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DIPHTHERIA INCIDENCE AND TRENDS IN RELATION TO ARTIFICIAL IMMUNIZATION, WITH SOME COMPARATIVE DATA FOR SCARLET FEVER [1]

By SELWYN D. COLLINS, *Head Statistician, United States Public Health Service*

CONTENTS

One of the many catastrophies of Europe that did not occur in the United States was a tremendous diphtheria epidemic with a total in 1943 of about 630,000 reported cases in all Europe except Russia. Estimates allowing for incompleteness of reporting and nonreporting countries (except Russia) put the total at a million cases in 1943 and at least that many in 1944 (*29*).

The countries which suffered the greatest increases (*19*) in diphtheria cases were: Norway, where the annual prewar level (median 1928–38)[2] was 968 cases of diphtheria but at the height of the epidemic in 1943, there were 22,787 cases, or 24 times the prewar level. Belgium with a prewar median of 2,089 cases reported 16,072 in 1943, or 7.7 times the expectancy.

The Netherlands, with a median of 3,967 cases in prewar years, reported 56,603 cases in 1943 and 60,226 in 1944, or 14 to 15 times the prewar level in 2 consecutive years. In France the 46,539 cases in the peak year of 1943 and 40,430 in 1944 were 2.3 and 2.0, respectively, times the prewar expectancy of 19,839 cases. Denmark, how-

[1] From the Division of Public Health Methods.

[2] In some countries the mean 1935–39 level of reported cases was considerably below the median 1928–38 which is used in this discussion, but generally the two averages are of the same order of magnitude.

ever, showed only 12 percent increase in its 1944 peak of 3,333 cases over the 1928–38 median of 2,969 cases. England and Wales (except for 50,797 cases in 1941) showed an uninterrupted decrease from a prewar level of 59,319 cases to 29,446 in 1944, or just about half the prewar expectancy.

In Germany the relative increase was not as great as in some of the overrun countries, but the actual numbers of cases were higher, reaching a peak of 244,500 in 1942 for the territory included in prewar Germany, or 3.1 times the prewar level of 78,452 for the same territory. Cases in 1943 were nearly as high, 238,409, or 3.0 times the prewar level.

Southern European countries were not generally affected to the same extent as the northern countries. Austria, Bulgaria, and Hungary, at their 1943 peaks, showed, respectively, only 24, 18, and 4 percent more cases than their medians for 1928–38; Roumania and Turkey showed decreases in 1943 of 55 and 27 percent, respectively, from their prewar levels.

The neutral countries of Sweden and Switzerland also suffered large increases in diphtheria cases. Sweden increased from a 1928–38 median of 1,484 to 6,040 cases in 1944, or 4.1 times the prewar level; cases in Switzerland increased from a median of 2,188 for 1928–38 to 4,211 in 1944, or 1.9 times the prewar level.

In Norway, Sweden, and to a lesser extent in the Netherlands and Switzerland, the reported cases of diphtheria were decreasing rather rapidly so that the level for 1935–39, and particularly for 1938 and 1939, was considerably below the 1928–38 medians used as the prewar level in the above discussion. Stowman (*29*) states that the low incidence in these countries, at least in Norway and the Netherlands, was reached without the aid of extensive artificial immunization and that few countries in Europe were thoroughly immunized, Hungary being the best immunized. He concludes that the reduction of diphtheria toward the vanishing point gives rise to a dangerous situation unless it is accompanied by extensive immunization.

In Great Britain the immunization program was greatly expanded during the war years when children were being relocated in rural areas for protection against bombing. As already noted diphtheria continued to decline in England and Wales throughout the war years but in Norway and the Netherlands, where immunization was not prevalent, there was a tremendous rise in incidence.

TREND OF DIPHTHERIA IN THE UNITED STATES

In the United States as a whole there has been a rapid decline in diphtheria incidence from about 120,500 reported cases in 1924 to 14,150 in 1944, or from 106 cases per 100,000 population to about one-tenth of that figure, 10.7 in 1944. Mortality has declined at a

similar relative rate from 10,035 registered deaths in 1924 to 1,145 in 1944, or from 8.8 per 100,000 to 0.86 in 1944. However, there was some slackening in the relative rates of decline after 1940 and some cities and geographic sections showed an increased incidence in 1944 and particularly 1945, according to provisional data for the latter year. For the country as a whole the excess in reported cases over the median for corresponding months of 1940–44 has increased during 1945 until it amounted to 30 to 45 percent for the last months of the year.

Trends in certain States.—Cases and deaths from diphtheria are available in a few States for exceptionally long periods. The recorded diphtheria death rate in Massachusetts is available back to 1842, in Michigan to 1869, and in New York to 1885. If the Massachusetts mortality records are complete for the early years, which may be doubted, diphtheria was on the increase up to roughly 1880, reaching peaks of nearly 200 deaths per 100,000 total population in 1863 and again in 1876. After this second peak there was a gradual decrease until around 1925, after which the general trend declined at a markedly accelerated rate. The straight line drawn in figure 1 through the fluctuating diphtheria death rates from 1898 to 1924 indicates the approximate trend during the 27-year period just preceding the great acceleration in the decline.

Reported cases during this same quarter-century decreased very little but in 1925 the trend of the case rate began a rapid decline which paralleled that in the death rate. Aside from considerable decline a few years prior to 1900, the recorded case fatality decreased

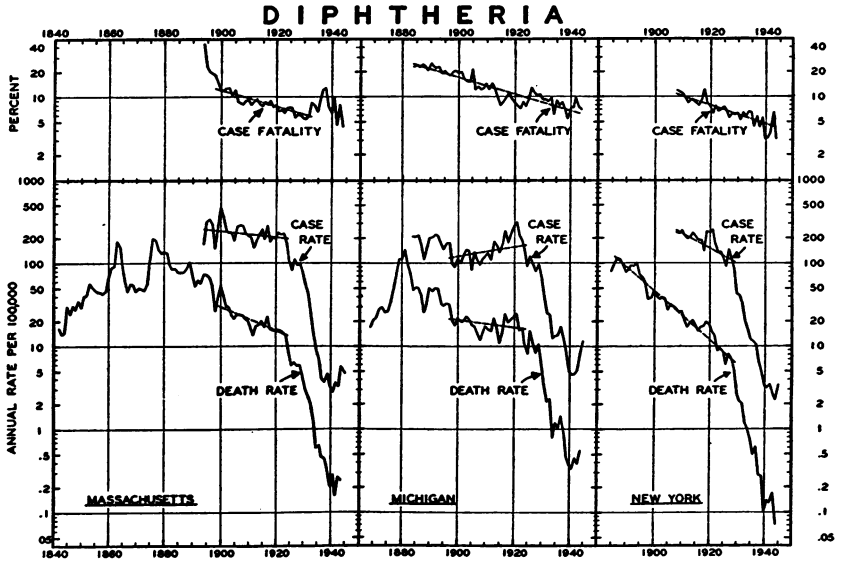

FIGURE 1.—Trend of diphtheria incidence, mortality, and case fatality in three States during 40 to 100 years ending in 1944 for deaths and 1945 (provisional) for cases. (Actual rates per 100,000 total population; deaths recorded by State registrars and cases reported to health departments (*26*, *27*, *28*, *34*).)

gradually until about 1933 when there was an increase to a maximum in 1938 followed by a decline to the approximate level of 1930. Although the rapid decline in the late nineties came at about the time when antitoxin first became available, it is based on the early years of case reporting and so may be unreliable.

Similar rates for Michigan and New York State are also plotted in figure 1. The data for Michigan are more variable, with an apparent increase in the case rate over a considerable period of years which may be due to better reporting. However, the general picture is the same, with a sharp change in the trend of the incidence and mortality from diphtheria about 1925, but with no marked change in the trend of case fatality.

New York State shows approximately the same history except that (*a*) from about 1890 to the late twenties the decline in the death rate was somewhat greater than in the two other States, and (*b*) there was some downward trend in the case rate during this early period. However, about 1929 there was a sharp break in these trends with a large acceleration in the rate of decline in both cases and deaths, but with no change in the general trend of case fatality.

Thus in these States the diphtheria death rate was declining before antitoxin came into use in the nineties and it continued to decline at a rate not very different from that in the pre-antitoxin period. During the antitoxin period from about 1895 to around 1920 there was a gradual decline in case fatality, as might have been expected with the use of better therapeutic agents. During this period the case rate remained approximately level or declined only slightly, as might have been expected, because antitoxin prevented the death of the patient but except among family contacts was not designed to prevent cases. Although active immunization was first used on humans in 1913, it was not until 1920 to 1925 that it was widely used in the general population; [3] it was in the twenties that a definite change occurred in the trend of the case incidence which was reflected in the mortality but not in case fatality.

It will be profitable to contrast these trends of diphtheria with those shown in figure 2 for scarlet fever. Before the use of the sulfa com-

[3] The Massachusetts Health Department report (*26*) for 1923 states that in 1919 less than 2,000 doses of toxin-antitoxin were distributed by the State health department. In 1920, 3,500 doses were distributed; in 1921, 10,000; in 1922, 95,000; and in 1923, 175,000 doses.

The Michigan Health Department report (*27*) for 1925–26 states that at least 200,000 children or one-fourth of the school population had been immunized against diphtheria in the preceding 2 years.

The New York State Health Department reports (*28*) from 1922 to 1926 mention immunization demonstrations in various cities; the 1926 report states that upwards of 200,000 children had been immunized during the years 1922–26, with more than 100,000 inoculated in 1926 when an organized campaign was carried on.

The New York City Health Department report (*5*) for 1920 mentions research work in Schick testing and active immunization and the setting up of a Schick-test committee. Later reports through 1927 mention the continuation of this work but it appears to be on a fairly small scale. The 1928 report speaks of the establishment of special diphtheria immunization stations and of plans to get the children into these clinics. The Diphtheria Prevention Commission began its work in January 1929. The Health Department report for 1931 states that during the 3 years 1929–31, 522,243 children were immunized.

pounds and other newer therapies (*14, 15, 25*), it was not uncommon to hear the statement that scarlet fever was declining like diphtheria even though nothing had been done about it. A comparison of figures 1 and 2 indicates that the decline in the two diseases was not alike. Although the scarlet fever death rate has been declining for many years, there is little or no break in the general trend of scarlet fever incidence. Thus, since 1920 this disease has not declined like diphtheria, for the decrease in scarlet fever has been due entirely to a declining case fatality. However, in the late thirties there is a definite acceleration in the decrease of the scarlet fever death rate [4], but again

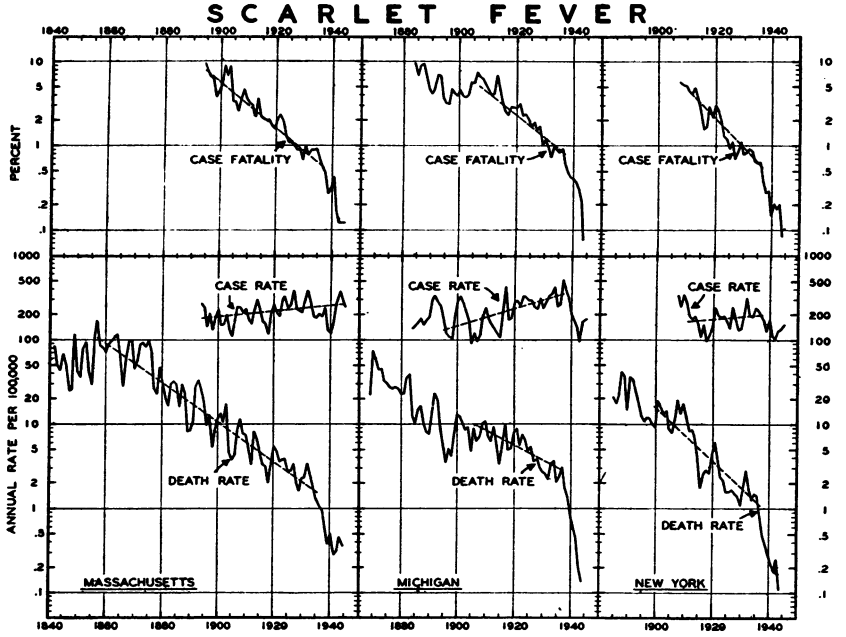

FIGURE 2.—Trend of scarlet fever incidence, mortality, and case fatality in three States during 40 to 100 years ending in 1944 for deaths and 1945 (provisional) for cases. (Actual rates per 100,000 total population; deaths recorded by State registrars and cases reported to health departments (*26, 27, 28, 54*).)

this rapid change in trend is due almost entirely to the change in case fatality. Chapin (*2*) writing in 1926 attributed the downward trend of scarlet fever mortality to a change in the virulence of the causative organism. The rapid decline which comes in the late thirties coincides with the increased use of sulfa in the treatment of scarlet fever and its complications (*25*). Since the newer methods have to do largely with the reduction of case fatality rather than the prevention [5] of cases, no change in the trend of the incidence would be ex-

[4] For the country as a whole deaths credited to scarlet fever decreased from a level of about 2,500 per year in 1933 to 1936 to about 450 per year in 1941 to 1943. The change does not appear to be due to the transfer of deaths to septic sore throat as that cause has also decreased in recent years.

[5] Although methods of immunizing against scarlet fever are available, surveys have indicated that they have not been used on a large enough scale to affect appreciably the trend of the disease (*7, 8*). Recently sulfadiazine has been used in prophylactic doses in the face of an epidemic (*21*).

pected. There is little evidence in figure 2 of any definite change in the trend of scarlet fever incidence although there is some suggestion of it in Michigan and New York.

Trends by geographic section.—The sharp change in the trend of diphtheria incidence and mortality to a definitely accelerated rate of decline at the approximate time when immunization became widely used in the general population suggests that it was an important factor in the change. It will be of interest to examine diphtheria trends in different geographic sections of the country since the extent of immunization varies considerably from State to State. Figure 3 shows trends of the reported incidence and recorded mortality from diphtheria in five geographic sections in the form of three-period moving averages of the actual rates as shown in table 1. Although the first 10 years included in this chart are based on a varying number of States in the different regions, it is believed that they represent at least a rough approximation of the sectional rate. Prior to 1922 case rates in the two northern regions were actually higher than in any other section, and the same is true of death rates prior to 1920. In the decade of the twenties the situation was reversed so that in 1930 the two northern sections and the Pacific coast had lower case rates than the South, and after 1935 had lower case rates than the Mountain region. The same is true of the death rates except that the Mountain section and particularly the South had higher diphtheria rates after 1929. In both case and death rates the Northeast, which was highest prior to 1920, was definitely the lowest after the early thirties.

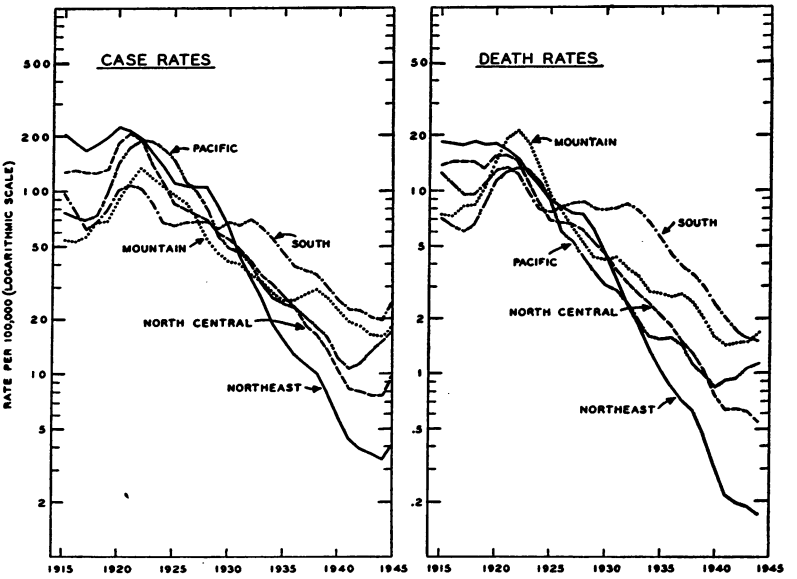

FIGURE 3.—Trend of diphtheria incidence and mortality in five geographic sections of the United States, 1915-44, with provisional case data for 1945. (3-year moving averages of actual rates per 100,000 total population as shown in table 1, with actual rates plotted for 1944 and 1945.)

These trends of rates for whole geographic sections do not show clearly the rather sudden change in the downward trend of diphtheria which appears in figure 1. Aside from the fact that the data plotted in figure 3 are three-period moving averages, the more gradual change in trend is probably due to the less homogeneous character of the situation in the sections involved. Since these regions include both urban and rural populations in parts of the country where doctors are fewer and medical services are less extensive, it is possible that

TABLE 1.—*Trend of diphtheria case and death rates* [1] *per 100,000 total population in the registration States of five geographic sections,* [2] *1914–45*

Year	Northeast		North Central		South		Mountain		Pacific	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
	Annual rate per 100,000 population									
1914	220.9	20.75	144.7	14.95	110.6	13.99	63.3	7.66	72.2	7.10
1915	207.3	18.11	117.3	13.17	97.0	12.20	64.6	7.24	88.6	7.59
1916	178.8	16.64	124.8	13.48	81.0	11.94	35.2	7.58	72.2	6.73
1917	163.7	19.41	148.2	16.66	58.1	8.83	61.8	7.26	60.3	5.21
1918	155.8	17.62	105.5	12.99	44.4	8.13	73.3	9.99	77.5	6.45
1919	218.1	18.98	124.8	13.30	99.9	12.02	67.9	8.23	80.5	8.26
1920	211.4	17.80	163.9	14.31	92.6	13.08	63.1	13.75	134.1	11.10
1921	234.9	17.71	257.5	18.76	116.6	14.32	142.6	22.51	216.2	14.69
1922	185.3	14.87	174.4	14.10	112.9	13.08	124.2	22.66	172.2	12.29
1923	161.1	12.52	146.9	11.84	79.0	9.73	132.8	19.91	182.6	12.78
1924	137.7	10.65	100.7	7.72	64.7	7.14	96.4	11.38	210.4	14.33
1925	108.8	9.04	78.5	6.32	61.4	7.46	95.3	9.30	120.0	6.79
1926	87.5	7.01	79.4	6.97	69.6	8.39	90.9	7.64	116.3	6.19
1927	122.1	8.31	78.2	7.02	72.7	8.62	72.5	7.32	107.2	5.41
1928	104.5	7.81	64.8	5.81	64.8	8.83	51.1	4.25	76.3	4.52
1929	87.6	6.48	63.6	5.80	68.0	8.35	44.2	4.41	50.7	3.39
1930	59.4	4.32	51.4	4.20	54.4	6.72	43.4	4.55	48.0	3.14
1931	43.5	2.84	51.2	3.69	79.0	8.86	35.9	3.82	48.8	2.76
1932	36.2	2.70	42.8	3.39	65.7	8.80	40.4	4.69	42.2	2.79
1933	23.7	1.61	31.6	2.62	67.1	7.89	28.2	2.91	29.3	1.76
1934	18.7	1.38	29.8	2.28	55.0	6.47	26.9	2.82	24.6	1.37
1935	15.4	1.08	31.5	2.42	45.2	5.80	28.6	2.79	25.8	1.71
1936	12.3	.75	19.4	1.64	37.4	4.37	20.8	2.76	23.6	1.64
1937	11.4	.77	17.9	1.48	35.8	3.64	27.5	2.51	19.3	1.42
1938	10.6	.64	18.7	1.40	39.3	3.74	33.6	3.00	19.6	1.24
1939	8.2	.47	13.7	1.00	31.7	3.09	26.1	1.97	15.3	.76
1940	5.2	.29	8.8	.75	19.4	2.17	19.8	1.18	12.5	1.00
1941	4.5	.19	8.7	.59	25.9	1.99	21.6	1.61	9.4	.75
1942	4.0	.17	7.4	.61	23.2	1.84	17.7	1.52	10.2	1.01
1943	3.5	.24	8.0	.73	18.6	1.40	15.0	1.31	14.4	1.12
1944	3.5	.17	7.7	.55	17.3	1.54	16.3	1.68	15.0	1.12
1945	4.0		9.6		24.6		17.9		16.7	
	Number of cases and deaths									
1924	43,737	3,381	36,282	2,781	22,761	2,512	[3] 2,914	[3] 398	14,137	963
1934	6,590	486	11,622	887	21,719	2,555	1,049	110	2,176	121
1944	1,183	58	2,998	216	7,458	663	706	73	1,805	135

[1] Rates based on cases reported to the U. S. Public Health Service by State health departments (*34*), and deaths as published by the U. S. Bureau of the Census (*32*), supplemented by State reports (*34*) for years when a State was not in the registration area. Data for 1944 and 1945 are provisional. Populations are intercensal estimates from the U. S. Bureau of the Census; after 1940 they are based on ration book registrations.

[2] Geographic sections are based on census regions as follows: *Northeast:* New England and Middle Atlantic; for cases, 6 to 8 States from 1914 to 1920, and all 9 thereafter; for deaths, all 9 States throughout. *North Central:* East and West North Central; for cases, 7 to 11 States from 1914 to 1921, and all 12 thereafter; for deaths, 9 to 11 States from 1914 to 1917, and all 12 thereafter. *South:* South Atlantic and East and West South Central; for cases, 6 to 16 States from 1914 to 1921, and all 17 thereafter; for deaths, 7 to 16 States from 1914 to 1920, all 17 thereafter except in 1926 and 1927 when Georgia was out of the registration area and figures were not available elsewhere. *Mountain:* For cases, 4 to 7 States from 1914 to 1924, and all 8 thereafter; for deaths, 5 to 7 States from 1914 to 1919, and all 8 thereafter except 1925 to 1928 when New Mexico had rates so far above any other State that it was omitted. *Pacific:* For cases and deaths, all 3 States from 1914 to 1944.

[3] Mountain States include 54 deaths for Utah in 1924, but Utah is not included in the States with case data.

the use of a new procedure like diphtheria imunization would be taken up more gradually than in more urban States like Massachusetts and New York. Also, these rates go back to only 1915 so the period prior to the beginning of immunization is not long.

A comparison of diphtheria mortality for 1939–40 in urban and rural areas combined (table 1) with rates for the same years for cities of 100,000 and over (table 11) indicates less variability from section to section in the rates for large cities. Thus for large cities the death rate for all ages in 1939–40 in the South was 3.6 times that in the Northeast, but for all places, including rural areas, the rate in the South was 6.9 times that in the Northeast. In each of the four regions[6] the rate for large cities was less than that for the section as a whole, the difference being particularly large in the South.

Trends in certain cities.—A few cities have records of diphtheria cases and deaths over long periods. The three large cities with easily

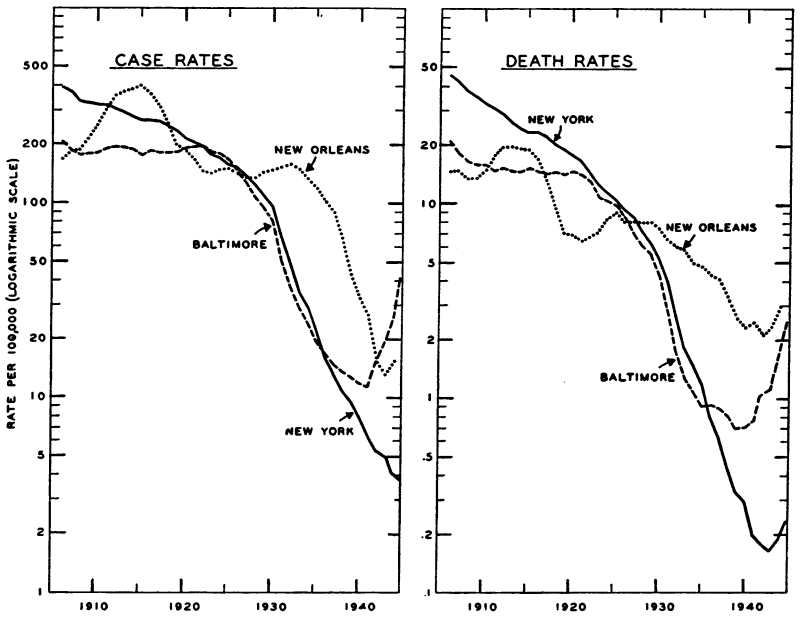

FIGURE 4.—Trend of diphtheria case and death rates in three large cities, 1906–45. (7-year moving averages of actual rates per 100,000 population, with a 5-year average for 1943, 3-year average for 1944, and the actual provisional rates for 1945 for New York and Baltimore. Data based on recorded deaths because resident deaths were available only for the last few years. Deaths recorded by city registrars and cases reported to city health departments (*4, 5, 6, 20*). New York City (6.4 percent colored in 1940) data are for total of white and colored. New Orleans (30.2 percent colored) data are for white only; Baltimore (19.4 percent colored) data are for white only but back of 1913 the death rate for white is estimated from that for the total population by ratios of white to total rate for the 6 years 1913 to 1918 which averaged 1.13. This ratio was applied to the 7-year moving averages back of 1913 to estimate the rate for white only. The case rate for white only was not available back of 1923 and was estimated in a similar way by an average of the ratios for the 6 years 1923–29, of 1.09. The ratios for both 6-year periods were based on the moving averages plotted in this figure)

[6] The two cities over 100,000 in the Mountain region did not afford sufficient data (4 deaths under 15) for reliable rates, so the Mountain and Pacific sections were combined as the West.

accessible data are New York City, Baltimore, and New Orleans.[7] In the two latter cities diphtheria rates vary greatly from year to year so they give a rather confused picture of the trend of the disease. The data plotted in figure 4 for all three cities are seven-period moving averages of the actual rates in each city. This seven-period moving average, even more than a three-period average, obscures any sharp changes in trends but does smooth out the data in a way that trends can be roughly compared. In New Orleans, as in the whole southern region shown in figure 3, the acceleration in the downward trend of diphtheria incidence began several years later than in Baltimore and New York City. The downward trend of the New Orleans curve parallels the trends in the other two cities, but the actual rates remain considerably above those in New York. Because of some slackening in the downward trend of the Baltimore incidence curve after about 1935 and actual increases in 1943, 1944, and 1945, rates in Baltimore and New Orleans were roughly the same for 1942 to 1944. Data not on the chart indicate that the incidence in New Orleans increased slightly in 1945. In New York City the decline in incidence continued through 1945.

The general trends of diphtheria death rates in the three cities are about the same as those for case incidence except that mortality in New Orleans remained above that in Baltimore and New York City from about 1929 through 1944. It may be seen that New York and Baltimore show some rise in diphtheria mortality in 1944 and 1945. Although the increase is small in terms of actual rates, it shows up as a considerable relative increase on a semilogarithmic chart like that used in figure 4. The New Orleans mortality rate was lower in 1945 than in 1944.

IMMUNIZATIONS AND TRENDS IN INCIDENCE

In view of the variation in the decline of diphtheria incidence and mortality in different parts of the country, with special reference to the lag in the South, it is of interest to consider the proportions of children of given ages in different geographic sections who have been immunized against the disease. No such data are obtainable for the general population of these regions but in a study of some years ago information of this kind is available from sample surveys in 28 cities of 100,000 or more inhabitants located in the several sections of the country (*7, 9*). The data were collected by house-to-house canvasses of families living in various census-enumeration districts of each city. In each household the informant, usually the housewife, was questioned in laymen's terminology as to whether any of the children under 25 years of age had ever been artifically immunized against

[7] A few smaller cities such as Charleston, S. C., have equally long series of such data but the population is not large enough to give much regularity to the trend of diphtheria rates.

diphtheria, and if so when the immunization was done. In the analysis the data were considered in two parts: (*a*) Immunizations done more than 12 months prior to the date of the interview, and (*b*) immunizations done during the year immediately preceding the date of the canvass, which was designated as the study year. Similar inquiries were made about cases of diphtheria and about certain other diseases and immunizations.

Data on the percentage of children of different ages who had been immunized prior to the study year have been published in considerable detail (*7*). The left section of figure 5 summarizes these percent-

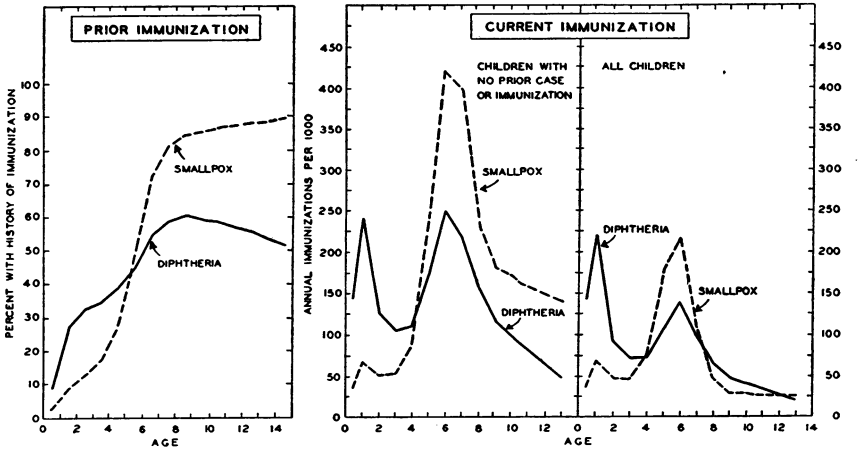

FIGURE 5.—Percentage of children of specific ages who had been immunized against diphtheria and smallpox prior to the survey, and immunization rates per 1,000 during the study year—canvassed white families in 28 large cities, 1935–36.

ages for diphtheria immunizations and smallpox vaccinations in the 28 cities combined. In the preschool ages more children had been immunized against diphtheria than smallpox but at the maximum at 8–10 years of age only about 60 percent of the children in these large cities had been immunized against diphtheria. However, many children acquire immunity to diphtheria by natural processes without a clinically recognized case. When the immunity acquired without artificial aid is taken into account, it may be computed that the 60 percent with a history of artificial immunization at the ages of 8–10 years represents some 75 to 80 percent of the children with actual immunity to diphtheria.[8] The declining percentage with a history of artificial immunization after the 8–10-year peak is presumably due to the fact that the older children passed through the ages when immunization was most actively carried out before the immunization program was as complete as at present.[9]

[8] For details of method of computation see table 2 of reference 10.

[9] Scarlet fever immunizations prior to the study were few. For the 28 cities combined, the maximum for any age was less than 3 percent, and the maximum for any age for any of the five geographic sections was 5 percent 7.

The age curve of immunizations during the study year may be considered in the same way as the age curve of the incidence of a communicable or other disease. Such data on immunizations are shown in table 2. In the right section of figure 5 are plotted for specific ages immunizations during the study year per 1,000 total children of that age, and in the middle section are plotted immunizations during the study year per 1,000 children not previously immunized or attacked. For comparative purposes similar rates of vaccination against smallpox are plotted in the same chart.

The first point on these charts (fig. 5) represents immunizations among children born during the study year, so a considerable part of their time under observation represents ages under 6 months; therefore, the average rate for the whole age group is low. The second point represents children who, at the middle of the study year, averaged 1.0 year of age; the diphtheria immunization rate based on the total children (right section) is higher at 1 year than at any other age, being considerably above the peak at the age of school entrance. However, the rate as based on children not previously immunized is slightly higher at 6 years than at 1 year of age. Apparently the times when diphtheria immunization is most likely to be done are during infancy and at school entrance; between those ages the rates for preschool children are much smaller, and after the age of school entrance immunization rates decrease rather rapidly.[10]

Vaccinations against smallpox during the study year per 1,000 total children (right section) are higher than immunizations against diphtheria from 4 to 7 and above 12 years of age. When the rates are based on children not previously vaccinated against smallpox (middle section), they are higher than similar diphtheria immunization rates at each of the ages above 4 years.

With figure 5 as a background for all cities combined, it is of more interest in connection with the present study to consider geographic variation in dipththeria immunization rates. Figure 6 shows for cities in five sections the percentage of white children who had been immunized prior to the study year, the percentage who reported a case of diphtheria prior to the study year, and immunization rates during the study year based on all children and on those not previously immunized or attacked. Since the trends of diphtheria shown in figures 3 and 4 indicate that the South and to a lesser extent the West have lagged behind other sections, immunizations in these regions are of particular interest. In the preschool ages the South ranks approximately with the North Central in the percentage of children who had been immunized prior to the study, the Northeast and West

[10] Scarlet fever immunizations during the study year amounted to about 3 per 1,000 children under 15 years of age, as compared with 72 for diphtheria immunizations. However, the relative age curves for the two types of current immunizations were similar, with high points at 1 and 6 years of age.

being below and the Intermediate section above those regions. However, for the ages 5 to 7 years the South is below all regions except the West, and above 7 years it is below all of the sections. The West, on the other hand, has the lowest percentages immunized from birth to 8 years but above that age it is in the middle with two sections below and two above. The Intermediate cities are at the top in the preschool ages but are low—next to the South—in the ages above 8 years. Considering all ages under 15 years, the South and West each had 39 percent of the children immunized, as compared with 48, 50, and 52 percent immunized in the Intermediate, Northeast, and North Central regions, respectively.

In terms of diphtheria immunizations during the study year per 1,000 children with no prior immunization or case (table 2 and fig. 6) the South is relatively high from 2 to 4 years and at 7 and older ages, but in infancy and the ages of school entrance other sections have higher rates. Considering all ages under 15 years the rate for the South is above both the West and the Northeast. The West is lowest in the preschool ages but is at the top in most of the ages above 6 years. However, it is the cumulative total of immunized children that is effective in preventing epidemics and in this respect the South is low.

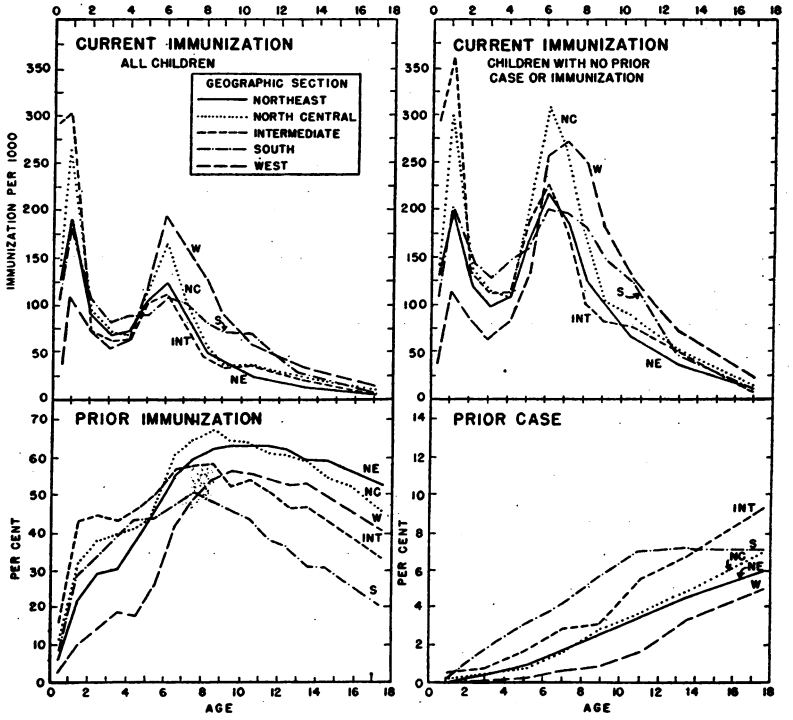

FIGURE 6.—Prior diphtheria immunizations and cases, and current immunizations among children of specific ages in five geographic sections—canvassed white families in 28 large cities, 1935–36.

Figure 6 shows also the proportion of children who, at the beginning of the study year, reported a history of a case of diphtheria at any time since birth. In this respect the South is highest and the Intermediate is next to the highest for most of the ages. The West, in spite of its low immunization rate, has a very low proportion of children with a history of an attack of diphtheria. These history data refer to white children.

TABLE 2.—*Diphtheria immunizations during the study year per 1,000 children of specific ages, in 5 geographic sections* [1]*—canvassed white families in 28 large cities, 1935–36*

Age last birthday at end of study year	All children						Children with no prior immunization or case [2]						All sections	
	All sections	Northeast	North Central	Intermediate	South	West	All sections	Northeast	North Central	Intermediate	South	West	All children	Children with no prior vaccination or case
	Annual diphtheria immunizations per 1,000 children												Smallpox vaccinations per 1,000	
Under 15	72.0	63.4	78.0	70.7	78.0	83.3	134.3	120.5	155.5	138.5	131.0	128.6	64.4	158.2
Under 1	144.1	128.9	141.7	295.3	108.6	38.9	144.1	128.9	141.7	295.3	108.6	38.9	35.4	35.4
1	219.6	191.5	267.6	304.6	186.5	110.1	240.6	203.5	301.7	361.8	204.6	113.6	66.8	68.3
2	91.4	93.3	94.9	77.6	105.7	76.2	125.9	120.0	140.2	135.9	148.1	84.7	46.6	50.1
3	71.1	71.4	74.3	63.3	84.4	56.1	104.9	99.9	117.3	114.0	129.5	64.0	46.1	52.6
4	72.5	74.4	68.7	65.1	90.1	65.2	109.9	106.9	111.0	114.0	147.9	80.8	71.9	86.0
5	107.7	107.0	117.1	102.6	91.1	108.9	174.1	168.8	197.0	189.2	161.4	133.2	176.6	240.9
6	140.1	125.1	167.6	113.1	109.2	195.2	249.9	221.0	312.0	227.7	202.0	260.3	218.0	422.4
7	99.1	89.1	101.8	76.7	101.7	164.8	217.3	189.9	258.3	181.7	199.3	275.2	111.0	398.7
8	65.5	55.0	61.4	44.8	84.6	132.9	156.6	128.8	169.8	103.2	183.9	251.5	45.8	234.0
9	47.5	40.1	39.4	34.7	73.4	92.9	116.2	103.4	104.5	83.1	150.2	185.4	30.2	181.5
10–11	38.2	26.1	37.0	37.1	68.6	58.7	88.9	66.8	88.1	78.2	126.3	130.5	26.8	162.7
12–14	22.2	15.3	24.6	22.0	28.7	35.9	47.2	36.6	53.2	44.3	47.0	72.6	26.9	140.1
Under 5	111.6	104.7	123.6	134.1	110.7	72.0	146.4	131.7	169.3	203.6	150.3	80.2	55.0	60.3
5–9	90.9	82.1	96.7	72.8	91.6	137.4	186.4	167.1	217.1	159.8	179.1	216.6	113.8	308.3
10–14	28.4	19.5	29.4	27.8	44.1	44.5	62.7	48.1	66.7	56.8	74.6	94.0	26.8	149.8
15–19	7.3	5.0	9.1	4.6	7.3	14.9	11.9	9.6	14.5	6.7	9.8	23.2	15.6	98.8
	Number of diphtheria immunizations												Number of smallpox vaccinations	
Under 15	11,424	3,768	3,549	1,555	1,359	1,193	10,881	3,605	3,325	1,498	1,306	1,147	10,225	9,436
Under 1	663	213	196	184	52	18	663	213	196	184	52	18	163	163
1	1,691	530	634	293	141	93	1,686	530	630	292	141	93	514	512
2	894	348	258	104	115	69	891	348	257	103	114	69	456	448
3	692	265	204	84	89	50	682	263	200	83	87	49	449	446
4	721	279	191	89	101	61	706	277	184	87	97	61	715	703
5	1,142	420	362	149	109	102	1,111	410	352	144	103	102	1,872	1,842
6	1,484	499	531	161	126	167	1,423	477	503	156	123	164	2,309	2,276
7	1,084	350	328	122	125	159	1,031	330	311	117	120	153	1,214	1,177
8	755	237	204	72	106	136	703	214	192	64	103	130	528	489
9	544	171	129	56	95	93	489	157	105	52	91	84	346	302
10–11	912	236	251	123	180	122	787	204	196	110	162	115	639	505
12–14	842	220	261	118	120	123	709	182	199	106	113	109	1,020	573
15–19	446	117	160	38	45	86	342	89	113	30	42	68	957	533

[1] All cities were 100,000 or over in population; those included in each section are: *Northeast:* Boston, Fall River, Buffalo, Syracuse, Newark, Trenton, Philadelphia, Pittsburgh. *North Central:* Chicago, Cleveland, Columbus, Detroit, Flint, Grand Rapids, St. Paul. *Intermediate:* Baltimore, Richmond, St. Louis. *South:* Atlanta, Birmingham, Dallas, Houston, New Orleans. *West:* Oakland, Portland, Salt Lake City, Seattle, Spokane.

[2] Few diphtheria reimmunizations were reported; among children in all sections under 15 years of age with a prior immunization, artificial immunizations during the study year amounted to 5.4 per 1,000. The rates by age were: under 5, 1.9; 5–9, 6.9; 10–14, 5.2; 15–19, 2.9.

Because of the considerable variation from year to year in diphtheria case rates, a 12-month record does not represent the typical incidence of the disease even aside from long-time trend. However, the data on the percentage of children with a prior attack of diphtheria should be supplemented with rates for the study year (table 3). In both large and small cities, diphtheria cases per 1,000 white children under 15 years of age in the South (including Intermediate) were approximately three times the corresponding rates in the North. The rates in the South are consistently high in each of the three age groups under 15 years. Data on a smaller group covered by the Communicable Disease Study make it possible to compute rates per 1,000 children not previously immunized or attacked; these data show the

TABLE 3.—*Incidence (new cases) of diphtheria and scarlet fever during the study year among white and colored persons and among residents of large and small surveyed cities, by geographic section, 1935–36*

[Communicable Disease Study and Health Survey combined]

Color, geographic section, and size of city [1]	Annual cases per 1,000 children				Number of cases [3]			
	All ages [2] under 15	Under 5	5–9	10–14	All ages [2] under 15	Under 5	5–9	10–14
	Diphtheria							
White:								
All sections:[3]								
100,000 or over	0.96	1.12	1.25	0.59	510	158	230	122
Less than 100,000	1.67	2.05	1.95	1.16	236	80	94	62
Northern cities:								
100,000 or over	.64	.84	.77	.38	241	84	101	56
Less than 100,000	.99	.88	1.32	.76	62	15	29	18
Southern cities:								
100,000 or over	2.35	2.61	3.25	1.37	237	69	114	54
Less than 100,000	2.86	3.79	3.24	1.86	168	62	64	42
Colored in cities of 100,000 or over:								
All sections [3]	1.38	1.41	1.71	1.03	96	28	42	26
Northern cities	1.02	.48	1.36	1.11	29	4	14	11
Southern cities	1.55	1.90	1.95	.91	55	19	24	12
	Scarlet fever							
White:								
All sections:[3]								
100,000 or over	11.1	8.2	16.9	7.9	5,913	1,158	3,130	1,625
Less than 100,000	9.6	6.9	14.1	7.5	1,357	270	683	404
Northern cities:								
100,000 or over	11.2	8.6	17.3	7.4	4,232	857	2,284	1,091
Less than 100,000	8.5	5.8	13.2	6.1	532	98	291	143
Southern cities:								
100,000 or over	5.8	4.6	9.6	3.1	582	122	338	122
Less than 100,000	6.1	4.7	8.7	4.8	358	77	172	109
Western cities:								
100,000 or over	20.5	11.9	28.4	19.8	1,099	179	508	412
Less than 100,000	23.5	16.9	33.1	20.1	467	95	220	152
Colored in cities of 100,000 or over:								
All sections [3]	4.2	3.7	5.9	2.9	291	73	145	73
Northern cities	7.1	6.5	9.7	4.7	201	54	100	47
Southern cities	1.7	1.2	2.4	1.4	60	12	30	18

[1] *Northern:* 15 cities listed in table 2 as in the Northeast and North Central, plus New York and Minneapolis. *Southern:* 8 cities listed as in the Intermediate and South, plus Cincinnati. *Western:* 5 cities listed as in the West, plus Los Angeles.

For machine tabulating reasons, cases and population with unknown income are excluded from the data for cities and towns of less than 100,000.

[2] Age last birthday as of end of study year.

[3] All sections includes the West. There were only 38 cases of diphtheria among white children under 15 years of age in the West, with a rate for cities over 100,000 of 0.60 (32 cases) per 1,000 canvassed population under 15 years.

same general picture of a higher incidence in southern than northern cities (table 4).

In contrast to the diphtheria situation, scarlet fever case rates during the study year were higher in the North and particularly in the West than in the South. The rates for white children in the South (including Intermediate) were consistently less than in the North and West in each of the three age groups under 15 years.[11]

Figure 6 discussed above shows the proportion of children of different ages who had been immunized prior to the study year. In considering immunizations in relation to the trend of diphtheria incidence and mortality over a period of years like that shown in figure 3, it is of interest to supplement data on the frequency of immuniza-

TABLE 4.—*Incidence (new cases) of diphtheria during the study year per 1,000 children of known immunization status—canvassed white families in 15 northern and 8 southern cities with populations of 100,000 or over, 1935–36*

Geographic section [1]	All children					Children with no prior immunization or case				
	All under 15 [2]	Under 5	5–9	10–14	15–19	All under 15 [2]	Under 5	5–9	10–14	15–19
	Annual diphtheria cases per 1,000 children									
Northern cities	0.60	0.98	0.60	0.34	0.22	1.13	1.28	1.17	0.86	0.53
Southern cities	2.36	3.46	2.90	1.16	.42	3.51	4.18	4.88	1.74	.46
	Number of diphtheria cases									
Northern cities	63	27	22	14	9	58	27	19	12	9
Southern cities	93	35	40	18	6	73	29	31	13	4

[1] *Northern:* Northeast and North Central. *Southern:* Intermediate and South—see note to table 2.
[2] Age last birthday at end of study year.

tion histories with some measure of the years since children of given ages had been immunized. The schedule used in the Communicable Disease Study provided for the recording of the age of the child at the time of immunization as well as the age at the time of the canvass; from these records it was possible to compute the average years since immunization and also the percentage of children who had been immunized a specified number of years prior to the study. Figure 7 and table 5 show data of this kind. It is seen that for children of specific ages the average time since immunization was rather consistently less in the West and South than in the Northeast and North Central, and considerably less than in the Intermediate section.

[11] The 49 diphtheria deaths among white persons under 15 years of age in the canvassed population indicate case fatalities of 7.2 and 6.1 percent in the North and South, respectively. However, the small differences between the two sections are not consistent in the three 5-year age groups; the fatality under 5 years was higher in the South but that in the other two age groups was higher in the North. The 50 scarlet fever deaths among white children under 15 years indicated case fatalities of 0.86 and 0.42 percent in the North and South, respectively.

Thus in the South, where the percentage of children immunized was relatively low, the indications are that the average period of years since immunization was also short; apparently the programs for immunizing children started more recently in the South and West than in the North and Intermediate regions. The same general facts are indicated by the proportion of immunized children in each geographic section who had been immunized for seven or more years, where the proportions for the South and West are lowest (fig. 7).

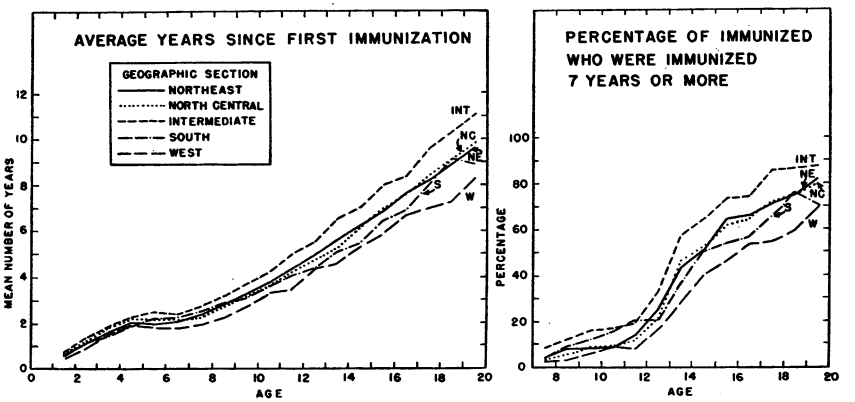

FIGURE 7.—Average years since diphtheria immunization and the proportion of immunized children of specific ages who had been immunized for seven or more years—canvassed white families in 28 large cities in five geographic sections, 1935–36.

TABLE 5.—*Average years since immunization for immunized persons of specific ages,*[1] *and percent of those immunized who had been immunized for 7 or more years—children of canvassed white household heads in 28 large cities classified by geographic sections, 1935–36*

Age last birthday at beginning of study year [1]	Mean years from immunization to time of study [1]					Percent of immunized children who had been immunized for 7 or more years before the study [1]				
	Northeast	North Central	Intermediate	South	West	Northeast	North Central	Intermediate	South	West
1	0.60	0.62	0.69	0.56	0.45					
2	1.12	1.28	1.35	1.10	.93					
3	1.64	1.84	1.87	1.43	1.50					
4	1.99	2.22	2.27	1.92	1.96					
5	1.94	2.20	2.48	2.21	1.88					
6	2.06	2.16	2.41	2.26	1.80					
7	2.34	2.29	2.73	2.54	1.94	4.4	3.2	8.2	4.0	2.2
8	2.82	2.75	3.20	2.89	2.24	7.9	5.8	12.2	8.4	3.1
9	3.27	3.19	3.74	3.18	2.71	8.1	8.5	15.9	11.8	5.4
10	3.79	3.63	4.29	3.60	3.35	8.5	9.1	16.9	15.2	8.3
11	4.36	4.24	5.02	4.08	3.49	13.8	11.8	19.3	20.0	8.0
12	4.96	4.76	5.53	4.40	4.37	24.8	21.2	32.8	20.1	15.8
13	5.66	5.33	6.53	5.08	4.65	43.2	46.0	57.0	36.5	27.8
14	6.27	6.11	7.05	5.99	5.31	50.7	52.3	64.0	50.3	39.6
15	6.87	6.99	8.05	6.43	5.95	63.9	61.2	73.0	53.2	45.2
16	7.68	7.66	8.40	6.96	6.74	65.9	64.3	73.9	56.5	53.1
17	8.22	8.46	9.60	8.05	7.03	71.0	71.8	85.2	65.0	54.2
18	8.97	9.11	10.33	9.15	7.33	74.5	75.1	86.4	75.3	59.1
19	9.65	9.88	11.09	8.93	8.33	81.1	79.4	87.4	70.3	69.1

[1] Immunization histories are recorded as of the beginning of the study year; ages are last birthday as of the same time, and years since immunization are years between immunization and the beginning of the study year. See table 2 for cities included in each section.

Correlation of diphtheria rates with percentages of children immunized.—Data are available for each of the 28 cities separately on the percentage of children of native white household heads who had been artificially immunized against diphtheria prior to the study year. Similar data for children of foreign-born household heads were not tabulated for individual cities but in all sections except the South, where the numbers of foreign-born are small, the percentages of children immunized were approximately the same for the foreign and the native white.[12] It appears logical, therefore, to use the data for the children of native white household heads as fairly representative in the matter of the extent of immunization in the respective cities. The number of diphtheria cases in the canvassed population during the study year was too small to yield reliable rates for individual cities, but cases reported to the city health departments are available. Using the percentage of children immunized in the native white canvassed population and the age-adjusted diphtheria case rate based on cases reported to the city health department (table 6), correlations were computed for the 28 cities, for 23 cities excluding the 5 southern cities, and for 23 cities excluding the 5 western cities. The correlation coefficients are shown in table 7. Some additional data were brought into the correlations: (*a*) The removal of the tonsils has been shown to be related to the incidence of diphtheria (*11, 13, 35*) so that fact, which was recorded on the schedule, was brought into the correlations; (*b*) Godfrey (*18*) indicated that with one-half or more of the children of the school ages immunized, the immunization of about one-third of the preschool children was sufficient to stop epidemics. This and other considerations led to the correlation of the diphtheria case rate with the percentage of children 5–14 years of age who had been immunized, holding constant by partial correlation the percentage of children under 5 years who had been immunized. The basic data that entered into the correlations are shown for each of the 28 cities in table 6.

Correlating the percentage of children under 15 years of age who had been immunized with the age-adjusted annual case rate for the 2 years 1935–36, the coefficient was —0.46. When the percentage of children under 15 whose tonsils had been removed was held constant, the correlation was increased only to —0.49. When the five southern cities were excluded the correlations were approximately the same, but the exclusion of the five western cities increased the coefficient to —0.59.

The correlation for the age-adjusted case rates with the percentage of children 5–14 years of age who had been immunized was —0.60 or somewhat higher than the —0.46 obtained by combining all ages under

[12] In the South the percentage of colored children immunized was less than for white children, but because of the small numbers of colored in the canvassed population this paper is based largely on white persons.

15 years. When the percentage of children under 5 years who had been immunized was held constant, the correlation was increased to −0.70. The exclusion of the five southern cities decreased these

TABLE 6.—*Percentage of children who were immunized prior to the study year and diphtheria case rates in each of the 28 surveyed cities, 1935–36*

	Children of specific ages [1] of native white canvassed household heads [2]								Diphtheria among all canvassed white children under 15 years [3]		Annual reported diphtheria cases per 1,000 persons of all ages in the total population		
	Percent immunized at beginning of study year					Percent with tonsils removed	Number of children				2 years 1935–36		6 years 1933–38
	Under 15	Under 5	5–9	10–14	5–14	Under 15	Under 5	5–14	Annual rate per 1,000	Number of cases	Age adjusted [4]	Crude	Crude
Northeast:													
Boston	43.0	14.3	54.2	57.9	56.1	30.3	3,669	8,085	36.8	13	15.2	15.2	16.1
Fall River	29.5	13.6	37.8	33.8	35.6	24.8	1,199	3,131	123.6	18	17.5	19.7	25.8
Buffalo	62.8	38.1	70.5	75.1	72.9	18.6	3,313	8,097	21.6	7	4.6	4.7	10.4
Syracuse	60.5	40.1	66.2	71.4	68.9	22.9	1,297	3,145	6.9	1	1.4	1.4	3.5
Newark	67.6	35.0	74.1	85.6	80.3	27.0	1,557	4,027	34.3	6	1.5	1.6	2.8
Trenton	49.2	13.9	55.3	67.2	61.9	21.3	1,097	3,051	37.9	4	4.7	4.8	7.1
Philadelphia	63.8	36.6	71.1	79.0	75.2	30.3	2,633	6,268	62.4	20	8.3	8.3	7.5
Pittsburgh	29.4	16.3	32.5	36.3	34.4	22.2	2,412	6,187	132.2	35	27.6	29.0	33.6
North Central:													
Cleveland	47.4	22.7	57.9	57.5	57.7	23.4	3,292	7,957	47.9	17	19.2	19.4	19.8
Columbus	16.7	9.3	20.1	19.7	19.9	21.7	1,174	2,701	133.0	15	48.0	45.7	42.5
Detroit	56.4	38.0	63.2	64.2	63.7	21.8	2,391	6,031	29.6	8	15.3	16.5	20.6
Flint	47.9	12.1	54.4	75.4	64.7	20.0	826	1,761	112.9	9	27.2	32.4	30.4
Grand Rapids	61.8	28.6	72.6	83.9	78.2	19.3	765	1,553	0	0	.3	.3	3.1
Chicago	69.8	61.8	77.5	68.7	73.1	26.2	3,533	8,767	156.7	62	21.4	20.8	15.9
St. Paul	54.1	13.5	65.7	75.1	70.6	29.3	1,166	2,867	0	0	9.6	9.6	11.1
Intermediate:													
Baltimore	56.7	47.6	62.7	58.1	60.3	27.0	2,992	7,486	29.3	9	15.5	15.8	17.8
Richmond	57.4	45.6	64.9	58.8	61.6	30.9	835	2,326	85.3	8	18.3	18.5	27.2
St. Louis	38.6	28.9	46.0	39.5	42.8	18.2	2,291	5,317	309.7	68	69.3	63.6	70.2
South:													
Atlanta	43.9	36.0	52.3	42.6	47.4	24.2	962	2,236	235.9	21	64.7	66.7	5.4
Birmingham	58.7	58.3	66.9	49.6	59.0	27.0	712	1,930	340.7	32	30.1	33.1	42.3
New Orleans	27.7	21.8	33.4	27.0	30.1	27.3	1,197	3,010	340.4	39	101.2	105.4	91.7
Dallas	52.5	40.2	66.9	49.6	57.6	29.7	1,063	2,512	209.0	22	91.2	91.2	102.0
Houston	27.7	20.8	31.9	29.9	30.9	17.2	897	1,913	224.2	21	99.9	100.9	81.5
West:													
Salt Lake City	44.0	10.5	54.4	65.6	60.0	41.3	1,201	2,498	8.7	1	5.2	6.2	7.2
Oakland	38.9	24.3	46.3	42.1	44.0	34.5	555	1,565	204.4	13	55.7	48.4	30.8
Portland	34.1	13.3	42.0	43.3	42.7	33.7	826	2,007	11.4	1	2.6	2.1	7.1
Seattle	41.2	13.1	44.5	60.7	53.7	33.6	826	1,865	0	0	2.6	2.2	4.2
Spokane	37.5	9.2	41.8	57.1	50.1	40.4	880	1,967	0	0	1.4	1.3	1.5

[1] Age last birthday at the beginning of the study year; immunization histories are recorded as of the same time.

[2] See table 1 in preceding paper (*9*) for further data about the canvassed and total population of each city.

[3] Diphtheria case rates in this column are based on the white population canvassed in the Communicable Disease Study and the Health Survey combined; in places where the percentage colored was small, the Health Survey data are for white and colored combined.

[4] Adjusted by the *indirect* method to the age distribution in 1935 of the total population of all 28 cities combined. Estimated populations for specific ages for each city in 1935 were obtained by averaging the 1930 and 1940 census populations for each age. Diphtheria case rates at specific ages per 1,000 canvassed population in the two surveys were used as standard rates and for a standard rate for all ages these rates were adjusted by the *direct* method to the age distribution of this estimated population for all 28 cities combined. Then the reported case rate for each city was adjusted by the *indirect* method as follows: The standard age-specific rates described above were multiplied by the population of the same age group for a given city to obtain an expected number of cases at all ages for that city if the age-specific rates were the same as the standard age-specific rates. This expected number of cases for all ages combined was divided by the estimated population of the city to obtain an expected rate. This expected rate for all ages was related to the standard rate (all cities combined) described above to obtain an adjustment factor which is of the nature of a percentage correction for differences in age distribution in the given city from the distribution in all cities combined. This adjustment or correction factor computed for each city is applied to the crude rate in that city to obtain its age-adjusted rate. A more detailed explanation of the process is given under the heading "Age adjusted death rates (A)" in Pearl (*24*), pp. 270–274.

correlations slightly and the exclusion of the five western cities increased them but not significantly.

To summarize, the percentage with tonsils removed prior to the study is not highly correlated with diphtheria rates during the study year in these cities. Also, the percentage of children under 5 years who had been immunized shows no correlation with age-adjusted diphtheria rates for all ages. In the whole 28 cities the percentage of children 5–14 years of age who had been immunized gives the best

TABLE 7.—*Correlation between age-adjusted reported diphtheria case rates for the 2 years 1935–36 and the percentage of children who had been immunized prior to the approximate beginning of that period—28 surveyed cities in 19 States* [1]

Items correlated or held constant	All 28 cities	23 cities (excluding 5 southern)	23 cities (excluding 5 western)
	Correlation coefficients [2]		
Age-corrected reported diphtheria case rate:			
With percent of children under 15 years who had been immunized [3]	−0.465	−0.455	−0.590
Percent of children under 15 years with tonsils removed, held constant [4]	−.488	−.515	−.588
With percent of children 5–14 years who had been immunized	−.600	−.573	−.678
Percent of children under 5 years who had been immunized, held constant [4]	−.702	−.664	−.718
With percent of children under 5 years who had been immunized	+.052	−.021	−.097
With percent of children under 15 years with tonsils removed	−.245	−.264	−.103

[1] See table 6 for detailed data for each city and the methods of tabulation and computation. Reported case rates refer to the whole city but immunization rates refer to children of native white canvassed household heads.

[2] Standard errors of the correlation coefficients are: Based on 28 items, ±0.189; based on 23 items, ±0.209.

[3] Correlation of the percentages of children under 15 years who had been immunized and the diphtheria case rate per 1,000 children under 15 years in the canvassed population in the 28 cities was −0.31. It will be noted in table 6 that the numbers of cases in this group were small.

[4] Zero order coefficients of correlations not shown in the table but entering into the computation of the partial correlations were:

(*a*) Percent of children under 5 years and 5–14 years who had been immunized: All 28 cities, +0.459; 23 cities excluding South, +0.532; 23 cities excluding West, +0.467.

(*b*) Percent of children under 15 years of age who had been immunized and percent under 15 years with tonsils removed: All 28 cities, −0.034; 23 cities excluding South, −0.142; 23 cities excluding West +0.282.

correlation with diphtheria rates when the percentage under 5 years who had been immunized is held constant, −0.70. Since the square of the correlation coefficient is a rough measure of the proportion of the total variability that is accounted for by the factors entering into the correlation, immunization apparently accounts for approximately half of the variability in the diphtheria rate in these cities.[13] The presence of correlation does not necessarily mean that immunization was the direct or causative factor—its relationship to the case rate may come through its effect upon other factors. The direct effect is a reduction in the number of Schick-positive children in the population but there may be indirect relationships to other factors such as the carrier rate (*23*) and the frequency of contact between susceptibles and diphtheria cases and carriers.

[13] The variation in the completeness of reporting of diphtheria in these cities is an uncontrolled factor but the numbers of cases recorded in the relatively small canvassed population were not sufficient in individual cities to use as a basis for rates for correlation purposes or for correcting the reported case rate for incompleteness.

The fact that there was no correlation between the case rate and the percentage of children under 5 who had been immunized suggests that more emphasis might be placed upon the Schick-test status of the child at school entrance. In a recent statement from the Baltimore City Health Department it is suggested that in addition to immunization at as early an age as possible, children entering school for the first time be given a booster dose of diphtheria toxoid unless the child has been inoculated within 3 years. This recommendation is made on the assumption that the low incidence of the disease in recent years has removed "the reinforcing stimulus necessary for maintaining immunity bestowed by toxoid given in infancy".[14] Substantially the same recommendations are made in a paper on immunizations and diphtheria in Kingston, N. Y. (*22*).

VARIATION IN DIPHTHERIA INCIDENCE AND MORTALITY

Survey data thus far presented have come largely from the Communicable Disease Study of 28 cities of 100,000 or more population. The National Health Survey covered 27 of the same cities with larger surveyed samples, and 4 other large cities and many smaller cities and towns; however, the canvassed population was heavily weighted by large cities. Although the Communicable Disease Study included specific questions about diphtheria and the National Health Survey only recorded the disease along with other causes of disabling illness, the case rates for all children under 15 years in the two surveys were similar, 1.04 per 1,000 in the 28 cities of the Communicable Disease Study as compared with 0.93 for the 31 cities of 100,000 or more in the Health Survey [15] and 1.13 for all cities and towns included in the Health Survey.

Variation with age.—Table 8 shows the age incidence of diphtheria, scarlet fever, and whooping cough, and figure 8 shows the curves on a relative basis, in the form of the ratio of the rate at each age to the rate under 15 years. Diphtheria rises rapidly to a maximum at 3 to 4 years which is maintained through the sixth year. Scarlet fever, on the other hand, rises more slowly to a maximum at 7 years with an immediate and fairly steep decline thereafter. Whooping cough has the youngest age distribution, reaching at the end of the first year of life a level which is maintained through the sixth year, but with an abrupt decline thereafter. It must be remembered that these curves represent relative age incidence and give no indication of the actual rates for the different diseases.

[14] From a communication to all physicians in Baltimore, dated Aug. 6, 1945, from Huntington Williams, Commissioner of Health, Baltimore City.

[15] Twenty-seven of the thirty-one cities are included in the Communicable Disease Study but there was no overlapping in the census enumeration districts canvassed within a city. The four additional cities were New York, Los Angeles, Cincinnati, and Minneapolis with very large samples for the first two, so exact agreement would not be expected.

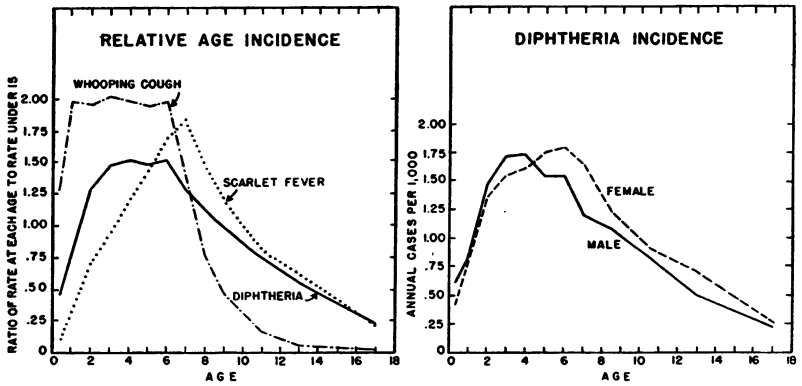

FIGURE 8.—Relative age incidence of certain communicable diseases, and diphtheria incidence among boys and girls of specific ages—canvassed white families in 84 cities and towns in 19 States, 1935–36.

TABLE 8.—*Age and sex incidence (new cases) of diphtheria, scarlet fever, and whooping cough during the study year* [1] *2,923,309 persons in canvassed white families in 84 cities and towns in 19 States, 1935–36*

[Communicable Disease Study and Health Survey combined]

Age last birthday at end of study year	Diphtheria			Scarlet fever			Whooping cough			Population	
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female	Male	Female
All ages [2]	0.33	0.30	0.36	2.94	2.96	2.91	3.8	3.8	3.8	1,411,122	1,512,187
All under 15	1.11	1.05	1.16	10.80	10.75	10.85	16.0	15.3	16.7	341,366	335,101
Under 1	.51	.60	.41	1.11	1.09	1.13	20.4	19.9	21.0	10,063	9,708
1	.81	.82	.79	3.48	3.83	3.11	31.7	30.1	33.4	16,973	16,375
2	1.42	1.48	1.35	7.55	7.47	7.46	31.2	29.3	33.3	21,565	20,805
3	1.64	1.72	1.55	10.06	10.77	9.32	32.0	31.0	33.0	21,453	20,697
4	1.67	1.73	1.61	12.81	12.17	13.47	31.7	29.5	33.9	21,939	21,164
5	1.64	1.54	1.75	15.50	15.89	15.10	31.0	28.2	33.8	22,724	22,315
6	1.67	1.54	1.79	18.22	17.49	18.97	31.5	30.9	32.2	22,702	22,294
7	1.42	1.19	1.65	19.63	19.70	19.54	22.1	22.1	22.2	23,446	23,024
8	1.12	1.13	1.11	15.69	15.39	16.00	12.4	12.2	12.5	24,694	24,249
9	1.17	1.02	1.33	12.97	12.18	13.77	7.1	6.5	7.8	24,544	24,102
10–11	.87	.83	.91	9.66	9.72	9.61	3.6	3.6	3.6	50,631	50,286
12–14	.60	.50	.70	6.65	6.75	6.54	1.0	1.0	1.0	80,632	80,082
Under 5	1.32	1.38	1.25	7.93	7.99	7.88	30.4	28.9	32.0	91,993	88,749
5–9	1.40	1.28	1.52	16.36	16.08	16.64	20.5	19.6	21.3	118,110	115,984
10–14	.70	.62	.78	7.81	7.89	7.72	2.0	2.0	2.0	131,263	130,368
15–19	.24	.22	.26	2.13	2.20	2.07	.3	.2	.3	125,950	136,212
20–24	.20	.09	.28	.74	.47	.97	.2	.1	.2	118,645	140,490
25–34	.10	.06	.15	.65	.45	.82	.2	.1	.2	233,439	265,471
35–44	.08	.06	.09	.33	.24	.41				224,906	238,485
45–54	.02	.01	.03	.09	.09	.10	.1	.03	.1	181,818	181,718
55 and over	.02			.04	.03	.04				183,685	211,294
	Number of cases										
All ages	966	429	537	8,581	4,183	4,398	11,100	5,312	5,788		
All under 15	749	360	389	7,306	3,670	3,636	10,818	5,236	5,582		

[1] The population used for under 1 year of age represents one-half of the persons born during the study, since the time they were under observation would average one-half year.

[2] All ages includes a few of unknown age. Diphtheria case rates per 1,000 for ages 8 and 9 combined are: Both sexes, 1.15; males, 1.08; females, 1.22.

The age curve of mortality in the continental United States is a useful supplement to the morbidity data.[16] Because of the inaccuracy of intercensal population estimates and a special supplementary volume on deaths in 1939 and 1940 (*30*), deaths for those years are used in relation to the 1940 census populations (table 9). The peak in the diphtheria death rate for the country as a whole comes at 2 years with a decline as age increases thereafter, which, relatively, is considerably more rapid than that in the case incidence. Although mortality is less in large cities, the peak in the rate occurs at approximately the same age.

Annual scarlet fever mortality among white persons for the same period was less than half that of diphtheria, 1.8 deaths per 100,000 persons under 15 years of age, as compared with 4.5 for diphtheria. The peak mortality of scarlet fever among white children occurs at 1 to 3 years but the relative variability of the rates with age is less than in diphtheria mortality.[17]

A comparison of diphtheria death rates of white children of specific ages in the general population in 1929–30 (*10*) with those for 1939–40 indicates that the greatest relative or percentage decline in mortality in the 10-year period occurred for the ages 10–14 years where the reduction was 82 percent, as compared with 75 percent for 15–19 years, 80 percent for 5–9 years, and 73 percent for children under 5 years. The reduction among infants under 1 year of age was 68 percent, with 72-, 73-, 75-, and 76-percent reductions for the ages 1, 2, 3, and 4 years, respectively.

Sex differences.—The right half of figure 8 shows diphtheria incidence for boys and girls. The curve for boys rises to a peak at 3 to 4 years with a rate for every age under 5 years that is larger than that for girls. The incidence for girls rises more slowly to a peak at 5 to 6 years with rates thereafter that are consistently larger than those for boys. Although not shown graphically, it may be seen in table 8 that the incidence of scarlet fever is almost identical for boys and girls. Considering all ages under 15, the rate for males is 10.7 and that for females is 10.8 per 1,000; in the specific ages the rate for girls is slightly above that for boys at one or two ages followed by one or two ages in which the reverse is true. For whooping cough the rates

[16] The decrease in diphtheria death rates has been so great that only the relative age curves for 1939–40 and 1935–36 can be compared. The few deaths in the survey of 1935–36 indicated a mortality rate of 7.2 per 100,000 children under 15 years of age, as compared with estimated rates of 10.2 and 7.8 for the continental United States in 1935 and 1936, respectively. The survey data are heavily weighted by the large cities and the mortality from diphtheria is less in large cities than in rural areas (*35*).

[17] The 49 diphtheria deaths among white persons under 15 years of age in the surveyed population indicate a case fatality of 6.5 percent. The fatality under 5 years of age was 11.3 percent (27 deaths); at 5–9, 4.6 percent (15 deaths); and at 10–14, 3.8 percent (7 deaths). There were only 5 diphtheria deaths above those ages. The 50 scarlet fever deaths among white persons under 15 years of age in the surveyed population indicate a case fatality of 0.68 percent or approximately one-tenth of the corresponding rate for diphtheria. Scarlet fever fatalities for other ages were: Under 5 years, 1.46 percent (21 deaths); 5–9 years, 0.60 percent (23 deaths); and 10–14 years, 0.29 percent (6 deaths). Only 6 deaths occurred above those ages.

TABLE 9.—*Annual diphtheria and scarlet fever mortality at specific ages in the general population of the United States* [1] *1939–40*

Age	Annual deaths per 100,000 population							Number of deaths in the 2 years				
	Both sexes			All sizes and rural				Both sexes all races		All sizes and rural		
	All cities and rural	Cities of 100,000 or over	Cities under 100,000 and rural	White			Colored, both sexes	Cities of 100,000 or over	Cities under 100,000 and rural	White		Colored, both sexes
				Both sexes	Male	Female				Male	Female	
	Diphtheria											
All ages	1.31	0.61	1.60	1.24	1.32	1.15	1.98	463	2,991	1,574	1,347	533
All under 15	4.67	2.38	5.36	4.47	4.82	4.10	6.06	366	2,711	1,419	1,166	492
Under 1 [2]	6.70	4.05	8.77	6.34	7.25	5.39	9.21	38	272	151	106	53
1	12.71	3.39	15.48	11.98	13.82	10.06	18.29	32	491	256	179	88
2	12.92	5.97	14.99	12.16	13.29	10.99	18.21	60	508	260	207	101
3	10.37	4.54	12.05	10.03	10.64	9.40	12.71	43	396	199	171	69
4	8.55	4.41	9.73	8.21	8.07	8.36	10.87	42	326	154	153	61
Under 5	10.47	4.49	12.23	9.95	10.85	9.01	14.18	215	1,993	1,020	816	372
5–9	3.39	2.36	3.70	3.38	3.51	3.24	3.50	115	610	333	297	95
10–14	.61	.63	.64	.57	.63	.52	.90	36	108	66	53	25
15–19	.25	.29	.23	.23	.18	.28	.37	19	42	20	31	10
	Scarlet fever											
All ages	.58	.40	.65	.61	.60	.62	.28	301	1,220	713	733	75
All under 15	1.70	1.49	1.77	1.83	1.82	1.84	.78	228	894	535	524	63
Under 1	1.49	1.07	1.90	1.53	1.63	1.42	1.22	10	59	34	28	7
1	3.09	2.86	3.15	3.39	3.83	2.92	.83	27	100	71	52	4
2	3.09	2.49	3.28	3.41	3.32	3.50	.90	25	111	65	66	5
3	3.02	3.49	2.89	3.28	3.21	3.35	1.29	33	95	60	61	7
4	3.09	3.05	3.10	3.15	2.88	3.44	2.67	29	104	55	63	15
Under 5	2.81	2.59	2.88	3.01	3.03	2.98	1.45	124	469	285	270	38
5–9	1.73	1.72	1.73	1.87	1.83	1.91	.74	84	285	174	175	20
10–14	.68	.35	.83	.75	.72	.78	.18	20	140	76	79	5
15–19	.41	.18	.49	.45	.41	.49	.07	12	88	45	53	2

[1] Based on Vital Statistics of the United States, pt. III, 1939–40 (*30*).
[2] 1940 census population except that the rate for under 1 year is based on the number of live births in all categories except by size of city.

for girls under 10 years are slightly but consistently higher than for boys.

In diphtheria mortality among white persons, as in case incidence, the rates in the younger ages are somewhat higher for boys than girls (table 9). At 5–9 and 10–14 years mortality is also slightly higher for boys, in contrast to case rates, but at 15 to 54 years the small rates are consistently higher for females for both mortality and incidence. Above 55 years, mortality is again higher for males. Unlike diphtheria, scarlet fever mortality shows no definite or consistent differences between the rates for males and females.[18]

[18] The 49 diphtheria deaths among white persons under 15 years of age recorded in the survey indicate case fatalities of 7.8 and 5.4 percent among boys and girls respectively; however, the differences are not consistent in the three age groups. The 50 scarlet fever deaths under 15 years of age in the surveyed group indicate case fatalities of 0.90 and 0.47 percent for boys and girls respectively, with consistently lower fatality rates for girls in the three 5-year age groups. In connection with the apparent inconsistency in scarlet fever as among incidence, mortality, and case fatality, it must be remembered that death rates quoted above are for the total United States but case fatalities are based on the relatively few deaths in a surveyed group which is heavily weighted with residents of large cities.

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Racial variation.—Negroes have traditionally been considered less susceptible than white persons to many of the communicable diseases, including diphtheria. Table 3 shows diphtheria incidence for colored and white in northern and southern cities of 100,000 or over that were covered in the survey. The 29 cases under 15 years of age among the colored in the North give rates that are somewhat higher than those for white in the ages above 5 years. However, in the South the incidence for the colored under 15 years is consistently lower than for the white. Scarlet fever incidence is consistently less among colored than white in both North and South.

Twenty-five years ago diphtheria death rates were generally less for colored [19] than white persons, and immunity as measured by the Schick test was as prevalent or more prevalent among colored than among white children (*1, 3, 12*). However, in the continental United States in 1939–40 the diphtheria death rate per 100,000 children under 15 years was 6.1 for colored as compared with 4.5 for white, with consistent excesses for the colored in the various ages up to 45 years (table 9).

Table 10 shows diphtheria mortality by years from 1930 to 1940 for white and colored of all ages in the South. Among the years 1930–34 there was only one with an excess for the white of less than 60 percent over the colored rate, but by 1940 the white rate was only 14 percent above the colored. Comparing the period 1931–33 with 1940, the white rate fell from 9.5 to 2.2 per 100,000 (76 percent) and the colored from 5.6 to 2.0 (64 percent). Thus in both actual rates and percentage

TABLE 10.—*Trend of diphtheria and scarlet fever mortality per 100,000 white and colored population of the 17 States in the 3 southern sections [1] of the United States, 1930–40*

	Year										
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
	Diphtheria										
White	7.24	9.84	9.90	8.78	7.16	6.27	5.00	4.13	4.04	3.28	2.24
Colored	5.27	5.97	5.52	5.20	4.34	4.31	3.83	2.84	2.84	2.51	1.97
	Scarlet fever										
White	1.69	2.00	1.64	1.64	1.64	1.35	1.09	0.90	0.78	0.54	0.47
Colored	.43	.44	.35	.35	.35	.32	.14	.24	.20	.17	.17

[1] South Atlantic and East and West South Central States. Population estimates and deaths from the U. S. Bureau of the Census.

[19] An examination of rates (*31*) for the decade 1910–20 indicates that diphtheria mortality was less for colored, not only for whole States where poor registration of deaths among the rural Negroes might have contributed to the deficiency for colored, but it was generally true also in large cities of both the South and the North. In many cities average rates for white persons over a considerable period were more than 50 percent in excess of those for colored, but there were a few cities where the rates were approximately the same.

declines, the advantage of the colored in diphtheria mortality seems to be disappearing.

Since so many of the colored people live in the rural South where diphtheria mortality is high, a more precise comparison can be made by limiting the data to cities over 100,000 population in the South. In this group in 1939–40, annual diphtheria deaths under 15 years per 100,000 children of those ages amounted to 4.8 for colored and 4.2 for white (table 11). Aside from a slightly lower rate for colored under 1 year of age, the few deaths indicate a small excess in the death rate for colored over that for white in each of the age groups 1–2, 3–4, 5–9, and 10–14 years.

TABLE 11.—*Annual diphtheria and scarlet fever mortality among residents of the 92 cities with populations of 100,000 or over in the different geographic sections [1] of the United States, 1939–40*

Geographic section [1]	Annual deaths per 100,000 population					Number of deaths [2] in the 2 years				
	All ages	All under 15	Under 5	5–9	10–14	All ages	All under 15	Under 5	5–9	10–14
	Diphtheria									
Northeast	0.27	1.06	2.23	1.04	0.17	85	67	42	21	4
North Central	.74	2.91	4.14	3.83	1.04	179	145	66	60	19
West	.93	2.85	5.71	1.73	1.16	80	42	28	8	6
South [3]	.98	4.34	9.65	3.15	.75	119	112	79	26	7
White	.92	4.18	9.44	3.01	.58	84	79	57	18	4
Colored	1.18	4.79	10.23	3.52	1.22	35	33	22	8	3
	Scarlet fever									
Northeast	0.29	1.01	2.02	1.09	0.17	89	64	38	22	4
North Central	.66	2.59	4.51	3.07	.49	159	129	72	48	9
West	.28	.82	.61	1.08	.77	24	12	3	5	4
South	.24	.89	1.34	1.09	.32	29	23	11	9	3
White	.24	.85	1.49	.84	.29	22	16	9	5	2
Colored	.24	1.02	.93	1.76	.41	7	7	2	4	1

[1] *Northeast:* 30 New England and Middle Atlantic cities. *North Central:* 27 East and West North Central cities; *South:* 23 South Atlantic and East and West South Central cities. *West.* 12 Mountain and Pacific cities. Population as enumerated in the Federal census of 1940.

[2] Based on Vital Statistics of the United States, Part III, 1939–40 (*10*).

[3] Diphtheria rates per 100,000 in South; under 1 year, white 11.3 (14 deaths), colored 9.6 (4 deaths); 1–2 years, white 10.1 (25 deaths), colored 12.9 (11 deaths); 3–4 years, white 7.7 (18 deaths), colored 7.9 (7 deaths).

A prior publication (*7*) indicated that in the surveyed group in the South the proportion of children of specific ages who had been immunized against diphtheria was consistently less for colored than white. It is possible that more immunization among white children has brought their death rates to lower levels than those of the colored. Death registration for both races should be reasonably complete in large cities.

In the continental United States in 1939–40 the annual scarlet fever death rate per 100,000 colored children under 15 years was 0.78, as compared with 1.83 for white, with consistent excesses for the white at each age. However, scarlet fever mortality is low in the South where the colored are concentrated; the few deaths in southern cities

with more than 100,000 population indicate that in 1939–40 the annual scarlet fever mortality for colored was 1.02 per 100,000 children under 15 years, as compared with 0.85 for white children of those ages. While the numbers (7 and 16 deaths for white and colored, respectively) are too small to have statistical significance, they suggest that underregistration in the rural areas of the South and the concentration of the Negroes in the geographic section with the lowest scarlet fever mortality may be factors in the apparently low colored rate.

Variation with urbanization.—Table 3 shows diphtheria and scarlet fever incidence in surveyed large cities as compared with towns and small cities. Diphtheria case rates in both the North and the South are rather consistently higher in the towns and small cities than in metropolitan places. However, the scarlet fever situation varies in different sections, probably indicating that there is considerable variation from year to year also.

Table 12 shows for the 2 years 1940–41 diphtheria and scarlet fever mortality in cities of different sizes and in rural areas. Considering all sections combined, the diphtheria death rate is lowest in cities of 100,000 or over with a steady progression to a rate in villages and rural areas that is 3 times that in large cities. The Northeast, East North Central, and West show small and somewhat irregular differences between rates in urban and rural areas, but the West North Central and particularly the South show higher diphtheria mortality rates in small towns and rural areas. Scarlet fever death rates are small and irregular but they tend to be somewhat higher in rural areas.

TABLE 12.—*Annual diphtheria and scarlet fever mortality among residents of cities of different sizes and rural areas, by geographic section,*[1] *1940–41*

Size of city	Annual deaths per 100,000 population						Number of deaths in the 2 years					
	All sections	Northeast	East North Central	West North Central	South	West	All sections	Northeast	East North Central	West North Central	South	West
	Diphtheria											
100,000 or over	0.49	0.20	0.61	0.46	0.80	0.84	370	62	114	25	97	72
10,000–100,000	.73	.28	.54	.52	1.56	1.00	360	51	61	20	179	49
2,500–10,000	1.21	.24	.68	1.08	2.62	.83	283	15	33	29	183	23
Rural	1.52	.25	.64	.92	2.46	1.25	1,737	42	117	138	1,296	144
	Scarlet fever											
100,000 or over	0.31	0.23	0.55	0.28	0.23	0.19	235	72	104	15	28	16
10,000–100,000	.36	.26	.59	.49	.27	.35	179	46	66	19	31	17
2,500–10,000	.52	.39	.70	.64	.49	.47	122	24	34	17	34	13
Rural	.51	.52	.85	.55	.40	.41	586	87	157	83	212	47

[1] Geographic sections: *Northeast:* New England and Middle Atlantic. *South:* South Atlantic and East and West South Central. *West:* Mountain and Pacific.

Variation with family income.—Table 13 shows diphtheria case rates during the study year among surveyed families of different income levels. Diphtheria case rates for the group of children under 15 years of age decrease consistently from 1.63 per 1,000 in relief families to 0.43 in families with annual incomes of $3,000 or above. The decline in case rates as income increases is reasonably consistent in all four age groups shown in the table. A prior publication (7) indicated that the proportions of children immunized against diphtheria were considerably greater in the higher income groups, particularly of children under 5 years of age.

TABLE 13.—*Incidence (new cases) of diphtheria and scarlet fever during the study year among persons in canvassed white families of different annual income levels in cities with populations of 100,000 or over, 1935–36*

Age last birthday at end of study year	Annual cases per 1,000 population					Number of cases				
	Relief	Nonrelief				Relief	Nonrelief			
		Under $1,000	$1,000–$1,500	$1,500–$3,000	$3,000 and over		Under $1,000	$1,000–$1,500	$1,500–$3,000	$3,000 and over
	Diphtheria									
All under 15	1.63	1.53	0.83	0.79	0.43	246	193	139	146	14
Under 5	1.84	1.79	.96	1.02	.56	75	63	45	48	4
5–9	1.93	1.92	1.16	1.01	.36	101	82	68	65	4
10–14	1.22	1.00	.42	.45	.43	70	48	26	33	6
15–19	.43	.25	.28	.14	.12	21	12	17	11	2
	Scarlet fever									
All under 15	12.9	8.4	10.4	11.1	10.6	1,938	1,057	1,746	2,066	340
Under 5	11.4	6.1	7.7	7.2	4.7	462	214	363	337	34
5–9	18.3	13.1	15.7	17.6	16.4	955	559	920	1,132	182
10–14	9.0	5.9	7.5	8.1	8.9	521	284	463	597	124
15–19	2.7	1.6	2.2	2.0	2.4	130	79	132	157	39

Aside from rather consistently higher scarlet fever rates among children in relief families, no definite income differences appear in the incidence of the disease. Among nonrelief families, the rates per 1,000 children under 15 years are about as high in the upper- as in the lower-income groups. Considering age incidence, scarlet fever rates under 5 years are roughly the same as at 10–14 years except in relief families where they are higher for the younger ages, and in families with incomes over $3,000 where the rate at 10–14 years is considerably higher than under 5 years.

ATTACK RATES AMONG NONIMMUNIZED AND IMMUNIZED CHILDREN

Table 14 shows for the Communicable Disease Study diphtheria case rates among all children and among those with no prior case or artificial immunization. The latter group would include some indi-

viduals who have acquired immunity by natural means, but in the absence of Schick tests it is the nearest approach to persons susceptible to diphtheria. If the incidence rates for the detailed ages among these "susceptibles" are applied to the numbers of children of corresponding ages in the group with a prior immunization but no prior case and the expected cases summated for children under 15 years, it is found that 120 cases would be expected if none had been previously immunized, but only 20 cases actually occurred. Computation of the standard error indicates that the 100 difference between expected and actual is statistically significant ($P=<0.0001$).

TABLE 14.—*Age incidence (new cases) of diphtheria among all children and among those with no prior immunization or case—canvassed white families in two surveys, 1935–36*

Age last birthday at end of study year	Communicable Disease Study (28 large cities)						Health Survey (83 cities and towns)		
	All children			Children with no prior immunization or case			All children		
	Case rate per 1,000	Number of cases	Population	Case rate per 1,000	Number of cases	Population	Case rate per 1,000	Number of cases	Population
All under 15	1.04	165	158,677	1.68	136	80,992	1.13	584	517,790
Under 1	.43	2	4,600	.43	2	4,600	.53	8	15,171
1	1.04	8	7,699	1.14	8	7,008	.74	19	25,649
2	1.64	16	9,782	2.12	15	7,077	1.35	44	32,588
3–4	1.88	37	19,682	2.48	32	12,926	1.59	104	65,571
5–6	1.42	30	21,190	2.07	25	12,075	1.73	119	68,845
7–9	1.09	37	33,905	2.01	27	13,442	1.28	141	110,154
Under 5	1.51	63	41,763	1.80	57	31,611	1.26	175	138,979
5–9	1.22	67	55,095	2.04	52	25,517	1.45	260	178,999
10–14	.57	35	61,819	1.13	27	23,864	.75	149	199,812
15–19	.29	18	61,262	.52	15	28,777	.23	46	200,900

Diphtheria secondary attack rates among the few children not previously immunized or attacked but exposed during the study year to another case in the household are shown in table 15. Applying the age-specific secondary attack rates for diphtheria in table 15 to children with a prior immunization but no prior case who were exposed to a case in the household during the study year, there was an expectancy of 8 diphtheria cases [20] in the 68 children under 15, as compared with 4 actual cases. While no statistical significance can be attached to these small numbers, they suggest that some children who had been artificially immunized prior to the study and might have resisted less intensive exposure did not have sufficient antitoxic immunity to withstand the intensive exposure of household contact.

Applying the age-specific diphtheria incidence rates for children with no prior immunization or case to children who had suffered an

[20] This computation is based on secondary attack rates using only one primary case per household, but the use of all cases occurring on the first day as primary cases changes the expected number of diphtheria cases only from 7.8 to 7.0. Secondary attack rates are used in 5-year age groups only.

attack of diphtheria prior to the study year, [21] there was an expectancy of 5 cases in the 3,717 children under 15 years, as compared with 8 actual cases. While the numbers are small, it may be noted that this finding is in agreement with the theory that diphtheria cases treated with antitoxin at an early stage of the disease do not result

TABLE 15.—*Secondary attack rates for diphtheria and scarlet fever among all children and among those with no prior immunization or case—canvassed white families in 28 large cities, 1935–36*

Age last birthday at end of study year	All children				Children with no prior immunization or case			
	Number of persons exposed [1] to case in household	Number attacked	Secondary attack rate per 100	Case rate per 100 in surveyed population	Number of persons exposed [1] to case in household	Number attacked	Secondary attack rate per 100	Case rate per 100 in surveyed population
	Diphtheria							
All under 15	269	30	11.2	0.104	192	25	13.0	0.168
Under 5	75	12	16.0	.151	63	12	19.0	.180
5–9	109	11	10.1	.122	71	8	11.3	.204
10–14	85	7	8.2	.057	58	5	8.6	.113
	Scarlet fever							
All under 15	2,145	505	23.5	1.24	1,919	483	25.2	1.31
Under 5	624	178	28.5	1.00	611	176	28.8	.99
5–9	824	231	28.0	1.89	733	220	30.0	2.02
10–14	697	96	13.8	.82	575	87	15.1	.89
Under 1	76	3	3.9	.07	76	3	3.9	.07
1	105	21	20.0	.47	103	20	19.4	.46
2–3	279	95	34.1	1.13	275	95	34.5	1.13
4–5	340	116	34.1	1.61	323	114	35.3	1.65
6–7	340	102	30.0	2.32	305	97	31.8	2.44
8–9	308	72	23.4	1.61	262	67	25.6	1.76
10–11	306	46	15.0	1.03	256	43	16.8	1.14
12–14	391	50	12.8	.69	319	44	13.8	.74
15–19	422	26	6.2	.21	353	25	7.1	.23
20–24	255	7	2.7	.06	220	7	3.2	.07

[1] "Exposed" means persons in attacked households minus primary cases. If 2 cases were reported as having become sick on the same day (2 or more order 1 cases), the first entry of such an order 1 case of this disease in the list of communicable diseases that occurred during the study year was used as the "primary" case. A sample tabulation indicated that the order of listing was not by age of the case. The use as primary cases of all cases with onset on the same day as the first case does not change the secondary attack rates materially and the age curve is practically the same as when all order 1 cases are used. Since the inquiry was at the end of the year, dates were not asked but only the "order" of occurrence of the cases. Cases with onset as much as 2 calendar months after the onset of the last preceding case were counted as a new series in the household.

No data are available on the use of antitoxin as a passive immunization to protect household contacts from attack.

in lasting immunity for the patient; therefore, the best medical practice is to immunize the child artificially within a few months after recovery.

The scarlet fever situation where few cases are treated with antitoxin is quite different. Applying age-specific scarlet fever incidence rates for children with no prior case or immunization to children who had suffered an attack prior to the study year, there was an expectancy of

[21] These children may or may not have had artificial immunization before or after the diphtheria case.

149 cases among the 11,454 children under 15 years, as compared with 38 actual cases, a difference which is statistically significant ($P=<0.0001$). Similarly, age-specific scarlet fever secondary attack rates of children with no prior case or immunization were applied to children with a history of a prior case who were exposed during the study year to a case in the household; the expectancy was 39 cases among the 181 children under 15 years, as compared with 10 actual cases—a difference which is statistically significant ($P=<0.0001$).

REPORTING OF COMMUNICABLE DISEASE TO HEALTH DEPARTMENTS

In the 28 large cities covered by the Communicable Disease Study, cases with onset within the study year as recorded in the family canvasses were checked by name with the files of cases reported to the city health department by attending physicians, clinics, and hospitals. Table 16 shows the results of this check for diphtheria and other communicable diseases.

Of the 227 diphtheria cases recorded in the Communicable Disease Study, 70 percent were found to have been reported to the health department, varying from 78 in the Northeast to 64 in the South. The proportion of scarlet fever cases reported was almost identical with diphtheria, the total being 73 percent. The level of reporting in the four more common diseases of whooping cough, measles, mumps, and chickenpox falls to about one-fourth of the cases, with only 15

TABLE 16.—*Percentage of cases of diphtheria and other communicable diseases recorded in the family survey that were located by name in the city health department files of reported cases—canvassed households in 28 large cities,*[1] *1935–36*

Geographic section[2]	Percentage of cases reported to health department							Total number of cases recorded in family survey which were checked against health department files[1]						
	Diphtheria	Scarlet fever	Whooping cough	Measles	German measles	Mumps	Chickenpox	Diphtheria	Scarlet fever	Whooping cough	Measles	German measles	Mumps	Chickenpox
All cities	70	73	26	27	15	23	26	227	2,315	4,065	7,450	5,295	4,851	5,902
Northeast	78	76	24	26	18	23	26	45	874	1,344	2,866	1,796	1,649	1,922
North Central	61	68	29	29	13	28	27	38	668	1,536	1,946	1,403	1,181	2,220
Intermediate	77	75	28	28	15	25	27	53	263	361	443	475	1,007	628
South:														
Total	64	67	4	9	1	1	3	83	91	392	929	719	525	400
White	68	68	6	10	1	1	3	57	84	295	749	687	373	332
Colored	54	(3)	0	6	0	0	3	26	7	97	180	32	152	68
West	(3)	76	38	38	25	30	38	8	419	432	1,266	902	489	732

[1] Cases recorded in the canvass as occurring outside of the city (while on vacation, prior to coming to the city, etc.) are excluded from the computation. The following cities where checking was not possible are also excluded: Whooping cough not reportable in Houston and Dallas; no file of cases in Atlanta and Richmond. Measles: not reportable in Houston; no file of cases in Flint for part of year. German measles not reportable in Houston. Mumps: not reportable in Buffalo, Syracuse, New Orleans, Houston, and Dallas; no file of cases in Richmond, Spokane, and Atlanta. Chickenpox: not reportable in Houston and Dallas; no file of cases in Richmond and Atlanta.

[2] See note to table 2 for cities included in each section.

[3] No percentage computed—less than 10 total cases.

percent of German measles cases reported. There are differences between the geographic sections but they are not large except for the South where not more than 10 percent of any of these five common diseases were reported, and the proportions reported for German measles, mumps, and chickenpox were 1 to 3 percent.

The results of such a check of individual names represents a minimum estimate of the completeness of reporting. Any name that was wrongly recorded on either the family survey or the physician's report to the health department may have resulted in counting the case as unreported. Moreover, a report on the family survey of a case that was not diphtheria and consequently not reported by the attending physician would also cut down the estimate of the percentage of cases reported.

Another method of calculating completeness of reporting is to estimate the total cases in each surveyed city from the canvassed family data and compare this figure with the actual reports to the health department. The cases from the Communicable Disease Study and the National Health Survey were combined for this purpose. The National Health Survey covered 27 of the 28 large cities included in the Communicable Disease Study with samples that were roughly twice the size of the Communicable Disease samples. [22] Applying this method to each of the 28 cities and adding to get totals for geographic sections, the percentage of the expected cases that were actually reported was computed. For the whole group of cities this latter method indicates that 90 percent of the diphtheria cases were reported. Thus the actual percentage reported would be estimated to lie between the 70 percent obtained by the name check and the 90 percent obtained by the estimate of total incidence. In the several sections, the estimate of the percentage reported would be from 78 to 83 percent in the Northeast; from 61 to 75 in the North Central; from 77 to 82 in the Intermediate; and from 64 to 100 in the South. [23]

IMMUNIZATIONS SINCE 1935–36

Diphtheria immunizations by or under the auspices of health departments are reported annually to the Public Health Service and the Children's Bureau.[24] Although the data are admittedly rough, sometimes representing the numbers of injections instead of the numbers of children immunized, and never distinguishing between original and second or later immunizations, they afford some approximate indication of the trend in immunizations since the time of this survey.

[22] No blocks were canvassed by both surveys, so there is no duplication of cases when the two studies are combined. Baltimore was included in the Communicable Disease Study but not in the Health Survey tabulations.

[23] In the West there were only eight cases in the name check, six of which were found; the second method indicated that nearly all of the cases were reported.

[24] The U. S. Children's Bureau kindly furnished a tabulation of current diphtheria immunizations for children of certain ages, as reported by health departments.

The most useful base for an immunization rate computed from these data seems to be the number of live births; the annual number of births represents an annual increment of unimmunized persons to the population. A correction for neonatal deaths could be made, but with these rough immunization data and no information on interstate migration, this does not seem necessary. It must be remembered also that these data refer to immunizations in both urban and rural parts of the States, whereas the survey data included in this paper refer only to cities over 100,000 in population.

The reported immunizations during the 7 years 1938–44 amounted to 49 percent of the live births within this period. By no means all persons immunized were infants under 1 year of age, but regardless of age at immunization this rate would mean that the numbers of immunizations during this period amounted to only about half of the number of unimmunized infants added to the population. In the large cities surveyed in this study, 48 percent of the children under 15 years of age had been immunized (7). If it be assumed that most of the reported immunizations were done for children under 15 years of age, and that the rate in the whole population was similar to that in the large cities, then it appears that current immunizations served only to keep up to the 1935–36 level of about half of the children having been immunized. However, it is likely that less than half of the rural children had been immunized, so it seems probable that there has been

TABLE 17.—*Current immunizations done by or under the auspices of health departments and reported to the Public Health Service and Children's Bureau, 1938–44*

Geographic section	Total 1938–44	1944	1942–43	1940–41	1938–39	Total 1938–44	1944	1942–43	1940–41	1938–39
	Annual current immunizations [1] at all ages per 100 live births					Number of immunizations [1] of all ages done in specified period (in thousands)				
All sections	49.0	42.0	50.5	47.3	53.6	8,233	1,196	2,817	2,021	2,200
Northeast	28.9	23.1	29.0	30.5	32.9	908	143	357	205	203
North Central	41.0	35.3	49.2	35.7	39.6	2,102	294	815	464	530
South	63.1	53.1	64.0	61.0	70.4	4,126	558	1,298	1,089	1,181
Mountain	68.3	59.1	68.8	61.6	80.1	454	61	139	113	141
Pacific	48.4	57.1	45.2	45.3	49.8	643	140	208	150	145
	Percent of current immunizations done for children under 5 years of age					Percent of current immunizations done for children under 1 year of age				
All sections	42.0	42.3	41.6	43.2	41.0	12.7	13.4	12.7	13.5	11.7
Northeast	48.1	51.2	46.8	46.0	50.5	18.7	21.3	18.6	18.2	17.7
North Central	25.1	28.3	27.3	23.2	21.9	4.9	5.7	6.1	3.6	4.0
South	51.7	52.4	51.2	53.8	50.0	17.0	17.9	16.9	18.4	15.4
Mountain	34.0	31.5	36.6	36.5	30.4	6.8	8.4	7.5	7.1	5.3
Pacific	31.0	26.7	32.4	32.2	31.8	5.5	5.6	5.3	6.1	5.2

[1] Excludes a few immunizations of unknown age. Because no reports were available for certain years, the following States are not included: Massachusetts, all periods; Pennsylvania, prior to 1942; Missouri, 1940–41.

considerable increase in the proportions immunized since this canvass was made.

Total immunizations as reported by health departments per 1,000 live births have been computed by geographic section for 4 periods: 1938–39, 1940–41, 1942–43, and 1944 (table 17). Although no definite trend is seen, it is true that in each section except the Pacific the immunization rate was less in 1944 than that for the 7 years combined. Comparing the geographic sections for all years combined, the rates in the South and Mountain sections were considerably above the other three; but in 1944 the rate for the Pacific section was nearly as high. The low rate in the Northeast may reflect the high proportion of children already immunized in that section rather than a lagging in immunizations.

There is considerable difference in the ages at which immunizations were done in the several sections. Taking the 7 years as a whole, 52 percent of the immunizations reported by health departments in the South were done when the child was under 5 years of age, with 17 percent under 1 year of age. In 1940–41, 54 percent of the immunizations in the South were done below 5 years of age. The section which most nearly approaches this record is the Northeast with a total of 48 percent under 5 years and 19 percent under 1 year, with 51 percent under 5 and 21 percent under 1 year in 1944.

To summarize, these reports from health departments on immunizations appear to indicate that the South and Mountain regions, where the decreases in case and death rates are lagging behind other sections, are currently doing more immunization work which tends to bring them nearer the immunization status of other geographic sections.

WHERE CURRENT IMMUNIZATIONS IN SURVEYED POPULATION WERE DONE

Considering all white surveyed children under 15 years in all geographic sections, 56 percent of the current diphtheria immunizations were reported as having been done in public clinics. For children under 5 years old, the figure was 44 percent in clinics, but in both the school ages of 5–9 and 10–14, 64 percent of the immunizations were done in clinics, dropping back to 53 percent at 15–19 years and 42 percent for adults aged 20 years and above. While there are variations, this general picture of more immunizations in clinics at the school ages is repeated in each geographic section (table 18).

Considering white children of all ages under 15 years, the West is at the top with 66 percent of the immunizations done in clinics, and the South at the bottom with 45 percent. Some confusion in reporting may have resulted from the practice in local health departments of doing immunizations upon request rather than in a formal clinic, or of

the health department furnishing the toxoid at a nominal price to private practitioners who do the immunizing.

Economic status plays an important part in the matter of who does the immunizations. Among families on relief during the study year, 71 percent of the diphtheria immunizations of children under 15 years of age were done in clinics, and among nonrelief families with less than

TABLE 18.—*Percentage of diphtheria and scarlet fever immunizations during the study year that were done in public clinics, by color, geographic section, and income—canvassed families in 28 large cities, 1935–36*

Geographic section, annual family income, and color	Percent of immunizations done in public clinics [1]					Total number of immunizations during year [2]				
	All ages under 15 [3]	Under 5	5–9	10–14	15–19	All ages under 15 [3]	Under 5	5–9	10–14	15–19
	Diphtheria									
All incomes:										
White:										
All sections	56.1	44.2	64.5	63.6	52.9	11,523	4,701	5,064	1,758	454
Northeast	52.8	42.8	62.6	52.6	46.6	3,778	1,637	1,684	457	118
North Central	58.6	43.8	68.7	70.9	61.4	3,578	1,496	1,570	512	166
Intermediate	60.3	51.1	67.4	72.4	51.3	1,565	758	565	242	39
South	44.6	40.4	46.7	47.6	46.7	1,367	499	568	300	45
West	66.2	43.5	71.9	78.4	48.8	1,235	311	677	247	86
Colored:										
All sections [4]	71.8	76.3	72.6	64.8	67.5	1,762	578	729	455	80
North	68.0	62.7	69.7	73.6	64.7	678	236	317	125	34
South	74.1	85.7	74.8	61.4	69.6	1,074	336	409	329	46
All geographic sections:										
White:										
Relief	71.2	71.0	72.4	68.2	68.0	2,468	822	1,177	469	122
Under $1,000	65.2	60.1	68.3	67.5	61.6	1,948	695	890	363	86
$1,000–$1,500	58.0	46.4	66.6	66.1	41.7	3,387	1,427	1,503	457	108
$1,500–$3,000	42.2	26.4	56.1	55.6	43.8	3,266	1,519	1,335	412	121
$3,000 and over	20.6	6.8	34.3	40.8	42.9	389	206	134	49	14
Colored:										
Relief	73.6	75.8	73.8	71.0	65.8	956	293	404	259	38
Nonrelief	69.7	77.3	71.1	56.6	69.0	803	282	325	196	42
	Scarlet fever									
All incomes:										
White:										
All sections	36.6	29.2	39.2	40.0	36.1	467	130	237	100	83
Northeast	45.3	46.2	44.7	46.2	25.0	181	52	103	26	16
North Central	37.3	21.4	38.0	51.2	57.1	177	42	92	43	28
South and Intermediate	23.1	33.3	15.4	18.2	-------	39	15	13	11	10
West	20.0	-------	34.5	20.0	34.5	70	21	29	20	29
All geographic sections:										
White:										
Relief	60.5	35.7	62.2	70.0	61.1	81	14	37	30	18
Under $1,000	60.7	52.6	61.5	72.7	55.6	56	19	26	11	9
$1,000–$1,500	45.5	46.9	48.1	30.8	23.1	99	32	54	13	13
$1,500–$3,000	22.2	16.3	26.4	19.4	25.0	171	49	91	31	36
$3,000 and over	8.6	-------	14.3	6.7	28.6	58	15	28	15	7

[1] The total immunizations under 15 years tabulated as done by clinics include 177 for diphtheria and 1 for scarlet fever reported as done by nurses, presumed to be in clinics or representing schools and health departments.

[2] In this table a second series of inoculations within the one study year is counted as a second immunization; in other tables immunizations refer to children receiving one or more series of inoculations of a given kind.

[3] Age last birthday as of end of study year.

[4] All sections includes the few colored in the West. For colored, *North:* Northeast and North Central; *South:* South and Intermediate.

$1,000 annual income, the figure was 65 percent, as compared with 21 percent for families with incomes of $3,000 or over. Among children under 5 years in families with incomes of $3,000 or above, only 7 percent of the current immunizations were done in public clinics, but at the school ages of 5–9 and 10–14 years the figures were 34 and 41 percent, respectively.

Among colored children under 15 years of age 72 percent of the current diphtheria immunizations were done in public clinics, as compared with 56 percent among white children. The figure for colored children in northern cities (Northeast and North Central) was 68 percent as compared with 74 percent for southern cities (South and Intermediate). In the South the proportion done in clinics was 77 percent for children in colored families on relief, and 71 percent for those not on relief; in the North the corresponding figures were 69 and 67 percent, respectively.

Scarlet fever immunizations during the study year amounted to about 3 per 1,000 white children under 15 years of age, as compared with 72 for diphtheria immunizations. For the whole surveyed population under 15 years of age, 37 percent of scarlet fever immunizations were done in clinics, as compared with 56 percent for diphtheria; the lower percentages for scarlet fever were true for each income group.

SUMMARY

An examination of the trend of diphtheria and scarlet fever incidence, mortality, and case fatality in certain States indicates a sharp break in diphtheria incidence and mortality between 1925 and 1930 with no marked change in the trend of case fatality. Scarlet fever mortality and case fatality have shown regular declines, but case incidence has shown no change or a slightly upward trend. Thus the decline in diphtheria mortality has resulted from a decrease in case incidence, but the decline in scarlet fever mortality has resulted from a decrease in case fatality.

An examination of the trend of diphtheria incidence and mortality in different geographic sections indicates that the decline in both cases and deaths has been slower in the Southern and Mountain States than in other sections. Prior to about 1925 diphtheria incidence and mortality was higher in the North than in the South, but after about 1930 rates in the South were definitely above other sections.

Data on the proportion of children of specific ages who had been immunized against diphtheria were collected in a house-to-house canvass in 28 large cities some years ago. It was found that the proportion of children of specific ages who had been immunized was less in the South than in other sections, particularly among children of the school ages. An analysis of the years since first immunization

indicated that, on the average, the immunized children in the South had been immunized for a shorter period than in other sections, indicating that the procedure got under way at a later date in the South.

The number of cases of diphtheria in the relatively small surveyed population was not sufficient for reliable rates but incidence based on cases reported to health departments was computed for each of the 28 surveyed cities. Using the proportion of children who had been immunized as obtained in the survey and these reported case rates, it was found that there was considerable correlation between diphtheria incidence and the proportion immunized. The correlation was −0.70 between reported diphtheria incidence (adjusted for age) and the proportion of children of the ages 5–14 who had been immunized, with the proportion of children under 5 years who had been immunized held constant.

Certain types of data not readily available outside of surveys have been summarized. Diphtheria incidence was higher for boys than girls in the several ages under 5 years but above 5 years the incidence was consistently higher for females. In contrast there were no consistent sex differences in the incidence of scarlet fever.

Some years ago diphtheria case and death rates were rather consistently lower for Negroes than white persons. Considering all of the surveyed cities of 100,000 or over, the incidence among Negroes was greater than among the white, but this was not true in the South. In the matter of mortality, the Negro diphtheria rates for the country as a whole and for cities of 100,000 or over in the South are all rather consistently higher in the several ages than the corresponding rates for white children.

Information reported to Federal agencies by health departments indicates no great change in the annual numbers of diphtheria immunizations done over the past 7 years, although there is a suggestion of some drop in 1944. The South shows rather consistently higher current immunization rates than other sections, with a consistently higher proportion of the immunizations done for children under 5 years of age. However, diphtheria incidence and mortality are still high in the South, particularly in the rural areas.

A check by name on the reporting of diphtheria cases to health departments of the surveyed cities indicated that about 70 percent were reported, varying in the different sections from 64 in the South to 78 in the Northeast. The level of reporting of scarlet fever was approximately the same but for the more common childhood diseases of whooping cough, measles, mumps, and chickenpox, only about one-fourth of the cases were reported. Other methods of estimating the completeness of reporting indicate somewhat higher percentages of diphtheria cases reported to health departments, particularly in the South.

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DEATHS DURING WEEK ENDED JANUARY 19, 1946

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

	Week ended Jan. 19, 1946	Corresponding week, 1945
Data for 93 large cities of the United States:		
Total deaths	10,401	9,656
Average for 3 prior years	10,091	
Total deaths, first 3 weeks of year	33,999	29,354
Deaths under 1 year of age	577	658
Average for 3 prior years	655	
Deaths under 1 year of age, first 3 weeks of year	1,832	1,911
Data from industrial insurance companies:		
Policies in force	67,111,222	66,938,620
Number of death claims	16,659	12,974
Death claims per 1,000 policies in force, annual rate	12.9	10.1
Death claims per 1,000 policies, first 3 weeks of year, annual rate	11.1	9.9

PREVALENCE OF DISEASE

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

UNITED STATES

REPORTS FROM STATES FOR WEEK ENDED JANUARY 26, 1946

Summary

The incidence of influenza declined during the week in all sections of the country except that in the East North Central area, which reported 350 cases as compared with 347 last week. A total of 14,481 cases was reported for the country as a whole, as compared with 21,110 for the preceding week and a 5-year (1941–45) median of 4,899. Of the 12 States reporting more than 200 cases each, only 4 reported increases. These States (Georgia, Oklahoma, Colorado, and California) reported an aggregate for the week of 1,334 cases, as compared with 1,067 last week. The other 8 States, all in the South Atlantic, South Central, and Mountain areas, reported an aggregate of 11,837 cases, as compared with 17,322 for the preceding week. The total to date this year is 116,267 as compared with 17,103 and 261,981, respectively, for the corresponding periods in 1945 and 1944, and a 5-year median of 17,421. For the 10-week period to date since November 18, 1945, a total of 454,833 cases has been reported, as compared with 587,193 and 32,620, respectively, for the corresponding periods of 1943–44 and 1944–45.

For other diseases included in the table, the totals for the first 4 weeks of the year (last year's figures in parentheses) are as follows: Anthrax 4 (5), diphtheria 1,724 (1,384), the dysenteries (combined) 2,110 (3,617), infectious encephalitis 31 (23), leprosy 1 (6), measles 20,285 (5,362), meningococcus meningitis 907 (953), poliomyelitis 210 (147), scarlet fever 10,939 (18,976), smallpox 29 (34), tularemia 104 (133), typhoid fever 169 (208), endemic typhus fever 246 (292), undulant fever 254 (268), whooping cough 7,336 (8,985).

A total of 10,157 deaths was recorded for the week in 93 large cities of the United States, as compared with 10,401 last week, 9,734 and 10,068, respectively, for the corresponding weeks of 1945 and 1944, and a 3-year (1943–45) average of 10,024. The total to date this year is 44,156, as compared with 39,088 for the same period last year.

Telegraphic morbidity reports from State health officers for the week ended Jan. 26, 1946, and comparison with corresponding week of 1945 and 5-year median

In these tables a zero indicates a definite report, while leaders imply that although none was reported cases may have occurred.

Division and State	Diphtheria			Influenza			Measles			Meningitis, meningococcus		
	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45
	Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945	
NEW ENGLAND												
Maine	3	3	0	1	------	1	27	2	34	2	1	1
New Hampshire	0	1	0	2	------	------	5	------	9	1	0	0
Vermont	0	1	1	53	------	------	3	------	19	1	0	0
Massachusetts	0	3	3	------	------	------	181	60	341	2	3	4
Rhode Island	0	0	0	2	------	------	1	------	22	1	0	1
Connecticut	1	2	1	43	7	14	27	38	107	3	2	2
MIDDLE ATLANTIC												
New York	11	8	12	[1] 28	[1] 3	[1] 14	993	57	[1] 928	25	27	27
New Jersey	6	1	4	32	3	24	67	14	431	7	4	4
Pennsylvania	14	12	8	16	1	1	738	42	1,272	16	17	15
EAST NORTH CENTRAL												
Ohio	40	8	8	31	7	15	59	22	152	10	12	5
Indiana	21	6	8	104	14	50	71	8	126	4	3	3
Illinois	6	3	14	14	1	13	556	45	273	24	16	7
Michigan [2]	13	19	6	8	2	2	628	18	141	9	3	3
Wisconsin	1	1	1	193	26	93	76	37	286	4	8	8
WEST NORTH CENTRAL												
Minnesota	6	8	5	2	3	3	5	4	19	3	1	1
Iowa	1	4	4	------	------	6	17	22	109	3	1	1
Missouri	7	5	5	13	5	5	235	10	55	4	7	7
North Dakota	1	2	1	40	1	14	2	2	42	0	0	0
South Dakota	0	0	0	------	------	------	48	9	39	2	0	0
Nebraska	1	3	3	23	2	3	10	14	19	1	1	1
Kansas	15	3	5	115	1	10	204	13	153	1	1	1
SOUTH ATLANTIC												
Delaware	0	1	1	------	------	------	2	43	12	1	1	1
Maryland [2]	20	9	9	15	16	16	32	21	32	2	1	4
District of Columbia	0	0	1	5	------	4	8	7	11	2	0	3
Virginia	13	12	8	1,465	385	567	124	22	168	6	5	6
West Virginia	4	4	4	67	14	34	84	11	54	4	2	2
North Carolina	12	9	11	------	------	45	92	20	87	3	7	7
South Carolina	11	19	8	1,567	810	810	54	17	25	0	1	1
Georgia	6	13	7	216	52	183	34	9	63	1	6	5
Florida	10	1	2	1	2	10	42	35	35	3	7	3
EAST SOUTH CENTRAL												
Kentucky	12	7	7	189	7	19	305	7	97	5	5	5
Tennessee	8	3	3	135	58	105	86	24	48	6	8	3
Alabama	2	12	12	757	266	644	20	4	62	6	13	7
Mississippi [2]	9	5	7	------	------	------	------	------	------	2	5	5
WEST SOUTH CENTRAL												
Arkansas	14	6	8	429	121	267	102	90	90	11	25	2
Louisiana	6	9	8	1,202	12	26	13	10	32	4	4	4
Oklahoma	10	7	9	543	192	192	55	7	7	0	1	1
Texas	60	57	53	5,035	2,138	2,138	346	173	173	8	8	8
MOUNTAIN												
Montana	1	1	2	12	38	38	10	5	77	0	0	0
Idaho	2	2	0	79	1	1	10	------	25	0	0	0
Wyoming	0	0	0	1	------	43	87	1	20	1	0	0
Colorado	4	10	9	214	30	113	95	6	166	0	3	3
New Mexico	3	6	3	15	5	5	2	8	21	1	0	0
Arizona	3	0	4	203	136	155	5	9	106	0	1	1
Utah [2]	0	1	1	1,179	2	15	76	33	33	0	0	0
Nevada	0	0	0	------	------	------	1	1	1	0	0	0
PACIFIC												
Washington	7	10	6	------	------	3	275	49	82	4	6	5
Oregon	2	6	4	71	10	35	40	42	87	2	5	3
California	38	28	28	361	20	155	759	430	430	21	21	21
Total	404	331	331	14,481	4,391	4,899	6,712	1,501	10,887	216	242	242
4 weeks 1946	1,724	1,384	1,355	116,267	17,103	17,421	20,285	5,362	36,328	907	953	953

[1] New York City only.
[2] Period ended earlier than Saturday.

Telegraphic morbidity reports from State health officers for the week ended Jan. 26, 1946, and comparison with corresponding week of 1945 and 5-year median—Continued.

Division and State	Poliomyelitis			Scarlet fever			Smallpox			Typhoid and paratyphoid fever [3]		
	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45	Week ended—		Median 1941–45
	Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945		Jan. 26, 1946	Jan. 27, 1945	
NEW ENGLAND												
Maine	0	1	0	31	49	21	0	0	0	0	0	0
New Hampshire	0	0	0	12	21	14	0	0	0	0	0	0
Vermont	0	0	0	11	8	8	0	0	0	0	0	0
Massachusetts	0	1	1	178	360	324	0	0	0	2	1	1
Rhode Island	0	0	0	6	13	13	0	0	0	0	0	0
Connecticut	1	0	0	33	85	65	0	0	0	0	0	0
MIDDLE ATLANTIC												
New York	2	6	2	404	465	416	0	0	0	0	2	3
New Jersey	0	0	0	82	135	135	0	0	0	0	2	1
Pennsylvania	0	4	1	254	324	324	0	0	0	2	35	5
EAST NORTH CENTRAL												
Ohio	1	3	1	249	392	318	0	0	0	0	1	1
Indiana	0	1	1	85	177	126	1	0	2	0	2	3
Illinois	2	2	2	196	430	257	0	0	0	6	0	1
Michigan [2]	2	0	0	110	279	207	0	0	1	2	0	1
Wisconsin	0	1	0	130	145	214	0	0	0	1	0	0
WEST NORTH CENTRAL												
Minnesota	0	0	0	57	95	93	0	0	0	1	0	0
Iowa	0	0	0	55	61	61	0	0	1	0	0	1
Missouri	2	0	0	60	143	93	0	0	0	0	0	0
North Dakota	0	0	0	13	7	13	0	0	0	0	1	0
South Dakota	0	0	0	34	24	32	0	0	0	0	1	0
Nebraska	0	0	0	59	67	34	0	0	0	0	0	0
Kansas	1	0	0	75	146	87	1	0	1	1	0	0
SOUTH ATLANTIC												
Delaware	0	0	0	4	6	8	0	0	0	0	0	0
Maryland [2]	0	0	0	63	157	83	0	0	0	1	0	1
District of Columbia	0	0	0	12	70	29	0	0	0	2	0	0
Virginia	0	0	0	74	86	50	0	0	0	2	2	2
West Virginia	1	2	0	30	75	48	0	0	0	0	0	0
North Carolina	0	1	1	38	74	63	0	0	0	0	2	0
South Carolina	0	1	1	9	6	6	0	0	0	1	3	1
Georgia	1	0	0	15	36	33	0	0	0	4	3	3
Florida	4	2	1	11	11	11	0	0	0	2	2	1
EAST SOUTH CENTRAL												
Kentucky	0	0	0	44	70	66	0	2	0	0	0	0
Tennessee	0	0	0	31	87	81	1	0	0	1	2	3
Alabama	0	0	0	9	25	18	0	0	0	1	0	1
Mississippi [2]	3	0	0	19	10	10	1	0	1	0	1	1
WEST SOUTH CENTRAL												
Arkansas	0	1	0	12	63	7	0	1	1	0	0	1
Louisiana	2	0	0	8	27	10	0	0	0	0	3	4
Oklahoma	2	0	0	15	22	24	0	0	0	0	0	1
Texas	4	0	1	74	163	64	0	0	1	5	3	3
MOUNTAIN												
Montana	0	0	0	8	17	24	0	0	0	0	0	0
Idaho	0	0	0	14	64	14	0	0	0	1	3	0
Wyoming	0	0	0	7	5	12	0	0	0	0	0	0
Colorado	0	1	1	40	73	68	2	0	0	0	0	0
New Mexico	0	0	0	30	29	7	0	1	1	0	1	1
Arizona	0	0	0	12	16	7	0	0	0	0	0	0
Utah [2]	0	3	0	39	53	53	0	0	0	0	0	0
Nevada	0	0	0	0	7	0	0	0	0	0	0	0
PACIFIC												
Washington	5	3	1	35	76	29	0	0	0	0	4	1
Oregon	2	0	0	34	44	20	0	0	0	1	0	0
California	*13	3	3	302	329	191	1	0	1	4	2	2
Total	48	36	31	3,123	5,127	3,746	7	4	24	40	76	72
4 weeks 1946	*210	147	136	10,939	18,976	14,150	29	34	67	169	208	253

[2] Period ended earlier than Saturday.
[3] Including paratyphoid fever reported separately, as follows: Massachusetts, 2; Georgia, 3; Texas 2.

*Correction: Week ended Jan. 5, 1946, poliomyelitis. California, 11 cases (instead of 1).

Telegraphic morbidity reports from State health officers for the week ended Jan. 26, 1946, and comparison with corresponding week of 1945 and 5-year median—Con.

Division and State	Whooping cough			Week ended Jan. 26, 1946							
	Week ended—		Median 1941–45	Dysentery			Encephalitis, infectious	Rocky Mt. spotted fever	Tularemia	Typhus fever, endemic	Undulant fever
	Jan. 26, 1946	Jan. 27, 1945		Amebic	Bacillary	Unspecified					
NEW ENGLAND											
Maine	26	70	47								1
New Hampshire	10	4	9								
Vermont	21	54	34								
Massachusetts	89	171	173								
Rhode Island	42	28	24								
Connecticut	63	67	71	1	1						2
MIDDLE ATLANTIC											
New York	215	219	351	2	6		2		1		3
New Jersey	77	106	126	1		1					1
Pennsylvania	124	138	288								
EAST NORTH CENTRAL											
Ohio	101	169	277		3				2		2
Indiana	28	20	22		2	1			1		
Illinois	76	83	108	3	3				1		2
Michigan [2]	109	85	262								
Wisconsin	64	85	149								3
WEST NORTH CENTRAL											
Minnesota	8	40	49	1							3
Iowa	16	2	15								
Missouri	28	1	14			1			2		
North Dakota	2		11								
South Dakota		15	5								3
Nebraska	6	3	3								
Kansas	18	67	66			1			1		4
SOUTH ATLANTIC											
Delaware	10	2	2								
Maryland [2]	27	49	49			1					
District of Columbia	5	6	7								
Virginia	47	45	58			24			3		
West Virginia	22	9	49								
North Carolina	56	108	162						2		
South Carolina	61	53	72	1	4					3	
Georgia	8	14	26							17	3
Florida	12	9	16	4						7	5
EAST SOUTH CENTRAL											
Kentucky	26	30	50				3				2
Tennessee	23	38	38				4		2	4	1
Alabama	15	38	26	1						8	1
Mississippi [2]									2	1	1
WEST SOUTH CENTRAL											
Arkansas	11	17	17	1	1		1				
Louisiana		3	7	1						2	
Oklahoma	10	21	8		1					2	
Texas	110	241	241	6	231	41				11	16
MOUNTAIN											
Montana		19	19								
Idaho	9		5								
Wyoming	1	9	9								
Colorado	20	20	27								
New Mexico	3	4	24		1	2					
Arizona	11	15	15			17					2
Utah [2]	14	23	32								
Nevada											
PACIFIC											
Washington	63	28	49								
Oregon	7	7	16								
California	138	224	224	6	5						5
Total	1,832	2,459	3,846	28	258	89	10	0	17	55	60
Same week, 1945	2,459			26	536	179	6	0	14	49	68
Average, 1943–45	2,774			19	299	96	7	[4] 0	15	[4] 44	
4 weeks: 1946	7,336			163	1,422	525	31	0	104	246	254
1945	8,985			115	2,766	736	23	1	133	292	268
Average, 1943–45	10,645		[4] 15,883	96	1,451	367	31	[4] 0	92	[4] 219	

[2] Period ended earlier than Saturday. [4] 5-year median, 1941–45.

Anthrax: New York 2 cases; Idaho 1 case.

WEEKLY REPORTS FROM CITIES

City reports for week ended Jan. 19, 1946

This table lists the reports from 87 cities of more than 10,000 population distributed throughout the United States, and represents a cross section of the current urban incidence of the diseases included in the table.

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
NEW ENGLAND												
Maine:												
Portland	0	0	1	0	------	0	0	0	2	0	0	8
New Hampshire:												
Concord	0	0	------	0	------	0	1	0	3	0	0	------
Vermont:												
Barre	0	0	------	0	------	0	0	0	1	0	0	------
Massachusetts:												
Boston	2	0	------	0	14	2	18	0	49	0	1	43
Fall River	0	0	------	0	------	0	2	0	4	0	0	------
Springfield	0	0	------	0	1	0	1	0	13	0	0	1
Rhode Island:												
Providence	0	0	2	0	------	1	0	0	9	0	0	69
Connecticut:												
Bridgeport	0	0	2	0	------	0	2	0	1	0	0	------
New Haven	0	0	5	1	------	0	5	0	1	0	0	------
MIDDLE ATLANTIC												
New York:												
Buffalo	0	0	------	0	11	1	7	0	12	0	0	36
New York	15	1	43	8	163	18	97	0	137	0	0	58
Rochester	0	0	------	0	14	0	4	0	8	0	0	15
Syracuse	0	0	------	0	433	0	4	0	9	0	0	8
New Jersey:												
Camden	0	0	------	0	4	1	4	0	3	0	0	6
Newark	0	0	10	0	4	2	8	0	12	0	0	16
Trenton	0	0	5	3	------	0	6	0	1	0	0	3
Pennsylvania:												
Philadelphia	5	0	16	7	167	5	38	0	43	0	0	51
Pittsburgh	1	0	------	1	1	3	14	0	9	0	0	3
Reading	0	0	------	1	1	0	2	0	2	0	0	12
EAST NORTH CENTRAL												
Ohio:												
Cincinnati	2	0	5	2	9	1	13	0	11	0	0	3
Cleveland	0	0	7	1	1	4	14	0	19	0	1	18
Columbus	6	0	1	1	0	2	3	0	4	0	0	2
Indiana:												
Fort Wayne	0	0	------	0	------	0	1	0	3	0	0	------
Indianapolis	3	0	------	1	16	0	9	0	19	0	0	5
South Bend	0	0	------	0	1	0	0	0	1	0	0	------
Terre Haute	0	0	------	0	------	0	2	0	0	0	0	------
Illinois:												
Chicago	0	0	4	0	360	5	47	1	48	0	0	35
Springfield	1	0	------	0	------	1	3	0	5	0	0	------
Michigan:												
Detroit	2	0	5	2	249	3	8	0	43	0	0	36
Flint	1	0	------	0	39	0	4	0	2	0	0	2
Grand Rapids	0	0	------	1	16	0	2	0	6	0	0	4
Wisconsin:												
Kenosha	0	0	------	0	1	0	0	0	1	0	0	------
Milwaukee	0	0	------	0	17	1	7	0	16	0	0	9
Racine	0	0	2	2	------	0	0	0	2	0	0	2
Superior	0	0	------	0	------	0	0	0	------	0	0	9
WEST NORTH CENTRAL												
Minnesota:												
Duluth	0	0	------	0	1	0	1	0	6	0	0	4
Minneapolis	4	0	------	1	2	2	8	0	9	0	0	2
St Paul	0	0	------	1	3	0	4	0	10	0	0	2
Missouri:												
Kansas City	4	0	5	1	58	0	8	0	5	0	0	------
St. Joseph	0	0	------	0	70	1	0	0	3	0	0	------
St. Louis	1	0	9	2	11	6	21	1	7	0	0	3

City reports for week ended Jan. 19, 1946—Continued

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
WEST NORTH CENTRAL—continued												
North Dakota:												
Fargo	0	0	------	0	-------	1	0	0	0	0	0	------
Nebraska:												
Omaha	0	0	------	0	4	0	5	0	3	0	0	------
Kansas:												
Topeka	0	0	------	0	13	0	1	0	4	0	0	2
Wichita	0	0	1	0	21	0	4	0	6	0	0	3
SOUTH ATLANTIC												
Delaware:												
Wilmington	0	0	------	1	3	0	6	0	0	0	0	------
Maryland:												
Baltimore	19	0	7	1	23	2	8	0	15	0	0	6
Cumberland	0	0	------	0	-------	0	0	0	0	0	0	------
District of Columbia:												
Washington	0	0	3	1	10	0	6	0	12	0	0	10
Virginia:												
Lynchburg	3	0	------	0	-------	0	0	0	2	0	0	2
Richmond	0	0	87	2	2	3	4	0	4	0	0	1
Roanoke	4	0	------	1	-------	1	1	0	1	0	0	------
West Virginia:												
Charleston	0	0	------	0	1	2	0	0	1	0	0	------
Wheeling	0	0	------	0	1	0	2	0	2	0	0	------
North Carolina:												
Raleigh	0	0	------	0	5	0	1	0	0	0	0	4
Wilmington	0	0	------	0	0	0	1	0	4	0	0	4
Winston-Salem	0	0	------	0	-------	0	0	0	1	0	1	------
South Carolina:												
Charleston	1	0	40	1	1	1	3	0	2	0	0	------
Georgia:												
Atlanta	0	0	42	3	1	0	6	0	3	0	0	------
Brunswick	0	0	------	0	-------	0	1	0	0	0	0	------
Savannah	0	0	8	3	-------	0	1	0	1	0	0	------
Florida:												
Tampa	2	0	------	0	8	2	2	0	2	0	0	3
EAST SOUTH CENTRAL												
Tennessee:												
Memphis	0	0	35	1	4	4	13	0	2	0	0	4
Nashville	0	0	------	2	11	2	5	1	0	0	0	0
Alabama:												
Birmingham	0	0	17	3	-------	1	3	0	4	0	0	------
Mobile	0	0	28	2	-------	0	0	0	2	0	0	------
WEST SOUTH CENTRAL												
Arkansas:												
Little Rock	0	0	7	1	-------	0	4	0	0	0	0	------
Louisiana:												
New Orleans	5	0	10	2	1	5	10	5	3	0	0	------
Shreveport	1	0	------	1	-------	0	4	0	1	0	0	------
Texas:												
Dallas	1	0	1	1	-------	0	3	0	7	0	0	1
Galveston	0	0	------	0	-------	0	3	0	1	0	0	------
Houston	1	0	------	2	-------	0	6	2	4	0	0	------
San Antonio	1	0	3	0	10	1	5	0	2	0	0	1
MOUNTAIN												
Montana:												
Billings	0	0	------	0	-------	0	0	0	0	0	0	------
Great Falls	0	0	------	0	-------	0	0	0	0	0	0	------
Helena	0	0	------	0	-------	0	2	0	0	0	0	------
Missoula	0	0	35	0	-------	0	1	0	0	0	0	------
Idaho:												
Boise	0	0	------	0	-------	0	0	0	0	0	0	------
Colorado:												
Denver	2	0	9	0	13	0	11	0	21	0	0	17
Pueblo	0	0	------	0	1	0	0	0	5	0	0	8
Utah:												
Salt Lake City	0	0	------	0	14	0	3	0	10	0	0	1

City reports for week ended Jan. 19, 1946—Continued

	Diphtheria cases	Encephalitis, infectious, cases	Influenza		Measles cases	Meningitis, meningococcus, cases	Pneumonia deaths	Poliomyelitis cases	Scarlet fever cases	Smallpox cases	Typhoid and paratyphoid fever cases	Whooping cough cases
			Cases	Deaths								
PACIFIC												
Washington:												
Seattle	6	0	------	1	56	0	8	0	2	0	0	5
Spokane	0	0	------	0	31	0	1	0	6	0	0	7
Tacoma	0	0	------	0	22	1	0	0	5	0	0	12
California:												
Los Angeles	2	0	45	6	50	4	7	1	40	0	0	10
Sacramento	1	0	------	0	14	0	2	0	4	0	0	0
San Francisco	3	0	16	0	112	4	11	3	12	0	1	5
Total	99	1	516	71	2,099	93	522	14	733	0	4	571
Corresponding week, 1945	69	------	183	33	253	------	419	------	1,464	0	11	588
Average, 1941–45	71	------	2,167	[1] 100	[2] 2,716	------	[1] 597	------	1,243	2	13	906

[1] 3-year average, 1943–45.
[2] 5-year median, 1941–45.

Dysentery, amebic.—Cases: New York, 1; Dallas, 1; Los Angeles, 1.
Dysentery, bacillary.—Cases: Charleston, S. C., 1; San Antonio, 1; Los Angeles, 10.
Dysentery, unspecified.—Cases: New Haven, 1; Baltimore, 1; San Antonio, 10.
Leprosy.—Cases: Los Angeles, 1.
Tularemia.—Cases: New York, 1; Lynchburg, 2; New Orleans, 2.
Typhus fever, endemic.—Cases: Tampa, 1; Nashville, 3; Mobile, 1; Shrevesport, 1; Galveston, 1; Houston, 1; San Antonio, 1.

Rates (annual basis) per 100,000 population, by geographic groups, for the 87 cities in the preceding table (estimated population, 1943, 34,025,200)

	Diphtheria case rates	Encephalitis, infectious, case rates	Influenza		Measles case rates	Meningitis, meningococcus, case rates	Pneumonia death rates	Poliomyelitis case rates	Scarlet fever case rates	Smallpox case rates	Typhoid and paratyphoid fever case rates	Whooping cough case rates
			Case rates	Death rates								
New England	6.4	0.0	31.8	3.2	48	9.5	92.2	0.0	264	0.0	3.2	385
Middle Atlantic	9.7	0.5	34.3	9.3	369	13.9	85.2	0.0	109	0.0	0.0	96
East North Central	9.1	0.0	14.6	6.1	431	10.3	68.7	0.6	109	0.0	0.6	76
West North Central	17.9	0.0	29.8	9.9	364	19.9	103.4	2.0	105	0.0	0.0	32
South Atlantic	47.6	0.0	307.0	21.3	90	18.1	69.0	0.0	82	0.0	1.6	49
East South Central	0.0	0.0	472.2	47.2	88	41.3	123.9	5.9	47	0.0	0.0	24
West South Central	25.8	0.0	60.3	20.1	32	17.2	100.4	20.1	52	0.0	0.0	6
Mountain	15.9	0.0	349.5	0.0	222	0.0	135.0	0.0	286	0.0	0.0	207
Pacific	19.0	0.0	96.5	11.1	451	14.2	45.9	6.3	109	0.0	1.6	62
Total	15.2	0.2	79.3	10.9	323	14.3	80.2	2.2	113	0.0	0.6	88

FOREIGN REPORTS

CANADA

Provinces—Communicable diseases—Week ended December 29, 1945.—During the week ended December 29, 1945, cases of certain communicable diseases were reported by the Dominion Bureau of Statistics of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Chickenpox		7		6	399	46	80	15	72	625
Diphtheria		1	2	12	10	5	1		6	37
Dysentery, bacillary				1						1
German measles				10	17		2	5	5	39
Influenza		6			95	1			4	106
Measles				12	577		4	20	31	644
Meningitis, meningococcus		1		1	1			1		4
Mumps				15	82	16	7	43	19	182
Poliomyelitis				4			1		8	13
Scarlet fever		6	8	22	73	11	2	10	15	147
Tuberculosis (all forms)		6	4	77	64	8	2	21	19	201
Typhoid and paratyphoid fever				12	1			2		15
Undulant fever				2	1					3
Venereal diseases:										
Gonorrhea	1	6	10	87	102	36	29	33	50	354
Syphilis		7	2	81	70	11	4	18	29	222
Whooping cough		17		35	24	14	1	5		96

CUBA

Provinces—Notifiable diseases—4 weeks ended December 29, 1945.—During the 4 weeks ended December 29, 1945, cases of certain notifiable diseases were reported in the Provinces of Cuba as follows:

Disease	Pinar del Rio	Habana [1]	Matanzas	Santa Clara	Camaguey	Oriente	Total
Cancer			13	14	1	11	39
Chickenpox		1			1		2
Diphtheria		14	5	1		3	23
Leprosy		3				3	6
Malaria	2	13	2	4	18	75	114
Measles					2	1	3
Tuberculosis	16	59	16	44	32	56	223
Typhoid fever	19	34		21	20	45	139
Yaws						1	1

[1] Including Habana city.

JAMAICA

Notifiable diseases—4 weeks ended January 12, 1946.—During the 4 weeks ended January 12, 1946, cases of certain notifiable diseases were reported in Kingston, Jamaica, and in the island outside of Kingston, as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Cerebrospinal meningitis	2		Leprosy		2
Chickenpox		13	Puerperal fever		3
Diphtheria	4	2	Scarlet fever	2	1
Dysentery, unspecified	3	8	Tuberculosis, respiratory	28	47
Erysipelas		1	Typhoid fever	21	102

MEXICO

San Luis Potosi—Cerebrospinal meningitis.—According to a report dated January 22, 1946, an outbreak of cerebrospinal meningitis had occurred in San Luis Potosi, Mexico.

REPORTS OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER RECEIVED DURING THE CURRENT WEEK

NOTE.—Except in cases of unusual incidence, only those places are included which had not previously reported any of the above-mentioned diseases, except yellow fever, during recent months. All reports of yellow fever are published currently.

A table showing the accumulated figures for these diseases for the year to date is published in the PUBLIC HEALTH REPORTS for the last Friday in each month.

Plague

Egypt—Alexandria.—For the week ended January 19, 1946, 1 confirmed case of plague was reported in Alexandria, Egypt.

Peru—Tumbes Department.—For the month of December 1945, 13 cases of plague with 3 deaths were reported in Tumbes Department, Peru, including 11 cases of plague with 3 deaths reported in the city of Tumbes. Plague infection in rodents was also reported in the city of Tumbes.

Smallpox

Peru.—For the month of November 1945, 45 cases of smallpox were reported in Peru, including 28 cases reported in Lima Department, and 15 cases reported in Puno Department.

Typhus Fever

Chile.—For the period November 3–30, 1945, 60 cases of typhus fever with 8 deaths were reported in Chile. Provinces reporting the highest incidence are: Santiago, 19 cases, 4 deaths; Concepcion, 7 cases.

Peru.—For the month of November 1945, 96 cases of typhus fever were reported in Peru. Departments reporting the highest incidence are: Ayacucho, 28 cases; Cuzco, 21 cases; Ancash, 20 cases.

Yellow Fever

Bolivia—Santa Cruz Department.—According to a telegraphic report dated January 18, 1946, 39 deaths from suspected yellow fever have occurred in the localities of San Rafael and San Miguel, Santa Cruz Department, Bolivia.

Colombia—Putumayo Commissary—Mocoa—Umbria.—On November 23, 1945, 1 death from yellow fever was reported in Umbria, Mocoa, Putumayo Commissary, Colombia.

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