PART 1

The 1918 Influenza in Missouri: Centennial Remembrance of the Crisis

by David S. McKinsey, MD, Joel P. McKinsey, MD & Maithe Enriquez, PhD

In September 1918, war-weary Missourians were bracing for the coming storm: not another extreme weather event, but the lethal influenza epidemic steamrolling through the country's eastern cities and military cantonments and bearing down on the Midwest. Tens of thousands of young people were dead; major cities were on the verge of collapse. Former Missourian Dr. Victor Vaughan, raised in rural Randolph County, headed the U.S. Army's Division of Communicable Diseases. In October 1918, Dr. Vaughan concluded, "If the epidemic continues its mathematical rate of acceleration, civilization could easily disappear from the face of the earth within a few weeks".[1]

This year marks the centennial anniversary of the 1918 Influenza pandemic. Although often overshadowed in our nation's collective memory by World War I, in fact influenza took more lives in a shorter time period in 1918-19 than any other event in human history.[2] Approximately 670,000 Americans succumbed to influenza in the U. S., more than the cumulative combat death toll of our military forces in World Wars I and II, the Korean conflict and the Viet Nam War.[3] Worldwide, 50-100 million died,[2,4] a figure vastly exceeding the mortality tolls of other pandemics in the 20th and 21st centuries (Figure 1). This article, the first in a series, will address the origins and spread of the 1918 influenza, its clinical and pathological manifestations, the impact of the pandemic on Missouri's population, the responses of dedicated medical and nursing professionals in our state, and insights gained from new assessment of available epidemiologic data. The word influenza is rooted in the medieval Italian phrase influentia del freddo (influence of the cold), reflecting the centuries-old observation that annual epidemics occur in the winter months.[5] Interspersed lethal pandemics emerge at unpredictable intervals a few times each century. In the early twentieth century, physicians had not yet identified the cause of this generally mild and self-limiting illness, commonly known as the "grippe." Although the germ theory of disease had been well-established for a few decades some physicians still attributed influenza to miasmas (noxious vapors) rather than infection. The field of virology was in its infancy and the possibility that influenza was a viral illness had not yet been considered seriously. No known treatment or prevention for influenza existed, nor would any become available until long after the 1918 pandemic (Figure 2.)

In 1918 the country's attention was focused squarely on World War I, which led to the mobilization of more than four million American military recruits and the construction of 30 hastily built cantonments throughout the country, each of which housed up to 50,000 soldiers in overcrowded barracks.[6] Historians have concluded that the war effort was inextricably linked to the spread of the 1918 influenza in the United States and abroad.[6] The extremely high risk for epidemics among soldiers had been well-known for centuries.[7] During the war millions of young men, many of whom were immunologically naive to highly contagious infections, were dispersed around the country to military camps en route to battlefields in Europe, setting the stage for an explosive pandemic.

Although the 1918 pandemic is widely known as the "Spanish Influenza," a more appropriate name could be the "Kansas Flu."[8] The federal Sedition Act of 1918 prohibited the use of "disloyal, profane, scurrilous, or



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abusive language" about the U. S. government, in a heavy-handed attempt to improve morale during the war. Accordingly, little was published in the U.S. about influenza. However, in neutral Spain the uncensored press reported freely about the influenza pandemic, leading to the enduring misperception that the disease had begun there. In fact most historians believe that the first wave of 1918 "Spanish" influenza in the world began on March 4, 1918 at Camp Funston, Kansas, 120 miles west of the Missouri border.[1] During the following weeks thousands of soldiers developed influenza and 38 died.[9] (Figure 3) As soldiers from Camp Funston were transported to other cantonments throughout the country, influenza spread like wildfire.

Thousands of military personnel worldwide developed influenza in the spring and early summer of 1918, but little alarm was raised as the illness was deemed to be "everywhere of a mild form."[9] Barry has postulated that the trigger for the Camp Funston epidemic was a smaller outbreak in Western Kansas the previous year.[2, 9] However, an analysis of death certificates in St. Joseph, the third largest city in Missouri in the early twentieth century, suggests a trend of increasing influenza mortality in Missouri as early as 1915.[10] The pandemic therefore may have been heralded by mutating viruses not only in Kansas but also in Missouri and elsewhere, well in advance of the deadly 1918-19 season.

Influenza Pandemic
Comparative Mortality

1918-9
U.S. 670,000 (0.6%)
Worldwide 50 Million (2.7%)

1957-8
U.S. 70,000 (0.03%)
Worldwide 2 Million (0.07%)

1968-9
U.S. 34,000 (0.02%)
Worldwide 1 Million (0.03%)

2009-10
U.S. 12,000 (0.004%)
Worldwide 284,000 (0.004%)

Figure 1. Influenza pandemic mortality, U.S. and worldwide, total (% of population).

The second wave of the 1918 influenza pandemic struck with a fury in August. Simultaneous outbreaks were reported in Camp Devins, Massachusetts, (near Boston), France, and Sierra Leone. In contrast to typical seasonal flu, the 1918 influenza strain that reappeared in August was exceptionally virulent and often lethal, especially among young adults. The highest mortality rates were reported among persons between 20 and 40 years old, an age group generally unscathed by seasonal influenza.[4] A contemporaneous description from a physician at Camp Devins paints a chilling picture. "Victims develop the most viscious (sic) type of Pneumonia that has ever been seen. Two hours after admission they have the Mahogany spots over their cheekbones and a few hours later you can begin to see the Cyanosis extending from the ears and spreading all over the face."[11] Typical symptoms included fever above 105 degrees, delirium, lethargy, prostration, bleeding from the nose and ears, and hemoptysis "(resembling) tomato puree."[12] A feature of illness noted by many observers was "strikingly intense cyanosis."[13] The mortality rate was shockingly high: 757 previously robust young soldiers at Camp Devins died.[14] Several observers described seeing people who were healthy one day and dead within 24 hours.

The 1918 flu also was particularly prone to enabling aggressive secondary bacterial pneumonia, a common cause of death.[15] A biphasic illness pattern was noted in many cases: typical influenza was followed by transient improvement but subsequent abrupt deterioration after secondary bacterial infection was established. Pathologists noted "immediate exudation of dark bloody fluid" from the lungs of influenza victims.[13] The lungs appeared shapeless, blue, foamy, and edematous.[16] Features consistent with acute respiratory distress syndrome, an entity not formally

Figure 2. Timeline of major events related to influenza

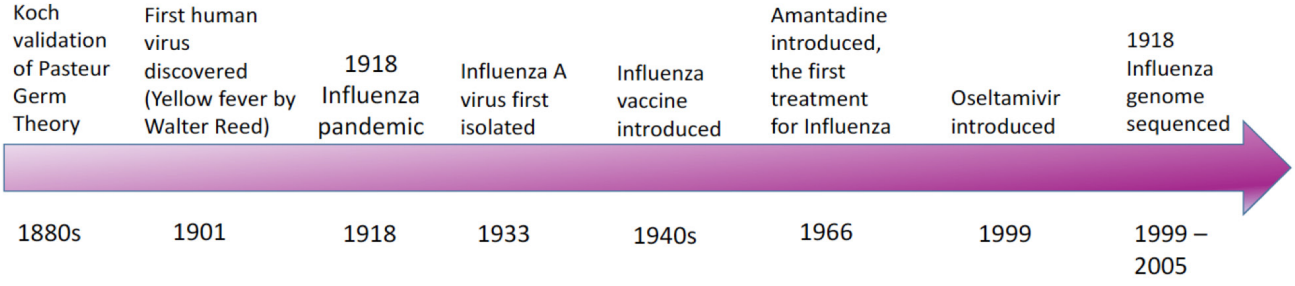




Figure 3. Camp Funston, Ks., emergency hospital during 1918 influenza epidemic.

described until decades after the pandemic, were noted in about half of autopsies.[17]

After influenza decimated Camp Devins and several other cantonments in September 1918, the disease quickly spread to eastern cities where public services and health care providers were nearly overwhelmed. The pandemic created widespread panic. A crossroads state, Missouri was an inevitable target. Historian Alfred Crosby's description was particularly applicable to our state: "Influenza moved across the United States in the same way as pioneers had, for it followed their trails, which had become railroads, and propagated fastest in those localities most attractive to them – the confluences of rivers and trails."[18] In a few weeks the state's health care workers would address the worst medical crisis in the state's history, one which took a heavy toll and had a lasting impact.

In the 1910s, Missouri's population was almost 3.3 million, seventh highest among the 48 states. St. Louis, population 687,000, was the nation's fourth largest city and Kansas City, with 248,000 citizens, ranked twentieth. The state's third, fourth, and fifth largest cities, respectively, were St. Joseph, Springfield, and Joplin. About half (49%) of the state's population resided in rural areas. Travelers primarily relied on a train system with more than 8,000 miles of track, twice today's figure. Although past their prime, riverboats plied the Osage River, which was still navigable a decade before the construction of Bagnell Dam created the Lake of the Ozarks, as well as the Mississippi and Missouri Rivers. Cross-state driving was challenging. Although each county was served by at least one highway, all of the highways were unpaved. Thus several routes existed for influenza's introduction to Missouri and its rapid spread throughout the state.

In Missouri, as in other states, the first cases of influenza probably began at a local military camp when infected soldiers arrived from cantonments in other parts of the country. The disease then spread quickly to the civilian population. On September 27, cases were reported at two Army motor schools in Kansas City; on October 4, 1918, influenza exploded at Missouri's large military base, Jefferson Barracks, near St. Louis, where 500 cases were reported among 6,000 soldiers. Simultaneously cases were reported in southwestern Missouri, possibly among soldiers returning home from training at cantonments in neighboring states. As the epidemic spread during the first weeks of October, physicians, nurses, hospitals, and health departments throughout Missouri struggled to cope with an unprecedented burden of disease, while handicapped by a substantially reduced work force: fully half of the state's physicians were away, serving in the military.

Missouri's physicians had few therapeutic options for their acutely ill patients with influenza. The primary goals of treatment were pain alleviation, cough control, and either stimulation or reduction of heart rate depending on the situation. The pharmaceutical armamentarium was limited. Quinine, first introduced in the U. S. in Arrow Rock, MO in the 1800s for treatment of malaria, was now given as an influenza preventative, without benefit. Other available medications included aspirin, morphine, codeine, heroin, atropine, digitalis, strychnine, and epinephrine. Physicians at the time correctly concluded that "no especial measure was of avail."[13] Aside from providing symptomatic treatment, probably the most useful functions of the physician were to advise bedrest and to monitor for signs of bacterial pneumonia, which

Table 1
Missouri All Cause Mortality Rate Analysis by Region (excluding St. Louis and Kansas City)
1915 and 1918, Missouri counties (n=112)

Region State of Missouri	*Number of counties*	***Pop. density mean (sd)*	*1915 mortality Mean (sd)*	*1918 mortality mean (sd)*	*% increase mortality from 1915 to 1918*
Southeast	13	33.7 (14.1)	11.8 (3.9)	15.1 (6.04)	28%
East	10	35.6 (17.2)	10.9 (1.7)	13.7 (1.9)	26%
West	12	37.2 (9.1)	11.2 (2.0)	13.7 (3.2)	22%
Northeast	16	34.3 (12.1)	9.5 (1.4)	12.6 (2.1)	32%
Central	13	31.5 (10.2)	10.2 (1.9)	12.5 (3.4)	22%
Northwest	15	32.5 (4.1)	10.3 (1.8)	11.7 (2.2)	13.5%
Southwest	18	35.1 (19.2)	9.3 (2.1)	11.4 (4.2)	23%
South Central	6	20.5 (2.6)	9.3 (1.9)	10.5 (1.7)	13%
South	9	17.8 (5.5)	7.9 (1.4)	9.4 (2.5)	19%

**Region based on current Missouri State Highway Patrol definition*
***Population density = people per square mile in 1910*

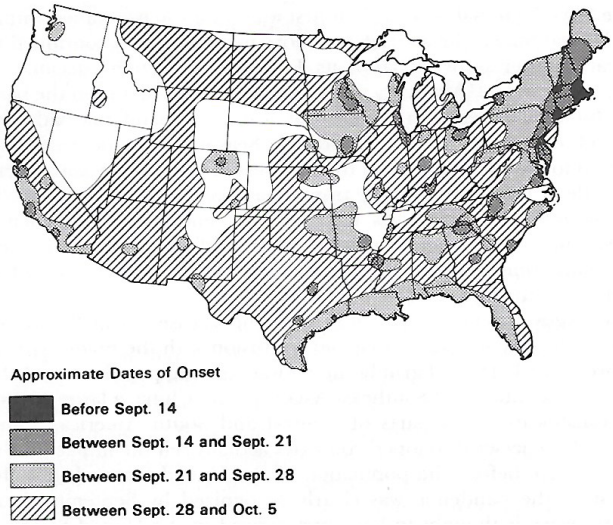


Figure 4. Approximate dates of onset.

connoted a worsened prognosis.[19]

Actually, by far the most important need of 1918 influenza patients was for nursing care. "Nursing is nine tenths, just the same," said the nurse in Katherine Anne Porter's "Pale Horse, Pale Rider," referring to the totality of a patient's care.[20] Porter, who almost died from influenza, probably was underestimating. However, in 1918 nurses were in even shorter supply than physicians: there were one-quarter as many trained nurses as doctors. The American Red Cross (ARC), founded by Clara Barton in 1882, stepped into the void. The Red Cross not only had full responsibility for supplying nurses for the U.S. Army, but also was tasked with identifying civilian nurses to battle the epidemic at home.[21] Many Missouri nurses became ill while caring for their patients, and those who remained on the job had staggering workloads of 30-40 inpatients per day.[22]

Missouri's influenza and pneumonia mortality rate in 1918, 476.6 per 100,000 population, ranked 22nd among in the 30 states for which data are available.[23] This figure more than doubled from the prior year.[24] In 1918 detailed disease surveillance data were maintained for the state's two largest cities, St. Louis and Kansas City, but not in other areas of the state. The mortality ratio in these two cities has been reported to be 1.32 times higher than in Missouri's rural areas.[24] However, "rural" areas included cities of up to 100,000 population.[24]

We conducted a more detailed analysis of the geographic differences of 1918 influenza on the state's population. The annual all-cause mortality rates of Missouri counties (n=112) were compared to baseline figures from 1915 using data from the U. S. Bureau of the Census (Table 1).[23] Data from St. Louis City and County (administratively distinct entities) and Jackson County, each of which had much higher death rates than the remainder of the state, were omitted from our analysis. Counties were grouped into nine regions, as defined by the Missouri State Highway Patrol currently. The mean statewide mortality in 1918 per 1,000 population was 12.4 (range 5.1-29.4), up from 10.1 (range 5.1-19.9) in 1915. In each of the state's regions the mortality rate in 1918 was significantly higher than that in 1915 (p= .000). The three counties with highest mortality rates were Dunklin (29.1), Vernon (23.1), and Butler (23); the lowest rates were identified in Dallas (5.1), Douglas (6.1), and McDonald (6.2) counties. The southeastern region of Missouri had the highest mortality rate (15.1); the two lowest rates were seen in the south (9.4) and south central (10.5) regions, the least populated areas in the state. A 5.7-fold mortality difference was noted between the state's highest and lowest ranked counties. Thus, although influenza in 1918 significantly increased mortality in every region of the state, there was an uneven impact on Missouri's population.

To some extent Missouri was fortunate to be struck by influenza's second wave at a later stage than the eastern seaboard, particularly in rural areas of the state (Figure 4). As a general rule influenza cases were less severe in the later weeks of the epidemic's



Figure 5. "We've got that durned influenzy agin" by A.B. Frost, *Kansas City Star,* November 27, 1918

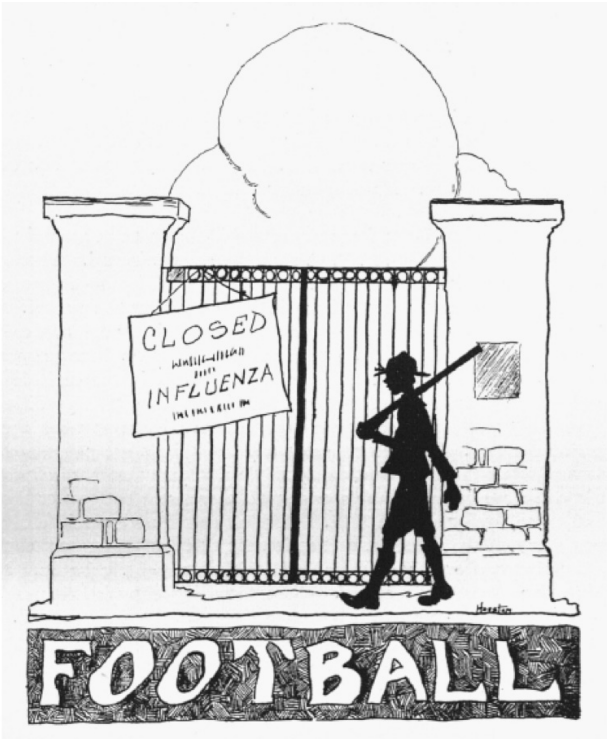


Figure 6. University of Missouri yearbook The Savitar, 1919

second wave than at the beginning.[25] This factor may have contributed to Missouri's disproportionately lower mortality than other highly populated states. Social determinants of health, such as poverty, may have accounted in part for the higher death rate in southeastern Missouri.

Contemporaneous accounts described the impact of influenza throughout the state. At the University of Missouri, Dr. Dan Stine recorded 1,020 student cases of influenza between September 26 and December 6. He "saw one patient die within 18 hours of this disease and 12 hours after being put to bed."[26] The volume of influenza cases was so high in Columbia that patients were admitted not only to Parker Hospital but also to the Athens Hotel, Welch Military Academy, and a women's dormitory at the University. In Van Buren, members of several families were all are sick in bed at the same time and "both local doctors (were) on the go both day and night."[27] Dr. William E. Kitchell of St. Clair, the county health officer, was so busy that he didn't change clothes for three straight days and nights.[28] Private Charles Hill died from influenza while fighting in France. His commanding officer informed Private Hill's mother of Dunnegan, Mo., that "it came so fast and with such little warning that the best medical care could not save him."[29]

Famous Missourians were among those afflicted with the 1918 influenza. General John J. Pershing, of Laclede Mo., was commander of the American Expeditionary Force in World War I. He developed severe influenza in late October and became encephalopathic, before he recovered fully. U.S. Representative Champ Clark, from Louisiana, Mo., the only Missourian to serve as U.S. Speaker of the House of Representatives, was confined to bed with influenza, necessitating a several-week recess of the U.S. Congress. Clark recovered but two of his fellow Missouri congressmen, Representatives Jacob Meeker and William Borlan, did not. Meeker visited Jefferson Barracks on October 10 and seven days later was dead from influenza, likely acquired at the base. Borlan, co-founder and former Dean of Kansas City School of Law (predecessor of the University of Missouri-Kansas City law school), died from influenza while touring army camps in France. Captain Harry Truman, writing to his fiancée Bess Wallace in Independence in early 1919 from Europe, expressed relief at her recovery from influenza. Walt Disney lived in Marceline, Mo., (the model for Main Street USA at Disney World) from 1906-11 and in Kansas City from 1911-17. He enlisted in the Red Cross Ambulance Corps in Chicago in September 1918, and developed influenza while in training. The resultant convalescence period delayed his departure to Europe until after conclusion of the war's bloodiest fighting.[30] Thus, arguably influenza may have saved Mr. Disney's life.

Missouri's schools and universities were substantially impacted by influenza. Each of the state's three medical schools (the American School

of Osteopathy, now known as A.T. Still University; Saint Louis University; and Washington University) graduated their classes early, to bolster the understaffed health care workforce. Washington University students received their degrees in absentia in Europe. Public school systems across the state cancelled classes for weeks at a time, sometimes on multiple occasions, leaving parents to care for restless children in their quarantined homes (Figure 5.) The University of Missouri was quarantined twice, and the Mizzou Tigers, under Coach John F. Miller, cancelled the entire 1918 football season (Figure 6).

After the 1918 influenza pandemic receded, Missourians continued to carry a heavy burden. Some survivors developed von Economo disease (post-encephalitic Parkinson Disease.)[31] Thousands of families lost loved ones; countless children were orphaned. Despite, or perhaps because of, the trauma of these grievous experiences, in the coming decades most survivors preferred to avoid the subject. Famous authors of the era, including former Kansas Citian Ernest Hemingway, a *Kansas City Star* reporter in 1917 and 1918, did not discuss influenza in their works. This dearth of recorded material may have contributed to the general lack of recognition by subsequent generations of the catastrophic impact of 1918 influenza.

The next article in this series will compare the well-documented experiences with 1918 influenza in Missouri's two largest urban areas, St. Louis and Kansas City, including important public health lessons that still resonate after a century. In addition the impact of influenza on Jefferson Barracks and Base Hospital 21, a World War 1 medical center in France staffed by Missourians, will be addressed.

Acknowledgment

The authors dedicate this manuscript to Ladene Stark Smith, our great Aunt, who succumbed to influenza in early 1919 at age 19 shortly after moving from Missouri to an adjacent state.

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PART 2

The 1918 Influenza in Missouri: Centennial Remembrance of the Crisis

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Introduction

2018 marks the centennial of the 1918 influenza epidemic, the worst medical crisis in Missouri's history. Although influenza decimated each of the state's eight regions,[1] Missouri's military personnel and its cross-state sibling cities St. Louis and Kansas City absorbed the epidemic's worst blows. This article, second in a two-part series, will chronicle the experiences at Missouri's Army base, Jefferson Barracks, and its World War I field hospital staffed by St. Louisans, Base Hospital 21; review the brutal impact of influenza on the populations of St. Louis and Kansas City; and discuss the effectiveness of public health responses in these cities.

Flu Hits Military Barracks

In the St. Louis area, the first cases of influenza were reported at Jefferson Barracks, the nation's oldest military installment west of the Mississippi River, 17 miles south of downtown. Two hundred thousand enlisted men passed through the base during World War I. On October 1 the first influenza cases were identified; within a week 800 soldiers were hospitalized.[2] Assistance was requested from the Red Cross in St. Louis, and women received hurried training at Barnes Hospital as nurses' aides. Fortunately, despite its initial rapid spread the epidemic was controlled quickly. In total there were more than 2,000 influenza cases at Jefferson Barracks, a much lower figure than at many other military bases in the country. Dr. C. E. Freeman, the Barracks' chief military officer, attributed this better-than-expected outcome to emergency aid from the Red Cross nursing staff.

Missourians also valiantly battled influenza "over there." At the onset of World War I the Army and the American Red Cross created 50 base hospitals, designated as official military units, utilizing personnel from university medical centers. Physicians and nurses from Washington University immediately agreed to staff Base Hospital 21, one of the first six base facilities mobilized in the war. The unit was stationed at a 1,350 bed hospital in Rouen, France.[3] Base Hospital 21's medical services were directed by Lieut. Col. Walter Fischel, brother of Dr. Ellis Fischel who later established a cancer center in Columbia. Patient volume was brisk: there were 500-600 admissions daily. The 61,000 admissions during the war were evenly divided between surgical and medical cases.[4] The most common diagnoses were gangrene or nerve gas poisoning but Base Hospital 21 also served as a treatment center for influenza patients.[5] (Figure 1) In October, 1918, the hospital's daily census crested at an astonishing 1,950 patients, coinciding with the peak of the influenza epidemic in Europe.

In 1918 St. Louis, population 687,000, had a distinctly different heritage and culture than its cross-state rival 340 miles upriver, Kansas City, home to 248,000 citizens. Established in 1764 as a European outpost, St. Louis was the nation's fourth largest city in the early twentieth century. On the western side of the state, Kansas City was not chartered until 1850. Fortunately its founders rejected two of the initially proposed names for the new town, Possum Trot and Rabbitville. By 1918 St. Louis had hosted an Olympics and a World's Fair and had become one of the largest industrial centers in the country, but Kansas City was



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Figure 1. Surgical Ward, Base Hospital 21 in Rouen, France 1918.

still considered a wide-open western boom town. If St. Louis was the older, famous, urbane Missouri sibling, Kansas City was its rambunctious younger brother with great potential but still-untamed behavioral issues, as will be discussed.

St. Louis

In late September St. Louis hoped to avoid the devastating experiences recently reported in eastern cities. The City Health Commissioner, Dr. Max Starkloff (Figure 2), son of a Civil War surgeon and great grandfather of the founder of the Starkloff Disability Institute, was a clear-headed, effective, and forceful leader during the emergency.[6,7,8] Mayor Henry Kiel granted unprecedented authority to Dr. Starkloff to implement closures of public places. On September 21, facing the inevitable arrival of the epidemic, Starkloff advised the public to avoid crowds, to get as much rest as possible, and to abstain from alcohol. Once cases were confirmed in the city, he was authorized to "issue public health edicts and impose heavy fines on physicians who fail to report influenza cases."



Figure 2. Dr. Max Starkloff, St. Louis City Health Commissioner during the 1918 influenza pandemic.

On October 7 Starkloff sprang into action and, as described by Appel, began "shutting down the city"[6] by closing schools, theaters, moving picture houses (in the parlance of the day) and places of amusement (Figure 3). Public gatherings of more than 20 persons were prohibited. The next day closure orders expanded to include playgrounds, library reading rooms, fraternal lodges, pool halls, and Municipal Court. Even churches were closed, for the first time in the city's history. The use of streetcars was limited. Hours for busy downtown department stores, including Famous-Barr, were restricted. A staggered work schedule was implemented at factories to reduce streetcar crowding.[7]

The church closure order was protested by Archbishop (later Cardinal) John J. Glennon to no avail, leading him to suspend temporarily the obligation of Catholics to attend Mass weekly. Eventually churches were allowed to reopen, with strict attendance limits. Father Frederick Holweck, pastor at St. Francis de Sales Church, was turned in to the St. Louis police after 200 parishioners were seen in his church, a violation of the city's anti-crowding ordinance. Father Holweck explained that many worshippers had snuck in through the church's side windows out of his view. Charges were not pressed. Ironically, despite the severe restrictions placed on houses of worship, saloons were allowed to remain open throughout the epidemic (in both St. Louis and Kansas City), three months before the Volstead Act established prohibition.

The epidemic continued for weeks longer than had been expected. In the face of intense pressure from business interests, restrictions were relaxed. On Armistice Day, November 11, when the streets were filled with exuberant citizens celebrating the war's end and "church bells ran nonstop," Starkloff allowed merchants to sell American flags, but only on the sidewalks outside their stores.[8]

Throughout the darkest days of the epidemic, public health authorities received critically important assistance from the American Red Cross (ARC). Surgical dressings, influenza masks, clothing, and hospital supplies were produced by ARC volunteers. The ARC women's motor corps transported health care personnel and patients, including ill cross-country travelers who were picked up at Union Station and taken to nearby hospitals (Figure 4). More than a million four-page informational pamphlets, containing such pithy advice as "cover up each cough and sneeze, if you don't you'll spread disease," were distributed to the public. The St. Louis Red Cross chapter was so effective during the 1918 influenza epidemic that almost a century later it was described as a "model chapter."[9]

The medical community in St. Louis was inundated by influenza victims. At Barnes Hospital, 410 influenza cases were admitted including nine pregnant women, six of whom died. Among 71 patients at Barnes who had frank pneumonia there were 27 mortalities. Ten of the hospital's 23 residents (so-called because they resided at the hospital throughout their training periods) developed influenza, one of whom, a stalwart young man, succumbed. Nurses fared better: among the 57 who became ill only one developed pneumonia and none died, a finding attributed at the time to mandatory immediate bed rest.[10]

A few scientific observations were reported by academicians, although research opportunities were curtailed by heavy clinical responsibilities. Dr. John Zahorsky, Director of Pediatrics at Saint Louis University School of Medicine, reported that his young patients fared relatively well: almost all had mild, self-limiting illnesses.[11] At Jefferson Barracks, psychiatrist Dr. F. M. Barnes noted a "usual number of deliria… but only one case of a true psychosis."[12] The most notable academic contribution was made by Dr. Eugene Opie, Chair of Pathology at Washington University, who led an Army commission assigned to study pneumonia at military camps. Dr. Opie published a book describing his commission's seminal research into secondary bacterial pneumonia.[13]

Kansas City

The first influenza cases in Kansas City were reported at the Sweeney Automobile School, a private facility converted to military use, during the last week of September. Within a week 800 fell ill. In all, 2,300 of 3,000 Army recruits studying to become mechanics developed influenza and 15 died. The first civilian cases were reported across the street at Fred Harvey's restaurant in Union Station on September 27.[14] Initially all influenza patients in Kansas City were treated at General Hospital, the predecessor of Truman Medical Center. However, after General filled to capacity St. Mary's Hospital was asked to open its doors to influenza victims. All of the nursing sisters at St. Mary's, each of whom worked 24 hour shifts, developed influenza. Sisters Mary Cypriana Mertens and Mary Antonia Schlochtermeyer and the Reverend Father Edmund Joseph Unruh all died from influenza acquired in the line of duty.[15]



Figure 3. "Life's Darkest Moment" *Kansas City Times*, October 19, 1918.

In Kansas City the implementation of epidemic control measures was impacted substantially, in a negative way, by local political dynamics. Although St. Louis Mayor Kiel was accused by some of being a machine politician, a historian concluded that "St. Louis fought the epidemic without political involvement."[16] This certainly was not the case in Kansas City, which was in a league of its own with regard to municipal corruption.



Figure 4. American Red Cross workers, St. Louis 1918.

For several decades in the late 19th and early 20th centuries political bosses ruled the city. According to the *Kansas City Star* in 1918, "practically every member of the health and sanitary departments (held) their jobs by the grace of the bosses." Further complicating matters, in 1918 Tom Pendergast and Joe Shannon had reached a "50-50 agreement" to share power with the result that public board members were split in their allegiances. The palpable animosity among board members severely hampered an effective public health response. A detailed description of this dysfunctional situation is provided by Sykes-Berry.[15]

The key figures in Kansas City's highly politicized public health squabble included the city's two top health officials, Dr. A. J. Gannon, Director of the Health Department's Contagious Diseases Department and Dr. E. H. Bullock, Kansas City Health Director and Superintendent at General Hospital; Mayor James Cargill; and W. T. Motley, a non-physician who was president of the Hospital and Health Department. Physicians at General Hospital served on an advisory board, but their advice often went unheeded. Mayor Cargill initially sought political cover from angry businessmen, who faced financial losses, by delegating controversial decisions to the advisory board. Subsequently he accused the Board of "incompetence" and overturned its decisions.[15,16]

Early in the epidemic Gannon sought to implement a number of measures but was overruled and publicly criticized by Motley who initially supported Bullock, who issued his own proclamations. Daily newspaper headlines trumpeted the arguments among these factions. Gannon became a scapegoat for the epidemic and, in a profane shouting match at a public meeting on November 26, was dismissed from his position. The public's frustration was evident: a *Kansas City Star* editorial described "the utter futility of the present hospital and health board coping with the influenza epidemic so long as it is a politically controlled body and forced to accept the dictates of political bosses."

Despite the public authorities' disagreements (one alderman called a ban of public meetings "Hun propaganda"), most of the same measures undertaken in St. Louis were implemented in Kansas City. Public schools were closed on three separate occasions (no other city in the country closed schools more than twice.) On October 10, classes at three dental schools and eight barber colleges were suspended. The latter were considered especially high-risk environments given that one towel typically was used on up to 50 clients. Spitting in public was declared a misdemeanor subject to arrest.[15, 16]

In addition to official closures and restrictions implemented by city government, general advice and recommendations from both the medical community and the lay public abounded. Dr. Gannon "believe(d) the epidemic had its start (here) by girls kissing soldiers in the Army schools and cantonments ...There is a lot of kissing ... and if a ban should be placed on it there would be less influenza."[16] Gannon also offered the following advice: "stay out of crowds, avoid dust, take laxatives, drink plenty of water, and spray (the) nose with dilute Listerine or salt water." He imputed a preventative role for garlic and onions, based on the lower incidence of disease in the city's Little Italy district. Gannon required saloons, soda fountains, and restaurants to close for 30 minutes twice a day to boil their dishes in soda and water. He suggested fumigation of schools and factories with formaldehyde candles, and recommended the use of disinfectant finger bowls for cashiers.[15,16]

His adversary Dr. Bullock recommended that citizens spend the nights on their sleeping porches. Bullock and Gannon both believed incorrectly that

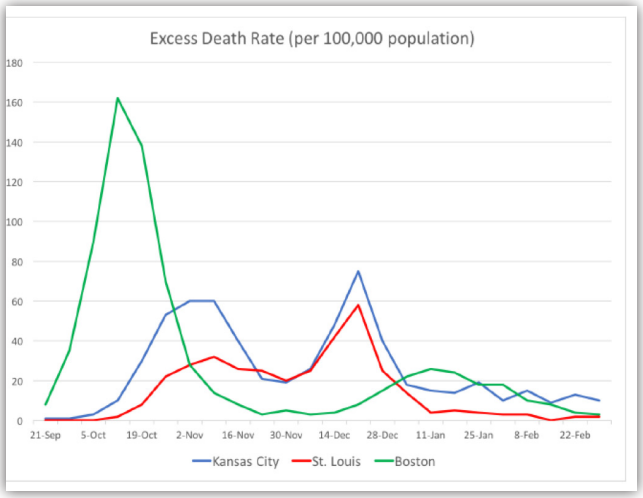


Figure 5. Weekly excess death rate per 100,000 population in Kansas City, St. Louis, and Boston during the 1918 influenza pandemic.

Table 1

Setting	Influenza/Pneumonia Deaths, last 4 months of year	Excess deaths over baseline	Mortality rate/100,000	Mortality ratio 1918:1915	Mortality above rural (%)[2]	Rank among 49 US Cities
Missouri						
-Total[3]	12,250	10,657	476	3.3		
-Excluding large cities	7,643	6,743	339[4]	N. A.	N. A.	
St. Louis	2,883	2,407	537	3.4	21	32
Kansas City	1,724	1,507	718	4.1	41	17

1. data are from 1918
2. rural defined as population <100,000
3. data include figures from St. Louis and Kansas City
4. estimate
N.A.: not available
Sources: Mortality Statistics 1919[20]; Hatchett[19]

"freezing weather and rain would eliminate the influenza epidemic by clearing the air." Dr. J. D. Griffith suggested consuming a teaspoon of soda in boiled water three to four times a day. As was the case elsewhere in the country, authorities insisted on the use of cotton masks for everyone who came into contact with the public; these masks were ineffective. In 2010 Dr. Charles White (1905-2014), who began his medical practice in Kansas City about a decade after the 1918 epidemic, told the authors that in his early years he and his colleagues "used to come up with very elaborate treatment protocols; of course there was no scientific basis for any of it." The same statement is applicable to many of the influenza prevention strategies promoted in 1918.

The general public joined in advocating a variety of practices to prevent influenza: wearing skunk oil vials around the neck; smoking; drinking; eating rock candy; and placing sliced onions on window sills. One lady ate a cake of yeast a day as a prophylactic. Although she was spared from influenza, she experienced severe abdominal pain, bloating and eructation; her friends told her she was "rising." In 1918 saloons lined the Missouri side of State Line Road; on the other side of the street in Kansas, the sale of alcohol would not be legalized until 1948. Many of these establishments advertised prophylactic quinine and whiskey to their patrons.[15,16]

As in St. Louis, community volunteer organizations in Kansas City played a crucial role in responding to the epidemic. The city's first meaningful action was taken by the Chairman of the Kansas City Chamber of Commerce, Bernard Parsons, who summoned the Mayor, the ARC, the Hospital and Health Board, and leading businessmen to action. The ARC volunteered the services of its personnel and the use of all its facilities and donated supplies valued at thousands of dollars to General Hospital. The Visiting Nurses Association (VNA) staff was mobilized into service immediately. VNA nurses made 4,392 visits to 1,254 influenza patients in the city, but there remained a critical nursing shortage. Mrs. Harry Mather, nursing director of the ARC, requested volunteer nurses' aides from the general public, stating ''they need have no experience, simply good health and ability to work long hours."[15] Although Kansas City (and St. Louis) would not desegregate until decades after the epidemic, and trained black nurses were rejected for service in World War I despite a desperate need, General Hospital requested and received much-appreciated service from black nurses during the height of the influenza crisis.[15]

Outcomes

Abundant available epidemiological data paint a clear, if grim, picture of influenza's toll in Missouri's two largest cities (Table 1). St.

Louis reported 31,693 influenza cases and 2,883 deaths. In Kansas City, 11,431 cases of influenza and 1,724 deaths were reported.[19] The actual numbers of influenza cases undoubtedly were much higher, as many cases were not reported. Both St. Louis and Kansas City had higher rates of excess mortality than other areas of Missouri. Despite these dreadful mortality figures, the two cities fared relatively well in comparison to many other large metropolitan areas. In St. Louis the mortality rate ranked 32nd highest among 49 U. S. cities with populations above 100,000 and was the lowest of the 10 largest cities in the country; Kansas City had the 17th highest mortality rate (Pittsburgh, Pa., ranked first; Grand Rapids, Mi., had the lowest mortality).[17]

What factors explain the widely variable death rates among American cities in the 1918 epidemic? In hindsight through the lens of 21st century epidemiologic analysis, insight is gained by assessment of several metrics: time from the first reported cases to the peak of the epidemic; overall excess mortality compared to baseline; excess mortality at the peak; and weekly mortality curves over the duration of the epidemic. Figure 5 shows the epidemic curves of St. Louis and Kansas City in comparison to Boston, a typical hard-hit eastern city which had the fifth highest mortality in the country. Boston experienced one dominant early autumn wave with an early peak and exceedingly high excess mortality. The epidemic curves in the two Missouri cities, which were comparable, had important distinctions from Boston: later onset of the epidemic; longer time from onset to peak; much lower peak mortality; and two autumn/winter waves with highest mortality in the last wave. Several factors accounted for these differences.

Cities that implemented what are now known as social distancing interventions earlier had much lower peak mortality rates than those which delayed action.[18] The flattened epidemic curves in St. Louis and Kansas City, as compared to Boston, indicate that control measures were effective and were implemented early enough to reduce mortality. In retrospect only a handful of the many "nonpharmaceutical interventions" used in 1918 worked: early closures of schools, churches, and theaters, and bans on public gatherings.[19] Each of these measures were enforced in both Missouri cities. The duration of implementation of nonpharmaceutical interventions also had a salutary effect on mortality. Both Missouri cities maintained social distancing policies longer than many other cities. The net result was that in hindsight, both St. Louis and Kansas City, despite the latter's political missteps, were among the four large U. S. cities, of 17 assessed, with the most effective interventions. In both cities disease transmission was 30-50% lower than expected.[19] Modern policy makers have used these findings to refine public health approaches for contemporary pandemic influenza preparedness.[17,18, 19]

Two other findings are notable. First, in both Missouri cities the higher second autumn/winter waves occurred after social distancing restrictions had been eased prematurely. Second, influenza mortality in Kansas City was consistently above that in St. Louis: from the onset of the epidemic in early October 1918 until its conclusion six months later, mortality rates were higher in Kansas City in 24 of 26 weeks.

In summary, from the vantage point of a century, we now recognize that social distancing actions taken by public health authorities in both St. Louis and Kansas City led to demonstrably reduced peak and overall excess influenza mortality rates. However, in both cities, premature easing of school closures and other epidemic control measures resulted in higher mortality in the second autumn/winter waves. History has given high marks to public health and volunteer organizational responses to 1918 influenza for both of Missouri's major cities, especially St. Louis, which benefitted from stronger leadership and a much less politicized public health approach than its sibling Kansas City.

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