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## HISTORY AND FREQUENCY OF TYPHOID FEVER IMMUNIZATIONS AND CASES IN 9,000 FAMILIES

Based on Nation-Wide Periodic Canvasses, 1928-31<sup>1</sup>

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Typhoid fever vaccine was developed during the nineties, and was first used on man in England and Germany in 1896 (20, 23). It was used to a considerable extent in the British Army in India in 1898, to some extent among the British troops in the Boer War, and in the German Colonial Army in South Africa from 1904 to 1907 (23). In 1911 typhoid vaccination was made compulsory for men under 45 years of age throughout the United States Army (23) and Navy (16). During the years of the World War, several million persons who served in the Army and Navy received injections of vaccine for protection against typhoid and paratyphoid A and B (23).

The use of typhoid vaccine in the civilian population has been much less frequent; aside from wholesale immunizations in certain Southern States under Federal appropriations for the protection of health in areas stricken in 1927 by the floods and in 1930 by the drought, no widespread movement has been made to carry this protective procedure to the civilian population.

The typhoid fever death rate per 100,000 population in the registration States<sup>2</sup> of 1900 decreased from 31.3 in 1900 to 1.1 in 1933. In

<sup>1</sup> From the Office of Statistical Investigations, U. S. Public Health Service.

This is the eighth of a series of papers on sickness and medical care in this group of families (1-7). The survey of these families was organized and conducted by the Committee on the Costs of Medical Care; the tabulation was done under a cooperative arrangement between the Committee and the Public Health Service. Committee publications based on the results deal primarily with costs and Public Health Service publications primarily with the incidence of illness, and the extent and kind of medical care, without regard to cost. As costs are meaningless without some knowledge of the extent and nature of the service received, there is inevitably some overlapping. The Committee staff, particularly Dr. I. S. Falk and Miss Margaret Klem, cooperated in the tabulation of the data.

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

<sup>2</sup> The registration States of 1900 include Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Michigan, Indiana, and the District of Columbia. The rate for the total continental United States was 3.6 in 1933 and 3.4 in 1934.

some large cities with efficient water purification and milk pasteurization the rate is even lower than this figure. In this spectacular decline the use of typhoid immunization apparently had little or no part, and there has recently been considerable discussion as to whether typhoid vaccination is effective in preventing typhoid fever in an individual.

On the question of the efficacy of typhoid vaccine this paper has nothing to offer. Regardless of the usefulness of the procedure, however, it is of interest to determine the extent to which the population of various parts of the United States have received the injections.

#### I. SOURCE AND CHARACTER OF DATA

In the study of illness in canvassed white families in 130 localities in 18 States<sup>3</sup> that was made by the Committee on the Costs of Medical Care and the United States Public Health Service, all service received from physicians and other practitioners was recorded, whether for illness, immunization, physical examination, or some other reason. The records of immunization<sup>4</sup> against typhoid fever for all persons in the observed population afford data on the frequency of this procedure during 12 months covered by periodic canvasses; information was also obtained on the history of typhoid fever immunization and cases at any time prior to the study. Because the probability of having received the immunizing injections prior to a given date is influenced greatly by the number of years the person has lived, the histories in this study are considered for persons of specific ages.

The composition and characteristics of the group of 8,758 families which were kept under observation for 12 consecutive months in the years 1928-31 have been considered in some detail in the first report in the series (1). These families, including a total of 39,185 individuals, resided in 18 States, representing all geographic sections. Every size of community was included, from metropolitan districts to small industrial and agricultural towns and rural unincorporated areas. The observed group was similar to the general population with respect to age and sex composition, percentage native born, and percentage married. With respect to income, the distribution was reasonably similar to the estimated distribution of the general population of the United States at the time of the survey.

Every locality included had a visiting nurse and a local health department or some other agency employing a visiting nurse. This

<sup>3</sup> The 18 States sampled and the number of canvassed families were as follows: California (890), Colorado (386), Connecticut (100), District of Columbia (99), Georgia (544), Illinois (463), Indiana (494), Kansas (301), Massachusetts (287), Michigan (329), Minnesota (224), New York (1,710), Ohio (1,148), Tennessee (212), Virginia (412), Washington (551), West Virginia (318), Wisconsin (290). Further details about the distribution of the canvassed population are included in a preceding paper (1).

<sup>4</sup> Typhoid fever "immunization" is used in this paper to mean the injection of the usual number of doses of typhoid fever vaccine; all cases receiving such service are designated as "immunizations".

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

TABLE 1.—History of typhoid fever immunizations and cases among persons of specific ages of each sex—canvassed white families in 18 States<sup>1</sup>

Age in years	Both sexes				Percentage of persons with history of—				Total number of persons considered <sup>2</sup>	
	Percentage of persons with history of—			Total number of persons considered <sup>2</sup>	Immunization at any time but no case		Case at any time			
	Immunization at any time	Immunization at any time but no case	Case at any time		Male	Female	Male	Female	Male	Female
All ages -----	11. 79	7. 53	4. 26	37, 846	8. 93	6. 17	4. 35	4. 18	18, 567	19, 279
Under 1. -----	. 33	. 33	. 06	919	. 22	. 90	-----	. 11	915	892
1. -----	. 90	. 79	-----	888	-----	-----	-----	-----	-----	-----
2. -----	1. 25	1. 25	-----	1, 044	-----	-----	-----	-----	-----	-----
3. -----	2. 40	2. 31	. 05	1, 083	1. 83	1. 74	-----	. 10	1, 093	1, 034
4. -----	2. 40	2. 65	-----	1, 132	-----	-----	-----	-----	-----	-----
5. -----	4. 19	3. 93	. 17	1, 169	3. 52	3. 10	. 35	-----	1, 138	1, 163
6. -----	5. 01	4. 49	-----	1, 158	-----	-----	-----	-----	-----	-----
7. -----	5. 73	5. 39	. 43	1, 170	5. 41	4. 46	. 25	. 61	1, 184	1, 144
8. -----	7. 22	6. 22	-----	1, 204	-----	-----	-----	-----	-----	-----
9. -----	8. 25	7. 26	1. 00	1, 006	6. 78	6. 67	1. 21	. 79	1, 076	1, 134
10-14. -----	9. 37	8. 17	1. 20	4, 567	8. 09	8. 25	1. 26	1. 15	2, 300	2, 267
15-19. -----	12. 47	10. 04	2. 43	3, 040	11. 09	8. 97	2. 62	2. 24	1, 524	1, 516
20-24. -----	11. 63	7. 93	3. 70	2, 109	9. 54	6. 75	3. 70	3. 70	892	1, 217
25-29. -----	12. 98	7. 99	4. 99	2, 483	-----	-----	-----	-----	-----	-----
30-34. -----	17. 75	12. 05	5. 70	3, 143	14. 92	6. 81	4. 60	5. 97	2, 393	3, 233
35-44. -----	19. 68	11. 95	7. 73	5, 923	15. 58	8. 28	7. 84	7. 63	2, 973	2, 950
45-54. -----	17. 07	7. 46	9. 61	3, 351	8. 17	6. 59	9. 85	9. 31	1, 848	1, 503
55-64. -----	16. 45	4. 30	12. 15	1, 465	-----	-----	-----	-----	-----	-----
65 and over. -----	12. 54	1. 85	10. 69	992	3. 82	2. 78	13. 00	10. 11	1, 231	1, 226

<sup>1</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

<sup>2</sup> A few individuals known as to case history were unknown as to immunization history (14 out of the 37,846 persons); the rates in every instance are based on the known only.

## II. HISTORY OF IMMUNIZATIONS AND CASES AT BEGINNING OF STUDY

### VARIATION WITH AGE AND SEX

Figure 1 shows for specific ages the proportion of individuals who had been artificially immunized against typhoid and who had suffered attacks of typhoid fever at any time in their lives (table 1). In the younger ages, up to 15 years, the percentages who had received immunizing injections amount to far more than the percentages who

had been attacked by the disease. As age increases above 20 years, the proportion who had been attacked rises rather rapidly to nearly 8 percent at 35-44 years and to 12 percent at 55-64 years. This increase with age represents more than the increased probability of having had the disease as the number of years lived increases. Because typhoid fever was formerly more prevalent than at present, those persons who are now 40 and 50 years of age have lived through a period when the incidence of typhoid fever was extremely high, whereas the lives of the younger persons have been lived in an environment where less opportunity for infection existed.

The proportion of individuals who had been immunized against typhoid fever reaches 10 percent at 15-19 years of age; there is a decline to 8 percent for individuals 20-24 and 25-29 years, with another increase to 12 percent at 30-34 and 35-44 years of age. Be-

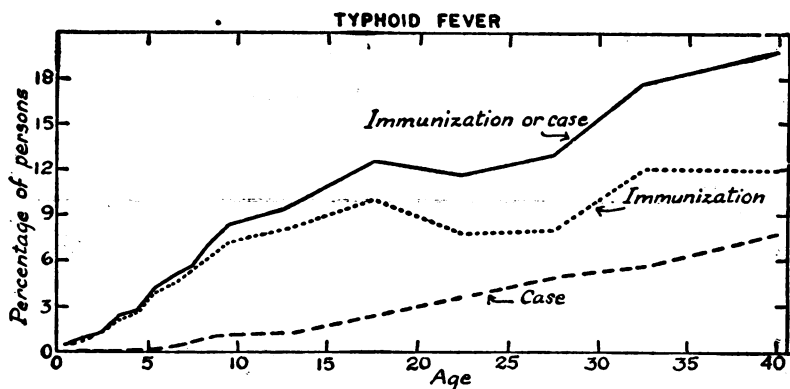


FIGURE 1.—Percentage of persons of specific ages (a) who had been immunized and (b) who had suffered an attack of typhoid fever—8,758 canvassed white families in 18 States, 1928-31.

yond 45 years the percentage declines as age increases. These variations are probably not due to chance. The peak in the late school ages reflects the ease with which the health department can apply immunizing procedures to children in schools. The plateau extending to 45 years reflects immunizations during the World War of men then in the military ages.

Considering all ages, 13.3 percent of the males and 10.4 percent of the females gave a history of immunization or a case of typhoid fever at some time in their lives. These percentages were made up of 8.9 and 6.2 for males and females, respectively, who had been immunized but had not suffered attacks, and 4.4 and 4.2 percent of males and females, respectively, who gave a history of an attack of typhoid fever. These data are shown for specific ages in table 1 and figure 2. With respect to the history of typhoid fever, there are no consistent differences between the sexes under 8 years of age, but from 8 to 20 the rate for males is slightly above that for females;

above 25 years the differences between the sexes are not consistent in the various ages.

For comparison with results in the present study, table 2 shows reports from male and female students in 11 colleges and universities (26), each person reporting his own typhoid history only. In these data the males report more attacks than females. The history rates for males in the present study may be low, because the women were usually the informants.

With respect to immunization histories in the surveyed families (fig. 2), no consistent differences between the sexes appear under 15

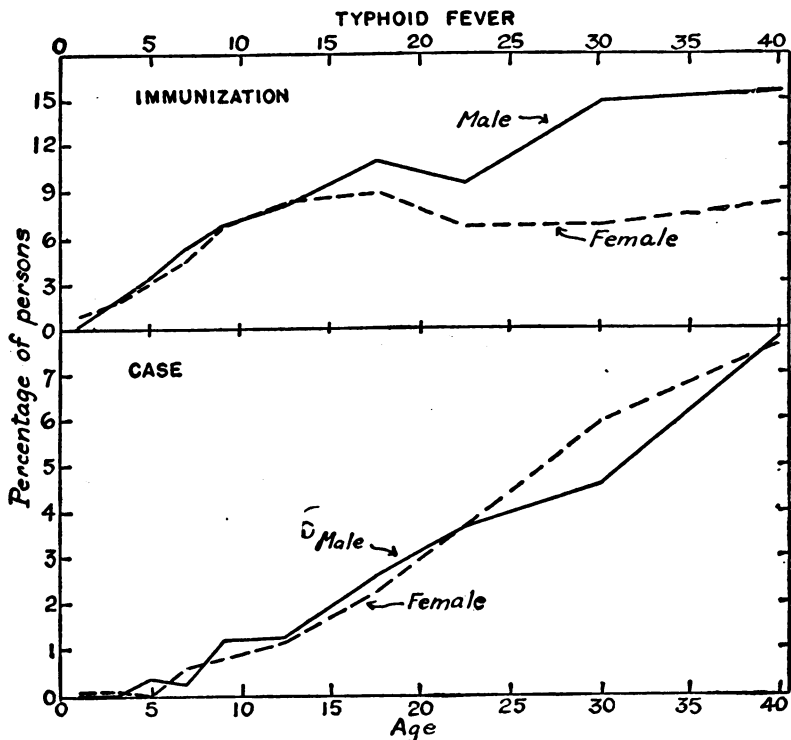


FIGURE 2.—Percentage of males and females of specific ages (a) who had been immunized and (b) who had suffered an attack of typhoid fever—8,758 canvassed white families in 18 States, 1923-31.

years, but above that age there are definitely more immunizations among males of every age group. The large differences from 25 to 44 years are no doubt the result of the immunization of males who were in the military services during the World War—there is no increase with age during these years in the curve for females. Probably the differences between the sexes are even greater than the data indicate, because women were usually the informants and would know their own histories better than those of others in the household. The excess in immunizations among males of the ages 15 to 25 is not so easily explained; one factor may be compulsory immunization of

male college students in the Reserve Officers' Training Corps and of males in the citizens' military training camps during the summer.

TABLE 2.—*History of typhoid fever cases at any time among male and female students in various universities,<sup>1</sup> 1925*

	All ages	17-18	19-20	21-22	23-24	25-29	30-34	35-39	40 and over
	Percentage of students who had suffered an attack								
Both sexes.....	7.2	4.8	3.9	7.2	5.7	10.0	9.5	21.0	18.6
Male.....	8.2	5.4	4.1	8.2	5.3	10.3	11.0	22.4	21.7
Female.....	5.8	4.4	3.8	5.9	6.9	8.6	5.7	18.8	14.3
	Total number of students reporting								
Both sexes.....	4,718	313	1,396	1,093	635	722	282	124	183
Male.....	2,787	130	629	618	475	571	182	76	106
Female.....	1,931	183	767	475	160	151	70	48	77

<sup>1</sup> The group considered made the reports at the end of the U. S. Public Health Service study of respiratory diseases (26); it included students in 11 colleges and universities throughout the country. The universities included are Harvard (Boston), Mount Holyoke College (South Hadley, Mass.), Johns Hopkins (Baltimore), Georgetown (Washington, D. C.), Winthrop College (Rock Hill, S. C.), Tulane (New Orleans), Chicago (Chicago), Ohio State (Columbus), Utah (Salt Lake City), Arizona (Tucson), and California (Berkeley).

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

The proportion of persons who have been immunized against typhoid fever might be expected to vary from one community to another, depending upon the nature and extent of the typhoid fever problem and the practices of health departments and private physicians.

*Cities and rural areas.*—In figure 3 the proportions of persons of specific ages who had been immunized are plotted for cities of various sizes and for rural areas (table 3). The rural areas show the highest rates for the history of immunization against typhoid; in the group of persons living on farms or in unincorporated places, the percentage of individuals who had been immunized is one and one-half to two times that in the small towns and small cities for each of the ages up to 25 years. The lowest immunization history rates appear for families living in large cities; nearly all cities of 100,000 and over have good water supplies and require pasteurization of milk, and so there is little occasion for immunization except for vacations or other trips into the less-protected rural areas.

The lower section of figure 3 shows for the same size of city groups the proportion of persons of specific ages who gave a history of an attack of typhoid fever (table 4). While the differences are not large, the rural areas show consistently fewer histories of typhoid attacks than the small towns and generally fewer than the small cities, in agreement with the findings of Leach and Maxcy (21) with

regard to typhoid fever cases and deaths in Alabama. However, the large cities (over 100,000) are definitely lower than any of the other categories, in agreement with the results of Milam and Sibley (22) on typhoid fever deaths in Tennessee. This low case-history rate reflects the relatively high sanitary status of the metropolitan areas and is no doubt the reason for their low immunization rates.

TABLE 3.—*History of typhoid fever immunizations among persons in cities of various sizes and in rural areas—canvassed white families in 18 States*<sup>1</sup>

Age in years	Percentage of persons with a history of—								Total number of persons con- sidered			
	Immunization or case at any time				Immunization at any time but no case							
	Cities of 100,000 or over	Cities 5,000- 100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000- 100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000- 100,000	Towns under 5,000	Rural areas
All ages...	8.6	12.7	13.5	15.2	5.3	8.0	8.1	10.9	14,087	9,527	7,445	6,787
Under 5...	.8	1.2	1.4	5.5	.2	1.1	1.4	5.5	1,799	1,420	1,032	815
5-9.....	1.7	6.3	7.3	12.8	1.2	5.4	6.5	12.7	1,993	1,515	1,197	1,002
10-14.....	3.7	9.4	10.6	17.4	2.9	7.8	9.0	16.3	1,577	1,105	909	976
15-19.....	7.9	13.1	14.6	16.9	6.2	10.3	10.9	14.8	1,035	756	569	680
20-24.....	6.8	12.7	14.0	18.8	4.1	9.2	9.0	14.1	863	503	360	383
25-34.....	12.8	17.8	18.4	16.4	8.7	11.4	12.6	11.0	2,361	1,427	1,096	742
35-44.....	16.3	22.9	22.6	19.4	10.1	13.8	12.5	11.6	2,305	1,508	1,133	977
45-54.....	15.5	17.8	19.9	16.5	8.3	7.4	6.2	7.1	1,247	803	628	673
55 and over....	11.8	17.7	17.3	15.2	3.5	4.8	3.1	1.8	907	490	521	539

<sup>1</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

TABLE 4.—*History of typhoid fever cases among persons in cities of various sizes and in rural areas—canvassed white families in 18 States*<sup>1</sup>

Age in years	Percentage of persons with history of a case at any time				Number of persons with history of a case at any time				Total number of persons considered			
	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000–100,000	Towns under 5,000	Rural areas
All ages...	3.3	4.7	5.4	4.3	469	448	400	295	14,087	9,527	7,445	6,787
Under 5...	.1	.1	-----	-----	2	1	-----	-----	1,799	1,420	1,032	815
5-9.....	.6	.9	.8	.1	11	14	9	1	1,993	1,515	1,197	1,002
10-14.....	.8	1.6	1.5	1.1	12	18	14	11	1,577	1,105	909	976
15-19.....	1.7	2.8	3.7	2.1	18	21	21	14	1,035	756	569	680
20-24.....	2.8	3.6	5.0	4.7	24	18	18	18	863	503	360	383
25-34.....	4.5	6.4	5.8	5.4	107	92	64	40	2,361	1,427	1,096	742
35-44.....	5.7	9.1	10.1	7.8	131	137	114	76	2,305	1,508	1,133	977
45-54.....	7.1	10.5	13.7	9.4	89	84	86	63	1,247	803	628	673
55 and over....	3.3	12.9	14.2	13.4	75	63	74	72	907	490	521	539

<sup>1</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

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

Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas), representing the North Central States; the *South* (District of Columbia, Virginia, West Virginia, Tennessee, Georgia), representing the South Atlantic and South Central States; and the *West* (Colorado, California, Washington), representing the Mountain and Pacific States.<sup>5</sup>

In figure 4 immunization history rates have been plotted for each of the four geographic sections of the United States (table 5). The South stands far above all other sections in the use of immunization

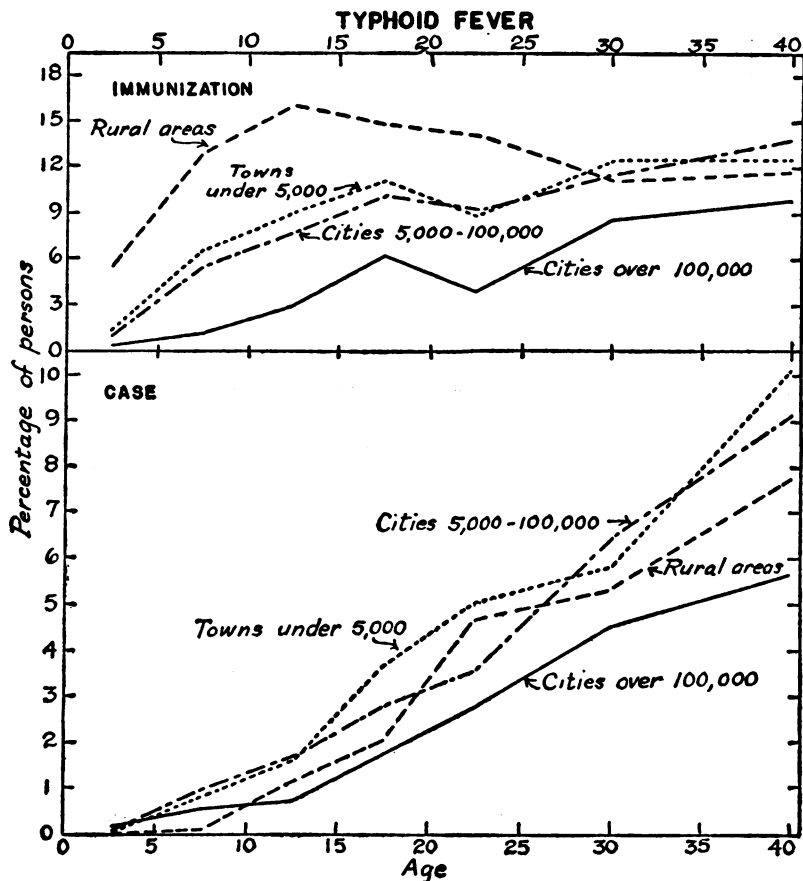


FIGURE 3.—Percentage of persons of specific ages in cities and rural areas (a) who had been immunized and (b) who had suffered an attack of typhoid fever—8,758 canvassed white families in 18 States, 1928-31.

against typhoid fever. Probably this showing is not the result solely of consistent efforts year after year to immunize as many persons as possible, but is also a reflection of wholesale immunizations done by State and county health departments under special grants from the Federal Government in the emergency following the widespread flood conditions of 1927 (ref. 14 for 1928). Large numbers of persons were

<sup>5</sup> Further details regarding the number of families from each State and each size of city are included in a previous paper (1).



also immunized in 1931 and 1932 in the work following the drought \* of 1930, but most of the schedules taken for the present study in the

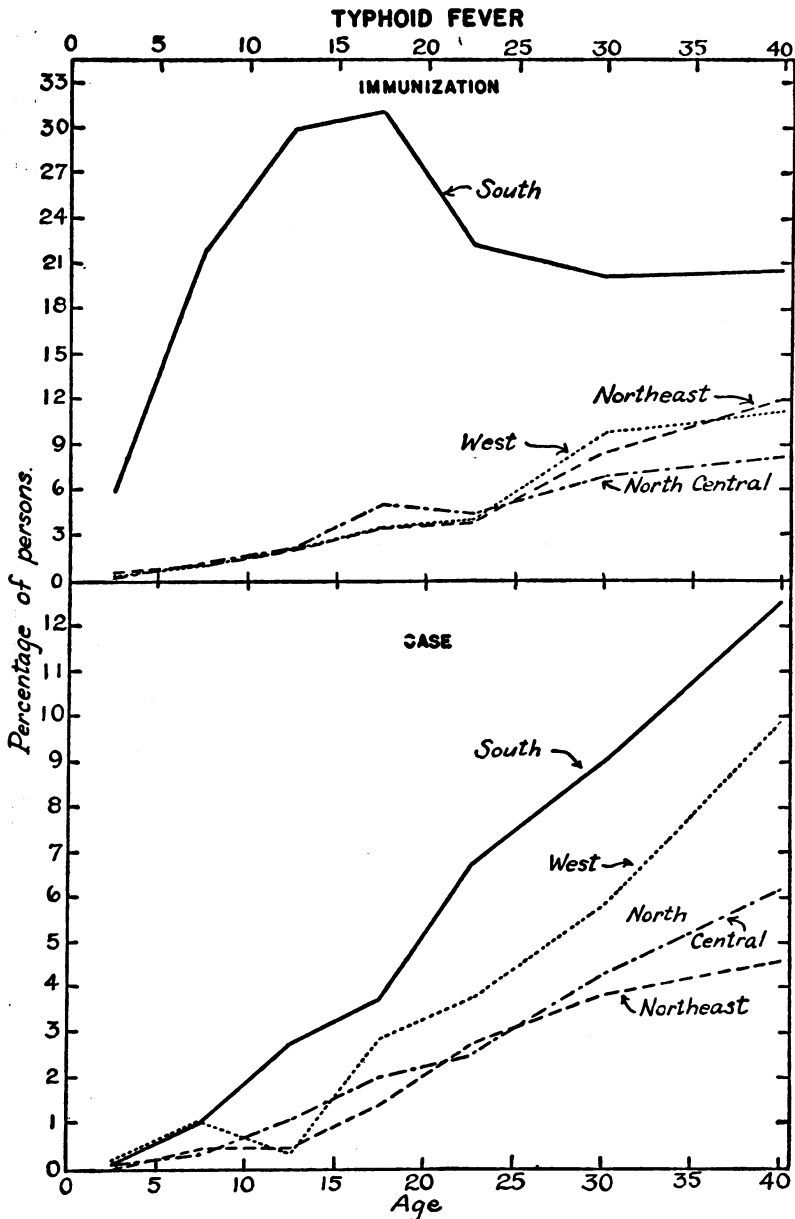


FIGURE 4.—Percentage of persons of specific ages in four geographic sections (a) who had been immunized and (b) who had suffered an attack of typhoid fever—8,758 canvassed white families in 18 States, 1928-31.

Southern States cover 12 months ending in the winter of 1929-30, and so would not reflect much of the work following this drought.

\* A total of more than 1,600,000 typhoid fever immunizations were done in the drought work of 1931-32, mostly in Southern States (ref. 14 for 1932, 18).

The objective in all the emergency work was to immunize persons of all ages, but the curve that appears in figure 4 indicates that children of the school ages were reached to a greater extent than adults, as might be expected, because of the ease of working through the schools. The low history for children under 5 years may reflect not only the reluctance to immunize at an early age but also the birth of infants after the flood year, when the widespread immunizations were done.

TABLE 5.—*History of typhoid fever immunizations among persons in four geographic sections<sup>1</sup> of the United States—canvassed white families in 18 States<sup>2</sup>*

Age in years	Percentage of persons with a history of—								Total number of persons considered			
	Immunization or case at any time				Immunization at any time but no case				North-east	North-Central	South	West
	North-east	North-Central	South	West	North-east	North-Central	South	West				
All ages.....	8.2	7.4	25.8	10.0	5.2	4.0	19.7	4.6	8,874	14,198	7,594	7,180
Under 5.....	.5	.2	6.1	.4	.5	.2	6.0	.2	1,149	1,984	1,112	821
5-9.....	1.6	1.5	22.7	2.0	1.1	1.2	21.7	.9	1,278	2,273	1,189	967
10-14.....	2.5	3.2	32.7	2.6	2.0	2.1	29.9	2.2	1,053	1,731	1,001	783
15-19.....	4.9	7.0	34.9	6.4	3.5	5.0	31.1	3.5	715	1,036	662	627
20-24.....	6.3	7.0	29.0	7.7	3.6	4.5	22.3	4.0	474	758	447	430
25-34.....	12.2	11.2	29.1	15.5	8.4	6.9	20.1	9.7	1,217	2,301	1,076	1,032
35-44.....	16.5	14.3	32.9	21.0	12.0	8.2	20.4	11.2	1,356	2,267	1,125	1,175
45-54.....	15.8	13.4	29.2	15.0	9.9	4.0	16.4	3.1	892	1,118	566	775
55 and over.....	12.7	13.8	20.9	14.5	3.3	2.6	6.2	2.1	740	730	416	671

<sup>1</sup> A preceding paper (1) gives the number of families canvassed in each State classified according to the size of the city of residence. States included in the survey were as follows:

*Northeast:* New York, Massachusetts, Connecticut.

*North Central:* Illinois, Ohio, Michigan, Indiana, Wisconsin, Minnesota, Kansas.

*South:* District of Columbia, Virginia, West Virginia, Tennessee, Georgia.

*West:* Washington, California, Colorado.

<sup>2</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

The Northeastern, the North Central, and the Western sections show about the same proportion of individuals immunized, all being far below the South.

The lower part of figure 4 shows for the different geographic sections the percentage of persons of specific ages who had suffered attacks of typhoid fever (table 6). The South shows the highest history rates for typhoid fever cases, the West second, and the North Central and Northeast the lowest rates, with approximately the same curves. Thus it appears that, in the South, where typhoid fever has been the greatest problem, there has been a greater resort to immunization in an attempt to control the disease. The West, however, has not resorted to immunization even in the face of relatively high history rates for typhoid fever. The more common use of typhoid immunization in the South may reflect the special health work done after flood conditions rather than an acceptance of immunization as a permanent method of controlling the typhoid problem.

**TABLE 6.**—*History of typhoid fever cases among persons in four geographic sections<sup>1</sup> of the United States—canvassed white families in 18 States<sup>2</sup>*

Age in years	Percentage of persons with history of a case at any time				Number of persons with history of a case at any time				Total number of persons considered			
	North-east	North-Central	South	West	North-east	North-Central	South	West	North-east	North-Central	South	West
All ages.....	3.0	3.5	6.1	5.4	206	492	467	387	8,874	14,198	7,594	7,190
Under 5.....		.1	.1	.1		1	1	1	1,149	1,984	1,112	821
5-9.....	.5	.3	1.0	1.0	6	7	12	10	1,278	2,273	1,189	967
10-14.....	.5	1.1	2.8	.4	5	19	28	3	1,053	1,731	1,001	782
15-19.....	1.4	2.0	3.8	2.9	10	21	25	18	715	1,036	662	627
20-24.....	2.7	2.5	6.7	3.7	13	19	30	16	474	758	447	430
25-34.....	3.9	4.3	9.0	5.8	47	99	97	60	1,217	2,301	1,076	1,032
35-44.....	4.6	6.1	12.5	9.9	62	139	141	116	1,356	2,267	1,125	1,175
45-54.....	5.9	9.4	12.7	11.9	53	105	72	92	892	1,118	566	775
55 and over....	9.5	11.2	14.7	12.4	70	82	61	71	740	730	416	571

<sup>1</sup> For States included in the different geographic sections, see footnote 1 to table 5.<sup>2</sup> Dates of interviews varied from 1923 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

For comparison with results in the present study, table 7 shows typhoid histories among students in 11 colleges and universities (26), classified according to the individual's home State. A higher percentage of the students from the South reported a history of an attack of typhoid, in agreement with the present study. Typhoid mortality and reported cases (table 18) both indicate that typhoid fever is more common in the South in the white as well as in the colored population.

**TABLE 7.**—*History of typhoid fever cases at any time among students in various universities classified according to the student's "home State", 1925<sup>1</sup>*

Section <sup>2</sup>	Percentage of students who had suffered an attack of typhoid						Total number of students reporting					
	All ages	17-19	20-24	25-29	30-34	35 and over	All ages	17-19	20-24	25-29	30-34	35 and over
Northeast.....	4.8	4.5	3.1	6.8	4.4	12.5	964	201	478	176	45	64
North Central.....	8.0	2.5	8.0	10.6	6.6	17.2	1,369	239	695	236	106	93
South.....	12.2	6.9	7.5	13.3	21.3	25.0	748	116	320	143	61	108
West.....	5.4	4.7	4.8	9.0	5.7	15.6	1,549	364	973	145	35	32

<sup>1</sup> The group considered made the reports at the end of the U. S. Public Health Service study of respiratory diseases (26); it included the students in 11 colleges and universities throughout the country. The total of 4,718 persons reporting on typhoid fever included 2,787 males and 1,931 females; 88 persons who did not designate their home State are excluded from this table. The universities included are Harvard (Boston), Mount Holyoke College, (South Hadley, Mass.), Johns Hopkins (Baltimore), Georgetown (Washington, D. C.), Winthrop College (Rock Hill, S. C.), Tulane (New Orleans), Chicago (Chicago), Ohio State (Columbus), Utah (Salt Lake City), Arizona (Tucson), and California (Berkeley).

<sup>2</sup> In terms of the geographic areas used in the U. S. Census reports, the four sections include the following areas:

Northeast: New England and Middle Atlantic.

North Central: East and West North Central.

South: South Atlantic and East and West South Central.

West: Mountain and Pacific.

*Cities and rural areas in each geographic section.*—Figure 5 shows the percentage of individuals of all ages who had been immunized and the percentage who had suffered attacks of typhoid fever in cities of different sizes in each of the four geographic regions. The

percentages have been adjusted for differences in the age distribution of the population under consideration. Immunization histories in the large cities are not much more frequent in the South than in other sections; but in small cities, and particularly in towns and rural areas, there are large excesses in immunization rates for the South. In the rural areas, few immunizations have been done in any section except the South (table 8).

In the history of attacks of typhoid fever which is shown in the left half of figure 5, the rates for all four city-rural categories are higher in the South than in other sections except small cities and

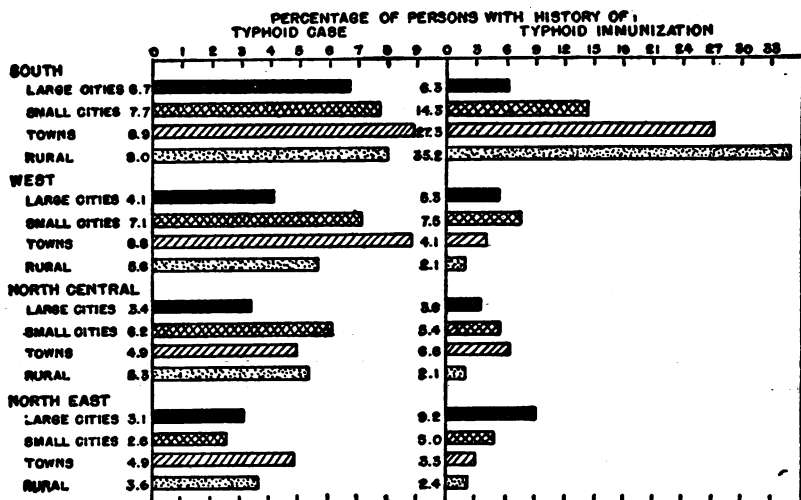


FIGURE 5.—Percentage of persons in metropolitan, urban, and rural parts of four geographic sections (a) who had been immunized and (b) who had suffered an attack of typhoid fever—8,758 canvassed white families in 18 States, 1928-31. (Rates adjusted to the age distribution of the white population of the registration States, 1930.)

towns of the West (table 9). In three of the four sections the history rate is somewhat lower for rural areas than for small towns, in agreement with the findings of Leach and Maxcy (21).

### III. IMMUNIZATIONS AND CASES DURING THE 12-MONTH STUDY

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

The histories of prior immunization refer to the whole life of the individual, and the resulting percentages tend to average out the periods of high and low immunization rates. The record for the one year, although more accurate than the history data, may represent more frequent or less frequent immunizations than the average over a period of years. Even the average over a period of years may not represent the true expectancy of immunizations; this is particularly true of typhoid immunizations in the South, where Federal

aid in certain emergencies resulted in more immunizations than would be expected in normal years.

TABLE 8.—*History of typhoid fever immunizations among persons in metropolitan, urban, and rural parts of 4 geographic sections<sup>1</sup> of the United States—canvassed white families in 18 States<sup>2</sup>*

Age in years	Percentage of persons with a history of—								Total number of persons considered <sup>1</sup>			
	Immunization or case at any time				Immunization at any time but no case							
	Cities of 100,000 or over	Cities 5,000-100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000-100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities 5,000-100,000	Towns under 5,000	Rural areas
Northeast <sup>1</sup>												
All ages---	11.6	6.7	7.3	5.3	9.1	4.6	3.2	2.2	2,873	1,831	2,416	1,754
Under 5---	.3	-----	.6	1.4	.3	-----	.6	1.4	313	255	363	218
5-9---	1.9	1.9	.9	1.6	1.0	1.9	.6	1.2	424	260	344	250
10-14---	3.1	3.9	1.9	.5	2.5	3.9	1.1	-----	359	229	266	199
15-19---	5.5	7.3	4.6	1.3	4.2	6.8	1.3	.7	238	177	151	149
20-24---	5.2	7.2	4.9	8.6	3.9	4.5	1.9	3.8	155	111	103	105
25-44---	20.0	10.5	12.9	9.6	16.4	7.2	7.7	4.7	938	458	730	447
45 and over---	23.3	11.5	13.3	8.0	17.0	5.9	2.2	1.6	446	341	459	336
North Central <sup>1</sup>												
All ages---	6.1	9.4	10.0	5.7	3.4	5.0	6.2	1.8	6,538	3,795	1,863	2,002
Under 5---	.2	-----	.4	.4	.1	-----	.4	.4	893	602	239	251
5-9---	1.3	2.0	2.8	-----	1.0	1.7	2.2	-----	947	657	351	307
10-14---	2.9	5.1	4.1	.3	1.9	3.5	2.3	.3	724	429	267	311
15-19---	5.5	9.8	12.3	3.0	4.4	6.3	10.3	1.0	436	254	146	200
20-24---	6.7	8.6	7.7	4.9	4.0	6.8	7.7	-----	443	161	65	81
25-44---	9.6	16.1	19.1	10.6	5.9	9.2	12.2	5.3	2,179	1,277	583	529
45 and over---	11.0	18.2	14.9	14.2	3.3	4.7	5.0	1.6	911	412	202	323
South <sup>1</sup>												
All ages---	11.5	20.3	35.8	45.4	6.0	14.2	28.6	39.1	1,900	2,004	1,152	1,629
Under 5---	-----	3.3	7.5	19.3	-----	3.1	7.5	19.3	269	485	146	212
5-9---	2.9	14.3	39.1	54.6	2.3	12.7	37.9	54.6	306	482	174	227
10-14---	7.5	20.7	44.8	65.6	6.4	17.7	41.1	62.1	252	333	163	253
15-19---	17.2	25.2	38.3	57.8	14.6	21.8	34.2	53.0	151	206	120	185
20-24---	7.1	21.7	40.8	47.1	3.6	14.5	29.3	42.0	84	166	78	119
25-44---	19.5	30.4	40.2	44.4	8.5	19.7	29.7	33.3	617	909	306	369
45 and over---	17.4	21.7	36.4	31.1	6.1	9.3	18.8	16.7	230	323	165	264
West <sup>1</sup>												
All ages---	9.5	14.2	11.3	6.2	5.5	7.3	4.0	1.9	2,767	997	2,014	1,402
Under 5---	.6	1.3	-----	-----	.3	1.3	-----	-----	324	78	284	135
5-9---	1.6	6.9	1.9	-----	1.0	3.5	.6	-----	316	116	318	217
10-14---	2.9	3.5	3.3	.9	2.9	2.6	2.8	.5	242	114	213	213
15-19---	9.0	7.6	7.9	-----	6.2	4.2	2.6	-----	210	119	152	146
20-24---	8.5	9.7	7.9	3.8	4.5	9.7	2.6	-----	176	62	114	73
25-44---	17.2	23.7	21.3	12.8	11.3	14.1	10.2	6.2	932	291	610	374
45 and over---	9.9	20.7	19.8	14.2	2.8	6.0	1.2	1.3	567	217	323	239

<sup>1</sup> For States included in the different sections, see footnote 1 to table 5.

<sup>2</sup> Dates of interviews varied from 1923 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

**TABLE 9.—History of typhoid fever cases among persons in metropolitan, urban, and rural parts of four geographic sections<sup>1</sup> of the United States—canvassed while families in 18 States<sup>2</sup>**

Age in years	Percentage of persons with history of a case at any time				Number of persons with history of a case at any time				Total number of persons considered			
	Cities of 100,000 or over	Cities of 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities of 5,000–100,000	Towns under 5,000	Rural areas	Cities of 100,000 or over	Cities of 5,000–100,000	Towns under 5,000	Rural areas
<b>Northeast<sup>1</sup></b>												
All ages.....	2.5	2.1	4.1	3.1	73	38	100	55	2,873	1,831	2,416	1,754
Under 10.....	.5	-----	.1	.2	4	-----	1	1	737	515	707	468
10–19.....	.8	.2	1.7	.6	5	1	7	2	597	406	417	348
20–34.....	3.0	3.3	3.5	4.9	16	11	17	16	542	336	484	329
35–44.....	3.6	3.0	6.9	4.9	20	7	24	11	551	233	349	223
45 and over.....	6.3	5.6	11.1	6.5	28	19	51	25	446	341	459	386
<b>North Central<sup>1</sup></b>												
All ages.....	2.7	4.4	3.8	3.8	179	166	70	77	6,538	3,795	1,863	2,002
Under 10.....	.2	.2	.3	-----	4	2	2	-----	1,840	1,259	600	558
10–19.....	1.0	2.3	1.9	.8	12	16	8	4	1,160	683	413	511
20–34.....	3.4	4.8	3.7	3.8	57	38	12	11	1,656	785	327	291
35–44.....	3.7	8.2	8.7	6.6	36	54	28	21	971	656	321	319
45 and over.....	7.7	13.6	9.9	12.7	70	56	20	41	911	412	202	323
<b>South<sup>1</sup></b>												
All ages.....	5.6	6.0	7.2	6.3	106	175	83	103	1,909	2,904	1,152	1,629
Under 10.....	.3	.9	.6	-----	2	9	2	-----	575	967	320	439
10–19.....	1.7	3.2	3.9	4.1	7	17	11	18	403	539	283	438
20–34.....	7.2	8.9	9.6	7.6	28	57	21	21	386	642	219	276
35–44.....	13.7	12.0	12.1	12.3	43	52	20	26	315	433	165	212
45 and over.....	11.3	12.4	17.6	14.4	26	40	29	38	230	323	165	264
<b>West<sup>1</sup></b>												
All ages.....	4.0	6.9	7.3	4.3	111	69	147	60	2,767	997	2,014	1,402
Under 10.....	.5	2.1	.7	-----	3	4	4	-----	640	194	602	352
10–19.....	1.3	2.1	2.5	.3	6	5	9	1	452	233	365	359
20–34.....	4.7	2.4	7.5	4.4	30	4	32	10	640	167	426	229
35–44.....	6.8	12.9	14.1	8.1	32	24	42	18	468	186	298	223
45 and over.....	7.1	14.7	18.6	13.0	40	32	60	31	567	217	323	239

<sup>1</sup> For States included in the different sections, see footnote 1 to table 5.

<sup>2</sup> Dates of interviews varied from 1928 to 1931. Data refer to histories at the beginning of the 12-month morbidity study.

As a test of the representativeness of the study year, the current rates may be cumulated<sup>7</sup> to approximate a curve of immunization histories that would result from the repetition year after year of the current typhoid immunization rates. Conversely, an approximation of the annual immunization rates per 100 for given years of age may be obtained from the cumulative curve by computing differences between the percentages immunized for successive ages. Considering both phases of this test, the cumulative history curve indicates that about 3.3 per-

<sup>7</sup> The method is valid only if all of the current immunizations are first immunizations, an assumption that seems approximately true up to 10 years of age.

cent % of children have been immunized against typhoid fever by the time they reach their fifth birthday, and the cumulation of the current rates up to 5 years of age (average rate is 0.22 per 100 children per year) gives 1.1 percent. To put it in another way, the cumulative figure of 3.3 percent by 5 years of age indicates an average annual rate under 5 years of 6.6 per 1,000, as against the observed rate of 2.2 per 1,000. For children under 5 years the immunizations during the study year amounted to only one-third of the annual average for preceding years. Carrying the procedure to 10 years of age, the history curve indicates that 7.3 percent were immunized by the tenth birthday, and the cumulation of the current rates gives 3.7 percent. If one deducts from the 7.3 percent who have been immunized by the tenth birthday the 3.3 percent immunized before the fifth birthday, there are 4.0 percent immunized between the fifth and tenth birthdays or an average annual rate of 8.0 per 1,000, as compared with an observed current rate at

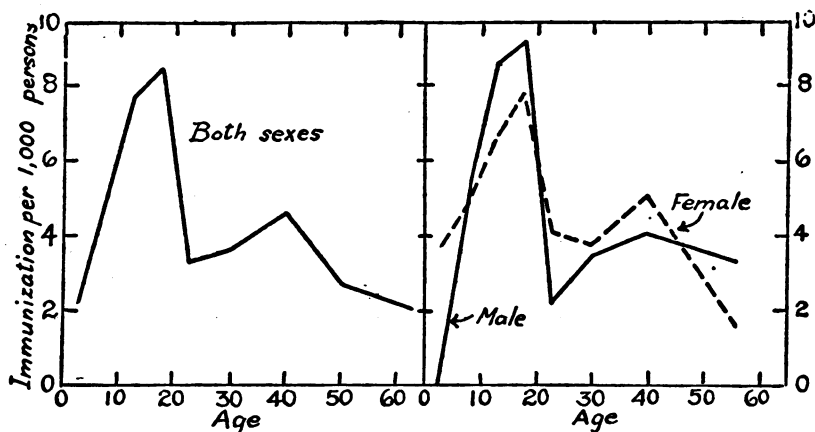


FIGURE 6.—Annual typhoid fever immunizations per 1,000 persons of specific ages for each sex—8,758 canvassed white families in 18 States during 12 consecutive months, 1928-31.

these ages of 5.1 per 1,000. Here, also, the annual average immunization rate in preceding years is considerably above the rate for the current year. Carrying the computations to the fifteenth birthday, the history curve indicates that 9.2 percent had been immunized, and the cumulation of the current rates is 7.5 percent. For the ages 10-14 years, the annual average immunization rate as estimated from the histories amounts to 3.8 per 1,000 as compared with an observed current rate of 7.7 per 1,000. Unlike the younger ages, the current immunization rate at ages 10-14 is higher than in the years immediately preceding the study.

In general, there is little agreement between typhoid immunization rates during the current year and the annual average immunization rate in preceding years. The disagreement may be due to one or more of the following reasons: (a) Incomplete reporting of either current or prior immunizations; (b) current immunizations may represent second or later immunizations for the same individual and therefore do not increase the percentage of persons with a history of immunization; (c) the current year may represent more immunizations than usual or less than usual; (d) the prior immunizations may represent more immunizations than usual or less than usual. A combination of these various possibilities is probably

<sup>1</sup> The figure 3.3 percent representing those who have been immunized by 5 years of age is a straight line interpolation between 2.6 at 4 years and 3.9 at 5 years of age at last birthday, which represent children of an average age of 4.5 and 5.5 years, respectively. A similar interpolation between the percentages for children 9 and 10 years of age was made to determine a figure for 10 years and an interpolation between the rates for 10-14 and 15-19 was made to determine a figure for 15 years of age.

the true reason for the disagreement; however, the last item mentioned appears to be the most important one, that is, the years immediately preceding the time of the survey have, at least in the South, all the earmarks of a period with far more immunizations than in normal years.

#### AGE, SEX, AND MARITAL STATUS

Figure 6 shows typhoid fever immunizations during the study year per 1,000 persons in specific age and sex groups (table 10). The maximum immunization rates occur at the ages between 10 and 20 years; this peak suggests more frequent immunizations through the schools, but it is probably influenced also by the fact that the younger ages (5-24 years) are the ones most frequently attacked by typhoid fever. There is a second but distinctly lower peak in immunizations at 35-44 years.

TABLE 10.—*Annual typhoid fever immunizations per 1,000 persons of specific ages of each sex—canvassed white families in 18 States during 12 consecutive months, 1928-31*

Age in years	Both sexes <sup>1</sup>			Immunizations per 1,000 population per year		Number of immunizations		Population (years of life)	
	Immunizations per 1,000 population per year	Number of immunizations	Population (years of life)	Male	Female	Male	Female	Male	Female
All ages <sup>1</sup> .....	4.4	170	1 38,544	4.4	4.4	83	87	1 18,896	1 19,627
Under 5.....	2.2	12	5,513	.7	3.7	2	10	2,806	2,694
5-9.....	8.1	29	5,715	5.3	4.8	15	14	2,820	2,895
10-14.....	7.7	35	4,568	8.7	6.6	20	15	2,301	2,267
15-19.....	8.5	26	3,060	9.2	7.9	14	12	1,527	1,523
20-24.....	3.3	7	2,119	2.2	4.1	2	5	894	1,225
25-34.....	3.5	20	5,640	3.3	3.7	8	12	2,402	3,238
35-44.....	4.6	27	4,930	4.0	5.1	12	15	2,979	2,951
45-64.....	2.7	9	3,351	3.2	1.5	10	4	3,066	2,736
65 and over.....	2.0	5	2,471						

<sup>1</sup> "All ages" includes a few of unknown age; "both sexes" includes a few of unknown sex.

TABLE 11.—*Annual typhoid fever immunizations per 1,000 single and married persons 20-34 years of age, in canvassed white families in 18 States during 12 consecutive months, 1928-31*

Marital status	Immunizations per 1,000 population per year			Number of immunizations			Population (years of life)		
	Both sexes	Male	Female	Both sexes	Male	Female	Both sexes	Male	Female
Single.....	4.4	2.2	6.7	8	2	6	1,812	922	890
Married.....	3.2	3.4	3.1	19	8	11	5,869	2,364	3,505

Considering the curves for each sex separately, immunizations were somewhat more frequent among males of the school ages, but the reverse is true for the ages from 20 to 45 years. Considering the



rather small number of immunizations, the two curves cannot be said to be significantly different.

Among persons 20-34 years of age, typhoid fever immunizations were more frequent among married than single males but less frequent among married than single females (table 11).

#### FAMILY INCOME

Considering persons of all ages, typhoid fever immunizations increased regularly from 2.2 per 1,000 in families with annual incomes of less than \$1,200 to 7.9 among persons in families with incomes of \$5,000 or more.<sup>9</sup> Figure 7 shows the rates for persons of specific

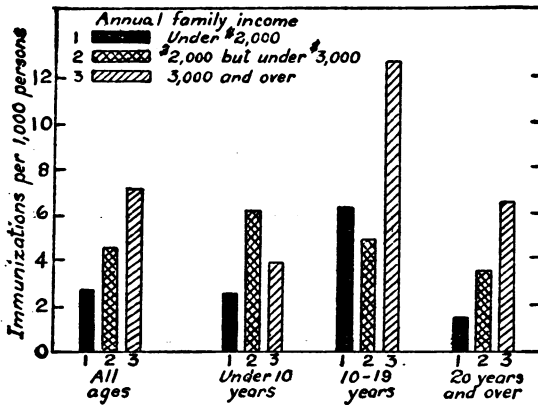


FIGURE 7.—Annual typhoid fever immunizations per 1,000 persons of specific ages in canvassed white families of different income levels in 18 States during 12 consecutive months, 1928-31.

ages classified into three family income groups. There are irregularities, but in general the higher income levels show more immunizations in each age group (table 12).

TABLE 12.—Annual typhoid fever immunizations per 1,000 persons of specific ages in canvassed white families of different income levels in 18 States during 12 consecutive months, 1928-31

Annual family income	Immunizations per 1,000 population per year				Number of immunizations				Population under observation <sup>1</sup>			
	All ages <sup>2</sup>	Under 10	10-19	20 and over	All ages <sup>2</sup>	Under 10	10-19	20 and over	All ages <sup>2</sup>	Under 10	10-19	20 and over
Under \$2,000.....	2.8	2.5	6.2	1.4	53	16	24	13	19,239	6,292	3,842	9,042
\$2,000 but under \$3,000.....	4.5	6.1	4.9	3.5	43	17	9	17	9,491	2,779	1,846	4,836
\$3,000 and over.....	7.1	3.9	12.7	6.5	68	8	24	86	9,600	2,059	1,896	5,572

<sup>1</sup> Nearly all persons were under observation the entire 12 months. For children born during the study an adjustment was made to reduce the observation period on them to full-time years of life.

<sup>2</sup> "All ages" includes a few of unknown age.

<sup>9</sup> Typhoid immunization rates per 1,000 for the three intervening classes were: \$1,200-\$2,000, 3.0; \$2,000-\$3,000, 4.5; \$3,000-\$5,000, 6.3.

## OCCUPATION

Typhoid fever immunizations during the study year were more frequent among professional men than among clerks, salesmen, and merchants.<sup>10</sup> Both of these groups had considerably higher immunization rates than skilled and unskilled laborers (table 13).

TABLE 13.—*Annual typhoid fever immunizations per 1,000 persons in certain occupations—canvassed white families in 18 States during 12 consecutive months, 1928-31*

Occupation	Immunizations per 1,000 population per year			Number of immunizations			Population		
	All ages, 15-64	15-44	45-64	All ages, 15-64	15-44	45-64	All ages, 15-64	15-44	45-64
Males									
Professional men.....	12.1	9.4	17.0	8	4	4	662	427	235
Clerks, salesmen, merchants, and business men.....	5.8	5.6	6.0	16	11	5	2,780	1,948	832
Skilled and unskilled laborers..	1.0	1.0	1.0	4	3	1	3,984	3,009	975
Females									
Employed women.....	3.7	4.2	-----	6	6	-----	1,629	1,433	196
Housewives <sup>1</sup> .....	3.7	4.1	2.2	29	25	4	7,897	6,041	1,856

<sup>1</sup> "Housewife" here means a person in charge of the home, and therefore includes a few single women.

## VARIATION IN GEOGRAPHIC SECTIONS

It has been seen that, as measured by histories, typhoid fever immunization has been used far more in the South than in any other section of the country. In current immunizations, also, the South led all other sections (table 14). However, the rates for rural areas and small towns were about the same as those for the cities in the same geographic section.

## VARIATION IN SPECIFIC LOCALITIES

Typhoid fever immunizations during the 12-month period of this study were largely concentrated not only in the South but in a few communities of the South. In table 15 the localities have been classified into those with large numbers of immunizations in the surveyed families, those with few or scattered immunizations only, and those with no typhoid immunizations during the 12 months. The table omits the few communities that were represented by less than 10 families; the great majority of the places included 30 or more households, the average being 73 families per community.

<sup>10</sup> The rate per 1,000 for merchants and business men (6.1) was about the same as for clerks and salesmen (5.5). Only 2 immunizations were done in the group of 958 farmers, a rate of 2.1 per 1,000. The rate for farm housewives was 3.0 and for town and city housewives 3.7 per 1,000.

**TABLE 14.—Annual typhoid fever immunizations per 1,000 persons in urban and rural parts of each geographic section—canvassed white families in 18 States during 12 consecutive months, 1928–31**

Geographic section <sup>1</sup>	All ages <sup>2</sup>			Under 20 years			20 years and over		
	All localities	Cities of 5,000 and over	Towns under 5,000 and rural areas	All localities	Cities of 5,000 and over	Towns under 5,000 and rural areas	All localities	Cities of 5,000 and over	Towns under 5,000 and rural areas
Immunization per 1,000 population per year									
All sections.....	4.41	4.49	4.28	5.41	5.83	4.76	3.49	3.30	3.82
Northeast.....	2.88	2.94	2.80	3.02	3.90	2.00	2.77	2.04	3.57
North Central.....	.97	.95	1.02	.42	.39	.47	1.53	1.48	1.68
South.....	13.95	14.04	13.80	18.22	19.23	16.51	9.33	8.53	10.75
West.....	2.99	3.88	2.01	3.66	4.49	2.90	2.51	3.56	1.15
Number of immunizations									
All sections.....	170	108	62	102	67	35	68	41	27
Northeast.....	26	14	12	13	9	4	13	5	8
North Central.....	14	10	4	3	2	1	11	8	3
South.....	108	69	39	74	49	25	34	20	14
West.....	22	15	7	12	7	5	10	8	2
Population (years of life)									
All sections.....	38,544	24,045	14,499	18,846	11,488	7,358	19,511	12,442	7,069
Northeast.....	9,043	4,762	4,281	4,309	2,305	2,094	4,692	2,448	2,244
North Central.....	14,413	10,502	3,911	7,194	5,077	2,117	7,188	5,402	1,786
South.....	7,741	4,914	2,827	4,062	2,548	1,514	3,646	2,344	1,302
West.....	7,347	3,867	3,480	3,281	1,558	1,723	3,985	2,248	1,737

<sup>1</sup> See footnote 1 to table 5 for States included in each geographic section.

<sup>2</sup> "All ages" includes a few of unknown age.

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

Typhoid fever immunizations in the surveyed families during the year of the study	Percentage of—			Number of—		
	Localities	Families	Immunizations	Localities	Families	Immunizations
All localities.....	100.0	100.0	100.0	119	8,713	165
Localities with a considerable number of immunizations (10 or more per 100 families).....	6.7	4.7	63.6	8	411	105
Localities with few immunizations.....	16.8	34.8	36.4	20	3,029	60
Localities with no immunizations.....	76.5	60.5	—	91	5,273	—

Eight communities, or 7 percent of the 119 localities, including 5 percent of the surveyed families, contributed 64 percent of the immunizations during the year. The other 36 percent of the immunizations were done in 20 communities (17 percent) which included 35 percent of the families. Seventy-six percent of the communities, including 60 percent of the families, reported no typhoid immunizations during the study year.

Although typhoid immunization is more frequently used in those areas where the typhoid problem is greatest, there is little indication in the available data that the procedure was extensively used in the face of epidemics, as is usual in the case of smallpox (7). Sharp and extensive outbreaks of typhoid fever, as waterborne epidemics usually are, now occur rather rarely, and the work of immunization is not stimulated by the presence of the disease in the way that it is in the more explosive smallpox epidemics. The longer period necessary to complete the three injections and acquire immunity also makes the procedure less applicable for use in the face of epidemics. However, the immunization of household contacts of typhoid fever is advocated by some health departments.

#### SEASONAL DISTRIBUTION

Typhoid fever immunizations are more frequent in the summer months than in the winter (fig. 8 and table 16). The peak of the

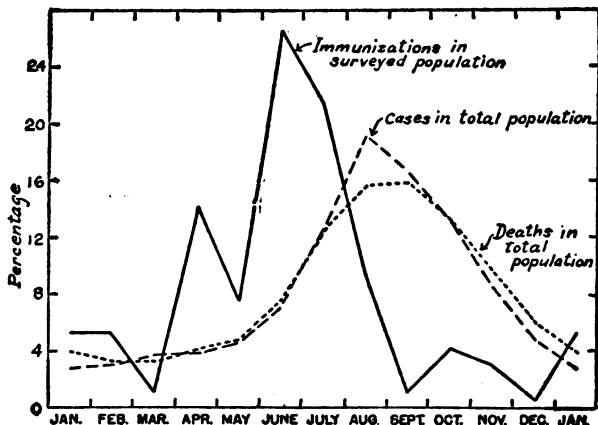


FIGURE 8.—Percentage of immunizations and of typhoid fever cases and deaths in each month (30-day basis)—immunizations in the surveyed families in 18 States, 1923-31; cases and deaths in the general population of 18 States, 1929-30.

immunizations in the group here considered came in June—about 2 months earlier than the peak <sup>11</sup> of the typhoid fever cases. It appears that typhoid immunizations are done in anticipation of the typhoid season or possibly of vacations and other summer activities that involve greater risk of contracting the disease.<sup>12</sup>

<sup>11</sup> The seasonal distribution of typhoid fever cases in the 28 localities having immunizations in the surveyed families is similar to that for the 18 States, with the peak in August. Harmon (19) has shown that the typhoid peak incidence comes earlier in the Southern States than in the Northern. According to his analysis, the highest incidence in the South comes in July, with August nearly as high; but June, the peak of the immunizations, is relatively low.

<sup>12</sup> No significant difference appears between the seasonal or the age distribution of immunizations in localities where there were many as compared with places with only few or scattered immunizations.

**TABLE 16.—Seasonal distribution of typhoid fever immunizations in the surveyed families and of typhoid fever cases and deaths in the general population**

	All months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Number	Percentage in each month (corrected to 30-day basis)											
<b>Typhoid fever immunization in the surveyed population, 1928-31—All localities.....</b>	170	5.3	5.3	1.2	14.2	7.7	26.6	21.3	9.5	1.2	4.1	3.0	0.6
<b>Typhoid fever<sup>1</sup> in the total population of the 18 surveyed States—Based on calendar years 1929-30:</b>													
Cases.....	22,448	2.8	3.0	3.7	3.9	4.6	7.2	12.6	19.0	16.6	13.1	8.6	4.8
Deaths.....	4,297	4.0	3.3	3.2	4.1	4.8	7.8	12.5	15.6	15.8	13.1	9.6	6.1
<b>Typhoid fever<sup>1</sup> in the total population of continental United States—Based on calendar years 1929-30:</b>													
Cases.....	50,480	2.5	2.7	3.4	3.6	4.7	8.2	13.8	18.3	16.4	12.8	8.8	4.7
Deaths.....	11,496	3.9	3.3	3.4	4.0	5.0	8.3	13.2	15.8	15.0	12.0	10.0	6.1
<b>Based on medians for the 7 years 1922-28:</b>													
Cases.....	34,417	4.0	3.3	2.9	3.2	4.3	7.4	13.1	17.6	17.5	13.4	7.9	5.3

<sup>1</sup> Cases from Notifiable Diseases in States (15) and deaths from Mortality Statistics (8), supplemented by State reports (15) for South Dakota in 1929 and Texas in 1929 and 1930.

#### TYPHOID IMMUNIZATIONS IN ATTACKED HOUSEHOLDS

*Immunizations prior to the study.*—Of the 71 persons in the 15 households which were attacked by typhoid fever during the 12-month study, 8 persons, or 11 percent, had been immunized prior to the study, as compared with 8 percent in the whole surveyed population. Of the 71 individuals in attacked households, 1 person, or 1.4 percent, had been previously attacked, as compared with 4.3 percent in the whole surveyed population.

*Immunizations during the 12-month study.*—Of the 56 persons in attacked households who were themselves not attacked, 16 persons, or 29 percent, were immunized during the year, presumably at the time that the case occurred and as a protection against it or its source of infection. This figure may be compared with only 0.44 percent of all individuals in the surveyed group who were immunized during the study year. Fifteen of the sixteen persons in attacked households who were immunized during the year were in the group of 45 unattacked persons who had never previously been immunized.

The 16 immunizations in the attacked households during the study year occurred in 4 of the 15 attacked families; the circumstances were as follows:

In a family of four persons, three of them were reported as having the first injection on May 16 and completing them on May 28, 1930. On June 5, 1930, one of the three, a 6-year old child, was reported as coming down with typhoid fever which involved 72 days in bed and 50 calls to the home by a physician. The head of the household was not immunized at this time but had been immunized in childhood.

In a family of seven persons, a 14-year old boy came down with typhoid on January 26 and died on February 21, 1929. On February 16 the other six members of the household received the first injection and completed the immun-

izations on March 3, 1929. These 6 immunizations were the only ones in the 97 surveyed families in that locality during the study year.

In a family of four persons, a case of typhoid had its onset on January 18, 1930, and the other three members started the injections on the same day and completed them on February 2. These 3 immunizations were the only ones in the 126 observed families in that community during the study year.

In a family of five persons, the mother, aged 31, came down with paratyphoid fever on July 7, 1929, and on the same day the other four members of the family started injections against typhoid, completing them on July 16. These 4 immunizations were the only ones during the year in the 100 families observed in that community.

A case in a household head, male, 26 years of age, was convalescent at the time the study began. The other two persons in the household had been immunized at the time of the onset of the case just prior to the year of the study.

#### TYPHOID FEVER CASES IN THE OBSERVED POPULATION

In the whole surveyed population there were 13 cases of typhoid fever with onset during the study year and 2 cases<sup>13</sup> with onset just prior to the year but sick during the year. The 13 new cases gives an annual rate of 33.7 per 100,000 persons, as compared with a reported average annual rate for the United States<sup>14</sup> of 20.6 for the years 1929-30, a period approximating that covered by the survey. Data on the completeness of reporting to health departments in North Carolina, Pennsylvania, California, and Illinois<sup>15</sup> in 1929 indicate that from 60 to 80 percent of the cases are reported. If these figures are applicable to the country as a whole, the rate for the surveyed population, although based on only 13 cases, is somewhere near the expectancy for the United States.

No data are available for the surveyed group on the time since receiving immunizing inoculations; in view of the rather short period of immunity following inoculation, it is not possible to make even a rough estimate of the effectiveness of the procedure in preventing typhoid in observed persons who had received the injections, because the procedure must be repeated at intervals of 2 or 3 years to be even partially effective.<sup>16</sup>

<sup>13</sup> The 15 cases of typhoid each occurred in a separate household. The 15 cases give an attack rate of 21 per 100 among the 71 persons in attacked households. Fourteen of the cases occurred among 59 individuals who had never been immunized or had a case—an attack rate of 24 per 100; 1 case occurred among the 8 individuals who had been immunized and none among the 4 persons who had had an attack prior to the study.

<sup>14</sup> In the 18 States included in the survey, the corresponding reported case rate was 16.8 per 100,000.

<sup>15</sup> A canvass of over 27,000 families including nearly 120,000 individuals in various counties of Illinois (11, p. 28) indicated that 62 percent of the 65 typhoid fever cases that occurred in the group during 1929 were reported to the health department. These and unpublished data from similar surveys in the other States mentioned form the basis for the estimate given above.

<sup>16</sup> The 14 cases among the 33,972 persons never immunized gives a case rate of 41.2 per 100,000; the one case among the 2,858 who had been immunized at some time in their lives gives a rate of 35.0 per 100,000; no cases occurred among the 1,621 persons who had suffered an attack of typhoid fever prior to the study. Computation of expected cases in the two latter groups from age-specific rates in the nonimmunized group shows no significant difference between actual and expected cases. However, no dependence can be placed on the results, because (a) the number of cases in nonimmunized persons and the number of immunized persons are both too small for the problem at hand and (b) many of the "immunized" persons represent individuals who received the injections only when in the military services more than 10 years prior to the study.

**AGE AND SEX INCIDENCE OF TYPHOID FEVER AS REPORTED TO STATE HEALTH DEPARTMENTS**

In the absence of sufficient data for the surveyed group, cases reported to health departments in Alabama, Mississippi, New York, Michigan, and California<sup>17</sup> are used to indicate in more detail the age curve of typhoid fever. Although typhoid fever rates vary greatly from city to rural areas (21, 22, 24), data based on reported cases in Michigan (12) indicate that the relative age curve is not greatly different in urban and rural places. Table 17 and figure 9 show the

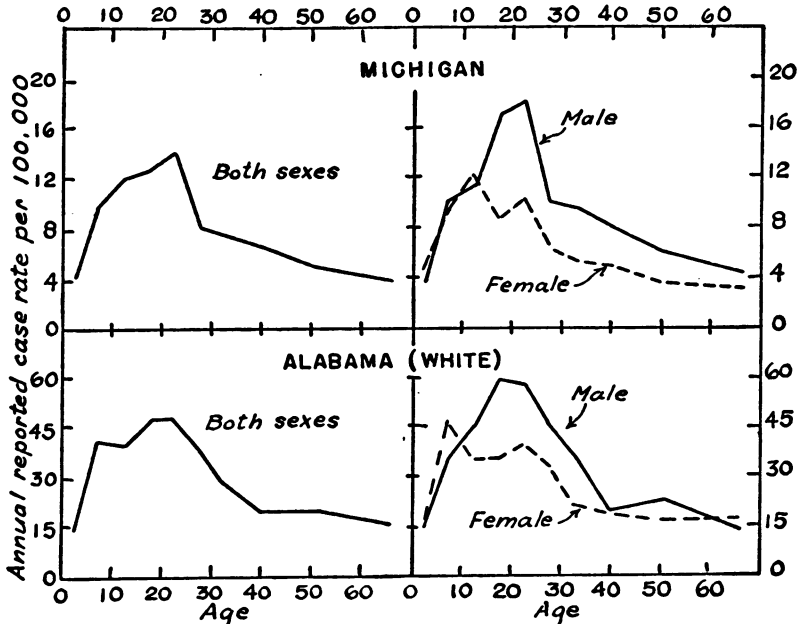


FIGURE 9.—Age and sex incidence of typhoid fever as reported to health departments in Michigan and Alabama, 1929-30. (Scales are so made that the rate for all ages of both sexes represents an interval on the vertical rate scale that corresponds to approximately 20 years on the horizontal age scale.)

rates for specific ages of each sex. Since the relative age curve is of more interest in this connection than the actual reported rates, the scales are arranged to make the curves comparable from that point of view.

In each State the highest incidence occurs in the school and young adult ages, with definite declines thereafter. Among females the peak incidence comes 5 to 10 years earlier than among males. Above 15 years the reported incidence is definitely higher for males than for females.

<sup>17</sup> These States are used as representing low and high typhoid death rates and various parts of the country. They are among the few which published reported cases of typhoid fever by age for the years 1929-30.

TABLE 17.—Age incidence of typhoid fever<sup>1</sup> in 5 States<sup>2</sup>—Based on cases reported to State health departments, 1929–30

	All ages <sup>3</sup>	Age									
		Un- der 5	5-9	10-14	15-19	20-24	25-29	30-34	35-44	45-54	55 and over
		Annual reported case rate per 100,000 population									
Alabama (white):											
Both sexes.....	32.2	14.8	40.9	40.4	47.6	48.1	39.2	28.8	19.7	19.9	15.8
Males.....	35.2	15.3	35.4	45.0	59.4	57.2	45.3	36.3	20.7	22.8	13.7
Females.....	29.1	14.3	46.6	35.6	35.8	39.5	33.4	21.6	18.7	16.7	17.4
Michigan (total):											
Both sexes.....	8.4	3.9	9.8	11.9	12.7	14.1	8.2	7.4	6.5	4.8	3.7
Males.....	9.6	3.4	10.1	11.3	17.0	18.0	9.9	9.4	7.9	6.0	4.3
Females.....	7.1	4.4	9.4	12.2	8.4	10.2	6.3	5.2	4.8	3.5	3.1
Mississippi (white):											
Both sexes.....	56.7	35.6	82.1	85.0	75.1	74.0	61.5	63.6	45.6	32.1	9.5
New York (total) <sup>4</sup> :											
Both sexes.....	12.6	7.3	19.6	20.1	19.7	16.9	14.5	11.5	11.2	9.1	4.8
California (total):											
Both sexes.....	13.0	9.9	21.8	21.7	17.1	22.0	13.0		7.5	6.5	3.3
Number of reported cases for the 2 years											
Alabama (white):											
Both sexes.....	1,094	61	175	157	176	156	103	63	75	61	49
Males.....	603	32	77	89	110	90	58	39	39	37	22
Females.....	490	29	98	68	66	66	45	24	36	24	26
Michigan (total):											
Both sexes.....	814	36	95	107	106	118	68	58	95	43	42
Males.....	483	16	50	52	71	76	43	39	63	32	25
Females.....	331	20	45	55	35	42	25	19	32	16	17
Mississippi (white):											
Both sexes.....	1,130	83	200	189	161	140	93	82	105	58	19
New York (total) <sup>4</sup> :											
Both sexes.....	1,194	56	168	170	155	126	102	82	159	103	78
California (total):											
Both sexes.....	1,481	80	203	184	147	209	255		139	94	55

<sup>1</sup> Including paratyphoid for all States except New York.<sup>2</sup> Data from annual reports of the respective State health departments.<sup>3</sup> "All ages" includes some of unknown age.<sup>4</sup> Exclusive of New York City, Buffalo, and Rochester.

## TYPHOID FEVER MORTALITY AND CASE FATALITY AT SPECIFIC AGES

Since there was only 1 death among the 15 cases in the surveyed families, mortality data for the general population are used. In continental United States there were 50,490 cases (white and colored) of typhoid fever reported in 1929 and 1930, an annual incidence rate of 20.6 per 100,000. The total of 11,496 deaths registered<sup>18</sup> gives an annual mortality of 46.8 per million, and a case fatality of 22.8 percent, a figure that is no doubt much too high because of the incompleteness of case reporting. To express it in another way, there were 4.4 cases reported for each death registered. In a group of 78 cities with populations of 100,000 or over (15) where reporting is better but still incomplete, the average annual case rate for 1929–30 was 9.7 per 100,000, the death rate 16.2 per 1,000,000, with a case fatality of 16.7 percent, or 6 cases reported for each death registered. Wood

<sup>18</sup> Mortality Statistics for the United States (8), supplemented by State reports (15) for South Dakota in 1929 and Texas in 1929 and 1930.



(27) found for Pennsylvania a case fatality of 10.6 percent by excluding deaths that had not been previously reported as cases. Leach and Maxcy (21) assumed 10 cases per death as representing complete reporting of typhoid fever, that is, a case fatality of 10 percent.

TABLE 18.—*Annual typhoid fever mortality and morbidity in the general population of 4 geographic sections of the United States, 1929-30, as reported to the health departments of all States and of the States sampled in the survey*

Geographic section <sup>1</sup>	Annual death rate per 100,000		Annual reported case rate per 100,000		Number of deaths in the 2 years		Number of cases reported in the 2 years		Number of States <sup>2</sup>	
	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States	Surveyed States	All States
All sections.....	3.22	4.68	16.85	20.56	4,297	11,496	22,448	50,490	18	49
Northeast <sup>1</sup> .....	1.18	1.57	8.71	10.63	435	1,063	3,214	7,316	8	9
North Central <sup>1</sup> .....	2.14	2.50	11.83	12.12	1,271	1,931	7,036	9,359	7	12
South <sup>1</sup> .....	10.86	10.17	48.52	38.66	2,208	4,703	9,862	29,268	5	17
White.....	8.74	8.01	( <sup>3</sup> )	( <sup>3</sup> )	1,348	3,747	( <sup>3</sup> )	( <sup>3</sup> )	5	16
Colored.....	17.56	16.70	( <sup>3</sup> )	( <sup>3</sup> )	860	2,886	( <sup>3</sup> )	( <sup>3</sup> )	5	16
West <sup>1</sup> .....	2.31	3.27	14.11	19.11	383	779	2,336	4,547	3	11

<sup>1</sup> The 4 sections in terms of the 9 U. S. Census geographic areas and their typhoid death rates in 1929-30 were as follows:

*Northeast:* New England (1.23) and Middle Atlantic (1.63).

*North Central:* East North Central (2.20) and West North Central (3.08).

*South:* South Atlantic (8.90), East South Central (11.30), and West South Central (10.91).

*West:* Mountain (6.42) and Pacific (1.85).

<sup>2</sup> South Dakota was not in the registration area in 1929; deaths were obtained from State reports (15).

<sup>3</sup> The District of Columbia is counted as a State.

<sup>4</sup> Texas deaths from State reports (15) are included in the total but are not available by color.

<sup>5</sup> Cases not available by color.

Typhoid mortality varies greatly in the different sections of the country. Data are available by individual States (8) and even by counties, but the summary for broad geographic sections in table 18

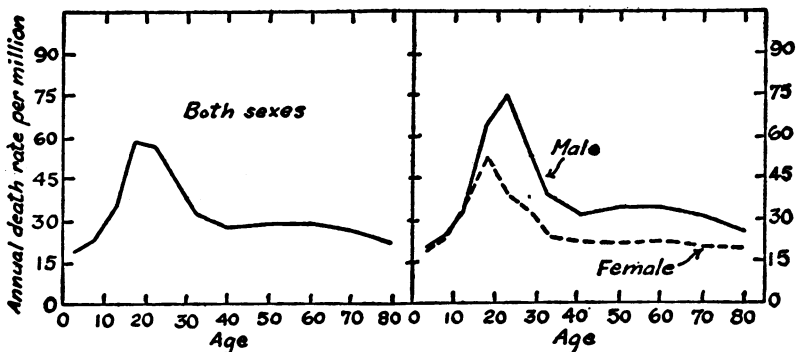


FIGURE 10.—Typhoid fever mortality at specific ages for each sex—white population in the registration States, 1929-30. (Scale is so made that the rate for all ages of both sexes represents an interval on the vertical rate scale that corresponds to approximately 20 years on the horizontal age scale.)

will indicate roughly the regions where the typhoid problem is greatest. The death rates in the white population of the South are definitely higher than in the North, with a still higher mortality among the colored.

Table 19 and figure 10 show by age and sex the mortality from typhoid fever in the white population of the total registration States. The mortality curve is similar to that of case incidence, with the highest rates between 15 and 25 years of age; the peak for females is at 15-19, and for males at 20-24 years. Below 15 years there is little difference between the sexes, but at the various ages above 15 the mortality of males is roughly 50 percent above that of females.

TABLE 19.—*Annual typhoid fever mortality, at specific ages for each sex—white persons, in the registration States,<sup>1</sup> 1929-30*

	Age												
	All ages <sup>2</sup>	Under 5	5-9	10-14	15-19	20-24	25-29	30-34	35-44	45-54	55-64	65-74	75 and over
Annual death rate per million:													
Both sexes.....	34.3	19.4	23.7	34.5	58.9	56.8	45.0	32.1	27.4	28.6	28.6	25.6	21.9
Male.....	39.6	19.9	24.5	33.3	64.2	74.2	55.9	39.0	32.1	34.9	34.5	31.2	25.1
Female.....	28.8	18.8	22.9	35.7	53.5	39.9	34.4	25.1	22.3	21.8	22.3	19.9	19.0
Number of deaths (2 years):													
Both sexes.....	7, 145	367	496	695	1, 135	1, 024	737	498	809	646	429	220	75
Male.....	4, 177	192	260	340	620	659	453	303	498	410	267	136	41
Female.....	2, 908	175	236	355	515	365	284	195	321	236	162	84	34

<sup>1</sup> Registration States included all except Texas and South Dakota in 1929 and all except Texas in 1930.

<sup>2</sup> "All ages" includes a few of unknown age.

Table 20 shows mortality rates for persons of specific ages in the five States for which case incidence figures were shown in table 17. The rates are much higher in the two Southern States; but, considering the small numbers of deaths for some of the ages, the relative

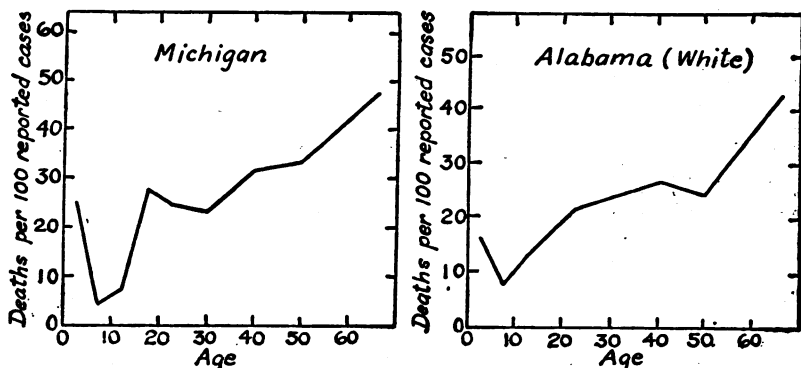


FIGURE 11.—Variation with age in the case fatality of typhoid fever—deaths per 100 reported cases in Michigan and Alabama, 1929-30. (Scales are so made that the rate for all ages represents an interval on the vertical rate scale that corresponds to approximately 20 years on the horizontal age scale.)

variation with age is reasonably similar in each State. The peak of the mortality comes in the late school and young adult ages, except in the New York State data, where it is somewhat later.

Table 20 also shows case fatality in terms of deaths per 100 reported cases. Since not all cases are reported, the actual fatality rates are

too high, but the age curves shown in figure 11 are of interest. The lowest case fatality occurs from 5 to 15 years, with a rise thereafter. The Michigan data indicate a small peak at 15-19 years, which is not present in the Alabama curve; however, the numbers of deaths are small, and so the apparent differences between the curves may be due to chance.

TABLE 20.—*Variation with age and sex in the case fatality of typhoid fever<sup>1</sup> in five States<sup>2</sup>—based on cases reported to health departments and total deaths registered, 1929-30*

	All ages <sup>3</sup>			Both sexes								
	Both sexes	Male	Female	Under 5	5-9	10-14	15-19	20-24	25-34	35-44	45-54	55 and over
Deaths per 100 reported cases												
Alabama (white)-----	18.6	19.1	18.2	16.4	8.0	12.7	17.6	21.8	23.5	26.7	24.6	42.9
Michigan (total)-----	21.4	21.1	21.7	25.0	4.2	7.5	27.4	24.6	23.0	31.6	33.3	47.6
Mississippi (white)-----	10.1	(0)	(0)	9.6	2.0	3.2	14.3	12.1	14.8	16.2	12.1	31.6
New York (total) <sup>4</sup> -----	12.4	(0)	(0)	4.0		10.0	7.1	12.7	12.0	22.0	20.4	23.3
California (total)-----	13.2	(0)	(0)	11.2	5.4	10.9	11.6	15.8	18.4	20.1	21.3	21.8
Annual death rate per million population												
Alabama (white)-----	60.0	67.1	52.8	24.3	32.7	51.4	83.8	104.8	81.0	52.5	49.0	67.9
Michigan (total)-----	18.0	20.2	15.5	9.7	4.1	8.8	34.8	34.7	17.9	20.5	16.1	17.8
Mississippi (white)-----	57.2	64.4	49.8	34.4	16.4	27.0	107.3	89.8	92.8	73.9	38.7	30.1
New York (total) <sup>4</sup> -----	15.6	18.8	11.9	5.5		20.1	14.0	21.4	15.5	24.6	18.5	11.2
California (total)-----	17.3	22.9	11.2	11.1	11.8	23.6	19.8	33.7	24.0	15.0	13.8	7.2
Number of deaths for the 2 years												
Alabama (white)-----	204	115	89	10	14	20	31	34	39	20	15	21
Michigan (total)-----	174	102	72	9	4	8	29	29	29	30	16	20
Mississippi (white)-----	114	65	49	8	4	6	23	17	26	17	7	6
New York (total) <sup>4</sup> -----	148	90	56	1	8	17	11	16	22	35	21	17
California (total)-----	196	135	61	9	11	20	17	32	47	28	20	12

<sup>1</sup> Including paratyphoid for all States except New York.

<sup>2</sup> Cases from the annual reports of the respective State health departments (see table 17); deaths from Mortality Statistics for the United States (8) for all States except New York.

<sup>3</sup> "All ages" includes some of unknown age.

<sup>4</sup> Exclusive of New York City, Buffalo, and Rochester.

<sup>5</sup> Cases not available by sex.

#### REACTIONS FOLLOWING IMMUNIZATION

Of the 170 immunizations against typhoid fever, only 2, or 1.2 percent, were reported as being accompanied by reactions of sufficient severity to cause loss of time from school, work, or other usual activities. In one of these immunizations, in a male 14 years of age, 2 days of illness were reported, with one of the days in bed; the other, male 49 years, reported one-half day lost from work, but was not in bed, and the report may have referred to time lost in going to the doctor for immunization rather than real disability. The figure of 1.2 percent of the 170 typhoid fever immunizations with reactions that caused disability may be compared with 6.0 percent for the

1,209 smallpox vaccinations, 1.2 for the 487 diphtheria immunizations, and 14.3 for the 28 scarlet fever<sup>10</sup> immunizations.

#### WHERE IMMUNIZATIONS WERE DONE

Of all typhoid fever immunizations during the study year, 52 percent were done in public clinics or by school physicians. This figure may be compared with 57 percent for diphtheria immunizations, 42 percent for smallpox vaccinations, 36 percent for scarlet fever immunizations, and 3 percent of cases given cold vaccine. Of all typhoid fever immunizations done in public clinics, 98 percent were free.

The percentage of typhoid fever immunizations that were done in public clinics decreases from 67 for persons under 5 years to 62 at 5-9, 51 at 10-14, and 38 at 15-19 years. Among adults 20-44 years of age the figure rises again to 52 percent, and in persons over 45 years 43 percent of the immunizations were done in public clinics. Of all typhoid immunizations, 4.1 percent were done by specialists and 2.4 percent had a visiting nurse on the case, presumably to urge immunization.

#### IV. SUMMARY

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

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

Considering the whole group, about 10 percent of persons 15-19 years of age gave a history of a typhoid immunization, and 2 percent gave a history of an attack. At 35-44 years, 12 percent gave a history of an immunization and 8 percent history of an attack (fig. 1).

Above 15 years of age, histories of typhoid immunizations were more frequent in males than females; the large differences between the sexes for the ages 30 to 45 are presumably the result of immunization in the military and naval services during the World War (fig. 2).

Persons living in rural areas showed the highest and those living in large cities the lowest percentages with a history of typhoid immunization. The large cities show the lowest typhoid fever history rates,

<sup>10</sup> These figures represent the results of injections made largely in 1929 and 1930 prior to the development of scarlet fever toxoid, which causes less reaction.

but the small towns and small cities have rates that are slightly above the rural areas. In general, typhoid immunization seems to have been resorted to most frequently where the typhoid problem is greatest (fig. 3).

The South, with the highest percentage of persons with a history of typhoid fever, has resorted to immunization far more than any other section (fig. 4). The West, with the next highest typhoid history rate, has not resorted to immunization any more than other geographic sections.

In cities over 100,000, immunizations are not much more frequent in the South than elsewhere; the excess for the South is particularly large for small towns and rural areas (fig. 5).

Typhoid fever immunizations during the 12 months of the morbidity study amounted to 4.4 per 1,000 population of all ages. There was no consistent difference between the sexes in the frequency of immunizations (fig. 6).

The frequency of typhoid immunizations increased regularly with family income (fig. 7).

Immunizations during the study year were also more frequent in the South than in other geographic sections. About 64 percent of the typhoid immunizations during the study year were done in 7 percent of the localities.

The seasonal peak of immunizations came about two months before that of typhoid cases and deaths (fig. 8). Immunizations in this group seem to have been done in anticipation of the typhoid season rather than in the face of epidemics.

Reported typhoid cases and deaths both show maximum rates between 15 and 25 years of age. The peaks come at an earlier age among females than among males. In the adult ages both incidence and mortality are definitely higher among males than among females (figs. 9 and 10).

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## POST-MORTEM FINDINGS IN FATALITIES DUE TO THE USE OF THE ARSPHENAMINE GROUP

### A Review of 44 Autopsies

By S. S. Cook, *Commander, Medical Corps, United States Navy*

The discovery of "606" by Ehrlich in 1910 ushered in a new era in the treatment of syphilis. Along with this new and superior therapeutic agent came new ideas and hopes for the cure of this disease. Also new problems were introduced in pharmacology and toxicology. Today, more than 25 years later, much remains to be learned of the toxicology of the arspenamines. The clinical signs of toxicity are fairly well understood, but no one can predict which patients will experience untoward symptoms nor is there agreement as to the exact mechanism of the toxic action of the organic arsenicals.

So far as can be determined by a reasonably careful search of the Navy records, there were 63 deaths chargeable to the arspenamines during the 17-year period 1919-35. There were 44 autopsies.

In the belief that a better understanding of the action of these drugs may be gained by a study of the lesions found at autopsy, this article is devoted to a review of the post-mortem findings in the 44 autopsies. The age, duration of infection, interval between the final injection and onset of symptoms, previous treatment, duration of illness, year of death, and post-mortem findings are shown in table 1.

*Age, sex, and race.*—The youngest man was 19 years of age, the oldest was 43, and 29 of the 44 were under 30. All of them were males. Cases 3, 36, and 37 were Filipinos, case 40 was a Hawaiian, case 19 was a Negro, and the remaining 39 were white.

*Duration of infection.*—All of the patients had syphilis, the duration of which was unknown in six instances. Of the remaining 38, in 21 it was less than 6 months; in 1, between 6 months and 1 year; in 4, between 1 and 3 years; in 2, between 3 and 5 years; and in 10, over 5 years.

*Interval between final injection and onset of symptoms.*—In 6 instances the interval could not be accurately determined, because symptoms developed gradually and did not attract attention until well advanced. In the remaining 38, symptoms appeared in 7 instances in 5 minutes or less; in 11, in less than 6 hours; in 11, between 6 hours and 48 hours; and in the remaining 9 the interval varied from 3 days to 29 days.

*Previous treatment.*—The type of arsenical given at the final injection was in 34 instances neoarsphenamine; in 5, salvarsan; in 2, arsenobenzol; in 2, arspenamine; and in 1 the type was not stated. This is not to be interpreted as an indication of the greater toxicity of neoarsphenamine; this arsenical is the one most extensively used in the Navy.

The number of injections that the patients had received, including the final one, were as follows:

Number of injections	Number of men	Number of injections	Number of men
2-----	12	10 and over-----	13
3-----	7	Unknown-----	1
4-----	2		
5-----	2	Total-----	44
6-9-----	7		

It is noted that there were no deaths following the first injection.

*Post-mortem findings.*—The striking features are the frequency of edema, congestion, and hemorrhages in the different organs. This is not surprising when one recalls that one of the effects of arsenic is to cause dilatation of the capillaries with increased permeability. An additional effect is attributed to the drug by many authorities, namely, damage to the endothelial lining of the capillaries. If this action extends to the reticulo-endothelial system, one has a basis for nearly all the manifestations of arsenic poisoning. It is obvious that these factors will produce marked variations in symptomatology and pathology, depending on the location and amount of edema and hemorrhage.

One of the most common and least serious reactions which follows the administration of the arsphenamines is the so-called nitritoid phenomenon. This has been attributed by Kolmer and others to a vasodilatation or vasoparesis. One of the reasons for this belief is the prompt relief which usually follows the injection of a vasoconstrictor such as adrenalin.

Probably the most severe reactions are those usually diagnosed as hemorrhagic encephalitis. In these there is the factor of edema, which causes increased intracranial pressure and the symptoms familiar to all, and the other factor of hemorrhage into vital centers. The characteristic pathologic picture is a wet brain with multiple punctate hemorrhages.

In this series of 44 autopsies, involvement of the brain was found in 21 instances; in 2 instances the findings were negative, and in the remaining 21 cases the brain was not examined. Judging from the clinical picture it is altogether probable that a number of the latter had involvement of the brain.

Hemorrhages in the liver were noted in 4 instances, edema in 3 instances, and in 18 additional cases there was some other type of liver involvement such as degeneration, necrosis, or congestion.



Hemorrhages in the kidneys were noted 9 times, and other lesions such as cloudy swelling, congestion, edema, and degeneration were noted 24 times.

Hemorrhages in the lung were noted 3 times and edema 12 times. In five instances there was hemorrhage into the myocardium or pericardium.

The spleen was found to be hemorrhagic in five instances.

There were hemorrhages into the pancreas in two cases.

Petechial hemorrhages were found in the stomach and small intestines on seven occasions.

It is noted that in many cases several organs showed hemorrhages or edema or both.

In case 4 there were edema and hemorrhages in the brain and also congestion of the lungs, heart, and spleen.

In case 16 there were hemorrhages in the brain, liver, kidneys, and spleen. This man, who had had syphilis for one month, died 4 days after his third injection of neoarsphenamine.

Case 21, a patient who had acquired syphilis 4 months previously, died 3 days after his second injection of neoarsphenamine and was found to have edema of the brain, liver, kidneys, and lungs and petechial hemorrhages in the walls of the small intestine.

Case 36, with syphilis of 4 months' duration, collapsed immediately after his eighth injection and died in 45 minutes. He had hemorrhages in all the tissues of the body, including the pancreas.

Case 41 had a convulsion 3 minutes after his fifth injection of neoarsphenamine and died in 6 hours. At autopsy there were found edema of the brain and lungs, congestion of the spleen and kidneys, and petechial hemorrhages of the small intestine.

The pathological findings which have been presented are suggestive of a common basis for the diverse clinical signs of arsphenamine poisoning. If capillary damage is the fundamental structural alteration, the concept of this problem is narrowed and greatly simplified.

#### SUMMARY

In the 17-year period 1919-35 there were 63 deaths in the United States Navy following the administration of the arsphenamines. All of the 44 autopsies were made on males, none of whom was over 43 years of age. In this group were 3 Filipinos, 1 Hawaiian, 1 Negro, and 39 whites.

All of the patients had syphilis. The duration of infection is known in 38 instances. In 21, or 55 percent, it was less than 6 months, and in 17, or 45 percent, over 6 months. The time interval between the final injection and onset of symptoms was less than 6 hours in 18 cases, over 6 hours in 20 cases, and unknown in 6 cases.

Neosarsphenamine caused the largest number (34) of the deaths, which was to be expected, as this is the arsenical most extensively used in the Navy.

None of the patients died after the first injection of an arsenical; 12 died after the second; 23 after 5 injections or less; and 20 had received more than 6 injections. In one instance the number is not known.

TABLE 1.—Deaths following administration of the arsphenamines,

Marginal no.	Age (years)	Duration of infection	Interval between treatment and onset	Previous treatment	Duration of illness	Year of death	Post-mortem findings
							Brain
1	20	1 month....	24 hours....	Feb. 17, 1919, 0.6 g salvarsan; Feb. 27, 1919, 0.5 g salvarsan.	24 hours....	1919	-----
2	26	do.....	Immediate..	May 20, 1919, 0.6 g salvarsan; May 27, 1919, 0.6 g salvarsan; June 3, 1919, 0.6 g salvarsan.	3 days.....	1919	-----
3	22	2 years....	24 hours....	Sept. 8, 1919, 0.6 g arsenobenzol; Sept. 16, 1919, 0.6 g arsenobenzol.	24 hours....	1919	-----
4	20	Unknown..	2 hours.....	Aug. 25, 1920, 0.6 g salvarsan; Sept. 1, 1920, 0.6 g salvarsan.	72 hours....	1920	Edema and hemorrhages.
5	25	3 years....	Immediate..	Unknown amount in 1917; Oct. 26, 1920, 0.6 g neosarsphenamine; Oct. 31, 1920, 0.6 g neosarsphenamine.	4 days.....	1920	-----
6	19	20 days....	48 hours....	July 13, 1921, 0.5 g neosarsphenamine; July 20, 1921, 0.8 g neosarsphenamine.	48 hours....	1921	Congestion.
7	20	2 months..	3 days.....	Dec. 22, 1920, to Feb. 1, 1921, 6 injections arsphenamine, 1 of 0.3 g and 5 of 0.6 g.	1 day.....	1921	No pathology.
8	22	5 months..	Few hours....	May 17, 1921, 0.3 g arsphenamine; May 24, 1921, 0.4 g arsphenamine.	14 days....	1921	-----
9	21	1 month....	Immediate..	Feb. 8, 1921, 0.6 g neosarsphenamine; Feb. 23, 1921, 0.6 g neosarsphenamine; Mar. 2, 1921, 0.9 g arsenobenzol.	1½ hours....	1921	-----
10	28	Unknown..	do.....	Feb. 23, 1922, 0.9 g salvarsan; Mar. 2, 1922, 0.9 g salvarsan.	96 hours....	1922	-----
11	36	1 month....	48 hours....	Aug. 9, 1923, 0.45 g neosalvarsan; Aug. 16, 1923, 0.9 g neosalvarsan.	24 hours....	1923	-----
12	24	19 days....	3 days.....	Nov. 12, 1924, 0.4 g salvarsan; Nov. 19, 1924, 0.6 g neosalvarsan.	48 hours....	1924	Edema with injection.
13	23	1 month....	Unknown....	May 28, 1924, to June 5, 1924, 3 injections neosarsphenamine.	Unknown....	1924	Congestion.
14	29	3¼ years..	5 hours.....	May 13, 1921, to Nov. 30, 1921, 7 injections arsenicals; Oct. 7, 1924, 0.45 g neosarsphenamine; Oct. 14, 1924, 0.9 g neosarsphenamine; Oct. 21, 1921, 0.9 g neosarsphenamine.	6 hours.....	1924	Edema.....
15	29	Unknown..	24 hours....	Apr. 1, 1926, to May 3, 1926, 5 injections neosarsphenamine, the last of 0.75 g.	24 hours....	1926	Weight, 1,425 g; injection of vessels.
16	27	1 month....	48 hours....	Oct. 1926, 3 injections neosarsphenamine, 0.45, 0.6, and 0.9 g.	48 hours....	1926	Hemorrhagic encephalitis; weight, 1,500 g.
17	21	18 days....	6 hours.....	Apr. 20, 1926, 0.45 g neosalvarsan; Apr. 27, 1926, 0.6 g neosalvarsan.	4 days.....	1926	Edema; injection of capillaries.
18	22	15 days....	12 hours....	Feb. 5, 1926, 0.45 g. neosalvarsan; Feb. 9, 1926, 0.55 g neosalvarsan; Feb. 16, 1926, 0.9 g neosalvarsan.	72 hours....	1926	Edema.

Autopsies were performed on 44 cases, the results of which are presented and discussed.

The striking findings were frequent hemorrhages and edema in the various organs of the body.

The autopsy findings are suggestive of a common pathologic basis for many of the clinical manifestations.

*United States Navy, 1919-35—Post-mortem findings in 44 cases*

Post-mortem findings					
Liver	Kidneys	Lungs	Heart	Spleen	Remarks
	Left—enlarged; soft.		Fibrosis.		
Enlarged and engorged with blood.	Swollen with hemorrhagic areas.			Enlarged and engorged.	
			Emboli in right auricle and right ventricle.		Embolus in cephalic vein above needle puncture.
	Enlarged.	Congestion.	Congestion.	Weight, 312 g; congestion.	
Dark and soft.	Enlarged with punctate hemorrhages.			Greatly enlarged.	
Mottled.			Dilated right auricle.	Mottled.	Enlarged abdominal lymph glands.
Necrosis.	Necrosis.			Necrosis.	Left adrenal enlarged and congested.
Hemorrhages.	Hemorrhages.	Bloody fluid in pleural cavity. Lower left adherent.		Hemorrhages.	Hemorrhage in pancreas and intestinal mucosa.
					Unneutralized arsenobenzol; thymus gland 5 cm x 1 cm x 1½ cm.
Hemorrhages.	Pus in pelvis.	Edema.		Hemorrhages.	
	Congestion.				General glandular enlargement.
		Congestion.			Positive blood cultures for staphylococcus aureus.
Acute congestive nephritis.				Marked enlargement.	
Congestion.	Acute tubular nephritis.	Edema.		Infarct.	
Passive congestion.	Mottling; blue in color.	Right lower lobe consolidated.	Weight 390 g; enlarged.		
Weight 1,700 g; hemorrhages.	Weight 200 g.			Weight 300 g; hemorrhages.	
	Edema.	Edema.			

TABLE 1.—Deaths following administration of the arsphenamines, United

Marginal no.	Age (years)	Duration of infection	Interval between treatment and onset	Previous treatment	Duration of illness	Year of death	Post-mortem findings
							Brain
19	36	11 years...	Few hours...	July 15, 1926, 1 injection neoarsphenamine; July 22, 1926, 0.45 g neoarsphenamine.	13 days....	1926	-----
20	40	Unknown	12 hours....	Mar. 23, 1927, 0.3 g salvarsan; Mar. 30, 1927, 0.6 g salvarsan.	36 hours....	1927	Intense congestion of meninges with exudate.
21	26	4 months...	48 hours....	Nov. 29, 1927, 0.45 g neosalvarsan; Dec. 8, 1927, 0.6 g neosalvarsan.	12 hours....	1927	Wet brain; blood in internal capsule.
22	42	20 years...	Unknown...	Feb. 24, 1927, to Aug. 4, 1927, 16 injections neoarsphenamine.	Unknown...	1927	-----
23	29	1 month...	2 hours....	Nov. 7, 1927, 0.45 g salvarsan; Nov. 10, 1927, 0.3 g salvarsan; Nov. 14, 1927, 0.45 g salvarsan.	31 hours....	1927	Negative.
24	24	4 months...	Unknown...	July 11, 1927, to Aug. 25, 1927, 4 injections neoarsphenamine.	Unknown...	1927	Engorgement of surface vessels.
25	28	5 years....	4 days....	1923 to 1926, 24 injections arsenicals; June 12, 1928, to Aug. 2, 1928, 8 injections neoarsphenamine.	48 hours....	1928	Hemorrhages with focal necrosis.
26	38	Unknown	3 minutes...	Sept. 29, 1928, to Nov. 10, 1928, 6 injections neoarsphenamine, the first of 0.25 and the others of 0.9 g.	45 minutes..	1928	Edema....
27	40	19 years...	15 days....	May 8, 1928, to Sept. 15, 1928, 10 injections arsenicals, amounts and types not stated.	Unknown...	1928	Abdominal incision only.
28	27	3 months...	6 days....	June 30, 1928, to Aug. 18, 1928, 8 injections of neoarsphenamine.	1 month....	1928	-----
29	24	10 months.	Unknown...	1928, 12 injections neoarsphenamine, 0.45 g each; Feb. 6, 1929, to July 22, 1929, 14 injections neoarsphenamine.	Unknown...	1929	-----
30	21	1 year....	do.....	1928, 5 injections neoarsphenamine, 0.6 g each; July 1, 1929, to Aug. 12, 1929, 4 injections neoarsphenamine.	do.....	1929	-----
31	41	17 years...	do.....	1912, 1 injection salvarsan; 1915, 8 injections neosalvarsan; 1924, 13 injections neosalvarsan; 1927, 4 injections salvarsan; Apr. 13, 1929, to May 11, 1929, 5 injections neosalvarsan.	do.....	1929	Cerebrum soft from previous hemorrhages.
32	30	3 years....	24 hours....	1927 and 1928, 27 injections neoarsphenamine; 1929, injections, number not given; Aug. 8, 1930, 0.3 g neoarsphenamine; Aug. 14, 1930, 0.6 g neoarsphenamine; Aug. 20, 1930, 0.4 g neoarsphenamine.	20 days....	1930	Congestion of meningeal vessels.
33	22	3 months...	48 hours....	Nov. 7, 1929, to Dec. 27, 1929, 8 injections neoarsphenamine, total 5.4 g; Feb. 6, 1930, to Feb. 27, 1930, 4 injections neoarsphenamine, total 2.1 g.	14 days....	1930	-----
34	31	11 years...	1½ hours...	1921-32, inclusive, 65 injections, the last of 0.2 g neoarsphenamine.	7 hours....	1932	Edema and hemorrhages.

## States Navy, 1919-35—Post-mortem findings in 44 cases—Continued

Post-mortem findings					
Liver	Kidneys	Lungs	Heart	Spleen	Remarks
Markedly enlarged and friable.			Intense congestion of myocardium and pericardium.		
Edema	Edema	Edema			Few petechial hemorrhages, small intestines.
Pale	Pale	Congestion			Emphysema due to gas bacillus infection; exfoliative dermatitis.
	Weight 175 g each; petechial hemorrhages.		Weight 275 g.		Many petechial hemorrhages, stomach and small intestines.
	Congestion		Hemorrhages in pericardium.		Petechial hemorrhages, skin and mesentery.
	Normal	Edema	Flabby muscle.		
				Enlarged	Bright red abdominal muscles.
	Marked enlargement.	Innumerable small abscesses.			100 cc bloody fluid in right pleural cavity; exfoliative dermatitis.
		Hemorrhagic bronchopneumonia.			Aplastic anemia.
Small, nodular destruction of cells.	Slightly enlarged. Destruction of tubular epithelium.				Echymotic patches, serosa, small intestine.
Cirrhosis	Nephrosis				Profound secondary anemia.
Cloudy swelling.	Cloudy swelling.		Sclerosis of aorta.		Fat necrosis in abdomen; acute pancreatitis with abscess formation.
	Hemorrhages	Edema	Hemorrhages		Hemorrhages in bladder, intestines, pleurae, pericardium, hypoplastic bone marrow.
Acute degeneration.	Acute degeneration.	do			Hypoplastic bone marrow, intense hyperemia of all viscerae.

TABLE 1.—Deaths following administration of the arsphenamines, United

Marginal no.	Age (years)	Duration of infection	Interval between treatment and onset	Previous treatment	Duration of illness	Year of death	Post-mortem findings
							Brain
35	30	10 years...	6 hours.....	1922-30, inclusive, 60 injections arsenicals; Mar. 14, 1932, to Nov. 1, 1932, 19 injections neoarsphenamine, the last of 0.5 g.	4 days.....	1932	Edema and hemorrhages.
36	35	4 months...	5 minutes...	Nov. 23, 1932, to Jan. 10, 1933, 6 injections neoarsphenamine; Mar. 4, 1933, 0.3 g neoarsphenamine, Mar. 11, 1933, 0.45 g neoarsphenamine.	45 minutes...	1933	Hemorrhages...
37	32	12 years...	1 hour.....	1921, 8 injections neoarsphenamine; 1922, 8 injections neoarsphenamine; 1925, 6 injections neoarsphenamine; July 11, 1933, 0.3 g neoarsphenamine; July 18, 1933, 0.6 g neoarsphenamine.	9 days.....	1933	-----
38	29	6 years.....	do.....	1927-32, inclusive, 41 injections neoarsphenamine; Nov. 25, 1933, to Dec. 9, 1933, 4 injections neoarsphenamine, the last of 0.6 g.	12 days.....	1933	-----
39	43	14 years...	do.....	Feb. 14, 1933, 0.3 g neoarsphenamine; Feb. 21, 23, and Mar. 7, 0.6 g neoarsphenamine.	5 days.....	1933	-----
40	37	2 months...	15 days.....	Feb. 23, 1933, to Mar. 28, 1933, 9 injections neoarsphenamine, total 4.5 g; the last injection 0.6 g.	15 days.....	1933	-----
41	24	Unknown.	3 minutes...	Apr. 14, 1934, to May 12, 1934, 5 injections neoarsphenamine, the last of 0.6 g.	6 hours.....	1934	Edema and hemorrhages.
42	34	10 years...	29 days.....	1924-33, inclusive, 29 injections arsenicals; Feb. 3, 1934, to Apr. 7, 1934, 8 injections neoarsphenamine.	Unknown...	1934	-----
43	23	2 months...	3 days.....	Mar. 12, 1934, to Apr. 17, 1934, 6 injections neoarsphenamine.	1 month.....	1934	Edema.....
44	28	3 months...	4 days.....	Oct. 19, 1934, to Nov. 13, 1934, 2.1 g neoarsphenamine; Dec. 5, 1934, to Jan. 29, 1935, 8 injections neoarsphenamine, total 4.5 g.	9 days.....	1935	-----

## States Navy, 1919-35—Post-mortem findings in 44 cases—Continued

Post-mortem findings					
Liver	Kidneys	Lungs	Heart	Spleen	Remarks
Congestion...	Congestion...	-----	-----	Congestion...	Hemorrhagic infiltration of all tissues including pancreas.
Hemorrhages..	Hemorrhages..	Hemorrhages..	Hemorrhages..	Hemorrhages..	
Congestion....	Congestion....	Slight edema..	Right dilated; petechial hemorrhages in myocardium.	-----	
Small with nutmeg mottling.	Enlarged, pale, and hemorrhagic areas, lower pole.	Hemorrhagic..	-----	-----	Degeneration adrenals.
Acute yellow atrophy.	Acute parenchymatous nephritis.	Edema with much fluid in pleural cavity.	Degeneration..	Degeneration..	
Fatty degeneration.	Diffuse granular changes.	Edema and patches of bronchopneumonia.	Degeneration of muscle.	-----	
-----	Congestion....	Edema.....	-----	Congestion....	Petechial hemorrhages, small intestines.
Degeneration..	Petechial hemorrhages, right kidney.	Bloody fluid in pleural cavity.	Hemorrhage of muscle.	-----	Degeneration of adrenals; acellular bone marrow.
Edema.....	Edema.....	Edema.....	Dilatation right heart.	-----	Hemorrhages in skin; exfoliative dermatitis.
Hypoplastic and fatty infiltration.	Parenchymatous nephritis.	Pneumonia, left lower lobe.	-----	Passive congestion.	Ulcerations of nose and mouth.

## DEATHS DURING WEEK ENDED JUNE 20, 1936

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

	Week ended June 20, 1936	Corresponding week, 1935
<b>Data from 86 large cities of the United States:</b>		
Total deaths.....	7,736	7,831
Deaths per 1,000 population, annual basis.....	10.8	10.9
Deaths under 1 year of age.....	506	563
Deaths under 1 year of age per 1,000 estimated live births.....	46	51
Deaths per 1,000 population, annual basis, first 25 weeks of year.....	13.0	12.3
<b>Data from industrial insurance companies:</b>		
Policies in force.....	68,692,630	67,863,479
Number of death claims.....	12,132	12,297
Death claims per 1,000 policies in force, annual rate.....	9.2	9.4
Death claims per 1,000 policies, first 25 weeks of year, annual rate.....	10.6	10.5

# PREVALENCE OF DISEASE

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

## UNITED STATES

### CURRENT WEEKLY STATE REPORTS

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

Reports for Weeks Ended June 27, 1936, and June 29, 1935

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 27, 1936, and June 29, 1935*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935
<b>New England States:</b>								
Maine.....				1	218	183	0	0
New Hampshire.....					26	2	0	0
Vermont.....		1			146	35	0	0
Massachusetts.....	5	10			582	318	2	0
Rhode Island.....	1	1			3	222	0	0
Connecticut.....		19	2		49	301	0	0
<b>Middle Atlantic States:</b>								
New York.....	34	39	14		1,476	2,063	15	15
New Jersey.....	7	15	6	3	364	1,020	1	1
Pennsylvania.....	25	31			1,134	988	5	11
<b>East North Central States:</b>								
Ohio.....	20	30	6	22	459	1,278	3	8
Indiana.....	5	11	8	9	10	54	3	1
Illinois.....	39	44	28	11	28	747	7	11
Michigan.....	12	6		1	50	1,423	1	3
Wisconsin.....	2	3	11	30	159	1,178	0	2
<b>West North Central States:</b>								
Minnesota.....	5	1	1	1	123	63	3	1
Iowa.....	2	4			3	41	2	1
Missouri.....	15	16	8	35	20	104	1	2
North Dakota.....		1		11	6	11	0	1
South Dakota.....						11	0	0
Nebraska.....	2				8	63	0	0
Kansas.....	2	5	9	9	7	189	1	0
<b>South Atlantic States:</b>								
Delaware.....	3	1			9	9	1	0
Maryland.....	5	4	1	2	211	61	2	0
District of Columbia.....	5	9		1	133	9	0	0
Virginia.....	4	6			46	150	9	4
West Virginia.....	7	11	11	14	12	105	3	2
North Carolina.....	13	9	8		5	31	4	4
South Carolina.....	4	3	41	59	11	16	0	1
Georgia.....	7	11					3	0
Florida.....		9	2			8	2	0

See footnotes at end of table.



*Cases of certain communicable diseases reported by telegraph by State health officers  
for weeks ended June 27, 1936, and June 29, 1935—Continued*

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935
<b>East South Central States:</b>								
Kentucky.....	10	4	3	2	21	25	9	5
Tennessee.....	1	9	17	8	13	14	2	2
Alabama.....	8	13	7	18	7	49	2	1
Mississippi.....	5	9					0	1
<b>West South Central States:</b>								
Arkansas.....	4	4	3	6		8	0	0
Louisiana.....	4	9	14	5	3	5	2	2
Oklahoma.....	4	9	8	19	4	8	1	0
Texas.....	20	26	59	24	100	50	4	0
<b>Mountain States:</b>								
Montana.....	2	4	12	2	4	85	1	0
Idaho.....				1	13	4	0	1
Wyoming.....					1	11	0	0
Colorado.....	3	9			10	106	5	0
New Mexico.....	1		1		39	3	0	0
Arizona.....	2				97		1	1
Utah.....					3	6	0	1
<b>Pacific States:</b>								
Washington.....			1		133	239	1	2
Oregon.....	1		10	16	14	84	0	1
California.....	20	34	466	26	1,201	665	8	5
<b>Total.....</b>	<b>309</b>	<b>430</b>	<b>747</b>	<b>336</b>	<b>6,968</b>	<b>12,045</b>	<b>104</b>	<b>94</b>
<b>First 26 weeks of year.....</b>	<b>13,098</b>	<b>15,531</b>	<b>139,713</b>	<b>102,317</b>	<b>253,856</b>	<b>668,253</b>	<b>5,458</b>	<b>3,630</b>

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935
<b>New England States:</b>								
Maine.....	0	0	11	10	0	0	1	5
New Hampshire.....	0	1	1	3	0	0	6	0
Vermont.....	0	0	4	4	0	0	0	0
Massachusetts.....	0	3	143	162	0	0	5	0
Rhode Island.....	0	0	27	10	0	0	0	2
Connecticut.....	0	1	22	50	0	0	2	1
<b>Middle Atlantic States:</b>								
New York.....	3	8	292	418	2	0	13	11
New Jersey.....	0	3	106	75	0	0	7	0
Pennsylvania.....	1	3	223	241	0	0	13	10
<b>East North Central States:</b>								
Ohio.....	1	1	121	204	0	0	7	10
Indiana.....	0	0	37	41	3	2	5	5
Illinois.....	3	2	262	450	27	0	2	22
Michigan.....	1	1	228	136	1	0	6	6
Wisconsin.....	0	1	173	230	6	6	2	0
<b>West North Central States:</b>								
Minnesota.....	0	0	122	98	11	3	0	30
Iowa.....	0	0	61	31	8	15	1	0
Missouri.....	0	0	67	14	11	0	18	16
North Dakota.....	0	0	13	19	5	0	0	3
South Dakota.....	0	0	11	3	3	14	0	0
Nebraska.....	0	0	26	8	24	23	0	2
Kansas.....	1	0	68	23	11	19	1	7
<b>South Atlantic States:</b>								
Delaware.....	0	0	2	3	0	0	0	1
Maryland.....	0	0	19	31	0	0	2	4
District of Columbia.....	0	0	6	7	0	0	0	3
Virginia.....	0	24	12	15	1	0	8	18
West Virginia.....	0	0	8	36	0	0	4	3
North Carolina.....	1	63	11	14	1	0	12	43
South Carolina.....	1	2		2	0	0	10	47
Georgia.....	0	1	4	6	0	0	23	34
Florida.....	2	0	1	5	0	0	1	9

See footnotes at end of table.

*Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended June 27, 1936, and June 29, 1935—Continued*

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1935	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935	Week ended June 27, 1936	Week ended June 29, 1935
<b>East South Central States:</b>								
Kentucky.....	0	1	12	22	0	1	11	18
Tennessee <sup>1</sup> .....	0	1	5	12	2	0	18	27
Alabama <sup>1</sup> .....	7	5	3	11	0	1	20	30
Mississippi <sup>1,2</sup> .....	0	0	6	10	0	0	21	16
<b>West South Central States:</b>								
Arkansas.....	0	0	-----	3	0	0	8	17
Louisiana.....	1	4	-----	6	0	6	20	23
Oklahoma <sup>1</sup> .....	0	0	-----	8	1	0	6	9
Texas <sup>1</sup> .....	2	0	32	21	0	2	15	35
<b>Mountain States:</b>								
Montana <sup>1</sup> .....	0	1	22	10	47	2	1	2
Idaho <sup>1</sup> .....	0	0	5	2	3	0	3	1
Wyoming <sup>1</sup> .....	0	0	3	7	1	10	0	0
Colorado <sup>1</sup> .....	0	0	13	44	0	1	3	2
New Mexico.....	0	0	13	3	1	0	10	6
Arizona.....	0	0	8	7	0	0	6	3
Utah <sup>1</sup> .....	0	0	6	50	0	0	0	0
<b>Pacific States:</b>								
Washington.....	1	0	30	30	3	35	3	8
Oregon <sup>1</sup> .....	0	1	26	20	2	10	5	1
California <sup>1</sup> .....	7	33	199	128	1	2	17	8
<b>Total.....</b>	<b>32</b>	<b>160</b>	<b>2,464</b>	<b>2,743</b>	<b>175</b>	<b>152</b>	<b>310</b>	<b>499</b>
<b>First 26 weeks of year.....</b>	<b>508</b>	<b>1,025</b>	<b>174,683</b>	<b>171,478</b>	<b>5,750</b>	<b>4,852</b>	<b>3,617</b>	<b>4,583</b>

<sup>1</sup> New York City only.

<sup>2</sup> Week ended earlier than Saturday.

<sup>3</sup> Rocky Mountain spotted fever, week ended June 27, 1935, 10 cases, as follows: Virginia, 2; Montana, 2; Idaho, 2; Wyoming, 1; Colorado, 1; Oregon, 2.

<sup>4</sup> Typhus fever, week ended June 27, 1935, 33 cases, as follows: South Carolina, 1; Georgia, 19; Florida, 1; Tennessee, 2; Alabama, 10; Mississippi, 1; Texas, 2; California, 2.

<sup>5</sup> Exclusive of Oklahoma City and Tulsa.

## SUMMARY OF MONTHLY REPORTS FROM STATES

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

State	Menin- gocce- cus menin- gitis	Diph- theria	Influ- enza	Mala- ria	Mea- sles	Pel- lagra	Polio- mye- litis	Scarlet fever	Small- pox	Ty- phoid fever
<i>April 1936</i>										
Puerto Rico.....		34	8,549	631	50	3	0	-----	0	43
<i>May 1936</i>										
Alabama.....	9	49	458	322	74	61	1	20	1	12
Louisiana.....	13	38	868	145	176	13	0	18	1	28
Mississippi.....	1	21	2,088	5,266	397	-----	2	32	1	-----
Nevada.....	1	-----	7	-----	10	-----	0	47	0	2
Oklahoma <sup>1</sup> .....	8	26	313	154	114	45	0	195	8	23
Oregon.....	1	7	101	1	779	-----	0	114	43	11
South Dakota.....	2	8	5	-----	15	-----	0	217	110	0
Vermont.....	-----	3	-----	-----	1,772	-----	0	17	0	5
Washington.....	3	4	26	-----	1,629	-----	0	273	19	12
Wisconsin.....	4	18	125	-----	840	-----	2	1,459	30	4

<sup>1</sup> Exclusive of Oklahoma City and Tulsa.

April 1936		May 1936—Continued		May 1936—Continued	
<b>Puerto Rico:</b>	<b>Cases</b>	<b>Hookworm disease:</b>	<b>Cases</b>	<b>Scabies:</b>	<b>Cases</b>
Chicken pox.....	46	Louisiana.....	16	Oklahoma <sup>1</sup> .....	7
Dysentery.....	22	Mississippi.....	342	Oregon.....	19
Mumps.....	17	<b>Impetigo contagiosa:</b>		<b>Septic sore throat:</b>	
Ophthalmia neonatorum.....	4	Oklahoma <sup>1</sup> .....	2	Louisiana.....	3
Tetanus.....	14	Oregon.....	29	Oklahoma <sup>1</sup> .....	29
Tetanus, infantile.....	4	Washington.....	1	Oregon.....	13
Whooping cough.....	44	<b>Leprosy:</b>		Washington.....	2
		Louisiana.....	2	Wisconsin.....	20
<b>May 1936</b>		<b>Mumps:</b>		<b>Tetanus:</b>	
<b>Actinomycosis:</b>		Alabama.....	332	Alabama.....	7
Oregon.....	1	Louisiana.....	48	Louisiana.....	1
<b>Chicken pox:</b>		Mississippi.....	1,160	Oklahoma <sup>1</sup> .....	3
Alabama.....	192	Nevada.....	1	<b>Trachoma:</b>	
Louisiana.....	19	Oklahoma <sup>1</sup> .....	74	Mississippi.....	9
Mississippi.....	150	Oregon.....	82	Oregon.....	1
Nevada.....	16	South Dakota.....	24	<b>Tularaemia:</b>	
Oklahoma <sup>1</sup> .....	41	Vermont.....	154	Louisiana.....	6
Oregon.....	123	Washington.....	241	<b>Typhus fever:</b>	
South Dakota.....	67	Wisconsin.....	2,155	Alabama.....	15
Vermont.....	63	<b>Ophthalmia neonatorum:</b>		<b>Undulant fever:</b>	
Washington.....	292	Alabama.....	4	Alabama.....	7
Wisconsin.....	1,325	Oklahoma <sup>1</sup> .....	2	Louisiana.....	2
<b>Dengue:</b>		Wisconsin.....	1	Nevada.....	1
Mississippi.....	1	<b>Paratyphoid fever:</b>		Oklahoma <sup>1</sup> .....	3
<b>Dysentery:</b>		Louisiana.....	2	Vermont.....	3
Alabama (amoebic).....	1	<b>Puerperal septicemia:</b>		Washington.....	2
Louisiana (amoebic).....	8	Mississippi.....	14	Wisconsin.....	4
Mississippi (amoebic).....	52	<b>Rabies in animals:</b>		<b>Vincent's infection:</b>	
Mississippi (bacillary).....	1,485	Louisiana.....	18	Oklahoma <sup>1</sup> .....	2
Oklahoma <sup>1</sup> .....	3	Mississippi.....	16	Oregon.....	7
Oregon (amoebic).....	1	Oklahoma <sup>1</sup> .....	3	Washington.....	1
<b>Epidemic encephalitis:</b>		Oregon.....	7	<b>Whooping cough:</b>	
Alabama.....	1	Washington.....	13	Alabama.....	106
Oklahoma <sup>1</sup> .....	1	<b>Rabies in man:</b>		Louisiana.....	238
Oregon.....	2	Mississippi.....	1	Mississippi.....	465
Washington.....	7	<b>Rocky Mountain spotted fever:</b>		Nevada.....	13
Wisconsin.....	2	Alabama.....	1	Oklahoma <sup>1</sup> .....	34
<b>German measles:</b>		Nevada.....	5	Oregon.....	123
Vermont.....	50	Oregon.....	13	South Dakota.....	4
Washington.....	467			Vermont.....	43
Wisconsin.....	147			Washington.....	154
				Wisconsin.....	127

<sup>1</sup> Exclusive of Oklahoma City and Tulsa.

## HUMAN AND RODENT PLAGUE IN MODOC, MONTEREY, AND SANTA CRUZ COUNTIES, CALIF.

Under date of June 26, 1936, the Director of Public Health of California reported a male patient from Monterey County, Calif., recovering at San Luis Obispo Hospital from glandular plague. Infection was confirmed bacteriologically and by animal inoculation.

The Director of Public Health of California has also reported plague infection proved in 21 squirrels received at the laboratory on June 19 and 20 from ranches in Santa Cruz County 4 to 8 miles east of Watsonville, and in 4 squirrels from Modoc County. One of the squirrels from Modoc County was received at the laboratory on June 17 from a place 3 miles north and 2 miles west of Davis Creek; two were received June 20 from a ranch 10 miles south of Pine Creek, in Fandango Valley, and one received at the laboratory on June 19, was found dead in Modoc National Forest  $\frac{1}{2}$  mile northwest of Hackamore.

## WEEKLY REPORTS FROM CITIES

City reports for week ended June 20, 1936

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

State and city	Diph- theria cases	Influenza		Meas- les cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
<b>Maine:</b>											
Portland.....	0		0	174	3	3	0	1	0	1	23
<b>New Hampshire:</b>											
Concord.....	0		0	0	2	0	0	0	0	0	5
Nashua.....	0			0		0	0		0	0	
<b>Vermont:</b>											
Barre.....											
Burlington.....	0		0	11	0	0	0	0	0	0	8
Rutland.....	0		0	4	0	1	0	0	0	0	3
<b>Massachusetts:</b>											
Boston.....	3		0	190	9	37	0	7	1	28	182
Fall River.....	0		0	2	2	3	0	1	0	1	81
Springfield.....	0		0	3	1	3	0	1	0	2	27
Worcester.....	0		0	89	2	9	0	2	0	2	44
<b>Rhode Island:</b>											
Pawtucket.....	0		0	0	0	0	0	0	0	0	
Providence.....	0		0	4	1	9	0	2	0	7	42
<b>Connecticut:</b>											
Bridgeport.....	0		0	2	0	0	0	0	0	3	18
Hartford.....	0		0	1	3	3	0	2	4	1	43
New Haven.....	0		0	0	1	0	0	1	0	21	37
<b>New York:</b>											
Buffalo.....	1		0	127	6	24	0	7	2	7	112
New York.....	33	4	3	991	71	191	0	76	4	85	1,313
Rochester.....	0		0	0	7	0	0	0	2	2	59
Syracuse.....	0		0	33	2	20	0	0	0	24	44
<b>New Jersey:</b>											
Camden.....	1		0	10	4	2	0	1	0	2	30
Newark.....	0		0	24	6	28	0	5	1	24	94
Trenton.....	0		0	2	5	2	0	0	0	3	39
<b>Pennsylvania:</b>											
Philadelphia.....	4	1	0	371	17	53	0	13	1	97	382
Pittsburgh.....	3		0	6	15	91	0	6	0	49	160
Reading.....	0		0	11	2	1	0	0	0	4	27
Scranton.....	0			1		0	0		0	0	
<b>Ohio:</b>											
Cincinnati.....	4		1	8	7	11	0	13	0	1	127
Cleveland.....	1	2	0	132	14	19	0	8	0	67	201
Columbus.....	1	1	1	2	5	1	0	4	0	7	71
Toledo.....	0		0	19	3	3	0	2	0	30	59
<b>Indiana:</b>											
Anderson.....	0		0	0	1	9	0	0	0	2	9
Fort Wayne.....	0		0	0	5	3	0	0	0	0	33
Indianapolis.....	0		1	5	7	3	0	3	0	7	85
Muncie.....	0		0	0	1	6	0	0	0	0	11
South Bend.....	0		0	0	1	1	0	0	0	1	13
Terre Haute.....	2		0	0	0	3	0	2	0	0	12
<b>Illinois:</b>											
Alton.....	2		0	1	1	2	0	0	0	1	9
Chicago.....	27	2	2	13	38	136	0	49	2	83	652
Elgin.....	0		0	0	0	0	0	0	0	1	4
Moline.....	0		0	0	0	0	0	0	0	1	8
Springfield.....	0	1	1	0	1	0	0	0	0	0	27
<b>Michigan:</b>											
Detroit.....	9		0	35	16	158	1	16	1	196	246
Flint.....	0		0	0	0	2	0	0	0	2	24
Grand Rapids.....	0		0	1	0	3	0	0	0	3	33
<b>Wisconsin:</b>											
Kenosha.....	0		0	0	0	4	1	0	0	2	8
Milwaukee.....	0	1	1	16	7	78	0	1	2	76	84
Racine.....	0		0	1	0	0	1	0	0	0	17
Superior.....	0		0	0	0	0	4	0	0	0	3
<b>Minnesota:</b>											
Duluth.....	0		0	1	1	10	0	3	0	7	34
Minneapolis.....	3		1	38	3	37	0	1	0	2	102
St. Paul.....	0		0	49	1	9	0	2	0	1	54

See footnotes at end of table.

## City reports for week ended June 20, 1936—Continued

State and city	Diph- theria cases	Influenza		Meas- les cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
<b>Iowa:</b>											
Cedar Rapids.....	0			0		1	0		0	4	
Davenport.....	1			0		3	0		0	0	
Des Moines.....	1			0		6	1		0	0	30
Sioux City.....	0			0		5	4		0	0	
Waterloo.....	0			0		3	0		0	0	
<b>Missouri:</b>											
Kansas City.....	4		0	1	1	27	0	2	0	4	62
St. Joseph.....											
St. Louis.....	4		0	5	6	23	0	13	2	13	191
<b>North Dakota:</b>											
Fargo.....	0		0	0	1	5	0	0	0	0	10
Grand Forks.....	0			0		0	0		0	0	
Minot.....	0			1		1	1		0	0	5
<b>South Dakota:</b>											
Aberdeen.....	0			0		7	0		0	0	
Sioux Falls.....	0			0		0	0		0	0	6
<b>Nebraska:</b>											
Omaha.....	0		0	2	5	15	3	1	0	0	53
<b>Kansas:</b>											
Lawrence.....	0		0	0	1	3	0	0	0	0	9
Topeka.....	0		0	0	0	11	0	0	0	1	19
Wichita.....	1		0	0	2	12	0	0	1	1	83
<b>Delaware:</b>											
Wilmington.....	0		0	6	1	0	0	0	0	3	22
<b>Maryland:</b>											
Baltimore.....	5		0	198	13	17	0	4	1	72	185
Cumberland.....	0		0	0	3	0	0	0	0	0	10
Frederick.....	0		0	1	0	0	0	0	0	0	4
<b>District of Columbia:</b>											
Washington.....	14		0	107	12	5	0	15	2	49	154
<b>Virginia:</b>											
Lynchburg.....	1		0	1		1	0	1	0	4	9
Norfolk.....	1		0	0	1	0	0	2	0	0	16
Richmond.....	0		0	0	4	3	0	3	0	0	68
Roanoke.....	1		0	1	2	0	0	0	0	0	16
<b>West Virginia:</b>											
Charleston.....	0		0	1	0	0	0	1	0	0	17
Huntington.....	1		0	0	0	0	0	0	0	0	
Wheeling.....	0		0	4	2	2	0	0	0	1	17
<b>North Carolina:</b>											
Gastonia.....	0		0	0	0	0	0	0	0	0	
Raleigh.....	0		0	0	1	0	0	1	0	1	12
Wilmington.....	0		0	0	0	0	0	0	0	0	6
Winston-Salem.....	0		0	5	1	0	0	1	1	0	13
<b>South Carolina:</b>											
Charleston.....	0		0	0	0	0	0	0	2	1	21
Columbia.....											
Florence.....	0		0	0	3	0	0	0	0	6	18
Greenville.....											
<b>Georgia:</b>											
Atlanta.....	1	1	1	1	8	4	0	3	1	1	83
Brunswick.....	0		6	0	0	1	0	0	0	0	1
Savannah.....	1		0	0	0	0	0	1	0	0	33
<b>Florida:</b>											
Miami.....	0	4	1	2	0	0	0	3	0	0	23
Tampa.....	0	1	1	1	3	1	0	0	1	0	28
<b>Kentucky:</b>											
Ashland.....	0		2	0	2	0	0	1	0	0	16
Covington.....	0		0	3	0	0	0	0	0	0	15
Lexington.....	0		0	0	2	0	0	1	0	1	19
Louisville.....	0		0	7	6	10	0	5	0	2	99
<b>Tennessee:</b>											
Knoxville.....	0		6	1	1	0	0	3	0	0	25
Memphis.....	2		0	0	5	1	0	1	2	11	66
Nashville.....	0		1	0	4	0	0	2	0	0	56
<b>Alabama:</b>											
Birmingham.....	1		0	1	8	0	0	2	3	0	92
Mobile.....	0		0	0	1	0	0	0	0	0	19
Montgomery.....	0	1		0		0	0		0	0	
<b>Arkansas:</b>											
Fort Smith.....	0			0		0	0		1	0	
Little Rock.....	0		0	0	3	0	0	2	0	0	7
<b>Louisiana:</b>											
Lake Charles.....	0		0	1	0	0	0	0	0	0	8
New Orleans.....	10	3	3	0	13	1	0	22	1	42	183
Shreveport.....	0		0	0	2	0	0	1	5	1	45
<b>Oklahoma:</b>											
Oklahoma City.....	0	3	0	0	0	4	0	1	0	2	52
Tulsa.....	0			0		2	0		0	3	

See footnotes at end of table.

## City reports for week ended June 20, 1936—Continued

State and city	Diph- theria cases	Influenza		Meas- les cases	Pneu- monia deaths	Scar- let fever cases	Small- pox cases	Tuber- culosis deaths	Ty- phoid fever cases	Whoop- ing cough cases	Deaths, all causes
		Cases	Deaths								
<b>Texas:</b>											
Dallas.....	2	-----	0	32	1	2	0	1	1	2	68
Fort Worth.....	0	-----	2	5	0	1	0	0	0	0	60
Galveston.....	0	-----	0	0	4	1	0	1	0	0	19
Houston.....	5	-----	2	1	1	2	0	7	0	0	74
San Antonio.....	1	-----	0	3	6	0	0	8	0	0	72
<b>Montana:</b>											
Billings.....	0	-----	0	0	0	2	0	0	0	1	9
Great Falls.....	0	-----	0	0	0	1	0	0	0	11	4
Helena.....	0	-----	0	1	0	0	1	0	0	0	1
Missoula.....	0	-----	0	0	1	0	0	0	0	0	6
<b>Idaho:</b>											
Boise.....	0	-----	0	2	1	0	0	0	0	0	7
<b>Colorado:</b>											
Colorado Springs.....	1	-----	0	1	1	2	0	0	0	0	7
Denver.....	1	-----	0	18	7	5	0	6	0	41	86
Pueblo.....	0	-----	0	0	1	1	0	0	0	4	4
<b>New Mexico:</b>											
Albuquerque.....	0	-----	0	5	0	5	0	3	0	0	11
<b>Utah:</b>											
Salt Lake City.....	0	-----	0	35	1	10	4	1	0	3	37
<b>Nevada:</b>											
Reno.....		-----									
<b>Washington:</b>											
Seattle.....	0	-----	0	97	6	2	0	4	0	6	85
Spokane.....	0	-----	0	10	0	14	0	0	1	8	20
Tacoma.....	0	-----	0	16	0	2	0	0	0	0	21
<b>Oregon:</b>											
Portland.....	0	-----	0	4	5	6	0	2	0	5	67
Salem.....	0	3	-----	5		0			0	0	
<b>California:</b>											
Los Angeles.....	8	3	0	135	12	27	0	22	0	74	311
Sacramento.....	0	-----	0	2	1	4	0	3	1	22	35
San Francisco.....	0	-----	0	81	5	53	0	4	0	9	157

State and city	Meningococcus meningitis		Polio- mye- litis cases	State and city	Meningococcus meningitis		Polio- mye- litis cases
	Cases	Deaths			Cases	Deaths	
<b>Massachusetts:</b>				<b>West Virginia:</b>			
Boston.....	0	1	0	Wheeling.....	1	0	0
<b>Rhode Island:</b>				<b>North Carolina:</b>			
Providence.....	3	1	1	Wilmington.....	1	1	0
<b>New York:</b>				<b>South Carolina:</b>			
Buffalo.....	0	0	1	Charleston.....	1	1	0
New York.....	5	2	0	<b>Kentucky:</b>			
Rochester.....	1	0	0	Ashland.....	2	0	0
Syracuse.....	0	1	0	<b>Alabama:</b>			
<b>New Jersey:</b>				Birmingham.....	1	0	1
Newark.....	1	0	0	<b>Arkansas:</b>			
<b>Pennsylvania:</b>				Little Rock.....	0	1	0
Philadelphia.....	2	1	0	<b>Louisiana:</b>			
Pittsburgh.....	1	1	0	New Orleans.....	1	0	0
<b>Ohio:</b>				<b>Oklahoma:</b>			
Cincinnati.....	0	1	0	Oklahoma City.....	1	0	0
Cleveland.....	1	0	0	<b>Texas:</b>			
<b>Illinois:</b>				Houston.....	1	0	0
Chicago.....	3	3	0	<b>Utah:</b>			
<b>Missouri:</b>				Salt Lake City.....	1	1	1
St. Louis.....	1	0	0	<b>Oregon:</b>			
<b>Maryland:</b>				Portland.....	1	0	0
Baltimore.....	4	1	0	<b>California:</b>			
Cumberland.....	0	1	0	Los Angeles.....	2	3	1
<b>District of Columbia:</b>							
Washington.....	1	1	0				
<b>Virginia:</b>							
Norfolk.....	3	0	0				
Roanoke.....	0	1	0				

Epidemic encephalitis.—Cases: St. Paul, 1; Denver, 1.

Pellagra.—Cases: Winston-Salem, 1; Charleston, S. C., 1; Birmingham, 1; Mobile, 1; Montgomery, 1; Dallas, 1; Los Angeles, 1.

Rabies in man.—Deaths: St. Louis, 1; Oklahoma City, 1.

Typhus fever.—Cases: Atlanta, 1; Knoxville, 1.

## FOREIGN AND INSULAR

### BRITISH WEST INDIES

*Barbados—Vital statistics—1935.*—The following table shows the vital statistics for Barbados, British West Indies, for the year 1935:

Number of marriages.....	831
Number of marriages per 1,000 population.....	9.06
Number of births.....	5,315
Number of births per 1,000 population.....	28.94
Number of stillbirths.....	139
Number of deaths.....	3,702
Number of deaths per 1,000 population.....	20.16
Deaths under 1 year of age.....	1,169
Average deaths under 1 year of age per 1,000 births.....	220

### CANADA

*Provinces—Communicable diseases—2 weeks ended June 13, 1936.*—During the 2 weeks ended June 13, 1936, cases of certain communicable diseases were reported by the Department of Pensions and National Health of Canada as follows:

Disease	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Total
Cerebrospinal meningitis..	-----	1	-----	2	-----	1	-----	-----	3	7
Chicken pox.....	-----	14	-----	196	399	79	44	45	65	842
Diphtheria.....	-----	6	2	37	2	3	2	1	1	54
Dysentery.....	-----	-----	-----	5	20	-----	-----	-----	-----	25
Erysipelas.....	-----	-----	-----	10	8	3	2	2	4	29
Influenza.....	-----	8	-----	-----	207	49	2	-----	3	269
Lethargic encephalitis.....	-----	-----	-----	-----	1	1	-----	-----	-----	1
Measles.....	-----	16	31	566	1,730	352	132	235	383	3,445
Mumps.....	-----	28	-----	-----	696	28	73	57	176	1,058
Paratyphoid fever.....	-----	-----	-----	-----	1	-----	-----	-----	-----	3
Pneumonia.....	12	7	-----	-----	17	-----	9	-----	5	50
Poliomyelitis.....	-----	-----	-----	-----	3	-----	-----	-----	-----	3
Scarlet fever.....	-----	11	1	117	361	127	40	108	24	739
Smallpox.....	-----	-----	-----	-----	-----	-----	-----	2	-----	2
Trachoma.....	-----	-----	-----	-----	-----	1	1	-----	5	7
Tuberculosis.....	6	16	35	126	95	63	30	19	32	422
Typhoid fever.....	-----	-----	3	41	4	7	1	4	4	64
Undulant fever.....	-----	-----	-----	1	3	-----	-----	-----	-----	4
Whooping cough.....	1	19	9	79	258	7	38	5	63	479

*Vital statistics—Fourth quarter 1935.*—The Bureau of Statistics of the Dominion of Canada has published the following preliminary statistics for the fourth quarter of 1935. The rates are computed on an annual basis. There were 18.6 live births per 1,000 population during the fourth quarter of 1935 and 19.2 per 1,000 population in the same quarter of 1934. The death rate was 9.2 per 1,000 population for the fourth quarter of 1935 and 9.3 per 1,000 population for the fourth quarter of 1934. The infant mortality rate for the fourth quarter of

1935 was 66 per 1,000 live births and 75 in the corresponding quarter of 1934. The maternal death rate was 4.5 per 1,000 live births for the fourth quarter of 1935, and 5.2 for the same quarter of 1934.

The accompanying tables give the number of births, deaths, and marriages by Provinces for the fourth quarter of 1935, and deaths from certain causes in Canada for the fourth quarter of 1935, and the corresponding quarter of 1934, and by Provinces for the fourth quarter of 1935.

*Number of births, deaths, and marriages, fourth quarter 1935*

Province	Live births	Deaths (exclusive of still-births)	Deaths under 1 year of age	Maternal deaths	Marriages
Canada <sup>1</sup> .....	51,369	25,344	3,368	231	22,743
Prince Edward Island.....	600	251	38	1	190
Nova Scotia.....	2,600	1,377	173	11	1,228
New Brunswick.....	2,377	1,151	178	8	966
Quebec.....	17,136	7,850	1,491	98	5,034
Ontario.....	14,577	8,762	766	63	7,290
Manitoba.....	3,189	1,444	175	14	1,837
Saskatchewan.....	4,626	1,414	239	16	2,754
Alberta.....	3,973	1,373	187	18	2,011
British Columbia.....	2,391	1,722	121	12	1,433

<sup>1</sup> Exclusive of Yukon and the Northwest Territories.

*Number of deaths, Canada, fourth quarter 1934 and 1935, and by Provinces, fourth quarter 1935*

Cause of death	Canada <sup>1</sup> (fourth quarter)		Province, fourth quarter 1935								
	1934	1935	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
Automobile accidents.....	337	394	1	21	13	102	197	14	4	11	31
Cancer.....	2,789	2,734	20	139	110	704	1,025	209	148	157	222
Diarrhea and enteritis.....	1,045	557	4	24	25	325	106	26	23	15	9
Diphtheria.....	71	109	-----	7	7	78	9	3	3	1	1
Diseases of the arteries.....	1,864	2,210	18	143	76	435	1,060	133	77	110	158
Diseases of the heart.....	4,142	4,095	35	201	150	998	1,741	227	221	195	327
Homicides.....	37	31	-----	2	-----	6	8	3	3	6	6
Influenza.....	489	555	2	27	14	273	131	28	25	33	22
Measles.....	83	94	4	2	13	33	22	-----	5	12	2
Nephritis.....	1,364	1,477	13	67	45	640	458	70	68	46	70
Pneumonia.....	1,581	1,847	32	89	116	619	561	113	126	97	94
Polioomyelitis.....	24	9	-----	-----	-----	3	1	1	2	2	-----
Puerperal causes.....	273	231	1	11	8	98	53	14	16	18	12
Scarlet fever.....	79	60	1	3	2	34	13	3	-----	-----	-----
Smallpox.....	1	3	-----	-----	-----	-----	-----	-----	1	-----	2
Suicides.....	234	222	1	4	3	34	85	12	25	28	30
Tuberculosis.....	1,421	1,441	9	114	74	578	287	90	62	79	148
Typhoid fever and paratyphoid fever.....	82	79	2	2	7	45	10	2	5	4	2
Other violent deaths.....	1,001	1,008	8	59	47	223	374	53	61	81	102

<sup>1</sup> Exclusive of Yukon and the Northwest Territories.

### GREAT BRITAIN

*England and Wales—Infectious diseases—13 weeks ended March 28, 1936.*—During the 13 weeks ended March 28, 1936, cases of certain infectious diseases were reported in England and Wales as follows:



Disease	Cases	Disease	Cases
Diphtheria.....	16,061	Puerperal pyrexia.....	1,532
Ophthalmia neonatorum.....	1,067	Scarlet fever.....	31,371
Pneumonia.....	18,784	Typhoid fever.....	270
Puerperal fever.....	595		

*England and Wales—Vital statistics—First quarter 1936.*—During the quarter ended March 31, 1936, 148,136 live births and 153,583 deaths were registered in England and Wales. The following vital statistics are taken from the Quarterly Return of Births, Deaths, and Marriages, issued by the Registrar General of England and Wales. The figures are provisional.

*Birth and death rates in England and Wales, quarter ended Mar. 31, 1936*

**Annual rates per 1,000 population:**

Live births.....	14.70
Stillbirths.....	.63
Deaths, all causes.....	15.20
Deaths under 1 year of age.....	<sup>1</sup> 80
Deaths from:	
Diarrhea and enteritis (under 2 years of age).....	<sup>1</sup> 6.3
Diphtheria.....	.09
Influenza.....	.28
Measles.....	.12
Scarlet fever.....	.02
Violence.....	.54
Whooping cough.....	.07

<sup>1</sup> Per 1,000 live births.

**ITALY**

*Communicable diseases—4 weeks ended April 26, 1936.*—During the 4 weeks ended April 26, 1936, cases of certain communicable diseases were reported in Italy, as follows:

Disease	Mar. 30-Apr. 5		Apr. 6-12		Apr. 13-19		Apr. 20-26	
	Cases	Com-munes affected	Cases	Com-munes affected	Cases	Com-munes affected	Cases	Com-munes affected
Anthrax.....	11	9	8	8	5	5	15	15
Cerebrospinal meningitis.....	37	32	16	13	20	17	29	26
Chicken pox.....	429	159	367	159	319	134	301	115
Diphtheria and croup.....	424	244	371	214	423	230	418	213
Dysentery.....	6	5	5	4	7	7	2	2
Hookworm disease.....	9	4	7	4	10	7	9	5
Leishmaniasis.....	1	1	7	6			2	2
Lethargic encephalitis.....	2	2	2	2	3	3	1	1
Measles.....	2,510	330	1,894	288	1,917	310	1,768	311
Mumps.....	386	104	306	98	357	90	368	101
Paratyphoid fever.....	18	18	31	26	32	27	19	17
Poliomyelitis.....	16	14	16	12	23	14	16	13
Puerperal fever.....	45	39	32	30	24	23	31	29
Rabies.....			1	1				
Scarlet fever.....	270	120	265	128	237	121	240	116
Typhoid fever.....	198	129	230	108	195	124	228	148
Undulant fever.....	90	57	93	63	93	59	117	76
Whooping cough.....	536	134	450	120	626	135	694	166

## YUGOSLAVIA

*Communicable diseases—May 1936.*—During the month of May 1936, certain communicable diseases were reported in Yugoslavia as follows:

Disease	Cases	Deaths	Disease	Cases	Deaths
Anthrax.....	28	6	Paratyphoid fever.....	7	11
Cerebrospinal meningitis.....	13	9	Scarlet fever.....	352	6
Diphtheria and croup.....	493	39	Sepsis.....	8	24
Dysentery.....	22	10	Tetanus.....	49	25
Erysipelas.....	232	1	Typhoid fever.....	227	7
Influenza.....	24	4	Typhus fever.....	125	
Measles.....	637				

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

NOTE.—A table giving current information of the world prevalence of quarantinable diseases appeared in the PUBLIC HEALTH REPORTS for June 26, 1936, pages 858-870. A similar cumulative table will appear in the PUBLIC HEALTH REPORTS to be issued July 31, 1936, and thereafter, at least for the time being, in the issue published on the last Friday of each month.

## Plague

*India—Bombay.*—During the week ended June 20, 1936, one death from plague was reported at Bombay, India.

*United States—California.*—A report of plague in California appears on page 939 of this issue of PUBLIC HEALTH REPORTS.

## Smallpox

*Algeria—Oran Department.*—During the week ended June 6, 1936, one case of smallpox was reported in Oran Department, Algeria.

## Typhus fever

*Algeria—Philippeville.*—During the week ended June 6, 1936, one case of typhus fever was reported at Philippeville, Algeria.

## Yellow fever

*Brazil.*—Yellow fever has been reported in Brazil as follows: Amazonas State, Labrea, March 28, 1936, one case, one death; Matto Grosso State, Tres Lagoas, April 23, 1936, one case, one death; Minas Geraes State, Uberaba, May 21, 1936, one case, one death; Fructal, May 30, 1936, one case, one death; Sao Paulo State, Serra Negra, May 18, 1936, one case, one death, Altinopolis, May 19, 1936, one case, one death.

*Senegal.*—On June 18, 1936, one case of yellow fever was reported at Thies, Senegal, and on June 11, 1936, one suspected case of yellow fever was reported at Tivaouane, Senegal.