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CURRENT PREVALENCE OF COMMUNICABLE DISEASES IN THE UNITED STATES [1]

November 1–28, 1936

The prevalence of certain important communicable diseases, as indicated by weekly telegraphic reports from State health departments to the United States Public Health Service, is summarized in this report. The underlying statistical data are published weekly in the Public Health Reports, under the section entitled "Prevalence of Disease."

Poliomyelitis.—Further decline in the incidence of poliomyelitis continued through the month of November. For the current period there were 543 cases, as compared with 902 for the preceding 4-week period. Although the incidence was less than 10 percent in excess of that for the corresponding period in 1935, it was considerably above the incidence in the 3 preceding years; the numbers of cases for this period in those years totaled 332, 268, and 177, respectively. In 1930 and 1931, when epidemics prevailed mostly in the East, the incidence had declined considerably by the end of November, but the numbers of cases were still large—625 and 866, respectively, for the period in those years corresponding to the 4 weeks of this report.

Each geographic region, except the West South Central and Mountain, reported a decline during the current period. For the entire South Central region the incidence was more than three times that for the corresponding period in recent years. The highest incidence, however, had shifted from the East South Central region, where the current excess incidence began, to States in the West South Central region; in Oklahoma the number of cases rose from 8 for the preceding 4-week period to 84 for the current period, with a decline, however, from 31 cases for the first week of the period to 11 for the last week; Arkansas reported 21 cases for the period. Colorado, in the Mountain region, reported 22 cases, as compared with 3 for the preceding 4 weeks, with a decline from 10 for the first week to none for the last week. In the North Central region the number of

[1] From the Office of Statistical Investigations, U. S. Public Health Service. These summaries include only the 8 important communicable diseases for which the Public Health Service receives weekly telegraphic reports from the State health officers. The numbers of States included for the various diseases are as follows: Typhoid fever, 48; poliomyelitis, 48; meningococcus meningitis, 48; smallpox, 48; measles, 47; diphtheria, 48; scarlet fever, 48; influenza, 44 States and New York City. The District of Columbia is counted as a State in these reports.

cases was the highest recorded in recent years. Most of the increase in the East North Central region occurred in Illinois and Ohio, while the numbers of cases reported in several States in the West North Central region were slightly above the seasonal expectancy. Along the Atlantic coast and in the far West the incidence was relatively low.

Meningococcus meningitis.—The number of cases of meningococcus meningitis rose from 243 for the preceding 4-week period to 378 for the 4 weeks ending November 28. An increase of this disease usually occurs at this season of the year, but the current rise was somewhat above the normal seasonal expectancy. The incidence was the highest since 1929, when the number of cases for this period reached 474. In 1935, 1934, and 1933 the numbers of cases reported were 288, 129, and 157, respectively. Each geographic region contributed to the current increase, and in each region except the West North Central the number of cases was the highest in recent years. Every section of the country has felt the effects of the relatively high incidence of this disease that has prevailed since the winter of 1934–35; in some regions it was confined to only one or two States, while in others practically every State contributed to the increase. The cases reported for the current period from the following States represent considerable increases over last year: New York, 41 cases; Ohio, 36; Kentucky, 26; Virginia, 22; North Carolina, 12; West Virginia, 10; Utah, 8; and Idaho, 7.

Smallpox.—For the 4 weeks ending November 28, 333 cases of smallpox were reported, as compared with 928, 376, and 408 for the corresponding period in the years 1935, 1934, and 1933, respectively. Of the total cases, Montana reported 66, Oregon 54, North Dakota 47, Kansas 25, and Wisconsin 22. These States have been continuously among those in the Mountain, Pacific, and North Central regions reporting a high incidence since the beginning of 1935. In other States where the disease has also been unusually prevalent, particularly Washington, Colorado, Nebraska, and South Dakota, the number of cases dropped somewhat below the level of recent years. No cases were reported from the Atlantic coast regions, and in the South Central region the incidence remained at a low level.

Influenza.—For the 4 weeks ending November 28 there were 3,650 cases of influenza reported, as compared with 3,359, 3,721, and 4,596 for the corresponding period in the years 1935, 1934, and 1933, respectively. The influenza situation was very favorable in all sections of the country. The only increase over last year of any significance was reported from the South Atlantic region and was due mostly to a rather large number of cases reported from South Carolina.

Typhoid fever.—For the country as a whole the incidence of typhoid fever (1,245 cases) during the current 4-week period stood at about the average level for recent years. A comparison of geographic

regions, however, shows that the current incidence in the Middle Atlantic and North Central regions was considerably above that for the corresponding period last year; States in that region reporting a high incidence were as follows: Pennsylvania, 129 cases; Ohio, 92; Illinois, 82; and Missouri, 66. The East South Central regions also showed a slight increase with the incidence in Kentucky (72 cases) and Tennessee (71 cases) somewhat above the seasonal expectancy. In all other regions this disease was less prevalent than at this time last year.

Scarlet fever.—This disease continued to maintain a low level in relation to recent years. Reported cases for the current 4-week period totaled 14,695, as compared with 19,731, 19,141, and 17,714 for the corresponding period in the years 1935, 1934, and 1933, respectively In each geographic region the incidence was below that of last year, when the disease was unusually prevalent, but the decline toward the normal incidence was somewhat slower in the West North Central, and Mountain and Pacific than in other regions. The number of cases in each of these regions continued well above the average for the years 1929–34, inclusive.

Measles.—The 3,477 cases of measles reported for the 4 weeks ending November 28 was the lowest for this period in the 8 years for which these data are available. In 1935 the number of cases for this period totaled 6,876, while in 1934 and 1933, when an unusually large number of cases occurred, 17,222 and 10,567 cases, respectively, were reported. The recent high incidence of measles started in November 1933 and continued until the fall of 1935; since then the number of cases has declined rapidly to its present low level.

Diphtheria.—The incidence of diphtheria continued at a favorable level. For the current 4 weeks 3,804 cases were reported, as compared with 5,162, 5,239, and 7,442 cases for the corresponding period in the 3 preceding years. In 1931 the total number of cases of diphtheria reported for this period was approximately 9,400, about three and one-third times the number for the current period. The South Atlantic region has followed the level of 1935 very closely; for the current period the number of cases was about 15 percent above that for the corresponding period last year; North Carolina, with 486 cases, and Georgia, with 212 cases, seemed mostly responsible for the increase. In all other regions the incidence has been definitely lower than in recent years.

Mortality, all causes.—The average death rate from all causes in large cities for the 4 weeks ended November 28, as reported by the Bureau of the Census, was 11.5 per 1,000 inhabitants (annual basis). For the corresponding period in the years 1935, 1934, and 1933 the rates were 11.0, 11.1, and 11.2, respectively. The current mortality is therefore slightly higher than in recent years. During almost the

entire current year the average death rates by 4-week periods stood at the highest level in 5 years. During the earlier part of the year a minor epidemic of influenza accounted for the somewhat higher death rate, as did the extreme heat in July. The current excess apparently is not due to any specific cause.

HISTORY AND FREQUENCY OF DIPHTHERIA IMMUNIZATIONS AND CASES IN 9,000 FAMILIES

Based on Nation-wide Periodic Canvasses, 1928–31 [1]

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Diphtheria was known as early as the Homeric period in Greece, and never since then has the world been free from occasional epidemics. In 1821 Bretonneau published a complete clinical description of the disease and gave it the name "diphtheria" (from the Greek, meaning "membrane"). In 1883 Klebs described the diphtheria bacillus, and in 1884 Löffler grew the bacilli in pure culture (*25*). Antitoxin was first used in 1894 for treating human cases and conferring temporary immunity upon family contacts. In 1913 Schick devised the test to determine immunity to diphtheria, and in the same year toxin-antitoxin immunization of a small number of human beings was reported by Von Behring (*26*). In the next 5 or 6 years the procedure was tested and used on a moderately extensive scale, particularly in institutions. The first extensive use of the method outside of institutions was inaugurated about 1920 by Park and Zingher (*26*) among New York City school and preschool children.

[1] From the Office of Statistical Investigations, U. S. Public Health Service.

This is the ninth of a series of papers on sickness and medical care in this group of families (*1–8*). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness and the extent and kind of medical care, without regard to cost. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some overlapping. The Committee staff, particularly Dr. I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

Special thanks are due to Dr. Mary Gover, who assisted in the analysis, to Miss Lily Vanzee, who was in immediate charge of tabulating the data, and to other members of the statistical staff of the Public Health Service, particularly Dr. W. M. Gafafer, for advice and assistance in the preparation of the study.

In the original registration States[2] the diphtheria death rate in 1900 was 40.4 per 100,000 total population; in 1910 the rate was 22.5 and the marked decline continued through the next decade, with a rate of 17.3 in 1920. About that time a still more rapid decline began, and the rate in the same group of States was 4.3 in 1930 and 1.3 in 1934.[3]

The course of diphtheria mortality in New York City and Massachusetts roughly parallels that in the registration States since 1900, and data from these sources are available for some years prior to 1870. Both sets of data indicate a peak about 1875, with a gradual decline thereafter. The New York City records reveal two periods when the decline in the diphtheria death rate was definitely accelerated, and these periods follow closely after the introduction of antitoxin in 1894 and the beginning of the more extensive use of toxin-antitoxin in 1920. In the Massachusetts data the latter point is clearly marked, but there is no apparent acceleration in the decline of the rate following the introduction of antitoxin.

At the time when the data for the present study were collected (1928–31), diphtheria immunization had been in fairly common use for a decade. This paper is concerned with the extent of the use of the procedure in cities of different sizes in the several geographic areas and in families of different income levels.

I. SOURCE AND CHARACTER OF DATA

In the study of illness in canvassed white families in 130 localities in 18 States[4] that was made by the Committee on the Costs of Medical Care (*22*) and the United States Public Health Service, all service received from physicians and other practitioners was recorded, whether for illness, immunization, physical examination, or other reason. The records of immunization[5] against diphtheria for all persons in the observed population afford data on the frequency of this procedure during 12 months covered by periodic canvasses; information was also obtained on the history of diphtheria immunizations and cases at any time prior to the study.

The composition and characteristics of the group of 8,758 families which were kept under observation for 12 consecutive months in the

[2] The original registration States of 1900 include Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Michigan, Indiana, and the District of Columbia.

[3] The rate for the total continental United States was somewhat higher, 3.3 per 100,000 in 1934.

[4] The 18 States sampled and the number of canvassed families were: California (890), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (494), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (*1*).

[5] "Immunization" is used in this paper to mean the injection of the usual number of doses of toxin-antitoxin or toxoid. All cases receiving such service are designated as "immunizations"; no data are available on Schick tests following the injections to indicate whether or not the process actually produced immunity in the individual.

years 1928–31 have been considered in some detail in the first report in the series (*1*). These families, including a total of 39,185 individuals, resided in 18 States representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas. The observed group was similar to the general population with respect to age and sex composition, percentage native born, and percentage married. With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

The method of the study required, among other things, that local visiting nurses from health departments and other agencies make the canvasses of the homes to secure the data. A process of selection obviously entered here, since each locality that was included had a visiting nurse and a local health department or some other agency employing a visiting nurse. In such communities a larger percentage of the population may have received the immunizing injections than in those without health organizations. On the other hand, since the report for the whole family was made by the housewife or some other adult female, the record of immunizations may be less complete than could be obtained by the questioning of individuals. However, the canvasses were periodic and corrections or additional information could be secured at subsequent visits.

II. HISTORY OF IMMUNIZATIONS AND CASES AT BEGINNING OF STUDY

VARIATION WITH AGE

Table 1 and figure 1 show for specific ages the proportion of individuals who had been artificially immunized against diphtheria and who had suffered attacks of diphtheria at any time in their lives. From 3.6 percent of children under 6 months and 7.5 percent of those 6 to 12 months of age who had received injections for immunizing against diphtheria, the curve rises to a maximum of 43 percent at 9 years. After this age there is a steady decline until at 20 to 24 years the percentage who had been artificially immunized is about the same as among children under 1 year of age. This curve represents the history of artificial immunization at any time in the past and would be expected to be cumulative in nature, but two facts account for the decrease at the adult ages: (*a*) Artificial immunization against diphtheria has been in extensive use only since about 1920 (10 years before these records were collected), and (*b*) adults are seldom given immunizing injections because the great majority of them have become immune to diphtheria by natural processes. Thus this curve of the history of artificial immunization against diphtheria, which is truly cumulative in character, does not appear to be cumulative;

however, a continuation of immunizations at the present rate until children now 10 years of age reach 40 or 50 years would result in a curve that would be cumulative in appearance.

TABLE 1.—*History of diphtheria immunizations and cases among persons of specific ages of each sex—canvassed white families in 18 States* [1]

Age in years	Both sexes				Percentage of persons with history of—				Total number of persons considered [2]	
	Percentage of persons with history of—			Total number of persons considered [2]	Immunization at any time but no case		Case at any time			
	Immunization or case at any time	Immunization at any time but no case	Case at any time		Male	Female	Male	Female	Male	Female
All ages	21.1	15.8	5.30	37,827	16.3	15.4	4.45	6.11	18,553	19,274
Under 6 months	3.6	3.6	.33	529	10.0	9.2	.33	.34	915	893
6–11 months	7.5	7.5		390						
1	14.7	14.0		889						
2	22.0	20.5	1.50	1,044	21.1	22.2	1.92	1.06	1,093	1,034
3	24.3	22.8		1,083						
4	30.6	28.5	1.87	1,133	31.1	30.3	2.55	1.20	1,139	1,163
5	34.4	32.8		1,169						
6	40.4	37.8	3.09	1,158	40.1	39.2	3.29	2.88	1,184	1,144
7	45.1	41.5		1,170						
8	46.5	42.6	3.76	1,204	43.3	42.4	4.09	3.44	1,076	1,134
9	46.7	43.1		1,006						
10	46.6	40.8	5.61	1,077	36.2	36.5	5.44	6.22	2,299	2,266
11	43.8	38.5		902						
12	42.3	35.6	6.36	914						
13	40.0	34.0		830						
14	36.8	31.6	5.76	842						
15	34.4	28.0		686						
16	26.7	19.8	5.95	708	19.6	17.7	6.16	5.94	1,525	1,516
17	22.6	17.8		586						
18	19.4	13.3	5.94	574						
19	16.9	11.2		487						
20–24	12.2	5.3	6.93	2,108	4.2	6.1	5.61	7.89	891	1,217
25–29	10.1	3.4	6.69	2,482	4.3	3.1	5.27	7.86	2,393	3,232
30–34	10.5	3.7	6.81	3,143						
35–44	9.4	2.9	6.49	5,914	3.5	2.2	4.89	8.11	2,966	2,948
45–54	8.2	1.6	6.57	3,349	.9	1.6	4.85	9.46	3,072	2,727
55–64	8.2	.9	7.31	1,463						
65 and over	8.7	.6	8.11	987						

[1] Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

[2] A few individuals known as to case history were unknown as to immunization history (11 out of the 37,827 persons); the rates in every instance are based on the known only.

In agreement with the White House Conference study (*24*), higher percentages of preschool children had been artificially immunized against diphtheria than had been vaccinated against smallpox. But this situation was true only in the preschool ages, and relatively few children are vaccinated until the time of school entrance; in the school ages a much larger percentage had been vaccinated against smallpox than had been immunized against diphtheria.

The percentage of children with a history of a clinically recognized and remembered attack of diphtheria was small as compared with the percentage artificially immunized; the curve, therefore, for the total with a history of an immunization or a clinical case is similar to that for artificial immunizations only. However, for the ages above 25 years the histories of clinical cases are twice as frequent as the histories of artificial immunizations.

None of these curves represents the total with immunity to diphtheria, because Schick tests indicate that a large proportion of persons, particularly older children and adults, are relatively immune to diphtheria without a history of an artificial immunization or a clinically recognized case. No data on Schick tests are available on the group considered in this study. In a former study, figures of this kind for three cities (Baltimore, Syracuse, and Kansas City) were assembled from the literature and combined rates computed for

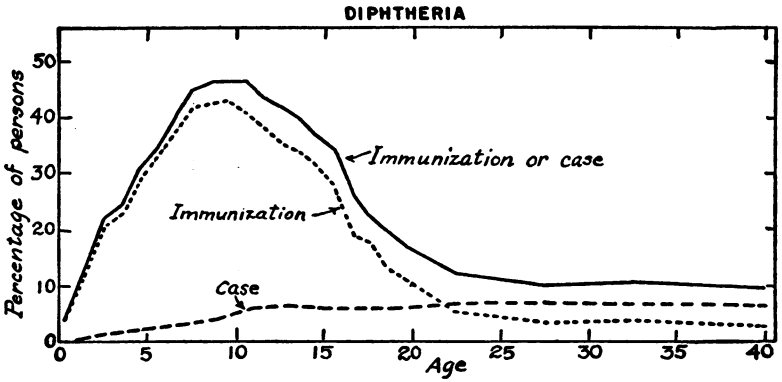

FIGURE 1.—Percentage of persons of specific ages (*a*) who had been immunized and (*b*) who had suffered an attack of diphtheria—8,758 canvassed white families in 18 States, 1928-31.

single years of age (*18*). In these three cities nearly 60 percent of adults had a negative Schick reaction prior to any artificial immunization. If the negative Schick curve for these cities is representative of other cities, it indicates that almost as many children under 10 years give a negative Schick reaction prior to immunization as give a history of artificial immunization. If the artificial immunizations were done without prior Schick tests (as is the common practice), a considerable part of them were not needed; but if it can be assumed that only those of positive Schick reaction were immunized, then the percentages with some present immunity would be nearly twice as high as the percentage artificially immunized. Table 2 presents a method of estimating the percentage of children with immunity to diphtheria acquired either by natural or artificial means, on the assumption of no Schick tests prior to immunization. The Schick test results from Baltimore, Syracuse, and Kansas City may

not be representative of the places of various sizes covered in this survey but they serve to illustrate the method.

TABLE 2.—*Method of estimating percentages of children of specific ages who are immune to diphtheria by artificial or natural processes when immunizations were done without preliminary Schick tests*

Age last birthday (in years)	Of a total of 100 children of each age				
	(1) Number who are Schick negative without artificial immunization	(2) Number who give a history of artificial immunization	(3) Number artificially immunized who would have been Schick negative without the artificial immunization	(4) Number artificially immunized who would otherwise have been Schick positive	(5) Number with immunity by artificial or natural processes
Under 1	11.1	5.2	0.6	4.6	15.7
1	6.7	14.0	.9	13.1	19.8
2	11.2	20.5	2.3	18.2	29.4
3	16.2	22.8	3.7	19.1	35.3
4	21.6	28.5	6.1	22.4	44.0
5	27.0	32.8	8.9	23.9	50.9
6	32.3	37.8	12.2	25.6	57.9
7	37.2	41.5	15.4	26.1	63.3
8	41.6	42.6	17.7	24.9	66.5
9	45.5	43.1	19.6	23.5	69.0
10	48.7	40.8	19.9	20.9	69.6
11	51.3	38.5	19.8	18.7	70.0
12	53.4	35.6	19.0	16.6	70.0
13	55.0	34.0	18.7	15.3	70.3
14	56.2	31.6	17.8	13.8	70.0

Column 1=Data for Baltimore, Syracuse, and Kansas City (*18*).
Column 2=Data for the surveyed families in this study (8,758 white families in 18 States).
Column 3=Column 2 multiplied by column 1 (with decimal moved 2 points to left).
Column 4=Column 2 minus column 3.
Column 5=Column 1 plus column 4. No correction is made for the fact that injections of toxin-antitoxin or toxoid do not always result in immunity in a given child; with more refined data and with immunizations and Schick tests for the same community, such a correction should be made.

It is seen in table 2 that, with an assumption of 49 percent of 10-year old children as Schick negative prior to immunization and an artificial immunization of 41 percent of such children without preliminary Schick tests, one would expect a total of 70 percent of children of this age to have some immunity acquired either by natural or artificial processes.

IMMUNIZATIONS AMONG MALES AND FEMALES

Considering all ages under 20 years, 33.6 percent of the males and 33.0 percent of the females gave a history of immunization or a case of diphtheria at some time in their lives. These percentages are made up of 29.8 and 29.4 for males and females, respectively, who had been immunized but had not suffered attacks, and 3.8 and 3.6 percent of males and females, respectively, who had suffered attacks of diphtheria. The data are shown for specific ages in table 1 and figure 2. The history of immunization is almost identical for the

two sexes. The history of cases is slightly more frequent among males than among females under 10 years of age. The large and consistent excess for adult females (table 1) is no doubt due in part to the fact that the women, who were usually the informants, knew their own histories better than those of their husbands and other adult males in the household. Because of this reporting error, the 8 percent of female adults with a history of diphtheria is probably nearer the truth for both sexes than the 6 to 7 percent shown in figure 1. In a study (*18*) based on data collected about 1920 it appeared that approximately 10 percent of living adults gave a history of diphtheria; the lower diphtheria rates in recent years may have reduced this for the young adults, and the figures for older adults are less reliable because of less and less complete reporting as the time of the childhood attack recedes into the past.

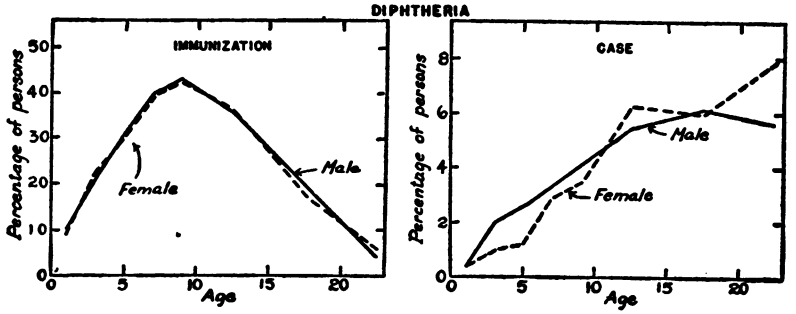

FIGURE 2.—Percentage of males and females of specific ages (*a*) who had been immunized and (*b*) who had suffered an attack of diphtheria—8,758 canvassed white families in 18 States, 1928-31.

TABLE 3.—*History of diphtheria cases at any time among male and female students in various universities,*[1] *1925*

Sex	Percentage of students who had suffered an attack of diphtheria					Total number of students reporting				
	All ages	17-19	20-24	25-29	30 and over	All ages	17-19	20-24	25-29	30 and over
Both sexes	10.8	9.6	10.4	12.0	13.3	4,689	927	2,485	719	558
Male	11.0	9.9	11.0	12.1	10.1	2,757	392	1,430	570	365
Female	10.6	9.3	9.6	11.4	19.2	1,932	535	1,055	149	193

[1] The group considered made the reports at the end of the U. S. Public Health Service study of respiratory diseases (*29*); it included students in 11 colleges and universities throughout the country. The universities included are Harvard (Boston), Mount Holyoke College (South Hadley, Mass.), Johns Hopkins (Baltimore), Georgetown (Washington, D. C.), Winthrop College (Rock Hill, S. C.), Tulane (New Orleans), Chicago (Chicago), Ohio State (Columbus), Utah (Salt Lake City), Arizona (Tuscon), and California (Berkeley).

For comparison with results in the present study, table 3 shows reports of case histories among male and female students in 11 colleges and universities (*29*), each person reporting on his or her own history only. In these data, which were collected in 1925, males of the three

age groups under 30 years show slightly higher percentages with a history of diphtheria than females of the same ages.

VARIATION IN THE FREQUENCY OF A HISTORY OF IMMUNIZATION WITH GEOGRAPHIC LOCATION AND SIZE OF CITY

The proportion of persons who have been immunized against diphtheria might be expected to vary from one community to another and from one geographic area to another because some health departments have had specific immunization campaigns and others have done little to encourage immunization.

Geographic location.—The 18 States in which the surveyed population lived may be divided into 4 geographic sections, the *Northeast* (New York, Massachusetts, Connecticut), representing the New England and Middle Atlantic States; the *North Central* (Illinois,

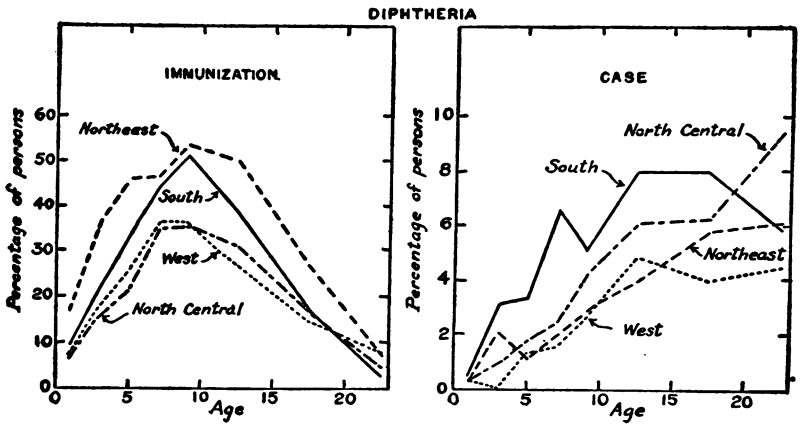

FIGURE 3.—Percentage of persons of specific ages in four geographic sections (*a*) who had been immunized and (*b*) who had suffered an attack of diphtheria—8,758 canvassed white families in 18 States, 1928-31.

Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas), representing the North Central States; the *South* (District of Columbia, Virginia, West Virginia, Tennessee, Georgia), representing the South Atlantic and South Central States; and the *West* (Colorado, California, Washington), representing the Mountain and Pacific States.[6]

In the left half of figure 3 immunization history rates have been plotted for each of the four geographic sections of the United States (table 4). The Northeast stands above other sections with the South next to it. The North Central and West show fewer immunizations.

The right half of figure 3 shows histories of clinical attacks of diphtheria (table 5). Although the numbers of cases are small and, consequently, the curves irregular, the South stands rather clearly above the other regions, with the North Central a little above the

[6] Further details about the number of families from each State and size of each city are included in a previous paper (*1*).

TABLE 4.—*History of diphtheria immunizations among persons in four geographic sections [1] of the United States—canvassed white families in 18 States [2]*

Age in years	Percentage of persons with a history of—								Total number of persons considered			
	Immunization or case at any time				Immunization at any time but no case							
	North-east	North Central	South	West	North-east	North Central	South	West	North-east	North Central	South	West
All ages	26.7	18.4	23.0	17.7	20.9	13.5	17.4	12.7	8,865	14,191	7,591	7,180
Under 2	17.3	6.9	10.0	7.3	17.0	6.6	9.5	7.0	388	699	418	303
2–3	38.5	15.8	25.2	17.3	36.4	14.9	22.0	17.3	483	852	445	347
4–5	47.0	23.5	37.1	27.5	45.9	21.7	33.8	26.1	545	908	482	367
6–7	48.5	37.2	50.5	38.3	46.5	34.7	44.0	36.7	513	929	505	381
8–9	56.2	39.5	56.1	39.1	53.4	35.4	51.0	36.5	498	869	452	391
10–14	54.2	37.1	46.6	31.7	50.2	31.0	38.6	26.8	1,052	1,731	1,000	782
15–19	32.5	22.8	25.0	18.7	26.8	16.5	17.0	14.7	715	1,036	663	627
20–24	13.5	13.8	8.1	12.3	7.4	4.3	2.3	7.9	474	757	447	430
25–44	10.7	9.1	8.2	12.0	3.0	6.2	2.3	4.4	2,570	4,567	2,197	2,205
45 and over	11.3	7.1	6.1	7.8	1.2	1.4	.9	1.3	1,627	1,843	982	1,347

[1] A preceding paper (*1*) gives the number of families canvassed in each State classified according to the size of the city of residence. States included in the survey were, by region—
Northeast: New York, Massachusetts, Connecticut.
North Central: Illinois, Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas.
South: District of Columbia, Virginia, West Virginia, Tennessee, Georgia.
West: Washington, California, Colorado.
[2] Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

TABLE 5.—*History of diphtheria cases among persons in four geographic sections [1] of the United States—canvassed white families in 18 States [2]*

Age in years	Percentage of persons with history of a case at any time				Number of persons with history of a case at any time				Total number of persons considered			
	North-east	North Central	South	West	North-east	North Central	South	West	North-east	North Central	South	West
All ages	5.81	4.94	5.64	5.00	515	701	428	359	8,865	14,191	7,591	7,180
Under 2	.26	.29	.48	.33	1	2	2	1	388	699	418	303
2–3	2.07	.94	3.15	------	10	8	14	------	483	852	445	347
4–5	1.10	1.76	3.32	1.36	6	16	16	5	545	908	482	367
6–7	1.95	2.48	6.53	1.57	10	23	33	6	513	929	505	381
8–9	2.81	4.14	5.09	2.56	14	36	23	10	498	869	452	391
10–14	3.99	6.12	8.00	4.86	42	106	80	38	1,052	1,731	1,000	782
15–19	5.73	6.27	7.99	3.99	41	65	53	25	715	1,036	663	627
20–24	6.12	9.51	5.82	4.42	29	72	26	19	474	757	447	430
25–34	8.14	5.69	7.34	6.88	99	131	79	71	1,216	2,301	1,076	1,032
35–44	7.31	6.05	4.55	8.27	99	137	51	97	1,354	2,266	1,121	1,173
45 and over	10.08	5.70	5.19	6.46	164	105	51	87	1,627	1,843	982	1,347

[1] For definition of sections, see footnote [1] to table 4.
[2] Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

Northeast and the West. The feeling generally prevails that less diphtheria would be expected in the South, probably because the disease in its clinical form is almost absent in tropical countries. However, diphtheria mortality in 1929–30 was definitely higher in southern than in northern States; the annual death rate per 100,000 population for these years was 7.5 in the South (8.5 for white), as compared with 5.4, 5.0, and 3.6 for the same period in the Northeast,

North Central, and West, respectively (table 24). In 1920, however, the diphtheria death rates were about as high in the northern as in the southern States (*19*).

In reported cases the South is not so high (table 24), but the completeness of the reports varies so much that little dependence can be placed in the comparison. The suggestion is afforded, however, that the relatively younger age of attack in the South, which has been pointed out by Doull (*21*) and Dauer (*19*), may result in a high case fatality of the disease; thus the death rate rather than the case rate would be exceptionally high in that geographic section.

Table 6 shows diphtheria history rates as given by college students who were reporting on themselves only, the students being classified according to their home States (*29*). The South tends to be high in histories of clinical diphtheria.

TABLE 6.—*History of diphtheria cases at any time among students in various universities classified according to the student's home State, 1925* [1]

Geographic section[2]	Percentage of students who had suffered an attack of diphtheria					Total number of students reporting				
	All ages	17–19	20–24	25–29	30 and over	All ages	17–19	20–24	25–29	30 and over
Northeast	11.6	8.1	12.7	10.8	14.7	957	198	474	176	109
North Central	11.3	11.4	10.7	12.0	12.7	1,352	237	684	234	197
South	13.0	11.4	13.8	12.0	13.3	747	114	318	142	173
West	8.9	8.8	8.1	13.1	12.3	1,547	365	972	145	65

[1] The group considered made the reports at the end of the U. S. Public Health Service study of respiratory diseases (*29*): it included the students in 11 colleges and universities throughout the country. The total of 4,689 persons reporting on diphtheria included 2,757 males and 1,932 females; 86 persons who did not designate their home State are excluded from this table. The universities included are Harvard (Boston), Mount Holyoke College (South Hadley, Mass.), Johns Hopkins (Baltimore), Georgetown (Washington, D. C.), Winthrop College (Rock Hill, S. C.), Tulane (New Orleans), Chicago (Chicago), Ohio State (Columbus), Utah (Salt Lake City), Arizona (Tucson), and California (Berkeley).

[2] In terms of the geographic areas used in the U. S. Census reports, the four sections represent the following areas:
Northeast: New England and Middle Atlantic.
North Central: East and West North Central.
South: South Atlantic and East and West South Central.
West: Mountain and Pacific.

Cities and rural areas.—Variations in immunization practice are more likely to follow municipality and State boundaries than geographic regions. In this study the numbers included from single States are not generally large and there is no uniformity in the urban-rural distribution of the canvassed population of the different States. However, the surveyed group in New York State was large, making up the bulk of the Northeast families, and was predominantly rural. Because of the unrepresentative urban-rural distribution of this large canvassed population and the greater frequency of immunizations in the State, further tabulations consider New York by itself. Table 7 shows immunization history rates for all surveyed States, for all except New York, and for New York State alone.

TABLE 7.—*History of diphtheria immunizations among persons in cities of various sizes and in rural areas—canvassed white families in 18 States* [1]

Age in years	Percentage of persons with history of—								Total number of persons considered			
	Immunization or case at any time				Immunization at any time but no case							
	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas
	All 18 surveyed States											
All ages	18.0	21.5	25.0	22.9	12.1	16.1	19.8	18.9	14,087	9,518	7,441	6,781
Under 2	8.6	8.8	12.7	12.1	7.9	8.8	12.4	12.1	677	537	331	263
2–3	17.2	22.3	29.0	30.0	14.8	20.9	28.1	29.4	748	584	448	347
4–5	29.0	30.2	38.8	35.1	26.8	28.5	37.0	33.6	758	639	503	402
6–7	40.7	42.8	46.6	42.1	36.2	39.6	44.5	41.1	838	586	524	380
8–9	40.9	47.4	52.1	50.4	34.8	44.5	49.7	48.3	772	589	424	425
10–14	36.9	43.6	47.0	44.7	29.2	37.4	42.7	41.0	1,577	1,104	908	976
15–19	18.4	26.4	30.7	27.5	10.5	20.1	25.4	24.0	1,035	757	569	680
20–24	13.6	11.2	13.9	8.9	4.7	4.4	7.0	6.3	863	502	360	383
25–44	9.4	10.8	11.3	7.6	2.7	3.1	4.8	2.8	4,666	2,931	2,226	1,716
45 and over	6.9	7.3	11.0	9.3	1.6	.6	1.4	1.3	2,153	1,289	1,148	1,209
	All surveyed States except New York											
All ages	16.5	21.0	23.1	20.8	11.0	15.2	17.7	17.1	12,442	8,048	5,035	5,137
Under 2	7.0	6.1	10.3	12.2	6.2	6.1	9.8	12.2	645	445	214	189
2–3	13.5	17.9	23.9	25.7	12.0	16.3	22.6	24.9	680	486	305	257
4–5	24.8	28.0	33.5	30.7	22.6	25.9	31.1	29.4	669	535	328	303
6–7	38.6	42.1	43.6	35.5	34.5	38.3	41.0	34.1	752	496	378	290
8–9	38.8	46.8	46.3	42.6	32.8	43.5	43.6	40.4	699	509	298	322
10–14	34.0	43.2	39.4	39.9	26.5	36.1	34.1	36.0	1,379	917	642	787
15–19	15.7	26.5	27.8	27.0	8.5	19.4	22.3	23.1	875	620	418	544
20–24	13.2	12.4	13.7	8.0	4.2	4.6	7.9	4.5	758	411	257	286
25–44	8.8	11.4	12.0	7.6	2.6	3.4	4.9	3.1	4,150	2,545	1,504	1,295
45 and over	6.5	6.7	10.4	7.4	1.6	.7	1.7	1.4	1,835	1,084	691	864
	New York State											
All ages	29.2	24.6	28.9	29.3	20.4	21.1	24.2	24.4	1,645	1,470	2,406	1,644
Under 2	40.6	21.7	17.1	12.2	40.6	21.7	17.1	12.2	32	92	117	74
2–3	54.4	43.9	39.9	42.2	42.6	43.9	39.9	42.2	68	98	143	90
4–5	60.7	41.4	48.6	48.5	58.5	41.4	48.0	46.5	89	104	175	99
6–7	59.3	46.7	54.1	63.3	51.2	46.7	53.4	63.3	86	90	146	90
8–9	60.3	51.2	65.9	74.8	53.5	51.2	64.3	72.9	73	80	126	108
10–14	57.1	45.5	65.4	64.5	48.0	43.4	63.5	61.9	198	187	266	189
15–19	33.1	25.5	38.7	29.4	21.2	22.6	34.1	27.2	160	137	151	136
20–24	16.2	5.5	14.6	11.3	7.6	3.3	4.9	11.3	105	91	103	97
25–44	13.6	6.7	9.8	7.4	3.5	1.6	4.6	1.9	516	386	722	421
45 and over	9.1	10.2	11.8	13.9	1.6	------	.9	.9	318	205	457	345

[1] Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

The left half of figure 4 shows immunization history rates for metropolitan, urban, and rural areas. The purpose of the chart is to compare cities of different sizes, and New York State is excluded to obtain more comparable groups of cities.

The three curves in figure 4 representing, respectively, rural areas, small towns, and small cities, appear quite close together. However, the rates for cities over 100,000 in this group are below those for the smaller towns and rural areas. In New York State also (table 7) the small towns and rural areas canvassed had higher immunization history rates than the large cities.

New York State Health Department records on immunizations are available for comparison; they are published for municipalities with populations of 10,000 or over and for smaller towns and rural areas. Rates for the 2 years 1929 and 1930, the approximate period of the survey, are shown in table 8, together with similar rates for the surveyed families. In both groups the cities show higher rates than the rural places for the ages 5–9 and lower rates for the ages 10–14 years. For children under 5 the health department reports show more immunizations in the cities, but the surveyed families show the reverse.

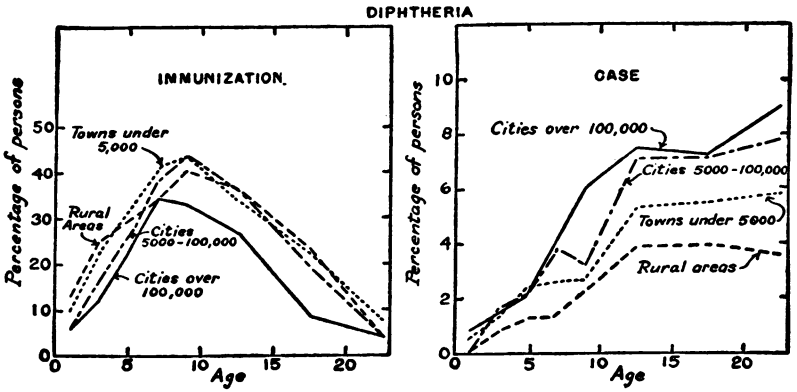

FIGURE 4.—Percentage of persons of specific ages in cities and rural areas (*a*) who had been immunized and (*b*) who had suffered an attack of diphtheria—7,048 canvassed white families in 17 States, 1928–31 (New York excluded).

For the various age groups the rates as reported by the health department for the general population are higher than those for the canvassed families.

As already noted, it is possible that the rural and small-town communities included in the present survey were a rather selected group with respect to immunizations, in that every community had a health department or a visiting nurse or both. However, with all of the qualifications and limitations that must be considered in the interpretation of the data, it seems clear that the differences between urban and rural areas with respect to diphtheria immunization were not as large as those found for smallpox vaccination (*7*). The White House Conference study (*24*) of diphtheria immunizations among pre-school children bears out this conclusion; although immunization rates in the several ages for the group of 156 selected cities were consistently

TABLE 8.—*Annual diphtheria immunizations per 1,000 persons of specific ages in urban and rural parts of New York State: (a) As reported by the State health department for the general population in 1929–30, and (b) as found in canvassed white families during 12 consecutive months, 1928–31*

Size of city	General population of New York State exclusive of New York City				Surveyed families in New York State							
					All immunizations				Immunizations in public clinics only			
	Total under 15 years	Under 5	5–9	10–14	Total under 15 years	Under 5	5–9	10–14	Total under 15 years	Under 5	5–9	10–14
	Annual diphtheria immunizations per 1,000 population											
Cities over 10,000	113.6	134.3	166.1	42.8	55.8	80.9	66.8	17.1	42.3	48.5	61.7	14.2
Towns under 10,000 and rural areas	77.8	79.7	107.6	45.6	51.4	89.4	31.7	24.6	45.8	80.5	25.3	24.6
	Number of diphtheria immunizations											
Cities over 10,000	168,937	61,736	85,145	22,056	62	30	26	6	47	18	24	5
Towns under 10,000 and rural areas	112,281	35,714	54,143	22,424	92	60	20	12	82	54	16	12

TABLE 9.—*History of diphtheria cases among persons in cities of various sizes and in rural areas—canvassed white families in 18 States* [1]

Age in years	Percentage of persons with history of a case at any time				Number of persons with history of a case at any time				Total number of persons considered			
	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas
	All 18 surveyed States											
All ages	5.9	5.4	5.2	4.0	832	517	384	270	14,087	9,518	7,441	6,781
Under 2	.7	------	.3	------	5	------	1	------	677	537	331	263
2–3	2.4	1.4	.9	.6	18	8	4	2	748	584	448	347
4–5	2.2	1.7	1.8	1.5	17	11	9	6	758	639	503	402
6–7	4.5	3.2	2.1	1.0	38	19	11	4	838	586	524	390
8–9	6.1	2.9	2.4	2.1	47	17	10	9	772	589	424	425
10–14	7.7	6.2	4.3	3.7	122	69	39	36	1,577	1,104	908	976
15–19	7.9	6.3	5.3	3.5	82	48	30	24	1,035	757	569	680
20–24	8.9	6.8	6.9	2.6	77	34	25	10	863	502	360	383
25–34	7.3	8.1	6.2	3.2	173	115	68	24	2,363	1,427	1,094	741
35–44	6.0	7.3	6.8	6.0	139	110	77	58	2,303	1,504	1,132	975
45 and over	5.3	6.7	9.6	8.0	114	86	110	97	2,153	1,289	1,148	1,209
	All surveyed States except New York											
All ages	5.5	5.8	5.4	3.7	688	466	270	190	12,442	8,048	5,035	5,137
Under 2	.8	------	.5	------	5	------	1	------	645	445	214	189
2–3	1.5	1.6	1.3	.8	10	8	4	2	680	486	305	257
4–5	2.2	2.1	2.4	1.3	15	11	8	4	669	535	328	303
6–7	4.1	3.8	2.6	1.4	31	19	10	4	752	496	378	290
8–9	6.0	3.3	2.7	2.2	42	17	8	7	699	509	298	322
10–14	7.5	7.1	5.3	3.9	104	65	34	31	1,379	917	642	787
15–19	7.2	7.1	5.5	3.9	63	44	23	21	875	620	418	544
20–24	9.0	7.8	5.8	3.5	68	32	15	10	758	411	257	286
25–34	6.8	8.2	6.7	3.2	146	100	48	17	2,158	1,226	716	532
35–44	5.7	8.0	7.5	5.5	114	105	59	42	1,992	1,319	788	763
45 and over	4.9	6.0	8.7	6.0	90	65	60	52	1,835	1,064	691	864

[1] Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

higher than in the group of 597 counties studied, the differences were not generally large (table 10).

TABLE 10.—*Comparison of the history of diphtheria immunizations among preschool children in the present study with the results of the White House Conference study in 156 cities in 45 States and 597 counties in 42 States*

Group	Percentage of children of the given ages who had been immunized					
	Under 1	1	2	3	4	5
URBAN						
Canvassed families:						
All States except New York (17 States):						
Cities of 100,000 or over	4.1	8.2	12.2	11.9	19.3	25.7
Cities 5,000–100,000	1.7	11.2	14.3	18.0	20.4	31.1
White House Conference study (*24, pp. 59, 174*):						
156 cities mostly over 50,000	3.3	16.5	22.1	24.1	27.0	31.8
Median of the 156 cities	1	8	13	16	19	25
RURAL						
Canvassed families:						
All States except New York (17 States):						
Towns under 5,000	5.4	13.1	23.4	21.9	31.8	30.5
Rural areas	7.0	17.8	23.8	25.9	30.3	28.4
White House Conference study (*24, p. 175*):						
Towns under 2,500 and farms	2.5	10.7	18.2	22.3	25.8	29.2

The right half of figure 4 shows diphtheria case history rates for cities of different sizes in the 17 surveyed States (excluding New York). The rates for the rural areas are the lowest and those for large cities the highest, with the other two groups falling logically between the two extremes. In New York State also the surveyed families in large cities had definitely higher case history rates, but there was little variation in the other three community classes.

It is possible that better diagnostic facilities in the large cities increase to some extent their reported diphtheria rates. It seems reasonable to assume that the identification of mild cases by laboratory methods occurs more frequently in cities than in rural areas.

Cities and rural areas in each geographic section.—Diphtheria immunization and case history rates may be considered for cities of different sizes in each geographic area. Figure 5 shows such rates (adjusted for age) for persons under 25 years of age. In each geographic area the immunization rates tend to be larger in the small towns and rural areas;[7] the case history rates, on the other hand, are significantly higher in the large cities than in the rural places in all the sections.

Mortality in the registration States bears out the conclusion that about 1930 diphtheria occurred more frequently in urban than in

[7] The differences between immunization rates in large cities and rural areas are statistically significant for the 3 sections but not for New York.

rural places. In the years 1929 and 1930 the annual average death rates were as follows:

Size of city	Annual diphtheria death rate per 100,000 population
Cities over 100,000	6.41
Cities of 10,000 but under 100,000	5.81
Towns under 10,000 and rural areas	5.27

An examination of diphtheria mortality since 1915 in the States of the expanding registration area indicates that in every one of the 16 years from 1915 to 1930 the rate in places with 10,000 or more population was higher than in rural areas, but in all 3 years from 1931 to 1933 (last available data on this point), the urban rate was below the rural.

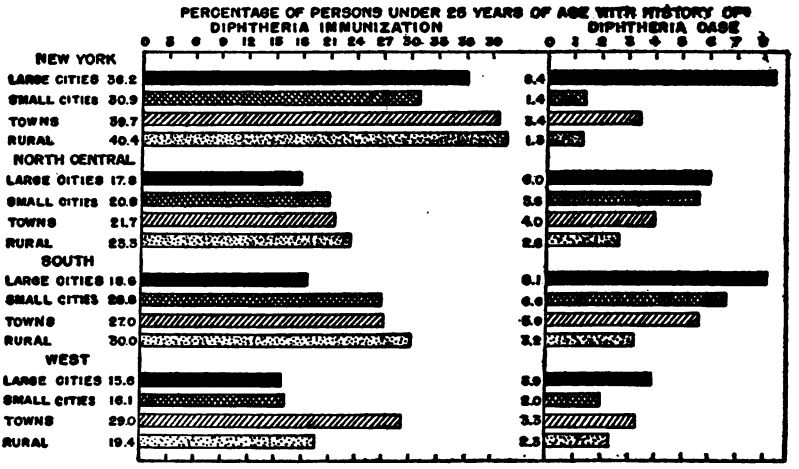

FIGURE 5.—Percentage of persons under 25 years of age in metropolitan, urban, and rural parts of four geographic sections (*a*) who had been immunized and (*b*) who had suffered an attack of diphtheria—8,371 canvassed white families in 16 States, 1928-31 (Massachusetts and Connecticut excluded). (Rates adjusted to the age distribution of the white population under 25 years of age in the registration States, 1930.)

There appears to be much variation in the different States with respect to the relation of urban to rural diphtheria mortality. In general, the rate for rural parts of the South seems to be higher than the rate for southern cities and in general the rate for rural parts of the North seems to be lower than the rate for northern cities, but in both areas there are numerous exceptions. The situation is changing so rapidly that any generalizations must be considered as more or less tentative.

Large shifts in the urban-rural distribution of the population occurred during the depression, which make population estimates less reliable since 1930. Also, there is always the possibility that the allocation of deaths for residence will change the urban-rural mortality picture. With respect to diphtheria, however, neither of these factors appears to explain the shift in the urban-rural diphtheria situation.

According to the annual reports of a number of large cities, for example, Baltimore and Detroit,[7a] the percentage of their child population that has been immunized has increased considerably since 1930. It is possible that the situation both as to the proportion of children immunized and the mortality in urban as compared with rural areas has changed considerably since 1930.

TABLE 11.—*Annual diphtheria immunizations per 1,000 persons of specific ages of each sex—canvassed white families in 18 States during 12 consecutive months, 1928–31*

Age in years	Both sexes [1]			Immunizations per 1,000 population per year		Number of immunizations		Population (years of life)	
	Immunizations per 1,000 population per year	Number of immunizations	Population (years of life)	Male	Female	Male	Female	Male	Female
All ages [1]	12.6	487	[1] 38,544	11.9	13.4	224	263	18,896	19,627
All ages under 15	30.5	481	15,796	28.1	32.9	223	258	7,929	7,846
Under 6 months	8.9	4	450	9.3	9.2	2	2	215	218
6–11 months	66.7	36	540						
1	65.0	82	1,261	56.2	62.3	83	85	1,476	1,365
2	47.9	50	1,044						
3	43.8	47	1,072						
4	40.1	46	1,146	39.4	43.1	66	74	1,675	1,715
5	40.1	47	1,172						
6	36.3	42	1,158						
7	20.5	24	1,171	22.1	30.7	50	70	2,262	2,281
8–9	24.4	54	2,214						
10–11	14.7	29	1,980	[2] 9.6	11.9	22	27	2,301	2,267
12–13	8.6	15	1,744						
14–15	4.6	7	1,530						
16–17	1.5	2	1,296	[3] .6	2.0	1	3	1,527	1,523
18–19			1,068						
20–24	.9	2	2,119		1.6		2	894	1,225
25 and over			17,392					8,467	8,925

[1] "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.
[2] 10–14 years.
[3] 15–19 years.

III. IMMUNIZATIONS AND CASES DURING THE 12-MONTH STUDY

The record of all medical care, whether for illness or preventive service, affords accurate data on the frequency of immunizations against diphtheria during the 12 months of the morbidity study.

The histories of prior immunization refer to the whole life of the individual and the resulting percentages tend to average out the periods of high and low immunization rates. The record for the 1 year,

[7a] In 1929 and 1930 only about 10 percent of Baltimore preschool children had been immunized against diphtheria, but in 1935 about 45 percent had been immunized; not much change had occurred in the percent of the 5–9 year group that had been immunized (Baltimore City Health Department Report, 1935, p. 98). In 1929 and 1930 one-fourth to one-third of Detroit preschool children had been immunized against diphtheria but in 1935 nearly 60 percent had been immunized. As in Baltimore not much change had occurred in the percent of the 5–9 year group that had been immunized (City Health, Bulletin of the Detroit Department of Health, July, 1936, p. 4).

although more accurate than the history data, may represent more frequent or less frequent immunizations than the average over a period of years. Even the average over a period of years may not represent the true expectancy. In fact the frequency of diphtheria immunizations has been changing so rapidly in recent years that any estimate of an expected rate would probably be unreliable even for the immediate future.

As a test of the representativeness of the study year, the current rates may be cumulated to approximate a curve of immunization histories that would result from the repetition year after year of the current diphtheria immunization rates.[8] Conversely, an approximation of the annual immunization rates per 100 for given years of age may be obtained from the cumulative curve by computing differences between the percentages immunized for successive ages.

It was pointed out in connection with figure 1 that the history of diphtheria immunization reaches a maximum at 9 years, after which the curve declines and thus ceases to resemble a cumulative curve such as would be expected if the immunization of children had been practiced for a longer period of years. However, a comparison of the cumulative curve and current rates may be made for children up to 9 or 10 years of age.

The cumulative curve of diphtheria immunization histories indicates that 30.7 percent[9] of children have been immunized by the time they reach their fifth birthday and the cumulation of the current rates up to 5 years of age gives 23.5 percent. To put it in another way, the cumulative figure of 30.7 percent by 5 years indicates an average annual rate for children under 5 years of 61.4 per 1,000 as against the observed rate of 48.1 per 1,000.

Carrying the procedure to 10 years of age the history curve indicates that 43.1 percent were immunized by the tenth birthday and the cumulation of the current rates gives 38.3 percent. If one deducts from the 43.1 percent who have been immunized by the tenth birthday the 30.7 percent immunized before the fifth birthday, there are 12.4 percent immunized between the fifth and tenth birthdays or an average annual rate of 24.8 per 1,000 as compared with an observed current rate at these ages of 29.2 per 1,000.

The current immunizations per 1,000 for children under 5 years of age amounted to about 80 percent of the average for years immediately preceding the survey, but for children 5–9 years of age the current rate was slightly above preceding years. When the age group under 10 years is considered as a whole, the average immunization rate for the period of the study was 38.3 per 1,000 children as compared with 43.1 for immediately preceding years.

In view of the fact that nurses were collecting the data in this study and may have suggested immunization in the course of their visits with the mother, it is rather surprising that the current rate is slightly less than that of preceding years. It suggests, however,

[8] The method is valid only if all of the current immunizations are first immunizations, an assumption that seems approximately true up to 10 years of age.

[9] The figure 30.7 percent who have been immunized by 5.0 years of age is a straight line interpolation between 28.5 at 4 years and 32.8 at 5 years of age at last birthday, which represent children of an average age of 4.5 and 5.5 years, respectively. For 10.0 years the figure for 9-year-olds (9.5 years) was used since the curve begins to decline at 10 years of age.

that the association of the nurse-enumerator with the health department did not affect the data as much as might have been expected.

AGE AND SEX

Figure 6 shows diphtheria immunizations during the study year per 1,000 persons in specific age and sex groups (table 11). In the curve as plotted for both sexes the first point represents children under 6 months and indicates that few immunizations are done before infants reach that age. However, the maximum immunization rate occurs among infants from 6 to 12 months of age, with the rate only slightly less for the 1-year-olds. From the maximum the curve declines almost without interruption as age increases. This

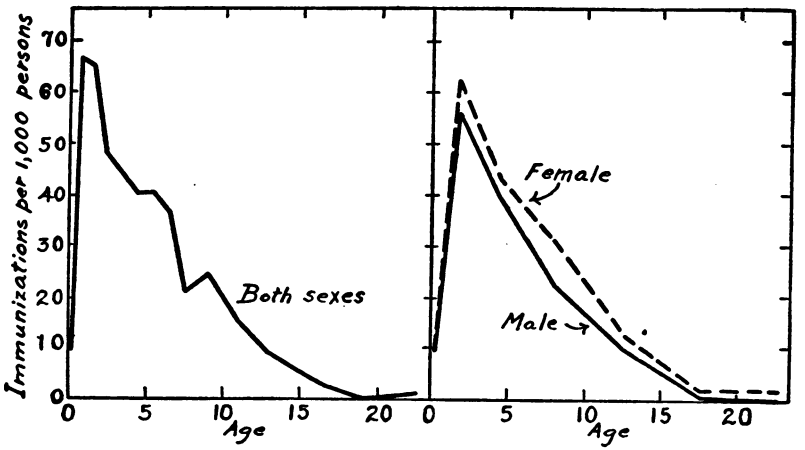

FIGURE 6.—Annual diphtheria immunizations per 1,000 persons of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928-31.

age curve is rather surprisingly ideal in that immunization at an early age has been extensively advocated to give the child immunity before the time of greatest risk of attack. In table 12 immunization rates are shown by geographic area, and in table 13 they are shown for cities of different sizes. In each category immunizations in the preschool ages were more frequent than in the school ages. Although the numbers were small in some areas, age specific rates (5-year groups) were computed for children in four sizes of city classes for each of the four geographic areas. Throughout these various classes of communities the tendency was clear for current immunization rates to be higher among preschool than school children.

In former years it was common practice for emphasis to be placed on immunizing the school children, probably because of the greater ease of reaching them in school. It is possible that the connection of the nurse-enumerator with the health department led her to suggest immunization to the mothers with infants and young children.

but it has just been seen that this practice was not so extensive as to make the total immunization rate excessively high for the study year.

TABLE 12.—*Annual diphtheria immunizations in four geographic sections* [1] *per 1,000 children of specific ages—canvassed white families in 18 States during 12 consecutive months, 1928–31*

Age in years	Immunizations per 1,000 population per year				Number of immunizations				Population (years of life)			
	Northeast	North Central	South	West	Northeast	North Central	South	West	Northeast	North Central	South	West
All ages under 15	49.9	29.4	17.1	23.7	179	181	58	63	3,589	6,157	3,396	2,654
Under 2	92.2	42.5	33.4	59.9	45	37	17	23	488	870	509	384
2–3	101.9	32.0	29.3	23.1	49	27	13	8	481	845	443	347
4–5	50.9	40.4	31.0	35.2	28	37	15	13	550	915	484	369
6–9	36.5	31.7	11.5	19.4	37	57	11	15	1,015	1,797	959	772
10–14	19.0	13.3	2.0	5.1	20	23	2	4	1,055	1,730	1,001	782

[1] A preceding paper (*1*) gives the number of families canvassed in each State classified according to the size of the city of residence. The States included in the survey were as follows:
Northeast: New York, Massachusetts, Connecticut.
North Central: Illinois, Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas.
South: District of Columbia, Virginia, West Virginia, Tennessee, Georgia.
West: Washington, California, Colorado.

TABLE 13.—*Annual diphtheria immunizations in cities of different sizes per 1,000 children of specific ages—canvassed white families in 18 States during 12 consecutive months, 1928–31*

Age in years	Immunizations per 1,000 population per year				Number of immunizations				Population (years of life)			
	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas
All ages under 15	32.2	28.1	30.2	30.8	178	117	98	88	5,535	4,158	3,242	2,861
Under 2	62.0	40.0	51.0	66.9	52	26	22	22	839	652	431	329
2–3	51.6	39.4	51.2	37.5	38	23	23	13	736	584	449	347
4–5	42.8	57.8	27.8	22.3	33	37	14	9	771	640	503	404
6–9	27.9	20.4	29.5	28.5	45	24	28	23	1,611	1,176	950	806
10–14	6.3	6.3	12.1	21.5	10	7	11	21	1,578	1,106	909	975

In view of the known shift from the immunization of children in the schools to a definite attempt to reach the preschool child, the age curve of diphtheria immunizations is a rather artificial and changing one. The reports of the New York State Health Department (*16*) show, in 5-year age groups, the number of known immunizations in New York State exclusive of New York City for each year since 1926. In 1926, 17 percent of the immunizations were among children under 5 and 53 percent were among those 5–9 years of age. Each year the percentage of the immunizations of children under

5 years has increased until in 1935, 63 percent were under 5 years and only 29 percent were 5–9 years of age. According to the State report, immunization rates in 1929–30 (the time that data for the present study were collected) were higher for the school than for the preschool ages (table 8).

The frequency of immunizations at specific ages for each sex is shown in the right half of figure 6 (table 11). The age groups used are somewhat broader, the first point representing infants under 6 months and the second point 6 months but under 3 years. Both sexes show low rates for children under 6 months and both likewise show the highest rates for the youngest group above 6 months of age. In the various ages above 6 months, immunizations are slightly more frequent among girls than boys but the differences are not statistically significant.[10] There would seem to be no reason to expect differences between the sexes with respect to immunization rates at these early ages.

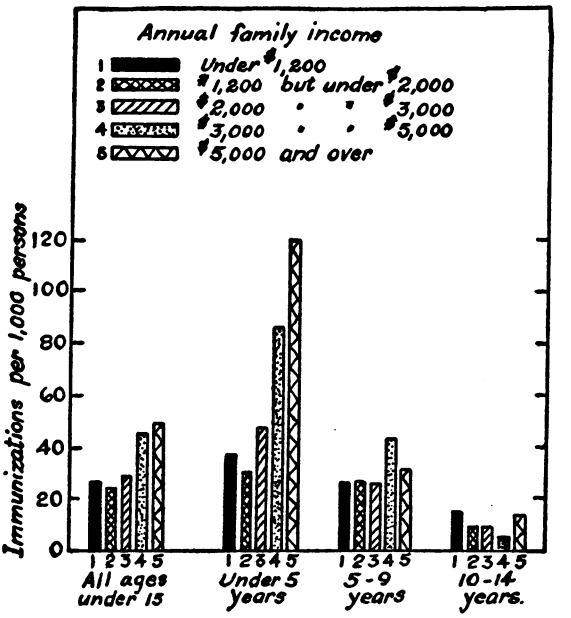

FIGURE 7.—Annual diphtheria immunizations per 1,000 persons of specific ages in canvassed white families of different income levels in 18 States during 12 consecutive months, 1928–31.

FAMILY INCOME

Considering children of all ages under 15 years, diphtheria immunizations increase from 27.2 per 1,000 in families with annual incomes of less than $1,200, to 49.7 among persons with family incomes of $5,000 or over. Figure 7 and table 14 show rates by family income for children of three age groups. Among preschool children (under 5 years) the increase in immunization rates with income is marked; the lowest rate, 31.6 per 1,000, occurs in families with $1,200–$2,000 annual income, with a slightly higher rate (37.4) in families with incomes of less than $1,200. The rate in families with an income of $5,000 or above (120.1) is approximately four times the rate in the

[10] The test applied was the probable error of the difference between the two series of rates (in the several age groups) as outlined by Dr. Lowell J. Reed (28).

$1,200–$2,000 income group. For the school ages there is little variation in immunization rates in the several income classes.

VARIATION IN SPECIFIC LOCALITIES

It has been seen that some sections of the country have higher immunization histories than others (fig. 3) and also that the current immunization rates differ considerably in the several geographic regions (table 12). An examination of data for individual surveyed localities discloses that diphtheria immunizations during the 12-month study were concentrated in rather few communities but not to such a degree as either typhoid immunizations (*8*) or smallpox vaccinations (*7*). Of the 119 localities with 10 or more families under observation, 18 localities, or 15 percent, including 12 percent of the families, contributed 51 percent of the current diphtheria immunizations. The other 49 percent of the immunizations were contributed by 40 percent of the communities while the remaining 45 percent of the communities, including 30 percent of the families, reported no immunizations among the surveyed families during the study year (table 15).

TABLE 14.—*Annual diphtheria immunizations per 1,000 children of specific ages in canvassed white families of different income levels in 18 States during 12 consecutive months, 1928–31*

Annual family income	Immunizations per 1,000 population per year				Number of immunizations				Population under observation [1]			
	All ages under 15	Under 5	5-9	10-14	All ages under 15	Under 5	5-9	10-4	All ages under 15	Under 5	5-9	10-14
Under $1,200	27.2	37.4	26.7	15.3	73	36	25	12	2,681	962	936	783
$1,200 but under $2,000	24.3	31.6	27.5	9.9	146	70	60	16	6,006	2,216	2,178	1,612
$2,000 but under $3,000	29.2	48.2	26.3	9.8	114	66	37	11	3,897	1,370	1,409	1,118
$3,000 but under $5,000	45.5	86.5	43.6	5.8	77	46	28	3	1,691	532	642	517
$5,000 and over	49.7	120.1	31.9	13.9	69	46	16	7	1,389	383	502	504

[1] Nearly all persons were under observation the entire 12 months. For births during the study an adjustment was made to reduce their observation period to full-time years of life.

TABLE 15.—*Percentage of localities, of families, and of diphtheria immunizations in places with considerable numbers of immunizations, with few and with no immunizations in the surveyed group—canvassed white families in 119 localities with 10 or more families under observation during 12 consecutive months, 1928–31*

Diphtheria immunizations in the surveyed families during the year of the study	Percentage of—			Number of—		
	Localities	Families	Immunizations	Localities	Families	Immunizations
All localities	100.0	100.0	100.0	119	8,713	487
Localities with a considerable number of immunizations (10 or more per 100 families)	15.1	11.8	51.4	18	1,032	250
Localities with few immunizations	39.5	58.7	48.6	47	5,113	237
Localities with no immunizations	45.4	29.5	----------	54	2,568	----------

No intensive study was made of a possible relationship between the prevalence of diphtheria and the time or frequency of immunization, but a cursory examination of the data indicates that the presence of a diphtheria case in the community did not stimulate immunizations to the extent that a smallpox case stimulated vaccinations (7). The longer period necessary to complete the three injections and acquire immunity makes the procedure less applicable in the face of epidemics.

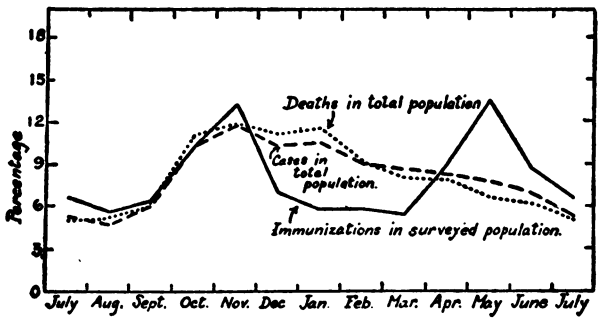

FIGURE 8.—Percentage of immunizations and of diphtheria cases and deaths in each month (30-day basis)—immunizations in the surveyed families in 18 States, 1928–31; cases and deaths in the general population of 18 States, 1929–30.

An interesting difference occurs in the age distribution of diphtheria immunizations in communities having a considerable number of immunizations and in those with few immunizations. In the group with considerable numbers, only 28 percent of the immunizations are among children under 3 years of age and 45 percent are in the school ages of 6–14 years. In the communities with few immunizations, 43 percent are among children under 3 years, with only 24 percent in the 6–14 year group (table 16). Although less frequent, immunizations that arise from individual initiative are apparently done at earlier ages than those stimulated by immunization campaigns.

TABLE 16.—*Age distribution of diphtheria immunizations in communities with considerable numbers and in those with few immunizations—canvassed white families in 119 localities with 10 or more families under observation during 12 consecutive months, 1928–31*

Immunizations in surveyed families during the year of the study	Percentage of immunizations that were in each age group						Number of immunizations					
	All ages	Under 3	3–5	6–9	10–14	15 and over	All ages	Under 3	3–5	6–9	10–14	15 and over
18 localities with a considerable number of immunizations (10 or more per 100 families)	100.0	28.4	25.2	30.4	14.4	1.6	250	71	63	76	36	4
47 localities with few immunizations	100.0	42.6	32.5	18.6	5.5	.8	237	101	77	44	13	2

SEASONAL VARIATION

Diphtheria cases and deaths are more frequent in the fall and winter months (October–January) than in other seasons of the year (fig. 8 and table 17). In the communities under study there seemed

to be little relation between the season of immunization and the seasonal prevalence of diphtheria. The data indicate a double peak in the frequency of immunizations—one in November and the other in May. However, it cannot be said that this double peak represents a tendency that would be expected to repeat itself.[11]

TABLE 17.—*Seasonal distribution of diphtheria immunizations in the surveyed families and of diphtheria cases and deaths in the general population*

	All months	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
	Number	Percentage in each month (corrected to 30-day basis)											
Diphtheria immunization in the surveyed population, 1928–31, all localities	487	100.0	6.7	5.6	6.5	10.2	13.3	7.1	5.8	5.8	5.4	9.0	13.5	8.8
Diphtheria [1] in the total population of the 18 surveyed States, based on calendar years 1929–30:														
Cases	81,766	100.0	5.3	4.7	6.0	10.4	11.8	10.4	10.6	9.1	8.6	8.3	7.8	7.0
Deaths	6,720	100.0	5.1	5.2	6.1	11.1	11.9	11.1	11.5	9.2	8.0	7.8	6.6	6.2
Diphtheria [1] in the total population of continental United States:														
Based on calendar years 1929–30:														
Cases	151,941	100.0	4.6	4.8	7.0	11.9	13.3	10.8	10.3	8.7	8.2	7.5	6.9	6.0
Deaths	14,085	100.0	4.3	5.2	6.8	12.4	13.5	12.3	11.7	9.0	7.4	6.7	5.6	5.2
Based on medians for the 7 years 1922–28:														
Cases	108,176	100.0	4.9	4.9	7.1	11.3	12.7	11.1	10.5	9.7	8.1	7.2	6.5	6.1

[1] Cases from Notifiable Diseases in States (*17*) and deaths from Mortality Statistics (*9*), supplemented by State reports (*17*) for South Dakota in 1929 and Texas in 1929 and 1930.

DIPHTHERIA IMMUNIZATIONS IN HOUSEHOLDS ATTACKED BY THE DISEASE

Immunizations prior to the study.—Of the 321 individuals in the 57 attacked households, 45 persons,[11a] or 14 percent, gave a history of artificial immunization, with no case prior to the study, as compared with 16 percent in the whole surveyed population. Of the 321 individuals, 19 persons, or 5.9 percent, had been previously attacked, as compared with 5.3 percent in the whole surveyed population.

Considering only persons under 15 years of age, there were 172 such individuals in attacked households and 36 of them, or 21 percent, had been previously immunized, as compared with 32 percent in the whole surveyed group; 10 of the children under 15 years, or 5.8

[11] The peak in immunizations which occurs in the autumn is quite largely the result of 39 immunizations among 91 families in a Kansas town of 14,000 population, which appears to be associated with a threatened outbreak of diphtheria. Of two diphtheria cases reported to the local health department during 1929, one occurred in October and the other in November. Of the 39 immunizations in the surveyed families, 9 were in October and 28 in November. The high concentration of immunizations in the months when cases occurred suggests that the immunizations may have been stimulated by this threatened epidemic. If these 39 immunizations are eliminated, the fall immunization peak is almost eliminated, but the spring peak seems to represent a more widespread tendency to do immunizations at this season of the year without regard to the presence of diphtheria in the community.

[11a] One other person who had no immunization or case before the study was immunized during the study and later had an attack. In the tables on attacks during the study, this person is counted as having a prior immunization.

percent, had been previously attacked, as compared with 3.3 percent in the whole surveyed group.

Immunizations during the 12-month study.—Of the 116 children under 15 years of age in attacked households who were themselves not attacked, 21 children, or 18.1 percent, were actively immunized (exclusive of antitoxin injections) during the study year, as compared with 3.1 percent among children of these ages in the whole surveyed group. The presence of a case in the household seems to have stimulated immunizations that would not have occurred otherwise.

Of the 74 children under 15 years of age in attacked households who were themselves not attacked and who had not been previously immunized or attacked, 20 children, or 27 percent, were immunized during the year. Of these 20 children, 16 also had antitoxin.

Of the 42 children under 15 years of age in attacked households who were themselves not attacked but who had been previously immunized or attacked, 1 child (2.4 percent) was immunized during the study year.

Of the 116 children under 15 years of age in attacked households who were themselves not attacked, 37 persons, or 32 percent, received antitoxin. Of the 74 children under 15 years of age in attacked households who were themselves not attacked and who had not been previously immunized or attacked, 33 persons, or 45 percent, received antitoxin.

DIPHTHERIA CASES IN THE OBSERVED POPULATION

Rates based on attacked households.—Among the 321 persons in attacked households, the 70 cases [12] of diphtheria that occurred amount to an attack rate of 21.8 per 100. Among the 172 children under 15 years of age in attacked households, there were 56 diphtheria cases, which gives an attack rate of 32.6 per 100.

Of the 70 cases of diphtheria, 59 were primary or first cases in the household and 11 were secondary cases, that is, attacks among those

[12] The 70 cases of diphtheria occurred in 57 households; 47 households had only 1 case; 8 had 2 cases, but in 2 households both cases had the same date of onset; 1 household had 3 cases; and 1 had 4 cases. Geographically the cases were distributed as follows:

State	Number of families attacked	Number of cases of diphtheria	Number of families under observation	State	Number of families attacked	Number of cases of diphtheria	Number of families under observation
New York	29	32	1,710	Georgia	2	2	544
Ohio	6	8	1,148	Kansas	2	2	301
Virginia	3	5	412	Michigan	2	2	329
California	4	4	890	Massachusetts	1	2	287
Illinois	1	4	463	West Virginia	1	2	318
Indiana	2	3	494	District of Columbia	1	1	99
Colorado	2	2	386	Washington	1	1	551

who were exposed to a case in the household. Deducting the 59 primary cases from the 321 persons in attacked households, there were 262 persons exposed to these cases and 11 of them, or 4.2 percent, were attacked.

TABLE 18.—*Diphtheria attack rates among persons exposed to a case in the household—57 attacked households among 8,758 canvassed white families in 18 States during 12 consecutive months, 1928–31*

Age in years	All persons in household					Persons with no history of artificial immunization or prior case				
	Total persons	Primary [1] cases	Total persons minus primary cases	Secondary [1] cases	Secondary attack rate per 100	Total persons	Primary [1] cases	Total persons minus primary cases	Secondary [1] cases	Secondary attack rate per 100
All ages	321	59	262	11	4.2	256	54	202	10	5.0
All under 15	172	47	125	9	7.2	125	43	82	8	9.8
Under 5	49	14	35	5	14.3	38	13	25	4	16.0
5–9	76	24	52	4	7.7	57	22	35	4	11.4
10–14	47	9	38	----	1.6	30	8	22	----	2.6
15–19	28	4	24	1		20	3	17	1	
20 and over	121	8	113	1	.9	111	8	103	1	1.0

[1] Two cases in a household with onset on the same day are both counted primary; secondary includes all with a date of onset subsequent to the first case.

Considering in a similar way those persons under 15 years of age who were exposed to a case in the household, 7.2 percent were attacked. Limiting the group under consideration still further to children under 15 years of age who were without prior attack or immunization, 9.8 percent of those exposed to a case in the household were attacked. These various types of secondary attack rates are shown in table 18 for children of three age groups. A further restriction of the exposed population to those with a positive Schick test would increase still more the secondary attack rate, but no data on Schick tests are available for the group surveyed in this study.[13]

The secondary attack rates among all children (table 18) are of the same order of magnitude as those found by Doull (*20, p. 399*) for Baltimore for the years 1920–23.

Among 82 children under 15 years with no prior immunization or attack who were exposed to a case in the household, there were 8 cases, or a secondary attack rate of 9.8 percent. Among 43 children of the same ages with a history of a prior immunization or attack who were exposed to a case in the household, there was 1 attack or a secondary attack rate of 2.3 percent.

[13] It is impossible to determine from the record whether any child who had a secondary case had received preventive antitoxin injections after the first case in the household occurred; any statement about antitoxin being given such a child who had a case may have referred to its therapeutic rather than its preventive use.

Incidence in the surveyed population.—Of the 70 cases of diphtheria in the surveyed population, 63 had their onset within the study year and 7 cases began just prior to but were sick during the year. The 63 new cases give an annual rate of 163 per 100,000 persons, as compared with a reported average annual rate of 62 per 100,000 for the United States in 1929–30. Adjustment of the rate in the surveyed group to the age distribution of the general population brings it down to 130 per 100,000, a figure that is still more than twice the reported case rate.

A canvass of over 27,000 families including nearly 120,000 individuals in various counties in Illinois (*13, p. 28*) indicates that 65 percent of the 232 diphtheria cases that occurred in that group during 1929 were reported to the health department.[14] If it can be assumed that 65 percent of diphtheria cases in the country as a whole are reported, then the rate for the United States would be about 95 per 100,000 as compared with 130 in the surveyed group. If a larger percentage is reported, the discrepancy between the two rates would be greater. It appears probable that the rate in the canvassed group was exceptionally high.

Of the total of 70 cases of diphtheria, 64 occurred among persons who had never been immunized, but 6 occurred among those who reported a history of injections for diphtheria immunization. Of the 6 cases, the injections in 2 instances were done within 10 weeks of the onset of the illness; in a third case the date of the injections was recorded only as "1929" and the onset of the case was on November 12 of that year. Park, Williams, and Krumwiede (*27, p. 366*) indicate that the full effect of a series of injections cannot be expected in all children before 2 to 3 months after the first injection. Thus in 3 of the 6 cases with prior injections, there is some doubt whether sufficient time had elapsed for the development of immunity. In the other 3 instances the cases occurred a year or more after the injections had been given. The data did not include results of Schick tests subsequent to the injections; since it is known that in a small proportion of children the usual number of injections does not produce a negative Schick reaction, one would expect some susceptibles in the group with a history of injections. In the computations that follow, all of the 6 cases under review are considered as occurring among the immunized group, although three of them are doubtful.

[14] In a group of 68 southeastern counties with full-time health officers, 84 percent of 568 diphtheria cases located by similar surveys were reported to the health departments. (Communicable diseases and activities for their control in the Brunswick-Greensville area. Brunswick-Greensville health administration studies no. 7. By J. O. Dean and Elliot H. Pennell. Pub. Health Rep., July 24, 1936. (Reprint No. 1761.)

TABLE 19.—*Age incidence of diphtheria in the total observed population and in that part of the population which had no history of an artificial immunization or a case—canvassed white families in 18 States, 1928–31*

	All ages [1]	All under 15 years	Age									
			Under 2	2–3	4–5	6–7	8–9	10–14	15–19	20–24	25–44	45 and over
Total observed population:												
Number of persons (years of life)	38,544	15,706	2,251	2,116	2,318	2,329	2,214	4,568	3,050	2,119	11,570	5,822
Number of cases	70	56	3	9	12	13	10	9	5	4	4	1
Annual case rate per 1,000	1.82	3.55	1.33	4.25	5.18	5.58	4.52	1.97	1.64	1.89	0.35	0.17
Persons with no history of artificial immunization or prior case:												
Number of persons (years of life)	[2]30,408	[2]10,409	[2]2,069	1,634	1,553	1,332	1,181	2,640	2,287	1,850	10,401	5,318
Number of cases	64	51	2	9	11	12	9	8	4	4	4	1
Annual case rate per 1,000	2.10	4.90	0.97	5.51	7.08	9.01	7.62	3.03	1.75	2.16	0.38	0.19

[1] "All ages" includes a few of unknown age.
[2] "Under 5 years" includes 441 years of life for the 761 children born during the study who are excluded from the history of immunization tables because the histories are recorded as of the beginning of the study before these children were born. Since they are exposed to the risk of attack, they belong in any table of current rates.

Table 19 shows diphtheria rates for the total population and for persons who gave no history of a prior case or artificial immunization. Since no data are available on Schick test results, the latter is the nearest approach which can be made to a nonimmune group, but it would include many who have become immune by natural processes. In table 20 the current incidence of diphtheria in the immunized group is compared with that among persons with no history of a prior case or immunization. Since the two groups differ considerably in age composition, it is necessary to correct the rates for these age differences. When this adjustment is made, the rate for those with a history of immunization is 0.43 per 1,000, as compared with 2.10 among those who had not been immunized or attacked. To put it in another way, the number of cases occurring in the group which had been immunized was only 20 percent of the number expected if the rates had been the same as in the group not previously immunized or attacked. A computation of the probable error of the expected number of cases indicates that the difference between the immunized and nonimmunized groups is statistically significant.

A similar computation was made for persons who had been previously attacked by diphtheria. No cases occurred in this group, while the expected number was four. The number of persons involved was rather small, and the difference between the actual and expected number (four cases) is not statistically significant as judged by its probable error.

Similar computations were made for persons under 15 years of age, with adjustment for age differences within that group (table 20). Although the rates for these ages are higher than for the total

population, the relationships are approximately the same as described above for all ages.

TABLE 20.—*Annual incidence of diphtheria in nonimmunized and immunized groups of the surveyed population—canvassed white families in 18 States during 18 consecutive months, 1928–31*

Group	Number of persons under observation	Case rate per 1,000		Actual number of cases [2]	Expected number of cases if there had been no history of immunization or case (age corrected [3])	Ratio of actual to expected (expected = 1.00)
		Crude	Adjusted [1]			
	All ages					
No history of immunization or prior case	30,408	2.10	2.10	64	64	1.00
History of immunization but no prior case	6,002	1.00	.43	6	30	.20
History of a prior case	2,012			0	4	
	All ages under 15 years					
No history of immunization or prior case	10,409	4.90	4.90	51	51	1.00
History of immunization but no prior case	4,869	1.03	.87	5	28	.18
History of a prior case	502			0	3	

[1] Adjusted to the age distribution of the group with no history of immunization or case by the method of expected cases as outlined in Pearl's Medical Biometry and Statistics (2d ed., pp. 265–269). Since the rates in the group with no history of immunizations were used as the standard age-specific rates in the adjustment process, the crude and adjusted rates for this group are the same.

[2] Of the 6 cases with prior immunization, 3 received the injections within a few months of the onset of the illness, and thus the disease may have been contracted before a sufficient time had elapsed for the development of an immunity. Of the 3 doubtful cases, 2 were under and 1 was over 15 years of age. See text for a more complete discussion.

[3] Expected cases obtained by applying age-specific rates (table 19) for persons who had never been immunized to the numbers of persons in the various ages in the group under consideration.

The significance of the difference between the expected and actual number of cases for a given group was tested as follows: (*a*) An expected rate was computed by dividing the expected cases by the number of persons in the group; (*b*) the standard error of the *expected number* of cases was computed by the formula $\sigma = \sqrt{npq}$, in which n = number of persons in group, p = expected rate per person, and $q = 1 - p$; (*c*) difference between actual and expected number of cases, x, was divided by the standard error, σ, as computed above; (*d*) from tables of $\frac{x}{\sigma}$ in Pearl's Medical Biometry and Statistics (2d ed., p. 440), the probability of a chance deviation as great as, or greater than, that occurring in this case was obtained.

The results indicate that the actual cases are significantly lower than expected for those who had been artificially immunized (all ages and also under 15 years), but not for those with history of a prior case (neither age class). The number of individuals in this group is too small to obtain reliability when dealing with as small a rate as that for diphtheria.

AGE AND SEX INCIDENCE OF DIPHTHERIA AS REPORTED TO STATE HEALTH DEPARTMENTS

The 70 cases of diphtheria in the surveyed population are sufficient to give only a general picture of the age incidence of the disease (table 21). However, a number of State health department reports show the age distribution of reported cases. Table 22 and figure 9 show the age incidence of diphtheria (single years to 10) in Alabama and New York State. The reported rates are quite different in the two States, but the curves are drawn on scales that afford an accurate comparison of the relative age curves. In Alabama the peak incidence

comes at 3 to 4 years of age, with a secondary peak at 6 years, which is presumably associated with school entrance. In New York the incidence has a single peak at 6 years; after this maximum the decline is more gradual in New York than in Alabama.

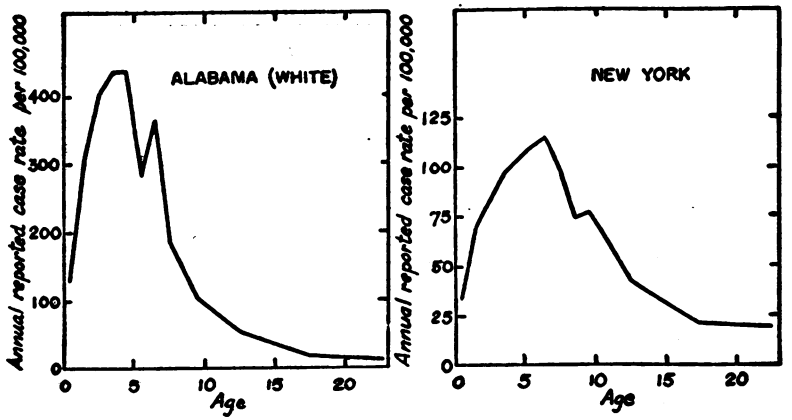

FIGURE 9.—Age incidence (in single years to 10) of diphtheria as reported to health departments in Alabama and New York (exclusive of New York City, Buffalo, and Rochester), 1929–30. (Scales are so made that the rate for all ages under 15 years represents an interval on the vertical scale that corresponds to approximately 10 years on the horizontal scale.)

TABLE 21.—*Annual incidence of diphtheria among males and females of specific ages—canvassed white families in 18 States during 12 consecutive months, 1928–31*

Age in years	Annual case rate per 1,000			Number of cases			Population (years of life)		
	Both sexes [1]	Male	Female	Both sexes [1]	Male	Female	Both sexes [1]	Male	Female
All ages [1]	1.82	1.96	1.68	70	37	33	[1] 38,544	[1] 18,896	[1] 19,627
All ages under 15	3.55	4.16	2.93	56	33	23	15,796	7,929	7,846
Under 2	1.33	[2] 2.96	[2] 1.90	3	[2] 5	[2] 3	2,251	[2] 1,691	[2] 1,583
2–3	4.25	[3] 6.57	[3] 2.92	9	[3] 11	[3] 5	2,116	[3] 1,675	[3] 1,715
4–5	5.18			12			2,318		
6–7	5.58	5.31	4.82	13	12	11	2,329	2,262	2,281
8–9	4.52			10			2,214		
10–14	1.97	2.17	1.76	9	5	4	4,568	2,301	2,267
15–19	1.64	1.31	1.97	5	2	3	3,050	1,527	1,523
20–34	.77	.21	.69	6	2	7	7,759	9,361	10,150
35 and over	.26			3			11,752		

[1] "All ages" includes some of unknown age; "both sexes" includes some of unknown sex.
[2] Under 3 years.
[3] 3–5 years.

Data for Alabama and Michigan (table 23) are available by sex and age. In figure 10 rates are plotted by sex in 5- and 10-year age groups. Again a definite difference appears between the southern and northern State, with a greater concentration of cases in the younger ages in Alabama than in Michigan. This phenomenon has been discussed by both Doull (*21*) and Dauer (*19*).

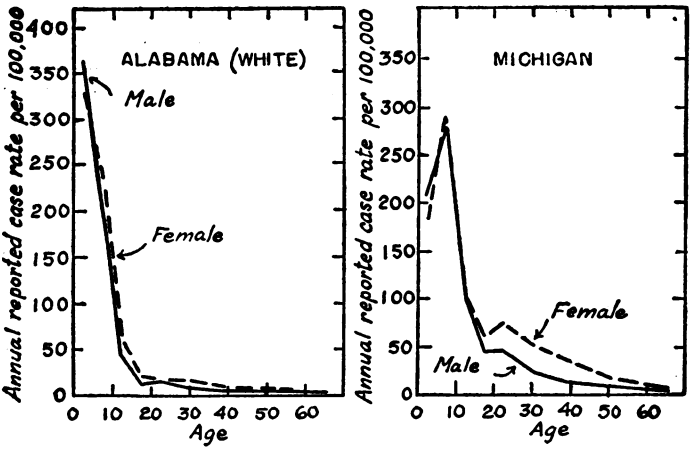

FIGURE 10.—Diphtheria incidence at specific ages (5- and 10-year groups) for each sex, based on cases reported to health departments of Alabama and Michigan. (Scales are so made that the rate for all ages of both sexes represents an interval on the vertical scale that corresponds to approximately 20 years on the horizontal scale.)

TABLE 22.—*Age incidence of diphtheria in Alabama, New York,[1] and Connecticut—based on cases reported to health departments,[2] 1929–30*

Age in years	Annual case rate per 100,000					Number of cases reported in the 2 years				
	Alabama (white)			Both sexes		Alabama (white)			Both sexes	
	Both sexes	Male	Female	New York	Connecticut	Both sexes	Male	Female	New York	Connecticut
All ages	83.9	81.5	86.4	25.9	54.5	[3] 2,855	[3] 1,398	[3] 1,457	2,464	[3] 1,752
All ages under 15	208.8	206.2	211.4	71.9	142.8	2,565	1,289	1,276	1,774	1,272
Under 1	130.9	167.2	93.1	34.2	80.8	106	69	37	49	40
1	311.5	346.9	274.5	68.7	47.6	246	140	106	100	24
2	399.3	430.8	366.6	82.8	235.6	333	183	150	130	128
3	437.8	451.1	424.1	98.0	205.2	379	198	181	157	114
4	435.5	402.6	469.7	103.4	194.7	357	168	189	165	109
5	284.8	272.8	297.0	111.5	212.4	245	119	126	188	126
6	366.5	313.0	421.9	115.6	230.6	315	137	178	194	137
7	193.0	187.4	198.7	97.6	165.5	160	79	81	166	99
8	145.7	153.3	137.9	75.3	187.0	129	69	60	133	119
9	103.1	93.1	113.4	77.4	127.3	87	40	47	135	80
Under 5	345.0	361.4	327.9	78.5	156.1	1,421	758	663	601	415
5–9	218.8	204.1	233.9	95.2	183.9	936	444	492	816	561
10–14	53.5	44.0	63.4	42.3	92.5	208	87	121	357	296
15–19	16.0	11.9	20.1	20.7	38.8	59	22	37	163	115
20–24	15.1	14.6	15.5	18.3	34.5	49	23	26	137	91
25–34	11.4	5.5	17.1	13.8	22.5	55	13	42	195	109
35–44	6.6	5.3	7.8	6.8	[4] 12.5	25	10	15	97	[4] 85
45–54	4.9	4.3	5.6	4.8	[5] 2.2	15	7	8	55	[5] 13
55 and over	1.6	1.9	1.3	2.8		5	3	2	43	

[1] Exclusive of New York City, Buffalo, and Rochester.
[2] Data from annual reports of the respective State health departments (*10, 12, 16*).
[3] "All ages" includes some of unknown age.
[4] 35–49.
[5] 50 and over.

TABLE 23.—*Age incidence of diphtheria in Michigan, California, and Mississippi—based on cases reported to health departments,*[1] *1929–30*

Age in years	Annual case rate per 100,000					Number of cases reported in the 2 years				
	Michigan			Both sexes		Michigan			Both sexes	
	Both sexes	Male	Female	California	Mississippi (white)	Both sexes	Male	Female	California	Mississippi (white)
All ages [2]	80.8	74.6	87.5	53.7	121.8	[2] 7,824	[2] 3,760	[2] 4,064	[2] 6,093	2,429
All ages under 15	197.8	200.9	194.6	166.2	316.4	5,562	2,864	2,698	4,305	2,211
Under 5	197.5	210.7	183.8	166.0	438.0	1,831	995	836	1,346	1,020
5–9	284.5	281.6	287.6	228.0	404.1	2,771	1,390	1,381	2,122	984
10–14	105.4	104.2	106.6	98.7	93.1	960	479	481	837	207
15–19	54.0	44.9	62.8	41.3	30.3	449	188	261	354	65
20–24	60.1	45.4	75.3	32.7	27.5	503	193	310	311	52
25–34	37.6	24.7	52.0	23.1	17.1	608	210	398	452	48
35–44	22.3	12.8	33.7	13.5	15.2	326	102	224	251	35
45–54	13.2	9.1	17.9	5.5	6.6	131	49	82	80	12
55 and over	4.3	2.9	5.7	3.0	3.0	48	17	31	49	6

[1] Data from annual reports of the respective State health departments (*11, 14, 15*).
[2] "All ages" includes some of unknown age.

In the adult ages the rates for females are definitely higher than for males, particularly in Michigan. The difference between the sexes presumably reflects the greater exposure to the disease by mothers who act as nurses for their children with diphtheria.

The concentration of diphtheria cases in the very early ages in Alabama and presumably in other southern States (see data for Mississippi in table 23) suggests that in the South effective protection against diphtheria calls for immunization at earlier ages than would be reasonably effective in the North, where the peak incidence occurs later.

TABLE 24.—*Annual diphtheria mortality and morbidity in the general population of four geographic sections of the United States, 1929–30, as reported to the health departments of all States and of the States sampled in the survey*

Geographic section [1]	Annual death rate per 100,000		Annual reported case rate per 100,000		Number of deaths in the 2 years		Number of cases reported in the 2 years		Number of States [3]	
	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States
All sections	5.04	5.74	61.4	61.9	6,720	14,085	81,766	151,941	[3] 18	[3] 49
Northeast [1]	4.18	5.37	69.2	73.1	1,543	3,696	25,584	50,313	3	9
North Central [1]	5.38	[3] 4.96	61.4	57.3	3,200	[3] 3,841	36,546	44,195	7	[3] 12
South [1]	7.03	[4] 7.51	56.7	61.0	1,429	[4] 5,687	11,531	46,182	5	[3 4] 17
White	7.47	8.45	(5)	(5)	1,153	3,951	(5)	(5)	5	16
Colored	5.63	5.40			276	994			5	16
West [1]	3.31	3.62	49.3	47.3	548	861	8,155	11,251	3	11

[1] The 4 sections in terms of the U. S. Census geographic areas and their diphtheria death rates in 1929–30 were as follows:
Northeast: New England (4.38) and Middle Atlantic (5.68).
North Central: East North Central (5.86) and West North Central (3.29).
South: South Atlantic (7.02), East South Central (8.59), and West South Central (7.27).
West: Mountain (4.47) and Pacific (3.23).
[3] South Dakota was not in the registration area in 1929; deaths were obtained from State reports.
[3] The District of Columbia is counted as a State.
[4] Texas deaths from State reports are included in the total but are not available by color.
[5] Cases not available by color.

DIPHTHERIA MORTALITY AND CASE FATALITY AT SPECIFIC AGES

In continental United States 151,941 cases (white and colored) of diphtheria were reported in the 2 years 1929 and 1930, an annual incidence of 61.9 per 100,000. A total of 14,085 deaths registered [15] gives an annual mortality of 5.74 per 100,000 and a case fatality of 9.3 percent, a figure that is no doubt too high because of the incompleteness of case reporting (table 24). To express it in another way, there were 10.8 cases reported for each death registered. In a group of 81 cities (*17*) with populations over 100,000 where reporting is probably better but still incomplete, the average annual case rate for 1929–30 was 91.6 per 100,000, and the death rate was 6.45 per 100,000, with a case fatality of 7.0 percent, or 14.2 cases reported for each death registered. Green and Moorehouse (*23*) found for Cleveland a case fatality of 6.8 percent by excluding from the computation all deaths that had not been previously reported as cases. Wood (*30*), in studies in Pennsylvania, found a case fatality of 6.6 percent, and an earlier study (*18*) from this office indicated a case fatality of 7.0 percent for cases under 15 years of age.

Diphtheria mortality varies considerably in different sections of the country. Table 24 shows for 1929–30 death rates and reported case rates for four broad geographic regions, with death rates for white and colored shown separately in the South. In these years the death rate was lowest in the Western region; the rates in the Northeast and North Central States were approximately the same, but the South showed a higher rate than any other region. The diphtheria rate among colored persons, like many of the other communicable diseases of childhood, was less than among whites.

Table 25 and figure 11 show diphtheria mortality by age and sex in the white population of the registration States. The peak of mortality comes at an earlier age than the maximum case incidence. For both sexes combined the peak mortality occurs at 2 years of age, and among males it occurs at 1 year. After the peak, the decline is rapid with nearly all of the deaths occurring under 15 years of age.

The high mortality at the very early ages again emphasizes the necessity for early immunization if it is to be effective in preventing diphtheria deaths.

Among children under 5 years the mortality of males is somewhat above that of females, but among adults the reverse is true. A higher case rate for adult women has already been noted.

Table 26 shows case fatality rates for persons of specific ages in five States. The variation from State to State is no doubt due in part to the incompleteness of reporting of cases. The purpose of

[15] Mortality Statistics (*9*) supplemented by State reports (*17*) for South Dakota in 1929 and Texas in 1929 and 1930.

the table is to show the relative case fatality at different ages rather than to compare States. In figure 12 these rates are plotted (single years to 5) for Alabama and New York State. The percentage of cases that end fatally is higher for infants under 1 year than at any other age. Although there is a definite decline in case fatality as age increases, the decrease is not as rapid for diphtheria as for the other diseases of childhood (*18*).

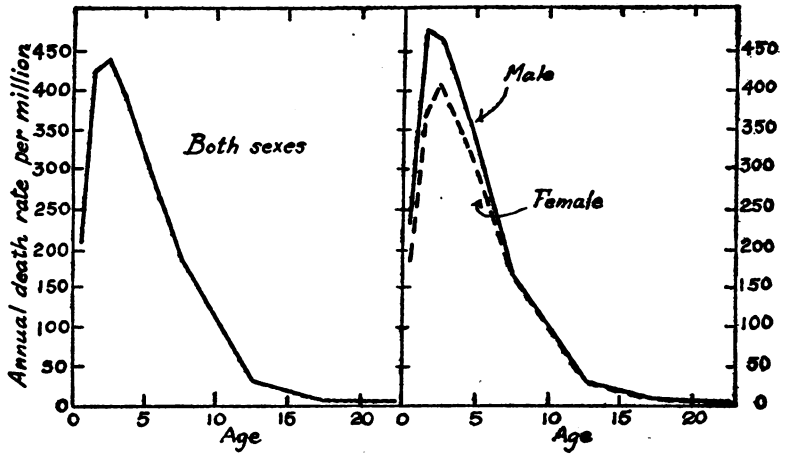

FIGURE 11.—Diphtheria mortality at specific ages (single years to 5) for each sex—white population in the registration States, 1929–30. (Scales are so made that the rate for all ages under 15 years represents an interval on the vertical scale that corresponds to approximately 10 years on the horizontal scale.)

TABLE 25.—*Annual diphtheria mortality at specific ages for each sex—white persons in the registration States,*[1] *1929–30*

Age in years	Annual death rate per million			Number of deaths in the 2 years		
	Both sexes	Male	Female	Both sexes	Male	Female
All ages [2]	57.4	59.4	55.3	11,957	6,268	5,689
All ages under 15	183.9	193.9	173.5	11,030	5,902	5,128
Under 1	208.4	232.0	183.9	753	427	326
1	425.4	476.8	369.9	1,531	878	653
2	442.2	472.6	410.7	1,704	926	778
3	395.2	419.8	370.0	1,561	841	720
4	344.9	362.0	327.2	1,352	723	629
Under 5	364.4	393.9	333.9	6,901	3,795	3,106
5–9	167.2	167.9	166.6	3,496	1,780	1,716
10–14	31.4	32.1	30.8	633	327	306
15–19	9.1	8.6	9.6	175	83	92
20–24	6.6	5.8	7.4	120	52	68
25–34	6.0	4.6	7.3	190	73	117
35–44	5.3	3.3	7.4	157	50	107
45–54	6.1	4.2	8.1	138	50	88
55–64	5.9	4.6	7.3	89	36	53
65–74	4.3	3.2	5.3	37	14	23
75 and over	5.0	3.7	6.1	17	6	11

[1] Registration States included all except Texas and South Dakota in 1929 and all except Texas in 1930.
[2] "All ages" includes a few of unknown age.

TABLE 26.—*Variation with age and sex in the case fatality of diphtheria in five States* [1]*—Based on cases reported to health departments and total deaths registered, 1929–30*

Age in years	Deaths per 100 reported cases					Annual death rate per million population					Number of deaths in the 2 years				
	Alabama (white)	New York [2]	Michigan	California	Mississippi (white)	Alabama (white)	New York [2]	Michigan	California	Mississippi (white)	Alabama (white)	New York [2]	Michigan	California	Mississippi (white)
All ages:															
Both sexes	12.4	8.7	10.2	6.3	9.1	104.4	22.6	82.6	33.6	111.4	355	215	800	381	[3] 222
Male	12.9	([4])	11.3	([4])	([4])	105.0	21.7	84.0	37.2	113.9	180	104	423	219	115
Female	12.0		9.3			103.8	23.5	81.1	29.6	108.8	175	111	377	162	107
Both sexes:															
All ages under 15	13.6	10.0	12.8	7.8	9.9	284.9	72.1	253.2	129.4	313.4	350	178	712	335	219
Under 1	29.2	26.5	([5])	([5])	([5])	382.7	90.6	184.7	150.7	249.0	31	13	33	23	11
1	27.2	23.0				848.4	158.0	338.2	197.0	848.5	67	23	60	30	37
2	19.5	20.0				779.4	165.6	415.5	299.7	888.9	65	26	79	49	42
3	18.2	16.6				797.0	162.2	473.7	236.0	754.6	69	26	91	40	38
4	13.7	9.7				597.8	100.3	376.5	202.5	611.0	49	16	71	35	29
Under 5	19.8	17.3	18.2	13.2	15.4	682.2	135.8	360.3	218.3	674.2	281	104	334	177	157
5–9	7.1	7.7	11.6	6.3	5.9	154.3	73.5	329.6	142.9	238.2	66	63	321	133	58
10–14	1.4	3.1	5.9	3.0	1.9	7.7	13.0	62.6	29.5	18.0	3	11	57	25	4
15–19	2.4	2.5	4.2	2.3	0.9	2.3	5.1	22.8	9.3	1.5	5	4	19	8	2
20–34		3.6	3.2	1.8			5.5	14.3	4.8			12	35	14	
35–54		4.6	5.9	4.8			2.7	11.0	4.8			7	27	16	
55 and over		32.6	14.6	16.3			9.2	6.2	4.8			14	7	8	

[1] Cases from the annual reports of the respective State health departments (see tables 22, 23); deaths from Mortality Statistics for the United States (*9*).
[2] Exclusive of New York City, Buffalo, and Rochester.
[3] "All ages" includes some of unknown age.
[4] Cases not available by sex.
[5] Cases not available by single years of age.

REACTIONS FOLLOWING IMMUNIZATION

Of the 487 diphtheria immunizations, only 6, or 1.2 percent, were reported as being accompanied by reactions of sufficient severity to cause loss of time from school or other usual activities or to result in a consultation with a doctor.[16] The figure of 1.2 percent of the diphtheria immunizations with reactions that caused disability may be compared with 6.0 percent for smallpox vaccinations and 1.2 percent for typhoid immunizations.

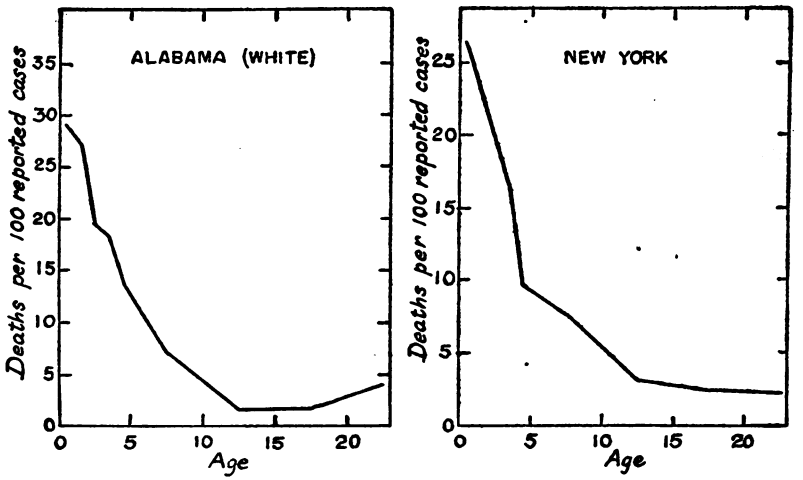

FIGURE 12.—Variation with age (single years to 5) in the case fatality of diphtheria—deaths per 100 reported cases in Alabama and New York (exclusive of New York City, Buffalo, and Rochester), 1929–30. (Scales are so made that the rate for all ages under 15 years represents an interval on the vertical scale that corresponds to approximately 10 years on the horizontal scale.)

WHERE IMMUNIZATIONS WERE DONE

Of the 487 diphtheria immunizations during the study year, 57 percent were done in public clinics or by school physicians. This figure may be compared with 52 percent for typhoid immunizations, 42 percent for smallpox vaccinations, 36 percent for scarlet fever immunizations, and 3 percent of cases given cold vaccine. Of all diphtheria immunizations done in public clinics, 90 percent were free and the others paid a nominal or a full-price fee.

The percentage of diphtheria immunizations that were done in public clinics increases from 54 percent under 5 years to 59 at 5–9, and 71 at 10–14 years. Only six immunizations were done above 15 years. Of all diphtheria immunizations 4.9 percent were reported as done by specialists and 7.4 percent had a visiting nurse on the case, presumably to urge immunization.

[16] In 4 reactions there was a report of 1 or more days in bed, but in the other 2 cases consultation with a doctor subsequent to the injections was the only basis for classifying the person as being sick.

IV. SUMMARY

Information on the history of artificial diphtheria immunizations and cases at any time and more detailed records of diphtheria immunizations during a 12-month period between 1928 and 1931 were obtained on 8,758 white families in 130 localities in 18 States. Each family was visited at intervals of 2 to 4 months to secure the data.

The surveyed families include representation from nearly all geographic sections, from rural, urban, and metropolitan areas, from all income classes, and of both native- and foreign-born persons. The proportions of these various elements included are not identical with those in the population of the United States, but the variations are not generally large. In other respects, also, the surveyed group is not dissimilar to families in the general white population of the United States.

Considering the whole group, 43 percent of 9-year old children gave a history of an artificial diphtheria immunization; above this age the percentage declined until at 20–24 years only 5 percent gave such a history. At 20–24 years, about 7 percent gave a history of an attack of diphtheria (fig. 1).

Boys and girls show about the same percentages with a history of diphtheria immunization. Boys under 10 years gave more histories of attacks than girls (fig. 2).

In the Northeast and the South the percentages of persons with a history of diphtheria immunization were somewhat higher than in the North Central and Western regions. The South was also high in histories of attacks, but the Northeast was low (fig. 3).

Histories of diphtheria immunization in the localities here studied were as frequent in rural as in urban places. Histories of diphtheria attacks were most frequent in large cities and least frequent in rural areas (fig. 4). This situation was true for each of four broad geographic sections (fig. 5).

Artificial diphtheria immunizations during the 12 months of the morbidity study amounted to 30.5 per 1,000 children under 15 years (fig. 6).

The frequency of diphtheria immunizations of children of the preschool ages increases regularly with family income; in the school ages the frequency of immunizations does not show any consistent relation to income (fig. 7).

About half of the diphtheria immunizations during the study year were done in 15 percent of the localities.

The peak of diphtheria case incidence occurs at a younger age in the South than in the North (fig. 9).

The peak of diphtheria mortality in the registration States occurs at 2 years of age (fig. 11). The maximum diphtheria case fatality occurs among infants under 1 year of age (fig. 12).

V. REFERENCES

A. PRECEDING PAPERS IN THIS SERIES

(1) Collins, Selwyn D: Causes of illness in 9,000 families based on Nation-wide periodic canvasses, 1928–31. Pub. Health Rep., Mar. 24, 1933. (Reprint 1563.)
(2) ————: Frequency of health examinations in 9,000 families, based on Nation-wide periodic canvasses, 1928–31. Pub. Health Rep., Mar. 9, 1934. (Reprint 1618.)
(3) ————: Frequency of eye refractions in 9,000 families, based on Nation-wide periodic canvasses, 1928–31. Pub. Health Rep., June 1, 1934. (Reprint 1627.)
(4) ————: A general view of the causes of illness and death at specific ages, based on records for 9,000 families in 18 States visited periodically for 12 months, 1928–31. Pub. Health Rep., Feb. 22, 1935. (Reprint 1673.)
(5) ————: Age incidence of illness and death considered in broad disease groups, based on records for 9,000 families in 18 States visited periodically for 12 months, 1928–31. Pub. Health Rep., Apr. 12, 1935. (Reprint 1681.)
(6) ————: Age incidence of specific causes of illness, based on records for 9,000 families in 18 States visited periodically for 12 months, 1928–31. Pub. Health Rep., Oct. 11, 1935. (Reprint 1710.)
(7) ————: History and frequency of smallpox vaccinations and cases in 9,000 families, based on Nation-wide periodic canvasses, 1928–31. Pub. Health Rep., Apr. 17, 1936. (Reprint 1740.)
(8) ————: History and frequency of typhoid fever immunizations and cases in 9,000 families, based on Nation-wide periodic canvasses, 1928–31. Pub. Health Rep., July 10, 1936. (Reprint 1758.)

B. OTHER REFERENCES

(9) Annual mortality statistics for the United States, 1929 and 1930, U. S. Bureau of the Census. Government Printing Office, Washington, D. C.
(10) Annual reports of the Alabama State Board of Health.
(11) Annual reports of the California State Department of Public Health.
(12) Annual reports of the Connecticut State Department of Health.
(13) Annual report of the Illinois State Department of Health for the year ending June 30, 1930.
(14) Annual reports of the Michigan State Department of Health.
(15) Annual reports of the Mississippi State Board of Health.
(16) Annual reports of the New York State Department of Health.
(17) Annual summaries of notifiable diseases published as supplements to the Public Health Reports (*a*) in States, 1929, Supplement No. 88, and 1930, Supplement No. 104; (*b*) in large cities, 1929, Supplement No. 85, and 1930, Supplement No. 98; and (*c*) unpublished data.
(18) Collins, Selwyn D.: Age incidence of the common communicable diseases of children. A study of case rates among all children and among children not previously attacked and of death rates and the estimated case fatality. Pub. Health Rep., Apr. 5, 1929. (Reprint 1275.)
(19) Dauer, C. C.: Morbidity and mortality from diphtheria in the South. Am. Jour. of Hyg., vol. 23, no. 3, pp. 486–492 (May 1936).
(20) Doull, J. A.: Factors influencing selective distribution in diphtheria. Jour. Prev. Med., vol. 4, pp. 371–404 (September 1930).

(21) Doull, J. A., Variations in the age distributions of mortality and morbidity from diphtheria, scarlet fever, and certain other diseases in relation to latitude. Am. Jour. of Hyg., vol. 8, no. 4, pp. 633–648 (July 1928).
(22) Falk, I. S., Klem, Margaret C., and Sinai, N.: The incidence of illness and receipt and costs of medical care among representative families. Publications No. 26 of the Committee on the Costs of Medical Care, University of Chicago Press, 1933.
(23) Green, H. W., and Moorehouse, G. W.: Corrected fatality rates in public health practice. Pub. Health Rep., Jan. 24, 1930. (Reprint 1354.)
(24) Palmer, G. T., Derryberry, M., and Van Ingen, P.: Health protection for the preschool child; report to the section on medical service, White House Conference on Child Health and Protection. The Century Co., New York, 1931.
(25) Park, W. H., and Dickson, A. J.: Diphtheria. Chap. CXLI in Abt's Pediatrics, vol. 6, pp. 64–107.
(26) Park, W. H., Schroder, M. C., and Zingher, A.: The control of diphtheria. Am. Jour. Pub. Health, vol. 13, no. 1, pp. 23–32 (January 1923).
(27) Park, W. H., Williams, A. W., and Krumwiede, C.: Pathogenic microorganisms. Lea and Febiger. Philadelphia and New York, 1924.
(28) Reed, Lowell J.: Statistical treatment of biological problems in irradiation. Chap. VI of Biological Effects of Radiation, Report of a Committee of the National Research Council. McGraw Hill Book Co., 1936.
(29) Townsend, J. G.: Epidemiological study of the minor respiratory diseases by the Public Health Service. Pub. Health Rep., Oct. 24, 1924. (Reprint 966.)
(30) Wood, H. B.: Case fatality of communicable disease. Jour. Prev. Med., March 1932.

SPOTTED FEVER, EASTERN TYPE, ON VESSEL ARRIVING AT LOS ANGELES HARBOR

The S. S. *Hollywood* arrived at Los Angeles harbor (San Pedro) on December 5, 1936, from South American ports with two cases of illness on board at first suspected to be typhus fever but later diagnosed by the Los Angeles health department as spotted fever, eastern type. The patients were taken to the Los Angeles County Hospital, where they were placed in isolation. A third patient was landed from the *Hollywood* by a Coast Guard boat at San Diego. This patient died, and the case was diagnosed as pneumonia, but it is believed that it also was spotted fever.

The *Hollywood* left Buenos Aires on October 16, and touched at Santos October 22, Rio de Janeiro October 27, Bahia November 2, Para November 12, Barbados November 17, Trinidad November 18, and Balboa November 23. The first case occurred on October 31 and the last on November 19. The vessel is now in Los Angeles harbor, where it will probably remain throughout the duration of the seamen's strike. Up to December 11 no further cases had been reported among the contacts.

COURT DECISION ON PUBLIC HEALTH

City held liable for death caused by contaminated water supply.—(Vermont Supreme Court; *Boguski* v. *City of Winooski*, 187 A. 808; decided Nov. 4, 1936.) The defendant city at one time maintained a valve connection between the city water supply and a nearby river in order to assure an adequate supply of water in the event of an unusual fire. Somehow this valve was left open, thereby permitting the river water to flow into the mains which carried the water for domestic use. One Joseph Boguski contracted a case of typhoid fever which was fatal. The plaintiff, his administrator, brought this action against the defendant city, alleging that the deceased contracted typhoid by drinking from the city's water supply. In addition to proving that the river water was carried into the domestic water supply, evidence was introduced to show that the river water was polluted with colon bacilli; that typhoid bacilli are to be expected where colon bacilli are found; that milk, fruit, or shellfish could not have caused the infection in the deceased; and that at least seven of the other cases of typhoid in the city could have been caused by drinking the polluted water of the city system. On the basis of this evidence the judgment in the lower court was rendered for the plaintiff, and on appeal this judgment was affirmed by the supreme court.

The court found that the circumstantial evidence presented was sufficient to send the case to the jury, although it had not been shown by direct evidence that the river water was polluted with typhoid bacilli. The court in the course of its opinion said:

* * * The question here in issue becomes a close one, only when we have to say whether enough appears in the record to charge the Winooski River with the responsibility for the pollution. It seems clear to us that the jury was well justified in its inference that the river was the responsible agency. Not only was the inference a logical one, but it seems difficult to see how any other could have been drawn from the facts disclosed.

DEATHS DURING WEEK ENDED NOV. 28, 1936

[From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce]

	Week ended Nov. 28, 1936	Corresponding week, 1935
Data from 86 large cities of the United States:		
Total deaths	8,259	7,939
Deaths per 1,000 population, annual basis	11.5	11.1
Deaths under 1 year of age	485	499
Deaths under 1 year of age per 1,000 estimated live births	44	46
Deaths per 1,000 population, annual basis, 48 weeks of year	12.0	11.3
Data from industrial insurance companies:		
Policies in force	68,752,055	67,800,258
Number of death claims	10,421	9,984
Death claims per 1,000 policies in force, annual rate	7.9	7.7
Death claims per 1,000 policies, 48 weeks of year, annual rate	9.7	9.5

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended December 5, 1936, and December 7, 1935

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 5, 1936, and Dec. 7, 1935

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935
New England States:								
Maine	5	1	----	----	33	358	1	0
New Hampshire	----	----	----	----	2	----	0	0
Vermont	----	3	----	----	----	21	0	0
Massachusetts	4	13	----	----	282	80	3	1
Rhode Island	1	----	----	----	147	78	0	0
Connecticut	4	9	4	9	75	110	1	0
Middle Atlantic States:								
New York	33	52	[1] 7	[1] 13	224	496	8	8
New Jersey	11	23	12	20	33	16	2	2
Pennsylvania	72	81	----	----	45	109	8	2
East North Central States:								
Ohio	34	77	4	11	10	72	5	2
Indiana	20	77	33	36	12	24	4	5
Illinois	25	98	22	33	19	32	3	7
Michigan	38	26	4	5	21	32	2	3
Wisconsin	6	2	27	54	44	70	0	1
West North Central States:								
Minnesota	7	6	1	----	15	57	0	2
Iowa	2	18	----	----	6	8	2	1
Missouri	29	49	58	136	7	8	3	3
North Dakota	5	2	11	8	----	5	0	0
South Dakota	----	2	----	----	1	4	0	0
Nebraska	5	4	----	----	2	30	2	1
Kansas	16	18	1	9	14	4	1	5
South Atlantic States:								
Delaware	3	----	----	----	9	111	0	0
Maryland [2]	19	19	14	11	84	20	6	6
District of Columbia	13	33	2	3	7	3	2	2
Virginia	57	48	----	----	30	27	3	5
West Virginia	26	35	24	33	15	4	3	3
North Carolina [2]	102	73	2	13	21	5	1	2
South Carolina [2]	16	6	331	228	24	----	2	0
Georgia [2]	30	27	----	57	----	----	1	0
Florida [2]	11	19	1	2	3	----	0	0
East South Central States:								
Kentucky	35	48	15	34	3	6	7	4
Tennessee [2]	40	38	68	59	1	2	0	3
Alabama [2]	29	35	82	130	2	13	3	1
Mississippi [2 3]	12	15	----	----	----	----	1	0

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 5, 1936, and Dec. 7, 1935—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935
West South Central States:								
Arkansas	10	20	24	54	----	2	0	1
Louisiana [3]	30	33	5	7	1	34	0	0
Oklahoma [4]	11	24	69	23	8	1	1	0
Texas [3]	152	123	631	173	78	4	9	6
Mountain States:								
Montana	3	2	4	12	4	5	1	0
Idaho [6]	1	----	1	1	104	7	0	1
Wyoming	----	1	----	2	1	6	0	0
Colorado	7	6	----	----	2	8	4	1
New Mexico	7	3	1	----	13	2	1	1
Arizona	6	9	65	27	28	2	3	1
Utah [2]	1	----	4	----	20	----	1	0
Pacific States:								
Washington	2	3	----	2	7	128	1	3
Oregon	----	1	41	15	11	248	1	2
California	53	22	83	29	27	241	4	3
Total	993	1,199	1,701	1,249	1,495	2,488	110	88
49 weeks of year	26,741	35,372	151,539	114,129	279,485	713,553	7,097	5,243

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935
New England States:								
Maine	0	11	11	34	0	0	0	6
New Hampshire	0	1	1	6	0	0	0	0
Vermont	0	1	14	14	0	0	0	0
Massachusetts	0	5	129	250	0	0	1	1
Rhode Island	0	1	28	20	0	0	2	0
Connecticut	0	2	44	33	0	0	1	1
Middle Atlantic States:								
New York	2	10	400	553	0	0	9	7
New Jersey	1	4	72	110	0	0	1	3
Pennsylvania	3	5	438	519	0	0	35	6
East North Central States:								
Ohio	7	2	285	429	0	0	13	4
Indiana	0	0	197	289	3	1	2	3
Illinois	6	1	343	512	1	9	13	10
Michigan	4	0	406	291	0	1	5	1
Wisconsin	0	1	197	389	7	5	1	6
West North Central States:								
Minnesota	0	0	140	298	4	4	2	0
Iowa	1	1	92	131	10	10	0	15
Missouri	1	2	139	132	3	2	16	5
North Dakota	0	0	43	84	12	1	0	2
South Dakota	0	0	55	67	15	21	3	1
Nebraska	1	0	42	132	0	66	0	1
Kansas	0	0	196	174	10	10	2	5
South Atlantic States:								
Delaware	0	0	10	14	0	0	3	1
Maryland [3]	1	0	87	88	0	0	3	8
District of Columbia	0	0	20	12	0	0	6	2
Virginia	2	1	61	45	0	0	7	9
West Virginia	0	0	52	101	0	0	6	1
North Carolina [5]	3	5	68	87	0	1	12	8
South Carolina [3]	1	2	6	8	0	0	5	1
Georgia [3]	1	0	35	26	3	0	8	18
Florida [3]	0	0	13	5	0	0	0	3
East South Central States:								
Kentucky	1	2	54	59	0	0	9	11
Tennessee [3]	4	3	37	74	0	0	11	7
Alabama [3]	3	0	30	16	0	0	6	2
Mississippi [3 5]	1	0	19	29	1	0	7	15

See footnotes at end of table.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended Dec. 5, 1936, and Dec. 7, 1935—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935	Week ended Dec. 5, 1936	Week ended Dec. 7, 1935
West South Central States:								
Arkansas	2	0	7	14	1	0	5	8
Louisiana [4]	3	2	9	19	1	0	7	12
Oklahoma [4]	4	1	16	23	0	2	3	8
Texas [3]	7	4	190	64	1	1	42	17
Mountain States:								
Montana	0	0	37	159	25	70	3	0
Idaho [5]	0	0	36	43	1	0	2	2
Wyoming	0	0	17	141	0	2	1	0
Colorado	0	0	27	130	0	46	0	0
New Mexico	1	0	17	35	0	0	9	11
Arizona	0	0	12	24	0	0	3	0
Utah [3]	0	0	19	74	0	0	0	0
Pacific States:								
Washington	1	1	57	85	2	50	3	2
Oregon	0	0	40	63	14	2	2	5
California	7	6	220	289	4	5	11	7
Total	68	74	4,468	6,194	118	309	280	225
49 weeks of year	4,360	10,574	220,782	233,342	6,941	6,994	14,137	16,964

[1] New York City only.
[2] Week ended earlier than Saturday.
[3] Typhus fever, week ended Dec. 5, 1936, 49 cases, as follows: North Carolina, 2; South Carolina, 2; Georgia, 13; Florida, 2; Tennessee, 1; Alabama, 6; Mississippi, 3; Louisiana, 1; Texas, 19.
[4] Exclusive of Oklahoma City and Tulsa.
[5] Rocky Mountain spotted fever, week ended Dec. 5, 1936, Idaho, 1 case.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week:

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
October 1936										
Kentucky	14	130	52	19	145	----	19	208	0	137
November 1936										
Arkansas	2	46	118	124	1	----	25	50	1	35
Connecticut	----	10	13	----	178	----	2	159	0	4
Delaware	1	4	----	2	22	----	0	23	0	4
District of Columbia	8	71	5	----	11	----	0	46	0	2
Florida	3	34	10	234	1	1	7	21	0	2

October 1936

	Cases
Kentucky:	
Mumps	62
Undulant fever	12
Whooping cough	123

November 1936

	Cases
Actinomycosis:	
Connecticut	1
Chicken pox:	
Arkansas	16
Connecticut	415
Delaware	75
District of Columbia	37
Florida	16
Conjunctivitis:	
Connecticut	3
Dengue:	
Florida	1

November 1936

	Cases
Dysentery:	
Connecticut (bacillary)	8
District of Columbia (bacillary)	3
Florida	4
Encephalitis, epidemic or lethargic:	
Connecticut	1
German measles:	
Connecticut	20
Mumps:	
Arkansas	6
Connecticut	250
Delaware	8
Florida	25
Paratyphoid fever:	
Connecticut	9
Septic sore throat:	
Connecticut	6

November 1936

	Cases
Tetanus:	
Connecticut	1
Trachoma:	
Connecticut	2
Tularaemia:	
District of Columbia	1
Typhus fever:	
Florida	1
Undulant fever:	
Arkansas	6
Connecticut	8
Florida	2
Whooping cough:	
Arkansas	19
Connecticut	448
Delaware	31
District of Columbia	84
Florida	16

WEEKLY REPORTS FROM CITIES

City reports for week ended Nov. 28, 1936

This table summarizes the reports received weekly from a selected list of 140 cities for the purpose of showing a cross section of the current urban incidence of the communicable diseases listed in the table. Weekly reports are received from about 700 cities, from which the data are tabulated and filed for reference.

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Maine:											
Portland	0	------	0	0	6	0	0	1	0	1	27
New Hampshire:											
Concord	0	------	0	0	0	6	0	0	0	0	10
Manchester	0	------	0	0	1	3	0	0	0	0	15
Nashua	3	------	--------	0	-------	0	0	-------	0	0	--------
Vermont:											
Barre	0	------	0	0	0	0	0	1	0	0	3
Burlington	0	------	0	0	0	0	0	0	0	0	4
Rutland	0	------	0	0	0	1	0	0	0	0	7
Massachusetts:											
Boston	0	------	0	5	13	32	0	9	0	151	225
Fall River	0	------	0	0	2	1	0	0	0	0	--------
Springfield	0	------	0	1	0	2	0	0	0	9	23
Worcester	1	------	0	3	4	6	0	3	0	22	51
Rhode Island:											
Pawtucket	0	------	0	0	0	1	0	0	0	0	14
Providence	3	------	0	0	3	13	0	3	2	10	58
Connecticut:											
Bridgeport	0	------	0	7	3	0	0	1	0	1	41
Hartford	0	------	0	1	4	11	0	0	0	0	51
New Haven	0	------	0	0	1	2	0	2	0	4	42
New York:											
Buffalo	0	------	0	20	12	15	0	3	0	18	153
New York	19	11	2	47	104	95	0	82	3	70	1,449
Rochester	2	------	1	0	7	3	0	0	0	3	64
Syracuse	0	------	0	0	7	9	0	1	0	15	62
New Jersey:											
Camden	1	------	3	0	4	5	0	0	0	4	29
Newark	0	1	0	7	7	1	0	2	0	31	110
Trenton	0	------	1	0	2	2	0	1	0	1	26
Pennsylvania:											
Philadelphia	5	4	4	9	28	81	0	25	2	131	421
Pittsburgh	8	------	3	0	26	30	0	8	0	23	180
Reading	1	------	1	2	5	3	0	0	0	16	40
Scranton	1	------	--------	0	-------	1	0	-------	0	0	--------
Ohio:											
Cincinnati	5	------	4	1	9	5	0	10	1	16	138
Cleveland	3	8	4	2	17	38	0	15	1	39	194
Columbus	0	1	1	0	3	10	0	1	0	6	75
Toledo	1	1	1	0	2	5	0	2	1	15	47
Indiana:											
Anderson	0	------	0	1	1	2	0	1	0	1	7
Fort Wayne	1	------	0	0	2	12	0	0	0	0	24
Indianapolis	0	------	0	2	18	13	0	2	0	4	94
Muncie	0	------	0	1	0	1	0	0	0	0	16
South Bend	0	------	0	0	3	1	0	0	0	4	12
Terre Haute	2	------	0	0	0	4	0	0	0	0	28

City reports for week ended Nov. 28, 1936—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Illinois:											
Alton	0	------	0	0	0	2	0	0	0	0	4
Chicago	6	4	1	8	44	151	0	41	0	55	659
Elgin	0	------	0	0	2	0	0	0	0	10	11
Moline	0	------	0	0	1	0	0	0	0	10	9
Springfield	3	------	0	0	0	0	0	0	0	15	15
Michigan:											
Detroit	11	4	2	7	18	90	0	18	3	72	274
Flint	1	------	0	0	3	6	0	1	0	10	26
Grand Rapids	0	------	0	1	6	12	0	1	0	15	34
Wisconsin:											
Kenosha	0	------	0	0	1	5	0	0	0	2	5
Madison	0	------	------	0	------	4	0	------	0	3	21
Milwaukee	1	1	1	6	3	32	0	2	0	36	86
Racine	0	------	0	1	1	11	0	0	0	1	15
Superior	0	------	0	0	2	1	0	0	0	0	10
Minnesota:											
Duluth	------	------	------	------	------	------	------	------	------	------	------
Minneapolis	6	------	1	2	3	13	0	1	0	9	92
St. Paul	0	------	0	2	11	18	0	1	0	3	60
Iowa:											
Cedar Rapids	0	------	------	1	------	1	0	------	0	0	------
Davenport	0	------	------	0	------	2	0	------	0	0	------
Des Moines	0	------	------	0	------	10	0	------	0	0	33
Sioux City	0	------	------	0	------	5	1	------	0	1	------
Waterloo	0	------	------	0	------	2	1	------	0	6	------
Missouri:											
Kansas City	2	------	0	0	9	17	0	5	2	6	96
St. Joseph	1	------	0	0	6	6	2	1	0	0	26
St. Louis	9	------	0	3	13	30	0	7	0	17	197
North Dakota:											
Fargo	0	------	0	0	1	1	0	0	0	1	9
Grand Forks	0	------	------	1	------	0	0	------	0	0	------
Minot	0	------	0	0	0	0	0	0	0	0	7
South Dakota:											
Aberdeen	0	------	------	0	------	8	0	------	0	0	------
Sioux Falls	0	------	0	0	0	1	0	0	0	0	10
Nebraska:											
Omaha	0	------	0	0	2	3	0	0	0	3	42
Kansas:											
Lawrence	0	------	1	0	1	0	0	0	0	0	23
Topeka	0	------	0	1	2	7	0	0	0	0	13
Wichita	0	------	0	1	0	7	0	0	0	2	20
Delaware:											
Wilmington	0	------	0	0	3	0	0	0	0	5	42
Maryland:											
Baltimore	6	4	1	56	21	20	0	6	1	80	224
Cumberland	0	------	0	1	1	2	0	0	0	0	11
Frederick	0	------	0	0	0	0	0	0	0	0	5
Dist. of Col.:											
Washington	14	1	0	2	16	12	0	11	0	14	179
Virginia:											
Lynchburg	2	------	0	0	2	1	0	1	0	3	14
Norfolk	0	------	0	0	4	3	0	1	0	0	20
Richmond	1	------	0	0	1	8	0	2	0	1	49
Roanoke	2	------	0	0	2	1	0	0	1	0	14
West Virginia:											
Charleston	1	2	0	0	3	0	0	1	0	0	36
Huntington	2	------	------	0	------	4	0	------	0	0	------
Wheeling	0	------	0	1	2	1	0	1	0	1	8
North Carolina:											
Gastonia	0	------	0	0	0	0	0	0	0	0	------
Raleigh	1	------	0	0	2	1	0	2	0	0	21
Wilmington	0	------	0	0	4	0	0	0	0	0	12
Winston-Salem	1	------	0	1	2	2	0	3	0	0	16
South Carolina:											
Charleston	5	22	0	0	2	3	0	1	0	0	20
Columbia	0	------	1	0	3	0	0	1	0	0	23
Florence	1	------	0	0	0	0	0	0	0	0	2
Georgia:											
Atlanta	6	19	3	0	10	10	0	3	1	1	83
Brunswick	0	------	0	0	1	0	0	0	0	0	6
Savannah	1	27	0	1	2	3	0	1	1	1	24
Florida:											
Miami	0	2	1	0	1	0	0	1	0	1	37
Tampa	0	------	0	0	1	1	0	0	0	0	26

City reports for week ended Nov. 28, 1936—Continued

State and city	Diphtheria cases	Influenza		Measles cases	Pneumonia deaths	Scarlet fever cases	Smallpox cases	Tuberculosis deaths	Typhoid fever cases	Whooping cough cases	Deaths, all causes
		Cases	Deaths								
Kentucky:											
Ashland	1		0	0	0	1	0	0	1	0	0
Covington	0		0	0	0	2	0	0	0	0	8
Lexington	0		0	0	2	0	0	1	0	0	21
Tennessee:											
Knoxville	4	1	0	0	3	1	0	2	2	0	20
Memphis	1		2	0	6	7	0	5	0	4	82
Nashville	1		0	1	3	2	0	0	0	1	43
Alabama:											
Birmingham	5	5	2	0	4	3	0	5	0	0	72
Mobile	0	2	1	0	1	4	0	0	0	0	28
Montgomery	1		[2]	6		0	0		0	0	
Arkansas:											
Fort Smith	0			0		3	0		0	0	
Little Rock	0		0	0	2	0	0	1	0	0	6
Louisiana:											
Lake Charles	0		0	0	0	0	0	0	0	0	4
New Orleans	1	7	2	0	23	4	0	7	3	0	163
Shreveport	0		0	0	4	2	0	0	0	0	39
Oklahoma:											
Oklahoma City	2		2	0	6	1	1	0	0	0	38
Tulsa	0			0		1	0		0	0	
Texas:											
Dallas	5		0	0	11	22	0	1	0	1	62
Fort Worth	2		0	15	1	11	1	0	0	0	38
Galveston	1		0	0	3	3	0	2	0	0	22
Houston	9		1	3	6	12	0	8	3	0	81
San Antonio	1		1	0	12	0	0	3	0	1	83
Montana:											
Billings	0		0	0	0	2	0	0	0	0	7
Great Falls	0		0	0	2	0	0	0	0	2	5
Helena	0		0	0	0	1	0	0	0	0	3
Missoula	0		0	2	0	0	0	0	0	0	8
Idaho:											
Boise	0		0	0	0	1	0	1	0	0	5
Colorado:											
Colorado Springs	0		0	0	2	0	0	2	0	0	13
Denver	6		1	6	6	8	0	2	0	21	83
Pueblo	1		0	0	3	3	0	0	0	0	11
New Mexico:											
Albuquerque	0		0	0	1	2	0	6	0	0	14
Utah:											
Salt Lake City	0		0	1	7	11	0	1	0	6	40
Nevada:											
Reno											
Washington:											
Seattle	0		1	2	6	5	0	1	0	2	92
Spokane	0		0	0	6	10	0	0	0	0	32
Tacoma	0		0	0	2	2	0	0	0	0	20
Oregon:											
Portland	0		0	0	9	5	0	0	1	9	88
Salem	0			0		1	0		0	1	
California:											
Los Angeles	19	11	2	4	17	35	3	16	0	38	310
Sacramento	2	1	1	0	5	15	0	1	0	2	31
San Francisco	1	3	1	0	9	14	0	9	0	27	180

City reports for week ended Nov. 28, 1936—Continued

State and city	Meningococcus meningitis		Poliomyelitis cases
	Cases	Deaths	
Massachusetts:			
Fall River	1	0	0
Connecticut:			
Bridgeport	1	0	0
New York:			
Buffalo	2	0	1
New York	11	5	0
Pennsylvania:			
Philadelphia	1	2	0
Pittsburgh	3	2	0
Ohio:			
Cincinnati	2	0	0
Cleveland	0	0	1
Toledo	1	0	0
Indiana:			
Indianapolis	1	0	0
Illinois:			
Chicago	4	0	1
Michigan:			
Detroit	1	1	1
Wisconsin:			
Milwaukee	1	1	0
Missouri:			
Kansas City	5	0	1
St. Louis	2	0	0
Kansas:			
Wichita	1	1	0
Maryland:			
Baltimore	2	1	0
Virginia:			
Norfolk	0	1	0
West Virginia:			
Wheeling	1	0	0
North Carolina:			
Wilmington	1	0	0
South Carolina:			
Charleston	3	2	0
Georgia:			
Atlanta	0	0	2
Florida:			
Miami	0	0	1
Kentucky:			
Covington	0	1	0
Lexington	1	1	0
Tennessee:			
Memphis	0	1	0
Arkansas:			
Fort Smith	0	0	1
Louisiana:			
New Orleans	1	0	4
Oklahoma:			
Oklahoma City	2	0	0
Tulsa	0	0	3
Texas:			
Houston	1	0	0
Montana:			
Missoula	1	0	0
Idaho:			
Boise	1	0	0
Colorado:			
Colorado Springs	1	0	0
Washington:			
Spokane	1	0	1
Oregon:			
Portland	0	0	1
California:			
Los Angeles	1	0	2
Sacramento	1	0	0
San Francisco	1	0	1

Encephalitis, epidemic or lethargic: Milwaukee, 2 cases.

Pellagra.—Cases: Boston, 1; Wilmington, N. C., 2; Charleston, S. C., 2; Savannah, 1; Los Angeles, 1; San Francisco, 1.

Smallpox.—Deaths: Fort Worth, 1.

Typhus fever.—Cases: New York, 1; Charleston, S. C., 1; Atlanta, 1; Savannah, 1; Montgomery, 1.

FOREIGN AND INSULAR

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for Nov. 27, 1936, pp. 1659-1673. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued Dec. 25, 1936, and thereafter, at least for the time being, in the issue published on the last Friday of each month.

Cholera

India—Province of Orissa.—During the week ended November 28, 1936, 155 cases of cholera with 81 deaths were reported in the Province of Orissa, India.

Plague

Hawaii Territory—Island of Hawaii—Hamakua District—Paauhau Sector.—A rat found December 7, 1936, in Paauhau Sector, Hamakua District, Island of Hawaii, Hawaii Territory, has been proved plague infected.

Typhus Fever

Peru.—Typhus fever has been reported in Peru by departments, as follows: During the month of August, 1936, Arequipa, 1 case; Cuzco, 33 cases; Huancavelica, 4 cases; Huanuco, 5 cases; Libertad, 4 cases; Puno, 10 cases. During the month of September 1936, Ancash, 1 case; Arequipa, 1 case; Cuzco, 29 cases; Huanuco, 1 case; Ica, 8 cases; Junin, 2 cases; Libertad, 6 cases.

Yellow Fever

Colombia—Correction.—The report of one death from yellow fever at Puerto Wilches, Colombia, as published on page 1427 of the PUBLIC HEALTH REPORTS for October 9, 1936, is an error. A later report states that this case should have been reported as occurring in Restrepo, Intendencia of Meta, Colombia.

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