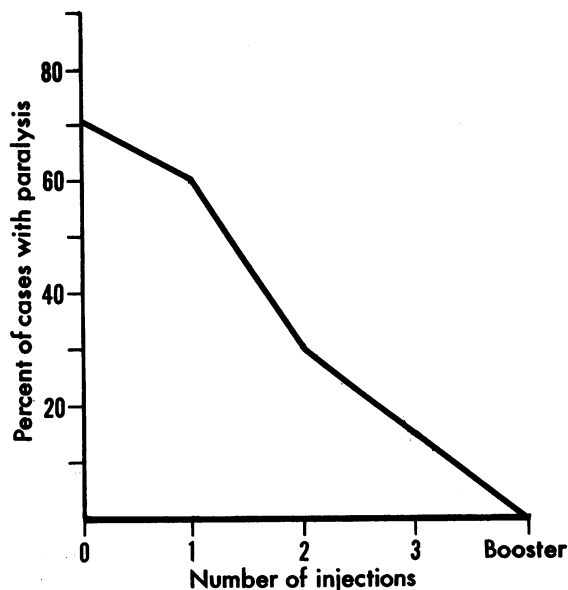
Sex	White	Non-white	Total
Nonparalytic			
Male.....	11.2	8.6	10.1
Female.....	15.8	10.6	13.5
Both sexes.....	13.2	9.5	11.6
Paralytic			
Male.....	14.8	5.5	7.2
Female.....	10.4	5.9	7.1
Both sexes.....	12.5	5.7	7.2
Nonparalytic and paralytic			
Male.....	12.1	6.5	8.6
Female.....	13.9	7.5	10.1
Both sexes.....	13.0	6.9	9.2

it would be helpful to know what proportion of the population was adequately protected in an area where the disease was epidemic, especially in the preschool age group. There are no easy means of determining those protected by virtue of inapparent infections, nor is the information obtained from informants concerning the individual's artificial immunization likely to be entirely correct. Such information needs careful verification. However, despite its limitations, the survey method represents a realistic approach to this problem. Serfling has formulated a useful sampling method for rapid survey of an area (3).

In order to have a basis for the effective promotion of immunization, a survey of current poliomyelitis immunity through vaccination was made in schools throughout Detroit. The index of relative vaccination coverage is indicated by the border in figure 1. While the data varied from school to school, on the average less than 50 percent of the children in elementary schools in the central area had had three inoculations of poliomyelitis vaccine. About 35 percent had had no vaccine at all. In the schools outside the central area a high protection level, indicated by the proportion of children having three or more inoculations, was demonstrated in well over 50 percent of the pupils. The correlation between the low rate of vaccination and the high incidence of paralytic poliomyelitis is graphically illustrated in figure 1. Because several immunization campaigns had been directed at the elementary school group in the central area during the preceding 3 years, apparently without marked success, a much lower state of immunization is believed to have existed in the preschool group at the time of the epidemic.

Studies made in Detroit and elsewhere have disclosed that not one but a variety of reasons were given to explain the lack of adequate protection against poliomyelitis through artificial immunization (4). Major factors seemed to be apathy, indifference, lack of "health awareness," ignorance of the facts concerning vaccination, outright opposition, or, in some instances, definitely expressed fear as to the safety of the procedure and of the vaccine. The unvaccinated group were not motivated by the usual mass media, such as newspapers, televi-

**Figure 3. Paralysis rates related to number of injections of Salk poliomyelitis vaccine among reported cases of poliomyelitis, Detroit, Mich., 1958**



sion, or radio, employed to promote immunization. Inability to pay for vaccination because of marginal income or unemployment, which was clearly evident in many instances, need not have been a deterrent. Clinics were available without cost and were close at hand; still they were not used. The lack of protection among young fathers was not limited to the central area of the city and would seem to indicate a serious failure of mass media to educate the entire public to the need for protection against poliomyelitis.

#### **Herman Kiefer Hospital Admissions**

Each year the communicable disease division of the Herman Kiefer Hospital admits more than 80 percent of all reported cases of poliomyelitis from the Detroit metropolitan area. This area includes the city of Detroit, and Wayne, Oakland, and Macomb Counties.

During 1958, 867 poliomyelitis patients were admitted to the hospital, 853 of them during the period July to November, and 955 patients were examined and returned to the care of private physicians. Of the 874 cases of poliomyelitis reported in Detroit and Wayne County, 742, or 84.8 percent, were cared for at Herman



Kiefer Hospital. The maximum number of patients admitted in one week was 117, during the week ending September 17. There were only 10 admissions through July 16. Many cases came from outside Detroit and Wayne County.

The 1958 hospital admissions were distributed as follows:

Area	Number cases	Number deaths
Detroit city-----	534	17
Remainder of Wayne County -----	208	2
Macomb County -----	76	6
Oakland County -----	45	0
Other -----	4	0
Total -----	867	25

Males exceeded females in all age groups. About 53 percent of the paralytic cases occurred in the 0-4 year age group; almost 60 percent were among nonwhites (table 9).

Forty percent of poliomyelitis admissions were for paralytic poliomyelitis (table 9) 84 percent of these patients had spinal involvement (table 10). Tracheotomies were performed on 27 patients, 18 of them males. Respirator cases numbered 54 (table 11). Thirty-eight were in males, and of these, 23 were nonwhite. Nine of the females were white. Most respirator cases were in the group aged 20 years and over.

Fatalities among patients admitted to the hospital numbered 25 (table 11). Twenty were

**Table 8. Number and percent of Salk vaccine injections<sup>1</sup> among all cases and among paralytic cases of poliomyelitis, by sex and race, Detroit, Mich., 1958**

Number of injections	Total		Males		Females		White		Nonwhite	
	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent
All cases										
0-----	365	59.3	214	58.8	171	60.0	103	41.5	282	70.3
1-----	55	8.5	33	9.1	22	7.7	18	7.3	37	9.2
2-----	81	12.5	44	12.1	37	13.0	27	10.9	54	13.5
3-----	121	18.6	71	19.5	50	17.5	94	37.9	27	6.7
4-----	7	1.1	2	.5	5	1.8	6	2.4	1	.3
Total-----	649	100.0	364	100.0	285	100.0	248	100.0	401	100.0
Average-----	0.94	-----	0.94	-----	0.93	-----	1.52	-----	0.57	-----
Paralytic cases										
0-----	272	78.6	154	79.8	118	77.1	54	72.0	218	80.5
1-----	33	9.6	17	8.8	16	10.5	8	10.7	25	9.2
2-----	24	6.9	12	6.2	12	7.8	2	2.7	22	8.1
3-----	17	4.9	10	5.2	7	4.6	11	14.6	6	2.2
4-----	0	.0	0	.0	0	.0	0	.0	0	.0
Total-----	346	100.0	193	100.0	153	100.0	75	100.0	271	100.0
Average-----	0.38	-----	0.37	-----	0.40	-----	0.60	-----	0.32	-----

<sup>1</sup> The peak of poliomyelitis cases occurred during an intensive Salk vaccine inoculation drive which was instituted in mid-August following several weeks of sustained high incidence of poliomyelitis cases to raise the antipoliomyelitis immune state in the general population and thus possibly to abort the epidemic. Thus, many persons received poliomyelitis vaccine inoculations at time of onset of poliomyelitis or after onset. Since the inoculations were received too late to affect resistance to infection, these inoculations were considered, for analytic purposes, as not having been received. Statistical tests indicated that inoculations received at time of or following onset of poliomyelitis did not prevent or cause infection or paralysis, nor did these inoculations modify or enhance the extent of residual paralysis among paralytic cases.

For the most part, these inoculations have been verified by a check of health department clinic records and by confirmation by private physicians who gave inoculations to patients. In less than 10 percent of the cases were statements by parents or guardians the sole verification accepted.

NOTE: For nonparalytic cases the average number of injections was 1.6. Adults and children received about the same average number.

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## Use of an Aluminum Phosphate Vaccine

There has been some discussion as to whether it is advisable to inoculate infants with vaccines using aluminum phosphate (or alum) as the mineral carrier during and immediately preceding the "polio season" because of the possibility of such agents "provoking" paralytic poliomyelitis in subsequently exposed individuals. Hill and Knowelden reported this phenomenon in the *British Medical Journal* for July 1, 1950, in reference to children receiving their first dose of diphtheria, tetanus, pertussis (DTP) vaccine within a month or so of the seasonal incidence of poliomyelitis in Great Britain.

Quite inadvertently, we were able to observe the experience of infants receiving such a substance just prior to the 1958 epidemic of poliomyelitis in Detroit and Wayne County, Mich. During the spring of 1958, the Detroit Department of Health had initiated a rather extensive clinical trial of Quadrigen, a multiple antigen containing poliomyelitis, diphtheria, tetanus, and pertussis antigens adsorbed onto aluminum phosphate. In this study 446 infants, ranging in age from birth through 6 months at the time they were placed on their primary series of inoculations, received four inoculations of Quadrigen at monthly intervals. Another 211 infants of the same age range were placed on a similar course of a standard DTP vaccine, in which aluminum phosphate was also the mineral carrier.

All children received their first dose in April, their second in May, their third in June, and completed their fourth dose by mid-July 1958. A single dose of Quadrigen was given to 460 children from both groups who returned for their "booster" in January 1959.

The Detroit poliomyelitis epidemic occurred between July and November 1958, reaching its peak in mid-September. This was Detroit's worst outbreak of paralytic poliomyelitis since 1952, with 346 reported paralytic cases in the city, nearly 10 percent of which occurred in infants under 1 year of age. Virus isolation studies performed by Dr. Gordon Brown of the University of Michigan on a number of patients revealed a preponderance of type 1 poliovirus infections (77 percent type 1 isolated from stools), with type 3 found to a lesser extent (23 percent type 3 isolated from stools). Type 2 apparently was not involved. Most of the children receiving Quadrigen or DTP antigen in the study

population came from homes in the geographic areas of the city hardest hit by the epidemic.

Because of the 211 children receiving DTP antigen but no poliomyelitis vaccine before or during this epidemic (these children received their poliomyelitis vaccine inoculations January through April of 1959), we were able to measure the impact of the epidemic on our study population. Blood tests revealed that 42 of these children experienced an unexplained but significant rise in antibody titer to type 1 poliovirus and to a lesser extent to type 3 after their primary series of DTP inoculations and before their booster dose of Quadrigen. This rise was also seen in the Quadrigen-inoculated groups. Among infants showing an unexplained rise in poliovirus antibody titer, a rise in type 1 antibody titer occurred in 73 percent (109 of 150 determinations), and in type 3 in 27 percent. No such phenomena occurred in respect to type 2 antibody levels. This serologic pattern in the controls would seem to confirm the virus isolation studies of Dr. Brown and, if this presumption is correct, definitely indicates that our study population received a heavy exposure to type 1 virus and to some extent to type 3.

Naturally, we have been concerned as to whether any of our study babies contracted poliomyelitis, and we are happy to report, after an extensive review of our records, that none of these children contracted clinically recognizable poliomyelitis either during this epidemic or at any time since. From this limited but timely experience we are in a position to say there is no apparent provocative effect from intramuscular immunizations with Quadrigen or DTP preparation with AlPO<sub>4</sub> in precipitating paralytic poliomyelitis infection in a child. We know of no reason why these observations would not apply with equal validity to poliomyelitis vaccine preparations using aluminum phosphate as a mineral carrier. We have also had these preparations under clinical investigation. Results of these studies are in preparation for a paper which will be submitted for publication in the near future.—  
JOSEPH G. MOLNER, M.D., M.P.H., *health commissioner, City of Detroit*, and C. DALE BARRETT, JR., M.D., M.P.H., *director of maternal and child health, Detroit Department of Health*.

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among males, and of these, 10 were white. Deaths among females numbered five; three were white. Fourteen deaths occurred in the 20-year and over age group; 11 were males. Of the six deaths among nonwhites, five were in males.

The admitting-room service functioned as a diagnostic and screening agency. During an epidemic of poliomyelitis-like illness a discussion of the differential diagnosis between nonparalytic poliomyelitis, aseptic meningitis, and Coxsackie or ECHO virus infection is completely academic. Any patient with any signs and symptoms that might be those of poliomyelitis was admitted to the nearest hospital, where observations and treatment could be given as needed.

The classic, biphasic type of onset was seldom seen in this epidemic. The duration of illness prior to examination ranged from 1 to 7 days, the majority ranging from 2 to 4 days. The most common symptoms were severe headache, vomiting, malaise, and generalized aching. Upper respiratory tract symptoms were common.

Physical findings included stiffness of the neck and back of varying severity and a temperature of 100° to 103° F. and higher in patients with bulbar or intercostal involvement. Many patients were paralyzed at the time of admission. Five cases exhibited a mild, discrete, morbilliform rash.

Acute and convalescent phase blood specimens and a stool specimen from 556 patients

**Table 9. Type of poliomyelitis among patients admitted to Herman Kiefer Hospital, Detroit, Mich., during 1958, by age, sex, and race**

Age, sex, and race	Total	Nonparalytic	Paralytic
Total cases.....	867	520	347
<i>Age (years)</i>			
0-4.....	285	102	183
5-9.....	215	146	69
10-19.....	185	142	43
20 and over.....	182	130	52
<i>Sex</i>			
Male.....	495	307	188
Female.....	372	213	159
<i>Race</i>			
White.....	512	372	140
Nonwhite.....	355	148	207

**Table 10. Type of paralytic poliomyelitis among patients admitted to Herman Kiefer Hospital, Detroit, Mich., by sex, 1958**

Type of paralytic poliomyelitis	Total	Male	Female
Total cases.....	347	188	159
Spinal.....	292	151	141
Bulbar.....	17	10	7
Spinobulbar.....	29	21	8
Encephalitic and other.....	9	6	3

**Table 11. Tracheotomies, respirator cases, and deaths among poliomyelitis patients admitted to Herman Kiefer Hospital, Detroit, Mich., by sex, 1958**

	Total	Male	Female
Tracheotomies.....	27	18	9
Respirator cases.....	54	38	16
Deaths.....	25	20	5

were subjected to virus studies (table 12): 433 stools and 112 paired blood specimens were examined; 11 examinations were incomplete (5).

Type 1 and type 3 polioviruses were obtained from the stools of paralytic patients, with type 1 predominating (table 12). No type 2 virus was recovered. Poliovirus was recovered from the stools of 72.0 percent of the paralytic cases and from 20.2 percent of the nonparalytic cases. Positive virus findings correlated fully with the clinical diagnoses in the paralytic cases. Recovery of poliovirus from nonparalytic cases in the Detroit central area exceeded considerably the recovery of other identifiable viruses, with the reverse being true outside the central area. More comprehensive laboratory data, from specimens collected throughout Michigan during 1958, have been reported by Brown and associates (5).

A majority of the patients with nonparalytic disease were hospitalized for 7 to 10 days. A few with extreme stiffness required hot packs and physical therapy for several weeks. The minimum period of hospitalization for patients with paralytic poliomyelitis was 14 days. Twenty patients, all with severe involvement, required very extensive treatment. It was the

impression of clinicians at the hospital, based on carefully obtained histories, that trauma and fatigue apparently played a very minor role in production of paralysis in the cases seen during 1958.

Two cases of poliomyelitis frequently occurred in the same family. In September, four members of a family, the father and three children, were admitted to the hospital. The father had paralysis of all extremities and intercostal muscles and required treatment in a respirator. One of the children had paralysis of a lower extremity; the other two were nonparalytic.

Three patients returned to the hospital with second attacks of poliomyelitis. Two were nonparalytic in type during both admissions. Poliovirus was recovered from the stools of both of these patients on both first and second admissions. Each illness was caused by a virus

of different type. The third patient had nonparalytic disease on the first admission and encephalitis plus paralysis of a lower extremity on the second.

During September, it was necessary to transfer convalescents to general hospitals, convalescent centers, and the rehabilitation center in Detroit, in order to obtain space for acute cases.

### Summary and Conclusions

During 1958 Detroit and Wayne County, Mich., experienced a poliomyelitis epidemic which contrasted sharply with the racial and regional occurrence of this disease characteristic of outbreaks in the past.

The epidemic commenced late in July, reached a peak in September, and ended in

**Table 12. Virus isolations from stools of 556<sup>1</sup> poliomyelitis patients treated at Herman Kiefer Hospital, Detroit, Mich., 1958**

Area	Total stools examined	Virus isolated									
		Poliomyelitis					Other				
		Number			Per-cent	Positive			Negative		
		Type 1	Type 3	Total		Number			Per-cent	Num-ber	Per-cent
						Cox-sackie	ECHO	Total			
Paralytic cases <sup>2</sup>											
Detroit:											
Central area.....	169	93	31	124	73.4	0	0	0	0	45	26.6
Outer area.....	17	10	0	10	58.8	0	0	0	0	7	41.2
Remainder of Wayne County..	39	26	2	28	71.8	0	0	0	0	11	28.2
Total.....	225	129	33	162	72.0	0	0	0	0	63	28.0
Nonparalytic cases											
Detroit:											
Central area.....	97	23	8	31	31.9	5	17	22	22.7	44	45.4
Outer area.....	52	4	0	4	7.7	2	7	9	17.3	39	75.0
Remainder of Wayne County..	59	5	2	7	11.7	0	13	13	22.1	39	66.2
Total.....	208	32	10	42	20.2	7	37	44	22.2	122	58.6
Grand total.....	433	161	43	204	47.1	7	37	44	10.2	185	42.7

<sup>1</sup> Paired blood specimens only were examined from 112 patients; examinations of 11 were incomplete.

<sup>2</sup> Paralytic cases received 60-day followup.

November. The final count showed 412 paralytic cases and 25 fatalities. More than three-quarters of the paralytic cases were concentrated in the central area of the city and largely involved a Negro population of low economic status. Sixty percent of the paralytic victims of the disease in Detroit had not yet reached their fifth birthday. Those in their second year of life were most susceptible.

The epidemic was due to type 1 and type 3 polioviruses, with type 1 predominating. Victims of paralytic disease had received little or no Salk vaccine. A crash immunization program was inaugurated during the epidemic. Well-advertised poliomyelitis protection clinics were set up throughout the county but were especially concentrated in the epidemic areas.

The pattern of poliomyelitis in a large city and community 4 years after Salk vaccine became available demonstrates the high level of protection afforded by the recommended number of doses of this vaccine. On the basis of effort directed at all levels of the population and a high per capita rate of inoculation with Salk vaccine, it had been believed that protection against poliomyelitis was at a safe level in Detroit. However, the distressing epidemic occurrence of paralytic poliomyelitis in infants and children concentrated largely in low-income groups evidenced not only pockets of the population which had received little or no vaccine but also demonstrated the cyclic, unpredictable character of the disease in those who lacked adequate protection.

An outbreak of poliomyelitis as severe as that which occurred in Detroit can best be prevented by searching for pockets of low artificial pro-

tection, making vaccination readily available to all, and, for some elements of the population, resorting to intensive personal persuasion or education to encourage inoculation. The peak occurrence of the paralytic cases in the second year of life indicates not only the urgent need to give protection as early in infancy as is possible, but offers a key to prevention of epidemics. Since births are a matter of public record, the effective followup of every infant during its first year of life seems the logical approach to building solid protection against poliomyelitis into a community.

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## Search for Energy Sources

Solar and nuclear energy were among the topics discussed at the International Conference on Science in the Advancement of New States which was held August 15-30, 1960, at the Weizmann Institute of Science, Rehovoth, Israel. More than 500 statesmen, scientists, scholars, and observers, representing 31 countries and 5 continents, attended the conference.

Dr. Alvin M. Weinberg, director of the Oak Ridge National Laboratory at Oak Ridge, Tenn., spoke on the eventual possibility of achieving autarky in energy by the use of breeder reactors, which manufacture more fuel than they consume.

Weinberg said he did not wish to encourage the statesmen present at the conference to go into the nuclear business in their new states. He urged that most of them wait until breeder reactors have been developed further, suggesting their use might become economically feasible in certain areas within 15 years. He also warned about the danger of starting large-scale nuclear energy programs until the problem of radioactive waste disposal had been solved.

"I think an economically autarkic world would be a more stable place than an economically interdependent world," Weinberg stated. "There are many examples of how concern for the supplies needed to produce energy or for other raw materials has led to acute anxiety and tension. The Suez crisis in 1956 is only one of many such crises which can be traced to worry over energy-producing materials. One need only imagine the course of events at Suez had all the countries involved at the time been truly self-sufficient in regard to energy. If their energy systems had been based on domestic uranium and thorium and the problem of converting nuclear energy into petrochemicals had been solved, it is hard to see how access to the Middle East could have become a major political issue."

The paper presented by Dr. Henry Tabor of the National Physical Laboratory of Israel dealt with solar energy as a source of power.

Tabor described a solar pool built to employ his system near the Dead Sea Works at S'dom. Salts are dissolved at the bottom of the pool, making the bottom layer of water heavier and preventing it from rising to the surface even when it has become hotter. Although the top layer remains at a stable temperature because it loses heat at the same rate as it picks it up, the lower level of water gradually gets hotter if it is undisturbed.

Tabor reported that a solar pool covering 1 square kilometer would produce heat valued at \$300,000 annually and would cost \$1 to \$1.5 million to construct. He estimated that such a pool would produce 6,000 kilowatts of electricity whenever the sun was shining. The cost of installed capacity would be only about \$250 per kilowatt, less than the estimated cost per kilowatt of production by nuclear power stations when they become operative.

He pointed out that most undeveloped countries have considerable quantities of flat land, salt, and hot sun, the three requirements for building solar pools. Salt is frequently present in flat areas, where very large pools could be built, and there are tens of thousands of square kilometers of such land in the world.

Three urgent needs of new states in the next 15 years were emphasized in discussions following the regular sessions of the conference:

1. Short-range programs carried out with the help of societies wealthier in capital and know-how, rather than long-range benefits from science.
2. Immediate training of administrative and technological personnel.
3. Small power rather than huge energy reactors. In this connection, Tabor's solar pool and the suggestion that wind power might be usable produced favorable response.

Discussion of desalination of sea water also impressed conference delegates, many of whom came from new states suffering shortage of sweet water.