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By

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PREPARED BY DIRECTION OF THE SURGEON GENERAL

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EPIDEMIOLOGICAL STUDIES OF POLIOMYELITIS IN KENTUCKY

By L. L. LUMSDEN, *Medical Director, United States Public Health Service*

These studies were conducted continuously from July 30 to September 20, 1935, and intermittently thereafter until December 31, 1935. They were carried out in active cooperation with the Kentucky State Health Department and with several of the local (county and city) health departments. They comprised (1) collection and collation or mortality and morbidity statistics from the records of the State and the local official health agencies; (2) surveys of local conditions thought possibly to influence the widely varying rates of incidence of the disease in different parts of the State; and (3) obtainment by visits to affected homes of detailed epidemiological histories of 184 cases officially reported as poliomyelitis.

Incidence

From such records as are available, it appears that during the last 25 years the incidence rate of recognized poliomyelitis in Kentucky probably has averaged fairly close to that of the United States as a whole, much below that of the New England and the Middle Atlantic States, and considerably above that of the group of States to the south and the southeast.[1]

Table 1 shows the number of cases of and number of deaths from poliomyelitis reported in Kentucky by counties and years from 1921 to 1935, inclusive.

[1] Public Health Bulletin No. 91, pp. 71–74, and Epidemiological Report of the Health Section of the League of Nations, October–December 1935, no. 10–12, p. 212.

TABLE 1.—*Cases of and deaths from poliomyelitis reported in Kentucky by counties and years from 1921 to 1935*

County	Population United States census of 1930	1921		1922		1923		1924		1925		1926		1927		1928		1929		1930		1931		1932		1933		1934		1935		Total	
		Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Adair	16,401	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	1	2	0	0	0	0	0	2	3
Allen	15,180	0	1	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	3	1	0	0	2	0	6	4
Anderson	8,494	0	0	0	0	0	0	2	0	2	0	0	0	2	1	1	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	9	3
Ballard	9,910	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	1
Barren	25,844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	1	11	2	16	4
Bath	11,075	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	1
Bell	38,747	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	2	0	1	0	0	1	2	2	0	0	0	0	4	1	10	7
Boone	9,595	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1
Bourbon	18,060	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	1	0	1	1	0	2	1	0	6	5
Boyd	43,849	3	1	0	0	13	2	1	1	0	0	1	1	1	0	1	0	0	0	1	2	0	0	1	2	2	0	2	1	1	0	24	8
Boyle	16,282	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	0	0	2	1	1	0	9	3
Bracken	9,616	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	4	0
Breathitt	21,143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	2	0	5	0
Breckinridge	17,368	0	0	0	0	0	0	0	1	0	1	1	0	1	0	1	1	0	0	2	0	0	0	0	0	0	0	0	0	5	9	10	4
Bullitt	8,868	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	2	4	3
Butler	12,620	0	1	0	1	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	2	5
Caldwell	13,781	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2
Calloway	17,662	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Campbell	73,391	0	0	0	0	0	0	0	1	0	1	0	1	3	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	5	6
Carlisle	7,363	1	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	1	2	0	0	0	0	1	1	5	5
Carroll	8,155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	1	0	2	1
Carter	23,839	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	6	1
Casey	16,747	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Christian	34,283	1	1	0	1	0	0	0	1	0	1	1	0	0	1	1	3	0	0	0	1	0	0	0	2	0	0	0	0	2	0	5	13
Clark	17,640	0	0	0	0	0	0	0	2	0	0	0	0	2	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	5	4
Clay	18,526	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	3	2
Clinton	9,004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	2
Crittenden	11,931	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Cumberland	10,204	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
Daviess	43,779	2	0	0	2	1	1	1	0	10	3	2	1	55	4	1	3	0	0	0	0	0	0	0	1	0	0	0	1	17	0	90	16
Edmonson	11,475	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	1	11	1	14	3
Elliott	7,571	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2
Estill	17,079	0	0	0	0	0	0	0	0	0	0	0	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	7	2
Fayette	68,543	0	0	0	0	0	0	0	1	0	0	0	0	2	4	0	0	1	0	0	2	0	2	0	0	2	0	5	1	1	0	12	10
Fleming	12,931	2	0	0	0	1	0	2	0	0	0	0	1	1	2	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	8	5
Floyd	41,942	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	3	10
Franklin	21,064	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
Fulton	14,927	2	0	1	0	0	1	0	1	0	0	2	0	0	0	3	1	1	1	0	0	0	1	1	0	0	0	2	0	2	0	13	6
Gallatin	4,437	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Garrard	11,562	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	4	4
Grant	9,876	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	3

Graves	30,778	2	1	0	0	0	0	0	0	0	0	0	0	3	1	4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	4
Grayson	17,055	0	0	0	0	0	1	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	11	0	12	6
Green	11,401	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	4
Greenup	24,554	1	0	0	1	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	2	1	0	0	7	1	0	0	10	7
Hancock	6,147	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardin	20,913	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	2	0	4	2
Harlan	64,557	0	0	0	0	0	0	0	0	0	1	3	2	2	2	0	0	0	1	0	2	0	2	1	0	0	1	7	2	0	0	13	13
Harrison	14,859	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Hart	16,169	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	5	1	7	2
Henderson	26,295	0	1	0	0	0	0	0	0	0	0	5	0	5	3	2	0	1	0	1	0	1	0	1	0	1	0	1	1	1	0	19	5
Henry	12,564	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	1
Hickman	8,725	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	1	0	1	1	0	0	4	3
Hopkins	37,449	0	0	0	0	0	1	1	0	3	0	1	1	4	2	14	0	0	1	4	0	1	1	1	1	0	0	0	0	5	0	34	7
Jackson	10,467	0	0	0	0	0	0	0	0	0	0	0	0	3	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	4	3
Jefferson	355,350	1	1	1	2	2	1	3	2	51	6	3	1	15	4	4	6	0	2	0	3	10	1	4	2	4	6	11	1	157	6	266	44
Jessamine	12,431	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	2
Johnson	22,968	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0	3	3
Kenton	93,534	0	0	0	0	0	0	2	1	1	0	0	1	4	1	1	0	1	0	9	0	1	0	0	1	1	0	5	1	0	0	25	5
Knott	15,230	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	1	0	3	1
Knox	26,266	0	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	2	3	6
Larue	9,093	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
Laurel	21,109	0	1	0	0	0	0	0	0	0	0	0	0	11	1	0	0	0	0	0	2	0	0	0	0	0	2	1	0	0	0	12	6
Lawrence	16,713	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	4	0
Lee	9,729	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Leslie	10,765	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	4	1	0	0	0	0	0	1	0	0	5	2
Letcher	35,702	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	5	0	1	1	6	4
Lewis	14,315	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	3	2
Lincoln	17,687	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	1	3	2
Livingston	8,608	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	1	3
Logan	21,875	0	0	0	0	0	0	0	1	0	0	2	0	2	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	4	0	10	2
Lyon	8,530	0	0	0	0	0	0	0	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	4	2
McCracken	46,271	0	0	0	0	1	0	0	0	3	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	6	1	11	5
McCreary	14,627	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	1	5
McLean	11,072	0	1	0	0	0	0	0	0	0	0	0	0	6	0	2	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	9	4
Madison	27,621	0	0	0	1	0	0	0	1	0	0	0	0	16	0	0	0	0	0	2	0	0	0	1	1	0	0	2	0	1	0	22	3
Magoffin	15,719	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1
Marion	15,499	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	1	0	0	3	3
Marshall	12,889	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0	1	1	0	0	0	1	0	4	2
Martin	8,584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	4
Mason	18,862	3	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	7	1
Meade	8,042	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Menifee	4,958	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	2
Mercer	14,471	0	0	0	0	0	0	0	1	0	3	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	1	5
Metcalfe	9,373	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	1	2
Monroe	13,077	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	1	0	3	0
Montgomery	11,660	0	0	0	0	0	0	0	0	2	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5	1
Morgan	15,130	0	1	0	1	0	0	0	2	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	8
Muhlenberg	37,784	0	0	0	0	0	0	0	0	0	1	0	0	0	0	3	2	0	0	0	0	1	2	0	0	1	0	3	3	8	2	16	10
Nelson	16,551	0	0	0	0	0	1	0	0	1	0	0	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0	1	0	4	0	10	2
Nicholas	8,571	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	3	1
Ohio	24,469	1	0	0	0	0	0	0	0	0	3	0	0	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	3	1	5	8
Oldham	7,402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	1
Owen	10,710	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	3

TABLE 1.—*Cases of and deaths from poliomyelitis reported in Kentucky by counties and years from 1921 to 1935*—Continued

County	Population United States census of 1930	1921		1922		1923		1924		1925		1926		1927		1928		1929		1930		1931		1932		1933		1934		1935		Total	
		Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Owsley	7,223	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	1
Pendleton	10,876	0	0	0	0	0	0	1	0	0	0	0	0	9	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	0	13	0
Perry	42,186	1	0	0	1	0	0	0	0	0	0	1	1	0	1	4	5	0	2	1	4	2	0	3	1	0	0	6	0	1	1	19	16
Pike	63,267	0	0	0	0	0	1	0	0	0	2	0	1	2	3	0	0	1	0	0	0	0	0	1	1	3	2	3	0	0	0	10	10
Powell	5,800	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	1	3	3
Pulaski	35,640	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1	2	1	0	2	4
Robertson	3,344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0
Rockcastle	15,149	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	1	2
Rowan	10,893	0	1	3	4	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	7	5
Russell	11,930	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	2
Scott	14,400	0	0	0	0	0	0	0	0	3	0	0	0	12	2	0	0	0	0	0	0	2	0	0	0	0	0	11	0	0	0	28	2
Shelby	17,679	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	1	0	2	3
Simpson	11,336	0	0	0	1	0	2	0	0	0	3	0	2	0	1	0	0	0	0	0	1	0	2	0	0	0	0	0	0	1	0	1	12
Spencer	6,606	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Taylor	12,047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	0	0	3	2
Todd	13,520	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	2	2
Trigg	12,531	0	1	0	0	0	0	0	0	0	1	0	0	6	1	0	1	0	0	0	0	0	0	2	0	0	0	0	0	3	0	11	4
Trimble	5,348	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1
Union	17,053	0	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	3	1	1	1	1	0	2	1	9	5
Warren	33,676	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	2	0	0	1	1	2	1	0	0	23	3	27	9
Washington	12,623	0	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	4
Wayne	15,848	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	0	0	0	3	1
Webster	20,534	0	0	0	0	0	0	0	0	0	0	0	1	0	0	4	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0	6	2
Whitley	29,730	0	0	0	2	2	1	0	0	0	1	0	0	0	3	0	1	0	1	0	0	0	1	0	3	0	0	1	0	0	1	3	14
Wolfe	8,425	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	2	2
Woodford	10,981	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	5
Total	2,614,589	23	18	6	22	21	17	17	26	82	47	26	30	192	61	58	41	11	19	27	28	30	33	52	41	44	27	118	45	328	37	1035	492

If the majority of the deaths were reported under correct diagnoses, the numbers of cases reported for most of these years were evidently far below the actual. The age distribution of the mortality suggests that in nonepidemic years some of the deaths were reported erroneously as deaths from poliomyelitis. In 1931, for example, the age of decedents was given as follows: Under 1 year, 3; 1 to 4 years, 15; 5 to 9 years, 5; 10 to 14 years, 3; 15 to 19 years, 1; 20 to 29 years, 1; 30 to 49 years, 2; 69 years, 1; 75 years, 1; 76 years, 1. Of those under 1 year, one was 5 months and one 3 months of age.

The evidence obtained in the course of these studies suggests that during the epidemic period of 1935 actual cases of poliomyelitis with definite paralysis attended by physicians were reported to a nearly complete degree throughout most of the State, and in a good many instances in some of the localities cases of illness were reported erroneously as poliomyelitis. It is quite possible, of course, that many actual cases with paralysis of slight degree and brief duration or without paralysis were not diagnosed and reported.

Of the 37 deaths reported in 1935, 3 occurred in January, 2 in March, 2 in April, 2 in May, 1 in June, 7 in July, 5 in August, 2 in September, 8 in October, and 5 in November. In the period July 1 to December 31, according to the records of the State health department, the number of cases reported was 320 and deaths 27, making a case fatality rate of 8.4 percent.

Age Distribution

The distribution of cases and deaths from poliomyelitis reported in Kentucky in 1935 among persons in different age groups was as follows:

TABLE 2.—*Number of cases and deaths reported as due to poliomyelitis in Kentucky, 1935, by age groups*

Age in years	Number of cases	Number of deaths	Case fatality rate per 100	Approximate case incidence per 100,000 population
0 to 4	141	21	14.9	48
5 to 9	95	7	7.4	30
10 to 14	54	5	9.2	20
15 to 19	21	3	14.3	8
Over 20	12	1	8.3	1
Not stated	5	0	0	----
Total	328	37	11.3	12

Of the decedents, six were under 1 year of age—one 11 months, one 8 months, one 7 months, one 6 months, one 3 months and 9 days, and one 2 months and 22 days. The oldest was 26 years of age.

Seasonal Prevalence

The seasonal distribution of reported cases in the 9-year period 1927 to 1935 is shown in table 3.

TABLE 3.—*Reported cases of poliomyelitis in Kentucky by months in the 9-year period 1927–35*

Month	Year									
	1927	1928	1929	1930	1931	1932	1933	1934	1935	Total
January	1	4	2	0	1	6	5	4	1	24
February	0	2	1	0	1	9	2	2	0	17
March	2	3	0	1	0	0	0	2	2	10
April	1	2	1	1	1	2	1	1	3	13
May	1	1	1	0	1	1	4	0	0	9
June	1	2	0	0	2	2	0	2	2	11
July	6	8	0	1	0	5	5	17	43	85
August	24	22	1	2	7	4	4	23	114	201
September	41	5	0	2	5	5	11	33	97	199
October	[1] 53	7	1	11	4	8	7	20	41	152
November	[2] 34	2	3	5	6	7	5	14	21	97
December	[3] 28	0	1	4	2	3	0	0	4	42
Total	192	58	11	27	30	52	44	118	328	860

[1] 33 of these were in Daviess County.
[2] 10 of these were in Daviess County.
[3] 15 of these were in Madison County.

It appears from the data in this table that the annual period of especially high incidence of the disease is that covered by the months of July, August, September, and October. A careful and thorough check-up on the diagnoses throughout each of the 9 years probably would have accentuated the seasonal distribution.

Geographical Distribution

Figures 1, 2, and 3, show the distribution by counties of reported cases in the calendar years 1927, in 1934, and in the period July 1 to December 31 of 1935, respectively. These seem to have been the 3 years of highest incidence of poliomyelitis in Kentucky since 1920. The difference in geographical distribution from year to year is striking. In 1935 there were three main centers of incidence—one in Jefferson County including the city of Louisville, one in Daviess County, and one in a group of five adjoining counties, Grayson, Edmonson, Warren, Barren, and Hart. All of these centers are in a section about 80 miles in diameter extending from the middle of the State westward, and from the Ohio River on the north nearly to the border of the State on the south. In the eight counties—Breckinridge, Bullitt, Butler, Hancock, Hardin, Larue, Meade, and Ohio, with an aggregate population of about 108,000—separating these three centers of high incidence, only 15 cases were reported from July 1 to December 31. In the same period the incidence rate of reported cases per 100,000 population was 38.6 in Daviess County, 42.5 in Jefferson County, 64.3 in Grayson County, 67.7 in Warren County,

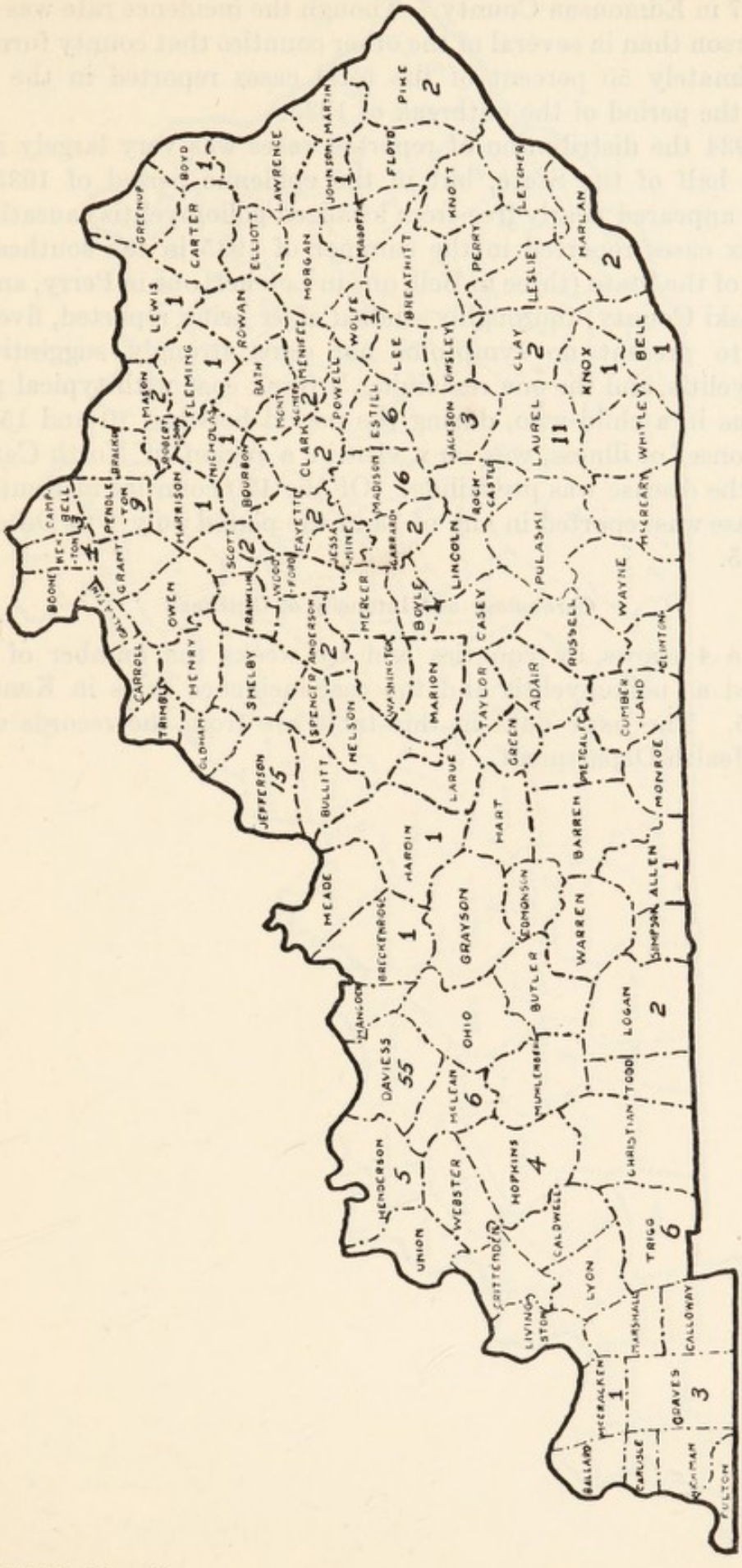

FIGURE 1.—Numbers of cases of poliomyelitis reported in counties of Kentucky in 1927.

and 95.7 in Edmonson County. Though the incidence rate was lower in Jefferson than in several of the other counties that county furnished approximately 50 percent of the total cases reported in the State during the period of the outbreak of 1935.

In 1934 the distribution of reported cases was very largely in the eastern half of the State, but in the epidemic period of 1935 this section appeared nearly free from localized poliomyelitis causation.

Of six cases reported in the summer of 1935 in the southeastern section of the State (three in Bell, one in Letcher, one in Perry, and one in Pulaski County) thoroughly studied after being reported, five were found to present no symptoms nor signs strongly suggestive of poliomyelitis, and the one remaining, a frank case with typical paralysis, was in a child who, during the period between 10 and 15 days before onset of illness, was on a visit in a region in North Carolina where the disease was prevailing. Of the 120 counties in Kentucky, not a case was reported in any of 73 in the period July 1 to December 31, 1935.

Chronology and Intensity of Outbreak

Table 4 shows by counties and by weeks the number of cases reported as poliomyelitis and the case-incidence rates in Kentucky in 1935. The basic data in this table are from the records of the State Health Department.

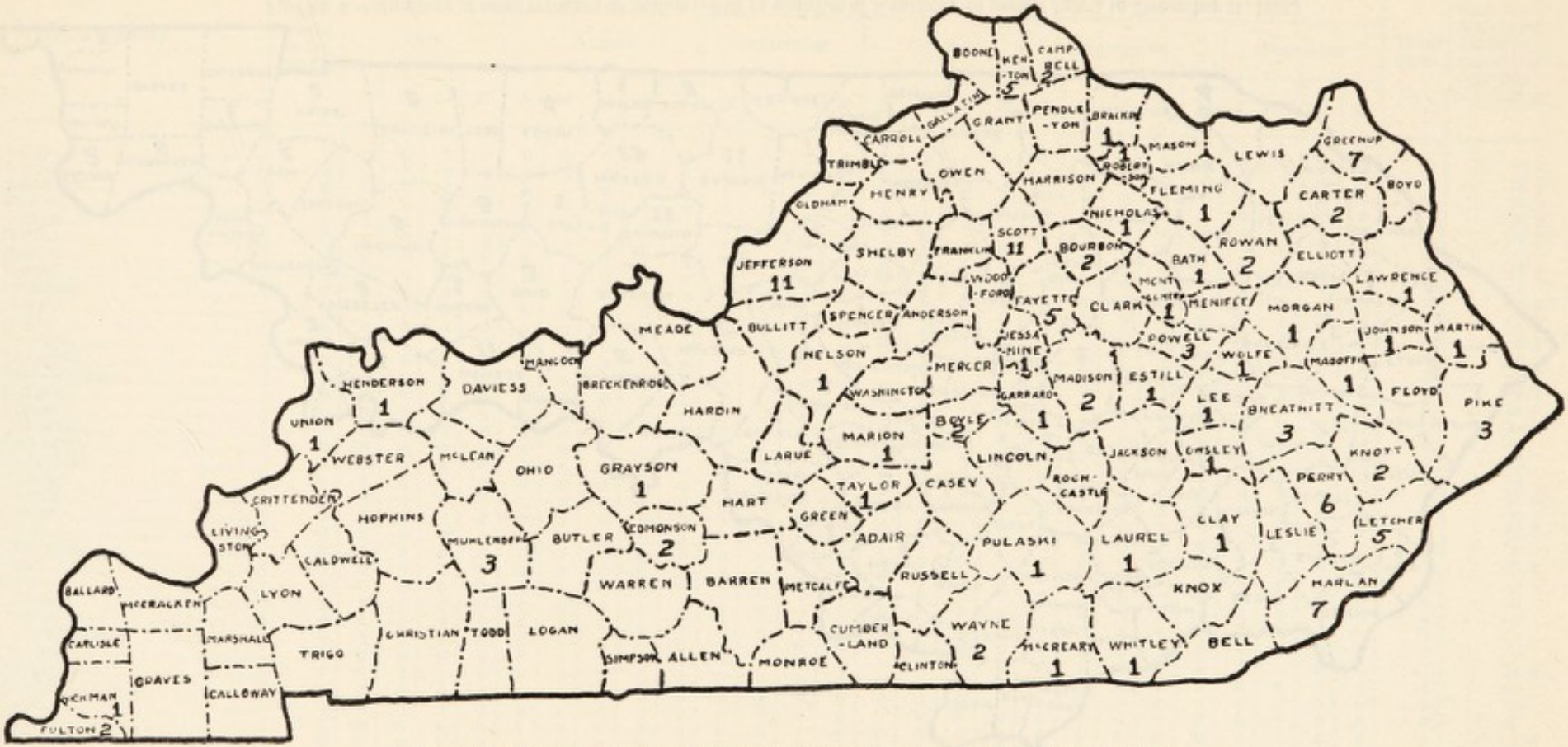

FIGURE 2.—Number of cases of poliomyelitis reported in counties of Kentucky in 1934.

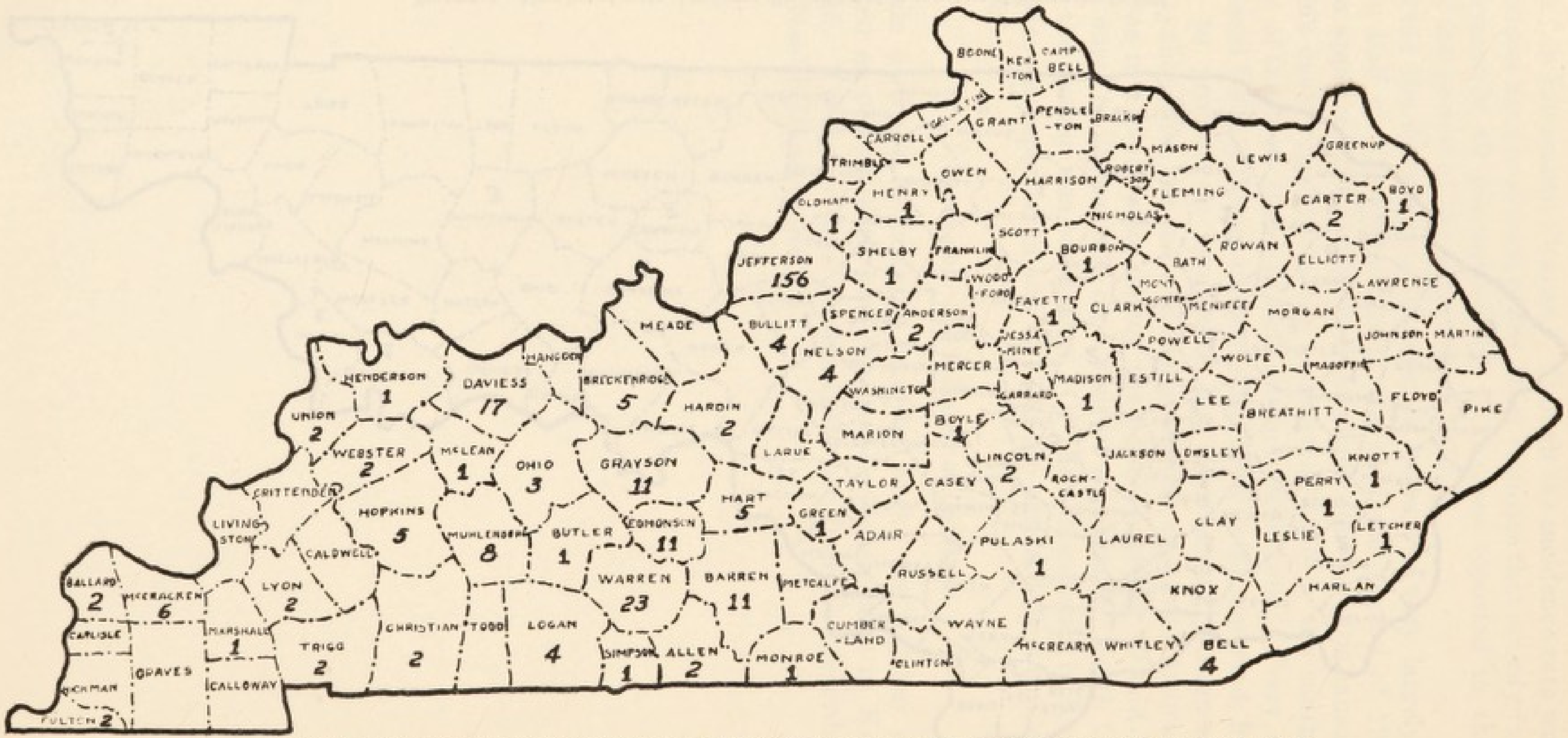

FIGURE 3.—Numbers of cases reported as poliomyelitis in counties of Kentucky in period July 1 to December 31, 1935.

TABLE 4.—*Cases of poliomyelitis reported in Kentucky in 1935*

County	26 weeks ended June 29	Week ended—																										Total cases	Case incidence rate (approximate) per 100,000 population
		July				August					September				October				November					December					
		6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28		
Adair	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Allen	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	13.2
Anderson	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	23.5
Ballard	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	2	20.0
Barren	0	0	0	0	0	0	0	1	0	1	4	0	1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	11	42.5
Bath	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bell	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	10.2
Boone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Bourbon	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5.5
Boyd	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2.2
Boyle	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	6.1
Bracken	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Breathitt	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	9.4
Breckinridge	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	1	1	0	0	0	0	0	5	28.8
Bullitt	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	0	0	0	0	4	44.9
Butler	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	7.9
Caldwell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Calloway	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Campbell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carlisle	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13.5
Carroll	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Carter	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	12.5
Casey	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Christian	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	5.9
Clark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clay	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Clinton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crittenden	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cumberland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Daviess	0	0	0	0	0	0	0	0	0	3	6	1	3	1	0	2	0	0	0	1	0	0	0	0	0	0	0	17	38.6
Edmonson	0	2	3	1	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	95.7
Elliott	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Estill	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fayette	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1.4
Fleming	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Floyd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Franklin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fulton	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	13.3
Gallatin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 4.—*Cases of poliomyelitis reported in Kentucky in 1935*—Continued

County	26 weeks ended June 29	Week ended—																									Total cases	Case incidence rate (approximate) per 100,000 population
		July				August					September				October				November					December					
		6	13	20	27	3	10	17	24	31	7	14	21	28	5	12	19	26	2	9	16	23	30	7	14	21	28		
Garrard	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grant	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Graves	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Grayson	0	0	0	0	1	3	0	2	1	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	11	64.3
Green	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	8.8
Greenup	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hancock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hardin	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	9.5
Harlan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Harrison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hart	0	0	0	0	0	1	2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	30.9
Henderson	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3.8
Henry	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	7.9
Hickman	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hopkins	0	0	0	0	0	0	0	0	0	3	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	13.2
Jackson	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9.5
Jefferson	1	0	1	0	3	7	8	18	29	20	19	13	6	6	7	2	8	1	3	2	1	0	2	0	0	0	0	157	42.5
Jessamine	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Johnson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kenton	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Knott	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	6.4
Knox	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3.8
Laure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laurel	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lawrence	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Leslie	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Letcher	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2.7
Lewis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lincoln	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	11.2
Livingston	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Logan	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	18.3
Lyon	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	23.3
McCracken	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	6	12.7
McCreary	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
McLean	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9.0
Madison	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	3.6
Magoffin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Marion	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Marshall	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	7.7
Martin	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mason	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Meade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Menifee	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mercer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Metcalfe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Monroe	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	7.6
Montgomery	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Morgan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Muhlenberg	0	0	0	0	0	0	0	0	2	1	0	1	0	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	8	20.9
Nelson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0	0	4	24.1
Nicholas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3	12.3
Oldham	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	13.3
Owen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Owsley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pendleton	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	9.2
Perry	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2.3
Pike	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Powell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pulaski	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	2.8
Robertson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rockcastle	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rowan	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Russell	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Scott	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shelby	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	5.7
Simpson	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	8.8
Spencer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Taylor	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Todd	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trigg	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	23.9
Trimble	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Union	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	11.7
Warren	0	0	3	4	0	5	1	1	3	0	0	1	0	0	1	0	1	1	1	0	0	2	0	0	6	0	0	0	0	23	67.7
Washington	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wayne	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Webster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	9.7
Whitley	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wolfe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Woodford	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	8	2	8	5	10	18	15	27	36	36	42	18	18	19	11	11	12	7	4	8	3	4	2	2	2	0	0	328	12.4		

The earliest cases reported in the outbreak period were in Edmonson, Grayson, and Warren Counties. The development of cases in Edmonson County was over by the time the outbreak began in Louisville, and the reporting of cases in outbreak proportion was about a month later in Daviess County than in Jefferson County.

In the epidemic of 1935 the incidence rate of reported cases was much lower in Kentucky than in Virginia and North Carolina, and was much higher in Kentucky than in the other neighboring States.

Table 5 shows the records as published in Public Health Reports of cases reported by weeks from December 30, 1934, to January 4, 1936, and the case incidence rates in Kentucky, North Carolina, Virginia, Tennessee, West Virginia, Missouri, Illinois, Indiana, and Ohio.

TABLE 5.—*Cases of poliomyelitis reported by weeks, and case incidence rates in Kentucky and neighboring States in 1935*

State	Week ended— January 5	12	19	26	February 2	9	16	23	March 2	9	16	23	30	April 6	13	20	27	May 4	11	18	25	June 1	8	15	22	29	July 6	13	20	27
Kentucky	0	0	1	0	0	0	0	0	0	0	1	0	1	0	2	0	0	0	0	0	0	0	0	0	1	1	0	0	5	10
North Carolina	0	0	0	0	2	1	0	0	1	0	1	2	0	3	1	0	3	2	0	2	18	25	17	57	60	63	55	52	48	52
Virginia	0	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0	0	1	3	1	0	2	1	3	16	24	28	45	72	87
Tennessee	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	5	11	3	9
West Virginia	0	1	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	0
Missouri	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	1	1	2	0
Illinois	0	0	0	0	1	1	2	0	1	2	1	0	1	1	1	0	1	1	0	0	0	1	1	2	0	2	2	5	2	4
Indiana	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	2
Ohio	0	3	0	3	1	0	3	1	1	1	0	2	3	0	0	1	0	0	0	0	0	0	1	1	2	1	1	0	1	6

State	Week ended— August 3	10	17	24	31	September 7	14	21	28	October 5	12	19	26	November 2	9	16	23	30	December 7	14	21	28	Jan. 4, 1936	Total for State	Approximate case rate per 100,000 population
Kentucky	18	15	27	36	36	42	18	18	19	11	11	13	7	4	8	3	4	2	2	2	0	0	1	319	12.3
North Carolina	40	26	17	11	9	11	14	8	15	9	9	8	3	2	1	7	7	2	5	4	3	1	0	677	21.3
Virginia	100	68	73	39	31	16	21	8	10	7	1	7	4	2	2	2	1	2	1	0	1	1	0	684	28.0
Tennessee	10	1	3	6	1	3	4	4	3	1	1	0	1	2	1	4	6	1	3	1	1	0	0	91	3.4
West Virginia	0	6	3	4	3	3	8	2	0	1	0	1	0	0	2	0	0	1	0	0	0	0	0	41	2.3
Missouri	2	1	2	1	0	3	4	1	2	2	1	1	1	2	2	2	1	2	2	1	0	0	0	44	1.2
Illinois	10	13	13	9	19	22	18	12	14	23	16	7	12	5	6	3	7	6	1	4	3	3	0	258	3.3
Indiana	0	1	3	2	2	3	3	3	1	1	4	3	4	2	3	4	0	0	0	1	0	0	1	48	1.4
Ohio	1	1	9	2	14	2	10	3	7	3	5	3	0	1	2	0	1	0	2	1	1	0	0	100	1.5

Figure 4 shows the chronology of the reporting of cases in Kentucky, North Carolina, and Virginia.

From these data it appears that the outbreak in Kentucky began about 2 months later than that in North Carolina and about a month later than that in Virginia. The peak of reporting was reached about September 5 in Kentucky, June 25 in North Carolina, and August 1 in Virginia. The decline in reporting began about September 10 in Kentucky, July 10 in North Carolina, and August 10 in Virginia. In all three of these States the time of reporting cases averaged about 1 week subsequent to the onset of disease. For the whole period of the epidemic the case incidence rate in Kentucky was a little over

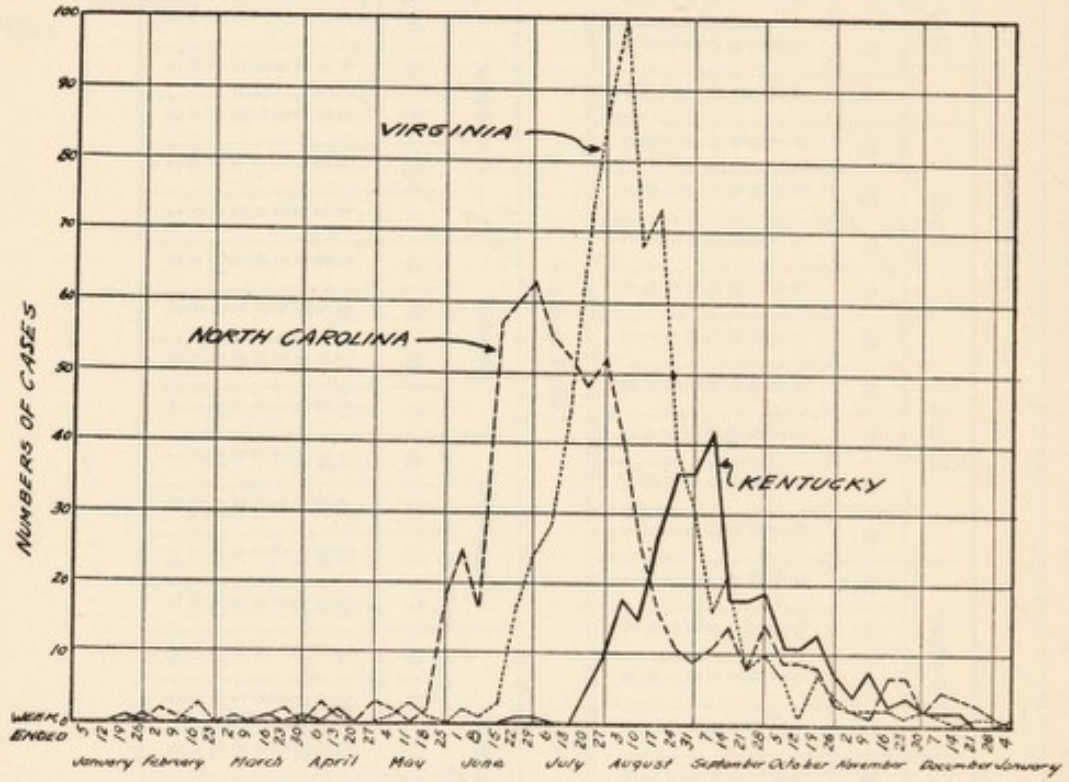

FIGURE 4.—Cases of poliomyelitis reported by weeks in Kentucky, North Carolina, and Virginia from December 30, 1934, to January 4, 1936.

half as high as that in North Carolina, less than half as high as that in Virginia, and nearly four times as high as that in Tennessee.

Method and Extent of Obtaining Epidemiological Histories of Cases

Visits were made to about 58 percent of the affected homes in the State with a view to obtaining all data regarding the cases which were thought likely to throw any light on the situation. Realizing that little or practically nothing is known about the epidemiological factors in the causation of poliomyelitis, a serious and consistent effort was made by the fact collectors throughout the studies to remain open-minded and broad-minded regarding the problem. The following case record form was used in taking the histories:

Poliomyelitis—Epidemiological case record

State_____ County_____ Locality____ Case No_____
Name of patient _____
Age, _____ years, _____ months. Sex _____ Race _____
Nationality of patient _____ father _____ mother_____
Location of residence at onset _____
How long resident there? _____ In community? _____
Previous residences within 3 months of onset _____
Visits away from home within 30 days of onset (place, duration, and travel—made how)_____
_____
Name and address of patient's parents _____
Attending physician _____ Address _____
Date first symptoms _____ What were they? _____
Date of paralysis (if any) first noticed _____ What parts? _____
Subsequent course of case to date _____ Spinal puncture _____
When _____ Result of examination of fluid _____
Previous illnesses of patient (character and dates) _____
Tonsils? _____ Frequent sore throat? _____
Recent open sores _____ Foul mouth _____ Boils _____ Discharge from ears_____ Prophylaxis: Removal (date and where)_____
Isolation _____ Efficiency _____ Immunization of other members of family
_____

Other members of household

Age	Sex	Relation to patient	Occupation, character, and place	Illness within 3 months

Servants: Places of abode _____
Other members of household who ever have had suspected or positive cases of poliomyelitis _____ When _____
Patient's occupation _____ School attended within 30 days prior _____ Grade _____ room _____
By others in family: Grade _____ room _____

Contact with_____	Definite case	Suspected case	Infected district by visit	People from infected district	General public
Direct_____					
Indirect_____					

Summarized details of contact_____
_____
Nearest previous or coincident case_____

Personal history of patient:

Immunization treatment against poliomyelitis (when and by whom)_____
_____

Notable differences from other children in family with respect to:

(*a*) General health_____ (*b*) Rate of growth_____
(*c*) Complexion_____ (*d*) Bodily structure_____
(*e*) Shape of eyes_____ (*f*) Cutting of teeth_____
(*g*) Spacing of teeth_____ (*h*) Physical activity_____
(*i*) Sleeping habits_____ (*j*) Diet_____
(*k*) Constipation_____ (*l*) Indigestion_____
(*m*) Frequent colds_____ (*n*) Fever blisters_____
(*o*) Vaccination against: Smallpox (year)_____; diptheria (year) _____; typhoid (year)_____.

Water used for drinking 30 days prior:

Sources_____ sole_____ principal_____ occasional_____
Milk (how used)_____ Sources: Sole_____ principal_____
occasional_____ kind_____
Ice cream_____ where_____ when_____
Sources_____
Butter_____ sources_____
Meats (kinds and sources)_____
_____
Fruits and vegetables (kinds and sources)_____
Did patient go swimming within 30 days prior?_____ Where and when?____
_____

Exposure to insects:

	Biting	*Stinging*	*Other*
(*a*) At home	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
(*b*) Away from home.	_____	_____	_____
	_____	_____	_____
	_____	_____	

Remarks_____

Environment

Neighborhood: General character _____ Population _____
Residence: Structure _____ structural condition _____ screening _____ age ___
Cellar or basement _____ used for what? ____ Floor: Cement _____ board ____
earth _____
Yard _____ well shaded _____ character of trees _____
Standing water in or near-by yard _____
Outhouses on premises _____
Excreta disposal: Sanitary _____ insanitary _____ Water closet: Indoors _____
Yard _____ Privy _____ type _____ distance from dwelling _____
Garbage disposal: Stables: On premises _____ adjoining _____
Distance nearest _____

Animals and fowls on premises (kind) _____
Association with animals _____
Sickness or death of animals or fowls recently _____
Are horses, cows, sheep, or other animals herded by premises frequently? _____
If so, state details _____
General cleanliness of premises: Excellent _____ good _____ fair _____ poor ___
Prevalence of insects: Houseflies _____, stomoxys _____, fleas _____, mosquitoes _____, honeybees _____, wasps _____, ants (in house) _____, roaches _____, small biting flies (or gnats) _____, sandflies _____, large blue or gray flies _____, horseflies _____, any other insects unusually prevalent this year _____, frogs, reptiles, or fish in yard or any place nearby dwelling _____ probability and evidence of rat infestation _____, probability and evidence of mouse infestation _____

Remarks

Local health officer's opinion of:
Correctness of diagnosis of case investigated _____
Other positive cases: In family _____
In immediate neighborhood _____
Suspected cases: In family _____
In immediate neighborhood _____
Especially notable conditions in situation _____
_____
_____
_____
_____
Persons interviewed (relations to patient) _____
_____
Their opinion of causation of case _____
_____
_____ _____
Date of investigation Investigator

Painstaking and patient efforts were made to obtain as accurately as possible the data called for by this form for every case intensively studied. Most of the visits to affected homes outside Jefferson County were made by the author and Dr. F. C. Campbell, an epidemiologist and pediatrician of the State Health Department, traveling together. In visiting the homes in each county they usually were accompanied by the health officer or a health nurse of the county health department. In Jefferson County outside Louisville most of the case histories were obtained by Dr. Campbell. In Louisville most of the case histories were obtained personally by the author accompanied by the he lth officer, the epidemiologist, or a specially detailed health nurse of the city health department. The histories of the cases reported after September 20 were obtained by a city health department nurse alone who was trained thoroughly in the epidemiological technique. In all of the localities in which the intensive studies were made the fact collectors worked in close cooperation and employed practically identical methods in obtaining and recording the data.

Epidemiological case histories were obtained by home visits for a total of 184 cases distributed by place of residence of persons affected

as follows: 16 in Warren County, 10 in Edmonson County, 6 in Grayson County, 3 in Muhlenberg County, 1 in Barren County, 1 in Hardin County, 1 in Hart County, 1 in Carter County, 1 in Boyle County, 1 in Letcher County, 3 in Bell County, 1 in Pulaski County, 1 in Fayette County, 17 in Jefferson County outside Louisville, and 121 in the city of Louisville.

Findings in Warren County

Detailed studies were made of 16 of the 17 cases reported as poliomyelitis between July 6 and August 24 in Warren County. The history of 1 of the 17 cases could not be obtained because the family had moved away. Of the cases studied, 8 were among persons residing in Bowling Green, a city with a population of about 13,000 located near the center of Warren County and on the main line of the Louisville and Nashville Railway, and 8 were among persons residing in the county outside the city. One of the city cases proved to be tertian malaria without symptoms or signs suggesting poliomyelitis. One of the county cases was in a child who had come from his home in Nashville, Tenn., about 4 days before onset of a slight febrile attack, on August 10, which continued for only a day or two and was not followed by any sign of paralysis or localized muscle weakness. Another county case was in a child who, 2 days before onset of systemic symptoms on July 14 followed by typical paralysis on July 17, had come from a visit of 3 weeks' duration in Michigan.

Detailed epidemiological histories were obtained for the 13 remaining cases—11 with definite paralysis and 2 without paralysis but with suggestive systemic symptoms—which appeared to be of local origin. All of the 13 cases were in white children. Of the seven city cases four were in males and three in females. All of the six county cases were in males. Of the seven city children, one was between 3 and 4, one was between 4 and 5, two were between 5 and 10, and three were between 10 and 15 years of age. Of the six county children, two were between 1 and 2, one was between 3 and 4, one was between 5 and 10, and two were between 10 and 15 years of age. Thus the age range of the city children was higher than that of the county children. The dates of onset of systemic symptoms and of paralysis, if present, in the 13 cases were as follows:

TABLE 6.—*Time of onset of symptoms and of paralysis in 13 cases*

City case no.	Onset	Paralysis	County case no.	Onset	Paralysis
1	June 20	June 22	1	July 23	July 27
2	June 29	July 2	2	July 24	Do.
3	July 1	July 1	3	Aug. 1	Aug. 6
4	July 6	None	4	Aug. 8	Aug. 13
5	July 12	July 13	5	Aug. 10	Aug. 14
6	July 25	July 29	6	Aug. 13	Aug. 16
7	July 28	None			

The chronological sequence suggests the possibility of the disease having spread from the city into the rural communities of the county. Offsetting such a possibility, however, is the fact that the outbreak in an adjacent county to the north, Edmonson, which is a strictly rural county, antedated the outbreak in Bowling Green.

Geographical distribution.—All of the city cases developed at residences on or within two blocks of College Street, the main thoroughfare of the city and a main highway between Nashville, Tenn., and Louisville, Ky., running north and south through the middle of Bowling Green. Two of the residences were near the north end, two near the south end, and three were one to five blocks apart within this zone, which is four blocks in width. Two of the cases were in one residence, the onset of systemic symptoms in the first case being on June 29 and in the second case on July 6. In the second case the general systemic symptoms were highly suggestive, but there was no paralysis nor sign of localized muscle weakness, and the spinal fluid was not examined.

The six county cases were in residences widely scattered in rural (mostly rugged and wooded) neighborhoods, no two being within 5 miles of each other. In their order of occurrence, one of the cases was at an isolated residence about 10 miles west from Bowling Green, one at a residence on the Louisville highway about 4 miles northeast from Bowling Green, one at a farm house about 10 miles southeast from Bowling Green, one at a farmhouse about 12 miles east from Bowling Green, one at an isolated residence about 12 miles northwest from Bowling Green, and one at a secluded country residence about 7 miles south from Bowling Green. Only two were at residences on or near a main highway.

Environmental conditions.—Four of the seven city cases were in residences located on the outskirts of the city where the surroundings were more rural than urban in general character. Of the six residences in which the cases occurred, five were in good and one in rather poor structural condition. In one there was a cellar and in each of two a basement; all were provided with indoor flush water closets. At five there were stables for horses or cows, or both, on or within a few hundred feet of the premises. All were on or near streets through which beef cattle on the hoof were herded or were brought into or carried through the city on trucks or railway freight cars. Kept on the premises were horses at one, cows at one, dogs at four, cats at two, canary birds at two, goldfish (in ponds) at three, and a pet skunk at one. Reported as frequent and more or less numerous visitors in the houses or on the premises were fleas at one, ants at three, roaches at four, rats at three, mice at five, and *Musca domestica*, *Stomoxys calcitrans*, mosquitoes, and English sparrows at all during the 30 days prior to onset of the cases.

Of the six residences in which the six county cases occurred, one was a log cabin in poor structural condition without screening, three were frame houses in poor structural condition without screening, and two were frame houses in fairly good structural condition but with inadequate screening. At four there were no privies, the nearby woods being used for deposit of the excreta on the surface of the ground, and at two grossly insanitary open-back privies were in use. At three there were ponds of standing water within a few hundred feet of the dwellings; at five the yards were well shaded—maple, poplar, elm, oak, and cedar predominating as the shade trees—and at two there were peach trees in the yards. At three there were stables on the premises; cows were kept on the premises at five, horses at two, chickens and dogs at all, and cats at three. The general cleanliness of the premises was poor at three and fairly good at three; house flies, stable flies (stomoxys), and mosquitoes were numerous at all, horseflies at five, fleas at three, honey bees at four, wasps at three, ants (in the house) at one, roaches at one, and small biting gnats at four. There was evidence of infestation of the premises by rats at four, by mice at four, and by English sparrows at all. At one of the affected homes chickens on the premises were reported to have been sick and dying from some sort of diarrheal disease during the 2 or 3 months before the onset of the case of poliomyelitis, and at another it was reported that at neighboring homes within a radius of a mile of this home three dogs had become ill with paralysis of the hind legs at about the same time that the case of poliomyelitis developed.

Visits away from home neighborhood.—Of the seven city children affected with the disease, three had been away from Bowling Green within the 30 days prior to onset of illness. One 12 to 15 days before the onset had spent 3 days at a country home about 6 miles southwest from the city. There was no history of a case or of a suspected case in the family visited. One about 3 weeks and again about 2 weeks before the onset had spent a day and night at a camp on Barren River about 10 miles from Bowling Green. The other child in the camping party remained well. One had been on a visit of a few hours in Louisville 3 days before onset of illness. Of the six county children affected with the disease, three had not been away from the immediate home vicinity and three had been on one or two visits of a few hours' duration each to Bowling Green within the 30 days prior to onset of illness.

Swimming.—Of the seven city children, five had been in swimming within 30 days prior to onset of the illness—three in a chlorinated pool in Bowling Green, and two at about the same place in a creek near the city.

Of the six county children only one had been in swimming within the 30 days before onset of illness. In that case the swimming was in a creek near the child's home.

Water supplies.—Of the seven city children, four had drunk water only from the city public supply and three had drunk water principally from the city supply and occasionally from country wells or springs during the 30 days prior to the onset of illness.

The water used for drinking by the six county children was solely or principally from individual home springs (by three), wells (by two), and a cistern (by one). All of these home water supplies were of doubtful sanitary quality.

Food supplies.—Most of the children affected had eaten within the 30 days prior to onset of the illness rather varied diets including meats (bacon, beef, and chicken) and vegetables and fruits (cooked and raw) from a number of different sources (public or private). All 13 has used milk as a beverage.

All the milk and butter used by the 6 county children was from private sources (family or neighbor). Only two of the county children has eaten any ice cream except that which was homemade, and the ice cream eaten by these two was from two different public supplies in Bowling Green.

Four of the seven city children, furnishing the first cases in the city series, had eaten ice cream and butter from one dairy company, all of whose supplies were said to have been pasteurized and to have composed about two-thirds of the total supplies of ice cream and butter distributed in the city. Those same four cases were in children who, during the 30 days prior to onset of illness, had drunk raw milk regularly and almost exclusively from one small supply with a daily distribution of about 20 gallons, composing only 1.5 percent of the total milk supply distributed in Bowling Green in July and August 1935. No two of the other three city children affected with the disease had used milk, butter, or ice cream from any one supply.

Possible predisposition.—Four of the seven city cases and five of the six county cases were in the youngest members of the affected households. Besides the patients, the total number of children under 15 years of age in the households was 19, and of these one, aged 7, had had poliomyelitis in 1931.

Of the 13 children affected, 11 were said to have been very active physically, more so as a rule than the other children in the families; 5 had had frequent colds or sore throat; in 5 the upper incisor teeth were more or less widely spaced; 4 were underweight; 2 had eyes approaching the mongoloid type, and within the 8 months before the onset of poliomyelitis 2 had had boils, 1 diseased tonsils, 1 chickenpox, 1 smallpox, and 1 German measles.

Personal contact.—The father of patient no. 1 in the city series had an attack of dysentery, with fever and blood-streaked stools, during

the 2 weeks before the child developed poliomyelitis. The mother of this child 22 years before, when 4 years of age, had what was probably a case of poliomyelitis. This family consisted of three persons. The father was a shoe repairer.

The home in which cases 2 and 4 of the city series developed with onsets June 29 and July 6, was visited for 2 or 3 days beginning June 1 by a relative who had come immediately from Raleigh, N. C. The visitor was not ill at the time and had had no recent indisposition.

Cases 7 and 8 of the city series were in two children who sat next to each other in school until the school term ended on July 12, but thereafter had no association with each other. The onset of case no. 7 was on July 25 and that of case no. 8 was on July 28.

Case no. 1 of the county series, with onset on July 23, was in a child 18 months of age living in a remote rural home with her father and mother and a sister 3 years of age. This child was away from home only once within the several months before the onset of illness. That was on a short visit to Bowling Green on July 13. On the way to the city this child with her mother and sister stopped for about a half hour at a neighbor's home where at the time another child, aged 3 years, was visiting. This child had returned the day before from a trip to Michigan, and developed systemic symptoms of poliomyelitis on July 14 and paralysis of the left leg on July 17. The several other young children who on the same occasion were in the home with the child from Michigan remained entirely well.

Except for these instances, no evidence was obtained of a common source of infection for any two cases or of direct or indirect personal contact between diagnosed cases, suspected cases, or possibly infected persons.

Preventive measures.—The children with diagnosed and reported cases were quarantined at their homes. The county health department solicited practicing physicians, school teachers, and other responsible persons throughout the county to report promptly any cases diagnosed or suspected of being poliomyelitis.

A schoolboy in one of the rural schools became ill with headache, fever, and vomiting, while at school on August 1. He developed paralysis of the legs on August 6. The case was reported to the county health department on August 11. The school was closed for 1 week beginning August 12 and then reopened. The other children, about 55 in number, who attended that school were observed closely for the following month, but none of them nor any other person in the immediate neighborhood was found to present symptoms of poliomyelitis.

Findings in Edmonson County

Edmonson County is a strictly rural county with hardwood timber regions and small farms covering most of its area. There are several

small villages but most of the population totaling about 11,500 is in rather sparsely settled rural neighborhoods. Brownsville, the county seat, is located near the center of the county.

Not a case of nor a death from poliomyelitis was reported in this county in the 5-year period, 1929–33. In 1934 two cases and one death were reported. In 1935 not a case was reported in the first 6 months, but in the period July 1 to July 27 eleven cases were reported. These cases and those in Bowling Green in Warren County, the adjacent county to the south, composed the earliest groups to be reported in outbreak proportion in Kentucky in the epidemic of 1935. The outbreak in Edmonson County terminated early and quite abruptly. Although the personnel of the county health department, the practicing physicians, the school teachers, and many other responsible citizens were remarkably vigilant, not a case diagnosed as or even strongly suggestive of poliomyelitis was found in the county between July 27 and December 31. The observation of the children of school age was thorough. All of the grade schools except one were opened on July 15 and continued open for several months thereafter. The exception was the school in an industrial settlement where the children, though not attending school, were observed closely. The enrollment of the 42 grade schools which were open was about 2,500. The seven high schools in the county were opened on August 12. One of the cases in the outbreak was in a child who had the onset of illness while at school. That school was attended by about 60 children, most of whom were under 10 years of age. The school was not closed. None of the other pupils attending it became ill with symptoms suggesting poliomyelitis within the next several months.

Notwithstanding the comparatively short duration of the outbreak in Edmonson County, the case rate incidence was higher in this county than in any other county of the State in 1935.

The following are some of the data obtained regarding the 11 persons whose cases were reported between July 1 and July 27, in the order of occurrence of the cases:

TABLE 7.—*Cases reported in Edmonson County between July 1 and July 27, 1935*

Case no.	Onset of systemic symptoms	Paralysis noted	Age in years	Sex	Approximate location of home in relation to Brownsville	Direct personal contact with—	
						Diagnosed case	Suspected case
1	June 9	June 13	4	Female	5 miles south	−	+
2	June 11	do	9¾	do	6 miles south	+	+
3	June 20	June 24	1½	do	10 miles southeast	−	−
4	June 29	July 1	2¾	Male	6 miles northwest	−	−
5	June 30	(?)	2	do	4 miles southeast	(?)	(?)
6	July 1	July 4	17	Female	15 miles southeast	−	−
7	July 5	July 7	6½	Male	3 miles northwest	−	−
8	July 9	July 9	1	Female	12 miles southeast	−	+
9	July 10	July 14	3	Male	15 miles north	−	−
10	July 16	July 18	4	do	2 miles north	−	−
11	July 19	July 22	7	Female	8 miles north	−	−

Visits were made to the affected homes and detailed epidemiological histories were obtained of all of these 11 diagnosed and reported cases except no. 5. The home at which case no. 5 occurred was quite isolated in a wooded country more than 2 miles from a road traversable by automobile. All of the cases were in white children who had lived from birth in Edmonson County and whose parents without exception were native-born Kentuckians.

Besides these cases, two cases were found in the course of the studies which very probably were cases of poliomyelitis. These two suspected cases are designated for convenience in this report as case A and case B.

Case A was in a girl, aged 4 years and 8 months, the youngest member of a family of eight, including her father and mother and five brothers. Four of the brothers were under 15 years of age. No other member of the family was ill within 2 months before or after the occurrence of the case, and none had ever had poliomyelitis. The onset of the systemic symptoms (headache, fever, sore throat, and neck stiffness) was on April 15. Paralysis of the left leg was noted on April 18. The case proceeded to complete recovery, evidence of the paralysis disappearing by about May 12. The parents stated that this girl had measles and whooping cough in 1934 and German measles in February 1935. The home was located about 6 miles south from Brownsville and about one-half mile from the home at which case no. 2 of the reported series occurred. The dwelling was well screened and otherwise in good structural condition. The privy and the well were of sanitary type. The premises were quite well kept. On the place were horses, cows, and chickens. Flies (house, stable, and horse), mosquitoes, fleas, rats, and English sparrows were rather numerous. Food supplies were nearly all home produced. The girl visited frequently at her grandfather's home, which was about a half mile away. There sanitary conditions were poor and in the yard where the family and the visitors spent much of the time in fair weather *Stomoxys calcitrans* were very numerous and pestiferous. A number of chickens on this place died from what was called "limber-neck" (probably botulism) during the period April 1 to June 1. While visiting at her grandfather's the girl, both before and after her attack of illness with the paralysis, played frequently with a number of other children, including those subsequently developing cases 1 and 2 of the reported series with onsets on June 9 and 11, respectively. This girl just after developing the paralysis attended a neighborhood church meeting at which there were many other children, but no evidence was found of any infection having been spread by her on that occasion. This case is of particular interest because it appeared to have been the first case of poliomyelitis that developed in the county or in that region of the State in 1935.

Case B.—This case was in a white girl, 10 years of age, who lived in a home located about 13 miles southeast from Brownsville at a junction of two highways, and at which a small country store and a gasoline filling station were operated. In the family were 2 other children each under 10 years of age. No other member of the family had been indisposed within the 6 months prior to the date of the inquiry (on Aug. 8) and none had a history of ever having had any illness suggestive of poliomyelitis. In this case the onset of systemic symptoms was on April 26 and paralysis of both legs was noticed about May 1. The paralysis disappeared about May 20. The only one of the reported cases with a history of any association, direct or indirect, with this child was no. 8 in the reported series, which case was in a baby who was in the store at the home of case B once about 3 weeks before onset of her illness on July 9.

The following data apply to the 10 reported cases whose detailed epidemiological histories were obtained.

Geographical distribution.—Except cases 1 and 2, which were in children closely connected by family ties, no two cases were in homes within 2 miles of each other. The homes were scattered in different rural and mostly remote, sparsely populated neighborhoods, only one being on or near a main highway. No two cases occurred in one home.

Environmental conditions.—Of the 10 residences, 2 were log cabins in poor structural condition without screening, 3 were frame houses in poor structural condition without screening, 3 were frame houses in fairly good structural condition but without screening, and 2 were frame houses in good structural condition and well screened; at 5 there was no toilet of any kind, nearby woods being used for deposit of excreta on the surface of the ground; at 4 grossly insanitary open-back surface privies were in use, and at 1 there was a sanitary pit privy. At six of these homes there were ponds of standing water on or within a few hundred feet of the premises; at eight the yards were well shaded—oak, maple, beech, hickory, cedar, and apple predominating as the shade trees. At eight there were stables for horses or cows, or both, on the premises, and at one there was a stable about 300 feet away on a neighboring place. On the premises were cows at eight, chickens at seven, horses at six, hogs at five, a pet squirrel at one, cats at six, and dogs at eight. The general cleanliness of the premises (except for excreta disposal) was good at four, fair at four, and poor at two. House flies and stable flies (stomoxys) were numerous at all, mosquitoes at nine, horseflies at nine, fleas at six, wasps at seven, ants (in house) at seven, roaches at four, small biting gnats at eight, "sweat bees" at three, honey bees at one, ticks and chiggers at two, frogs (in yard) at seven, rats at eight, mice at eight, and English sparrows (on premises) at all. Two of the cases, nos. 1 and 2, were in children who during the 30 days prior to onset of illness were in

contact with chickens which were sick and dying from "limberneck", one while visiting at her grandfather's and one both at her own home and while visiting at her grandfather's. At the home of another patient, case no. 3, with onset June 20, there was a pet squirrel which, after an illness of several days with paralysis of the hind legs, died about May 30.

Visits away from home neighborhood.—Only two of the cases were in children who within the 30 days prior to onset of illness had been out of their home neighborhoods. Four had not been off the immediate home premises within such period. The two children who had been on visits out of their own neighborhood, interestingly, were cases no. 1 and no. 2. Each was in Bowling Green for a part of a day, one about 7 days before onset of illness, and the other about 20 days before onset of illness. The only food either ate while in Bowling Green was ice cream which they both ate at the same place. The ice cream was from the same source as that of which four of the Bowling Green children with cases of poliomyelitis had partaken within the 3 weeks prior to onset of illness.

Swimming.—Only two of the affected children, those with cases nos. 6 and 10, had been in swimming within the 30 days prior to onset of illness. The swimming ponds used by them were in different vicinities.

Water supplies.—Excepting cases 1 and 2, which were in children who had drunk water at their grandfather's home and in Bowling Green, no two of the cases were in children who had drunk water from the same source. Of the 10 homes, the supplies were obtained from open dug wells at seven, unprotected springs at two, and from a bored well at one.

Food supplies.—Excepting cases 1 and 2, no two of the cases were in children who had eaten food at the same place. The diets were mainly of home produced foods and were quite varied, including meats (mostly bacon and chicken) and vegetables and fruits (cooked and raw). All of the cases were in children who used raw milk (home or neighborhood produced) as a beverage.

Possible predisposition.—Six of the cases were in the youngest members of the affected households. Besides the patients the total number of children under 15 years of age in the affected households was 22. In one of the households an uncle of the patient had an attack of paralysis in 1910, when 2 years of age, and continued lame thereafter. No member of any of the other households had had previously an illness suggestive of poliomyelitis. Of the 10 children affected, 5 were said to have been very active physically—more so as a rule than the other children in the families; 1 had had frequent colds and another had had frequent attacks of tonsillitis; in 4 the upper incisor teeth were widely spaced; 2 were underweight. Within the 8 months before onset of poliomyelitis four had had measles, one

German measles, one fever blisters, and two otitis media. Immediately before onset of poliomyelitis one had had severe prickly heat, one impetigo, one infected chigger bites, one had been given typhoid vaccine, and two sustained slight injury from falls.

Personal contact.—Cases 1 and 2 were in children who during the 30 days prior to onset of illness were associated frequently and intimately with a child, case A, convalescing from an attack of illness which very probably was poliomyelitis. In case A the onset was on April 15 and recovery appeared complete about May 12. Onsets of cases 1 and 2, respectively, were June 9 and June 11. If the infection in these two cases was contracted from case A, either the incubation periods were long or case A carried the infection for some time after recovery. If the infection in case 2 was contracted from case 1, the incubation period of case 2 apparently was short. In the family of case 2 were 3 other children, 3, 5, and 7 years of age, all of whom remained entirely well. The father of case 2 had several attacks of diarrhea in May and June. The history of direct personal contact in this group of cases stands out in interesting contrast with that of case 1 of the Warren county series.

In the household of 10 persons with case 4, an aunt and an uncle of the patient, 30 and 20 years of age, respectively, had attacks of acute tonsillitis for several days beginning about 3 days after the onset of the case of poliomyelitis.

The baby, with case 8, about 3 weeks before onset of illness was for a few minutes in a store located in the home in which case B was then convalescing from a probable attack of poliomyelitis (with onset about April 26). Whether or not the two children on that occasion were in direct contact with each other could not be remembered by the baby's mother.

A sister, 9 years of age, of the child with case 10 had fever and sore throat about July 7, lasting only one day.

Case 11 was in a home in which a baby 1 year of age died on June 12 after an illness of 2 months duration attended with convulsions, supposed to have been tubercular meningitis. Another child, aged 3 years, in this family, had diarrhea for 3 days beginning about July 1. The onset of case 11 was on July 19. A post office was located in the home and, interestingly, this child who had more contact with the outside world than any of the other children stricken in the county had the latest case to develop and to be found in the county.

Except for these instances, no evidence was found suggesting even remotely the spread of the infection through direct or indirect personal contact, or of the development of secondary, coincident, or antecedent cases.

Preventive measures.—Although practically no measures, except a sort of technical quarantine of the diagnosed cases, were carried out

in this county with a view to preventing or controlling the infection, the outbreak in Edmonson County continued for a much shorter period than those in some of the other communities of the State in which such measures were applied quite vigorously.

Findings in Grayson County

Grayson County in its general features is quite similar to but is somewhat more hilly and rugged than Edmonson County, the adjacent county to the south. The population is about 17,000. Leitchfield, the county seat, is located about 5 miles northeast from the center of the county.

Not a case of nor a death from poliomyelitis was reported in this county in the 5-year period, 1929–33.[2] In 1934, one case and one death were reported. In 1935 not a case was reported from January 1 to July 20, but in the period July 21 to October 12, 11 cases were reported.

Detailed epidemiological histories were obtained of six of the seven cases reported between July 20 and August 24. Some of the data obtained are presented in the order of the occurrence of the cases in the following table:

TABLE 8.—*Six cases reported in Grayson County, between July 20 and Aug. 24, 1935*

Case no.	Onset of systemic symptoms	Paralysis noted	Age in years	Sex	Approximate location of home in relation to Leitchfield	Direct personal contact with—	
						Diagnosed case	Suspected case
1	July 16	July 20	1¼	Male	11 miles southeast	—	—
2	July 17	July 21	2	do	10 miles southeast	—	—
3	July 21	July 24	10¼	do	10 miles southeast	—	—
4	July 28	Aug. 10	6¼	do	5 miles northeast	—	—
5	Aug. 7	Aug. 7	4⅔	do	4 miles northwest	—	—
6	Aug. 16	Aug. 18	2½	Female	13 miles southeast	—	—

Case 1.—This case occurred in the youngest member of a household of seven, which included the patient's grandmother 65, mother 35, father 34, brother 12, brother 10, sister 7, and brother 4 years of age, living in a poorly constructed and poorly kept unscreened log cabin on a small farm in a sparsely populated rugged and remote region. Distance from nearest highway about 3 miles and from the Nolin River on the southern border of the county about 1 mile. Only eight homes within a radius of a mile of this. Location of dwelling in low ground near the mouth of a ravine between steep wooded hills. A creek running through the edge of the yard and carrying drainage from two other cabin home premises, within a few hundred yards upshed, frequently overflowed in times of rain flooding the yard and the spring which with the creek furnished the water for drinking and other purposes at this home. The premises were insanitary. There was no toilet of any kind. Flies (house and stable), mosquitoes, fleas, ants, ticks, chiggers, roaches, small biting gnats, horseflies, sweat bees, frogs, rats, mice, and English

[2] In the course of these studies in 1935, however, the whole-time county health officer obtained histories of 5 cases at widely separated homes in the county in 1931, 4 being near the southern border and 1 near the center of the county.

sparrows were frequent and numerous on the place. The domestic animals on or ranging near the premises were dogs, cows, horses, and chickens. Most of the chickens owned by the family had died from "limberneck" during the several weeks before the onset of the case of poliomyelitis. The family was on relief. The foods were home-produced mainly, and some were from the relief store. The baby was still nursing, but was fed besides the mother's milk, beans, potatoes, onions, apples, and buttermilk. She was undernourished and pale. The family had little contact with their neighbors or with other persons. The child with poliomyelitis had not been away from home for months before the onset of the illness. The main contact with the outside world was through a visit once a week by the mother or the father to a country store about 2 miles away for relief supplies. As a sort of indication of the secluded life of this family was the fact that no member of the household except the grandmother had ever had measles. Offsetting somewhat this fact, however, was the history that of the three elder children all had whooping cough and scarlet fever in 1929, and one had diphtheria in 1925. No member of the household except the baby gave a history of ever having had any illness suggesting poliomyelitis. All of the members of the household had dysentery in the 2 weeks prior to the onset of the case of poliomyelitis. The father had been indisposed for a month before with what he thought was a recurrence of malaria. The family with which this family was associated most and almost exclusively was one of relatives including father, mother, and three children living nearby. One of the children in that family, while living in another neighborhood at a home on a highway in Edmonson county, had a typical case of poliomyelitis in 1931 when 3 years of age.

Case 2.—Developed in the youngest member of a family of six, including the patient's father 32, mother 28, and three sisters, 8, 5, and 3 years of age. A baby brother was born on August 1, 2 weeks after the onset of the poliomyelitis case. The dwelling was a small unscreened one-room log cabin located in a clearing on the side of a wooded hill about a mile and a half from the nearest highway, and about 300 yards from the nearest wagon road. This home was about a mile and a half by air line due west from the home in which case 1 occurred. There was no association direct or indirect between these two families. The premises were insanitary. There was no toilet of any kind. The water supply was from a spring which was exposed to contamination with human excreta and animal droppings. On the premises were chickens, hogs, a dog, a cat, and a cow, and flies (house, stomoxys, and horse), mosquitoes, fleas, wasps, ants, roaches, small biting gnats, frogs, rats, mice, and wild birds (including English sparrows) were more or less numerous. Food supplies were mostly home produced and were supplemented with occasional purchases from neighborhood stores. The family had very limited contact with the outside world. None of the children had ever had measles. The child with poliomyelitis had not been away from home for months before the onset of the illness, and never had been outside the immediate neighborhood. The father traveled about considerably in the neighborhood. A grandmother, who was a midwife, visited the home frequently. The two elder children went on July 7 to a funeral in the neighborhood which was attended by a large crowd. None of the persons with whom the affected child had been associated had had, so far as was known, any direct or indirect personal contact with a previous recent case of poliomyelitis. There was no illness of any kind in the family within the 3 months before the onset of this case of poliomyelitis. None of the near relatives of the affected child had ever had any illness suggestive of a case of poliomyelitis. Among the interesting events which occurred within a period of 4 weeks at this isolated home were (1) the development of a case of poliomyelitis on July 17, (2) the birth of a baby on August 1, and (3) the striking of the house by lightning on July 14. The lightning tore out a log from the side

of the cabin and caused rather severe stunning of all, the mother and the four children, who were in the cabin at the time.

Case 3.—In a schoolboy who in age was next to the youngest in a family of eight, including the patient's father 51, mother 49, three brothers 25, 16, and 13, and two sisters 19 and 6 years of age, living in an old rundown, unscreened frame dwelling on a rather poor farm located about two and a half miles from a main highway and about four miles due west by air line from the home in which case 2 occurred. None of the other 35 children of the public school attended by this boy was stricken. None of the other members of the family had any illness within the 3 months before the onset of his attack and none of them ever had had poliomyelitis. There was no case in his immediate neighborhood among persons with whom he was directly or indirectly associated. He was at a funeral on July 7 which was attended by the two sisters of the child who afterwards developed case 2, but so far as was known he had no close association with those children on that occasion. The sanitary conditions at his home were poor. There was no toilet of any kind. The water supply was from a spring exposed to occasional pollution. On the premises were horses, mules, cows, hogs, cats, and dogs, and flies (house, stable, and horse), mosquitoes, fleas, roaches, rats, and mice were more or less numerous. The yard in which the family spent much time on fair days was well shaded with oak, apple, and peach trees. The fruit on the peach trees appeared to attract many birds (mostly English sparrows). In July and August a number of chickens on the place died from "limberneck." The food supplies were almost exclusively home produced. During the 2 weeks prior to onset of illness the boy had an infected (briar) wound of the foot and stayed close at home, taking no meals elsewhere and having practically no direct contact with persons outside the family.

Case 4.—In a boy next in age to the youngest in a family of eight, including the patient's father 42, mother 39, two brothers 12 and 8, and two sisters 16 and 14 years of age, and one sister 19 months of age, living in a fairly well constructed and partly screened frame house located in Clarkson, a village with a population of about 600. The nearest home with a previous case (no. 1 in the outbreak) was about 11 miles by air line due south from this home. There was no history of direct or indirect personal contact between case 4 and any previous case. No other case had been found in the village or in the vicinity thereof. No other member of the family had had any illness within 3 months prior to the onset of this case, and none of them ever had had poliomyelitis. The child when well was very active and played with a number of other children of the village. The day before onset of illness he was at a picnic with a crowd of children, and on several occasions in the 3 weeks before he was on trips (by motor truck) to different places in the general vicinity of his home, but on none of these was he, so far as was known, near a home in which there was a case of diagnosed or suspected poliomyelitis. The father's occupation was that of ice man. At the home an open, insanitary surface privy was in use. The home water supply was from a cistern apparently well protected from pollution. On the premises were chickens and cows, and other cows and also horses were stabled or pastured nearby. House and stable flies and mosquitoes were fairly numerous about the place. Milk and milk products used by the boy were all from the home source. About 2 weeks before the onset of his illness the boy had a bad fall, alighting on his head. The symptoms in his attack were listlessness and stupor with inability to talk for 3 days. The paralysis was in the left upper eyelid. The spinal fluid was not examined. There appears room for doubt as to the correctness of the diagnosis in this case.

Case 5.—In a preschool child in a family of 10, including the patient's father 48, mother 43, 2 brothers 14 and 12, 4 sisters 10, 8, 7, and 3 years of age and a sister

11 months of age, living in a dwelling over 100 years old of frame construction in ramshackle condition and without screening. The location of the home was on a small farm about 2 miles from a highway in a very sparsely populated wooded section. The boy had not been away from home for over a year before the onset of his illness, and so far as was known he had had no contact with any person associated directly or indirectly with a recent previous case of poliomyelitis nor had he been within 8 miles of any place at which a diagnosed or a suspected case had been found. The children of school age in the family were attending a school in the neighborhood. No case suggesting poliomyelitis had been found by a diligent and repeated search among the children at that school. In the 3 months before the onset of this case the only member of the family having any illness was the baby, who had a slight attack of diarrhea in the latter part of July. There was not any history or evidence of a case of poliomyelitis ever having occurred previously in any member of the family or among the near relatives. None of the children in this family had had measles. The premises were poorly kept and insanitary. There was no toilet of any kind. The water supply was from a spring exposed to excretal pollution. On the premises were horses, mules, cows, hogs, chickens, turkeys, guineas, cats, and dogs. Flies (house, stable, and horse), mosquitoes, fleas, wasps, roaches, small biting gnats, chiggers, frogs, snakes, rats, and mice were more or less numerous. Several hundred chickens and turkeys on the place died from "limberneck" in July and August, the outbreak among them beginning about 2 weeks before the onset of the case of poliomyelitis in the boy. Dead chickens and turkeys were found floating in the stream in which the boy had gone swimming from time to time. The boy affected had eaten no food away from home in the several months before the onset of his illness. Practically all of the food was home produced. The boy when well was said to have been the healthiest of the children and physically very active. He had widely spaced upper incisor teeth. He was found wormy in 1933. Except for a very rare cold he had had no illness before his present attack of poliomyelitis.

Case 6.—In the youngest member of a household of seven, including the patient's grandmother 74, father 30, mother 28, two sisters 8 and 6, and brother 4 years of age, living in a frame dwelling located near the top of a high hill on a farm in a rather sparsely populated rural neighborhood. The house was in fairly good structural condition but with inadequate screening. This child had had no known association with any person in direct or indirect contact with a previous case in the outbreak. The nearest home with a case was at a distance of about 4 miles by air line due west in which home case 1 developed. The father, a farmer, suffered with chronic ulcer of the stomach. Excepting that, there was no illness in the family within the 3 months prior to onset of the case of poliomyelitis. The sister, aged 8, had poliomyelitis while living at this same home in 1928. The older children attended public school. No case was found among the children at that school. The child affected had not been away from the home neighborhood within a month before her onset of illness. She was at one church meeting within that period. She had decayed teeth, a foul mouth, and otitis media. At the home an open, insanitary surface privy was in use. The water supply was from an open dug well. The child had eaten no food away from home and most of the food supplies were home produced. On the premises were chickens, turkeys, hogs, cows, and mules. About 30 of the turkeys on the place died from "limberneck" in July and August. The barnyard, about 100 feet from the dwelling, was poorly kept. In it was a pond of standing water. On the place flies (house, stable, and horse), fleas, rats, and mice were numerous. In the yard were fruit trees, peach and apple, which attracted birds, including English sparrows. Under the dwelling house was a damp cellar used mainly for the storage of canned foods.

The histories of these six earliest cases reported in the outbreak in this county are given in somewhat extreme detail because the cases compose an exceedingly interesting group. Among the striking features are (1) the entire lack of evidence of spread of the disease through personal contact; (2) the geographical distribution of the affected homes, four of the homes being spaced 1½ to 4 miles apart almost on a line running east and west about 2 miles north from the southern border of the county, and two of them (which housed cases 1 and 2) being in the same vicinity with three homes in which cases occurred in 1931; (3) the insanitary conditions and the prevalence of insects and vermin at the homes; (4) the poor economic status of most of the families and their very limited contact with the outside world; (5) the absence of other cases of illness in the families or among their associates which appeared to warrant a definite suspicion of poliomyelitis infection; and (6) the prevalence of "limberneck" (presumably botulism) among the fowls on the premises of four of the homes at which cases of poliomyelitis occurred. An accurate determination of the prevalence of "limberneck" at the other homes in these neighborhoods was not undertaken, but from such information as was obtained it appears that this fowl disease was much more common at the homes at which poliomyelitis developed than at the others.

Findings in Muhlenberg County

Histories were obtained of the first three cases reported as poliomyelitis in Muhlenberg County in the period of the outbreak. All occurred in white children under 2 years of age in poor families.

The first case reported was in a boy, 19 months of age, the youngest in a family of seven, including the patient's father 36, mother 36, two brothers 12 and 10, and two sisters 8 and 5 years of age, living in a poorly constructed, unscreened frame shack in an outskirt of a mining village about 11 miles south from Greenville, the county seat. The father was a coal miner. The premises were very insanitary. An open surface privy was in the yard. The water supply was from an open dug well. A cat, a dog, and chickens were on the place and cows were pastured nearby. Houseflies, stomoxys, mosquitoes, ants, mice, and English sparrows were numerous on the premises. There had been no recent illness among the other members of the family. None had ever had poliomyelitis. The baby became ill about July 3 with diarrhea, vomiting, and probably slight fever. He appeared to have some weakness of the legs about 2 weeks later. The diarrhea continued with varying degrees of severity and was marked at the time of the examination on August 29. The baby's diet had consisted mainly of potatoes and evaporated milk with an unripe apple now and then. He was pale and puling. The spinal fluid had not been examined. The examination of the patient on August 29 re-

vealed no evidence of paralysis or localized muscle weakness. The diagnosis of poliomyelitis in this case was considered very probably erroneous.

The second case reported, with onset of systemic symptoms on July 30 and with development of paralysis about August 2, appeared to be a typical case of poliomyelitis. This case was in a girl, 1 year and 9 months of age, the youngest member of a household of eight, composed of four children under 10 years of age and four adults living in an old ramshackle, unscreened frame dwelling, located in a rather thickly populated rural community about a mile and a half north from Central City. The economic status of the family was poor. The child's father was unemployed and the family was on relief. The premises were insanitary. The privy used was of the open-surface type. The water supply was from an open dug well located about 30 feet down hill from the privy. On the premises were cats, dogs, chickens, and a cow, and on places within 300 feet of this home cows and horses were stabled and pastured. In and about this home flies (house, stable, and horse), mosquitoes, honey bees, wasps, fleas, small biting gnats, rats, mice, and English sparrows were numerous. The food supplies were mostly from the relief stores, but the milk and milk products were entirely from the home source. Due to fear of measles, the mother had kept the baby strictly at home during the 6 weeks prior to the onset of the illness. There had been no recent illness in any of the other members of the household, and none of them had ever had poliomyelitis. No previous diagnosed or suspected case was found in the neighborhood. So far as was known there had been at the home no visitor associated with a recognized or a suspected case. The baby before her attack of poliomyelitis was weakly, anemic, and had rickets. Her eyes were of somewhat mongoloid type.

The third case reported was in a boy, 2 years of age, in a home located about 6 miles west from Central City. The illness began about August 1 and terminated in death about 2 weeks later. The clinical history of this case strongly suggested meningitis and was so different from that of poliomyelitis that the case was not included in the list for epidemiological purposes.

Findings in Barren, Hardin, and Hart Counties

A detailed epidemiological history was obtained of each of the first cases reported in these counties in 1935.

The Barren County case was in a girl 5 years and 10 months of age in a family of five, including the patient's father 38 years, mother 35 years, and two sisters 11 years and 23 months of age, living in a well-constructed, well-screened frame dwelling located 2 blocks from a main State highway in Cave City (a village with a population of about 700). The occupation of the father was bank cashier. The

onset of systemic symptoms was on August 10; paralysis was noted on August 12, and death occurred on August 15. The child immediately after onset of the illness was taken to a hospital in Glasgow for treatment. In the month before the development of her case she was on several visits of a few hours each in Bowling Green and Glasgow, but so far as was known she had in that period no direct or indirect contact with any person exposed to a case of poliomyelitis. No other member of the family had had any recent illness and none had had poliomyelitis. The colored day-servant at this home stated that in her household, living a few blocks away, two or three young children had had "upset stomach" for a few days in the first half of August. A child from Louisville, while visiting at this home about the middle of June, had severe gastroenteritis for 2 days. The sanitary condition of the premises was good. A sanitary pit privy was used. The water was from the village supply obtained from a deep-bored well. Milk and butter were obtained from the nearby place of the patient's grandfather and were consumed raw. The child ate ice cream frequently while away from home in the 30 days prior to onset of her illness, once or twice in Bowling Green where she ate ice cream from the same source as that to which four of the Bowling Green cases gave a history of exposure. The only domestic animals with which the child had close association at home were pet dogs. Beef cattle frequently were carried in trucks along the highway near the home. On the premises flies (house and stomoxys), mosquitoes (including anopheles), roaches, and mice were more or less numerous. This child had always been healthy and physically very active.

The Hardin County case was in a boy 3 years and 10 months of age. The family consisted of five, the patient's father, a practicing physician, 40; mother 31; and two sisters, 9 and 6 years of age. The home was a well constructed, screened frame dwelling in Elizabethtown (a town with a population of about 2,500 on the main line of the Louisville & Nashville Ry., halfway between Bowling Green and Louisville). Systemic symptoms developed August 3 and paralysis was noted on August 9. The only evidence of possible connection with a previous case was that on July 13 this child's father had examined and given medicine to a child from Louisville who was brought to the doctor's home with an attack of vomiting. The child remained in the automobile while there. A day or two later, after returning to Louisville, he was reported to have developed a case of poliomyelitis. To the best of the recollection of the doctor and his wife there was no direct contact between this child and their own child. The other members of the doctor's family remained well. None of them had ever had poliomyelitis. The affected child had measles in the spring of 1935. The premises were sanitary. There was an indoor flush water closet. The water was from the city

supply. The milk and milk products, consumed raw, were from the dairy of the patient's grandfather. No domestic animals were kept on the premises but cows and horses were stabled and pastured in the general vicinity. House and stable flies and mosquitoes were present, but not numerous. The child was of good bodily structure and activity and had widely spaced teeth.

The Hart County case was in a boy 13 years of age in a family of seven, including the patient's father, 35; mother, 32; sister, 14; and three brothers, 15, 12, and 11 years of age; living in a fairly well constructed, poorly screened, frame dwelling on a farm in a rather thickly populated community about 6 miles east from Munfordville, the county seat. The onset of systemic symptoms was on July 20, paralysis of the whole body was noted on July 23, and death occurred on July 25. The boy had earache for 1 week before and a sore on the lip for 1 month before the definite onset of illness. He went swimming with other boys in a pond on July 15 and in Green River on July 19. The only trip away from his immediate home vicinity was by automobile on July 17 to Glendale in Hardin County. There was no history of direct or indirect contact with any person exposed to a case of poliomyelitis. None of the other members of the family had had any recent illness and none ever had had poliomyelitis. The premises were insanitary. An open surface privy was in use. The water supply was from a cistern exposed to pollution. The milk and milk products and most of the other foods were home produced. On the premises were horses, cows, hogs, and chickens. House flies, stomoxys, and mosquitoes were numerous. A number of chickens on the place died from limber-neck in July. In the month following the development of this case no other case of poliomyelitis was found among the close associates of this boy.

Findings in Eastern Kentucky

With a special view to obtaining a general idea of the true incidence of the disease in the eastern section of the State during the period of the epidemic, careful studies were made of the one case reported in that period in Carter County, the one reported in Boyle County, the one reported in Letcher County, three of the four reported in Bell County, the one reported in Pulaski County, the one reported in Perry County, and the one reported in Fayette County. The follow-up clinical observations and the detailed histories indicated that these cases in Letcher, Pulaski, and Perry Counties, and two of the three in Bell County were in all probability not poliomyelitis and they were "no-cased" from an epidemiological viewpoint.

The remaining case in Bell County seemed a typical case of poliomyelitis with onset of systemic symptoms on August 26 and of paralysis on August 31. This case was in a boy, 4 years of age, the youngest

in the family of the keeper of the county jail, the living quarters for the family being in the jail building. The father and mother and the three children went on an automobile trip of about 10 days, duration beginning August 11 through southwest Virginia, eastern Tennessee, and western North Carolina (including Asheville). The two other children, 9 and 6 years of age, and the parents remained well. None of them had had poliomyelitis. The child who developed the case of poliomyelitis had measles in the spring of 1935, followed by impetigo and whooping cough. He had rickets in infancy and was subject to frequent colds and tonsilitis. The upper incisor teeth were found widely spaced and some of the other teeth badly decayed. It appears quite probable that this child contracted poliomyelitis while on the trip to North Carolina.

The Carter County case, with onset of systemic symptoms on August 26 and of paralysis on August 29, was in a girl, 5 years of age, in a family of five, including the patient's father, 33, mother, 26, and two (twin) brothers, 2 years of age, and brother, 7 months of age. The home was a well-constructed fairly well-screened log-cabin dwelling on a small farm located about 5 miles south from Grayson, the county seat, in a rural neighborhood. The yard was well shaded with oak and other trees and the children were outdoors most of the time on fair days. This was the only case of poliomyelitis found in Carter County from January 1 to November 5, 1935. There was no evidence of direct or indirect personal contact with another case. About 6 weeks before the onset of this case the father and mother had mild attacks of influenza. There was no other recent illness in the family. None of the near relatives of the affected child ever had had poliomyelitis. The children had measles in June 1935. The premises were insanitary. There was no toilet of any kind. Water was from a spring exposed to occasional pollution. All of the milk and milk products and most of the other foods were home produced. On the place were chickens, hogs, dogs, and cows. Flies (house, stable, and horse), mosquitoes, wasps, roaches, small biting gnats, and mice were numerous. Several of the chickens on the place died, probably from limber-neck, in August. The children in this family had very limited contact with the outside world.

The case reported from Boyle County, with onset of systemic symptoms on August 23, and of paralysis on August 24, was in a boy 12 years of age, the only child in a household of four living in an old partly screened log-cabin dwelling on a small farm located near the Mercer County line about 6 miles northwest from the village of Perryville in a sparsely populated wooded region. There was no history of direct or indirect personal contact with another case. This was the only case found and reported in either Boyle or Mercer County in 1935. The boy within the 30 days prior to onset of illness had been on several trips to villages in the vicinity, on August 10

to attend a county fair and on August 15 to attend a church association meeting. The home premises were insanitary. An open surface privy was used. The water supply was from a drilled well. The foods were mostly home produced, but the boy ate ice cream while on visits to the neighboring villages. On the premises were cows, chickens, turkeys, and a dog. Flies (house, stable, and horse), mosquitoes, ants (in the house), roaches, frogs, rats, mice, and English sparrows were more or less numerous.

The Fayette County case was in a nonresident who was ill upon arrival at Lexington and who had come immediately from Virginia.

Findings in Jefferson County (Outside Louisville)

Of 156 cases reported between July 6 and November 30, 1935, in Jefferson County, 124 were in the city of Louisville and 32 in the county outside the city limits. In that period the case incidence per 100,000 population was approximately 64 in the county exclusive of Louisville, and 40 in Louisville. The outbreaks in the county and the city coincided, the peak of each being reached in the week ended August 24 (see chart II).

A considerable proportion—about one-fourth—of the county population is in the suburbs of Louisville but about another fourth of it is in strictly open country and remote neighborhoods. Detailed epidemiological histories were obtained of 17 of the 19 county cases reported between July 20 and September 15. Some of the data obtained are presented, in the order of the occurrence of the cases, in the following table:

Case no.	Onset of systemic symptoms	Paralysis noted	Age in years	Sex	Race	Approximate location of residence in relation to county courthouse in Louisville	Direct personal contact with—		Indirect personal contact with—	
							Diagnosed case	Suspected case	Diagnosed case	Suspected case
1	July 25	July 27	7¾	Male	White	4½ miles south	−	−	−	−
2	July 26	July 29	8	do	do	5 miles east	−	−	−	−
3	Aug. 1	Aug. 2	6	Female	do	6 miles southeast	−	−	−	−
4[1]	Aug. 5	Aug. 19[2]	17	Male	do	4 miles northeast	−	−	−	−
5	Aug. 6	Aug. 8	5¾	do	do	7 miles south	−	−	−	−
6	Aug. 15	Aug. 21	7¾	Female	do	10 miles south	−	+	−	+
7	Aug. 16	([3])	3¾	Male	Colored	11 miles east	−	−	−	−
8	Aug. 17	Aug. 21	4¼	Female	White	7 miles southeast	−	−	−	−
9	Aug. 17	do	⅝	Male	do	6 miles southeast	−	−	−	−
10	Aug. 19	None	14¾	do	do	9 miles southwest	−	+	−	+
11[4]	Aug. 19	Aug. 21	9¼	Female	do	11 miles southeast	−	+	−	+
12	Aug. 19	Aug. 23	3½	Male	do	5½ miles east	−	−	−	−
13[4]	Aug. 20	do	8¾	do	do	11 miles southeast	−	+	+	+
14	Aug. 23	Aug. 25	4	Female	do	5¼ miles east	−	−	−	−
15	Aug. 24	Aug. 27	5¾	Male	do	6 miles south	−	+	−	+
16	Aug. 25	Aug. 27	19	do	do	4½ miles southeast	−	−	−	−
17	Aug. 29	None	8¾	do	do	5½ miles east	−	−	+	−

[1] Diagnosis very questionable.
[2] Not noted until few hours before death on that date.
[3] None definite.
[4] Cases 11 and 13 in related and closely associated families. Onset of cases probably coincident.

Geographical distribution.—Ten of these seventeen early cases were at residences located within 2 miles of the city limits of Louisville. The homes in which cases 1, 3, 5, and 15 occurred were in the suburb of a southern section of the city in which the disease was prevalent. Cases 2, 4, 12, 14, 16, and 17 were near a large eastern section of the city which appeared practically free from local cases of the disease throughout the outbreak. The remainder of these cases were at homes in different sections of the county located 3 to 7 miles from the city limits. No two of the cases were in the same home. The county health officer reported, however, an instance in the latter part of the outbreak of three cases developing within 2 or 3 days of each other, about October 10, at a home in the southwestern part of the county in the family of a tenant living in a crowded cottage on a stock farm, the home premises being very insanitary with respect to excreta disposal and heavily infested with rats, flies, and mosquitoes.

Environmental conditions.—Of the 17 residences, 1 was a log cabin in good structural condition and well screened, 2 were brick houses in good structural condition and well screened, 9 were frame houses in good structural condition, 7 with good and 2 with incomplete screening, and 5 were frame houses in poor structural condition and without screening. At 16 the yards were well shaded, fruit, oak, maple, elm, and cedar predominating as the shade trees. At two there was no toilet of any kind; at nine insanitary open-back surface privies were in use; at two there were flush water closets connected with insanitary, frequently overflowing cesspools, and at four there were indoor flush water closets connected with septic tanks. At nine there were ponds or ditches of standing water on or nearby the premises; nine were in rather densely and eight in rather sparsely populated neighborhoods. At 15 there were stables for horses or cows on or within a few hundred feet of the dwelling; on the premises were cows at 2, chickens at 11, dogs at 9, cats at 6, horses at 3, hogs at 5, rabbits at 1, and a goat at 1. Cattle were herded or carried in trucks past the premises more or less frequently at 12. The general cleanliness of the premises, except for excreta disposal, was good at 10, fairly good at 3, and very poor at 4. More or less numerous on the premises were houseflies and stableflies (stomoxys) and mosquitoes at all, horseflies at 9, ants (in house) at 6, roaches at 6, small biting gnats at 8, fleas at 2, frogs at 9, honey bees at 8, wasps at 13, rats at 11, mice at 9, and English sparrows at all. At the home in which case 11 developed a number of chickens died from what was reported as "hard craw" during the month before the onset of the case. At the home in which case 14 developed a pet sparrow, after being droopy for a week, died about 3 weeks before the onset of the case.

Visits to Louisville.—All of the cases except numbers 6, 10, 12, and 14 were in persons who within the 30 days prior to their onsets of illness were in Louisville on one or more visits varying in duration from a few hours to a few days.

Swimming.—Five of the seventeen affected persons gave a history of having been in swimming once or more within the 30 days prior to onset of illness—2 in pools in Louisville, 1 in the Ohio River, and 2 in ponds in their respective home vicinities.

Water supplies.—The sole or principal sources of drinking water at the 17 homes were the Louisville public supply at 8, protected bored or drilled wells at 5, cisterns at 2, and open dug wells at 2.

Food supplies.—The foods were from various sources, including Louisville markets and neighborhood stores. Some was produced at home. The only foods to which any considerable proportion of the persons affected gave a history of exposure in common were milk and ice cream distributed by one of the dairy companies operating on a large scale in Louisville. Nine of the cases, numbers 1, 2, 3, 5, 10, 12, 14, 15, and 17, were in persons who during the 30 days prior to the onset of illness consumed frequently or regularly milk or ice cream, or both, distributed from this one supply. The father of the family in which case 15 occurred was engaged as route foreman for this company until he suffered an attack of "heat exhaustion" on August 2. This dairy company is designated dairy company A and is discussed further in the Louisville section of this report.

Possible predisposition.—Nine of the seventeen cases were in the youngest members of the affected households. Besides the patients, the total number of children under 15 years of age in the households was 42. No member of any of the affected families gave a history of having had poliomyelitis before the outbreak of 1935. Of the 17 patients, 13 were said to have been very active physically; 6 had had frequent colds or sore throat; 6 had widely spaced upper incisor teeth; the eyes of 2 were mongoloid type; 5 were poorly nourished; 2 had diseased tonsils and adenoids; 1 had undergone a tonsillectomy 18 days before onset of poliomyelitis; within a month before onset of illness 2 had impetigo and 2 had fever blisters on the lips. Within 8 months before onset of poliomyelitis two had measles, two whooping cough, two otitis media, and one chicken pox.

Personal contact.—Case 1 was in a child who because of whooping cough in the neighborhood was kept strictly on the home premises and had very little contact with persons outside the family for the 3 weeks prior to onset of illness. About 3 days after the onset of this case the father and mother of the child developed colds with sore throat and coughing and slight fever which continued for about 2 weeks.

Case 6.—Beginning about July 25 the brother of case 6 had an attack of vomiting with some stiffness of muscles which continued for 2 days, and on August

11 the mother of this child had an attack of vomiting which continued intermittently for a day or two.

Case 8.—The mother of the child had diarrhea for several days beginning about August 8. The child was in a hospital in Louisville for 1 day for a tonsillectomy operation on July 26.

Case 10.—The three other children, 10, 9, and 3 years of age, in the family of case 10 were slightly ill with headache, vomiting, perhaps a little fever, and constipation for about 2 days beginning August 10. The father of these children was a shoe repairer and the stepmother was the head nurse in a local tuberculosis sanitarium.

Case 11 was in a child whose sister, 6 years of age, was ill and in bed with headache, vomiting, and slight fever for 2 days beginning August 9. The other six children in this family 16, 14, 14, 11, and 4 years, and 5 months of age were entirely well during the 3 months before and the month after the onset of the diagnosed case of poliomyelitis. The child with the diagnosed case was isolated in the Louisville City Hospital on and after August 21.

Case 13 was in a child who played frequently with the children in the family in which case 11 developed. The two families were related and were closely associated through intervisiting. The onsets of cases 11 and 13 were within 24 hours of each other. Two other children under 15 years of age in the family with case 13 remained entirely well.

Case 15.—A brother, 14 years of age, of the child with case 15 was ill for 2 days beginning August 12 with headache, slight fever, pains all over the body, and slight stiffness of the neck. The father, route foreman for dairy company A, had an attack diagnosed by the attending physician as heat exhaustion beginning August 2 with severe headache, fast pulse, and general weakness (but without fever, muscle stiffness, or paralysis) which continued for several weeks. A playmate of the child with case 15 had what the attending physician diagnosed as arthritis of both knees for several days beginning about August 10.

Case 17, with onset on August 29, was in a boy who played freqnently with the children of a family in which case 14 developed on August 23. The child with case 14 was kept at home throughout the period of her acute illness.

Besides these instances no evidence was obtained in the histories of the 17 cases even remotely suggesting the spread of the disease through personal contact. Four of the cases were in children who, because of fear of poliomyelitis or other infectious disease, were kept strictly at home practically isolated from persons outside the families during the 3 or 4 weeks prior to the onset of poliomyelitis.

Preventive measures.—Ten of the seventeen cases were hospitalized immediately or within 2 or 3 days after onset of illness. The county health department undertook to quarantine the cases cared for at home. The assembling of children under 15 years of age was discouraged and the opening of the public schools was postponed for about a month.

The Outbreak in Louisville

Louisville, located on the south bank of the Ohio River, is the largest city and the chief business center of Kentucky. The land area is 39.22 square miles. The population in 1930, according to the United States census, was 307,701—native white composing 81.6

percent, foreign-born 2.9 percent, and Negroes 15.4 percent. The land surface is flat and low for the most part, in the northwestern, central, and southern sections, and becomes hilly as the eastern and southern outskirts of the city are approached. The elevation above sea level ranges from 466 to 554 feet.

In the city are several spacious attractive public parks with playgrounds and lakes. Some of the streams in the parks are rather heavily polluted with sewage causing them to be less attractive than they would be otherwise.

The public water supply is pumped from the Ohio River at a point about 1 mile upstream from the city, is passed through sedimentation basins, and is filtered and chlorinated. Over 95 percent of the dwellings are connected with the public water supply.

At the time of these studies, the estimate was that about 85 percent of the residences were connected with the city sewerage system. Of the approximately 11,800 dwellings not so connected there were cesspools or septic tanks at about 300 and insanitary privies, either of unprotected open vault or surface type, at about 11,500. The largest proportions of dwellings with privies in use were found by a special survey to be in the northwestern, northeast central, and southern sections of the city.

Large areas in the southern section are more rural than urban in general character.

The main vegetable and poultry markets and most of the large slaughtering plants for beef and pork are in the northeast central section; some slaughter houses are in the northwest section.

About 95 percent of the milk supply of the city is distributed from pasteurizing plants.

Garbage collection and disposal was found far from satisfactory from a sanitary viewpoint. The home containers were mostly loose baskets and uncovered metal cans. Regularly, the garbage collected by the city service is incinerated, but in the period May 1 to September 1, 1935, the incinerator was not in operation and during that period most of the collected garbage along with other refuse was dumped without covering or other treatment in the four main city dump grounds, the locations of which are indicated on map IV. These dumps were found literally alive with flies, rats, and English sparrows. It was generally stated that in the poorer parts of the city flies and rats were much more prevalent in the summer of 1935 than in any of the several previous summers.

In 1935 the weather conditions appeared not far from the annual average, but an unusually hot dry spell began the last part of July and continued for about 3 weeks.

Of the 124 cases reported as poliomyelitis between July 1 and November 30, 1935, in Louisville and retained in the records of the

city health department, detailed epidemiological case histories were obtained of 121.

Incidence.—Cases of poliomyelitis in Louisville, in the 16-year period, 1920–35, by months, is shown in the following table:

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
1920	1	0	1	0	0	0	0	0	0	0	0	0	2
1921	0	0	0	0	0	0	0	0	0	0	0	0	0
1922	0	0	0	0	0	0	0	0	0	0	0	0	0
1923	0	0	0	0	0	0	0	0	0	1	0	0	1
1924	0	0	0	0	0	0	0	0					
1925									11	33	4	0	48
1926	0	0	0	0	0	0	0	1	0	0	0	0	1
1927	0	0	0	0	0	0	0	0	5	3	1	1	10
1928	0	0	0	0	0	0	0	0	2	0	0	0	2
1929	0	0	0	0	0	0	0	0	0	0	0	0	0
1930	0	0	0	0	1	0	1	0	0	1	1	0	4
1931	0	0	0	0	0	0	0	4	1	3	1	0	9
1932	0	0	0	0	0	0	1	0	2	0	0	1	4
1933	0	0	0	0	0	0	0	1	3	0	0	0	4
1934	0	0	0	0	0	1	1	1	3	3	1	0	10
1935	0	0	0	0	0	0	5	64	40	9	6	0	124

So far as the city health department records and other sources of information indicate, the incidence rate in 1935 was much higher than in any previous year. The rate per 100,000 population in the outbreak period of 1935 was about 40 as against that of about 16, the previous high record in 1925. Following a period of 7 months without a case being reported in the city, cases were reported in the last part of July and the early part of August 1935, in such number as to suggest that a definite outbreak of poliomyelitis had begun in Louisville. The reporting of cases in unusually large number continued for 3 months. The outbreak reached its peak in the week ended August 24, then declined from week to week until the latter part of September and, after rising slightly for the next 3 weeks, again declined and terminated on November 18. By months of onset of systemic symptoms, 12 cases developed in July, 65 in August, 34 in September, 10 in October, 3 in November, and none in December. The onset of the last case reported in 1935 was on November 18. Figure 5 [3] shows, by weeks, the dates of onset of cases reported in Louisville and Jefferson Counties from July 1 to October 18.

The dates of onset of the six cases developing in Louisville after October 17 were one each on October 20, 27, and 31, and November 11, 13, and 18.

Clinical features.—Of the 124 cases, 77 were paralytic and 47 nonparalytic. A considerable proportion of the cases diagnosed as abortive or preparalytic and reported as poliomyelitis were very mild, the duration of the illness in some of them being only 2 to 5 days. A majority of these mild cases, however, showed a definitely increased cell content of the spinal fluid. In seven cases at first

[3] The original of this chart was prepared by the epidemiologist of the city health department.

reported as poliomyelitis the diagnosis was changed, and these cases were deleted from the official record.

Only two deaths occurred in the outbreak series, giving the remarkably low case fatality rate of 1.6 percent. Of one of the cases terminating fatally the diagnosis was open to doubt. The child, 5 years of age, was admitted to a hospital on the morning of August 16 for a tonsillectomy. He seemed at that time entirely well. The operation was performed at 2 p. m. No considerable bleeding nor other adverse symptoms were noted until about 10 p. m., when he was found to have complete paralysis of both lower extremities. He died at 12:55 a. m., August 17.

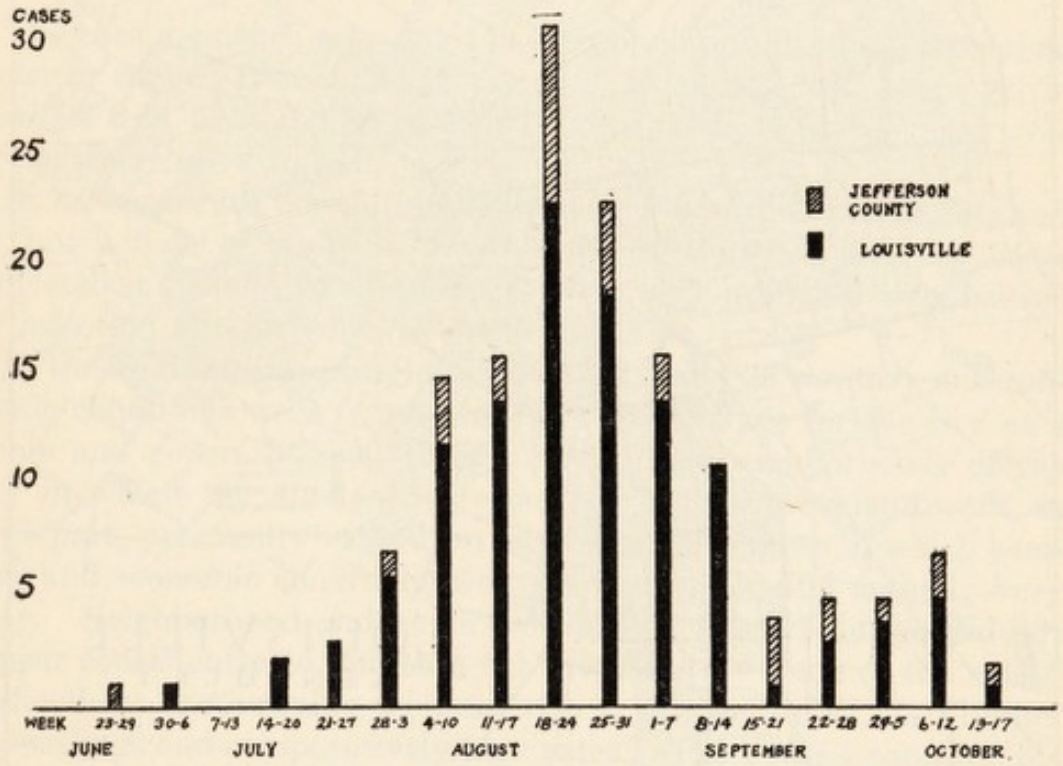

FIGURE 5.—Cases of poliomyelitis in Louisville and in Jefferson County, Ky., by dates of onset in period June 23 to October 18, 1935.

In presenting most of the data in the following paragraphs and tables of this section of this report the paralytic and the nonparalytic cases are listed separately.

Out-of-city infection.—Of the persons with the 121 cases of which epidemiological histories were obtained, 1 certainly, 3 probably, and 25 possibly contracted the disease while away from Louisville. The remaining 92 cases were in persons who within the 30 days prior to onset of illness had not been away from the city. The one who certainly contracted the infection away from the city was a nonresident who was ill upon arrival in Louisville. Of the three cases regarded as probably out-of-city infections, one, with onset September 3, was in a boy who was away from July 15 to August 30; one, with onset August 17, was in a girl who was visiting at a home in Jefferson

County from July 29 to August 16, and one, with onset July 17, was in a girl who was visiting in Warren and Logan Counties, Ky., from July 3 to 12. The two latter cases were among the residents of a large northeast section of Louisville among whom no other case was reported in the course of the outbreak. The 25 cases regarded as possibly due to out-of-city infection were in persons who within the 30 days prior to onset of illness were away on short trips of a few hours to 2 or 3 days' duration. Only one of these gave a history of exposure through personal contact or environmental conditions with another

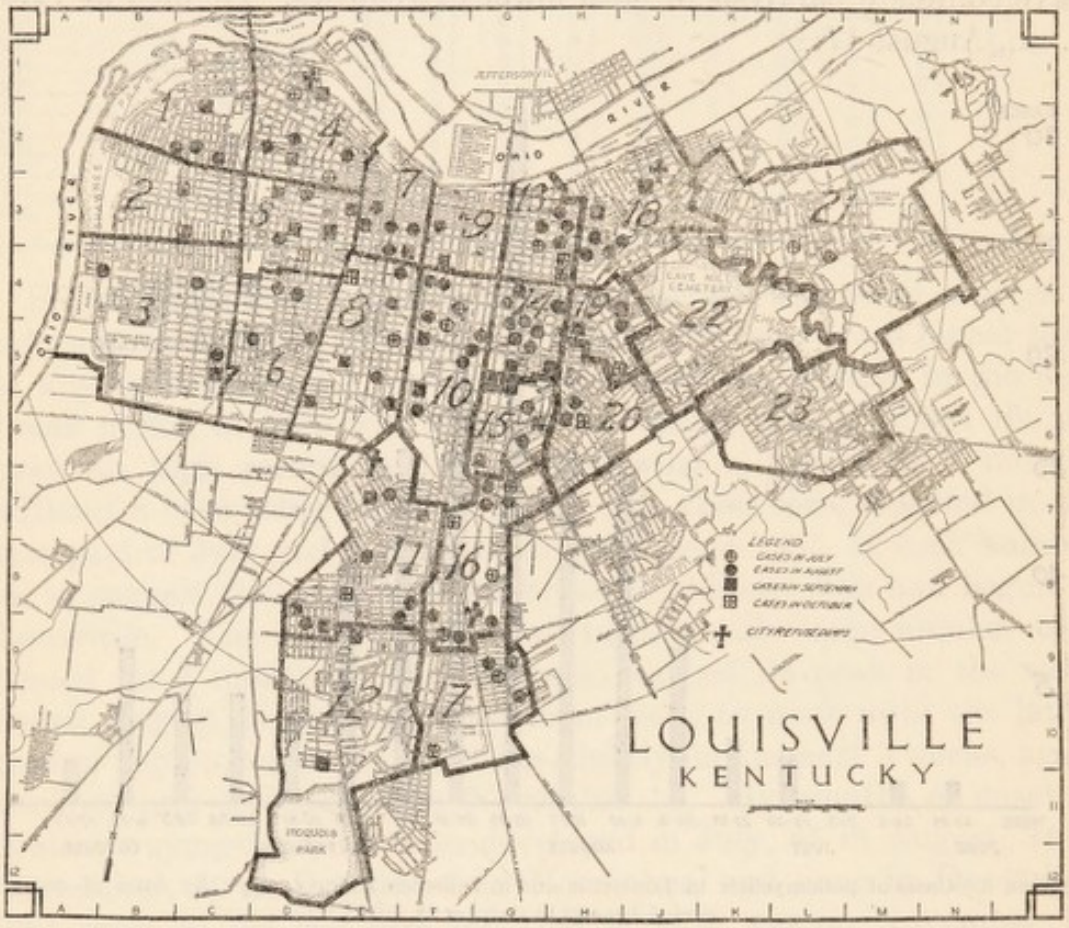

FIGURE 6.—Cases of poliomyelitis by place of residence in statistical districts and by month of onset in Louisville, Ky., from July 1 to October 31, 1935.

case while away. That case, with onset on September 22, was in a child who visited for a few hours on September 8 at a home in an outskirt of Louisville in Jefferson County. In this home where conditions were very insanitary, a child had just then become ill with a case later diagnosed poliomyelitis.

Geographical distribution.—Figure 6 shows the location of residences in the 23 statistical districts of the city in which the cases developed in July, August, September, and October. The distribution of the cases by districts is shown in the following table:

District	Population in 1928	Number of cases July to November 1935	Approximate case rate per 100,000 population	District	Population in 1928	Number of cases July to November 1935	Approximate case rate per 100,000 population
1	7,608	4	52.5	14	9,653	12	124.3
2	12,521	2	15.9	15	8,944	4	44.7
3	13,943	4	28.6	16	8,051	10	124.2
4	21,760	7	32.1	17	7,111	5	70.3
5	17,056	7	41.0	18	14,495	6	41.3
6	16,890	4	23.6	19	8,900	4	44.9
7	14,869	6	40.3	20	11,589	3	25.8
8	15,357	8	52.0	21	12,859	2	15.5
9	10,819	2	18.4	22	10,857	0	0
10	25,009	11	43.9	23	15,133	0	0
11	13,827	10	72.3				
12	6,607	2	30.2	Total	298,389	120	40.2
13	14,531	7	48.1				

The case incidence rates per 100,000 population in the 23 statistical districts ranged from none in districts 22 and 23 and below 30 in districts 2, 3, 6, 9, and 20 to over 70 in districts 11 and 17, and over 124 in districts 14 and 16.

In an aggregate population of over 38,000 in districts 21, 22, and 23, not a case certainly of local origin developed. The two cases indicated in district 21 (discussed above) very probably were caused by infection contracted away from Louisville.

In the section comprising districts 21, 22, and 23 sanitary and economic conditions were found far above the average for the city as a whole and generally good to excellent. The neighborhoods of the city in which the disease was especially highly prevalent were, in large part, practically without exception, among those in which sanitary and economic conditions were comparatively and actually very poor. Neighborhood and home crowding of the population did not appear consistently to influence the prevalence. Some of the neighborhoods in the outlying sections with a very scattered distribution of dwellings had comparatively high rates. There was a considerable concentration of cases in the stockyard regions, and in the main poultry and vegetable marketing region. Most of the affected residences were within a mile or two of one or more of the four main city refuse dumps (see map IV) and, therefore, within range of them by flight of flies and scavenger birds. English sparrows, which perhaps fittingly should be designated flying vermin, swarmed over the dumps and were observed in all parts of the city, but most numerously, of course, at places where decaying fruit and vegetable matter and other refuse were readily accessible. Though not even a rough estimate was undertaken of the regional distribution of rats, it did appear that they were comparatively numerous in most of the city neighborhoods in which the incidence of poliomyelitis was much above the average.

Age, sex, and race.—The distribution of the 77 paralytic cases and of the 47 nonparalytic cases by age, sex, and race of the persons affected is shown in the following table:

Age in years	Paralytic cases					Nonparalytic cases					Grand total
	White		Negro		Total	White		Negro		Total	
	Male	Female	Male	Female		Male	Female	Male	Female		
Under 1	1	2	0	0	3	0	0	0	0	0	3
1–2	6	2	0	0	8	0	0	0	0	0	8
2–3	2	6	0	1	9	1	0	0	1	2	11
3–4	4	1	0	1	6	3	0	0	1	4	10
4–5	4	1	0	1	6	1	0	1	0	2	8
5–9	14	10	2	3	29	6	7	2	5	20	49
10–14	4	5	1	1	11	9	1	3	1	14	25
15–19	2	2	1	0	5	1	1	0	0	2	7
20–24	0	0	0	0	0	1	0	0	0	1	1
25–29	0	0	0	0	0	2	0	0	0	2	2
Total	37	29	4	7	77	24	9	6	8	47	124

The age range of the nonparalytic was considerably higher than that of the paralytic. Of the nonparalytic 17 percent, and of the paralytic 41.5 percent, were under 5 years of age. Negroes composing about 15 percent of the population furnished 20.2 percent of the total cases, the percentage furnished by them being much higher among the nonparalytic than among the paralytic. Among whites a much larger proportion was furnished by males than by females, while among Negroes the number of cases in females was considerably larger than that in males. The most marked difference in the sex distribution was for the nonparalytic cases among white persons.

The age range for the city cases was about the same as that for the cases occurring in the rural communities of Jefferson County.

Personal contact.—Only 1 of the 120 cases developing in Louisville and covered by the studies gave a history of direct personal contact with a previous case. In that instance the person affected was exposed while on a visit of a few hours' duration to a home outside the city in Jefferson County. The onset of this case, in which paralysis developed, was about 14 days after the exposure.

Only four cases (two nonparalytic and two paralytic) gave a definite history of exposure through indirect personal contact to previous cases. One of these, with onset August 25, was in a child who occasionally played with the children of a family in which a case developed on August 10 and was hospitalized on August 12. One was in a man, 25 years of age, with onset of illness on August 31, who associated occasionally with the parents of a child whose case developed on August 18 and who was hospitalized on August 22. One, with onset August 13, was in a child who played with the brothers and sisters of a child who developed, on August 8, a case of slight fever, without

paralysis, which continued for only about 8 days but was diagnosed poliomyelitis. One was in a baby who a few days before onset of illness, on October 3, was in contact with a man whose child developed poliomyelitis on September 29 and was hospitalized on October 1.

Two cases were in children living in the same neighborhood who while well played together frequently, and who were stricken on the same day.

There were only two instances of more than one case in a household. In each of these the onset of the two cases were on the same day.

Painstaking efforts were made throughout the studies to obtain all traces of transmission of the disease through personal contact, but it appears that in this outbreak in Louisville evidence of personal association between the cases of poliomyelitis, suggestive of cause and effect, was no more common than that which might have been found if histories had been taken of personal association between cases of broken bones occurring in the city in the same period.

The affected households were remarkably free from illness even remotely suggesting poliomyelitis during the 3 months prior to the onset of the disease. There was no history of acute systemic illness of any sort in such period among 103 of the 118 affected households visited. The cases in the other 15 households were mostly colds and summer diarrhea, not one being strongly suggestive of poliomyelitis. The total number of children under 15 years of age, exclusive of the patients, in these 118 households was 232. Among the members of the affected households no one gave a history of a previous attack of poliomyelitis. In a number of instances the nearby homes with children were canvassed, but no unreported case of diagnosed or suspected poliomyelitis was found.

Among an aggregate of 2,700 children domiciled in the 19 orphanages and other institutions for children in different sections of the city and its environs, not a case of poliomyelitis was reported. The case incidence among children of comparable age—under 15 years—for the city as a whole was 1 in about 700.

In the Louisville City Hospital, where the majority of the cases occurring in the outbreak were treated, not a case developed among the personnel of about 430.

Environmental conditions.—Of the 118 affected homes, 74 were located in densely populated sections and 44 in rather sparsely populated suburban neighborhoods. At nearly all of the affected suburban homes and at some in the more central parts of the city there were on or near the premises fruit trees, mostly plum, peach, and apple, and grape arbors which attracted birds, mostly English sparrows, and insects. A large majority of the homes were in poor neighborhoods where the economic status of the residents generally was low. The

structural condition of the dwelling was good at 23, fair at 42, and poor at 53. Screening of doors and windows was good at 18, partial to none at 48, and entirely lacking at 52. At 52 of the homes there were, within 300 yards of the dwellings, stables or pastures in which cows or horses, or both, were kept, and on highways or railways within short fly flight of most of the other affected homes livestock frequently were herded or freighted. The general cleanliness of the premises and the housekeeping were found good at 21, fair at 53, and poor at 44. The presence of family-owned domestic animals on the premises was as follows: Horses at 1, cows at 3, goats at 2, sheep at 1, cats at 30, dogs at 51, white rats at 1, rabbits at 3, chickens at 20, pigeons at 4, geese at 1, ducks at 2, canary birds at 7, goldfish at 2, and a raccoon at 1. Evidence found of insects and vermin on the 118 premises is shown in the following table:

Insects or vermin	Homes—			Insects or vermin	Homes—		
	With paralytic cases	With non-paralytic cases	Total		With paralytic cases	With non-paralytic cases	Total
Houseflies	71	47	118	Roaches	40	29	69
Stomoxys calcitrans	68	44	112	Mice	14	5	19
Mosquitoes	66	44	110	Rats	61	44	105
Fleas	6	11	17	English sparrows	55	40	95
Ants	35	24	59				

House and stable flies and mosquitoes were more or less numerous at practically all of the homes except those at which cases developed after the advent of cold weather in the last part of October. Among the more striking of these data is the frequency of rat infestation. Of the 105 homes at which there was a history or evidence of such infestation, it appeared that rats were very numerous at 40, fairly numerous at 56, and few and occasional at 9. The difference between the recorded frequency of rat infestation and that of mouse infestation is impressive. It seems quite probable that if a serious outbreak of typhus fever or of bubonic plague had occurred in Louisville in the summer of 1935 the geographical distribution would have been much the same as that of the outbreak of poliomyelitis.

The findings with respect to excreta disposal at the 118 affected homes and their immediate vicinities are shown in the following table:

Disposal system	Homes—		
	With paralytic cases	With nonparalytic cases	Total
Insanitary open privy in use on premises	30	13	43
Insanitary (hopper-type) water closet in yard with insanitary privies on nearby premises	3	8	11
Insanitary (hopper-type) water closet in yard with no privy nearby the dwelling	3	0	3
Sanitary water closet indoors with insanitary privies on adjacent premises or within 50 yards of dwelling	29	17	46
Sanitary water closet indoors with no privy nearby the dwelling	7	8	15
Total	72	46	118

It is interesting to observe that for the city as a whole the incidence rate of the disease was much higher among persons living in homes at which insanitary privies were in use than among those living in homes at which sanitary water closets connected with the city sewerage system were in use. Of the 72 homes in which the paralytic cases occurred, insanitary privies were in use at 41.6 percent, and of the 46 in which the nonparalytic cases occurred, insanitary privies were in use at 28.3 percent. Persons living in homes with privies in use on the premises compose only about 14 percent of the total population of the city. Therefore, the incidence rate of cases diagnosed poliomyelitis among those persons was about 98 per 100,000, being approximately four times as high as that among the persons living in the sewered dwellings of the city.

Figure 7 [4] shows the number of cases of poliomyelitis reported from July 1 to October 31, 1935, and the number of privies found by a special survey in each of the 23 statistical districts of Louisville. For most of the districts the correlation or coincidence is rather impressive.

Swimming.—Sixteen of the paralytic and nine of the nonparalytic cases were in persons who had been in swimming or wading within the 30 days prior to onset of illness. The swimming or wading places were the public city pools for 21 and creeks in the country for 4. Children were prohibited from using the city pools from the time the outbreak was recognized in the first part of August to the end of the season.

Milk.—The only foods which appeared as a common denominator to any considerable proportion of the cases were milk and milk products. For the 120 cases the following histories were obtained as to the use of fresh milk by the patients in the 30 days prior to onset of illness:

[4] The original of this chart was prepared by the epidemiologist of the city health department.

Milk used—	*Number of cases*
As a beverage	100
In fruits or cereals only	3
In hot coffee or tea only	0
Not in any way	13
Not recorded	4
Total	120

The following table shows the approximate percentages of the total supply of milk distributed by the principal dairymen or dairy companies in Louisville in the summer of 1935, and the number of cases

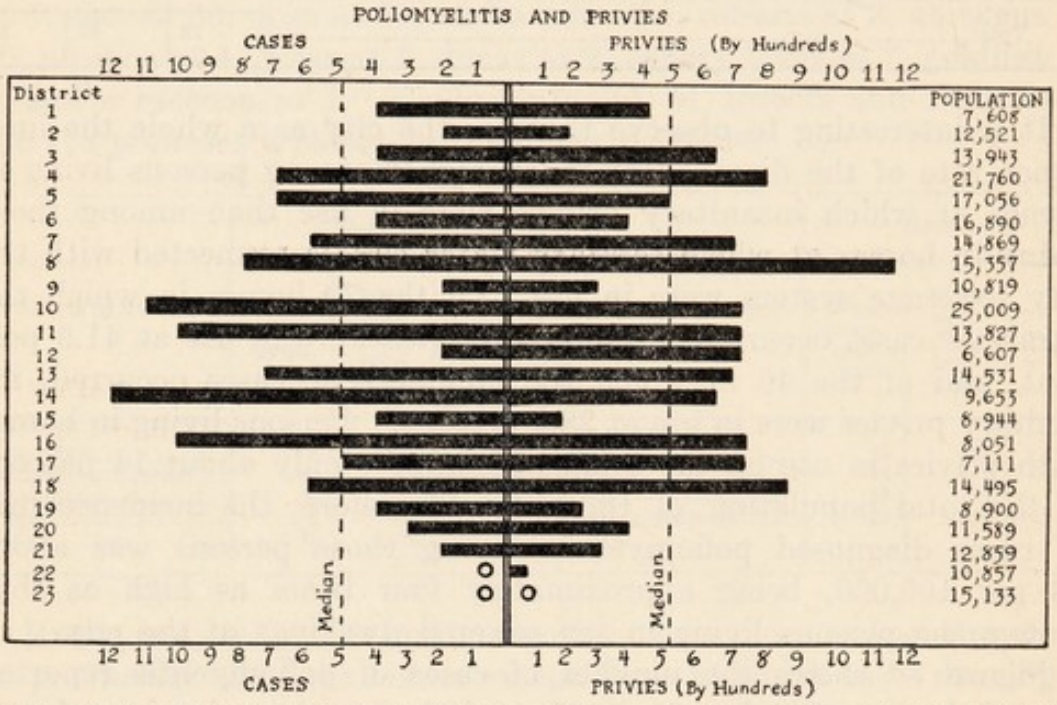

FIGURE 7.—Numbers of privies (by hundreds) and of cases of poliomyelitis reported in statistical districts of Louisville in period July 1 to October 31, 1935.

of poliomyelitis occurring among persons who used milk solely, principally, or occasionally from each of these sources:

Dairy or dairy company	Percentage of total supply distributed	Number of cases of poliomyelitis among persons using milk from the different sources—			Total cases	Percentage of total cases
		Solely	Principally	Occasionally		
A	27.33	55	7	8	70	62.4
B	16.04	9	5	1	15	13.4
C	8.5	2	1	2	5	4.5
D	7.04	0	0	1	1	.9
E	4.44	0	1	0	1	.9
F	4.20	3	1	2	6	5.4
G	3.77	0	1	0	1	.9
H	3.12	3	2	0	5	4.5
I	2.74	2	1	0	3	2.7
J	2.62	0	0	0	0	0
K	1.76	2	0	3	5	4.5
Total					112	

The most striking feature of this table is the proportion of cases among the users of milk distributed by dairy company A. Besides the cases among the users of milk from this supply, there were 12

cases in persons who used milk entirely from other sources but who within the 30 days prior to onset of their cases had eaten ice cream manufactured and distributed by dairy company A. The basis for any suspicion that the output of this company may have been a considerable factor in the spread of the disease, however, is mitigated by the fact that about 65 percent of that output was distributed through grocery stores, composing about 36 percent of the total city supplies so distributed, and the majority of the families in which cases occurred during the outbreak obtained their milk supplies from the grocery stores. The approximate percentages of milk distributed through grocery stores by the other principal dairy companies were as follows: 15 by B, 50 by C, 58 by D, 23 by E, 70 by F, 70 by G, 75 by H, 100 by I, 60 by J, and 70 by K. The entire supply of milk and milk products distributed by dairy company A was said to be pasteurized and the output of that company was given consistently a high sanitary rating by the city health department.

So far as the histories indicated, there was no disproportionately large number of cases among the consumers of ice cream or butter from any one source.

Possible predisposition.—Forty-one of the seventy-three paralytic cases, and 25 of the 47 nonparalytic cases were in the youngest members of the affected households.[5]

Some of the associated conditions among the persons stricken are shown in the following table:

Condition	Paralytic cases	Nonparalytic cases	Total cases
Measles within 8 months	17	12	29
German measles within 8 months	6	2	8
Whooping cough within 8 months	4	2	6
Chickenpox within 8 months	2	2	4
Scarlet fever within 8 months	1	1	2
Mumps within 8 months	0	1	1
Frequent fever blisters	5	3	8
Vaccination against smallpox within 1 year	2	0	2
Diphtheria toxoid within 1 year	8	2	10
Tonsillectomy within 6 months	3	1	4
Frequent colds or sore throat	19	18	37
Enlarged and diseased tonsils	9	4	13
Impetigo or other recent open sores	5	3	8
Decayed teeth and foul mouth	12	10	22
Recent boils	3	2	5
Otitis media	2	3	5
Undernourished	21	12	33
Habitual constipation	16	11	27
Frequent indigestion	4	4	8
Eyes approaching mongoloid type	9	3	12
Widely spaced upper incisor teeth	9	12	21
Very active physically when well	42	27	69

[5] It is conceivable that the operation of the age factor in the incidence of poliomyelitis may be influenced more by habits than by physiological predisposition. Children 2 to 5 years of age are as a rule more prone to put soiled things into their mouths and noses, and are less resistant to insect bites, than are older children. In undertaking in the course of these studies to ascertain the difference in habits between the child stricken and the other children in the same family some interesting reports were obtained. The following is an example: In a Louisville family with three children under 10 years of age, the youngest, aged 3, was stricken. In a corner of the yard there was a small plum tree which belonged to the baby. During the 3 weeks before the onset of the case about a dozen plums ripened on the tree and fell to the ground. The baby upon arising in the morning would toddle to his plum tree. If a plum was on the ground it was his. None of the other children shared the plums with him. About 10 feet from the plum tree there was on the adjacent premises a large open privy vault filled to overflowing. Both of the premises were infested with rats and flies.

The items regarding vaccination against smallpox and diphtheria toxoid were included in the histories of only 21 of the paralytic and 8 of the nonparalytic cases studied. The other items in this table apply to all of the cases whose histories were obtained.

The disease seemed to attack especially children who were undernourished, who were when well very active physically, who were subject to frequent colds or sore throat, who had decayed teeth, who were habitually constipated, or who recently had had measles. The histories in a very considerable proportion showed that the child attacked had been from birth very active physically—much more so as a rule than the other children in the family had been at corresponding age periods.

Preventive measures.—The dwellings in which cases were reported were placarded very conspicuously. The city health department undertook vigorously to quarantine the patients and the young children in the affected households. Throughout the period of the recognized outbreak, children under 14 years of age were prohibited from attending moving-picture shows and were dissuaded from attending other places of large assemblage. The opening of the public schools was postponed for 2 weeks—until September 23. Vaccines of three or four varieties were administered on a considerable scale by the local practicing physicians, and two, the Park-Brodie and the Kolmer, were administered under controlled conditions by the city health department. Continuous newspaper publicity was a large factor in causing many parents to restrict the movements of their children.

Beginning September 11 and completed September 24, chlorination of all the privies, approximately 11,500, in the city was carried out thoroughly. The labor for this activity was furnished by the Federal Emergency Relief Administration, and the chemical was provided by the city. A pound of fresh chlorinated lime mixed in 2 or 3 gallons of water was applied to the contents and the soiled structural parts of every privy. This activity perhaps did not prevent any poliomyelitis, but it had an educational effect which probably has helped and will help in the prevention locally of other diseases with much higher rates of annual incidence and mortality than poliomyelitis ever has had in Louisville. Since that work, hundreds of the privies have been abolished and replaced with sewer connections.

It is interesting to compare the duration of the outbreak in Louisville with the duration of that in Edmonson County.

Summary

The case incidence rate of poliomyelitis in Kentucky in the period July 1 to October 31 of 1935 was higher than that recorded for any previous period of comparable duration.

The disease in 1935 reached epidemic proportion in Kentucky about 2 months later than in North Carolina and about 1 month later than in Virginia.

In Kentucky, there were in this epidemic three main centers of incidence. They were 50 or more miles apart in the west-central part of the State. About 40 percent of the reported cases developed in the city of Louisville. Most of the eastern half of the State was free from the disease. Three Kentucky cities, Lexington, Newport, and Covington, each with a population over 30,000, within 75 miles of and closely connected by heavy traffic with Louisville escaped entirely. Large cities—Cincinnati, Nashville, St. Louis, Indianapolis, and Chicago—in neighboring States also connected by heavy and rapid traffic with Louisville had no excessive incidence of the disease. In the period January 1 to October 1, 1935, only two cases were reported in Cincinnati and only four, including three in nonresidents, were reported in Nashville.

Of the 184 cases reported as poliomyelitis in Kentucky in the epidemic of 1935 and covered by these studies, only 5 were in persons who gave histories of exposure, suggesting spread of the infection by contagion, through direct personal contact with other cases known to be poliomyelitis or diagnosed as such, and only 12 gave histories of exposure through indirect personal contact even remotely suggestive of the spread of the disease in that manner. Of those giving histories of direct personal contact the exposure of one was with a case in the late incubation period 1 day before onset of definite symptoms, and the exposure of two others was with a case in late convalescence.

There were only three instances of more than one case in a household, and in two of these the interval between the onset of the two cases was less than 12 hours.

In a large proportion of the affected households the youngest member was stricken.

A large majority of the cases were in persons living under poor economic and insanitary conditions. The association with insanitary conditions on home premises was especially notable with respect to excreta disposal.

Almost all of the cases were in persons frequently exposed to houseflies, stable flies (*Stomoxys calcitrans*), and mosquitoes.

The cases in large proportion were in persons living on premises infested with rats and English sparrows and on or near which cattle frequently were pastured, stabled, herded, or freighted.

In each of two of the local outbreaks—one in Louisville and one in Warren County—an excessive proportion of the cases occurred in persons using milk from one source of supply.

The outbreaks in Edmonson and Grayson Counties began about a month earlier, and the outbreak in Daviess County about a month later than that in Louisville. In most of the affected localities the outbreaks terminated with the advent of cool or cold autumn weather, but in Edmonson County the outbreak terminated in midsummer. The incidence rate in Edmonson County was higher than that in any other county of the State.

The measures carried out for preventive purposes appeared to have no effect on the course of incidence of the disease.

Conclusions

1. The findings from these studies warrant no definite conclusion as to the mode or modes of spread or the sources of poliomyelitis.
2. Much work, field and bench, on the problem is still in order.
3. Future studies of the disease should be comprehensive and intensive and should be conducted with broad-mindedness and thorough open-mindedness.

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