Economic Effects of the 1918 Influenza Pandemic

Implications for a Modern-day Pandemic

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The report is also available online at
www.stlouisfed.org/community/other_pubs.html.

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Abstract

The possibility of a worldwide influenza pandemic in the near future is of growing concern for many countries around the globe. Many predictions of the economic and social costs of a modern-day influenza pandemic are based on the effects of the influenza pandemic of 1918. This report begins by providing a brief historical background on the 1918 influenza pandemic, a short-lived, but tragic event that has all but escaped the public's consciousness today.

Detailed influenza mortality statistics for cities and states, including those in the Eighth Federal Reserve District, are presented. These data provide insight into mortality differences based on race, income and place of residence. Next, anecdotal evidence on the economic effects of the 1918 influenza are reported using newspaper articles published during the pandemic. There is also a survey of economic research on the subject. The information presented in this report and information provided in two prominent publications on the 1918 influenza pandemic are then used to formulate a list of the likely economic effects of a modern-day influenza pandemic.

I. Introduction

The possibility of a worldwide influenza pandemic (e.g., the avian flu) in the near future is of growing concern for many countries around the globe. The World Bank estimates that a global influenza pandemic would cost the world economy $800 billion and kill tens-of-millions of people.[1] Researchers at the U.S. Centers for Disease Control and Prevention calculate that deaths in the United States could reach 207,000 and the initial cost to the economy could approach $166 billion, or roughly 1.5 percent of the GDP.[2] Long-run costs are expected to be much greater. The U.S. Department of Health and Human Services paints a more dire picture—up to 1.9 million dead in the United States and initial economic costs near $200 billion.[3]

While researchers and public officials can only speculate on the likelihood of a global influenza pandemic, many of the worst-case scenario predictions for a current pandemic are based on the global influenza pandemic of 1918, which killed 675,000 people in the United States (nearly 0.8 percent of the 1910 population) and 40 million people worldwide from the early spring of 1918 through the late spring of 1919.[4] In all of recorded history, only the Black Death that occurred throughout Europe from 1348-1351 is estimated to have killed more people (roughly 60 million) over a similar time period.[5]

The years 1918 and 1919 were difficult not only as a result of the influenza pandemic; these years also marked the height of U.S. involvement in World War I. Given the magnitude and the concurrence of both the influenza pandemic and World War I, one would expect volumes of research on the economic effects of each event. Although significant literature on the economic consequences of World War I does exist, the scope of research on the economic effects of the 1918 influenza pandemic is scant at best. Most research has focused on the health and economic outcomes of descendants of pandemic survivors and the mortality differences across socioeconomic classes.[6] Certainly an event that caused 40 million worldwide deaths in a year should be closely examined not only for its historical significance, but also for what we can learn in the unfortunate chance the world experiences another influenza pandemic.

This report discusses some of the economic effects of the 1918 influenza pandemic in the United States. The first sections of the report present and discuss demographic differences in pandemic mortalities. Were deaths higher in cities than in rural areas? Did deaths differ by race? Did deaths differ by income? Detailed influenza mortality data at various geographic and demographic levels at the time of the pandemic are available. The presentation of numerous mortality data series allows for an almost unlimited number of comparisons and analyses that afford the reader the opportunity to study the available data and generate his own analyses and conclusions in addition to those presented here.

Evidence of the effects of the pandemic on business and industry is obtained from newspaper articles printed during the pandemic, with most of the articles appearing in newspapers from the Eighth Federal Reserve District cities of Little Rock, Ark., and Memphis, Tenn. Newspaper articles from the fall of 1918 were used because of the almost complete absence of economic data from the era, such as data on income, employment, sales and wages. This absence of data, especially at local levels (e.g., city and county) is a likely reason for the scarcity of economic research on the subject, though several studies that have used available economic data are reviewed here and nicely complement the information obtained from newspaper articles.

Although the influenza pandemic occurred nearly 90 years ago in a world that was much different than today, the limited economic data and more readily available mortality data from the time of the event can be used to make reasonable inferences about economic and social consequences of a modern-day pandemic. Despite technological advances in medicine and greater health coverage throughout the 20th century, deaths from a modern-day influenza pandemic are also likely to be related to race, income and place of residence. Thus, the geographic and demographic differences

in pandemic mortalities from 1918 can shed light on the possible effects of a modern-day pandemic, a point that is taken up in the last section of the report.

Overview of the 1918 Influenza Pandemic

The influenza pandemic in the United States occurred in three waves during 1918 and 1919.[7] The first wave began in March 1918 and lasted throughout the summer of 1918. The more devastating second and third waves (the second being the worst) occurred in the fall of 1918 and the spring of 1919. According to one researcher:

> *"Spanish influenza moved across the United States in the same way as the pioneers had, for it followed their trails which had become railroads…the pandemic started along the axis from Massachusetts to Virginia…leaped the Appalachians…positioned along the inland waterways…it jumped clear across the plains and the Rockies to Los Angeles, San Francisco, and Seattle. Then, with secure bases on both coasts...took its time to seep into every niche and corner of America."*[8]

But the pandemic's impact on communities and regions was not uniform across the country. For example, Pennsylvania, Maryland and Colorado had the highest mortality rates, but these states had very little in common. Arguments have been made that mortality rates were lower in later-hit cities because officials in these cities were able to take precautions to minimize the impending influenza, such as closing schools and churches and limiting commerce. The virulence of the influenza, like a typical influenza, weakens over time, so the influenza that struck on the West Coast was somewhat weaker than when it struck the East Coast. But these reasons cannot completely explain why some cities and regions experienced massive mortality rates while others were barely hit with the influenza. Much research has been conducted over the past decades to provide insights into why the pandemic had such different effects on different regions of the country.[9]

The global magnitude and spread of the pandemic was exacerbated by World War I, which itself is estimated to have killed roughly 10 million civilians and 9 million troops.[10] Not only did the mass movement of troops from around the world lead to the spread of the disease, tens of thousands of Allied and Central Power troops died as a result of the influenza pandemic rather than combat.[11] Although combat deaths in World War I did increase the mortality rates for participating countries, civilian mortality rates from the influenza pandemic of 1918 were typically much higher. For the United States, estimates of combat-related troop mortalities are about one-tenth that of civilian mortalities from the 1918 influenza pandemic.

Mortality rates from a typical influenza tend to be the greatest for the very young and the very old. What made the 1918 influenza unique was that mortality rates were the highest for the segment of the population aged 18 to 40, and more so for males than females of this age group. In general, death was not caused by the influenza virus itself, but by the body's immunological reaction to the virus. Individuals with the strongest immune systems were more likely to die than individuals with weaker immune systems.[12] One source reports that out of 272,500 male influenza deaths in 1918, nearly 49 percent were aged 20 to 39, whereas only 18 percent were under age 5 and 13 percent were over age 50.[13] The fact that males aged 18 to 40 were the hardest hit by the influenza had serious economic consequences for the families that had lost their primary breadwinner. As discussed later in the report, the significant loss of prime working-age employees also had economic consequences for businesses.

Despite the severity of the pandemic, it is reasonable to say that the influenza of 1918 has almost been forgotten as a tragic event in American history. This is not good, as learning from past pandemics may be the only way to reasonably prepare for any future pandemics. Several factors may explain why the influenza pandemic of 1918 has not received a notable place in U.S. history.[14]

First, the pandemic occurred at the same

time as World War I. The influenza struck soldiers especially hard, given their living conditions and close contact with highly mobile units. Much of the news from the day focused on wartime events overseas and the current status of America troops. Thus, the pandemic and World War I were almost seen as one event rather than two separate events. Second, diseases of the day like polio, smallpox and syphilis were incurable and a permanent part of society. Influenza, by contrast, swept into communities, killed members of the population, and was gone. Finally, unlike polio and smallpox, no famous people of the era died from the influenza; thus there was no public perception that even the politically powerful and rich and famous were not immune from the virus.

Although the influenza pandemic of 1918 may be an event that has been relegated to the shadows of American history, the event had significant economic effects. The fact that most of these effects were relatively short-lived does not make them less important to study, especially given the nonzero probability of a future influenza pandemic.

While not a primary focus of this report, the influenza pandemic of 1918 resulted in great human suffering in select areas, as increasing body counts overwhelmed city and medical officials (partly exacerbated by personnel absences from the war). In some cities, like Philadelphia, bodies lay along the streets and in morgues for days, similar to medieval Europe during the Black Death. In light of the potential economic turmoil and human suffering, an understanding of state and federal government response to the 1918 pandemic may also provide some light into what, if anything, government at any level can do to prevent or minimize a modern-day pandemic.

II. Pandemic Mortalities in the United States

Data on mortalities from the 1918 influenza pandemic are found in *Mortality Statistics*, an annual publication that is released by the U.S. Census.[15] Mortalities resulting from hundreds of causes of death are listed (depending upon the level of data aggregation), and are also broken down, in some cases, by age, race and sex. Data are available at the national, state and municipal levels, and may be available by week, month and year. In terms of coverage, "(a)ll death rates are based on total deaths, including deaths of non-residents, deaths in hospitals and institutions, and deaths of soldiers, sailors, and marines."[16] The mortality rates used in this study represent deaths from both influenza and pneumonia in a given year because "it is not believed to be best to study separately influenza and the various forms of pneumonia....for doubtless many cases were returned as influenza when the deaths were caused by pneumonia and vice versa."[17]

Although *Mortality Statistics* provides a remarkable number of statistics, a major disadvantage of the earlier reports is that, in the 1910s, data coverage is for 75 to 80 percent of the total population. This is because the U.S. Census acquired the mortality data from a registration area that consisted of a growing group of states over time. So, mortality data for certain states are not consistently available over time. For the purposes here, influenza mortality data for the 1910s are available for about 30 states and encompass, on average, about 79.5 percent of the U.S. population. A casual look at the states that did and did not report mortality information does not reveal any systematic differences across each group of states with regard to population, income and race. So, the available mortality statistics are unlikely to provide a biased picture of influenza mortalities.

The following sections report select influenza mortality data at various levels of data aggregation (city and state), by race (white and nonwhite) and residence (urban versus rural). The abundance of mortality statistics makes it impossible to use all existing data in a single report. However, the statistics used here do reveal some general mortality patterns that provide insights into which groups of people may be most/least affected by a modern-day pandemic, as well as how influenza mortalities differed across cities and states.

State and City Pandemic Mortalities

Pandemic mortality rates (per 100,000) for 27 states are shown in Table 1 for years 1918 and 1919. The mortality rate for 1915 is also included, and the ratio of 1918 mortalities to 1915 mortalities is shown to reveal the relative magnitude of deaths in 1918 to a nonpandemic year. For the states shown in Table 1, Pennsylvania, Maryland and New Jersey had the highest mortality rates in 1918, whereas Michigan, Minnesota and Wisconsin had the lowest. The pandemic also lasted throughout the spring of 1919; so, the ranking of states in 1918 does not reflect total mortalities in each state for the entire pandemic (though the rankings do remain similar).

The ratio of the 1918 mortality rate and the 1915 mortality rate ranges from a low of 3.2

Table 1: Influenza Mortality Rates (per 100,000) for Select States

State	1910 pop.	Area (sq. mi.)	Population Density	1915 Mortality Rate	1918 Mortality Rate	1919 Mortality Rate	Ratio of 1918 and 1915 Rates	1918 Rank
CA	2,377,549	155,652	15.27	102.1	537.8	214.7	5.3	15
CO	799,024	103,658	7.71	170.5	766.5	253.5	4.5	5
CT	1,114,756	4,820	231.28	169.2	767.7	224.5	4.5	4
IN	2,700,876	36,045	74.93	126.1	408.1	213.7	3.2	24
KS	1,690,949	81,774	20.68	116.7	474.4	188.1	4.1	22
KY	2,289,905	40,181	56.99	118.0	537.3	284.6	4.6	16
ME	742,371	29,895	24.83	166.0	589.4	229.2	3.6	14
MD	1,295,346	9,941	130.30	171.0	803.6	238.4	4.7	2
MA	3,366,416	8,039	418.76	170.7	726.7	207.8	4.3	8
MI	2,810,173	57,480	48.89	111.9	389.3	192.2	3.5	27
MN	2,075,708	80,858	25.67	100.3	390.5	166.9	3.9	26
MO	3,293,335	68,727	47.92	144.2	476.6	206.1	3.3	20
MT	376,053	146,201	2.57	117.7	762.7	225.4	6.5	6
NH	430,572	9,031	47.68	153.2	751.6	231.6	4.9	7
NJ	2,537,167	7,514	337.66	163.4	769.4	226.5	4.7	3
NY	9,113,614	47,654	191.25	185.2	598.2	233.7	3.2	12
NC	2,206,287	48,740	45.27	148.4	503.1	234.4	3.4	18
OH	4,767,121	40,740	117.01	135.2	494.3	222.0	3.7	19
PA	7,665,111	44,832	170.97	168.9	883.1	236.5	5.2	1
RI	542,610	1,067	508.54	185.8	681.2	239.2	3.7	9
SC	1,515,400	30,495	49.69	131.9	632.6	291.5	4.8	10
TN	2,184,789	41,687	52.41	135.3	476.0	234.8	3.5	21
UT	373,351	82,184	4.54	119.5	508.8	270.8	4.3	17
VT	355,956	9,124	39.01	150.0	597.2	228.9	4.0	13
VA	2,061,612	40,262	51.20	131.1	621.1	267.2	4.7	11
WA	1,141,990	66,836	17.09	78.4	411.5	187.9	5.2	23
WI	2,333,860	55,256	42.24	119.6	405.6	178.5	3.4	25

Notes: Mortality rates are from Mortality Statistics 1920 *and include mortalities from influenza and pneumonia. Mortalities for South Carolina and Tennessee in 1915 are 1916 and 1917 figures, respectively.*

(Indiana and New York) to a high of 6.5 (Montana). This means that the 1918 influenza mortality rates in Indiana and New York were 3.2 times greater than influenza mortality rates in a nonpandemic year, whereas 1918 rates in Montana were more than 6 times greater than a nonpandemic year. One caveat is that an equal increase in mortalities for a low-population state and a higher-population state will result in a greater mortality ratio for the lower-population state because the increase in mortalities is a greater percentage of the low state's population. Nevertheless, a comparison of 1915 mortality rates with those in 1918 and 1919 clearly reveals how much more severe the 1918 influenza was relative to influenza in a nonpandemic year.

Also shown in Table 1 are state population, area and population density. It serves as an interesting exercise to see if there is a relationship between mortalities and state population, size and population density. It is also worth exploring whether the relationships are different in a pandemic year versus a nonpandemic year. Table 2 presents correlations (and their statistical significance) between state population, area and population density, and 1915 mortality rates, 1918 mortalities rates and the ratio of the two mortality rates.

Table 2: Correlations of State Characteristics with Influenza Mortalities

	1915 Mortality Rate	1918 Mortality Rate	Ratio of 1918 and 1915 Rates
Density (pop/sq. mi.)	0.632*	0.447*	-0.097
Area (sq. mi.)	-0.566*	-0.253	0.350
Population	0.250	0.031	-0.236

Note: denotes statistical significance at 5 percent or better. Correlations are based on the data in Table 1 (n = 27).*

The correlations shown in Table 2 reveal that mortality rates in 1915 were greater in more densely populated states (0.632), but lower in larger states (-0.566). State size had no significant correlation with 1918 mortality rates, but population density was correlated with 1918 mortality rates (0.447). Note, however, that the correlation between mortality rates and density is less for 1918 mortalities than for 1915 mortalities. This finding, in addition to the fewer significant correlations (albeit just one), suggest that state size and population density had less influence on mortality rates in 1918 than in 1915. Thus, as suggested by earlier research, the location of individuals was less of a factor in dying from the 1918 influenza than from a nonpandemic influenza.[18] Furthermore, the ratio of mortality rates had no relationship with state size, population or population density, as seen in the last column of Table 2.

Mortality statistics for 49 cities are listed in Table 3. As seen in the state-level statistics, influenza mortalities in U.S. cities during the pandemic were three to five times higher, on average, than during a nonpandemic year (1915). There is slightly more variation in 1918 mortality rates across cities (standard deviation = 182) than across states (standard deviation = 146). The cities with the highest 1918 mortality rates (Pittsburgh, Scranton and Philadelphia) are all located in Pennsylvania, and the cities with the lowest rates Grand Rapids, Minneapolis and Toledo are all located in the Midwest.

To get an idea of the influenza's effect on rural areas versus urban areas, the average 1918 mortality in all cities in a state (for which mortality data were available) was calculated and then divided by the state-level mortality rate.[19] These ratios are shown in Table 4. A ratio >1 suggests influenza deaths were, on average, greater in a state's cities than in the rural areas of the state, and vice versa for a ratio <1. As seen in Table 4, most of the ratios are >1, with some much >1 (Missouri, Kansas, Tennessee), thus revealing that cities in their respective state had higher mortality rates than rural areas of the states. This finding supports the positive correlation between population density and influenza mortalities shown in Table 2.

Table 3: Influenza Mortality Rates (per 100,000) for Select Cities

City	1910 pop.	1915 Mortality Rate	1918 Mortality Rate	1919 Mortality Rate	Ratio of 1918 and 1915 Rates	1918 Rank
Albany, N.Y.	100,253	187.1	679.1	244.8	3.6	22
Atlanta, Ga.	154,839	165.7	478.4	291.4	2.9	40
Baltimore, Md.	558,485	207.1	836.5	230.6	4.0	7
Birmingham, Ala.	132,685	158.1	843.6	319.1	5.3	6
Boston, Mass.	670,585	214.6	844.7	256.3	3.9	5
Bridgeport, Conn.	102,054	206.0	825.4	272.3	4.0	8
Buffalo, N.Y.	423,715	168.7	637.5	206.2	3.8	28
Cambridge, Mass.	104,839	157.3	676.5	180.0	4.3	23
Chicago, Ill.	2,185,283	172.7	516.6	191.5	3.0	35
Cincinnati, Ohio	353,591	163.4	605.4	253.2	3.7	29
Cleveland, Ohio	560,663	155.1	590.9	260.5	3.8	30
Columbus, Ohio	181,511	136.5	451.9	213.5	3.3	43
Dayton, Ohio	116,577	142.7	525.2	154.6	3.7	33
Denver, Colo.	213,381	184.8	727.7	228.5	3.9	15
Detroit, Mich.	465,766	148.1	413.4	242.4	2.8	46
Fall River, Mass.	119,295	213.5	799.7	216.8	3.7	9
Grand Rapids, Mich.	112,571	100.0	282.7	93.8	2.8	49
Indianapolis, Ind.	233,650	146.7	459.4	240.6	3.1	42
Jersey City, N.J.	267,779	211.2	756.6	317.0	3.6	13
Kansas City, Mo.	248,381	176.1	718.1	301.1	4.1	17
Los Angeles, Calif.	319,198	87.4	484.5	186.8	5.5	38
Lowell, Mass.	106,294	191.3	696.1	198.4	3.6	19
Memphis, Tenn.	131,105	179.3	666.1	340.6	3.7	24
Milwaukee, Wis.	373,857	158.9	474.1	187.7	3.0	41
Minneapolis, Minn.	301,408	121.6	387.7	169.4	3.2	48
Nashville, Tenn.	110,364	179.9	910.2	301.0	5.1	4
New Haven, Conn.	133,605	207.9	768.0	212.3	3.7	11
New Orleans, La.	339,075	245.8	768.6	333.7	3.1	10
New York, N.Y.	4,766,883	212.1	582.5	265.8	2.7	31
Newark, N.J.	347,469	146.6	680.4	213.3	4.6	21
Oakland, Calif.	150,174	98.6	496.6	238.2	5.0	36
Omaha, Neb.	124,096	150.9	660.8	191.8	4.4	26
Paterson, N.J.	125,600	159.4	683.6	235.7	4.3	20
Philadelphia, Pa.	1,549,008	189.2	932.5	222.9	4.9	3
Pittsburgh, Pa.	533,905	260.1	1243.6	431.8	4.8	1
Portland, Ore.	207,214	69.6	448.2	246.4	6.4	44
Providence, R.I.	224,326	191.4	737.4	253.3	3.9	14
Richmond, Va.	127,628	209.9	661.0	269.5	3.1	25

Table 3: Influenza Mortality Rates (per 100,000) for Select Cities						
City	1910 pop.	1915 Mortality Rate	1918 Mortality Rate	1919 Mortality Rate	Ratio of 1918 and 1915 Rates	1918 Rank
Rochester, N.Y.	218,149	121.8	522.7	152.8	4.3	34
San Francisco, Calif.	416,912	130.6	647.7	283.3	5.0	27
Scranton, Pa.	129,867	223.7	985.7	247.5	4.4	2
Seattle, Wash.	237,194	74.7	425.5	189.8	5.7	45
Spokane, Wash.	104,402	91.9	487.4	210.7	5.3	37
St. Louis, Mo.	687,029	156.7	536.5	202.3	3.4	32
St. Paul, Minn.	214,744	127.8	480.6	145.9	3.8	39
Syracuse, N.Y.	137,249	120.5	704.6	155.9	5.8	18
Toledo, Ohio	168,497	126.8	401.0	181.9	3.2	47
Washington, D.C.	331,069	189.8	758.8	225.9	4.0	12
Worcester, Mass.	145,986	188.9	727.1	248.9	3.8	16

Notes: Mortality rates are from Mortality Statistics 1920 *and include mortalities from influenza and pneumonia. Mortalities for Dallas and Houston in 1915 are 1916 and 1917 figures, respectively.*

Table 4: City Influenza Mortalities Relative to State Mortality Rate (1918)	
State	Average of Cities Relative to State
Michigan	0.89
Colorado	0.95
California	1.01
New York	1.02
Maryland	1.04
Massachusetts	1.06
Connecticut	1.07
Washington	1.11
Pennsylvania	1.11
Minnesota	1.11
Indiana	1.13
New Jersey	1.16
Wisconsin	1.17
Virginia	1.17
Ohio	1.19
Missouri	1.32
Kansas	1.58
Tennessee	1.66

Influenza Mortalities and Race

Influenza mortalities by race are available for some cities in the United States, though the racial breakdown is not as detailed as the modern-day mortality statistics. Mortality statistics for 1918 are provided on the basis of white and nonwhite. Table 5 presents a breakdown of white and nonwhite mortality rates (per 100,000 for each racial group) for 14 U.S. cities. For each racial group, influenza mortality rates for 1915 are also included; so, a comparison can be made between a pandemic year and a nonpandemic year.

Looking at the first six columns of Table 5, it is evident that nonwhite mortalities from influenza are higher than white influenza mortalities in both pandemic and nonpandemic years (except for Kansas City in 1918). However, white influenza mortalities as a percentage of nonwhite mortalities were less in 1915 than in 1918. Thus, white influenza mortality rates were typically less than nonwhite mortality rates, but this difference decreased in the influenza pandemic of 1918. As a group, whites were struck relatively harder by the influenza pandemic than nonwhites. This is supported by the last two columns of Table 5 that show 1915 influenza mortality rates relative to 1918 mortality rates for each racial group. Clearly, across the 14 cities listed, the relative difference in mortality rates for the two years is larger for whites than it is for nonwhites.

It is reasonable to assume that racial differences in influenza mortality rates are reflecting, to some degree, differences in population

Table 5: Influenza Mortality Rate By Race and City, 1915 and 1918								
	1	2	3	4	5	6	7	8
City	White Mortality Rate 1918	Nonwhite Mortality Rate 1918	White, % of Nonwhite 1918	White Mortality Rate 1915	Nonwhite Mortality Rate 1915	White, % of Nonwhite 1915	White 1915, % of White 1918	Nonwhite 1915, % of Nonwhite 1918
Birmingham, Ala.	676.3	1,101.8	61.4%	114.7	225.0	51.0%	17.0%	20.4%
Atlanta, Ga.	362.2	730.3	49.6%	99.3	305.5	32.5%	27.4%	41.8%
Indianapolis, Ind.	440.6	615.2	71.6%	132.9	264.5	50.2%	30.2%	43.0%
Kansas City, Mo.	758.5	701.6	108.1%	216.9	445.2	48.7%	28.6%	63.5%
Louisville, Ky.	1,012.3	1,015.5	99.7%	111.2	369.6	30.1%	11.0%	36.4%
New Orleans, La.	679.7	1,019.0	66.7%	165.1	472.3	35.0%	24.3%	46.3%
Baltimore, Md.	787.8	1,086.9	72.5%	169.3	406.0	41.7%	21.5%	37.4%
Memphis, Tenn.	608.0	766.0	79.4%	111.4	290.7	38.3%	18.3%	38.0%
Nashville, Tenn.	884.0	1,060.4	83.4%	130.0	288.7	45.0%	14.7%	27.2%
Dallas,* Texas	572.8	845.8	67.7%	67.9	149.8	45.3%	11.9%	17.7%
Houston,* Texas	485.8	618.5	78.5%	98.0	143.9	68.1%	20.2%	23.3%
Norfolk, Va.	739.8	835.6	88.5%	98.8	305.8	32.3%	13.4%	36.6%
Richmond, Va.	555.8	883.4	62.9%	131.5	367.0	35.8%	23.7%	41.5%
Washington, D.C.	694.3	942.0	73.7%	129.9	354.9	36.6%	18.7%	37.7%

**Mortality rates for Dallas and Houston are for 1916 and 1917, respectively, not 1915.*

Table 6: Location and Race, 1890-1990				
Year	White as a Percent of U.S. Urban Population	Nonwhite as a Percent of U.S. Urban Population	Percent of White Population That Is Urban	Percent of Nonwhite Population That Is Urban
1890	93.35%	6.65%	35.06%	17.54%
1910	93.45%	6.55%	48.73%	27.26%
1930	92.18%	7.82%	57.63%	43.20%
1950	89.93%	10.07%	64.29%	61.64%
1970	86.24%	13.76%	72.45%	80.71%
1990	76.88%	23.12%	72.02%	88.21%

Note: Population data are from Historical Statistics of the United States, *U.S. Census.*

density (as seen in Table 2) and geography (as seen in Table 4). To confirm this hypothesis, data on white and nonwhite population, as well as rural and urban place of residence, were gathered for several decennial Census years. These data are shown in Table 6.

In 1910, the great majority of the urban population (having a higher population density than rural areas) in the United States was white (over 90 percent). This can explain why whites as a group had a much larger increase in influenza mortalities during the pandemic than did nonwhites.

What does this imply if an influenza pandemic struck today? The last two columns of Table 6 reveal that the nonwhite population in the United States has become much more urban (27 percent in 1910 and 88 percent in 1990) compared with the white population (49 percent in 1910 and 72 percent in 1990). However,

the fact that both racial groups are becoming more urban does not bode well for either group because population density will certainly be a significant determinant of mortality. A modern-day pandemic may result in greater nonwhite mortality rates because a greater percentage of the nonwhite population in the United States lives in urban areas.

Of course, race and place of residence (and population density) are not the only factors that are likely to influence mortality rates. Access to health care is likely to be critical (assuming health professionals themselves are not decimated by the pandemic). So, it stands to reason that mortality rates in urban areas may be somewhat mitigated given the relatively greater access to health care than in rural areas. Ability to pay, which relates to income, may also be important. Urban areas, on average, tend to have greater incomes, but this is an average and ignores those individuals with low incomes in urban areas who cannot afford health care. The ability of free clinics and emergency rooms to remain open during a pandemic will be crucial to the treatment of lower-income individuals. The final section of this report discusses the implications for a modern-day pandemic and will expand on these points.

Pandemic Mortalities in Eighth Federal Reserve District States

Data on mortalities from 1915 to 1920 for cities located in Eighth Federal Reserve District States are shown in Table 7. The first column of data contains mortality rates per 100,000 population (from *Mortality Statistics 1920*). These data are also shown in Figure 1. The number of deaths (found by multiplying the rate in the first column by city population) is shown in the second column. The third column contains "normal" influenza deaths and was calculated by subtracting the number of excess deaths in each year from the total number of deaths shown in column 2 (see notes to Table 7). Normal influenza deaths reflect the number of influenza deaths absent a pandemic. The ratio of total deaths to normal deaths presented in column 4 provides a measure of the severity of influenza in each year relative to a normal influenza. Clearly, this ratio is much larger for the years 1918 and 1919.

The data in Table 7 allow for several interesting comparisons. First, in all cities, the ratio of total deaths to normal deaths in pandemic years was at least twice the normal rate. The ratio was more than four times as high in Nashville and Kansas City in 1918 and at least three times as high in Memphis, St. Louis and Indianapolis. Chicago and Louisville had the lowest ratios in 1918 (2.47 and 2.59, respectively). So, although larger cities like Chicago had more influenza deaths in 1918 (and other years as well), the relative mortality of influenza in a larger city like Chicago was less than in other cities like Nashville and Kansas City.

State-level mortality rates and rural mortality rates for states located in the Eighth Federal Reserve District are shown in Table 8. The rural mortality rates are not necessarily reflective of what one thinks a rural area to be: The rural mortality rates in Table 8 are computed by subtracting the number of mortalities in a state's city (from Table 7) from the number of mortalities at the state level (first column of Table 8).[20] Thus, for example, the rural mortality rate in Kentucky is the mortality rate for all of Kentucky except for Louisville. Certainly there are other nonrural areas in Kentucky in addition to Louisville, but mortality data on these areas are not available. Nevertheless, because mortality rates are generally available for the largest cities in a state, the rural mortality rates are likely to provide an approximate picture of the influenza's impact on less populated areas of a state.

The rural mortality rate relative to the city rate for each state is similar to the data presented in Table 4, but the data in Table 8 allow for multiple-year comparisons and a comparison between rural and city rather than city and state. As Table 8 shows, the state rural rate is almost always less than the city rate (except Kentucky in 1920), which also supports the results in Table 2 that reveal a positive correlation between population density and influenza mortalities.

Although the rural mortality rate is less than the city rate in most cases, there are differ-

Table 7: Influenza Mortalities Cities in Eighth District States

Louisville, Ky.

Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	156.5	359	340	1.06
1916	185.2	427	342	1.25
1917	209.5	485	366	1.33
1918	1,012.9	2,357	1,287	1.83
1919	357.8	837	322	2.59
1920	197.2	463	322	1.44

Memphis, Tenn.

Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	179.3	263	261	1.01
1916	n/a	n/a	n/a	n/a
1917	219.0	335	282	1.19
1918	666.1	1,040	312	3.33
1919	340.6	542	316	1.71
1920	311.4	506	369	1.37

Nashville, Tenn.

Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	179.9	206	209	0.98
1916	n/a	n/a	n/a	n/a
1917	188.6	219	230	0.95
1918	910.2	1,063	249	4.27
1919	301.0	354	234	1.51
1920	301.9	357	232	1.54

St. Louis, Mo.

Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	156.7	1,144	1,191	0.96
1916	200.4	1,480	1,212	1.22
1917	227.0	1,696	1,216	1.39
1918	536.5	4,054	1,262	3.21
1919	202.3	1,546	1,207	1.28
1920	262.9	2,032	1,198	1.70

Kansas City, Mo.

Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	176.1	504	386	1.31
1916	138.7	408	397	1.03
1917	205.0	618	407	1.52
1918	718.1	2,220	479	4.64
1919	301.1	954	429	2.22
1920	353.6	1,147	489	2.35

Table 7: Influenza Mortalities Cities in Eighth District States

Chicago, Ill.				
Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	172.7	4,220	4,884	0.86
1916	168.4	4,202	5,000	0.84
1917	201.7	5,137	5,082	1.01
1918	516.6	13,423	5,433	2.47
1919	191.5	5,075	4,388	1.16
1920	223.9	6,049	2,893	2.09
Indianapolis, Ind.				
Year	Total Influenza Deaths Per 100,000	Total Influenza Deaths	Normal Influenza Deaths	Ratio of Total Deaths to Normal Deaths
1915	146.7	420	383	1.10
1916	153.7	452	396	1.14
1917	156.6	472	301	1.57
1918	459.4	1,420	467	3.04
1919	240.6	762	425	1.79
1920	240.9	782	432	1.81

Note: Explanation of variables:
Column (1): Total influenza deaths per 100,000 are from Mortality Statistics 1920.
Column (2): The number of influenza deaths was computed by multiplying the death rates in column 1 by the city population for the respective year.
Column (3): This variable uses information on excess influenza deaths. Excess deaths from influenza are reported in Table A of Mortality From Influenza and Pneumonia in 50 Large Cities of the United States, 1910-1929, *U.S. Treasury and Public Health Service, Government Printing Office, Washington D.C., 1930. The report defines excess deaths (on an annual basis) per 100,000 as the excess over the median monthly rate for the period 1910-1916 prior to July 1, 1919, and as the excess over the median monthly rate for the period 1921-1927 after July 1, 1919. For the purpose here, the rates on an annual basis were converted to a monthly basis, then converted to levels, and then summed for the year to get a measure of the total number of excess deaths for the city for the year. It is this number that is subtracted from total deaths (column 2) to get the number of normal deaths shown in Column 3.*

Figure 1: Ratio of Total Influenza Deaths to "Normal" Deaths

Cities in Eighth District States

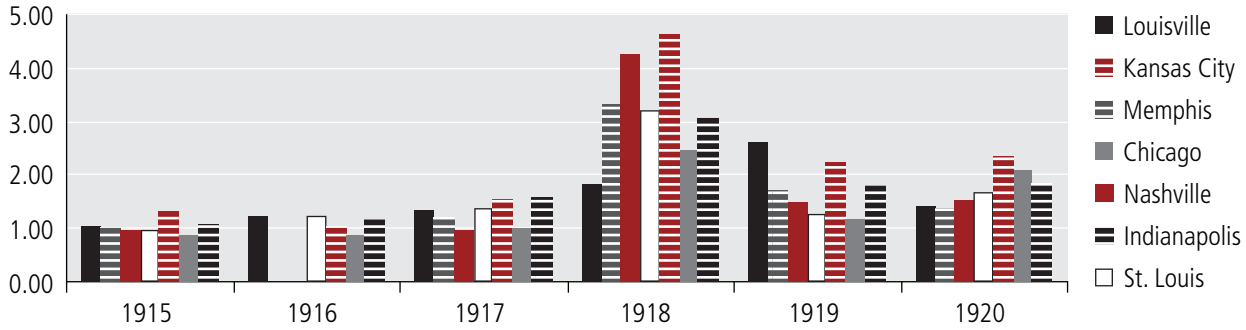

Table 8: Urban/Rural Influenza Mortalities: Eighth District States and Cities

Kentucky

Year	State Mortality Rate Per 100,000	Rural Mortality Rate Per 100,000	Rural Rate as a Percentage of Louisville
1915	118.0	113.9	72.8
1916	152.7	149.3	80.6
1917	144.7	137.8	65.8
1918	537.3	486.8	48.1
1919	284.6	276.7	77.4
1920	197.6	197.6	100.2

Illinois

Year	State Mortality Rate Per 100,000	Rural Mortality Rate Per 100,000	Rural Rate as a Percentage of Chicago
1915	n/a	n/a	n/a
1916	n/a	n/a	n/a
1917	n/a	n/a	n/a
1918	498.8	486.2	94.1
1919	187.9	185.4	96.8
1920	213.2	205.9	92.0

Indiana

Year	State Mortality Rate Per 100,000	Rural Mortality Rate Per 100,000	Rural Rate as a Percentage of Indianapolis
1915	126.1	123.8	84.4
1916	147.1	146.4	95.2
1917	146.2	145.0	92.6
1918	408.1	401.9	87.5
1919	213.7	210.4	87.5
1920	211.7	208.1	86.4

Missouri

Year	State Mortality Rate Per 100,000	Rural Mortality Rate Per 100,000	Rural Rate as a Percentage of St. Louis	Rural Rate as a Percentage of Kansas City
1915	144.2	n/a	n/a	n/a
1916	167.9	n/a	n/a	n/a
1917	181.4	164.4	72.4	80.2
1918	476.6	423.5	78.9	59.0
1919	206.1	194.2	96.0	64.5
1920	261.2	247.6	94.2	70.0

Tennessee

Year	State Mortality Rate Per 100,000	Rural Mortality Rate Per 100,000	Rural Rate as a Percentage of Memphis	Rural Rate as a Percentage of Nashville
1915	n/a	n/a	n/a	n/a
1916	n/a	n/a	n/a	n/a
1917	135.3	126.1	57.6	66.9
1918	476.0	436.1	65.5	47.9
1919	234.8	222.7	65.4	74.0
1920	220.0	208.0	66.8	68.9

Note: The state mortality rates are from Mortality Statistics 1920. *The rural mortality rates are for the state less the city(ies) listed. This statistic was computed by obtaining the number of influenza deaths at the state level (the first column multiplied by population) and then subtracting the number of city dead (shown in Table 7). This value was then normalized by the rural population (the difference between the state population and the city population). The final column was computed by dividing the rural mortality rate by the city mortality rate shown in the first column of Table 7.*

ences in rates across states and over time. For example, the rural-to-city rate in Illinois averages about 94 percent whereas the rate averages around 77 percent in Missouri. There does not appear to be, however, a consistent difference in mortality rates between pandemic years and nonpandemic years when comparing across the states, though it appears that the rural-to-city ratio is substantially higher in nonpandemic years in Kansas City, Louisville and Nashville. What one can conclude from Table 8 is that rural influenza mortality rates were typically less than city influenza rates in both pandemic and nonpandemic years, and only in the case of a few cities is there evidence that the rural-to-city mortality ratio was less in a pandemic year compared with nonpandemic years.

III. Economic Effects of the 1918 Influenza Pandemic

This section of the report sheds light on some economic effects of the 1918 influenza pandemic. As mentioned earlier, the greatest disadvantage of studying the economic effects of the 1918 influenza is the lack of economic data. There are some academic studies that have looked at the economic effects of the pandemic using available data, and these studies are reviewed later. Given the general lack of economic data, however, a remaining source for information on (some) economic effects of the 1918 pandemic is print media.

Newspapers in the Eighth Federal Reserve District cities of Little Rock and Memphis that were printed in the fall of 1918 were researched for information on the effects of the influenza pandemic in these cities. Piecing together anecdotal information from individual cities can provide a relatively good picture of the general effects of the pandemic. These general effects in 1918 can be used to extrapolate to the potential economic effects of a modern-day pandemic.

The 1918 Influenza Pandemic in the News

This section presents headlines and summaries from articles appearing in two newspapers in Eighth Federal Reserve District cities: *The Arkansas Gazette* (Little Rock) and *The Commercial Appeal* (Memphis). Articles listing the number of sick or dead from the influenza appeared almost daily in these newspapers and other papers as well (St. Louis and Louisville, for example). Also appearing frequently were articles on church, school and theater closings, as well as dubious remedies and cures for the influenza.[21] However, articles that described the influenza's effects on the local economy were far less numerous. The several articles that appeared in the fall of 1918 that did discuss the economic impact of the influenza are summarized below.

Little Rock, Ark.

"How Influenza Affects Business." The *Arkansas Gazette*, Oct. 19, 1918, page 4.

- Merchants in Little Rock say their business has declined 40 percent. Others estimate the decrease at 70 percent.
- The retail grocery business has been reduced by one-third.
- One department store, which has a business of $15,000 daily ($200,265 in 2006 dollars), is not doing more than half that.
- Bed rest is emphasized in the treatment of influenza. As a result, there has been an increase in demand for beds, mattresses and springs.
- Little Rock businesses are losing $10,000 a day on average ($133,500 in 2006 dollars). This is actual loss, not a decrease in business that may be covered by an increase in sales when the quarantine order is over. Certain items cannot be sold later.
- The only business in Little Rock in which there has been an increase in activity is the drug store.

Memphis, Tenn.

"Influenza Crippling Memphis Industries." *The Commercial Appeal*, Oct. 5, 1918, page 7.

- Physicians report they are kept too busy combating the disease to report the number of their patients and have little time to devote to other matters.
- Industrial plants are running under a great handicap. Many of them were already short of help because of the draft.
- Out of a total of about 400 men used in the transportation department of the Memphis Street Railway, 124 men were incapacitated yesterday. This curtailed service.
- The Cumberland Telephone Co. reported more than a hundred operators absent from their posts. The telephone company asked that unnecessary calls be eliminated.

"Tennessee Mines May Shut Down." *The Commercial Appeal*, Oct. 18, 1918, page 12.

- Fifty percent decrease in production reported by coal mine operators.
- Mines throughout east Tennessee and southern Kentucky are on the verge of closing down owing to the epidemic that is raging through the mining camps.
- Coalfield, Tenn., with a population of 500, has "only 2 percent of well people."

Survey of Economic Research

One research paper examines the immediate (short-run) effect of influenza mortalities on manufacturing wages in U.S. cities and states for the period 1914 to 1919.

The testable hypothesis of the paper is that influenza mortalities had a direct impact on wage rates in the manufacturing sector in U.S. cities and states during and immediately after the 1918 influenza. The hypothesis is based on a simple economic model of the labor market: A decrease in the supply of manufacturing workers that resulted from influenza mortalities would have had the initial effect of reducing manufacturing labor supply, increasing the marginal product of labor and capital per worker, and thus increasing real wages. In the short term, labor immobility across cities and states is likely to have prevented wage equalization across the states, and a substitution away from relatively more expensive labor to capital is unlikely to have occurred.[22] The empirical results support the hypothesis: Cities and states having greater influenza mortalities experienced a greater increase in manufacturing wage growth over the period 1914 to 1919.

Another study explored state income growth for the decade after the influenza pandemic using a similar methodology.[23] In their unpublished manuscript, the authors argue that states that experienced larger numbers of influenza deaths per capita would have experienced higher rates of growth in per capita income after the pandemic. Essentially, states with higher influenza mortality rates would have had a greater increase in capital per worker, and thus output per worker and higher incomes after the pandemic. Using state-level personal income estimates for 1919-1921 and 1930, the authors do find a positive and statistically significant relationship between statewide influenza mortality rates and subsequent state per capita income growth.

A recent paper explored the longer-term effect of the 1918 influenza.[24] The author questions whether in utero exposure to the influenza had negative economic consequences for individuals later in their lives. The study came about after the author reviewed evidence that suggested pregnant women who were exposed to the influenza in 1918 gave birth to children who had greater medical problems later in life, such as schizophrenia, diabetes and stroke. The author's hypothesis is that an individual's health endowment is positively related to his human capital and productivity, and thus wages and income.

Using 1960-1980 decennial census data, the author found that cohorts in utero during the 1918 pandemic had reduced educational attainment, higher rates of physical disability and lower income. Specifically, "(m)en and women show large and discontinuous reductions in educational attainment if they had been in utero during the pandemic. The children of infected

mothers were up to 15 percent less likely to graduate from high school. Wages of men were 5-9 percent lower because of infection."[25]

Summary

Most of the evidence indicates that the economic effects of the 1918 influenza pandemic were short-term. Many businesses, especially those in the service and entertainment industries, suffered double-digit losses in revenue. Other businesses that specialized in health care products experienced an increase in revenues.

Some academic research suggests that the 1918 influenza pandemic caused a shortage of labor that resulted in higher wages (at least temporarily) for workers, though no reasonable argument can be made that this benefit outweighed the costs from the tremendous loss of life and overall economic activity. Research also suggests that the 1918 influenza caused reductions in human capital for those individuals in utero during the pandemic, therefore having implications for economic activity occurring decades after the pandemic.

IV. Implications for a Modern-day Pandemic

The potential financial costs and death tolls from a modern-day influenza pandemic in the United States that were presented at the beginning of this report suggest an initial cost of several hundred billion dollars and the deaths of hundreds of thousands to several million people. The information presented in this report and information provided in two prominent publications on the 1918 influenza pandemic are now used to formulate a list of the likely economic effects of a modern-day influenza pandemic and possible ways to mitigate the severity of any future pandemic:

- Given the positive correlation between population density and influenza mortalities, cities are likely to have greater mortality rates than rural areas. Compared with 1918, however, urban and rural areas are more connected today—this may decrease the difference in mortality rates between cities and rural areas. Similarly, a greater percentage of the U.S. population is now considered urban (about 80 percent) compared with the U.S. population at the time of the pandemic (51 percent in 1920).
- Nonwhite groups as a whole have a greater chance of death because roughly 90 percent of all nonwhites live in urban areas (compared with about 77 percent of whites). This correlates with lower-income individuals being more likely to die—nonwhite (excluding Asians) households have a lower median income ($30,858 in 2005) compared with white households ($50,784 in 2005).[26] Similarly, only 10 percent of whites were below the poverty level in 2005 compared with more than 20 percent for various minority groups (except Asians).[27]
- Urban dwellers are likely to have, on average, better physical access to quality health care, though nearly 19 percent of the city population in the United States has no health coverage compared with only 14 percent of the rural population.[28] The question remains as to affordability of health care and whether free-service health-care providers, clinics and emergency rooms (the most likely choices for the uninsured) are able to handle victims of the pandemic.
- Health care is irrelevant unless there are systems in place to ensure that an influenza pandemic will not knock out health-care provision and prevent the rapid disposal of the dead in the cities (as it did in Philadelphia, which was exacerbated by medical leaves during World War I). If medical staff succumbs to the influenza and facilities are overwhelmed, the duration and severity of the pandemic will be increased. In Philadelphia during the 1918 pandemic, "the city morgue had as many as ten times as many bodies as coffins."[29]
- A greater percentage of families with life insurance would mitigate the financial effects from the loss of a family's primary

breadwinner. However, life insurance is a normal good (positively correlated with income); so, low-income families are less likely to be protected with insurance than are higher-income families.[30]

- Local quarantines would likely hurt businesses in the short run. Employees would likely be laid off. Families with no contact to the influenza may too experience financial hardships. To prevent spread, quarantines would have to be complete (i.e., no activity allowed outside of the home). Partial quarantines, such as closing schools and churches but not public transportation or restaurants (as done in Philadelphia, St. Louis and Washington, D.C.) would do little to stop the spread of influenza.
- Some businesses could suffer revenue losses in excess of 50 percent. Others, such as those providing health services and products, may experience an increase in business (unless a full quarantine exists). If the pandemic causes a shortage of employees, there could be a temporary increase in wages for remaining employees in some industries. This is less likely than in 1918, however, given the greater mobility of workers that exists today.
- Can we rely on local, state and federal governments to help in the case of a modern-day pandemic? Government has shown its inability to handle disasters in the past (e.g., Hurricane Katrina). Local preparedness by health departments and hospitals, volunteer services (e.g., Red Cross) and private businesses, and responsible actions of the population are likely to mitigate the effects of a modern-day influenza pandemic.

V. Final Thoughts

The influenza of 1918 was the most serious epidemic in the history of the United States. Hundreds of thousands of people died and millions were infected with the highly contagious influenza virus. The possibility of a future influenza pandemic has focused research back to the 1918 pandemic as a foundational model for the likely effects of a modern-day influenza outbreak in the United States. Despite the severity of the 1918 influenza, however, there has been relatively little research done on the economic effects of the pandemic. This report has provided a concise, albeit certainly not complete, discussion and analysis of the economic effects of the 1918 influenza pandemic based on available data and research.

The influenza of 1918 was short-lived and "had a permanent influence not on the collectivities but on the atoms of human society – individuals."[31] Society as a whole recovered from the 1918 influenza quickly, but individuals who were affected by the influenza had their lives changed forever. Given our highly mobile and connected society, any future influenza pandemic is likely to be more severe in its reach, and perhaps in its virulence, than the 1918 influenza despite improvements in health care over the past 90 years. Perhaps lessons learned from the past can help mitigate the severity of any future pandemic.

Of course, mitigating a pandemic will require cooperation and planning by all levels of government and the private sector. Unfortunately, a 2005 report suggests that the United States is not prepared for an influenza pandemic.[32] Although federal, state and local governments in the United States have started to focus on preparedness in recent years, it is fair to say that progress has been slow, especially at local levels of government.[33] Different levels of governments have been relatively ineffective in coordinating a response to disasters in the past, whereas private charities and volunteer organizations like the American Red Cross often perform admirably and are often the first responders. Assuming that citizens want government to mitigate an influenza outbreak, there should be concern about government's readiness and ability to protect citizens from a pandemic. Perhaps public education on flu mitigation, a greater reliance on charitable and volunteer organizations, and a dose of personal responsibility may be the best ways to protect Americans in the event of a future influenza pandemic.

Endnotes

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12. Barry, John M. (2004). *The Great Influenza: The Epic Story of the Deadliest Plague in History*. Penguin Group, New York.
13. The 272,500 deaths are from a sample of about 30 states. See Crosby, Alfred W. (2003). *America's Forgotten Pandemic: The Influenza of 1918*. Cambridge University Press, Cambridge, page 209.
14. Crosby, Alfred W. (2003). *America's Forgotten Pandemic: The Influenza of 1918*. Cambridge University Press, Cambridge, pages 319-322.
15. Copies of the historical reports are available at the Centers for Disease Control, National Center for Health Statistics,

or at www.cdc.gov/nchs/products/pubs/pubd/vsus/historical/historical.htm.

16. U.S Bureau of the Census, *Mortality Statistics 1920*, page 9.

17. U.S Bureau of the Census, *Mortality Statistics 1919*, page 28.

18. See Crosby, Alfred W. (2003). *America's Forgotten Pandemic: The Influenza of 1918*. Cambridge University Press, Cambridge.

19. Mortality rates for 64 cities (49 of which appear in Table 3) were used in the calculations. The 15 cities were not included in Table 3 because of missing data. The mortality rates for these 15 cities can be obtained from the author.

20. See the note in Table 8 for more information on how the rural mortality rate was calculated.

21. Copies of all articles are available from the author, including articles from the *St. Louis Post-Dispatch* and the *Louisville Courier-Journal*.

22. The long-run effect of influenza and war mortalities on manufacturing wage growth is less clear. One popular growth model suggests that capital per worker will eventually fall (due to diminishing returns to capital) and therefore decrease wages. However, another growth model predicts capital per worker will continue to rise over time as a result of nondiminishing returns to capital, thereby increasing wages. Over time, there may have also been an opportunity for some degree of wage equalization across the states. It is also possible that the war and the pandemic decreased consumer confidence, investment and savings, and long-term income growth of households due to the death of households' primary breadwinners. These factors would result in lower aggregate output and production, thereby decreasing the demand for labor and placing downward pressure on manufacturing wages.

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26. U.S. Census Bureau. I*ncome, Poverty, and Health Insurance Coverage in the United States: 2005*, Table 1 (www.census.gov/prod/2006pubs/p60-231.pdf).

27. U.S. Census Bureau. *Income, Poverty, and Health Insurance Coverage in the United States: 2005*, Table 4 (www.census.gov/prod/2006pubs/p60-231.pdf).

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32. Infectious Diseases Society of America. "IDSA's Principles for Actions Needed

to Prepare the U.S. to Effectively Respond to Interpandemic/Pandemic Influenza." March 2005. www.idsociety.org.

33. See www.pandemicflu.gov, a site managed by the U.S. Department of Health and Human Services. The lack of influenza vaccines, low production capacity, inadequate supply networks, slow government response and poor public education are cited as problems.