

A STATISTICAL STUDY OF INFLUENZA IN ILLINOIS, FISCAL YEAR, JULY 1, 1918-JUNE 30, 1919

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In the year 1918 the death in the United States was the highest in the experience of the Census Bureau. It was 18 per thousand. The preceding year the rate for the country was 14.2. A study of the statistics showed that the excess mortality was practically confined to the last

three months of the year when a great epidemic of influenza was raging. The excess in number of deaths due to influenza and pneumonia for the year was almost exactly equal to the excess in general mortality.

In speaking of the mortality rate for individual diseases it is customary to speak of the rate per 100,000 of population. During the year 1918 the rate in the United States was 298.9 for influenza, and 284.3 for pneumonia, all forms. This rate is not as large as the rates which will be given for the State of Illinois, but it must be remembered that the year 1918 closed while the epidemic was in full sway. The statistics which are studied for Illinois are for the fiscal year of the State beginning July 1, 1918 and closing June 30, 1919. These data for the State of Illinois, therefore, cover the entire period of the epidemic.

For the annual report of the Department an estimate was made, county by county, of the cost of certain communicable diseases. For influenza we estimated the cost of treatment for each case at \$10 and the loss of time at \$15. Each funeral was estimated at \$100 and each life lost was valued at \$3,000. This very moderate estimate showed an economic loss in the State of Illinois of \$73,710,000, or an equivalent to a per capita loss of \$11.59 to each resident of the state during the single year, 1918-19. The fact that a disease is communicable indicates that theoretically it can be controlled; but to control it we must know the conditions favorable. Accordingly a special study was undertaken relative to this disease in the State.

In making a statistical study of influenza in Illinois we must constantly bear in mind the sources of possible error.

1. *Estimated population.* The Census in Illinois is taken on decennial years, and the population for intermediate years is estimated according to previous growth. Unusual development or decline in population is not expressed in these estimates. In other words the estimated population for any area may be falsely large or small.

2. *Errors in diagnosis.* Errors in diagnosis are common, and especially when the germ of a disease is not surely identified such errors cannot be guarded against. Under normal conditions the tendency is to fail to recognize such a disease as influenza at least in its milder cases, and so the reported cases would only be a fraction of the whole. On the other hand in the height of an epidemic and especially of a great pandemic the psychological effect results in calling anything approaching influenza in nature a genuine case. It is quite possible, then, that the reported cases would exceed the true number.

3. *Health authorities are often negligent in collecting and forwarding reports of communicable disease.* Thus in Pope County during the year studied there were reported less cases of influenza than there were deaths from the disease. Statistics based chiefly upon morbidity reports are therefore very misleading.

4. *Death Certificates.* In Death Certificates we are exposed to the same errors in diagnosis as for morbidity reports. In addition a large proportion of Illinois physicians do not make out their Death Certificates properly. Fatal influenza is almost invariably connected with pneumonia. The proper certificate should give influenza as the cause of death and pneumonia as the contributory cause or complication. This is not the arbitrary ruling of the State Department of Public Health; it is in accord with the rulings of the U. S. Census Bureau, and with the rules laid down by the international committee. Nevertheless, in one County Medical Society meeting, where the question was asked, fifteen out of the sixteen present said they would give pneumonia as the cause of death. In many of these certificates, although the real cause of death was influenza, there has been no mention of influenza as related to the case.

All certificates giving pneumonia or bronchopneumonia as the cause of death are questioned by our Department. It is the experience of the U. S. Bureau of Census, of our own Department and of other investigators that such questions result in a decided reduction in the number of deaths recorded for pneumonia and a corresponding in-

crease in the deaths assigned to other diseases. In five years experience of the Metropolitan Life Insurance Company such investigation of deaths reported simply for pneumonia resulted in a transference of 7.5 per cent to other causes.

In this study an estimate was first made of influenza alone, county by county through the State. When it seemed best to study the reports for cities it was found that there had been such a transference of assigned cause from the pneumonias to influenza that the deaths in the city from influenza exceeded the total formerly given for the entire county.

The experience of statisticians in the study of influenza indicates that it is generally best to consider deaths assigned to the different forms of pneumonia with those assigned to influenza. This was done in comparing the rates in the cities with those of the counties in which the cities were located. For the purpose of studying the distribution of the disease through the State we depended solely upon the records of influenza. In comparing cities with containing counties we compare the number of deaths from influenza and all the pneumonias with morbidity reports only of influenza for the reason that through most of the State cases of pneumonia are very imperfectly reported.

5. *There is another source of error in Death records.* Some undertakers neglect to obtain burial permits promptly and it seems impossible to get some local registrars to send in their reports each month. This negligence on the part of some registrars is assisted by the absolute failure of boards of county commissioners to provide for the payment of the fees which the Law demands. Cook County Commissioners have never since the Law went into effect provided for the payment of registrars in the County. After the data were collected for this study bunches of death certificates were received from some local registrars which would have decidedly increased the mortality rate.* * *

* Since this paper was written Cook County has paid local registrars.

* * * * The reported cases and deaths due to influenza were collected for each county and from these data we estimated the rate per 100,000 of population and the deaths per 1,000 of cases. We found that the average for the State was 3,517 cases and 396.6 deaths per 100,000 of population and the deaths were 112.7 per 1,000 cases. Dividing reported cases and deaths each into three classes we find nine possible combinations:—High mortality and high morbidity, high mortality and medium morbidity, high mortality and low morbidity, etc. Upon coloring the map of the state according to these nine classes we find the various colors are pretty evenly distributed through the State. Neither north nor south, east nor west shows any special color. Two counties, namely Pope and Schuyler, were given a distinctive color because their reports were manifestly unreliable. We do find that the populous centers and the coal mining areas show a large amount of the disease. The counties showing both high mortality and high morbidity are Lake, LaSalle, Grundy, Rock Island, Peoria, Champaign, Christian, Franklin, Perry and Union. Those showing low morbidity and low mortality are Carroll, Lee, Kendall, DuPage, Putnam, Stark, Cumberland, Clark, Clinton, Hamilton and Williamson.

It is easy to see that where the population is close together the opportunities for infection are more numerous; also where people are closely associated the chance is greater that the infective dose will be large. The indications are that the germ of influenza is conveyed through exhaled droplets. In crowded work rooms and in mines the chance is great that the air may be saturated with these germs if there be cases present. We are not surprised, therefore, that in crowded sections the cases should be numerous and severe, but Cook County, and especially Chicago, shows less mortality than Lake, LaSalle or Grundy, where the density of population is less. There must be some other important factor.

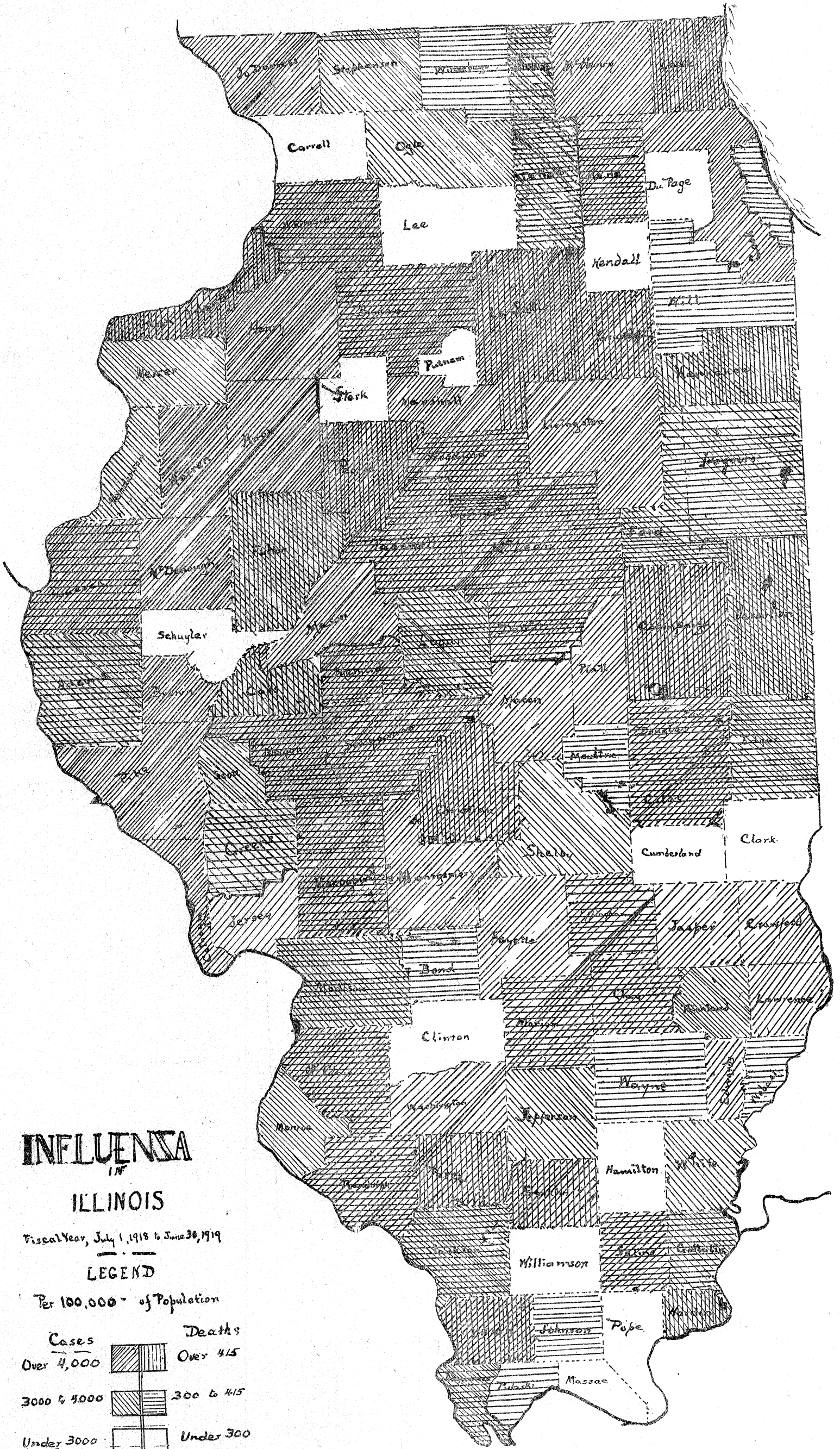
There are certain important general biologic laws which must be remembered. (a) When a germ is im-

planted in favorable soil, under favorable conditions it tends for a time to increase in virility.

(b) After the soil has been to a degree impoverished by any special strain of germ the growth will become weaker and more stunted.

(c) Germs, whether weak or strong, when transferred to an average soil tend to preserve their former character.

Most elderly persons by virtue of having had influenza in the epidemic of 1889 or later had therefore a degree of immunity to the germ. Young persons generally had a less degree of immunity because at the most they had been exposed to an attenuated form of the germ. The normal community is made up of both young and old, and its susceptibility to such a disease may therefore be considered as normal. A community made up chiefly of young people would theoretically have more than the normal degree of susceptibility to the disease, and would prove a favorable soil. We should therefore expect such a community to show high morbidity and high mortality. This is well represented in Lake County which contained a large Army Camp at Fort Sheridan, and the Great Lakes Naval Training Station. Champaign County contains a large university and the aviation field at Rantoul. There was a camp in Peoria County. On the other hand, communities which had lost an appreciable proportion of their young people, especially if they contained no important business interests which would attract large numbers of people, might reasonably be expected to show a lessened susceptibility. Though the disease might find many victims in such communities we should not expect a high death rate. In the main our study of the records for the State bears out these general conclusions, but we are struck with a marked exception. Winnebago County, containing the largest camp in the State at Rockford is classed as low in morbidity and average in mortality. When, however, we include the figures for the pneumonias we find that its morbidity total was very heavy. In most counties the deaths from pneumonia were recorded as less than those from influenza. In Winnebago the deaths



INFLUENZA

ILLINOIS

Fiscal Year, July 1, 1918 to June 30, 1919

LEGEND

Per 100,000 of Population

Cases	Deaths
Over 4,000	Over 415
3,000 to 4,000	300 to 415
Under 3,000	Under 300
(No oblique)	H&B (Neither horizontal nor perpendicular)

from pneumonia are four times as numerous as those from influenza.

A study of the map shows that though Chicago is medium in morbidity and medium in mortality the county outside of the city is high in number of cases but low in mortality. The low number of cases in the city may be misleading. It is not impossible that the cases were more fully reported in the surrounding area. However, we find a similar condition shown in Alexander County as compared with Cairo, in Macon County as compared with Decatur, in McLean County as compared with Bloomington, in Rock Island County as compared with Rock Island, in Tazewell County as compared with Pekin. It is very natural that the inhabitants of the surrounding area should get their infection at their County Seat. Their sickness would be at home and away from the germ laden air of the city. We find in Winnebago County a reversal of these conditions. The morbidity is higher in Rockford than in the county, according to report, but the mortality is more than ten times greater in the county. This is explained by the fact already mentioned that Camp Grant was located in the County outside the limits of the city, and its death rate was very great because it was made up of extremely susceptible material.

Returning now to the map of the state, attention is called to Calhoun County. This county is a ridge of high ground between the Mississippi and the Illinois Rivers. It is the only county in the State which is not touched by a railroad and it is not even served by an electric line. It contains no large town; the people are very largely farmers. Its isolated position and its rural character would lead one to expect that it would have few cases and that they would be of a mild nature. In fact we found that the cases reported were at the rate of 8,862 per 100,000, more than double the average for the State. The death rate however was 267.1 whereas the average for the State was 396.6. The large number of cases may have been the result of duplication of reports, because the reporting areas are not clearly defined. The small population of the county—8,610—makes it possible that a very

few double reports would be very misleading as each case would be at the rate of 100 per 100,000.

Comparing a map showing density of population of counties with the influenza map we see that density of population has apparently little direct relationship either with the incidence or fatality of influenza. Of the counties showing high incidence and high mortality only three have a population of over 90 to the square mile according to the 1910 census, namely, Lake, Rock Island and Peoria. Williamson County is high in population but low both in incidence and mortality from influenza. The mortality in Cook County from Influenza is medium, and there the population is most dense. The same is true of Madison and St. Clair Counties, which are also reckoned among the dense population. Carroll, Lee, Kendall, Stark, Putnam, Clark, Clinton and Hamilton Counties which are low both in incidence and mortality from influenza have a population of less than 45 to the square mile. Generally speaking the counties having a population less than 45 to the square mile show low mortality.

On looking over the death certificates one is struck with the large number of names which show Italian, or Slav nationality. This class of people generally live in crowded quarters which are poorly ventilated. We are lead to suspect that their great mortality is not due to their nationality per se but it is more likely to be the result of their environment and manner of living. This predominance of such foreign born among the deaths in mining communities may perhaps to some degree account for the increased mortality among miners. A special study was not made upon this point, but the suggestion is made more from a general knowledge of conditions.

STATE OF ILLINOIS
DEPARTMENT OF PUBLIC HEALTH
JANUARY, 1920

INFLUENZA, Illinois, Fiscal Year, July 1, 1918-June 30, 1919

	Popula- tion	Reported		Per 100,000 of		Deaths per 1,000 cases
		Cases	Deaths	Cases	Deaths	
STATE	6,359,102	223,683	25,222	3,517	396.6	112.7
Adams	64,588	2,580	211	M3,995	M326.7	81.8
Alexander	25,699	795	82	M3,094	M319.2	103.2
Bond	17,949	418	57	L2,330	M317.7	136.3
Boone	15,481	466	51	M3,010	M329.5	109.5

INFLUENZA, Illinois, Fiscal Year, July 1, 1918-June 30, 1919—Continued

	Popu- lation	Reported		Per 100,000 of		Deaths per 1,000 cases
		Cases	Deaths	Population Cases	Population Deaths	
Brown	10,397	973	19	H9,364	L182.8	19.5
Bureau	46,934	2,931	148	H6,245	M315.3	50.5
Calhoun	8,610	763	23	H8,862	L267.1	30.1
Carroll	18,035	479	42	L2,657	L235.1	87.7
Cass	17,501	674	79	M3,851	H451.4	117.2
Champaign	55,539	3,314	231	M5,968	H416.0	69.7
Christian	35,309	1,768	167	H5,008	H473.1	94.5
Clark	23,517	559	68	L2,378	L289.2	121.6
Clay	18,661	954	57	H5,113	M307.9	59.7
Clinton	25,480	687	63	L2,696	L246.7	91.7
Coles	34,842	2,604	126	H7,474	M361.6	48.4
Cook	2,904,800	59,136	9,278	L2,036	M319.5	156.9
Crawford	32,490	1,427	76	H4,392	L233.9	53.3
Cumberland	14,281	198	40	L1,386	L280.1	202.0
DeKalb	34,953	1,236	115	M3,536	M329.0	93.0
DeWitt	18,906	1,350	77	H7,143	M407.4	57.0
Douglas	20,024	968	68	H4,835	M339.7	70.2
DuPage	38,044	720	83	L1,893	L218.2	115.2
Edgar	27,336	844	83	M3,088	M303.7	98.3
Edwards	10,049	949	21	H9,452	L209.1	22.1
Effingham	20,055	1,120	83	H5,586	M413.9	74.1
Fayette	28,083	1,374	82	H4,893	L292.0	59.7
Ford	17,096	618	67	M3,616	M392.0	108.4
Franklin	31,466	2,284	244	H7,260	H775.6	106.8
Fulton	52,501	2,022	244	M3,851	H464.8	120.6
Gallatin	14,628	506	53	M3,461	M362.5	104.7
Greene	22,863	758	84	M3,390	M375.7	110.8
Grundy	24,183	1,415	101	H5,852	H417.7	71.4
Hamilton	18,227	475	37	L2,607	L203.0	77.9
Hancock	30,638	1,286	93	H4,198	M303.6	72.3
Hardin	7,015	263	53	M3,749	H755.5	201.5
Henderson	9,724	294	22	M3,023	L226.2	74.8
Henry	43,224	2,211	120	H5,116	L277.6	54.3
Iroquois	35,543	1,164	111	M3,275	M312.3	95.4
Jackson	36,262	1,344	140	M3,706	M386.1	104.2
Jasper	18,157	806	43	4,441	236.9	53.3
Jefferson	29,973	1,142	70	M3,810	L233.6	61.3
Jersey	13,954	774	28	5,548	200.7	36.2
Jo Daviess	22,654	1,110	43	4,901	189.8	33.7
Johnson	14,331	77	56	527.3	390.8	727.3
Kane	103,386	4,321	335	4,179	324.3	77.5
Kankakee	43,919	1,449	133	M3,300	H416.7	126.3
Kendall	10,777	292	27	2,711	250.7	92.5
Knox	48,405	1,987	140	4,105	239.2	70.5
Lake	73,180	3,145	1,085	4,298	1,482.0	545.0
LaSalle	92,208	6,681	400	7,246	433.9	59.9
Lawrence	28,072	137	61	4,881	217.3	445.2
Lee	27,750	441	64	1,539	230.6	145.1
Livingston	40,465	3,454	121	5,536	299.1	35.0
Logan	31,564	1,015	116	M3,216	M367.5	114.2
Macon	63,163	2,634	187	4,170	296.1	71.0
Macoupin	58,116	4,954	186	8,525	320.1	37.5
Madison	112,027	4,105	399	3,665	356.2	97.2
Marion	39,188	1,915	133	4,888	339.4	69.5
Marshall	15,679	920	37	5,868	236.3	40.2
Mason	17,377	1,546	50	8,397	287.8	32.4
Massac	15,157	434	91	2,865	600.7	209.7
McDonough	26,887	1,917	73	7,094	271.5	38.3
McHenry	34,930	1,569	70	4,492	300.4	44.6
McLean	68,149	3,432	243	5,036	356.6	70.8

INFLUENZA, Illinois, Fiscal Year, July 1, 1918-June 30, 1919—Concluded

	Popula- tion	Reported		Per 100,000 of		Deaths per 1,000 cases
		Cases	Deaths	Population Cases	Deaths	
Menard	12,796	1,803	51	10,180	398.6	39.6
Mercer	19,723	639	55	3,240	278.9	86.1
Monroe	13,508	416	25	3,081	185.2	60.1
Montgomery	39,254	1,893	111	4,823	283.8	58.6
Morgan	34,420	2,949	135	8,563	392.2	45.9
Moultrie	14,630	305	46	2,085	314.4	150.8
Ogle	27,864	1,008	40	3,613	143.5	39.7
Peoria	110,524	10,442	491	9,428	444.3	47.0
Perry	24,075	1,426	107	5,924	444.5	75.0
Piatt	16,376	1,754	45	10,710	274.9	25.7
Pike	28,622	1,261	66	4,406	230.6	52.3
Pope	11,215	4	18	35.7	160.6	4,500.0
Fulaski	16,616	380	62	2,288	373.3	163.2
Putnam	10,041	132	19	1,314	189.2	144.9
Randolph	30,101	1,921	113	6,382	375.4	58.8
Richland	15,970	490	29	3,068	181.6	59.2
Rock Island	83,767	4,502	391	5,375	466.8	86.9
Saline	37,715	3,113	135	8,255	358.0	43.4
Sangamon	108,155	5,517	410	5,101	379.3	74.3
Schuyler	14,852	74	43	498.3	289.8	581.6
Scott	10,067	353	19	3,509	188.8	53.8
Shelby	31,693	1,040	75	3,282	236.6	72.1
Stark	10,098	216	17	2,140	168.5	78.7
St. Clair	149,130	7,519	595	5,041	399.0	79.1
Stephenson	39,142	1,391	98	3,554	250.2	70.5
Tazewell	34,734	2,674	135	7,699	388.7	50.5
Union	21,856	885	120	4,050	549.2	135.6
Vermilion	88,894	3,525	403	3,966	453.4	114.3
Wabash	16,965	385	56	2,270	330.2	145.4
Warren	23,442	1,808	54	7,713	230.4	29.9
Washington	18,759	1,219	40	6,498	213.3	32.8
Wayne	25,697	585	90	2,277	350.3	153.8
White	23,052	769	63	3,336	273.3	81.9
Whiteside	34,507	2,274	113	6,589	327.5	49.7
Will	92,841	1,287	376	1,336	405.0	292.2
Williamson	60,353	844	160	1,398	265.1	189.6
Winneshago	76,649	1,461	300	1,906	391.4	205.3
Woodford	20,506	1,735	72	8,461	351.2	41.5
Total		223,683	25,222			
Chicago City	2,621,419	43,371	8,459	1,654	323.7	195.0
Cook Co., outside Chicago	283,481	15,765	819	5,566	288.9	52.0

ILLINOIS FISCAL YEAR, JULY 1, 1918 TO JUNE 30, 1919

Comparison of Cities with Remainder of Including Counties

Per 100,000 population

City County (Outside)	Population	Reported cases influenza	Deaths influenza- pneumonia	Deaths—Influenza- pneumonia, per 1,000 cases of influenza
Quincy	36,883	4,454	586.8	131.8
Adams Co.	27,705	3,368	360.9	107.2
Cairo	16,296	1,602	693.4	433.0
Alexander Co.	9,403	5,679	553.2	9.4
Champaign	15,865	8,339	598.8	71.8
Urbana	10,624	5,045	677.7	134.3
Champaign Co.	29,050	6,615	668.3	101.1
Mattoon	12,996	10,111	400.1	39.6
Coles Co.	21,846	5,905	508.1	86.0
Chicago	2,621,419	1,654	584.4	353.2
Cook Co.	283,481	5,563	518.0	93.0
DeKalb	10,036	4,812	458.3	95.2
DeKalb Co.	24,917	2,219	402.5	19.9
Kewanee	19,184	6,778	372.9	55.0
Henry Co.	24,040	2,770	424.3	153.2
Galesburg	25,155	5,702	481.0	67.0
Knox Co.	23,250	2,379	322.5	135.6
LaSalle	12,495	1,521	920.4	60.5
Streator	14,313	11,801	1,020.0	86.4
LaSalle Co.	55,865	4,716	426.0	100.9
Decatur	44,261	1,701	423.6	197.8
Macon Co.	18,902	9,147	402.1	44.0
Alton	30,036	3,702	464.2	131.3
Madison Co.	63,515	3,608	538.9	149.3
Bloomington	27,663	3,561	571.2	160.4
McLean Co.	40,480	5,986	383.3	64.0
Jacksonville	15,543	10,030	855.7	85.3
Morgan Co.	18,877	7,199	360.2	50.0
Peoria	72,184	11,374	669.1	58.8
Peoria Co.	38,340	6,457	546.8	84.7
Rock Island	32,561	2,442	540.5	274.0
Rock Island Co.	23,230	5,349	779.2	136.4
Springfield	64,877	5,860	678.2	115.7
Sangamon Co.	43,278	4,009	318.9	80.5
Belleville	21,161	9,593	926.2	96.5
East St. Louis.	78,213	5,043	719.8	142.8
St. Clair Co.	49,756	3,105	154.8	49.8
Freeport	19,844	4,812	462.5	96.3
Stephenson Co.	19,298	2,259	243.6	107.8
Pekin	12,137	4,070	667.4	164.0
Tazewell Co.	22,597	9,647	508.9	52.8
Danville	32,969	2,563	785.6	366.5
Vermilion Co.	55,925	4,810	448.8	93.3
Joliet	39,353	480	947.8	1,974.0
Will Co.	53,925	2,036	421.0	206.7
Rockford	60,213	2,031	634.4	312.3
Winnebago Co.	16,436	1,448	7,676.0	5,294.0