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INFLUENZA STUDIES.

I. ON CERTAIN GENERAL STATISTICAL ASPECTS OF THE 1918 EPIDEMIC IN AMERICAN CITIES.[1]

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I. Introduction.

The pandemic of influenza which swept over the world in 1918 was the most severe outbreak of this disease which has ever been known, and it takes an unpleasantly high rank in the roster of epidemics generally. It is certainly impossible now, and perhaps always will be, to make any precise statement of the number of people who lost their lives because of this epidemic. But it is certain that the total is an appalling one. Undoubtedly a great many more people died from this cause than from all causes directly connected with the military operations of the Great War. In the United States alone conservative estimates place the deaths from the influenza epidemic at not less than 550,000, which is approximately five times the number (111,179) of American soldiers officially stated[2] to have lost their lives from all causes in the war. And the end of the epidemic is by no means yet reached. In England and Wales the curve of mortality from influenza was even in 1907, seventeen years after the epidemic of 1890, higher than it was in any of the 40 years preceding 1890. The decline in the mortality rate after the 1848 epidemic in Great Britain was similarly slow.[3] There is no evident reason to suppose that conditions following the first explosion of this present epidemic will be essentially different from those which obtained in the earlier cases.

For two reasons the hygienist and epidemiologist should be interested in the intensive study, from every possible angle, of the present pandemic. In the first place, owing to the advances which have been made in every branch of medical science since the epi-

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[1] Papers from the Department of Biometry and Vital Statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 5. This investigation was carried on in consultation with the United States Public Health Service, Office of Field Investigations on Influenza, Dr. W. H. Frost, surgeon in charge.

[2] As of date Apr. 30, 1919.

[3] Cf. Article on "Influenza" in Encyclopedia Britannica, 11th Edition, for a conveniently accessible verification of these statements.

demic of 1890, there is now available a much more adequate investigational armament with which to attack the problems raised by such an epidemic than was the case earlier. Furthermore, the whole machinery for getting accurate records of the incidence and results of the outbreak are much better now than they were 30 years ago. This is particularly true in the United States. The records of mortality connected with the present epidemic are unquestionably more complete and accurate than any that have ever before been available in this country for any epidemic of anything like so great extent or force.

In the second place, the very magnitude of this epidemic is in itself a challenge to the whole medical profession. The hygienists of the world are the standing army, which is, in theory at least, maintained by society to organize and hold the defenses against such dread invaders as these. Such a blow as the present one may well inspire a slogan like that which saved Verdun, "*Ils ne passeront pas.*" If every epidemiologist does not take advantage of the present opportunity to investigate with all possible thoroughness epidemic influenza, to the end of making a better defense next time, he will have been derelict in his plain duty.

The present paper is intended as a first contribution toward the statistical analysis of certain phases of the 1918 influenza epidemic. It will be followed by further papers in the same series dealing with other aspects of the problem. In the first studies in the series attention will be confined entirely to the *mortality* records of some forty of the larger cities of the United States. The reason for this limitation to mortality only and to large cities is that accurate and reliable data within these limitations are now available, and the same can not be said of morbidity records, on anything like so general a scale. Later it is expected that sufficiently accurate and extensive morbidity statistics of the epidemic to warrant statistical analysis will be available.

The data of this study are taken primarily from the Weekly Health Index.[1] On account of varying medical opinions as to the properly reportable terminal cause of death of persons dying after having had influenza during this epidemic, it has been thought safest to use death rates from all causes for study, rather than those specifically reported to the registrar as due to influenza or pneumonia. Consequently, we shall deal with death rates from all causes in discussing the present epidemic. This makes no practical difference in the statistical results, because the deviation of the curves of total mortality from their normal course during the epidemic was due entirely to causes inherently associated with the epidemic itself. The use of the death rate from all causes during the epidemic has the fur-

[1] A typewritten publication issued weekly by the Bureau of the Census, and compiled under the direction of Dr. W. H. Davis, Chief for Vital Statistics.

ther advantage that it takes into account those deaths which occur from diseases of the heart or kidneys some weeks or months after an attack of influenza from which the patient has apparently recovered, but which in reality are responsible for the fatal break-down of a part of the organic machinery which had long been weak, and only required for its complete collapse some such strain as the attack of influenza superimposed.

The general problem with which the first study in this series will have to do is that of the statistical analysis of the *first explosive outbreak* of epidemic mortality in large Ame ican cities. As will presently appear, there was an extraordinary degree of variation amongst the different cities in respect of the initial force and duration of this first explosion. These *differences* between cities in respect of the severity and suddenness with which they were attacked by the disease constitute the first great problem which the epidemic has raised. What factors had a causal influence in determining this great observed variation among cities? The full significance of this problem will be apparent when the facts of variation in force of explosive outbreak are before us. The first task of this study is to present the data in such a manner as to bring out the real extent and magnitude of the variation in the epidemic.

I am indebted to Mr. John Rice Miner for the greater portion of the laborious arithmetic connected with this investigation.

II. General Survey of the Mortality Curves.

In order to get in hand the general problem it is desirable to examine with some care the mortality by weeks in each of the cities dealt with. To this end Figures 1 to 6 have been prepared. On these diagrams are plotted, for each city, the annual death rates per 1,000 population from all causes, for each week, the data being those of the Weekly Health Index. The plotting is done on a logarithmic scale of ordinates (rates) and an arithmetic scale of abscissæ (weeks).[1] The curves begin with the week ended July 6, 1918, and continue to 1919. The scale is the same for all diagrams, though different combinations of parts of the logarithmic "decks" are used in certain cases in order to fit the diagrams to the page.

Anyone examining these curves thus collected together on a uniform scale for comparison can not fail to be impressed by the fact that there is an extraordinary amount of difference between different cities in respect of the force with which they were struck by the epidemic at its initial outbreak. Compare, for example, the Albany, Boston, Baltimore, Dayton, or Philadelphia curves with those for Atlanta, Indianapolis, Grand Rapids, Milwaukee, or Minneapolis. The former curves show an initial sudden explosive outbreak of great

[1] For a discussion of the advantages of "arithlog" paper see Fisher, I. "The 'Ratio' Chart for plotting Statistics." Quarterly Publications Amer. Stat. Assoc., 1917, pp. 577-601.

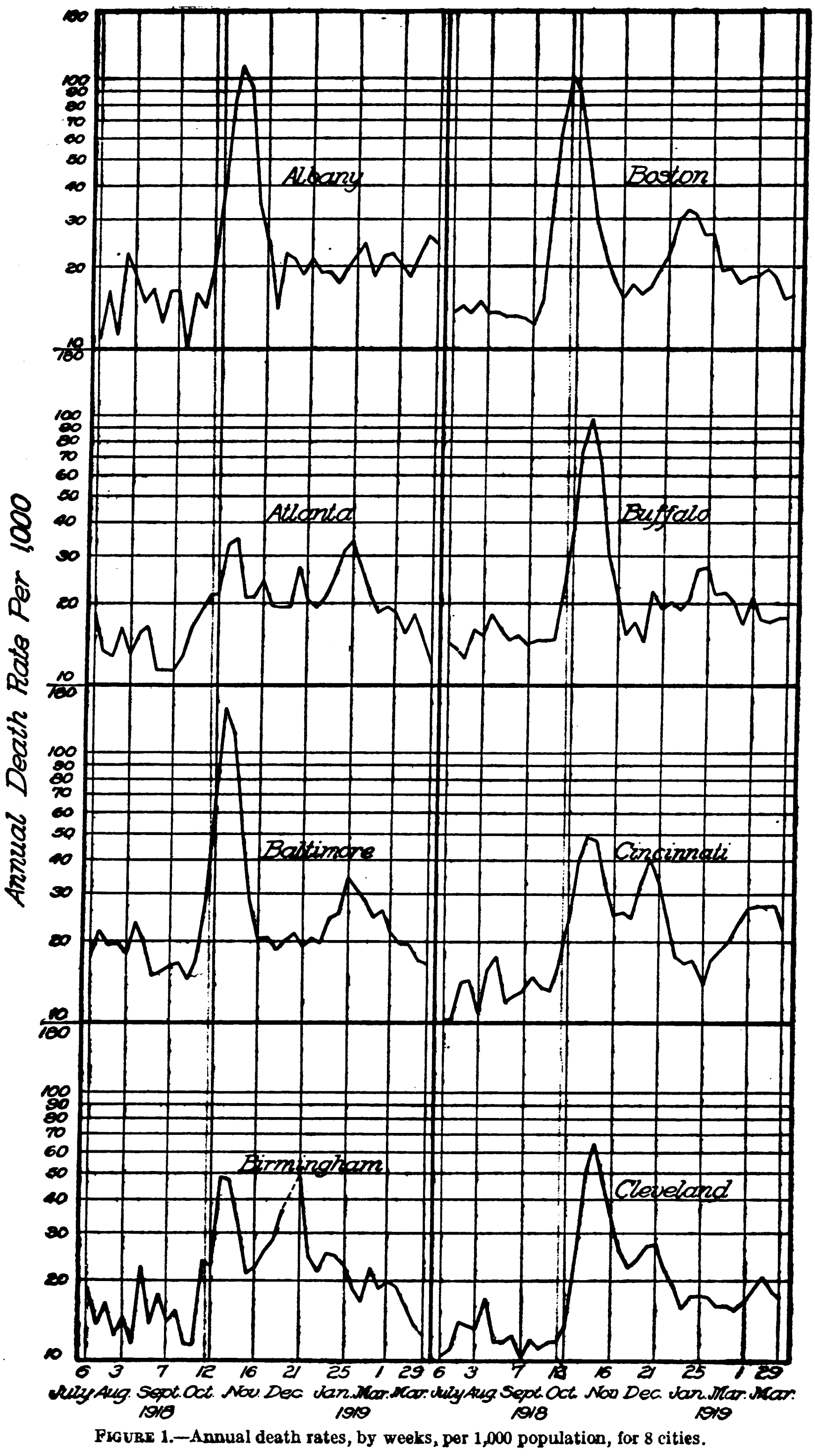

FIGURE 1.—Annual death rates, by weeks, per 1,000 population, for 8 cities.

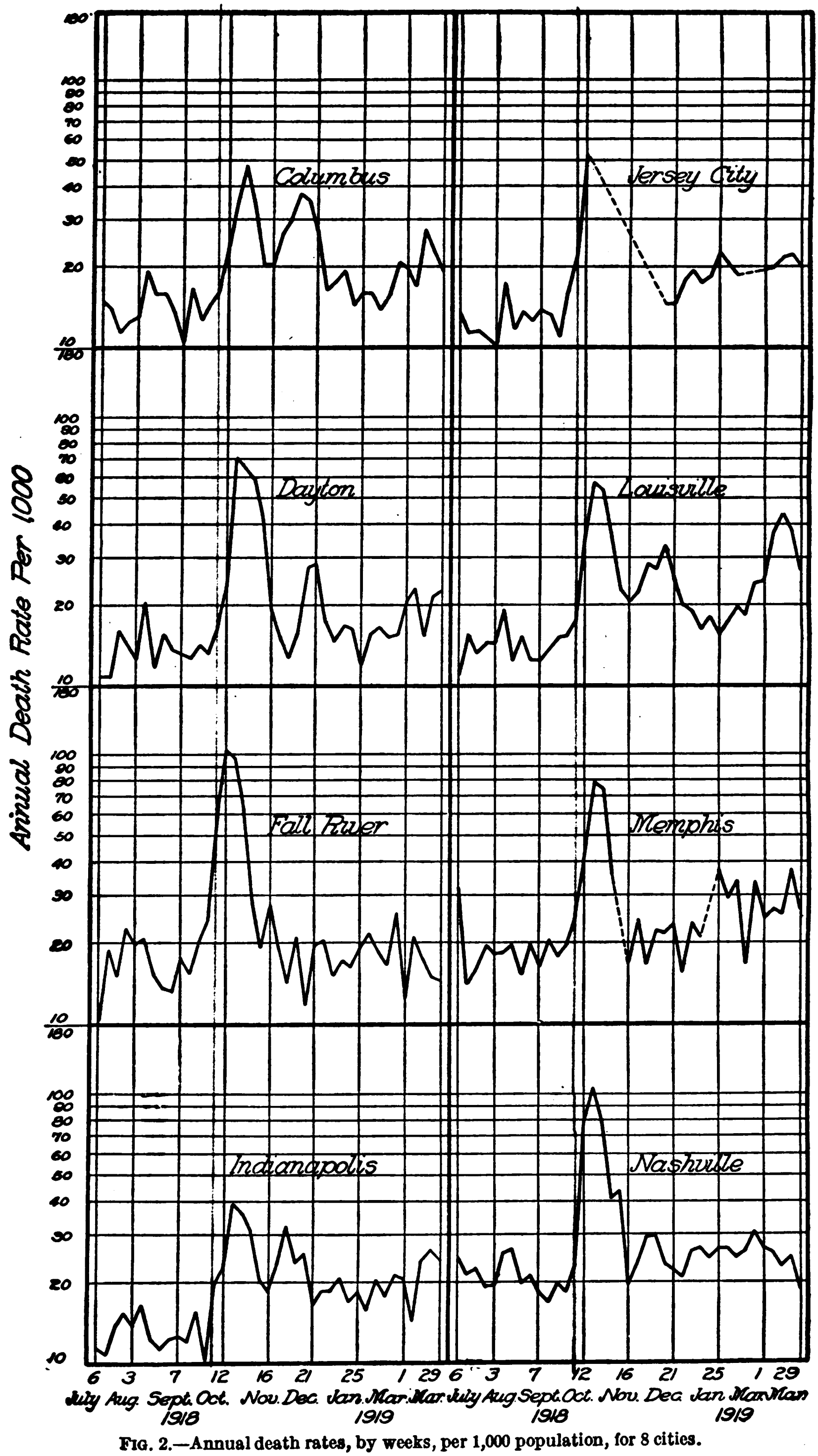

FIG. 2.—Annual death rates, by weeks, per 1,000 population, for 8 cities.

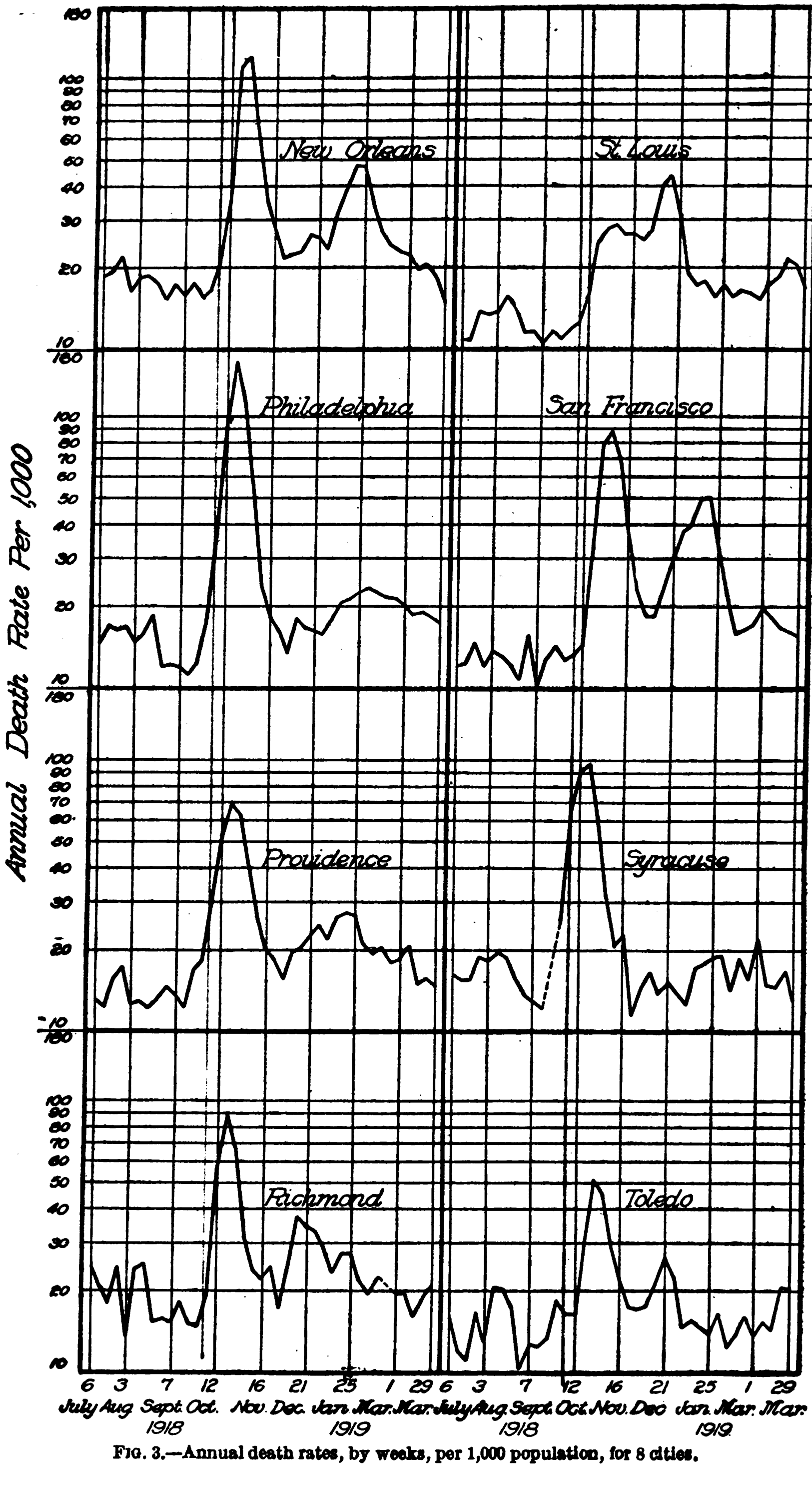

FIG. 3.—Annual death rates, by weeks, per 1,000 population, for 8 cities.

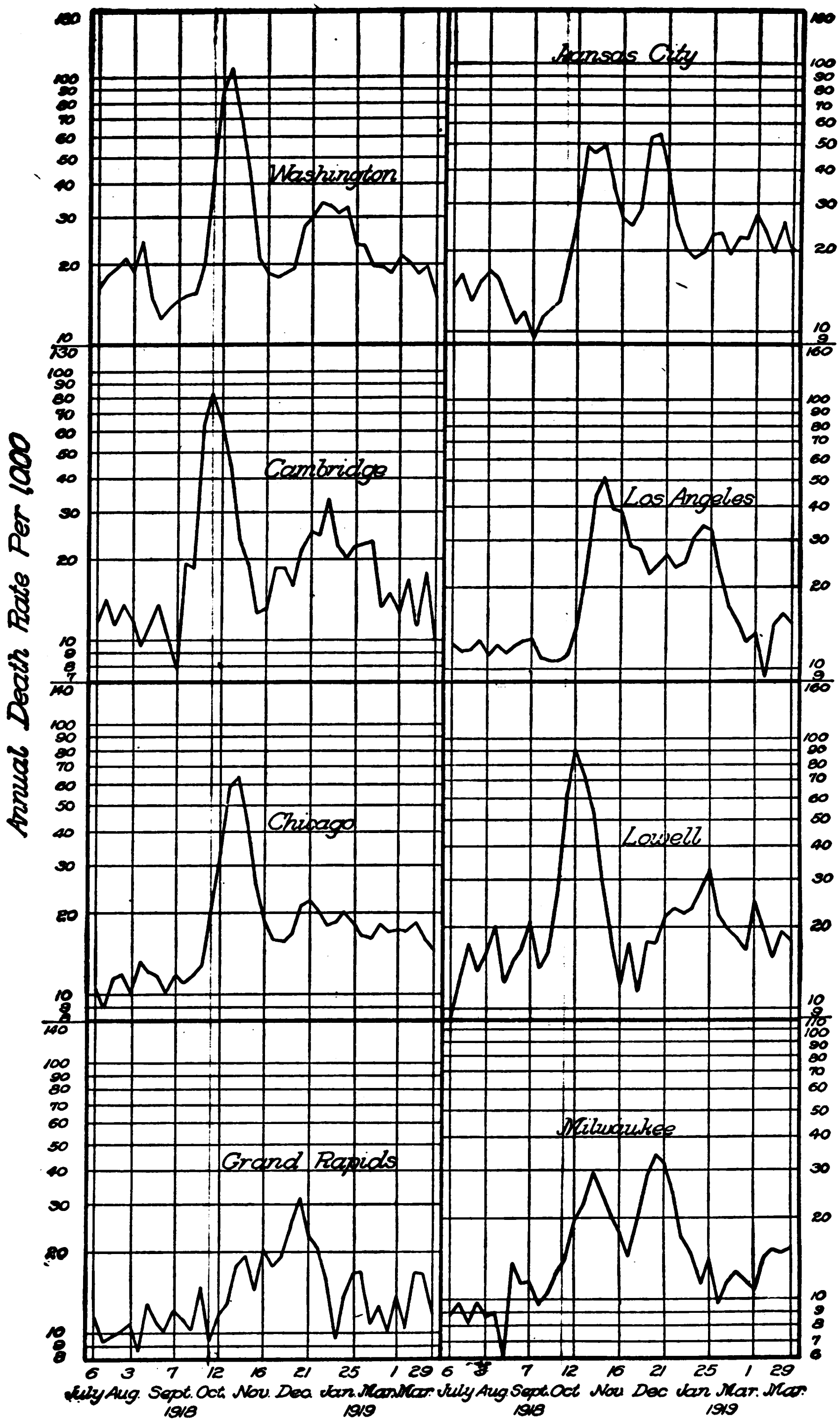

FIG. 4.—Annual death rates, by weeks, per 1,000 population, for 8 cities.

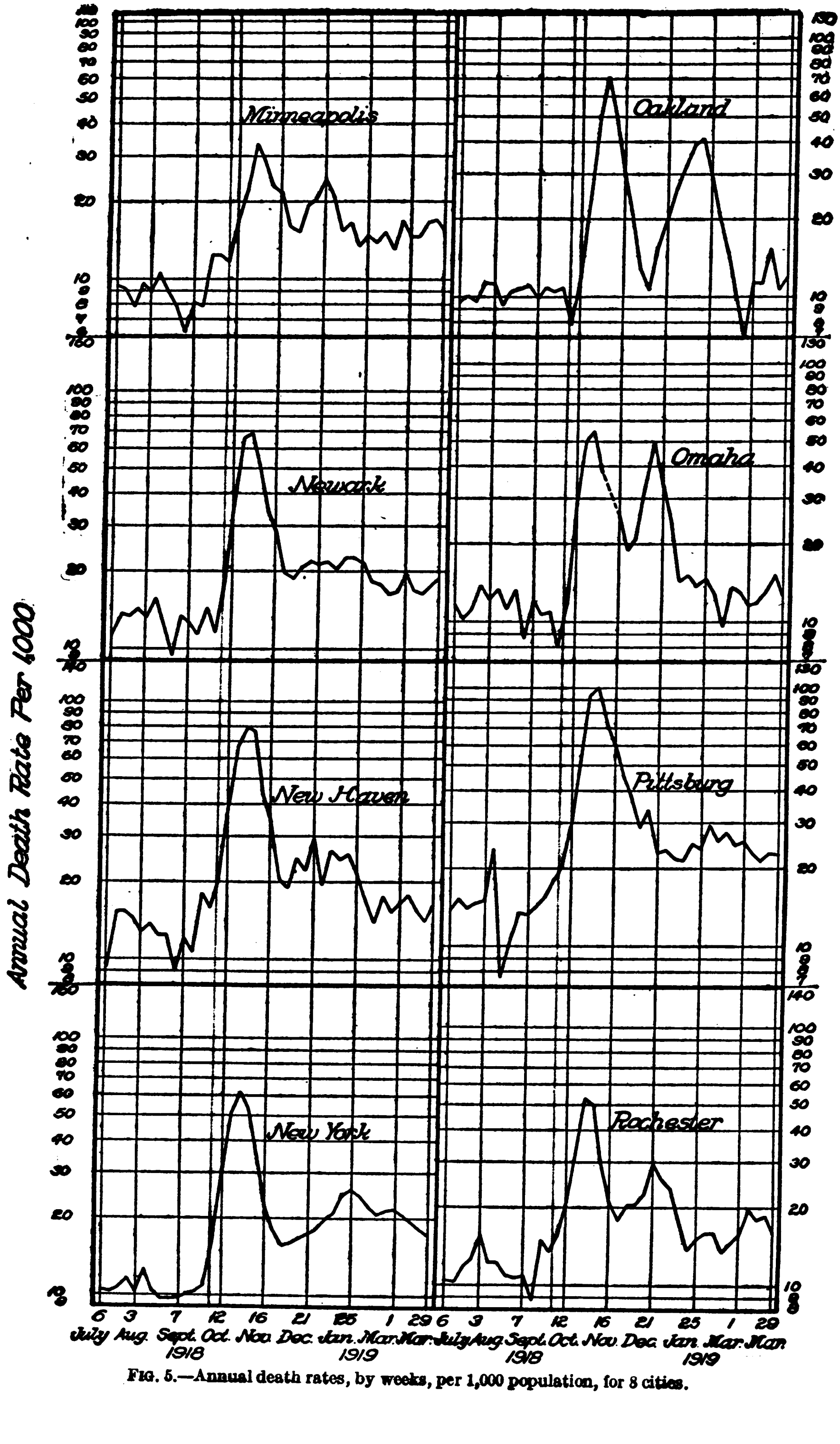

FIG. 5.—Annual death rates, by weeks, per 1,000 population, for 8 cities.

force, while the latter exhibit a much slower and milder increase of the mortality rate.

In some cases the curve of the first epidemic outbreak rises to the peak (ascending limb) and declines from the peak (descending limb) at about the same rate. This condition of affairs is exemplified in the Albany and Baltimore curves, to mention but two. In other cases the rate of ascent to the peak is very rapid while the decline is slow and long drawn out. Such a condition is shown in the curves for Cleveland or St. Paul.

Some of the cities, such as Albany, show but a single well-defined peak in the mortality curve. Many show two peaks. Boston, New Orleans, and San Francisco give beautifully typical curves of this sort. Finally, a few of the cities show three well-marked peaks. Louisville is a good example of the latter class.

In most cases the first peak was the highest and the second and third were progressively lower. This was not true in all cases, however. Milwaukee and St. Louis showed second peaks higher than the first. The wave-like character of the curves in general is of great interest. The usual phenomenon was a large first wave followed by a series of other smaller ones. This general characteristic of the curves is so pronounced and definite that any epidemiological theory which is to be at all adequate must take account of it.

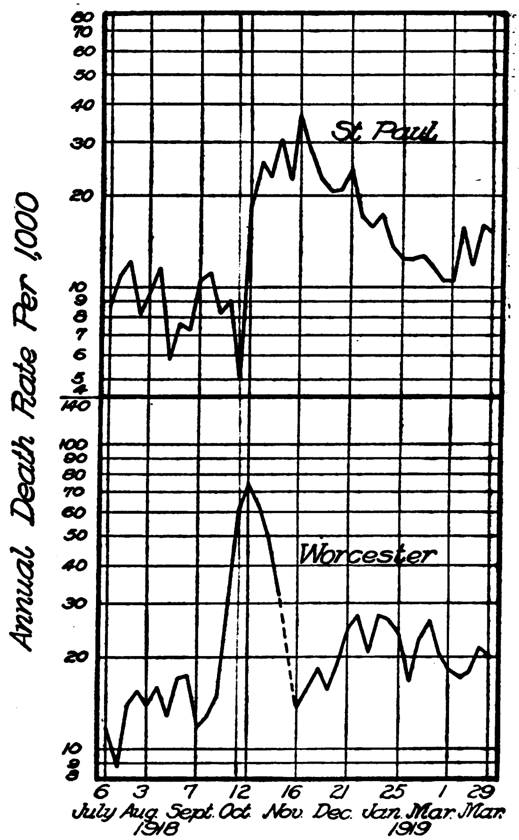

FIG. 6.—Annual death rates, by weeks, per 1,000 population, for 2 cities.

It is evident from general inspection of these curves that there is a strong justification for taking, as the first general problem in connection with this outbreak of influenza, the significant causal factors concerned in bringing about this observed differentiation between the different cities in respect of the form of the epidemic mortality curves. The extent and definiteness of the differences between the several curves indicate that there must be discoverable clean-cut differentiating factors which influenced the influenza death rates.

TABLE I.—*Certain data regarding the time relation of the influenza epidemic in large cities.*

Name of city.	Highest peak rate.	Reached on week ended—	Number of peaks.	Date of second peak.	Weeks, first to second peak.	Date of third peak.	Weeks, second to third peak.	Weeks rate was outside normal range.	Weeks, start to peak.	Weeks, peak to normal rate.	25-week excess rate.	Notes.
Albany, N. Y.	112.0	Oct. 26	1					7	3	4	4.7	
Atlanta, Ga.	35.1	...do...	2	Jan. 25	13			23	4	19	2.7	A minor intermediate third peak not counted.
Baltimore, Md.	148.3	Oct. 19	2	...do...	14			7	3	4	6.1	
Birmingham, Ala.	48.6	...do...	2	Dec. 21	9			14	3	11		
Boston, Mass.	100.2	Oct. 5	2	Jan. 4	13			9	3	6	6.5	
Buffalo, N. Y.	99.7	Oct. 26	2	Jan. 25	13			8	4	4	5.8	
Cambridge, Mass.	83.0	Oct. 5	2	Jan. 4	13			9	4	5	5.9	
Chicago, Ill.	64.2	Oct. 26	2	Dec. 21	8			8	4	4	3.8	Second peak small as compared with first.
Cincinnati, Ohio	49.7	...do...	3	Dec. 14	7	Mar. 22	14	17	4	13	4.0	
Cleveland, Ohio	65.6	Nov. 2	3	Dec. 21	7	Mar. 15	12	13	3	10	4.0	
Columbus, Ohio	47.2	Oct. 26	3	Dec. 7	6	...do...	14	12	3	9	3.2	
Dayton, Ohio	71.6	Oct. 19	2	Dec. 21	9			8	2	6	3.5	
Fall River, Mass.	100.4	Oct. 12	1					7	3	4	5.8	
Grand Rapids, Mich.	31.6	Dec. 14	1					12	8	4	1.5	Very low, irregular curve.
Indianapolis, Ind.	39.0	Oct. 19	3	Nov. 30	6	Mar. 22	16	12	3	9	2.5	Whole curve low.
Louisville, Ky.	57.6	...do...	3	Dec. 14	8	Mar. 15	13	14	2	12	3.6	Typical 3-peak curve.
Los Angeles, Calif.	51.9	Nov. 2	2	Jan. 18	11			20	4	16	5.2	
Lowell, Mass.	89.8	Oct. 12	2	Jan. 25	15			7	3	4	5.1	
Memphis, Tenn.	79.3	Oct. 19	2	...do...	14			7	3	4		
Milwaukee, Wis.	34.4	Dec. 14[1]	2	Dec. 14	7			16	11	5	2.9	Second peak definitely higher than first.
Minneapolis, Minn.	33.1	Oct. 26	2	Dec. 21	8			22	6	16	2.7	
Nashville, Tenn.	104.2	Oct. 19	1					6	2	4	7.8	
Newark, N. J.	69.0	Oct. 26	2	Jan. 18	12			20	4	16	5.1	Both possibly 1-peaked. But 2 seems on whole best, especially for New Haven.
New Haven, Conn.	78.8	...do...	2	Dec. 21	8			21	6	15	5.6	
New Orleans, La.	120.1	...do...	2	Jan. 18	12			7	3	4	7.2	Beautiful typical 2-peak curve.
New York, N. Y.	61.6	...do...	2	Jan. 25	13			9	4	5	4.7	
Oakland, Calif.	70.5	Nov. 2	2	Jan. 18	11			18	3	15	5.9	It is possible that this is 3-peaked.
Omaha, Nebr.	55.1	Oct. 26	2	Dec. 14	7			15	3	12		
Philadelphia, Pa.	158.3	Oct. 19	2	Feb. 1	15			7	3	4	7.3	Second peak low.
Pittsburgh, Pa.	100.7	Nov. 2	2	...do...	13			11	4	7	8.0	
Providence, R. I.	69.8	Oct. 19	2	Jan. 18	13			10	4	6	5.3	
Richmond, Va.	88.4	...do...	2	Dec. 14	8			5	2	3		
Rochester, N. Y.	53.8	Oct. 26	3	Dec. 21	8	Mar. 8	11	16	4	12	2.7	Possibly this should be 2.
St. Louis, Mo.	44.0	Dec. 14[2]	3	Dec. 14	6	Mar. 15	13	15	10	5	3.0	
St. Paul, Minn.	36.2	Nov. 16	1					19	6	13	3.3	Abnormal curve.
San Francisco, Calif.	89.0	Nov. 2	2	Jan. 18	11			17	3	14	7.5	Typical 2-peak.
Syracuse, N. Y.	96.7	Oct. 19	1					9	4	5		
Toledo, Ohio	51.1	Oct. 26	3	Dec. 28	9	Mar. 22	12	6	2	4	2.1	
Washington, D. C.	109.3	Oct. 19	2	...do...	10			6	3	3	6.6	
Worcester, Mass.	72.2	Oct. 12	2	...do...	11			7	3	4		

[1] First peak date Oct. 26.

[2] First peak date Nov. 2.

III. Classification of the Data.

As a first step in the analysis it is desirable to make certain rough classifications of the facts brought out by the mortality curves. To this end Table I has been prepared. In this table are set forth the following data regarding each of the cities:

1. The highest peak death rate attained in any week of the epidemic up to March 29, 1919.
2. The date [1] on which the highest peak rate was reached.
3. The number of distinct peaks exhibited by the mortality curve within the time period here studied. These different peaks indicate recrudescences or waves of the epidemic.
4. The date at which the second peak in the mortality curve occurred, in the case of those cities showing 2 or more peaks.
5. The number of weeks elapsing between the first peak and the second.
6. The date at which the third definite peak, if any, occurred in the mortality curve.
7. The number of weeks elapsing between the second peak and the third.
8. The number of weeks during which the mortality rate was higher than it had been at any time between the week ended July 6, 1918, and the beginning of the epidemic. The range of fluctuation of the weekly annual death rate in the period from July to the end of September was held to be sufficiently accurate indication of the normal range of fluctuation of the death rate in any particular city.
9. The number of weeks elapsing from the beginning of epidemic mortality to the highest peak of the curve. This gives a measure of the time factor on the ascending side of the epidemic explosion.
10. The number of weeks elapsing from the time of the highest peak of the mortality curve to the time when the curve came again within the normal range of fluctuation. This gives the time factor on the descending limb of the epidemic outbreak.
11. The excess mortality rate, over the normal for the same season of the year for the same places, for the 25 weeks between September 8, 1918, and March 1, 1919. These figures were issued as a supplement to the Weekly Health Index by the Census Bureau.[2]

From this table a number of points present themselves for discussion. They may best be taken up in separate sections, in order of the successive rubrics of the table.

1. *Maximum peak death rates.*—The highest or maximum peak rate of mortality during the epidemic varied greatly, having ranged from

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[1] It is to be understood that all dates here and throughout are as of "weeks ended" on the specified date. The original statistics are given only in weeks and hence any finer time differentiation is impossible.

[2] Cf. Public Health Reports, vol. 34, No. 11, p. 505, 1919.

31.6 in the case of Grand Rapids, Mich., to 158.3 in the case of Philadelphia.

The distribution of the different maximum peak rates over this range is shown in detail in Table II.

TABLE II.—*Showing the frequency of occurrence of different maximum peak death rates during the epidemic.*

Maximum peak rates.	Number of cities.		
30.0– 39.9	6	10	20
40.0– 49.9	4		
50.0– 59.9	5	10	
60.0– 69.9	5		
70.0– 79.9	5	9	16
80.0– 89.9	4		
90.0– 99.9	2	7	
100.0–109.9	5		
110.0–119.9	1	2	3
120.0–129.9	1		
130.0–139.9	0	1	
140.0–149.9	1		
150.0–159.9	1		
Total	40		

From Table II it appears that in the 40 cities considered the peak rates which were of the most frequent occurrence were, generally speaking, rates below 70. Twenty out of the 40 fell below that figure. Only 9 out of the 40 cities showed a maximum peak rate of 100 or more. Up to a maximum peak rate of 70 the distribution is very even in the four classes of 10 points each in the rate. From 70 on it falls off rapidly, with the single exception of the class of rate from 100 to 109.9, which has a frequency of 5.

The detailed distribution of the maximum peak rate is shown graphically in Figure 7.

TABLE III.—*Constants for maximum peak death rates.*

Constant.	Value.
Mean maximum peak rate	73.9±3.2
Median maximum peak rate	70.0±4.0
Standard deviation	30.3±2.3

Three of the cities, Milwaukee, Kansas City, and St. Louis, show higher maximum peak rates on the second wave than on the first.

2. *Date of occurrence of maximum peak rate.*—The date of the week in which the maximum peak rate occurred is given in the third column of Table I. It will be seen that the earliest date, October 5, occurs but twice, namely, in Boston and Cambridge. These two cities, of course, are in a demographic sense practically a single unit though politically separate. At the other extreme the latest maximum peak rate date is December 14. The cities showing a culmina-

tion of the epidemic mortality during the week which ended on this latter date are Grand Rapids, Milwaukee, and St. Louis. Grand Rapids has an extremely peculiar curve, unlike that of any other city in the country. Milwaukee and St. Louis are two of the cities showing the second peak higher than the first, so in these two cases the date in the third column of Table I refers to the second peak, while in all other cities it refers to the first peak. On these accounts the upper range end for maximum peak date should probably not

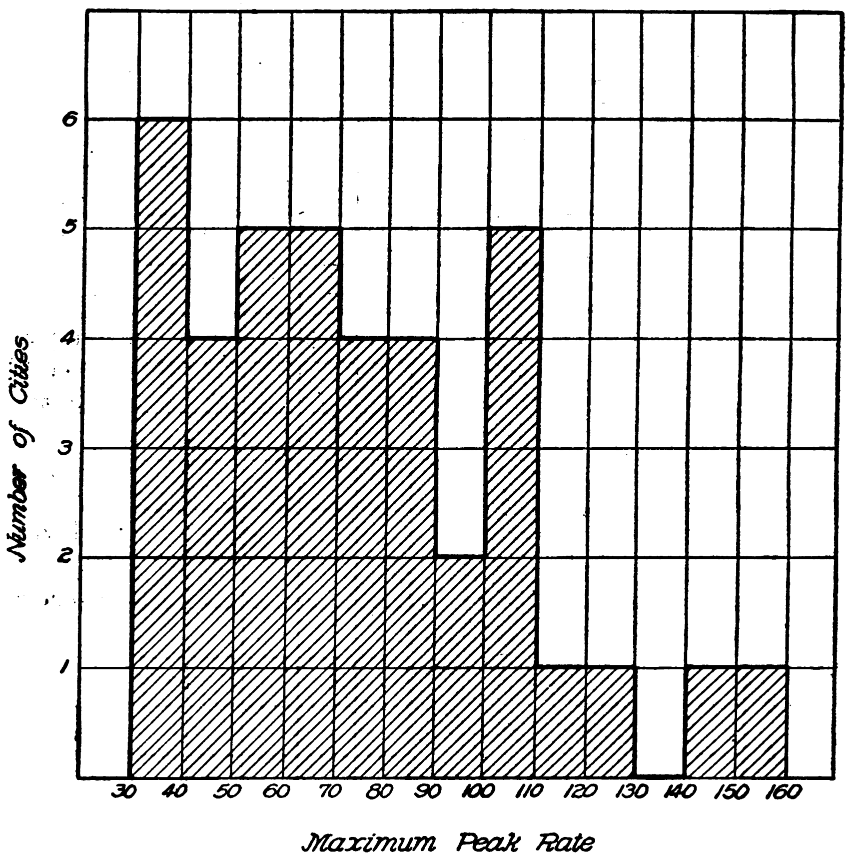

FIG. 7.—Distribution of maximum peak death rates in 40 cities. Certain constants of the distribution shown in Table II are exhibited in Table III.

be taken as December 14, but as November 2, since the only other later date, November 16, appears in a single case, St. Paul, and the curve for that city is again abnormal. There are five cities showing the peak of the mortality curve in the week ended November 2, namely, Cleveland, Los Angeles, Oakland, Pittsburgh, and San Francisco.

The distribution of maximum peak dates is shown in Table IV, and graphically in Figure 8.

TABLE IV.—*Distribution of dates of maximum peak mortality.*

Maximum peak in week ended—	Number of cities.
October 5	2 } 5 } 31
October 12	3
October 19	12 } 26
October 26	14
November 2	5 } 5 } 6
November 9	0
November 16	1 } 1
November 23	0
November 30	0 } 0
December 7	0
December 14	3
Total	40

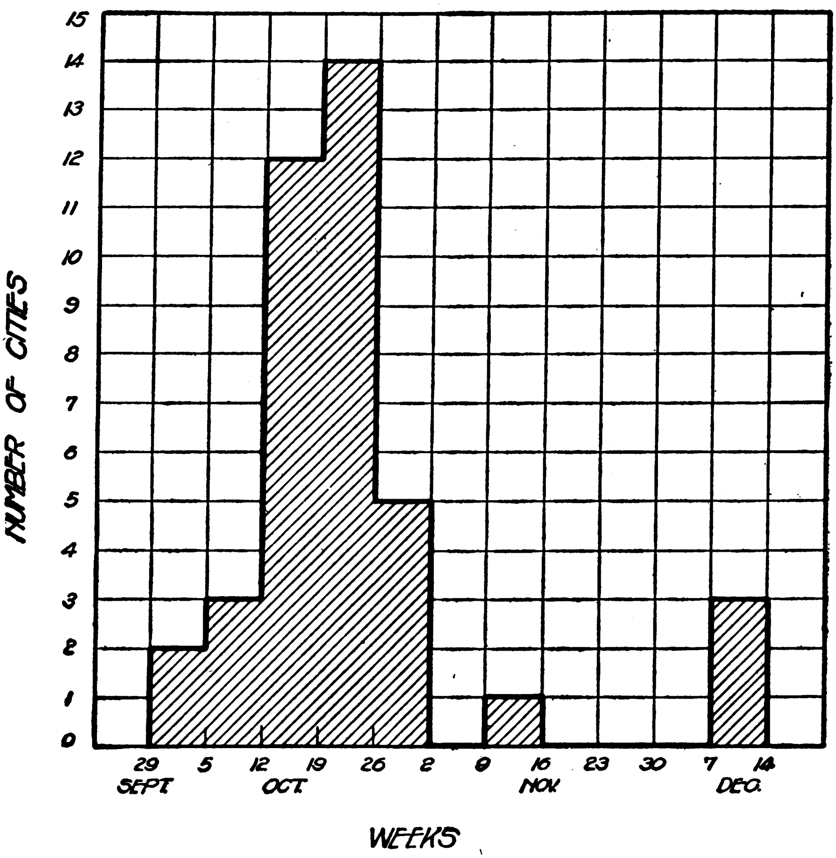

FIG. 8.—Distribution of peak dates of the epidemic.

Using all the data, we find the following constants for date of maximum peak.

Mean peak date = October 23 ± 1.68 days.

Standard deviation in peak date = 15.75 ± 1.19 days.

These constants will serve as a useful record of the time factor in the epidemic of the autumn of 1918 in American cities.

Thirty-one out of the 40 cities had attained the peak rate of mortality prior to November 2.

3. *Number of peaks in mortality curve.*—It is clear from the diagrams already shown that there was considerable variation in the different cities in respect of the number of epidemic mortality peaks exhibited.

The details on this point are shown in Table I. Putting the data together in the form of a frequency distribution we have the results shown in Table V.

TABLE V.—*Showing number of distinct peaks in mortality curve from the beginning of the epidemic to Apr. 1, 1919.*

Number of distinct peaks.	Number of cities.	Per cent of cities.
1	6	15
2	26	65
3	8	20
Total	40	100

Thus it is seen that 26, or 65 per cent, of the 40 cities showed two distinct peaks in the mortality curve, while 6, or 15 per cent, had one peak, and 8, or 20 per cent, had three peaks. The diminishing wave-like character of the successive peaks is clearly shown in the diagrams.

4. *Dates of second and third peaks of mortality.*—In the case of cities having two or three peaks the distribution of dates of occurrence of the second peak is shown in Table VI.

TABLE VI.—*Distribution of second-peak dates.*

Week ended—	Occurrence of second peak in 2-peak cities.	Occurrence of second peak in 3-peak cities.	Occurrence of second peak in all cities.
November 30		1	1
December 7		1	1
December 14	3	3	6
December 21	5	2	7
December 28	2	1	3
January 4	2		2
January 11			
January 18	6		6
January 25	6		6
February 1	2		2
Total	26	8	34

Certain interesting facts stand out clearly from this table. In the 8 cities which had three distinct peaks of mortality the second peak came early—prior to December 28. The distribution for the 26 cities having two peaks of mortality is distinctly bimodal, 12 of them showing a mode for the week ended December 21, and 14 a mode somewhere in the weeks of January 18 and 25. No city had a second peak of mortality in the week ended January 11.

Table VII gives the distribution of dates of the third peak of mortality.

TABLE VII.—*Distribution of third peak dates.*

Week ended—	Occurrence of third peak.
March 8	1
March 15	4
March 22	3
Total	8

Here the observed mode evidently falls somewhere in the week ended March 15.

The data of Tables VI and VII are shown graphically in Figure 9.

The figures and diagram at once suggest that the group of 12 two-peak cities showing the second peak somewhere between December 7 and January 4 were cities which at that time were presumably destined to show a third distinct wave and peak of mortality, but in which for some reason not now apparent the third wave did not eventuate. In contradistinction to these stand the 14 cities showing a second peak of mortality between January 11 and January 21. These latter are presumably cities in which the complex of factors determining the form of the mortality curve was such as to lead definitely to a two, and only two, peaked curve. This idea will be substantiated by further evidence to be presented immediately.

As a matter of record of the epidemic in American cities, the mean dates calculated from Tables VI and VII are given in Table VIII.

TABLE VIII.—*Constants for dates of second and third mortality peaks.*

Item.	Mean.	Standard deviation.
Date of second peak	Jan. 1 ± 2.13 days	18.40 ± 1.51 days.
Days from beginning of October to second peak.	92.26 days	
Date of third peak	Mar. 14 ± 1.10 days.	4.63 ± 0.78 days.
Days from beginning of October to third peak.	165.25 days	

Putting all the data together we find for the whole group of cities the following *average* relations:

(*a*) Days from average date to maximum peak in all cities to second peak in cities showing two or three mortality peaks = 69.26.

(*b*) Days from date of second peak, in all cities showing two or more peaks, to third peak, in cities having three mortality peaks = 72.99.

These relations seem at first sight to point to a cycle of about 10 weeks' duration in the secondary mortality waves of this influenza

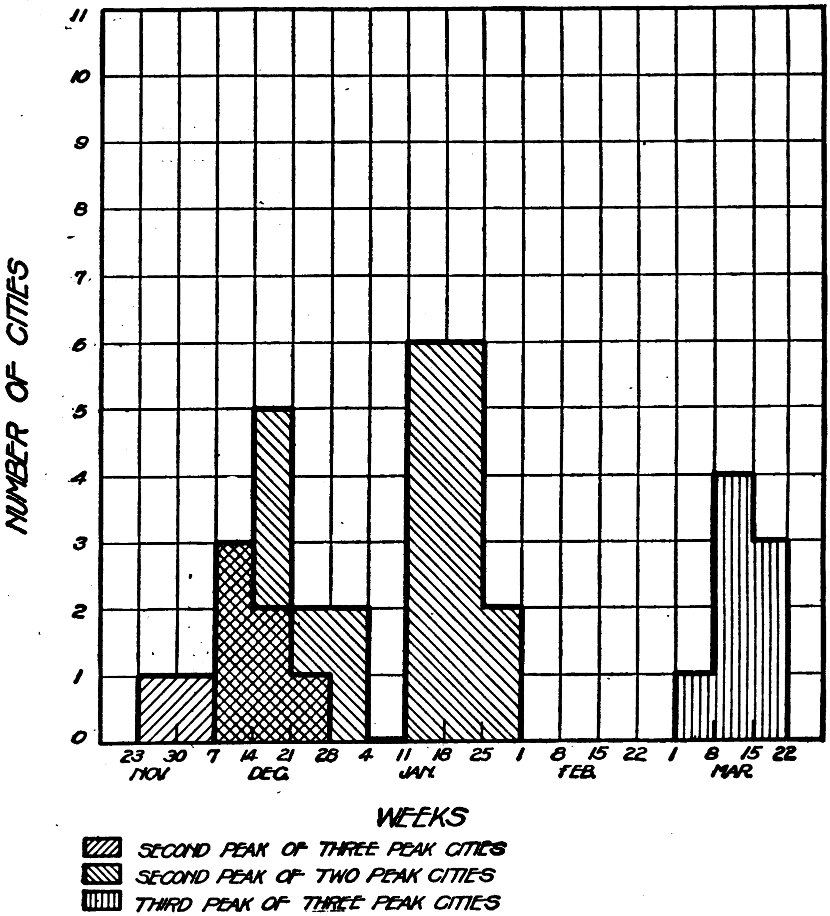

FIG. 9.—Frequency of occurrence of second and third peaks of mortality at different dates.

epidemic, after the first wave. This point can, however, be more accurately discussed by reference to the data set forth in Table I on the number of weeks elapsing between the successive peaks.

These data are presented in the form of frequency distributions in Table IX.

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TABLE IX.—*Frequency distributions of number of weeks elapsing between successive mortality peaks.*

Number of weeks.	Number of cities.			
	Between first and second peak.			Between second and third peak.
	All cities.	2-peak cities.	3-peak cities.	
6	3		3	
7	4	2	2	
8	6	4	2	
9	3	2	1	
10	1	1		
11	4	4		1
12	2	2		2
13	7	7		2
14	2	2		2
15	2	2		
16				1
Total	34	26	8	8

From this table it appears clearly that there was a definite tendency for the two-peak cities to fall into two groups in respect of the time elapsing between first and second peaks. About a third of them had the second mortality peak around 8 weeks after the first peak. The remaining two-thirds had the second peak, on the average, about 13 weeks after the first. The three-peak curves had the second peak on an average 7.1 ± 0.3 weeks after the first, and the third peak on an average 13.1 ± 0.3 weeks after the second. The cycle in the epidemic waves would therefore appear to be nearly a multiple of 7 weeks rather than the 10 weeks tentatively deduced from the dates of peaks. There the process of averaging obscured the true relations.

5. *Duration of explosive outbreak.*—We may next consider the question of the duration in weeks of the explosive epidemic outbreak. The pertinent data are given in the columns of Table 1 headed "Weeks rate was outside normal range," "Weeks, start to peak," "Weeks, peak to normal rate." In discussing any question of duration of an epidemic outbreak of a disease it is necessary to define sharply and usually arbitrarily what are to be taken as limiting points. It is always difficult, and usually impossible, to define these limiting points precisely and logically so that no one will or can criticize their location. The point has recently been discussed by Hitchcock and Carey[1] who say: "The difficulty * * * lies in deciding at just what point an undue prevalence or outbreak becomes epidemic." The general epistemological principle to be observed is clearly this: That since it is usually impossible to say with mathematical precision, in the case of an endemic disease, exactly when an epidemic outbreak begins or ends one must, in order to avoid

[1] Hitchcock, J. S. and Carey, B. W., "A Median Epidemic Index. Amer. Jour. Public Health, Vol. IX, pp. 355-357. 1919.

unconscious bias in dealing with a series of different localities, lay down an arbitrary rule and follow it absolutely. Then the results will be correct *relative to each other*, even though there may be room for argument as to whether they are absolutely correct or not. Following this principle the following rule was laid down and has been used throughout: The epidemic *mortality* was considered to have begun in any city on the date when the mortality curve for that city first passed outside the range of fluctuation exhibited by the curve between the week ended July 6, 1918, and the end of the week immediately preceding the epidemic rise of the curve. The mortality of the first epidemic outbreak was considered to have ended on the date when the curve again passed within the same range of fluctuation.

This measure of duration is admittedly rough, but I think it suffices for a first approximation to the facts. It must be clearly understood that the data collected under this definition will not measure the duration of the *epidemic*, with any accuracy at all, for several reasons. In the first place, we are dealing in this paper solely with mortality and not at all with morbidity. The mortality of an epidemic can only begin a definite and significant period of time *after* the epidemic incidence of the disease has begun. In the second place, the arbitrary definition on which we are operating here will include both peaks of some 2-peaked curves and only the first peak of others, the differentiating factor being of course whether the mortality curve dropped down to within the "normal" range between peaks or did not. Now while this will seem to some a serious, not to say totally invalidating, criticism of the here defined measure of duration of first outbreak, I think it really has no weight at all. The facts are that in some cities (A) there was a sharp explosive outbreak of epidemic mortality. The death rate curve went up abruptly and came down abruptly till it was as low as it was before the epidemic outbreak. In other cities (B) the curve went up abruptly and came down, but only some part of the way, distinctly not reaching so low a rate as prevailed before the epidemic. Now by any canons of common sense it would seem clear that in the A cities the *particular epidemic outbreak* about which we are talking came to an end when the death rate was again normal for the locality and season. Subsequently the death rate may have again risen abruptly. But if it did it was a *new* and distinct epidemic outbreak, temporally and spatially related to the first outbreak if one likes, but definitely separated from it by a longer or a shorter period in which the mortality rate was *normal*. Conversely in the B cities even though the mortality rate did decline from the maximum peak rate, still it did not go back to normal, or in other words it remained an *epidemic* mortality, in the common sense of that word. The rate after this depression may have risen to a new second peak, but all the time it was part of the same epidemic outbreak. Thus it clearly appears that there is a real distinction between the A cities and the B cities. This distinction is reflected perfectly in the duration definition here adopted, and would be wholly lost in any scheme of measuring duration by peaks alone. It only needs to be kept firmly fixed in mind that we are here measuring the length of time during which the death rate was higher than the normal death rate for the same city, in the first continuous outbreak of influenza mortality.

We may first consider the total number of weeks that the mortality was outside the July to September range of fluctuation. The frequency distribution is given in Table X.

TABLE X.—*Frequency distribution of cities in respect of number of weeks mortality curve was outside "normal" range of fluctuation in first outbreak.*

Weeks.	Number of cities.		
5	1	4	15
6	3		
7	8	11	
8	3		
9	4	5	9
10	1		
11	1	4	
12	3		
13	1	3	7
14	2		
15	2	4	
16	2		
17	2	3	6
18	1		
19	1	3	
20	2		
21	1	2	3
22	1		
23	1		
Total	40		

The range of variation in the duration of the first outbreak of epidemic mortality, as here defined, is great, from five weeks on the one hand (Richmond, Va.) to 23 weeks on the other (Atlanta, Ga.). So great is this variation that its general trend is not easily comprehended until the figures are somewhat combined. If that is done, certain general relations appear. First of all, it is to be noted that 20 cities, exactly one-half the total number, showed a duration as here defined of 10 weeks or less, while in the other half the duration was 11 weeks or over. The median duration was then 10.5 weeks.

In general, the tendency was for the shorter duration to occur more frequently. This is well shown by Figure 10, which is plotted from the last column of combined figures in Table X.

Considerably the largest single area in the histogram is the first one covering durations of five to eight weeks inclusive. The frequencies for the longer periods, shown in four-week groups, become successively smaller.

From the ungrouped data of Table X the following constants have been calculated:

Mean duration of epidemic mortality in the first outbreak = 11.90 ± 0.55 weeks.

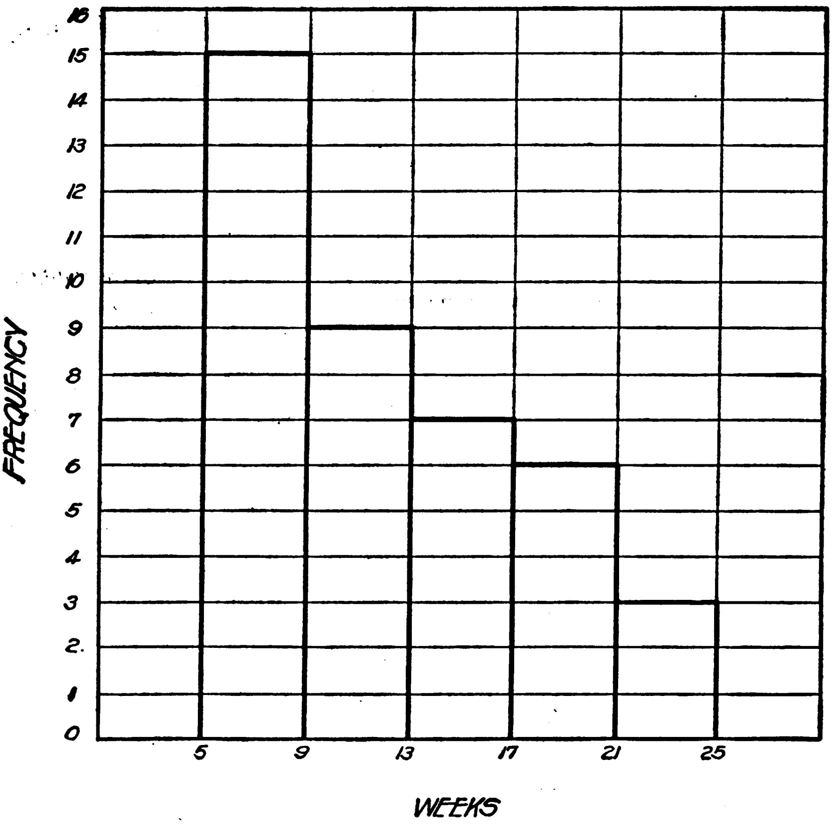

FIG. 10.—Frequency of different durations of the first outbreak of epidemic mortality.

Standard deviation = 5.17 ± 0.39 weeks.

We may next consider the two limbs of the explosive mortality curve. The frequency distributions for the time duration of the ascending limbs and the descending limbs are given in Table XI.

TABLE XI.—*Frequency distributions for two moieties of epidemic mortality curve (first outbreak).*

Weeks.	Frequency.			
	Normal to peak (ascending limb).	Cumulated frequency.	Peak to normal (descending limb).	Cumulated frequency.
2	5	5	....	....
3	17	22	2	2
4	12	34	13	15
5	....	34	5	20
6	3	37	3	23
7	....	37	1	24
8	1	38	....	24
9	....	38	2	26
10	1	39	1	27
11	1	40	1	28
12	....	40	3	31
13	....	40	2	33
14	....	40	1	34
15	....	40	2	36
16	....	40	3	39
17	....	40	....	39
18	....	40	....	39
19	....	40	1	40
Total	40	....	40	....

The first point which strikes one from this table is that it, in numerical form, confirms what is apparent from inspection of the individual curves, namely that (*a*) the epidemic mortality curve in the first outbreak tends in general to ascend to the peak at a more rapid rate, or in other words more abruptly than it descends; and (*b*) there is a great deal more variation among the cities in respect of the time interval covered by the ascending limb of the mortality curve than in the time required for the mortality to come from the peak rate back to normal. In 34 of the 40 cities it required 4 weeks or less time for the mortality rate to pass from normal to its epidemic peak. But in only half as many (17) of the cities did the rate come down from its peak to normal again in a period of 4 weeks or less.

The constants of the two distributions are as follows:

Mean time from normal mortality rate to peak $= 3.90 \pm 0.21$ weeks.

Standard deviation in time from normal mortality rate to peak $= 1.93 \pm 0.15$ weeks.

Mean time from peak mortality rate to normal $= 8.00 \pm 0.50$ weeks.

Standard deviation in time from peak mortality rate to normal $= 4.68 \pm 0.35$ weeks.

From these figures it appears that on the average it took about twice as many weeks for the mortality curve to come back from its peak condition to the normal again, as were required for the increase from normal to peak at the beginning of the explosion. In round figures, the ascending limb of the mortality curve occupied about a month and the descending limb about two months.

The differences between the two distributions of Table XI are well shown graphically in Figure 11, in which the cumulated or integral curves are plotted.

6. *Excess mortality.*—Early in March, 1919, the Census Bureau issued a supplement to its Weekly Health Index showing for 34 of

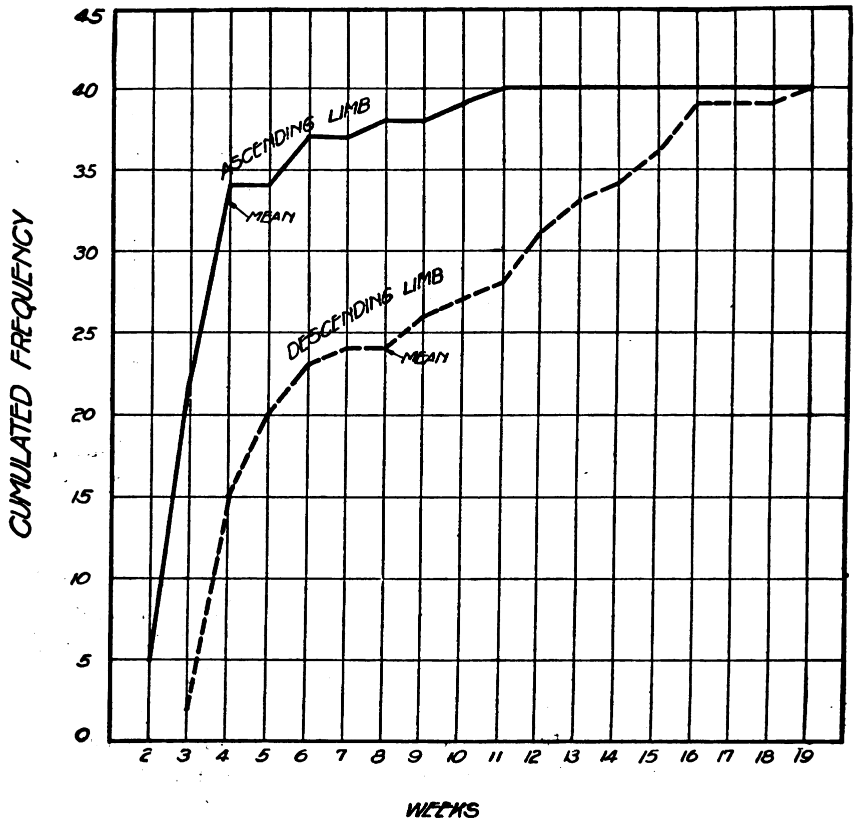

FIG. 11.—Cumulated frequency curves for time covered by (*a*) ascending limb, and (*b*) descending limb of epidemic mortality curve.

the 40 cities of Table 1 the mean excess rate of mortality due to the epidemic for the period of 25 weeks preceding March 1. These data are given in the last column of Table 1. They are arranged in the form of a frequency distribution in Table XII.

TABLE XII.—*Excess mortality for 25-week period.*

Mean excess mortality rate.	Number of cities.
1-1.9	1
2-2.9	6
3-3.9	6
4-4.9	4
5-5.9	9
6-6.9	3
7-7.9	4
8-8.9	1
Total	34

Considering the small numbers involved, this is a fairly smooth unimodal distribution. Half of the cities have excess rates below five, and half above. Calculating from the ungrouped material we find—

Mean 25-week excess mortality rate $= 4.75 \pm 0.20$.

Standard deviation in 25-week excess mortality rate $= 1.76 \pm 0.14$.

7. *Summary of variation data.*—Summarizing, it may be said that the purpose of the material so far presented is simply to place in orderly array the basic statistical characteristics of the weekly mortality curves of the 1918–19 influenza epidemic in American cities, to the end that the extraordinarily great and entirely distinct differences between different cities in respect of the various characteristics of the epidemic may be apparent. It is essential to make this variation distinctly evident as a preliminary to the analytical discussion of its causes. It has been shown clearly that in respect of each of the following attributes or characters of the epidemic mortality there was a marked variation among the 40 American cities studied.

1. General form of mortality curve.
2. Maximum peak mortality rate.
3. Peak dates.
4. Number of distinct peaks in mortality curve.
5. Time between peaks of mortality.
6. Steepness of ascending and descending limbs of mortality curve.
7. Excess mortality rate.
8. Duration of epidemic mortality.

The variation among cities in these different epidemiological characters constitutes a problem of first-class hygienic interest and importance. Why did it exist? Why were not all cities at least reasonably alike in their influenza epidemic? If we can find sound and correct, even though only partial, answers to these questions we shall have gained greatly in that understanding of the epidemiology of influenza which must always underlie any effective control of it. It is to the analysis of this problem that attention will next be devoted.

IV. Epidemicity Indices.

With the variation data in hand one further step is necessary before the analysis by multiple correlation can be completed. We must have a single numerical measure or index of the force of the epidemic explosion in any particular place. In the earlier sections we have seen that the mortality curves in some cities have a single very sharp peak, while in other cases the curve of epidemic mortality is a long, low, flat curve. To deal practically with such differences, it is essential to have some single numerical index which will be sensitive to changes of any order in the curve, and at the same time will measure the essential characteristic which we want to measure in an epidemic curve.

Confining the discussion to mortality solely, it appears to the writer that the essential characteristic of an epidemic curve is that the death rate rises with greater or less abruptness above its normal level to a peak, more or less pointed, and then declines again to the normal level, in a more or less steep or abrupt manner. In such a movement of the death rate curve there are two fundamental variables, namely, (*a*) the *time* during which the mortality departs from its normal level, and (*b*) the *extent* or degree of departure. If we suppose the time (*a*) made a constant then the extent of departure measures the force of epidemic mortality. In general, common sense would indicate that any measure of the force of an epidemic, or, in a single word, any measure of the epidemicity of a disease must properly incorporate both these variables.

In the discussion of the desiderata of an epidemicity index it will help to have some simple diagrams of different types of epidemics. For this purpose Figures 12 and 13 are introduced. They are purely hypothetical illustrations.

In each of the two epidemics shown in these diagrams the same number of people died and the peak death rate was reached at the same time. But clearly the outbreak depicted in Figure 12 would be generally regarded as a more severe or explosive epidemic, *qua* epidemic, than the one shown in Figure 13. Such changes of the death rate as are shown in Figure 13 may indeed not be regarded as epidemic at all. We do not commonly think of the seasonal rise in the endemic influenza rate as an epidemic. Yet it is quantitatively of the same order as the circumstances depicted in Figure 13. It is of the essence of the idea of an epidemic, as commonly held, that it should have something of an explosive character—that is, there must be a relatively large increase in the death (or morbidity) rate, occurring in a relatively short space of time, in order to constitute an epidemic.

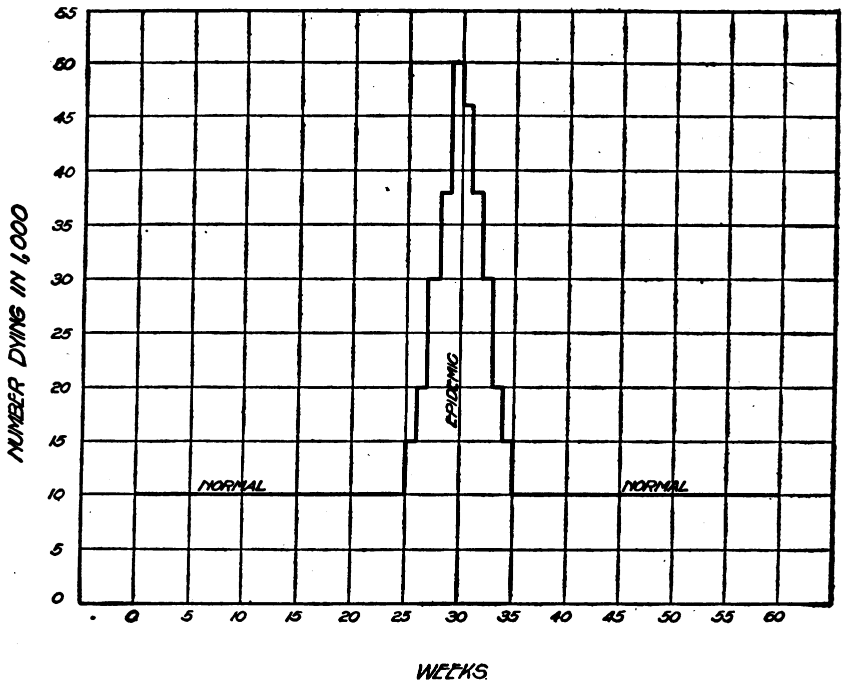

FIG. 12.—Hypothetical diagram to show epidemic of great explosiveness.

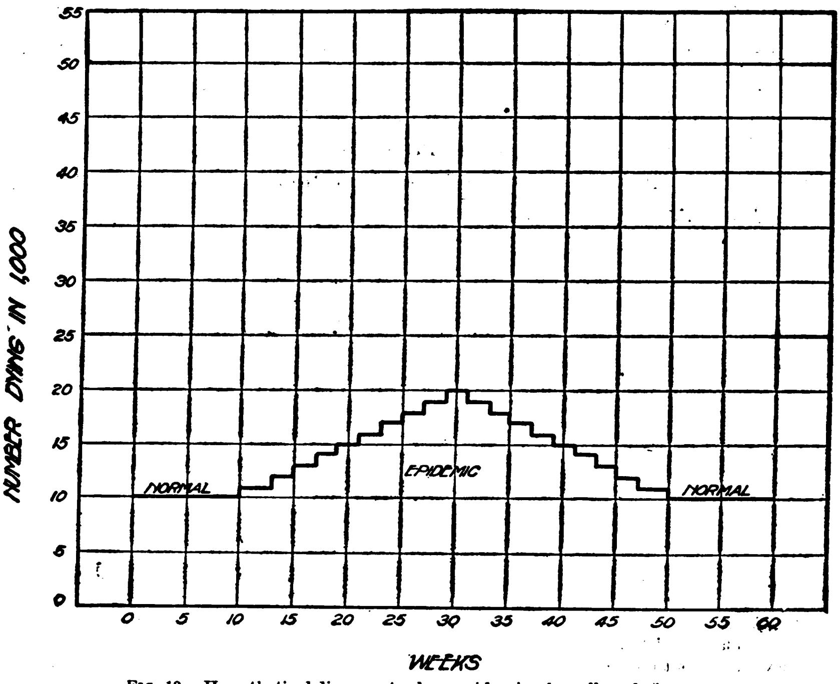

FIG. 13.—Hypothetical diagram to show epidemic of small explosiveness.

This being so, any proper measure of the degree of epidemicity must first of all measure the degree of *explosiveness* of the outbreak of the disease under discussion. There are a number of ways, mathematically, in which this can be done. The decision as to which is the best method will turn upon the degree of sensitiveness with which each measures the essentially explosive feature of the outbreak. In arriving at a measure of epidemicity for the analytical study of the influenza epidemic in American cities five different plans have been tried. We may now discuss these different indices, and decide upon which is the best for present purposes. The data used are the weekly mortality rates for thirty-nine American cities dealt with in earlier sections.

1. *Standard deviation of epidemic.*—The first epidemicity index which would occur to the biometrician is that expressed by the standard deviation of the epidemic outbreak, measured in weeks, the death rates being regarded as frequencies. An epidemic curve like that of Figure 12 obviously has a smaller standard deviation in time than one such as is shown in Figure 13. In general, the greater the explosiveness of the outbreak the smaller will be the standard deviation. Practically the manner in which this index is calculated is as follows:

(*a*) Take as the basis of calculation the duration of the epidemic outbreak as defined earlier.[1]

(*b*) Within the range so defined calculate the standard deviation[2] in weeks in the ordinary way, the observed death rates being taken as ordinates.

In the present instance the constant takes this form: Let y denote the death rate in a particular week, and x the deviation of the week in which that rate occurred from the mean. Then, if I_1 denotes the epidemicity index, we have

$$I_1 = \sqrt{\frac{\Sigma_{x_1}^{x_n} y x^2}{N}}$$

when N is the number of weeks in the epidemic period, and Σ denotes summation. This index is easy to calculate and has a definite physical meaning. Practically, it would probably be desirable if I_1 were to be used as an epidemicity index generally, to take some multiple of its reciprocal for tabling, since as the index now stands it becomes numerically smaller as the explosiveness of the epidemic becomes greater. The value $100/I_1$ would be satisfactory.

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[1] Vide p. 1760.

[2] The "standard deviation" is a well-known constant used in biometric work. It is the root-mean-square-deviation about the mean. For a detailed discussion of this constant see Yule's "Introduction to the Theory of Statistics," or any of the modern texts on elementary statistical methods.

2. *Variation of excess death rates.*—Another measure of epidemicity which may be considered is of a more complex character than the last. Its nature may be indicated symbolically as follows:

Let M = mean death rate during epidemic, the latter being delimited as to duration by the definition in an earlier section already referred to;

M' = mean death rate in the period from July 6, 1918, to outbreak of epidemic.

$M'' = M - M'$ = increase in mean death rate during epidemic.

$S = \sqrt{\frac{\Sigma_1^n y^2}{n}}$, where y is the deviation of any particular week's death rate from M, and n is the number of weeks in the epidemic period. S is the standard deviation of the epidemic death rates, each equally weighted.

Then the second epidemicity index is

$$I_2 = \frac{100S}{M''}$$

This quantity will increase as the explosiveness of the outbreak increases. In ordinary biometric terminology it is the coefficient of variation of the weekly death rates in the epidemic period, referred to the mean excess rate as a base.

3. *Mean increase in death rate during epidemic.*—As a third epidemicity index we may take the quantity called M'' in the preceding section. We then have

$$I_3 = M''$$

4. *Twenty-five weeks excess rate.*—It has been suggested that the average excess weekly annual death rate for the 25 weeks ended March 1, 1919, might be used as a measure of the force of the epidemic. Indeed, it has been so used practically by various health officials. In the present connection we may designate this measure as I_4.

5. *Peak-time ratio.*—An epidemicity index which immediately makes strong appeal by virtue of its simplicity is a constant for any mortality curve which may be called the peak-time ratio. The symbolical expression for it is:

$$I_5 = \frac{P - M'}{T}$$

where P denotes the maximum peak mortality rate observed during the duration T of the epidemic, T being delimited by the definition stated earlier in this paper, and M' is the quantity defined under the same symbol in section 2 above. This index increases as the explosiveness of the outbreak increases. In fact, it measures explosiveness in the most simple and direct way possible.

V. Numerical Values of Epidemicity Indices.

It is evident at once that these five indices have different degrees of validity and usefulness. Before attempting to discuss them in detail, however, it will be well to get the numerical values for each, in the case of each of the 39 cities under discussion. This is done in Table XIII.

TABLE XIII.—*Showing values of different epidemicity indices of mortality in American cities during influenza epidemic of 1918.*

Cities.	I_1 (weeks).	I_2 (per cent).	I_3.	I_4.	I_5.
Albany	1.61	85.9	40.13	4.7	13.81
Atlanta	6.68	58.5	9.31	2.7	.92
Baltimore	1.54	94.5	48.61	6.1	18.61
Birmingham	4.66	60.7	17.04	…	2.41
Boston	1.96	88.5	33.47	6.5	9.62
Buffalo	1.85	92.0	31.19	5.8	10.55
Cambridge	2.00	88.9	27.68	5.9	7.94
Chicago	1.98	72.4	24.04	3.8	6.61
Cincinnati	4.55	69.8	15.41	4.0	2.15
Cleveland	3.63	74.2	18.30	4.0	4.09
Columbus	3.55	56.4	14.94	3.2	2.74
Dayton	6.24	91.4	24.67	3.5	7.20
Fall River	1.66	80.9	38.70	5.8	11.92
Grand Rapids	3.41	65.7	8.10	1.5	1.68
Indianapolis	3.42	55.9	12.51	2.5	2.15
Louisville	4.11	78.4	15.45	3.6	3.07
Los Angeles	5.50	62.7	15.78	5.2	2.00
Lowell	1.70	71.5	34.60	5.1	10.58
Memphis	1.76	94.7	24.15	…	8.60
Milwaukee	4.48	57.4	11.57	2.9	1.53
Minneapolis	5.98	55.1	9.80	2.7	1.12
Nashville	1.58	72.6	39.39	7.8	13.83
Newark	5.70	99.0	15.34	5.1	2.81
New Haven	5.43	100.6	18.89	5.6	3.16
New Orleans	1.60	90.2	40.95	7.2	14.60
New York	2.19	71.2	23.29	4.7	5.67
Oakland	5.25	77.0	18.74	5.9	3.35
Omaha	4.17	69.6	18.47	…	2.91
Philadelphia	1.52	86.2	56.08	7.3	20.51
Pittsburgh	2.79	67.0	37.62	8.0	7.82
Providence	2.46	86.4	21.79	5.3	5.60
Richmond	1.33	66.1	35.12	…	13.91
Rochester	4.48	79.2	13.94	2.7	2.62
St. Louis	4.06	59.1	13.47	3.0	2.11
St. Paul	5.12	57.8	11.31	3.3	1.43
San Francisco	5.06	78.4	26.50	7.5	4.49
Syracuse†	2.09	94.2	30.77	…	8.97
Toledo	1.67	69.8	17.19	2.1	5.95
Washington	1.49	66.3	45.08	6.6	15.34

Of these five indices there are only two which need to be taken seriously into account as practical working measures of epidemicity. These are the first and last, I_1 and I_5. The other three fail in that they do not adequately take account of the time or duration variable, which, as we have already seen, must be an essential factor in measuring epidemic explosiveness. These other indices really measure other aspects of the epidemic better than they do explosiveness of the outbreak, which is the thing we are just now interested in. The inadequacy of I_2, I_3, or I_4 to measure relative explosiveness of outbreak can be readily seen by comparing, city by city, the values given in these columns of Table XIII with the curves for the same cities in Figures 1–6.

As between I_1 and I_5 the advantage, for present purposes, of I_5 is clear. It is numerically more sensitive to changes in the epidemic mortality curves. This fact is reflected in a comparison of the relative variation of the five indices which is made in Table XIV. For comparing the relative sensitivity of the indices to differences in the epidemic mortality curves, the ratio of the standard deviation of each index to its mean has been taken. This ratio has no significance in this case except for comparative purposes.

TABLE XIV.—*Relative sensitivity of different epidemicity indices.*

Index.	Ratio of S. D. to mean.
I_1	0.49
I_2	.18
I_3	.49
I_4	.37
I_5	.77

By conventional biometric standards it might seem *a priori* that I_1 would be a better epidemicity index than I_5. Practically it is seen from Table XIV that the superiority of I_5 is outstanding. The reason for this superiority appears upon analysis to be that this index relates in the simplest mathematical manner possible the two essential factors in relative explosiveness, namely, the height of the explosion, and the time it required, and is therefore most sensitive to differences in relative explosiveness. The same type of constant might be used for the measure of variation in frequency curves generally, except for the fact that ordinarily it is impossible to delimit the range by absolute definition, as can be done in the case of epidemics. In an ordinary frequency curve the probable error of any determination of the range is large. The nature of the definition of the range or duration which we have here adopted for epidemic curves, as well as the characteristics of epidemic curves themselves, largely reduces this probable error in the present connection. And in any case, whatever effect the probable error of the empiric determination of duration may have will tend to be greater in the case of I_1 than of I_5.

Taking all the facts into consideration it has been decided to adopt I_5 as the measure of explosiveness of outbreak in the further analytical study of the influenza epidemic.

VI. The Correlation of the Explosiveness of the Outbreak of Mortality in the Influenza Epidemic with Various Other Factors.

We come now to the most essential part of the study, namely, the attempt to find factors directly related to or concerned in the production of the extraordinary differences between different cities in respect of the relative explosiveness of the outbreak of epidemic mortality. The method of analysis which will be followed is that of multiple correlation.[1] The general principle of the correlation method is simple. If in the present case, for example, we should find that, in general, when a city had a high influenza epidemicity index it also had a high density of population, and conversely, that cities having low epidemicity indices had low density of population, it would be said that there was a positive correlation in variation between explosiveness of epidemic and density of population.

In a system of n variables correlation between any two, with the others remaining constant, is measured by the coefficient.

$$r_{12.34\cdots\cdots n}=\frac{r_{12.34\cdots\cdots(n-1)}-r_{1n.34\cdots\cdots(n-1)}\cdot r_{2\cdot n\cdot 34\cdots\cdots(n-1)}}{(1-r^2_{1n.34\cdots\cdots(n-1)})^{1/2}(1-r^2_{2n.34\cdots\cdots(n-1)})^{1/2}}$$

and a coefficient of zero order is found from the observations by the following well-known expression:

$$r_{12}=\frac{S(xy)}{N\sigma_1\sigma_2}$$

In the present case, because of the statistically small number of cities for which data are available, the zero order coefficients were all determined by the direct product-moment method, without the formation of correlation tables.

The first group of phenomena of which one would naturally wish to know the extent to which they were correlated with explosiveness of outbreak are certain general demographic characteristics of the several cities. The following will be considered:

(*a*) *Density of population.*—It is conceivable—not to say *a priori*, rather probable—that the explosiveness of outbreak of any epidemic disease would be highly correlated with the number of persons living on a unit of area. The figures for density used were calculated in terms of persons per acre of land area, on July 1, 1916.[2]

(*b*) *Geographical position.*—It is a well known epidemiological fact that, in certain classes of epidemic disease at least, the force of the epidemic diminishes as one passes from the primary center or focus, This fact was very clearly demonstrated for the 1916 poliomyelitis epidemic by Lavender, Freeman, and Frost,[3] where New York City was the center. Now, in point of time, the influenza epidemic of the autumn of 1918 in the United States began in and about Boston, Mass. A great explosive outbreak occurred in Boston and Cambridge earlier than in any other cities in the country. We may then ask this question: Did the influenza epidemic, as it spread over the whole country, follow the epidemiological rule already referred to becoming less intense and less explosive the farther, geographically, it traveled from the Atlantic seaboard in general, and Boston in

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[1] Cf. Yule, G. U. "On the Theory of Correlation," Jour. Roy. Stat. Soc., Vol. LX, 1897, and "On the Theory of Correlation for any Number of Variables, treated by a New System of Notation," Proc. Roy. Soc. A, vol. 79, pp. 182-193, 1907.

[2] Data from "Financial Statistics of Cities Having a Population of over 30,000 in 1917." Bureau of the Census, 1918.

[3] Public Health Bulletin No. 91, U. S. Public Health Service, 1918.

particular? To answer this question, so far as the epidemic mortality records of the present group of cities is concerned, we have correlated the epidemicity index I_5 for each city with the distance in a straight line of the same city from Boston, Mass., measuring these straight line distances on a map. Such distance measurements are rough, of course, from an absolute standpoint, but relatively they are sufficiently accurate, and may be relied on, to show correlation if any exists.

(*c*) *Age distribution of population.*—In the case of a disease showing so selective a mortality in respect of age as does influenza it might well be the case that the explosiveness of the outbreak of epidemic mortality would be markedly influenced by the age composition of the population in the several cities. To test this point by the correlation method one must have a single numerical measure or index of the age composition of the population in each city. Such a single numerical measure is not at hand. The problem of obtaining one is a problem which has bothered vital statisticians for a long time, as the need for it always arises in death rate correlation studies of any sort. Theoretically, of course, no *single* numerical expression can possibly be found which will uniquely describe all the properties of a complex curve. The best that can be done is some form of approximation.

For present purposes an index of differences in age composition of populations was adopted, which is admittedly rough and in special cases may be inexact, but which practically has been found, in the case of the 40 cities here dealt with, to give a sufficiently accurate picture of the differences in age constitution. The statistical procedure adopted was to determine for each city the following value:

$$\chi^2 = S\left(\frac{\Delta^2}{P}\right)$$

where Δ is the deviation for each of six age groups (viz, 0–4, 5–14, 15–24, 25–44, 45–64, 65 and over) of the percentage of the actual population of each city in 1910 in each age group, from the percentage in the same group in the Standard Population of Glover's [1] Life Table, denoted in the formula by P. S denotes summation of all six values. The value χ^2 measures through the extent to which each city deviates in the age constitution of its population from a fixed standard, but does not tell the nature or kind of the deviation. For present purposes the latter point is unessential. We are proposing to measure the correlation between explosiveness of epidemic and departure of population from normal in age distribution. Are large variations in explosiveness generally associated with large deviations in age constitution of the population? This question can be answered perfectly by the use of the present index of age consti-

[1] Glover, J. W. United States Life Tables, 1910. Bureau of the Census, 1916.

tution. If it were found that there existed a high correlation between I_5 and χ^2 it would be desirable and necessary to analyze further the nature of the deviations in age constitution. But as will presently appear this necessity does not arise.

As has been said, the age distributions for the cities in the year 1910 were used. This was necessitated by the fact that no later census data were available. It seems fairly certain, however, in as old, large, and settled communities as these dealt with are, that the age composition of the population will only change slowly, and that 1910 figures may be taken as reasonably indicative of present conditions in respect to this matter.

(*d*) *Percentage growth of population between 1900 and 1910.*—It might conceivably be the case that the explosiveness of the outbreak of an epidemic disease would be influenced by the rapidity with which a city had grown in the recent past. To test this possible factor in the present case the epidemicity index I_5 is correlated with the percentage growth of the population in each city in the decade 1900–1910.

The data for these various correlations are assembled in Table XV.

TABLE XV.—*Data for correlation of demographic characteristics of cities with explosiveness of epidemic influenza mortality.*

City.	Epidemicity. Index I_5.	Density of population (persons per acre).	Geographical position.	Age distribution χ^2.	Growth in population.
Albany	13.81	8.89	128	4.76	6.5
Atlanta	.92	11.42	920	13.06	72.3
Baltimore	18.61	30.57	348	6.81	9.7
Birmingham	2.41	5.68	1,028	15.80	245.4
Boston	9.62	27.36	....	7.18	19.6
Buffalo	10.55	18.97	376	8.86	20.2
Cambridge	7.94	28.23	3	6.51	14.1
Chicago	6.61	20.28	828	11.45	28.7
Cincinnati	2.15	9.10	712	6.73	11.6
Cleveland	4.09	20.08	532	11.88	46.9
Columbus	2.74	15.18	616	8.35	44.6
Dayton	7.20	12.65	684	6.56	36.6
Fall River	11.92	5.91	45	10.87	13.8
Grand Rapids	1.68	11.85	720	6.17	28.6
Indianapolis	2.15	10.96	776	7.23	38.1
Louisville	3.07	16.61	796	7.57	9.4
Los Angeles	2.00	2.40	2,520	7.67	211.5
Lowell	10.58	13.63	23	7.35	11.9
Memphis	8.60	12.06	1,104	14.24	28.1
Milwaukee	1.53	26.92	832	10.33	31.0
Minneapolis	1.12	11.27	1,084	11.46	48.7
Nashville	13.83	10.11	924	9.19	36.5
Newark	2.81	27.52	192	10.19	41.2
New Haven	3.16	13.06	100	6.81	23.7
New Orleans	14.60	2.96	1,332	9.25	18.1
New York	5.67	29.54	164	11.79	38.7
Oakland	3.35	6.41	2,604	6.51	124.3
Omaha	2.91	8.34	1,248	10.83	21.0
Philadelphia	20.51	21.02	260	7.19	19.7
Pittsburg	7.82	22.81	456	11.53	18.2
Providence	5.60	22.35	40	6.88	27.8
Richmond	13.91	10.76	460	10.55	50.1
Rochester	2.62	18.62	328	6.97	34.2
St. Louis	2.11	19.36	1,004	9.51	19.4
St. Paul	1.43	7.40	1,072	12.70	31.7
San Francisco	4.49	17.55	2,624	12.65	21.6
Syracuse	8.97	13.34	248	6.21	26.6
Toledo	5.95	10.91	620	7.26	27.8
Washington	15.34	9.55	376	6.58	18.8

As a matter of record, and for reference in connection with the correlation data, the mean and standard deviation of the variables included in Table XV are given in Table XVI.

TABLE XVI.—*Constants for demographic data of Table XV.*

Character.	Mean.	Standard deviation.
Epidemicity index, I_5......	6.78 ± 0.56	5.22 ± 0.40
Density of population......	15.17 ± .82	7.56 ± .58
Geographical position......	721 ±71.00	658.95 ±50.00
Age distribution, χ^2........	9.063± .28	2.609± .20
Growth in population......	40.43 ± 5.2	48.81 ± 3.7

Coming now to the consideration of the correlations we have the following results:

(*a*) For the correlation between explosiveness of epidemic mortality (I_5) and density of population—

$$r = +0.092 \pm 0.107.$$

The coefficient is less than its probable error, or is, in short, substantially zero. This value justifies the conclusion that relative density of population in these 39 cities had nothing to do with the explosiveness of the influenza outbreak.

The insignificant degree of correlation in this case is shown graphically in Figure 14. The plan of this figure is first to convert the absolute values of the epidemicity index and density of population for each city to relative figures, the mean for all cities being taken as the base 100. The cities are then arranged in descending order of relative epidemicity index (solid line) and the relative density figures for the same cities are plotted as a broken line. The higher the correlation the more closely will the two lines tend to parallel each other. Here it is evident that the density line runs quite independently of the epidemicity line.

(*b*) For the correlation between I_5 and geographical position, measured by straight line distance from Boston

$$r = -0.348 \pm 0.095.$$

This, clearly, is a wholly different order of result from that which we had in the case of the density of population. The coefficient in the present case is nearly four times its probable error and may almost certainly be regarded as significant. The odds against its being simply a widely deviant chance result of random sampling are more than 78 to 1.[1] The sign of the coefficient is negative. This result means that the greater the linear distance of a city from Boston the

[1] Cf. Pearl, R., and Miner, J. R. A Table for Estimating the Probable Significance of Statistical Constants. Me. Agr. Expt. Stat. Ann. Rept. 1914, pp. 85-88.

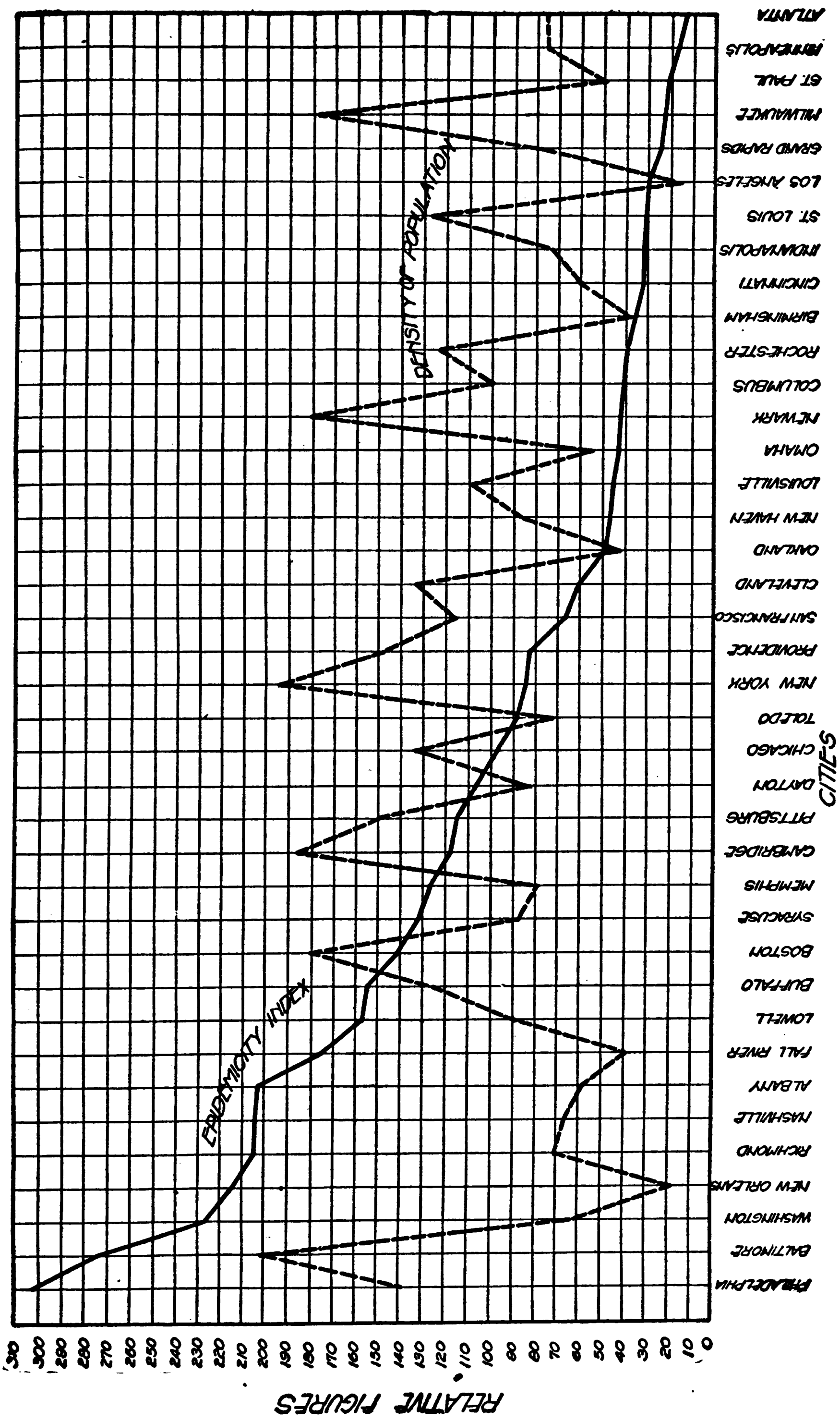

FIG. 14.—Diagram showing lack of correlation between variation in epidemicity index and density of population (Explanation in text).

less explosive did the outbreak of epidemic mortality in that city tend to be. This is in accord with the general epidemiological rule that the force of an epidemic tends to diminish as it spreads from its primary or initial focus. It must be noted, however, that the correlation coefficient in this case is not large. It is barely past the value where it may safely be regarded as statistically significant. This fact may probably be taken to mean that influenza does not follow the epidemiological law referred to with anything like such precision as do some other epidemic diseases, notably poliomyelitis.

(*c*) For the correlation between explosiveness of epidemic mortality (I_5) and the deviation of the population in the several cities from a standard population in respect of age distribution

$$r = -0.262 \pm 0.101.$$

This coefficient is only a little more than two and a half times its probable error, and can not safely be regarded as significant. If there were no correlation whatever, a value of the coefficient as great as the present one would be expected to occur as often as approximately 8 times in every 100 trials with samples of 39 each. In any case it is evident that the difference in age constitution of the population in the different cities can have had but extremely little, if any, influence in bringing about the observed differences in explosiveness of epidemic mortality.

(*d*) For the correlation between epidemicity index I_5 and percentage growth of population in the last intercensal decade

$$r = -0.327 \pm 0.096.$$

The coefficient in this case is slightly more than 3 times its probable error, and is to be regarded as probably statistically significant. On its face the coefficient, having the negative sign, means that there is a definite but not pronounced tendency for cities in the 39 which made a relatively great percentage growth in population in 1900–1910, to show a relatively small explosion of influenza mortality during the epidemic, and vice versa. This would seem to indicate that the epidemic mortality tended to be greatest in the older and larger cities and least in the newer and smaller cities, since the old and large cities generally are not now showing so high a percentage growth from year to year as are the younger cities. The sample of 39, however, is too small to warrant such a conclusion, because in so large a cou try, and one so relatively recently urbanized in many parts, the rate of urban population growth is largely bound up with distance from the Atlantic seaboard. The cities which showed the largest percentage increase in population in 1900–1910 are in general those of the middle west.

We can get at a quantitative estimate of the matter by the method of multiple correlation. Letting the subscript 1 denote epidemicity index I_5, 2 denote percentage growth of population 1900–1910, and 3 denote geographical position measured by straight line distance from Boston, as before, we have for the net correlation between the explosiveness of epidemic mortality and rate of population growth, with geographical position constant

$$r_{12\cdot3} = -0.188 \pm 0.104.$$

It then appears that the supposition made above is substantially correct. This net coefficient between epidemicity index and rate of population growth can not be regarded as statistically significant in comparison with its probable error. In other words, if we make geographical location constant the correlation practically disappears between the other two variables.

The general conclusion to which we come from an examination of the correlation data assembled to this point is that these four general demographic factors, density of population, geographical position, age distribution of population, and rate of recent growth in population, have practically nothing to do, either severally or collectively, with bringing about those differences between the several cities in respect of explosiveness of the outbreak of epidemic mortality in which we are interested. Significantly casual or differentiating factors must be sought elsewhere.

The next general field to which one naturally turned for correlation study was that of the normal death rates, both from all causes and from various particular causes, in the several cities. The death rate, crude or standardized, of any particular community of considerable size, is a relatively constant attribute of that community. The death rate does change, to be sure, with the passage of time, but only slowly. Over a short period of years the death rates of any large city will be found to be nearly constant. In so far they are definite attributes of the city, which are, in general, indicative of the normal vital condition of the population. It is, therefore, important to determine the extent which the normal mortality from various causes is correlated with the severity of the unusual and explosive mortality arising from a great epidemic.

Since, at the time of writing, the mortality statistics for the registration area and its parts have been published only up to and including 1916, the nearest available annual death rates, in point of time, to the 1918 epidemic are those for 1916.[1] Accordingly, these figures are used. In view of the fact already stated that for large aggregates of population, death rates normally change only very slowly, it is clear that we are justified in taking the 1916 rates as indicative, to a first approximation, of the normal general mortality conditions

[1] Mortality Statistics 1916, Seventeenth Annual Report. Bureau of the Census, 1918.

prevailing in the several cities at about the time (in a broad sense) that the influenza epidemic broke out. The cause of death selected for correlation purposes in the first study are exhibited in Table XVII. For convenience of reference and comparison the epidemicity index I_5, with which these death rates are to be correlated, is given in the second column of the table. All the death rates are crude rates.

TABLE XVII.—*Data for correlation of explosiveness of influenza epidemic mortality, with death rates from various causes for 1916.*

City.	Epidemicity index I_5.	Death rate from all causes per 1,000.	Death rates per 100,000 living, from—							
			Pulmonary tuberculosis.	Organic heart diseases.	Acute nephritis and Bright's disease.	Influenza.	Pneumonia (all forms).	Typhoid fever.	Cancer.	Measles.
Albany	13.81	19.3	208.5	235.8	197.2	35.8	161.3	7.5	120.8	24.5
Atlanta	.92	15.3	117.0	110.2	158.5	14.7	141.2	22.0	63.5	1.6
Baltimore	18.61	18.1	200.5	193.2	174.3	21.5	235.7	18.1	106.7	5.4
Birmingham	2.41	14.1	173.9	84.7	85.8	13.2	137.5	43.5	56.1	.....
Boston	9.62	16.9	145.0	220.4	102.6	11.2	210.8	3.4	115.8	14.5
Buffalo	10.55	16.1	142.8	170.1	127.0	10.2	166.3	10.9	100.7	15.8
Cambridge	7.94	13.5	172.6	191.2	70.8	9.7	159.3	1.8	112.4	7.1
Chicago	6.61	14.5	132.8	159.9	107.2	11.7	158.1	5.2	91.3	5.4
Cincinnati	2.15	16.4	208.3	202.7	158.8	26.8	145.4	3.2	116.2	15.3
Cleveland	4.09	14.8	132.2	119.6	90.9	16.3	182.2	5.3	86.8	8.9
Columbus	2.74	15.5	125.2	156.4	90.3	33.5	155.9	13.0	100.5	15.8
Dayton	7.20	15.2	121.8	180.8	119.5	18.9	146.2	19.7	114.8	1.6
Fall River	11.92	17.0	161.3	158.9	105.9	24.1	243.8	10.9	91.9	30.4
Grand Rapids	1.68	12.2	64.7	134.8	88.9	9.4	70.2	16.4	88.1	2.3
Indianapolis	2.15	15.6	159.6	175.6	115.0	17.4	141.8	26.1	99.4	9.8
Louisville	3.07	15.0	159.9	145.7	154.0	33.1	146.9	13.4	83.7	2.1
Los Angeles	2.00	12.3	176.7	161.0	111.3	9.3	78.0	2.6	105.6	2.0
Lowell	10.58	17.3	103.3	161.6	89.2	14.1	178.4	11.5	85.7	25.6
Memphis	8.60	19.8	262.1	145.1	171.1	37.0	136.9	26.7	86.2	2.7
Milwaukee	1.53	12.7	78.8	102.9	79.9	15.8	154.2	15.3	92.8	27.7
Minneapolis	1.12	12.4	117.8	120.0	101.8	8.8	111.4	5.5	96.0	20.4
Nashville	13.83	17.2	201.8	211.2	132.8	25.0	152.6	37.1	77.6	.9
Newark	2.81	15.0	145.5	153.6	140.9	17.4	161.2	6.1	85.6	25.7
New Haven	3.16	17.0	95.5	175.0	122.3	37.4	225.1	8.7	116.2	5.3
New Orleans	14.60	18.4	259.0	207.4	231.1	26.9	117.3	23.1	93.1	3.5
New York	5.67	13.9	154.9	168.7	131.4	9.8	179.9	3.9	84.5	9.9
Oakland	3.35	10.5	94.2	189.3	89.1	8.6	75.5	4.0	89.6	.....
Omaha	2.91	14.4	101.5	93.7	91.3	18.7	173.4	3.0	90.0	1.8
Philadelphia	20.51	16.2	170.6	197.4	177.7	24.0	172.2	7.6	101.1	6.6
Pittsburgh	7.82	17.4	110.7	144.7	92.0	26.6	331.0	9.0	89.8	23.7
Providence	5.60	15.8	134.1	167.5	142.4	25.9	174.1	5.1	100.0	25.1
Richmond	13.91	19.7	187.0	189.5	204.9	20.4	194.0	23.6	97.0	26.2
Rochester	2.62	14.4	91.9	192.3	136.7	8.9	121.6	5.0	114.7	8.1
St. Louis	2.11	14.9	129.0	144.6	176.8	22.8	173.5	9.4	95.3	8.8
St. Paul	1.43	11.3	99.1	122.6	92.6	9.3	80.5	5.7	87.0	7.3
San Francisco	4.49	15.4	169.4	250.7	135.3	4.1	129.0	3.5	133.1	1.3
Syracuse	8.97	15.2	88.0	201.1	112.5	10.9	134.3	12.2	110.5	.....
Toledo	5.95	18.1	168.1	192.8	89.3	19.7	156.5	22.2	97.9	33.8
Washington	15.34	17.8	187.4	230.5	168.1	24.2	164.3	12.9	107.7	2.2

The basic variation constants for the data of Table XVII are assembled in Table XVIII. In the last column of the table have been placed the values of the gross or zero order correlation coefficients measuring the correlation between the epidemicity index I_5 (which we have adopted as the measure of the explosiveness of the outbreak of epidemic mortality) on the one hand, and the death rates from the several causes, on the other hand.

TABLE XVIII.—*Mean and standard deviation for death rates from various causes.*

Cause of death.	Mean death rate.	Standard deviation in death rate.	Coefficient of correlation between epidemicity index I_3 and the death rate from the specified cause.
All causes [1]	15.55±0.24	2.21±0.17	+0.661±0.061
Pulmonary tuberculosis	147.50±4.94	45.73±3.49	+ .525± .078
Organic heart disease	168.29±4.19	38.82±2.96	+ .567± .073
Acute nephritis and Bright's disease	127.39±4.17	38.57±2.95	+ .507± .080
Influenza	18.80± .96	8.86± .68	+ .287± .099
Pneumonia (all forms)	158.40±5.18	47.99±3.66	+ .388± .092
Typhoid fever	12.41±1.04	9.64± .74	+ .176± .105
Cancer	97.07±1.62	14.99±1.14	+ .198± .104
Measles	11.00±1.09	10.08± .77	+ .069± .107

[1] Death rate per 1,000; in all other cases in the table the death rate is per 100,000.

The outstanding fact which strikes one at once from this table is the high order of the correlation which exists between the explosiveness of the outbreak of epidemic mortality in these communities and the normal death rate from certain causes of death in the same communities. In the first four lines of the table the correlation coefficients range from about 6 to more than 10 times the probable errors. There can be no question as to the statistical significance of coefficients of such magnitude. On the other hand, the remaining coefficients in the table are of a distinctly lower order of magnitude, ranging from smaller than the probable error up to three or four times that value. It is clear that we have here hit upon a clue as to the basis of the observed variation in cities in respect of explosiveness of epidemic influenza mortality which will repay careful examination.

The highest correlation coefficient of all is that on the first line of the table, for the correlation of epidemicity index with death rate from all causes. The existence of this high correlation at once indicates that an essential factor in determining the degree of explosiveness of the outbreak of epidemic influenza in a particular city was the normal mortality conditions prevailing in that city. In the group of communities here dealt with those cities which had a relatively high normal death rate had also a relatively severe and explosive mortality from the influenza epidemic. Similarly, cities which normally have a low death rate had a relatively low, and not sharply explosive, increase in mortality during the epidemic.

It will also be noted that the correlation in the next three lines of the table, namely those for pulmonary tuberculosis, so-called organic diseases of the heart, and chronic nephritis and Bright's disease, are of the same order of magnitude as that between the death rate from all causes and the explosiveness of epidemic outbreak of influenza. These facts have certain aspects of general biological, and, in the opinion of the writer, hygienic interest. They will, however, not be discussed here, save in one respect.

Because of the potential importance of these facts, it is desirable to examine them with the greatest critical care. A point which occurs to one at once is the possibility that the observed high correlation between epidemicity index and pulmonary tuberculosis, organic heart diseases, and acute nephritis and Bright's disease, arises because of differences in age constitution of the population in the different cities. In general, it is known that the crude death rate from these causes is influenced, in greater or less degree, by the age constitution of the population. May this not be the whole, or at least the main, cause of the observed correlation? Again, it has already been seen earlier in the paper that there is a distinct, though small, correlation between the geographical position of the cities studied and the explosiveness of the epidemic mortality. May this factor not play an important part in the observed correlations of the epidemicity index with the causes of death showing a high correlation with epidemicity index?

The simplest and most direct method of settling these questions is that of multiple correlation. What is needed is to get the net correlation between the death rate from organic heart diseases, let us say, and epidemicity index, for a constant age distribution of the population and constant geographical position. In the usual terminology of vital statistics we must correct our results for age distribution and geographical position. If we let the subscript 1 denote the cause of death (pulmonary tuberculosis, organic heart disease, or acute nephritis and Bright's disease, as the case may be); the subscript 2 denote the value of the measure of the explosiveness of the epidemic mortality, our epidemicity index I_5; the subscript 3 denote geographical position, measured as before by linear distance from Boston; and the subscript 4 denote deviation of the population from a standard age distribution, the thing desired to settle the points raised above is the net correlation coefficient, $r_{12.34}$.

By means of the equation already given (p 1773) these net coefficients have been determined with the following results:

1. Net correlation between influenza epidemicity index and death rate from pulmonary tuberculosis, for constant age distribution and geographical position, $r_{12.34} = +0.609 \pm 0.068$

2. Net correlation between influenza epidemicity index and death rate from organic diseases of the heart, for constant age distribution and geographical position, $r_{12.34} = +0.594 \pm 0.070$

3. Net correlation between influenza epidemicity index and death rate from acute nephritis and Bright's disease, for constant age distribution and geographical position, $r_{12.34} = +0.510 \pm 0.080$

From these results it is seen that, instead of the correlation between the explosiveness of epidemic mortality and death rate from the diseases mentioned being due to uncorrected age and locality factors, the *net* correlations after correction has been made for these factors, *are actually higher than were the gross, uncorrected correlations.* The net correlation of the pulmonary tuberculosis death rate with epidemicity index is the highest of the three. It has a value about 9 times its probable error. The chances are literally billions to 1 against this correlation being due to accident or chance. We may conclude that the most significant factor yet discovered in causing the observed wide variation amongst these 39 American cities in respect of the explosiveness of the outbreak of epidemic influenza mortality in the autumn of 1918 was the relative normal liability of the inhabitants of the several cities to die of one or another of the three great causes of death which primarily result from a functional breakdown of one of the three fundamental organ systems of the animal body, the lungs, the heart, and the kidneys.

VII. Summary.

In this first study the weekly mortality statistics of the influenza epidemic beginning in the autumn of 1918 have been analyzed in a preliminary way for some 39 large American cities. It has been shown in the first instance that there was an extraordinary degree of variation amongst the several cities in this group of cities in respect of the relative degree of explosiveness of the outbreak of epidemic mortality. The first problem confronting the student of the epidemic was the analysis of this variation, to find, if possible, primary factors concerned in its causation. Such an analysis, by the method of multiple correlation, appears to demonstrate that an important factor so far found in causing the observed wide variation amongst these 39 American cities in respect of the explosiveness of the outbreak of epidemic influenza mortality in the autumn of 1918 was the magnitude of the normal death rates observed in the same communities, particularly those death rates from pulmonary tuberculosis, diseases of the heart and of the kidneys.

OBSERVATIONS ON THE FOOD OF ANOPHELES LARVÆ.

By C. W. Metz, Ph. D., Special Investigator, United States Public Health Service.

Obviously, food is an important factor in determining the abundance and distribution of Anopheles larvæ, and for this reason it is a factor to be considered in connection with Anopheles eradication. The following results are from experiments and observations made in an attempt to ascertain the essential food requirements of Anopheles larvæ. At first it was intended that the analysis extend to the particular species of animals and plants contributing to the larval food, with a view toward evolving an indirect method of Anopheles control through diminution of the food supply; but it was soon evident that this would be very difficult to accomplish owing to the wide range of suitable food materials. The observations are, therefore, recorded mainly for the additional light they throw on anopheline characteristics. They deal primarily with the general types of food, the effects of chemical contamination, water pollution, active decomposition of food materials, and related subjects.

The experiments were conducted during the summer and autumn of 1918 in Alabama (near Montgomery) and in Florida (near Lakeland). They deal with the three common Atlantic coast species of Anopheles: *A. punctipennis* Say, *A. quadrimaculatus* Say, and *A. crucians* Wied., especially the latter two. Some of the observations herein recorded were noted briefly in a previous paper, "Anopheles Crucians: Habits of Larvæ and Adults" (Public Health Reports, vol. 33, pp. 2156–2169).

So far as the writer is aware relatively little has been published respecting the larval food of American Anopheles. Howard, Dyar, and Knab (1912, vol. 1, p. 230) observe concerning Anopheles larvæ in general:

"The larva feeds upon everything that floats. It is especially often found in stagnant water on which there is more or less of an algal scum; therefore, a very frequent food consists of algal spores, and the color of the larvæ is influenced more or less by the character of the food, green algæ making it green. Daniels, in his African investigations, found that the contents of the intestines of the larvæ are mainly vegetable matter, in some cases entirely so: 'Occasionally limbs of minute insects or crustaceans are found, as well as the scales of mosquitoes or other insects. On watching them feeding, it is seen that all minute particles are drawn to the mouth, but many of them are rejected. This rejection is somewhat arbitrary, as a particle at first rejected is often subsequently swallowed. Amongst the bodies seen to be swallowed I have seen living minute crustaceans and young larvæ, both of Anopheles and Culices, but, as a rule, living animal bodies either escape or are rejected.' Christophers and Stephens state that in their observations in Sierra Leone the food of the Anopheles larvæ seemed to be a unicellular organism. James and Liston state that the food of Anopheles larvæ consists chiefly of minute water animals which abound among algæ and other plants. They believe that the larvæ can not subsist upon a vegetable diet alone and that the duration of the larval stage depends chiefly upon the supply of animal food. When this is small in proportion to the number of larvæ, they state, the stronger larvæ kill and eat the weaker. The cause for the discrepancies in these observations undoubtedly lies, at least in part, in the fact that different species were under observation. Thus we have found that the tree-hole-inhabiting larvæ of our *Caelodiazesis barberi* are very largely predaceous and prey upon other *culicid* larvæ associated with them. The species inhabiting *bromeliads* (pineapple family of plants) have similar habits, as has been recorded for *Anopheles cruzii* by Peryassu."

Similarly in Volume IV of the same work (1917, p. 965) they note that "the larvæ of Anopheles generally occur in water containing algæ, upon which they feed; but James and Liston state that they can not subsist upon a vegetable diet alone, but feed upon minute water animals. Some of the species are, in part, at least, predaceous upon other mosquito larvæ." Thus no significant additions to the subject are recorded by Howard, Dyar, and Knab between 1912 and 1917. Miss Cora A. Smith (Psyche, 1914, Vol. XXI, pp. 1–19) notes certain observations on food made in connection with a study of the development of *Anopheles punctipennis*, and doubtless other similar observations have been recorded that have not come to the attention of the writer, but apparently no especial study of the subject has been made.

The observations of Miss Smith may be summarized as indicating that *punctipennis* larvæ feed on filaments of Spirogyra, Zygnema, and Mougeotia and on particles of Cladophora and Lemna and perhaps Polygonum. They were observed to brush off and devour Vorticellæ, diatoms, etc., that adhered to their own bodies and to ingest other small organisms that happened to be drawn into the mouth. Miss Smith also noted finding robust larvæ in a small pool, the bottom of which was covered with dead leaves, but in which the water was clear and without any visible algæ or other plants. This latter observation is of particular interest in connection with some of the experimental evidence given below, indicating that the larvæ may develop prolifically on dead, disintegrated plant tissue.

FIELD OBSERVATIONS.

General observations.—Certain characteristics of Anopheles, in regard to choice of breeding places, are well known, as, for instance, the usual preference for natural waters instead of artificial containers, the general aversion for sewage-polluted waters, and the usual avoidance of salt water (sea water). The various species differ somewhat in these respects, but the three under consideration show the above characteristics in a definite manner, although *crucians* exhibits less aversion for salt water than do the other two. Each of the three characteristics presents an interesting problem to the student of mosquitoes. The avoidance of artificial containers is probably due to at least two things—an unsuitable food supply, and insufficient aeration.

It is well known that Anopheles larvæ kept in small containers will usually die even in the presence of suitable food and under conditions that present no obstacles to the propagation of Culex and other mosquitoes. Artificial aeration will often remedy this difficulty, and hence it is assumed that a lack of oxygen or an excess of CO_2 is the responsible factor. In larger containers aeration is less important and absence of suitable food is probably more often the deciding factor, although it seems not unlikely, from results noted below, that an undue concentration of food with attendant excess of decomposition may be an important element in restricting the distribution in such receptacles as eaves and troughs that become filled with leaves, grass or rubbish. It would appear that the usual absence of Anopheles in artificial containers is due to the restricted range of adaptability of larvæ of this genus, coupled with the widely diverse conditions found in artificial containers. On this view the number of records of Anopheles breeding in artificial containers would be an index of the frequency with which conditions such as food and aeration happened to be suitable in these containers.

The absence of Anopheles in sewage-polluted waters appears to be merely an extreme example of the general avoidance of polluted waters by members of this genus (at least the three considered here). Other examples are to be found in natural waters in case these are confined (i. e., in pools or puddles) and are full of decomposing vegetable or animal matter. Barnyard or pasture puddles containing considerable amounts of manure also furnish illustrations of Anopheles' avoidance of polluted water.

The general aversion for salt water, or water otherwise impregnated with chemicals, would seem to be due to a physiological reaction, and furnishes another illustration of the limited range of adaptability of the species here considered. It is to be noted, however, that the individual species are by no means alike in this respect, *crucians*, especially, being able to adapt itself to a considerable range of alteration in chemical content of the water. This feature has been dealt with in greater detail by the writer in the paper previously referred to.

Special observations.—Detailed individual observations of Anopheles larvæ feeding on certain kinds of organisms have been made by numerous observers. In most cases these relate to the larvæ feeding on green algæ (filamentous or unicellular) and other water plants. Howard, Dyar, and Knab (loc. cit.), however, cite James and Liston as claiming that the food consists mainly of water animals and that a vegetable diet will not suffice. The latter authors even maintain that in the absence of sufficient animal food of this sort the larvæ kill and eat each other. Their statements are probably intended to apply only to the particular species of Anopheles with which they dealt and may, therefore, be justifiable, but it is practically certain that they do not apply to the three American species considered here. That *punctipennis, quadrimaculatus* and *crucians* will develop on a diet mainly, if not entirely, vegetable is made probable by the records of several observers (e. g., Smith, 1914, loc. cit.) corroborated by the writer, and has been demonstrated experimentally by the writer (vide infra). The field observations indicate that most, if not all, of the green algæ are suitable for food, the plants being ingested entire if small enough, and in the form of filaments or particles if large. The writer has observed *punctipennis* larvæ in puddles in which the water was green with a profusion of unicellular and colonial green algæ that formed the bulk of the larval food.

But it is also probable that an animal diet is equally suitable for Anopheles development. The writer has observed one case in which Anopheles larvæ (*quadrimaculatus* or *crucians* or both) flourished in water containing little, if any, available food other than green rotifers. This water was swarming with the rotifers, of which there were apparently two species of very different sizes. It was observed that the larvæ fed mainly on the smaller, darker form—presumably because the larger was too large to be swallowed. Examinations of the stomachs of some of these larvæ revealed nothing but the remains of the rotifers. A score or more of the larvæ were brought into the laboratory and kept in a pan of the water in which they were taken. These developed rapidly and hatched into vigorous adults. So far as could be determined, their food, both in the pond and after being taken into the laboratory, was almost exclusively green rotifers.

It would appear, then, that the natural food of the Anopheles larvæ includes a wide range of aquatic organisms, and that, so far as the species under consideration are concerned, the organisms may be either animals or plants.

In certain cases, however, prolific Anopheles breeding has been observed in waters containing very few living organisms of any kind small enough to furnish food. One case that may be of this sort is mentioned by Miss Smith (loc. cit.). Another was observed by the writer (loc. cit.). The latter case was that of a large swamp contaminated with chemicals. Centrifuged samples of water from this swamp gave a residue composed almost entirely of minute particles of disintegrated tissue. Since there were no fish and few other aquatic animals except mosquito larvæ in this water, and since there was an abundance of dead leaves, etc., covering the bottom of the swamp, it is practically certain that the disintegrated tissue was mainly plant tissue. If so, the diet of the larvæ was almost exclusively vegetable. In this instance only one species of Anopheles was involved—*A. crucians.*

EXPERIMENTS.

The field observations noted above suggested the following experiments designed to ascertain the suitability of certain food materials and to determine the effects of sterility as contrasted with active decomposition in the food.

Experiment 1. (Montgomery, Ala.)—On July 29, 1918, 13 very small, newly hatched Anopheles larvæ were taken from a ditch and put into a pan of boiled water from the same ditch. Each day thereafter until the experiment was completed the water in the pan was replaced with newly boiled water from the ditch. In this way a culture was secured that closely resembled the natural environment of the larvæ, except that it was sterile and afforded no living food. The larvæ in this culture flourished and grew rapidly. Four of them died, probably from injury, but the remaining nine pupated and all hatched within 16 days into vigorous adults of *A. punctipennis.*

In two control cultures of larvæ taken from the same place at the same time and kept under identical conditions, except that the water was not boiled, all but three of the larvæ died. These three pupated and hatched.

Experiment 2.—On August 13 a similar experiment was begun with small larvæ of *A. crucians* from a swamp. The larvæ were kept in freshly boiled water, which was changed daily. They likewise grew rapidly and pupated. The experiment had to be terminated on August 28, when only one adult had appeared; but it was evident that the food and environment in the culture were well suited to the needs of this species.

Experiment 3.—On August 12 several very small larvæ of *A. crucians* were put in a culture consisting of dead leaves, dried and ground, added to essentially sterile water from a deep well. This was likewise changed daily. Again the larvæ grew vigorously, began pupating on August 22, and continued to pupate until the culture was discarded on August 28.

Experiment 4 (Lakeland, Fla.).—On November 12 a mass of decaying vegetation (leaves, grass, etc.) was thoroughly boiled and samples were added to two pans of city tap water—from deep wells. In one pan (a) the concentration was approximately twice that in the other (b). Between 25 and 30 very small larvæ were added to (a) and half that number to (b). In both of these pans the larvæ grew rapidly and matured. The food was not renewed daily, as in the previous experiments, but was renewed once—on November 20. However, no protozoal or bacterial action was observed in the culture and microscopic examination of the stomach contents of a large larva from (a) on November 18 revealed only disintegrated plant tissue. The larvæ in these two cultures pupated and hatched approximately as follows:

CULTURE (a).

Pupated.		Hatched.			Pupated.		Hatched.		
Date.	Number.	Date.	Number.	Species.	Date.	Number.	Date.	Number.	Species.
Nov. 20	2	Nov. 24	2	Crucians.	Nov. 27	4	Nov. 29	5	Crucians.
21	2	25	4	Do.	28	2	Dec. 2	1	Do.
22	2	26	1	Do.	29	1	4	1	Do.
24	5	27	2	Do.	30	2	6	1	Do.
26	2	28	5	Do.					

CULTURE (b).

Pupated.		Hatched.			Pupated.		Hatched.		
Date.	Number.	Date.	Number.	Species.	Date.	Number.	Date.	Number.	Species.
Nov. 24	1	Nov. 26	1	Quadrimaculatus.	Dec. 3	2	Dec. 6	1	Crucians.
25	4	28	4	Crucians.		......	7	1	Do.
27	1	29	1	Do.					

It was observed during the course of this experiment that the larvæ in culture (a) grew more rapidly and appeared more vigorous than those in (b), presumably because of the greater concentration of food in (a).

Experiment 5.—This experiment differed from the preceding mainly in the substitution of one particular species of plant for the heterogeneous mixture used as food in Experiment 4. A mass of Spirogyra was taken from relatively clean water in a lake, washed thoroughly to remove all but traces of any animal matter that might be adhering, and then baked and ground. A portion of this was added to tap water in a pan and from 15 to 20 very small Anopheles larvæ were introduced on November 19. These grew vigorously, and pupated and hatched approximately as follows:

Pupated.		Hatched.			Pupated.		Hatched.		
Date.	Number.	Date.	Number.	Species.	Date.	Number.	Date.	Number.	Species.
Nov. 27	1	Dec. 2	4	Crucians.	Nov. 30	3	....	......	
28	3	3	3	Do.	Dec. 1	3	....	......	
29	4	5	5	Do.	2	2	....	......	

Experiment 6.—A similar experiment was performed at the same time, using the roots of a local "water hyacinth" (Eichornia) washed, baked, and ground. Again the larvæ grew vigorously to maturity. The culture was discarded before hatching was completed, but two pupæ were transferred to a hatching bottle and retained. They proved to be *quadrimaculatus.*

Experiment 7 (Montgomery, Ala.).—On August 8 several small larvæ were put into a culture of Spirogyra similar to that in Experiment 5, except that in this case the Spirogyra was dried, ground, and then boiled, and the larvæ were transferred daily to a freshly prepared medium, insuring a practically sterile culture at all times. The same rapid growth and general vigor were observed in this experiment. The larvæ pupated from August 14 to 22, and began hatching on August 16. Four specimens of *quadrimaculatus*, 2 of *punctipennis*, and 2 of *crucians* were obtained before the culture was discarded on August 24.

Experiment 8.—This experiment differed from the last in the substitution of uncooked Chara for cooked Spirogyra. Apparently Chara is less suitable as food for the larvæ, for they did not thrive, and only one specimen hatched—*A. quadrimaculatus*.

DISCUSSION.

It is evident from these experiments that the diet of Anopheles larvæ may be either heterogeneous or homogeneous—consisting of mixed animal and vegetable materials, of mixed vegetable materials, or of individual species of plants or animals. And, apparently, it makes little difference whether the food is composed of living organisms or their dead remains. No effort was made to ascertain how many types of animals and plants furnish suitable food materials, since the range is evidently great. Only one of the types tested gave indications of being unsuited. This was Chara, and even it provided adequate food for the development of some larvæ to maturity.[1]

Of greater interest, perhaps, is the evidence regarding the effect of pollution or decomposition on the larval development. In most of the above experiments the culture media in which the Anopheles larvæ developed were essentially sterile, i. e., there were practically no protozoa present, and there was a negligible amount of bacterial action. The cultures were kept in shallow, granite pans, 10 to 12 inches in diameter and 3 inches deep, and it was found that no artificial aeration was necessary. In other cases, when cultures containing relatively large amounts of decomposing vegetation were brought into the laboratory and kept without sterilization or aeration, the larvæ usually lost vigor and died in a few days.[2]

Thus the experimental evidence leaves little doubt as to the detrimental effects of pollution or decomposition. Whether the injurious effects of decomposition are due directly to bacterial or protozoal action on the larvæ themselves or indirectly to an excess of CO_2 or other gases resulting from the decomposition, is not certain. The

[1] It should be noted that Miss Smith (Psyche., Vol. XXI, p. 3) cites the feeding of *punctipennis* larvæ among the filaments of fruiting Chara.

[2] See Carter, Le Prince, and Griffitts, Public Health Bulletin No. 79, pp. 15, 22-23. These authors note the deleterious effects of decaying grass both in natural waters—i. e., pools—and in collecting pails containing larvæ.

latter seems more probable, however, since the detrimental effects may often be prevented by aeration.

Contrary to popular belief, then, it appears that the purer and more sterile the waters may be, so long as they contain sufficient food, the more suitable they are for Anopheles breeding. This would seem to account for the fact that rain-water puddles and seepage pools frequently permit much more prolific breeding than near-by, stagnant waters. It also serves to emphasize the danger of doing more harm than good by cleaning the refuse from such places as sloughs and stagnant puddles, unless adequate provision is made for subsequent drainage, oiling, fish control, or some other method of mosquito eradication.

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LOCATION OF DETENTION HOSPITALS.

COURT DECIDES THAT BOARD OF HEALTH CAN NOT LOCATE AND MAINTAIN A DETENTION HOSPITAL IN A THICKLY SETTLED RESIDENTIAL SECTION.

A board of health can not establish and maintain a detention hospital for the treatment of communicable diseases in a thickly settled residential district. This is the decision in a case[1] decided by the Supreme Court of Michigan.

Suit was brought to restrain the maintenance of a detention hospital in a residential district by the board of health of the city of Lansing. The city charter provided as follows:

> The said board of health shall have power, and it shall be its duty, to take such measures as shall be deemed effectual to prevent the entrance of pestilential disease into the city, * * * to establish, maintain, and regulate a pesthouse or hospital at some place within the city or not exceeding 3 miles beyond its bounds.

The court in granting the injunction said:

> We conclude that the provisions of the charter under consideration do not vest in the defendant board of health the power to locate a pesthouse in a thickly settled residential district, where, by reason of its location, it would be a nuisance, and where its permanent maintenance would work continuing damage to adjoining and near-by property and would result in the destruction of the home in its comfort and well-being; and that the discretion lodged in the board is a discretion to be exercised by it in determining between different lawful locations.

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[1] Birchard et al. v. Board of Health of City of Lansing et al., 169 N. W., 901.

DEATHS DURING WEEK ENDED JULY 26, 1919, IN CITIES.

From the "Weekly Health Index," July 29, 1919, issued by the Bureau of the Census, Department of Commerce.

Deaths from all causes in certain large cities of the United States during the week ended July 26, 1919, infant mortality (per cent), annual death rates, and comparison with corresponding week of preceding years.

City.	Population July 1, 1918, estimated.	Week ended July 26, 1919.		Average annual death rate per 1,000.[2]		Per cent of deaths under 1 year.		
		Total deaths.	Death rate.[1]			Week ended July 26, 1919.	Previous year or years.[2]	
Albany, N. Y.	112,565	21	9.7	C.	21.3	14.3	C.	8.7
Atlanta, Ga.	201,732	39	10.1	C.	15.8	5.1	C.	13.1
Baltimore, Md.	[3] 609,981	200	15.6	A.	18.3	27.5	A.	28.7
Boston, Mass.	785,245	155	10.3	A.	13.4	12.9	A.	17.4
Buffalo, N. Y.	473,229	122	13.4	C.	16.3	26.2	C	27.7
Cambridge, Mass.	111,432	20	9.4	A.	11.8	15.0	A.	18.7
Chicago, Ill.	2,596,681	501	10.1	A.	12.5	19.0	A.	21.3
Cincinnati, Ohio	418,022	91	11.4	C.	14.3	13.2	C.	13.0
Cleveland, Ohio	810,306	148	9.5	C.	11.6	16.2	C.	23.2
Columbus, Ohio	225,296	49	11.3	C.	12.0	6.1	C.	13.5
Dayton, Ohio	130,655	26	10.4	C.	14.0	7.7	C.	5.7
Denver, Colo.	....	68	....	....		10.3	....	
Fall River, Mass.	128,392	30	12.2	C.	23.1	16.7	C.	52.6
Grand Rapids, Mich.	135,450	23	8.9	C.	10.0	17.4	C.	11.5
Indianapolis, Ind.	290,389	72	12.9	C.	15.1	16.7	C.	15.5
Jersey City, N. J.	318,770	60	9.8	C.	10.6	15.0	C.	27.7
Kansas City, Mo.	313,785	64	10.6	C.	15.0	14.1	C.	11.1
Los Angeles, Calif.	568,495	127	11.6	A.	10.8	13.4	A.	11.6
Louisville, Ky.	242,707	66	14.2	C.	14.4	15.2	C.	11.9
Lowell, Mass.	109,081	18	8.6	A.	16.3	27.8	A.	35.5
Memphis, Tenn.	154,759	66	22.2	C.	19.5	19.7	C.	10.3
Milwaukee, Wis.	453,481	95	10.9	A.	10.1	28.4	A.	18.2
Minneapolis, Minn.	383,442	75	10.2	C.	9.4	10.7	C.	18.8
Nashville, Tenn.	119,215	39	17.1	C.	19.2	15.4	C.	18.2
Newark, N. J.	428,684	90	10.9	C.	13.9	31.1	C.	28.1
New Haven, Conn.	154,865	19	6.4	C.	14.1	21.1	C.	23.8
New Orleans, La.	382,273	112	15.3	A.	16.7	10.7	A.	12.1
New York, N. Y.	5,215,879	1,021	10.2	C.	12.6	19.0	C.	17.0
Oakland, Calif.	214,206	37	9.0	A.	10.2	10.8	A.	9.7
Omaha, Nebr.	180,264	22	6.4	C.	12.7	9.1	C.	20.5
Philadelphia, Pa.	1,761,371	353	10.5	[4]	14.0	22.4	[4]	24.1
Pittsburgh, Pa.	593,303	157	13.8	C.	14.5	20.4	C.	26.1
Portland, Oreg.	....	44	....	....		9.1	C.	11.1
Providence, R. I.	263,613	41	8.1	C.	17.0	12.2	C.	19.8
Richmond, Va.	160,719	47	15.2	C.	24.3	10.6	C.	16.0
Rochester, N. Y.	264,856	63	12.4	C.	12.6	15.9	C.	14.1
St. Louis, Mo.	779,951	166	11.1	C.	13.3	10.2	C.	17.6
St. Paul, Minn.	257,699	41	8.3	C.	7.9	14.6	C.	7.7
San Francisco, Calif.	478,530	141	15.4	C.	11.8	12.1	C.	6.5
Spokane, Wash.	....	12	....	....		16.7	C.	0.0
Syracuse, N. Y.	161,404	25	8.1	C.	18.4	16.0	C.	19.3
Toledo, Ohio	262,234	56	11.1	A.	12.4	12.5	A.	14.8
Washington, D. C.	401,681	108	13.4	A.	15.5	19.4	A.	17.9
Worcester, Mass.	173,650	41	12.3	C.	12.6	24.4	C.	16.7

[1] Annual rates per 1,000 estimated population.
[2] "A" indicates data for the corresponding week of the years 1913 to 1917, inclusive. "C" indicates data for the corresponding week of the year 1918.
[3] Population estimated as of July 1, 1919.
[4] Data are based on statistics of 1915, 1916, and 1917.

Summary of information received by telegraph from industrial insurance companies for week ended July 26, 1919.

Policies in force	40,730,709
Number of death claims	6,803
Death claims per 1,000 policies in force, annual rate	8.7

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 STATE SUMMARIES.

Telegraphic Reports for Week Ended August 2, 1919.

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

ALABAMA.

	Cases.
Diphtheria	2
Influenza	1
Malaria	34
Poliomyelitis	3
Scarlet fever	5
Smallpox	2
Tuberculosis (pulmonary)	6
Typhoid fever	26
Venereal diseases	21
Whooping cough	3

ARKANSAS.

	Cases.
Cerebrospinal meningitis	2
Chicken pox	5
Diphtheria	4
Dysentery	1
Influenza	3
Malaria	159
Measles	6
Pellagra	15
Scarlet fever	10
Smallpox	4
Tuberculosis	19
Typhoid fever	32
Whooping cough	9

CALIFORNIA.

	Cases.
Cerebrospinal meningitis:	
San Quentin	1
San Francisco	3
Influenza	5
Smallpox:	
Orange City	1
Ventura City	4
Ventura County	4
Humboldt County	3
Fresno County	3
Stockton	2
Oakland	3
Monterey County	9

CALIFORNIA—Continued.

Smallpox—Continued.	Cases.
San Francisco	9
Santa Clara County	2
Gilroy	1
San Jose	3
Santa Cruz City	3
Typhoid fever:	
Sierra Madre	2
Ventura County	4
Santa Paula	4
San Francisco	2
Riverside City	1
Amador County	1
Oakland	1
Gilroy	1

CONNECTICUT.

	Cases.
Tetanus:	
Ridgefield	1

DELAWARE.

	Cases.
Chancroid	3
Chicken pox	2
Cholera infantum	1
Gonorrhea	31
Malaria:	
New Castle	1
Measles	2
Syphilis	1
Tuberculosis:	
Wilmington	3
Cheswold	1
Laurel	1
Bridgeville	1
Delmar	1
Typhoid fever:	
Dover	1
New Castle	1
Seaford	1
Whooping cough	1

CURRENT STATE SUMMARIES—Continued.

Telegraphic Reports for Week Ended August 2, 1919—Continued.

FLORIDA.

	Cases.
Diphtheria	6
Malaria:	
Citrus County	4
Clay County	8
Duval County	10
Escambia County	3
Gadsden County	2
Lafayette County	1
Levy County	7
Marion County	15
Polk County	11
Suwannee County	2
Walton County	3
Scattering	71
Typhoid fever	12

GEORGIA.

Actinomycosis	2
Acute infectious conjuntivitis	8
Chicken pox	8
Diphtheria	11
Dysentery (amebic)	7
Dysentery (bacillary)	3
Gonorrhea	74
Hookworm	11
Influenza	3
Malaria	63
Measles	3
Mumps	4
Pneumonia (acute lobar)	5
Scarlet fever	5
Septic sore throat	1
Smallpox	7
Syphilis	159
Tuberculosis (pulmonary)	17
Typhoid fever	61
Whooping cough	12

ILLINOIS.

Cerebrospinal meningitis:	
Chicago	7
Diphtheria:	
Chicago	61
Peru	2
Streator	5
Pontiac	2
Decatur	6
Kane County—Batavia Township	3
Scattering	11
Gonorrhea	123
Poliomyelitis:	
Chicago	8
Ladd	2
Princeton	1
Champaign	1
Champaign County—Colfax Township	1
Evanston	1
Cumberland County—Spring Point Township	1
Jo Daviess County—Rush Township	1
Peru	2
Edwardsville	1
Piatt County—Sangamon Township	1

ILLINOIS—continued.

	Cases.
Poliomyelitis—Continued.	
Sigel	1
Monmouth	1
Scarlet fever:	
Chicago	20
Peoria	2
Marion County—Iuka Township	2
Scattering	12
Smallpox:	
White Hall	3
Scattering	1
Syphilis	58
Typhoid fever:	
Chicago	8
Elgin	2
North Chicago	2
Monmouth	2
Scattering	35

INDIANA.

Chancroid	1
Diphtheria:	
Epidemic in Wayne County.	
Lawrence County	1
Hendricks County	1
Grant County	3
Tipton County	1
Marshall County	2
Parke County	1
Lake County	2
Gonorrhea	115
Scarlet fever:	
Prevalent in—	
Randolph County.	
Wabash County.	
Smallpox:	
Prevalent in—	
Hamilton County.	
Whitley County.	
Vermilion County.	
Syphilis	[illegible]
Typhoid fever:	
Lawrence County	1
Monroe County	1
Spencer County	1
Shelby County	4
Greene County	1

IOWA.

Cerebrospinal meningitis:	
Westphalia	1
Chancroid	3
Diphtheria:	
Cedar Rapids	4
Council Bluffs	2
Davenport	1
Des Moines	1
Dubuque	2
Fort Dodge	2
Lawler	1
Ottumwa	3
Polk County	1

CURRENT STATE SUMMARIES—Continued.

Telegraphic Reports for Week Ended August 2, 1919—Continued.

IOWA—continued.

	Cases.
Gonorrhea	67
Scarlet fever:	
Council Bluffs	2
Des Moines	1
Lawler	1
Jones County	1
Linn County	1
Polk County	1
Smallpox:	
Council Bluffs	1
Davenport	3
Ottumwa	3
Marshall County	1
Syphilis	20

KANSAS.

Cerebrospinal meningitis:	
Valley Falls	1
Diphtheria	12
Influenza	2
Scarlet fever	6
Smallpox	13

LOUISIANA.

Cerebrospinal meningitis	1
Chancroid	16
Diphtheria	14
Gonorrhea	135
Leprosy	2
Lethargic encephalitis	1
Pellagra	9
Smallpox	16
Syphilis	78
Typhoid fever	18

MAINE.

Chancroid	2
Chicken pox:	
Portland	4
Lewiston	1
South Portland	1
Sanford	1
Diphtheria:	
Biddeford	1
Fort Fairfield	1
Gonorrhea	25
Measles:	
South Portland	1
Mumps:	
Sanford	1
Pellagra:	
Bar Harbor	1
Pneumonia:	
Sanford	2
Scarlet fever:	
Portland	5
Smallpox:	
Lewiston	1
Long Pond	1
Bath	1
Wilton	1
Syphilis	21

MAINE—continued.

	Cases.
Tuberculosis	23
Typhoid fever:	
Portland	4
Sanford	2
Milo	1
South Portland	1
Fort Fairfield	1
Harrison	1
Whooping cough:	
Stonington	4

MINNESOTA.

Cerebrospinal meningitis	3
Chancroid	5
Gonorrhea	85
Poliomyelitis	11
Smallpox:	
Kanabec County—	
Arthur Township	1
Grasslake Township	1
Murray County—	
Lake Sarah Township	1
Otter Tail County—	
Parkers Prairie Village	1
Washington County—	
South Stillwater	1
Syphilis	54

MONTANA.

Cerebrospinal meningitis:	
Great Falls	1
Diphtheria	3
Scarlet fever	16
Smallpox	10
Typhoid fever	8

NEW JERSEY.

Influenza	7
Pneumonia	30

NEW YORK.

(Exclusive of New York City.)

Cerebrospinal meningitis:	
Penn Yan	1
Diphtheria	130
Gonorrhea (voluntary reports)	30
Measles	21
Poliomyelitis	1
Pneumonia	7
Scarlet fever	59
Smallpox:	
Buffalo	3
Worcester	1
Interlaken	1
Syphilis (voluntary reports)	127
Typhoid fever	33
Whooping cough	166

NORTH CAROLINA.

Cerebrospinal meningitis	1
Chicken pox	3
Cholera infantum	2

CURRENT STATE SUMMARIES—Continued.

Telegraphic Reports for Week Ended August 2, 1919—Continued.

NORTH CAROLINA—continued.

	Cases.
Diphtheria	22
Dysentery (bacillary)	2
Measles	27
Poliomyelitis	1
Pneumonia (broncho)	2
Pneumonia (lobar)	2
Scarlet fever	11
Septic sore throat	3
Smallpox	31
Typhoid fever	140
Whooping cough	87

OHIO.

	Cases.
Diphtheria:	
Columbus	7
Smallpox:	
Youngstown	10
Typhoid fever	
Columbus	7

VERMONT.

No outbreak or unusual prevalence.

VIRGINIA.

	Cases.
Smallpox:	
Wise County	1

WASHINGTON.

	Cases.
Chicken pox	35
Diphtheria	14
Gonorrhea	15
Leprosy:	
Olympia	1
Measles	5
Mumps	18
Pneumonia	3
Scarlet fever	30
Smallpox	33
Syphilis	1
Tuberculosis (pulmonary)	4
Typhoid fever	8
Whooping cough	40

WEST VIRGINIA.

	Cases.
Diphtheria:	
Charleston	2
Montgomery	1
Weston	2
Measles:	
Morgantown	2

WEST VIRGINIA—continued.

	Cases.
Poliomyelitis:	
Charleston	2
Scarlet fever:	
Clarksburg	1
Hinton	2
Smallpox:	
Hinton	3
Morgantown	3
Typhoid fever:	
Beckley	1
Charleston	1
Hinton	12
Martinsburg	2
Princeton	1
Weston	1

WISCONSIN.

	Cases.
Chicken pox:	
Milwaukee	4
State	6
Diphtheria:	
Milwaukee	9
State	18
Encephalitis lethargica	1
Gonorrhea	110
Measles:	
Milwaukee	6
State	9
Ophthalmia neonatorum	3
Poliomyelitis:	
Milwaukee	13
State	15
Scarlet fever:	
Milwaukee	8
State	22
Smallpox:	
Milwaukee	4
State	10
Syphilis	9
Tuberculosis:	
Milwaukee	20
State	22
Typhoid fever:	
Milwaukee	1
State	1
Whooping cough:	
Milwaukee	85
State	37

SUMMARY OF CASES REPORTED MONTHLY BY STATES.

Tables showing by counties the reported cases of cerebrospinal meningitis, malaria, pellagra, poliomyelitis, smallpox, and typhoid fever are published under the names of these diseases. (See names of these and other diseases in the table of contents.)

The following monthly State reports include only those which were received during the current week. These reports appear each week as received.

State.	Cerebrospinal meningitis.	Diphtheria.	Malaria.	Measles.	Pellagra.	Poliomyelitis.	Scarlet fever.	Smallpox.	Typhoid fever.
Colorado:									
January, 1919		40		10			76	110	6
February, 1919		17		2			109	47	4
March, 1919		38		2			165	128	5
April, 1919		36		27			118	170	1
May, 1919	1	32		16			88	121	6
June, 1919		43		16			97	135	5
Iowa—June, 1919	2	46					60	160	
Kansas—June, 1919	2	54	1	70	1	2	97	343	48
Mississippi—June, 1919	2	37	9,955	241	888	2	39	238	377
Oregon—June, 1919		24		25			72	318	5
South Dakota—June, 1919	2	38	1	25			51	66	3
Vermont—June, 1919		12		93		1	20		13

ANTHRAX.

Wilmington, Del., Week Ended July 19, 1919.

During the week ended July 19, 1919, one case of anthrax was reported at Wilmington, Del.

CEREBROSPINAL MENINGITIS.

Monthly State Reports, 1919.

Place.	New cases reported.	Place.	New cases reported.
Colorado (May):		Mississippi (June):	
Weld County	1	Chickasaw County	1
Iowa (June):		Tallahatchie County	1
Cerro Gordo County	2	Total	2
Kansas (June):		South Dakota (June):	
Cheyenne County—St. Francis	1	Day County	2
Wyandotte County—Kansas City	1		
Total	2		

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Baltimore, Md	2	2	Los Angeles, Calif	1	
Birmingham, Ala	1	2	Milwaukee, Wis	2	2
Boston, Mass	1		Nashville, Tenn	1	1
Chicago, Ill	2		New York, N. Y	9	5
Danville, Ill		1	Pittsburgh, Pa	1	
Detroit, Mich	1		Portland, Oreg		1
Fall River, Mass	1	1	St. Louis, Mo	2	1
Fort Wayne, Ind		1	Trenton, N. J	1	1
Jersey City, N. J	1	1	West Hoboken, N. J		1
Kalamazoo, Mich	1	1	Wheeling, W. Va		1

DIPHTHERIA.

See Telegraphic weekly reports from States, p. 1793; Monthly summaries by States, p. 1797; and Weekly reports from cities, p. 1808.

LEPROSY.

Philadelphia, Pa., Week Ended July 19, 1919.

During the week ended July 19, 1919, one case of leprosy was reported at Philadelphia, Pa.

MALARIA.

State Reports for June, 1919.

Place.	New cases reported.	Place.	New cases reported.
Kansas:		Mississippi—Continued.	
Marshall County—		Leflore County	320
Independence	1	Lincoln County	88
		Lowndes County	110
Mississippi:		Madison County	59
Adams County	34	Marion County	136
Alcorn County	83	Marshall County	73
Amite County	180	Monroe County	140
Attala County	51	Montgomery County	60
Benton County	30	Neshoba County	60
Bolivar County	1,037	Newton County	59
Calhoun County	79	Noxubee County	83
Carroll County	78	Oktibbeha County	80
Chickasaw County	78	Panola County	193
Choctaw County	24	Pearl River County	66
Claiborne County	42	Perry County	27
Clarke County	63	Pike County	118
Clay County	88	Pontotoc County	174
Coahoma County	529	Prentiss County	88
Copiah County	86	Rankin County	99
Covington County	112	Scott County	64
DeSoto County	103	Sharkey County	105
Forrest County	130	Simpson County	128
Franklin County	65	Smith County	64
George County	36	Stone County	37
Greene County	56	Sunflower County	634
Grenada County	24	Tallahatchie County	252
Hancock County	64	Tate County	164
Harrison County	72	Tippah County	91
Hinds County	310	Tishomingo County	47
Holmes County	360	Union County	90
Humphreys County	243	Walthall County	30
Issaquena County	61	Warren County	197
Itawamba County	34	Washington County	182
Jackson County	47	Wayne County	51
Jasper County	62	Webster County	66
Jefferson County	94	Wilkinson County	81
Jefferson Davis County	41	Winston County	146
Kemper County	34	Yalobusha County	100
Lafayette County	79	Yazoo County	319
Lamar County	84		
Lauderdale County	87	Total	9,955
Lawrence County	128		
Leake County	30	South Dakota:	
Lee County	238	Clark County	1

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Baton Rouge, La	1		New Orleans, La		1
Birmingham, Ala	2		New York, N. Y		1
Charleston, S. C		2	Oak Park, Ill	2	
Dallas, Tex	1		Pasadena, Calif	1	
East St. Louis, Ill	3		Piqua, Ohio	1	
Elgin, Ill	1		Pontiac, Mich	1	
Kansas City, Mo		1	Quincy, Ill		1
Little Rock, Ark	4		Rocky Mount, N. C		1
Long Beach, Calif	1		Rome, Ga	1	
Los Angeles, Calif	3		Savannah, Ga	5	1
Louisville, Ky	2		Spartanburg, S. C	1	
Memphis, Tenn	9	1	Tuscaloosa, Ala	4	

MEASLES.

See Telegraphic weekly reports from States, p. 1793; Monthly summaries by States, p. 1797; and Weekly reports from cities, p. 1808.

PELLAGRA.

State Reports for June, 1919.

Place.	New cases reported.	Place.	New cases reported.
Kansas:		Mississippi—Continued.	
Sedgwick County—		Lincoln County	17
Wichita	1	Lowndes County	7
		Madison County	15
Mississippi:		Marion County	8
Amite County	7	Marshall County	10
Attala County	2	Monroe County	14
Benton County	3	Montgomery County	4
Bolivar County	223	Neshoba County	3
Calhoun County	2	Newton County	1
Carroll County	2	Noxubee County	6
Chickasaw County	14	Oktibbeha County	3
Claiborne County	1	Panola County	4
Clarke County	6	Pearl River County	5
Clay County	10	Pike County	7
Coahoma County	71	Pontotoc County	5
Copiah County	10	Prentiss County	5
Covington County	3	Rankin County	3
De Soto County	12	Scott County	2
Forrest County	7	Sharkey County	9
George County	3	Simpson County	5
Greene County	1	Smith County	4
Hancock County	1	Sunflower County	111
Harrison County	3	Tallahatchie County	35
Hinds County	19	Tate County	2
Holmes County	17	Tippah County	8
Humphreys County	19	Tishomingo County	7
Issaquena County	1	Union County	9
Itawamba County	2	Walthall County	15
Jasper County	14	Warren County	4
Jefferson County	2	Washington County	19
Jefferson Davis County	1	Webster County	4
Kemper County	2	Winston County	2
Lauderdale County	7	Yalobusha County	1
Lawrence County	15	Yazoo County	30
Leake County	4		
Lee County	14	Total	888
Leflore County	6		

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Atlanta, Ga		1	Memphis, Tenn	2	1
Birmingham, Ala		2	New Orleans, La	1	3
Brunswick, Ga		1	Tuscaloosa, Ala	2	
Dallas, Tex		2	Winston-Salem, N. C	3	2
Houston, Tex	1				

PLAGUE-INFECTED GROUND SQUIRRELS.

Alameda and Contra Costa Counties, Calif.

During the period July 7–17, 1919, there were reported three plague-infected ground squirrels in Alameda County and one in Contra Costa County, Calif. In each case diagnosis was based upon animal inoculation and cultures. Intensive hunting and poisoning operations are being carried on.

PNEUMONIA.

City Reports for Week Ended July 19, 1919.

Place.	Lobar.		All forms.		Place.	Lobar.		All forms.	
	Cases.	Deaths.	Cases.	Deaths.		Cases.	Deaths.	Cases.	Deaths.
Atlanta, Ga		3			Lowell, Mass		1		
Atlantic City, N. J	1	1			Macon, Ga		3		
Baltimore, Md	6	3			Malden, Mass				1
Battle Creek, Mich	1				Manitowoc, Wis	1	1		
Bedford, Ind	1				Mankato, Minn				1
Belleville, N. J	2				Memphis, Tenn		3		
Birmingham, Ala		5			Newark, N. J	8	1		
Boston, Mass	14	4			New Bedford, Mass	1			
Brockton, Mass	1				New Haven, Conn				1
Brookline, Mass	1				New Orleans, La	1	6		
Cambridge, Mass	1				New York, N. Y			14	53
Charleston, W. Va	1				Oakland, Calif		6	1	9
Chicago, Ill			58	16	Oak Park, Ill	1			
Cleveland, Ohio	1	1			Oklahoma City, Okla				1
Colorado Springs, Colo		1			Omaha, Nebr				2
Cumberland, Md	1				Pasadena, Calif			1	
Dallas, Tex		1			Passaic, N. J	1			
Dayton, Ohio	1	1			Paterson, N. J	2	2		
Denver, Colo		2		3	Peoria, Ill		1		
Detroit, Mich	2	6	6	9	Philadelphia, Pa	22	9		
Duluth, Minn		1			Pittsfield, Mass		1		
El Paso, Tex		2			Plainfield, N. J		1		
Fall River, Mass	1				Portland, Oreg				4
Findlay, Ohio	1	1			Portsmouth, Va		3		
Fitchburg, Mass		1			Quincy, Ill		1		
Flint, Mich	1	1			Racine, Wis		1		
Fort Worth, Tex	1	1			Rochester, N. Y	6	1		
Freeport, Ill	1				Rome, N. Y	1			
Fremont, Ohio		1			San Francisco, Calif	4	4		
Grand Rapids, Mich	2	2			Somerville, Mass	1			
Greenwich, Conn	1	1			Taunton, Mass		1		
Hartford, Conn		1			•Topeka, Kans	1	1		
Haverhill, Mass	2				Troy, N. Y		1		
Independence, Mo			1	1	Washington, D. C		2		
Indianapolis, Ind				2	West Orange, N. J	1			
Jersey City, N. J		4			White Plains, N. Y		2		
Kansas City, Mo			1	6	Wilmington, Del		1		
Lackawanna, N. Y		2			Wilmington, N. C		1		
Lincoln, Nebr		1			Worcester, Mass	1	1		
Los Angeles, Calif	4	2		5	Yonkers, N. Y		1		
Louisville, Ky	1	3							

POLIOMYELITIS (INFANTILE PARALYSIS).

State Reports for June, 1919.

Place.	New cases reported.	Place.	New cases reported.
Kansas:		Mississippi:	
Seward County—		Montgomery County	1
Liberal	1	Simpson County	1
Shawnee County—		Total	2
Topeka	1	Vermont:	
Total	2	Grand Isle County	1

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Baltimore, Md	1		Kansas City, Mo	1	
Chicago, Ill	6		Marinette, Wis		1
Flint, Mich	1		Milwaukee, Wis	8	
Galesburg, Ill	1		Philadelphia, Pa	1	
Iowa City, Iowa	1		Pontiac, Mich	1	1

RABIES IN ANIMALS.

Niagara Falls, N. Y., and Winston-Salem, N. C.

During the week ended July 19, 1919, there were reported one case of rabies in animals at Niagara Falls, N. Y., and one at Winston-Salem, N. C.

SCARLET FEVER.

See Telegraphic weekly reports from States, p. 1793; Monthly summaries by States, p. 1797; and Weekly reports from cities, p. 1808.

SMALLPOX.

Monthly State Reports, 1919—Vaccination Histories.

Place.	New cases reported.	Deaths.	Vaccination history of cases. Number vaccinated within 7 years preceding attack.	Number last vaccinated more than 7 years preceding attack.	Number never successfully vaccinated.	Vaccination history not obtained or uncertain.
Colorado (January):						
Denver County—						
Denver	59			6	46	7
Eagle County	5				5	
El Paso County	5			1	3	1
Grand County	6				4	2
Larimer County	8				4	4
Otero County	6				6	
Phillips County	1				1	
Pueblo County	3					3
Routt County	4				4	
Sedgwick County	3				3	
Weld County	10					10
Total	110			7	76	27
Colorado (February):						
Adams County	1				1	
Bent County	1				1	
Denver County—						
Denver	18			4	14	
Larimer County	8				5	3
Otero County	2				1	1
Prowers County	2				2	
Pueblo County	14					14
San Miguel County	1					1
Total	47			4	24	19
Colorado (March):						
Denver County—						
Denver	46			3	42	1
Huerfano County	1				1	
Jefferson County	7				7	
Larimer County	38				25	13
Moffat County	9				9	
Montrose County	3				3	
Phillips County	1				1	
Prowers County	1					1
Pueblo County—						
Pueblo	5				2	3
Routt County	2				1	1
Weld County	15			1	2	12
Total	128			4	93	31
Colorado (April):						
Alamosa County	1				1	
Arapahoe County	1					1
Boulder County	6			1	5	
Conejos County	1				1	
Delta County	2				2	

SMALLPOX—Continued.

Monthly State Reports, 1919—Vaccination Histories—Continued.

Place.	New cases reported.	Deaths.	Vaccination history of cases. Number vaccinated within 7 years preceding attack.	Number last vaccinated more than 7 years preceding attack.	Number never successfully vaccinated.	Vaccination history not obtained or uncertain.
Colorado (April)—Continued.						
Denver County—						
Denver	48			3	41	4
El Paso County	1				1	
Huerfano County	1				1	
Larimer County	49			1	36	12
Mesa County	2					2
Moffat County	12			2	8	2
Otero County	10				10	
Phillips County	6			4	2	
Pueblo County—						
Pueblo	2					
Weld County	28				8	20
Total	170			11	116	43
Colorado (May):						
Arapahoe County	4					4
Archuleta County	1			1		
Boulder County	23			2	19	2
Chaffee County	1				1	
Denver County—						
Denver	48			1	44	3
El Paso County	5				5	
Kit Carson County	1			1		
Larimer County	1				1	
Moffat County	8				7	1
Montrose County	1				1	
Otero County	4				4	
Phillips County	2				2	
Pueblo County—						
Pueblo	2					2
Weld County	20			3	17	
Total	121			8	101	12
Colorado (June):						
Alamosa County	4				3	1
Archuleta County	2			2		
Boulder County	27			1	24	2
Chaffee County	4					4
Denver County—						
Denver	40			13	27	
El Paso County	3				3	
Garfield County	5				4	1
Jefferson County	1					1
Kit Carson County	2				2	
Larimer County	5			1	4	
Las Animas County	3				3	
Mesa County	3					3
Moffat County	17			1	14	2
Morgan County	1				1	
Otero County	2				2	
Pueblo County—						
Pueblo	5					5
Weld County	11			1	6	4
Total	135			19	93	23
Kansas (June):						
Anderson County—						
Greeley	4			1		3
Atchison County—						
Atchison	19				4	15
Barber County—						
Kiowa	5				4	1
Sun City	1					1
Butler County—						
Elbing	4				4	
Potwin	3					3
Derby	2					2
Eldorado	8				4	4

SMALLPOX—Continued.

Monthly State Reports, 1919—Vaccination Histories—Continued.

Place.	New cases reported.	Deaths.	Vaccination history of cases. Number vaccinated within 7 years preceding attack.	Number last vaccinated more than 7 years preceding attack.	Number never successfully vaccinated.	Vaccination history not obtained or uncertain.
Kansas (June)—Continued.						
Cherokee County—						
Columbus	1				1	
Cowley County—						
Wilmot	1					1
Arkansas City	3				2	1
Crawford County—						
Girard	6					6
Walnut	10				2	8
Brazelton	3					3
Pittsburg (1 R. D.)	6				2	4
Croweburg	1				1	
Edson (R. D.)	1				1	
Doniphan County—						
Sparks	3				2	1
Troy	3				3	
Douglas County—						
Lawrence (R. D.)	1				1	
Edwards County—						
Lewis	3				1	2
Ford County—						
Bucklin	2					2
Kingsdown (R. D.)	1					1
Harvey County—						
Newton	14				6	8
Jackson County—						
Holton	1					1
Jefferson County—						
Nortonville	11				10	1
Labette County—						
Chetopa	1				1	
Parsons	9		1	1		7
Leavenworth County—						
Leavenworth (R. D. 1)	6		2	1	2	1
Lansing	2					2
Marion County—						
Lost Springs	1					1
Marion	1					1
Peabody	1				1	
Marshall County—						
Marysville	4				3	1
Vliets	1					1
Meade County—						
Meade	6				6	
Montgomery County—						
Caney	9					9
Independence	2				2	
Neosho County—						
West Mulberry	2			1		1
Erie	1			1		
Chanute (2 R. D.)	13			1	2	10
Kimbal	1					1
Norton County—						
Norton	1					1
Osborne County—						
Alton	1					1
Pratt County—						
Preston	1			1		
Pratt	1				1	
Rawlins County—						
Atwood	1					1
Reno County—						
Hutchinson	4				3	1
Republic County—						
Courtland	1				1	
Riley County—						
Ogden (R. D.)	1					1
Manhattan	1					1
Saline County—						
Salina	4			1	1	2
Sedgwick County—						
Wichita	110		1			109

SMALLPOX—Continued.

Monthly State Reports, 1919—Vaccination Histories—Continued.

Place.	New cases reported.	Deaths.	Vaccination history of cases.			
			Number vaccinated within 7 years preceding attack.	Number last vaccinated more than 7 years preceding attack.	Number never successfully vaccinated.	Vaccination history not obtained or uncertain.
Kansas (June)—Continued.						
Shawnee County—						
Topeka	12		2		4	6
Sherman County—						
Goodland	3				1	2
Smith County—						
Kensington	3			1	1	1
Stafford County—						
St. John	1				1	
Stevens County—						
Hugoton	5				2	3
Sumner County—						
Conway Springs	1					1
Oxford	1					1
Thomas County—						
Levant	1			1		
Wichita County—						
Leoti	5				4	1
Wyandotte County—						
Bonner Springs	1				1	
Kansas City	7			1	4	2
Total	343		6	11	89	237

State Reports for June, 1919.

Place.	Cases.	Deaths.
Iowa:		
Blackhawk County	5	
Boone County	17	
Buchanan County	1	
Buena Vista County	1	
Calhoun County	3	
Carroll County	1	
Cedar County	1	
Cerro Gordo County	3	
Decatur County	16	1
Dubuque County	1	
Henry County	2	
Jasper County	1	
Keokuk County	1	
Linn County	35	1
Mahaska County	1	
Marshall County	3	
Mitchell County	1	
Monona County	1	
O'Brien County	3	
Polk County	13	
Pottawattamie County	1	
Scott County	40	
Shelby County	1	
Wapello County	1	
Webster County	7	
Total	160	2
Mississippi:		
Alcorn County	6	
Amite County	2	
Attala County	26	
Bolivar County	45	
Calhoun County	1	
Carroll County	10	
Chickasaw County	10	
Clay County	3	
Coahoma County	9	
Mississippi—Continued.		
De Soto County	6	
Hinds County	12	
Holmes County	14	
Humphreys County	4	
Kemper County	2	
Lafayette County	1	
Lawrence County	15	
Leflore County	3	
Madison County	2	
Monroe County	1	
Oktibbeha County	2	
Pearl River County	8	
Pike County	2	
Sunflower County	23	
Tallahatchie County	2	
Warren County	1	
Washington County	19	
Yalobusha County	9	
Total	238	
Oregon:		
Clackamas County	39	
Clatsop County	2	
Hood River County	2	
Jackson County	1	
Josephine County	3	
Lane County	2	
Linn County	9	
Marion County	1	
Multnomah County	3	
Sherman County	16	
Umatilla County	1	
Union County	2	
Yamhill County	3	
Portland	234	
Total	318	

SMALLPOX—Continued.

State Reports for June, 1919—Continued.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
South Dakota:			South Dakota—Continued.		
Beadle County	14		Lake County	1	
Bon Homme County	12		Minnehaha County	4	
Brown County	2		Potter County	1	
Clark County	1		Spink County	3	
Codington County	5		Union County	5	
Custer County	4		Walworth County	4	
Fall River County	2		Yankton County	3	
Hamlin County	3				
Hughes County	1		Total	66	
Jones County	1				

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Alton, Ill	1		Missoula, Mont	2	
Atchison, Kans	4		Mobile, Ala	2	
Atlanta, Ga	1		Morgantown, W. Va	1	
Austin, Tex	2		Newport News, Va	4	
Battle Creek, Mich	5		Oakland, Calif	1	
Boise, Idaho	1		Ogden, Utah	3	
Cheyenne, Wyo	1		Oklahoma City, Okla	2	
Cincinnati, Ohio	1		Omaha, Nebr	5	
Cleveland, Ohio	5		Oshkosh, Wis	3	
Covington, Ky	4		Parsons, Kans	2	
Cumberland, Md	1		Pekin, Ill	1	
Davenport, Iowa	3		Pontiac, Mich	2	
Denver, Colo	5		Portland, Oreg	42	
Des Moines, Iowa	1		Racine, Wis	6	
Detroit, Mich	3		Roanoke, Va	3	
Duluth, Minn	8		St. Paul, Minn	5	
East St. Louis, Ill	1		Salt Lake City, Utah	2	
Everett, Wash	2		San Francisco, Calif	2	
Flint, Mich	4		San Jose, Calif	5	
Fond du Lac, Wis	2		Saulte Ste. Marie, Mich	1	
Hoquiam, Wash	2		Seattle, Wash	6	
Houston, Tex	1		Spokane, Wash	2	
Independence, Mo	1		Steubenville, Ohio	1	
Kansas City, Mo	1		Stockton, Calif	3	
Kokomo, Ind	2		Superior, Wis	3	
La Fayette, Ind	3		Tacoma, Wash	3	
Lexington, Ky	1		Toledo, Ohio	1	
Lincoln, Nebr	3		Topeka, Kans	1	
Logansport, Ind	5		Walla Walla, Wash	1	
Long Beach, Calif	3		Wichita, Kans	2	
Memphis, Tenn	3		Yakima, Wash	8	
Minneapolis, Minn	12		Youngstown, Ohio	12	

TETANUS.

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.	Place.	Cases.	Deaths.
Council Bluffs, Iowa	1	1	Milwaukee, Wis	1	1
Denver, Colo		1	Philadelphia, Pa	1	2
Fall River, Mass	1	1	Rochester, N. Y		1
Hartford, Conn		1	St. Joseph, Mo		2
Los Angeles, Calif	1	1	Savannah, Ga		1
Lynn, Mass	1		Wilmington, N. C		1
Mankato, Minn		1			

TUBERCULOSIS.

See Telegraphic weekly reports from States, p. 1793, and Weekly reports from cities, p. 1808.

TYPHOID FEVER.

Monthly State Reports, 1919.

Place.	New cases reported.
Colorado (January):	
Denver County—	
Denver	5
El Paso County—	
Colorado Springs	1
Total	6
Colorado (February):	
Archuleta County	1
Denver County—	
Denver	2
Pueblo County—	
Pueblo	1
Total	4
Colorado (March):	
Denver County—	
Denver	2
Montrose County	1
Pueblo County—	
Pueblo	1
Weld County	1
Total	5
Colorado (April):	
Jefferson County	1
Colorado (May):	
Denver County—	
Denver	1
Larimer County	1
Pueblo County—	
Pueblo	3
Weld County	1
Total	6
Colorado (June):	
Adams County	1
Denver County—	
Denver	1
Mesa County	1
Pueblo County—	
Pueblo	2
Total	5
Kansas (June):	
Barber County—	
Kiowa	1
Sharon	2
Barton County—	
Great Bend	1
Butler County—	
Eldorado	1
Crawford County—	
Walnut (R. D.)	1
Pittsburg	1
Decatur County—	
Jennings (R. D.)	1
Douglas County—	
Lawrence	1
Elk County—	
Moline	1
Ellis County—	
Ellis	1
Franklin County—	
Ottawa (2 R. F. D.)	3
Harvey County—	
Burrton	1
Hodgeman County—	
Grayling	1
Kingman County—	
Basil	1
Kingman	1
Kansas (June)—Continued.	
Labette County—	
Parsons	1
Leavenworth County—	
Leavenworth	1
Lyon County—	
Wycoff	1
Emporia	2
Marion County—	
Marion	1
Montgomery County—	
Independence	3
Morris County—	
Dunlap	1
Morton County—	
Elkhart	1
Neosho County—	
St. Paul	1
Osborne County—	
Osborne	1
Natoma	1
Pawnee County—	
Garfield	1
Pratt County—	
Coate	1
Riley County—	
Manhattan	1
Sedgwick County—	
Wichita	2
Shawnee County—	
Topeka	2
Sumner County—	
Mayfield	1
Wilson County—	
Fredonia	2
Altoona	1
Wyandotte County—	
Kansas City	5
Total	48
Mississippi (June):	
Adams County	4
Amite County	2
Attala County	3
Benton County	3
Bolivar County	22
Calhoun County	8
Carroll County	6
Chickasaw County	3
Claiborne County	2
Clarke County	5
Clay County	3
Coahoma County	10
Copiah County	8
Covington County	10
De Soto County	5
Forrest County	3
Franklin County	2
George County	7
Greene County	3
Grenada County	2
Hancock County	1
Harrison County	8
Hinds County	13
Holmes County	7
Humphreys County	4
Itawamba County	2
Jefferson County	13
Kemper County	3
Lafayette County	6
Lamar County	2
Leake County	1
Lee County	2
Leflore County	3
Lincoln County	18
Lowndes County	3
Madison County	7

TYPHOID FEVER—Continued.

Monthly State Reports, 1919—Continued.

Place.	New cases reported.
Mississippi (June)—Continued.	
Marion County	9
Marshall County	3
Monroe County	6
Montgomery County	2
Neshoba County	3
Newton County	6
Noxubee County	4
Oktibbeha County	5
Panola County	10
Pearl River County	1
Pike County	6
Prentiss County	4
Rankin County	2
Scott County	2
Simpson County	5
Smith County	3
Sunflower County	10
Tallahatchie County	13
Tate County	12
Tippah County	9
Tishomingo County	4
Union County	8
Walthall County	4
Washington County	21
Wayne County	5
Webster County	3
Wilkinson County	1
Winston County	1
Yalobusha County	5
Yazoo County	11
Total	377
Oregon (June):	
Multnomah County—Portland	4
Linn County	1
Total	5
South Dakota (June):	
Brown County	1
Faulk County	1
Jones County	1
Total	3
Vermont (June):	
Chittenden County	1
Orleans County	10
Rutland County	2
Total	13

City Reports for Week Ended July 19, 1919.

Place.	Cases.	Deaths.
Adams, Mass	1	
Alton, Ill	2	
Anniston, Ala	2	
Atlanta, Ga	8	
Austin, Tex	1	
Baltimore, Md	9	1
Beaumont, Tex	1	
Berkeley, Calif	1	
Binghamton, N. Y	1	
Birmingham, Ala	6	1
Boston, Mass	2	
Brunswick, Ga	1	
Buffalo, N. Y	3	
Camden, N. J	1	
Charleston, W. Va	3	1
Cincinnati, Ohio	1	
Cleveland, Ohio	1	1
Coffeyville, Kans	1	
Columbus, Ga	3	
Columbus, Ohio	2	
Corpus Christi, Tex	1	
Covington, Ky	1	
Cumberland, Md	1	
Dayton, Ohio	2	
Denver, Colo	5	
Detroit, Mich	9	
Elgin, Ill		1
Elizabeth, N. J	1	
El Paso, Tex	2	
Evanston, Ill	1	
Everett, Mass	2	
Fall River, Mass	1	
Flint, Mich	1	
Fort Dodge, Iowa		1
Fort Wayne, Ind	1	
Gloucester, N. J	1	
Hackensack, N. J	1	
Hartford, Conn	3	
Haverhill, Mass	1	
Highland Park, Mich	2	
Hutchinson, Kans	1	
Ithaca, N. Y	1	
Jersey City, N. J	1	
Knoxville, Tenn	10	1
La Fayette, Ind	2	1
Lexington, Ky	1	
Lima, Ohio	3	
Little Rock, Ark	1	
Los Angeles, Calif	5	1
Louisville, Ky	12	
Lynchburg, Va	2	
Lynn, Mass	1	
Macon, Ga		2
Mankato, Minn	1	
Martinsburg, W. Va	3	
Medford, Mass	1	
Memphis, Tenn	2	1
Milwaukee, Wis	3	
Mobile, Ala	2	1
Morgantown, W. Va	1	
Morristown, N. J	1	
Nanticoke, Pa	1	
Nashville, Tenn	9	1
New Orleans, La	4	2
Newport News, Va	2	
New York, N. Y	22	3
Niagara Falls, N. Y	4	
Norfolk, Va	6	
North Tonawanda, N. Y	6	2
Oakland, Calif	1	
Ogden, Utah	2	
Oklahoma City, Okla	6	
Philadelphia, Pa	16	
Phoenixville, Pa	1	
Pittsburgh, Pa	1	
Pomona, Calif	2	
Portland, Me	2	
Portland, Oreg	1	
Portsmouth, Va	3	
Poughkeepsie, N. Y	2	
Richmond, Va	3	
Roanoke, Va	3	

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TYPHOID FEVER—Continued.

City Reports for Week Ended July 19, 1919—Continued.

Place.	Cases.	Deaths.
Rochester, N. Y	4	
Rome, Ga	1	
Sacramento, Calif	3	
Saginaw, Mich	1	
St. Joseph, Mo	1	
St. Louis, Mo	10	2
Salem, Mass	1	
Salt Lake City, Utah	1	
San Diego, Calif	3	
San Francisco, Calif	1	
Scranton, Pa	1	
Shenandoah, Pa	2	
Spartanburg, S. C	1	
Springfield, Mass	1	
Springfield, Ohio	2	
Stockton, Calif	1	
Toledo, Ohio	1	
Topeka, Kans	6	
Troy, N. Y	1	
Tulsa, Okla	3	
Tuscaloosa, Ala	2	
Waco, Tex		1
Washington, D. C	3	
Waterbury, Conn	1	
Wheeling, W. Va	1	
Wilmington, N. C	2	1
Winston-Salem, N. C	6	
Winthrop, Mass	1	

TYPHUS FEVER.

Denver, Colo., Week Ended July 19, 1919.

During the week ended July 19, 1919, there was reported one death from typhus fever at Denver, Colo.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS.

City Reports for Week Ended July 19, 1919.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Aberdeen, S. Dak	15,926						1			
Aberdeen, Wash	21,392		1							
Adams, Mass	14,406	1							1	
Akron, Ohio	93,604	21	2		3		1		7	
Alameda, Calif	28,433	4	5		2		3		1	
Albany, N. Y	106,632		2		6		2		4	
Allentown, Pa	65,109		7		3					
Alton, Ill	23,783						1			
Altoona, Pa	59,712		2				1		3	
Anniston, Ala	14,326								1	
Ansonia, Conn	16,954	3							1	
Arlington, Mass	13,073	2					1		4	
Asbury Park, N. J	14,629	6		1						
Atchison, Kans	16,785						2			
Atlanta, Ga	196,144	47			1				1	4
Atlantic City, N. J	59,515	7	1		5				2	
Attleboro, Mass	19,776	5								2
Austin, Tex	35,612	17					1		3	4
Bakersfield, Calif	17,543	4								
Baltimore, Md	594,637		18	1	3		16		38	16
Baton Rouge, La	17,544	5					2		1	1
Battle Creek, Mich	30,159		1		4		1			
Bayonne, N. J	72,204		1							
Beatrice, Nebr	10,437	2								
Beaumont, Tex	28,851	9								
Beaver Falls, Pa	13,749						1			
Bedford, Ind	10,613	3								1
Belleville, N. J	12,797		1						4	
Beloit, Wis	18,547	7	3	1			1		1	
Benton Harbor, Mich	11,099	2								
Berkeley, Calif	60,427	10	1				1			1
Berlin, N. H	13,892	4								
Beverly, Mass	22,128	4	1							
Binghamton, N. Y	54,864	13					1		2	1
Birmingham, Ala	189,716	49			5		1		8	4
Bloomfield, N. J	19,013	5	1	1						

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Contd.

City Reports for Week Ended July 19, 1919—Continued.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Bloomington, Ind	11,661	1								
Bluefield, W. Va	16,123		2							
Boise, Idaho	35,951	3					3			
Boston, Mass	767,813	175	37	2	18		14		39	28
Braddock, Pa	22,060		1		1		1		1	
Brazil, Ind	10,472	2								
Bridgeport, Conn	124,721	26	4		8	1			4	2
Bristol, Conn	16,318	4	1				1		1	
Brockton, Mass	69,152		2		1				3	
Brookline, Mass	33,526	6			2				1	
Brunswick, Ga	10,984	5							2	
Buffalo, N. Y	475,781	112	28	3	16		10		28	6
Burlington, Iowa	25,144	8					1			1
Burlington, Vt	21,802	3	1						1	
Butler, Pa	28,677		1							
Butte, Mont	44,057				2		1		3	
Cadillac, Mich	10,158	4	1							
Cairo, Ill	15,995	4			3					1
Cambridge, Mass	114,293		3		4		6		6	2
Camden, N. J	108,117		2		2		1		5	
Canton, Ohio	62,566	7	1							1
Cape Girardeau, Mo	11,146	2								1
Carlisle, Pa	10,795				2					
Centralia, Ill	11,838				1					
Chambersburg, Pa	12,475				1					
Charleston, S. C	61,041	16	1							
Charleston, W. Va	31,060	14	2		2					1
Chelsea, Mass	48,405	4	1		2				2	
Chester, Pa	41,857		2						4	
Chicago, Ill	2,547,201	475	87	9	159	3	21		275	53
Chicopee, Mass	29,950	10							2	1
Chillicothe, Ohio	15,625	3								
Cincinnati, Ohio	414,248	112	6		32	1	7		27	18
Cleveland, Ohio	692,259	146	26	3	34	2	5		20	16
Clinton, Mass	[1]13,075	2								2
Coffeyville, Kans	18,331		2							
Cohoes, N. Y	25,292	2								
Colorado Springs, Colo	38,965	11							5	4
Columbus, Ga	26,306	10			8				1	1
Columbus, Ohio	220,135	57	1		4		1		5	6
Concord, N. H	22,858	1							1	
Connellsville, Pa	15,876								1	
Council Bluffs, Iowa	31,838	6	2							
Covington, Ky	59,623	11	1						2	
Cumberland, Md	26,686	4					6		2	
Dallas, Tex	129,738	30	2						2	1
Danville, Ill	32,969	2			1		1			1
Davenport, Iowa	49,618						1			
Dayton, Ohio	128,939	39			4		1		3	2
Decatur, Ill	41,483	12							1	
Dedham, Mass	10,618		3							
Denver, Colo	268,439	53	5		10		6			7
Des Moines, Iowa	104,052		1							
Detroit, Mich	619,648	161	33	4	70	2	22		64	19
Dover, N. H	13,276	2								
Du Bois, Pa	14,994		1				1			
Dubuque, Iowa	40,096		1							1
Duluth, Minn	97,077	20	2		7				3	1
Durham, N. C	26,160	1							2	
East Chicago, Ind	30,286	3								
Easton, Pa	30,854	10							3	
East Orange, N. J	43,761	4			1		1			
East Providence, R. I	18,485		2							
East St. Louis, Ill	77,312	10	2		2		1			1
Eau Claire, Wis	18,887						2			
Elgin, Ill	28,362	4			8					
Elizabeth, N. J	88,830		3							1
Elmira, N. Y	38,272	10	1		1		1		1	1
El Paso, Tex	69,149	33			1				5	5
Englewood, N. J	12,603		1						1	
Erie, Pa	76,592		4						12	
Eureka, Calif	15,142	4					1			

[1] Population Apr. 15, 1910.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Contd.

City Reports for Week Ended July 19, 1919—Continued.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Evanston, Ill	29,304	7							1	
Everett, Mass	40,160	2	1				1		2	
Everett, Wash	37,205						1			
Fall River, Mass	129,828	27	5		13			1	8	
Fargo, N. Dak	17,872				6					
Farrell, Pa	10,190		1							
Findlay, Ohio	14,858	3			2				1	1
Fitchburg, Mass	42,419	10	1	1	2					
Flint, Mich	57,386	6	9		2		1			
Fond du Lac, Wis	21,486	2								
Fort Dodge, Iowa	21,039	1								
Fort Wayne, Ind	78,014	20	3		4				2	1
Fort Worth, Tex	109,597	19							1	1
Framingham, Mass	14,149	7	1				1		1	
Freeport, Ill	19,844	5								
Fremont, Nebr	10,080	5								
Fremont, Ohio	11,034	3			1					
Galesburg, Ill	24,629	6					1			
Galveston, Tex	42,650	9								1
Gloucester City, N. J	11,375				1		1		1	
Gloversville, N. Y	22,314				10					
Grand Rapids, Mich	132,861	31					2		2	1
Great Falls, Mont	[1] 13,948	8	2						1	1
Greeley, Colo	11,942	3								
Green Bay, Wis	30,017	6	1							
Greenfield, Mass	12,251	5								
Greensboro, N. C	20,171	5								
Greenwich, Conn	19,594			1					1	
Hackensack, N. J	17,412	5							1	
Hammond, Ind	27,016	10								2
Harrisburg, Pa	73,276		1		16					
Hartford, Conn	112,851	33	6	1			1		2	2
Haverhill, Mass	49,180	9	3		1	1				2
Hazleton, Pa	28,981		1		3		1			
Highland Park, Mich	33,859	9	11	2	5		1		3	1
Hoboken, N. J	78,324	8	2						3	1
Holland, Mich	12,459	2								
Holyoke, Mass	66,503	14					4		3	1
Hoquiam, Wash	12,230						1			
Houston, Tex	116,878	20	2						1	
Hudson, N. Y	12,898	6								
Independence, Mo	11,964	8			1	1			1	1
Indianapolis, Ind	283,622	65	8	1	6		4		22	13
Ironton, Ohio	14,079	2								
Irvington, N. J	16,710		1		1		1			
Ithaca, N. Y	16,017	4			1					
Jamestown, N. Y	37,431	9			3					1
Janesville, Wis	14,411	9								1
Jersey City, N. J	312,557		25		9				12	5
Johnstown, N. Y	10,678	1								
Joplin, Mo	33,400	4								
Kalamazoo, Mich	50,408	11			2		4			
Kankakee, Ill	14,270	6	1						1	
Kansas City, Mo	305,816	71	8	2	7		1		1	4
Kearny, N. J	24,325	6	1		1				1	
Keene, N. H	10,725						1			
Kenosha, Wis	32,833	6	2		6		3		2	
Knoxville, Tenn	59,112		3		1		1		2	2
Kokomo, Ind	21,929	6					1			
Lackawanna, N. Y	16,219	1								
La Crosse, Wis	31,835	11	2						2	1
La Fayette, Ind	21,481	5								
Lakewood, Ohio	23,813	4								
Lancaster, Ohio	16,086	6								
Lancaster, Pa	51,437				1				1	
Lawrence, Kans	13,477	1								
Lawrence, Mass	102,923	18	2				3		6	4
Leominster, Mass	21,365	9			5		1			
Lexington, Ky	41,997	16								1
Lima, Ohio	37,145	12	2		5					3
Lincoln, Nebr	46,957	6								
Little Rock, Ark	58,716	10								1

[1] Population Apr. 15, 1910.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Contd.

City Reports for Week Ended July 19, 1919—Continued.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Logansport, Ind.	21,338	2	1		1		1			
Long Beach, Calif.	29,163	13			2				1	
Long Branch, N. J.	15,733	1								
Lorain, Ohio	38,266	10					1		1	1
Los Angeles, Calif.	535,485	125	7		1		2		27	16
Louisville, Ky.	240,808	59	1		2		1		10	10
Lowell, Mass.	114,366	21			4		5		6	3
Ludington, Mich.	10,566	3								1
Lynchburg, Va.	33,497	13							1	2
Lynn, Mass.	104,534	13	6		7				1	2
McKeesport, Pa.	48,299				1					
Macon, Ga.	46,099	22								1
Madison, Wis.	31,315	5			1					
Mahanoy City, Pa.	17,709		4		1					
Malden, Mass.	52,243	11								1
Manchester, Conn.	15,859	1								
Manchester, N. H.	79,607	20	6						7	
Manitowoc, Wis.	13,931	7			4		2	1		
Mankato, Minn.	[1] 10,365	4								
Marinette, Wis.	[1] 14,610	3								
Marion, Ind.	19,923	7	6				1			
Marlboro, Mass.	15,285	3			1					
Marquette, Mich.	12,555	2			5		1			
Martinsburg, W. Va.	12,984						7			
Mason City, Iowa	14,938	1								
Meadville, Pa.	13,968		1							
Medford, Mass.	26,681	2			2					1
Melrose, Mass.	17,724	2			1				1	
Memphis, Tenn.	151,877	10	4		1				1	3
Methuen, Mass.	14,320	3								
Middletown, N. Y.	15,890						1			
Middletown, Ohio	16,384	7								
Milwaukee, Wis.	445,008	73	9	1	2		6		16	7
Minneapolis, Minn.	373,448		15	1	16		5		15	9
Missoula, Mont.	19,075	11					2			
Mobile, Ala.	59,201	21					1			2
Moline, Ill.	27,976	1	1						2	1
Montgomery, Ala.	44,039	18								1
Morgantown, W. Va.	14,444	2			2					
Morristown, N. J.	13,410	4			1					
Moundsville, W. Va.	11,513	4								
Mount Carmel, Pa.	20,709		1		4				3	
Mount Vernon, N. Y.	37,991	3	1							
Nanticoke, Pa.	23,811		1							
Nashua, N. H.	27,541	9								
Nashville, Tenn.	118,136	36							9	2
Natick, Mass.	10,140	1								
Newark, N. J.	418,789	77	24		6	1	3		39	10
New Bedford, Mass.	121,622	22	2		8				14	3
New Britain, Conn.	55,385	7	2				1			
New Brunswick, N. J.	25,855		1							
Newburgh, N. Y.	29,893	12	1						1	
Newburyport, Mass.	15,291	4								
New Haven, Conn.	152,275	32	3		2				6	3
New Orleans, La.	377,010	128	3		5				29	20
Newport News, Va.	22,622	9							1	
Newport, R. I.	30,585	6					1			1
Newton, Mass.	44,345	10	1				1		2	1
New York, N. Y.	5,737,492	1,055	186	12	88	2	34	2	215	112
Niagara Falls, N. Y.	38,466	10	1		10				2	
Norfolk, Va.	91,148		1							
Norristown, Pa.	31,969				1				5	
North Adams, Mass.	[1] 22,019	5								1
Northampton, Mass.	20,006	2					1		1	
North Attleboro, Mass.	11,248	1								
North Tonawanda, N. Y.	14,060	5							1	
Norwalk, Conn.	27,332									1
Norwich, Conn.	21,923	1					1		2	1
Norwood, Ohio	23,269	3								
Oakland, Calif.	206,405	42	1		1		5		3	3
Oak Park, Ill.	27,816	7			2					
Ogdensburg, N. Y.	16,845	4								

[1] Population Apr. 15, 1910.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Contd.

City Reports for Week Ended July 19, 1919—Continued.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Ogden, Utah	32,343	5	4							
Oil City, Pa	20,162				5					
Oklahoma City, Okla	97,588	21	1		1					1
Omaha, Nebr	177,777	36	2		2		1			4
Orange, Conn	14,393	6								2
Orange, N. J	33,636	4			1		1		1	
Oshkosh, Wis	36,549	1					1			
Parkersburg, W. Va	21,039	5								
Parsons, Kans	15,952						2		5	
Pasadena, Calif	49,620	7					1		1	
Passaic, N. J	74,478	16	2						2	4
Paterson, N. J	140,512	3	3	1			2			
Peekskill, N. Y	19,034	5								1
Pekin, Ill	10,973		1							
Peoria, Ill	72,184	14	2				1		2	2
Perth Amboy, N. J	42,646	3							1	
Philadelphia, Pa	1,735,514	380	45	5	60	1	29		86	52
Phillipsburg, N. J	15,879	4	1				1			
Piqua, Ohio	14,275	2								
Pittsburgh, Pa	586,196		12		12		4		12	
Pittsfield, Mass	39,678	13							3	3
Plainfield, N. J	24,330	2			2				2	
Plattsburg, N. Y	13,111	4	1						2	
Plymouth, Mass	14,001	2								
Plymouth, Pa	19,439				1					
Pomona, Calif	13,624	3	3	2			1			
Pontiac, Mich	18,006	7	3		2	1				
Port Chester, N. Y	16,727	2							7	1
Portland, Me	64,720	11					2			1
Portland, Oreg	308,399	67	7		3		3		10	5
Portsmouth, Va	40,693	12	1							1
Pottstown, Pa	16,987				2					
Pottsville, Pa	22,717				1					
Poughkeepsie, N. Y	30,786	8							10	1
Providence, R. I	259,895	42	7	1			1			3
Quincy, Ill	36,832	11	1							
Quincy, Mass	39,022	4	2				1		2	
Racine, Wis	47,465	10	1		2					
Rahway, N. J	10,361	2								
Reading, Pa	111,607		1		1		1		8	
Redlands, Calif	14,573	4								2
Reno, Nev	15,514	5								
Richmond, Va	158,702	44	1		5				7	3
Riverside, Calif	20,496	11	2	1						2
Roanoke, Va	46,282	4			1		1			
Rochester, N. Y	264,714	43	5		4		1		9	5
Rockford, Ill	56,739	5					3			
Rock Island, Ill	29,452	6							1	
Rocky Mount, N. C	12,673	8								
Rome, Ga	15,607		2				3		1	
Rome, N. Y	24,259		1		1				3	
Rutland, Vt	15,038	4								
Sacramento, Calif	68,984	19			1		4		4	1
Saginaw, Mich	56,469	8	1		1					
Saint Joseph, Mo	86,498		3	1					4	4
Saint Louis, Mo	768,630	165	37	2	24		3		40	8
Saint Paul, Minn	252,465	41	13		11		2		10	5
Salem, Mass	49,346	12	3	1			2		2	
Salem, Oreg	21,274	8							5	1
Salt Lake City, Utah	121,623	26	9	2	1		3		1	
San Angelo, Tex	[1] 10,321	2								1
San Diego, Calif	56,412	11							1	3
Sandusky, Ohio	20,226	5			3					
San Francisco, Calif	471,023	104	8		4		6		28	15
Santa Barbara, Calif	15,360	4								
Santa Cruz, Calif	15,150	1								
Saratoga Springs, N. Y	13,839	5	1						1	1
Saugus, Mass	10,210		1				2			
Sault Ste. Marie, Mich	14,130	3	1							
Savannah, Ga	69,250	25	2				1		3	
Schenectady, N. Y	103,774	17			3				7	2
Scranton, Pa	149,541		3				4		5	

[1] Population Apr. 15, 1910.

DIPHTHERIA, MEASLES, SCARLET FEVER, AND TUBERCULOSIS—Contd.

City Reports for Week Ended July 19, 1919—Continued.

City.	Population as of July 1, 1917 (estimated by U. S. Census Bureau).	Total deaths from all causes.	Diphtheria.		Measles.		Scarlet fever.		Tuberculosis.	
			Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Seattle, Wash	366,445		6		9		11			
Shamokin, Pa	21,274		2		12					
Shenandoah, Pa	29,753				1				2	
Sioux Falls, S. Dak	16,887	3	1				2			
Somerville, Mass	88,618	11					4		4	
South Bend, Ind	70,967	15			2					1
Southbridge, Mass	14,465	3								
Spartanburg, S. C	21,985	7		1						1
Spokane, Wash	157,656				8		4			
Springfield, Ill	62,623	16			1					1
Springfield, Mass	108,668	23		1	1		1		3	2
Springfield, Mo	41,169	14								2
Springfield, Ohio	52,296								5	1
Stamford, Conn	31,810								2	
Steelton, Pa	15,759				1					
Steubenville, Ohio	28,259	1								
Stockton, Calif	36,209	6	1							
Sunbury, Pa	16,661		1		3					
Superior, Wis	47,167	31					3			
Syracuse, N. Y	158,559	33	2				3		3	
Tacoma, Wash	117,446		1		2					
Taunton, Mass	36,610	11			1					
Terre Haute, Ind	67,361	20								1
Tiffin, Ohio	12,962	4								1
Toledo, Ohio	202,010	30	1		82	1	2		10	6
Topeka, Kans	49,538	15	2						1	1
Trenton, N. J	113,974	17			17	1	1		6	2
Troy, N. Y	78,094	14					1		5	2
Tulsa, Okla	32,507		1				1		1	
Tuscaloosa, Ala	10,824	2	1						2	
Uniontown, Pa	21,600								1	
Vallejo, Calif	13.803	2								
Waco, Tex	34,015	9								
Waltham, Mass	31,011	5			1					
Washington, D. C	369,282		10	2	3		8		25	12
Washington, Pa	22,076		1		1					
Waterbury, Conn	89.201	1	4		2		2		3	1
Watertown, Mass	15,188						1			
Watertown, N. Y	30,404		1				1		1	
Wausau, Wis	19,666	3			1		1			
West Chester, Pa	13,403		3							
Westfield, Mass	18,769	3					1		1	1
West Hoboken, N. J	44,386	2	3						3	
West New York, N. J	19,613	2								
West Orange, N. J	13,964	1	1						4	1
Wheeling, W. Va	43,657	9							1	
White Plains, N. Y	23,331	6			2		1		3	
Wichita, Kans	73,597	22							1	1
Wilkes-Barre, Pa	78,334		2		1		1		2	
Williamsport, Pa	34,123						1			
Wilmington, Del	95,369	28								4
Wilmington, N. C	30,400	13								
Winchester, Mass	10,812	3								
Winston-Salem, N. C	33,136	15							2	
Winthrop, Mass	13,105		1		1					
Woburn, Mass	16,076	3								
Worcester, Mass	166,106	40	4		14		2		13	5
Yakima, Wash	22,058						1			
Yonkers, N. Y	103,066	19	2				1		5	3
York, Pa	52,770		2							
Youngstown, Ohio	112,282	24					2		3	4
Zanesville, Ohio	31,320	8								1

FOREIGN.

CUBA.

Communicable Diseases—Habana.

Communicable diseases have been notified at Habana as follows:

Disease.	June 1-10, 1919.		Remaining under treatment June 10, 1919.
	New cases.	Deaths.	
Broncho-pneumonia	5		
Cerebrospinal meningitis	[1] 1	1	
Diphtheria	3	1	6
Leprosy			17
Malaria	9		[2] 16
Measles	1		1
Paratyphoid fever			2
Scarlet fever	1		2
Typhoid fever	6		[3] 61
Varicella	1		

[1] Foreign. [2] From the interior 13; foreign 1. [3] From the interior 20.

GREAT BRITAIN.

Plague—Liverpool.

A fatal case of plague occurring in a dock laborer was reported July 30, 1919, at Liverpool, England.

GREECE.

Influenza—Saloniki.

Influenza was reported present at Saloniki during the first week in June, 1919.

PERU.

Restrictions for Vessels Calling at Paita.

According to information dated July 31, 1919, regular west coast steamships traversing the Panama Canal were authorized, July 20, 1919, by the United States Public Health representative at Callao, Peru, to call at Paita, Peru, the vessels to anchor one and one-half miles from shore and to take on cargo, not passengers.

PHILIPPINE ISLANDS.

Cholera—Manila.

Cholera was reported epidemic at Manila, July 28, 1919.

SPAIN.

Influenza—January-June, 1919.

Influenza has been reported in cities in Spain as follows:

Almeria.—(Population, estimated, 49,000.) Present from May 18 to 31, 1919, with 12 reported cases.

Barcelona.—(Population, estimated, 800,000.) Present in Barcelona and the surrounding country during the month of January and the first week of February, 1919. During the second week in February influenza was reported present in epidemic form with 7 fatal cases, during the third week with 6 fatal cases, and during the final week with 57 fatal cases. In March, 273 fatal cases were reported and during the first two weeks of April and from April 16 to June 11, influenza was reported continuously present.

Bilbao.—(Population, estimated, 102,508.) During the month of January, 1919, 25 fatal cases of influenza were reported; during February, 20 fatal cases; March, 19 fatal cases; April, 19 fatal cases; May, 12 fatal cases; June 1 to 10, one fatal case.

Cadiz.—(Population, census, 67,306.) During the month of January, 1919, 33 fatal cases were reported and during month of April, 1919, 12 cases.

Madrid.—(Population, estimated, 634,253.) During the month of January, 1919, 167 fatal cases of influenza and 67 of pneumonia were reported; month of February, 153 fatal cases of influenza and 53 of pneumonia; month of March, 236 fatal cases of influenza and 47 of pneumonia; month of April, 74 fatal cases of influenza and 28 of pneumonia; month of May, 37 fatal cases of influenza and 21 of pneumonia.

Malaga.—(Population, estimated, 142,000.) During the months of January and February, 1919, 58 cases of influenza were reported; during two weeks in March, 70 cases; and from April 10 to 30, 28 cases.

Tarragona.—(Population, estimated, 23,950.) A renewal[1] of influenza was reported at Tarragona during the week ended February 15, 1919. The disease continued to be reported present in the city and surrounding country to March 15, 1919.

Valencia.—(Population, estimated, 243,057.) Influenza was reported through the month of January, 1919, with 149 cases; in February, with 67 cases; from March 1 to 26, 42 cases.

Vigo.—On January 25 a few cases were reported in the district of Vigo, and on February 1, a few cases.

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[1] Reported present Aug. 13, 1918.

SWITZERLAND.

Influenza—Zurich—January-May, 1919.

During the week ended January 4, 1919, 432 cases of influenza were reported at Zurich, Switzerland. During the two weeks following no new cases were reported but during the week ended January 25, 1919, 127 new cases were notified and from January 19 to May 31, 1919, 3,472 cases. The report for the week ended April 4, 1919, has not been received. Population about 212,000.

UNION OF SOUTH AFRICA.

Influenza—Cape Town.

Influenza was reported present at Cape Town, Union of South Africa, during the four weeks, ended May 30, 1919, with 17 cases, of which 10 were of Europeans. (Population, 172,050; European, 89,700.)

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

Reports Received During Week Ended Aug. 8, 1919.[1]

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
India:				
Bombay	June 1-7	2	1	
Rangoon	do	15	8	
Indo-China:				
Cochin-China—				
Saigon	May 18-25	20	18	

PLAGUE.

Place.	Date.	Cases.	Deaths.	Remarks.
Ecuador:				
Guayaquil	June 16-30	2	1	
Posorja	do	1		
Great Britain:				
Liverpool	July 30	1	1	In dock laborer.
India				June 1-7, 1919: Cases, 584; deaths, 491.
Bombay	June 1-7	17	16	
Karachi	June 15-21	10	11	
Rangoon	June 1-7	5	5	
Indo-China:				
Cochin-China—				
Saigon	May 19-25	4	2	
Mesopotamia:				
Bagdad	May 31-June 6	50	45	

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Canada:				
Nova Scotia—				
Halifax	July 13-19	12		Counties: Antigonish, Halifax, Hants (East and West), and Lunenburg.
Ontario				June 1-30, 1919: Cases, 68; deaths, 2.
Quebec—				
Quebec	July 13-19	3		

[1] From medical officers of the Public Health Service, American consuls, and other sources.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received During Week Ended Aug. 8, 1919—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Ceylon:				
Colombo	May 25-31	1		City case.
Egypt:				
Cairo	Feb. 19-Mar. 4	64	3	
Finland				May 16-31, 1919: Cases, 140.
Abo Och Bjorneborg	May 16-31	3		
Kuopio	do	33		
Nyland	do	6		
St. Michael	do	25		
Tavastehus	do	6		
Vasa	do	3		
Viborg	do	64		
India:				
Bombay	June 1-7	45	30	
Karachi	June 15-21	3	1	
Rangoon	June 1-7	13	8	
Mexico:				
San Jeronimo	June 17-30	5		In State of Oaxaca. Fifty kilometers from Salina Cruz.
Siberia:				
Vladivostok	May 1-31	14		
Spain:				
Vigo	Apr. 12	2		From vessel. Mar. 22, 1919: Present in villages in vicinity.
Tunis:				
Tunis	June 23-28	1		

TYPHUS FEVER.

Egypt:				
Cairo	Feb. 19-Mar. 4	137	64	
Port Said	do	3	1	
Finland				May 16-31, 1919: Cases, 1.
Province—				
Nyland	May 16-31	1		
Japan:				
Nagasaki	June 24-29	1		
Mesopotamia:				
Bagdad	May 31-June 6	4	2	
Siberia:				
Vladivostok	May 1-31	67		

YELLOW FEVER.

Brazil				Reported July 29, 1919, seriously prevalent in States of Bahia and Pernambuco.

Reports Received from June 28 to Aug. 1, 1919.

CHOLERA.

Place.	Date.	Cases.	Deaths.	Remarks.
Ceylon:				
Colombo	Apr. 20-26	10		
China:				
Canton	June 8-21	10	3	
Foochow	July 3			Present.
Swatow	June 2-21		118	
India:				
Bombay	Apr. 28-May 31	27	24	
Calcutta	May 4-31		476	
Madras	May 18-24	10	8	
Rangoon	Apr. 28-May 31	58	45	
Indo-China:				
Cochin-China—				
Saigon	Apr. 21-June 8	198	134	City and district.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from June 28 to Aug. 1, 1919—Continued.

CHOLERA—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Japan:				
Pescadores Islands	July 14	40		In one village.
Java:				
East Java				Apr. 2-May 20, 1919: Cases, 553; deaths, 459.
Surabaya	Apr. 23-May 20	83	66	
Mid-Java				Mar. 28-Apr. 24, 1919: Cases, 1,595; deaths, 1,225.
Samarang	Mar. 28-Apr. 24	75	74	
West Java				May 2-June 9, 1919: Cases, 70; deaths, 43.
Batavia	May 2-June 5	12	5	
Persia:				
Ardebil	May 2			Present.
Enzeli	Apr. 23	1		
Khorram-Ahab	May 3			Outbreak.
Mianedge	Apr. 28			Do.
Zindjan	Apr. 21-May 4		49	
Philippine Islands:				
Manila	Apr. 26-May 31	7	2	
Provinces				May 4-24, 1919: Cases, 567; deaths, 383.
Batangas	May 4-24	25	23	
Bulacan	do	48	25	
Cebu	do	162	84	
Laguna	do	20	15	
Mindoro	do	19	14	
Misamis	do	9	2	
Pampanga	do	166	131	
Tayabas	do	118	89	
Provinces				June 1-14, 1919: Cases, 164; deaths, 117.
Batangas	June 1-14	25	19	
Bulacan	do	32	19	
Cavite	June 8-14	7	2	
Laguna	do	5	6	
Nueva Ecija	June 1-14	10	7	
Pampanga	do	48	38	
Pangasinan	June 8-14	9	5	
Tayabas	do	22	17	
Siam:				
Bangkok	Apr. 13-May 17		693	

PLAGUE.

Place.	Date.	Cases.	Deaths.	Remarks.
China:				
Canton	May 25-June 21			Present Apr. 27-May 10, 1919: Cases, 3; present May 24-June 7, 1919.
Foochow	May 18-24			Do.
Hongkong	June 15-28	42	33	
Ecuador:				
Posorja	June 1-15	2	1	Bathing place 65 kilometers from Guayaquil.
Egypt				Jan. 1-June 25, 1919: Cases, 638; deaths, 339.
Cities—				
Cairo	May 15		1	
Kantarah	June 19-20	4	2	2 European. Septicemic.
Port Said	May 1-4	1	2	
Suez	June 5-11	3	3	
Provinces—				
Assiout	May 17-June 24	80	41	
Beni-Souef	May 19-June 21	6	5	
Fayoum	May 18-June 21	8	7	
Girgeh	May 15-June 25	3	4	
Menoufia	June 8-24	5	1	
Minieh	May 24-June 25	29	11	
Hawaii:				
Paauhau	July 19	1		
India				Apr. 27-May 31, 1919: Cases, 7,223; deaths, 5,741.
Bombay	Apr. 28-May 31	242	166	
Calcutta	May 18-31		30	
Karachi	May 18-June 14	134	120	
Rangoon	Apr. 28-May 24	41	39	
Indo-China:				
Cochin-China—				
Saigon	Apr. 21-May 18	18	14	City and district.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from June 28 to Aug. 1, 1919—Continued.

PLAGUE—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Japan:				
Yokohama	June 9-15	1	1	
Java:				
East Java				Apr. 8-May 20, 1919: Cases, 77; deaths, 77.
Surabaya	Apr. 23-May 20	6	6	
Mesopotamia:				
Bagdad	Apr. 19-May 16	267	201	
Basra	May 3-10	108	89	Including suburb of Ashar. Total from date of outbreak to May 19, 1919, 288 cases.
Siam:				
Bangkok	Apr. 27-May 17	2	2	
Straits Settlements:				
Singapore	Apr. 13-26	2	1	
On vessel:				
S. S. City of Sparta	Apr. 19-21	1	1	From Bombay Apr. 3, 1919; case, a soldier; at sea.
Do	May 13-17	1	1	At Liverpool; case, a native member of the crew. (Public Health Reports, June 27, 1919, p. 1463.)

SMALLPOX.

Place.	Date.	Cases.	Deaths.	Remarks.
Arabia:				
Aden	May 13-19		1	
Austria				Mar. 9-Apr. 5, 1919: Cases, 92.
Salzburg	Mar. 9-Apr. 5	60		
Vienna	do	17		
Azores:				
St. Michaels	June 7-20	1		
Brazil:				
Bahia	Apr. 20-May 3	2		
Canada:				
British Columbia—				
Vancouver	June 15-July 5	4		
New Brunswick—				
Campbellton	June 15-21	1		
Moncton	July 6-12	1		
Nova Scotia—				
Cities—				
Halifax	June 15-July 12	80		
Sydney	June 8-21	3		
Counties—				
Antigonish	June 28			Present.
Cumberland	do			Do.
Guysborough	do			Do.
Halifax	do			Do.
Hants	do			Do.
Ontario—				
Province				May 1-31, 1919: Cases, 98; deaths, 2.
Hamilton	June 29-July 5	1		
Harwich	May 1-31	14	2	Township in Kent County.
Ottawa	June 15-July 5	4		
Peterborough	June 15-21	4		
Walpole Island	May 1-31	42		Kent County. Island in Lake St. Clair. Among Indians.
Prince Edward Island—				
Charlottetown	July 6-19	6		
Quebec—				
Montreal	June 8-28	18		
Quebec	June 29-July 12	5		June 8-14, 1919: 10 cases. On incoming vessels.
Saskatchewan—				
Regina				Jan. 1-Apr. 30, 1919: Cases, 41; deaths, 1.
Ceylon:				
Colombo	May 1-24	3		
China:				
Amoy	May 20-June 16		13	
Canton	May 18-June 21			Present.
Chefoo	June 8-21			Do.
Chungking	May 4-June 14			Do.
Foochow	May 18-31			Do.
Hongkong	May 18-June 7	4	4	
Nanking	May 25-June 21			Do.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from June 28 to Aug. 1, 1919—Continued.

SMALLPOX—Continued.

Place	Date.	Cases.	Deaths.	Remarks.
Chosen (Korea):				
Chemulpo	Apr. 1-May 31	19	4	
Fusan	do	294	81	
Seoul	do	3	1	
Czecho-Slovakia:				
Prague	May 18-June 21	11	2	
Egypt:				
Alexandria	May 14-June 24	233	95	
Cairo	Jan. 2-28	17	4	
Finland				Apr. 16-May 15, 1919: Cases, 217.
Provinces—				
Abo Och Bjorneborg	Apr. 16-May 15	5		
Kuopio	do	12		
Nyland	do	3		
St. Michael	do	26		
Tavastehus	do	24		
Vasa	do	4		
Viborg	do	132		
France:				
Marseille	May 1-31		2	
Paris	May 11-June 21	12	6	
Great Britain:				
Cardiff	June 15-July 5	4		
Dundee	June 1-7	1		
Glasgow	June 8-21	5		
London	May 25-July 5	12		
Greece:				
Saloniki	May 15-21		18	
India:				
Bombay	Apr. 28-May 31	394	191	
Calcutta	May 4-31		353	
Karachi	May 4-June 14	25	16	
Madras	May 18-24	23	11	
Rangoon	Apr. 28-May 31	149	67	
Indo-China:				
Cochin-China—				
Saigon	Apr. 21-May 18	11	4	City and district.
Italy:				
Leghorn	June 16-22	1		
Messina	June 1-21	13		Province, June 8-21, 1919: Cases, 23; deaths, 3.
Milan	Mar. 1-Apr. 30	20	5	
Milazzo	June 1-7	1	1	
Naples	June 2-22	96	79	
Palermo	May 2-June 20	39	5	
Turin	May 18-June 22	4	1	
Venice	May 26-June 1	2		
Japan:				
Kobe	May 4-31	48	17	
Nagoya	June 1-7	1	1	
Taiwan	May 21-June 17	9	4	Entire island.
Tokyo	May 1-June 5	2		
Yokohama	May 26-June 1	1		
Java:				
East Java				Apr. 9-15, 1919: Cases, 1.
West Java				May 2-June 5, 1919: Cases, 419; deaths, 81.
Batavia	Apr. 18-June 5	4	1	
Manchuria:				
Dairen	May 13-June 2	3	2	
Mesopotamia:				
Bagdad	May 24-30	1		
Mexico:				
Mexico City	June 1-July 5	20	1	
Piedras Negras	June 22-28	2	2	
Vera Cruz	July 6-12	2		
Newfoundland:				
St. Johns	June 13-July 4	3		June 13-July 18, 1919: Outports, 31 cases.
Philippine Islands:				
Manila	May 11-17	1		
Portugal:				
Oporto	June 2-14	17	9	
Portuguese East Africa:				
Laurenco Marques	Apr. 1-May 31	2	1	
Siberia:				
Vladivostok	June 8-15	9		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from June 28 to Aug. 1, 1919—Continued.

SMALLPOX—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Spain:				
Almeria	May 18–June 16	48	5	
Barcelona	May 15–June 19	3	6	
Bilbao	May 1–10	1		
Cadiz	Apr. 1–May 31		5	
Madrid	May 1–31	3		
Valencia	May 11–June 7	174	12	
Straits Settlements:				
Singapore	Mar. 24–May 10	4	2	
Tunis:				
Tunis	June 15–21		1	
On vessels:				
S. S. Eastern	Apr. 25–26	2	1	Death at sea. Second case landed at Woodman's Quarantine Station, Fremantle, Australia Apr. 29. Vessel from England via Egypt and Colombo.
S. S. Karoa	Apr. 19	1		Landed at Colombo. Vessel from the United Kingdom via Egypt and Colombo.
S. S. Khyber	Apr. 10–May 4	4		From Liverpool, via Port Said, Suez, and Colombo. One case landed at Port Said Apr. 10, 2 cases at Colombo Apr. 22, one at quarantine, Fremantle, Australia, May 4, 1919.

TYPHUS FEVER.

Place.	Date.	Cases.	Deaths.	Remarks.
Algeria:				
Algiers	May 1–31	76	8	
Austria				Mar. 23–Apr. 5, 1919: Cases, 118.
Vienna	Mar. 23–Apr. 5	9		
China:				
Changsha	May 11–17	1	1	
Chosen (Korea):				
Chemulpo	Apr. 1–May 31	54	8	
Fusan	May 1–31	4	1	
Seoul	Apr. 1–May 31	79	14	
Czecho-Slovakia:				
Prague	May 18–24	1		
Egypt:				
Alexandria	May 14–June 24	425	236	
Cairo	Jan. 2–28	13	2	
Port Said	Jan. 9–15	3	3	
Finland				Apr. 16–May 15, 1919: Cases, 15.
Provinces—				
Abo Och Bjorneborg	May 15	1		
Nyland	Apr. 16–May 15	3		
St. Michael	do	8		
Viborg	do	3		
Germany	Jan. 12–Feb. 22	344		Military.
Do	Feb. 23–Mar. 22	220		Civil.
Do	Mar. 23–Apr. 12	333		Civil, military, prisoners of war, deserters.
Great Britain:				
Dundee	June 30–July 5	3		
Glasgow	June 8–July 5	13	2	
Greece:				
Saloniki	May 15–21		2	
Hungary				Feb. 24–May 9, 1919: Cases, 258.
Budapest	Feb. 24–May 9	124	6	
Debreczin	do	42		
Italy				Apr. 28–June 8, 1919: Cases, 3,470—Austrian prisoners, 3,321; Italian soldiers, 82; civil population, 67.
Genoa	June 25–July 1	62		17 Austrian prisoners.
Naples	May 12–June 22	50	16	
Venice	Apr. 27–June 14	58	9	
Japan:				
Nagasaki	June 16–22	2		
Mesopotamia:				
Bagdad	Apr. 19–May 30	30	20	

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued.

Reports Received from June 28 to Aug. 1, 1919—Continued.

TYPHUS FEVER—Continued.

Place.	Date.	Cases.	Deaths.	Remarks.
Mexico:				
Mexico City	May 4–July 5	211		
Newfoundland:				
St. Johns	June 21–27	1		From vessel.
Palestine:				
Jaffa				Oct. 22–Dec. 22, 1918; Cases, 8; deaths, 3.
Portugal:				
Oporto	June 1–15	52		
Siberia:				
Vladivostok	June 9–15	23		
Spain:				
Barcelona	May 15–21		1	
Madrid	May 1–31		1	
Tunis:				
Tunis	May 24–June 21	3	1	

YELLOW FEVER.

Brazil:				
Bahia	Apr. 12–May 17	22	15	
Ecuador:				
Guayaquil	May 1–31	1	1	
Naranjito	May 1–June 15	2	1	
Mexico:				
Merida	June 30–July 28	17	7	State of Yucatan.
Peru:				
Paita	July 10–22	8	5	Department of Piura.
Piura	do	46	10	Do.
Salvador:				
La Union	July 6	2		
St. Miguel	June 24–July 6	4		75 miles from city of San Salvador.
San Salvador	do	1	1	

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