

Spanish Influenza 1918

The World's Greatest Pandemic

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SPANISH INFLUENZA 1918 THE WORLD'S GREATEST PANDEMIC

Ninety years ago this month the United States, in addition to being mobilized for "The Great War," suffered an Influenza pandemic of a proportion that dwarfed any pandemic before that time or since. This paper will be about that Influenza pandemic, its setting, the biology of the Influenza virus, the pandemic statistics, as well as the effects of the flu on history of that time.

I will briefly review the efforts at finding the cause and mechanism of the 1918 Influenza epidemic, which have lasted until the present and, finally, a brief discussion of the implications for moderate times and particularly the avian flu virus which in the last few years has been reported numerous times by the media.

The Great War was one which the United States entered only late in its course and which for this country lasted only 18 months.

You may recall that this was begun on June 28, 1914 with the assassination by Princep in Serbia of the heir to the Austro-Hungarian Empire Archduke Franz Ferdinand and his wife Sophia. The assassin was from the Kingdom of Serbia and from a group demanding independence from the Empire. There was rapid retaliation by Vienna against the Kingdom of Serbia which set up a chain reaction across Europe. Germany was an ally of the Austro-Hungarian Empire and on July 23, 1914 declared war against France, England, Russia, and Serbia.

The popular work, *The Guns of August* by Barbara Tuchman describes the first months of that war and the mobilization by the various countries in Europe as well as the first battles on the European continent.

While the clouds of war had been seen brewing in Europe, Woodrow Wilson, was elected in 1912. He ran for re-election in 1916 under the pledge to keep the United States neutral and out of the European War. He was re-elected and at least for the first year it appeared Wilson would be able to keep his pledge. In May of 1915, the *Lucitania* had been torpedoed off the coast of Ireland. This was a British ship sailing from New York to Liverpool with barely secret extensive war material and supplies for England. 128 Americans died. Still that did not bring the United States into War World I. Approximately a year later in what was known then as the Sussex Pledge, the Kaiser of Germany pledged to stop submarine warfare against any but British and French flagged ships. In January of 1917, however, Germany resumed unrestricted submarine warfare. Soon thereafter, the Zimmerman Telegram was intercepted wherein Germany had invited Mexico to join it in an alliance and in the process of that, invade the Southwestern United States to detract the U.S.'s attention from a European War. Congress declared war on April 6, 1917. And then although officially neutral to that point, mobilized itself to participate in a European war. Laws were quickly passed by Congress, including the first

universal draft the United States had ever had, liberty bonds for financing the war and a war industrial board which took almost dictatorial power over heavy industry and production in the United States. Wilson pressed Congress for censorship rights to eliminate or discredit any anti-war sentiment in speaking or printing. Censorship not only about the war but against anything that might affect morale came swiftly and heavily upon the newspapers. Some people were even jailed for “anti-war rhetoric.” Soon after the declaration, a million American men went to 21 hastily constructed or enlarged cantonment Army military camps in the United States. These cantonments brought into very crowded circumstances young healthy men from all walks of life and locations in the United States, trained them, made them into soldiers with skills and equipment and rapidly shipped them to France where the U.S. was aiding the allies in the war effort.

On January 8, 1918, Woodrow Wilson gave a speech before Congress outlining the 14 points he urged should be part of the post war settlement, including the basic outline of an international body to enforce postwar peace, the League of Nations. Armistice or the end of the war came November 11, 1918, 90 years ago last week with huge parades and gatherings. It was followed by a Peace Conference in Paris starting January 12, 1919. Wilson himself attended the Peace Conference and urged the imposition of his 14 points into the eventual treaty, which was to be called the Treaty of Versailles. He was against very strong French and English positions that Germany should be stripped of its colonies, stripped of significant elements of its home territory, be completely demilitarized and be made to pay reparations for starting the war. Wilson was a moderating influence in these negotiations, but in early February himself contracted the Spanish flu, was ill for almost 3 weeks and, according to one theory, never actually recovered. Close advisors stated that Wilson was never the same man, that is, he suffered from what appeared to be a neurologic condition of lethargic and apathy and from that point on, failed to vigorously oppose French and English calls for revenge which became embodied in the Treaty of Versailles and some say eventually led to another great European and, in fact, a world war.

I speak so much about War World I which is probably fairly common knowledge in this group because it had 5 effects which supported and, in fact, may have ignited the Spanish Influenza Pandemic. These are:

1. Millions of young men were in close quarters in the cantonments in the United States, allowing free and rapid spreading of the disease.
2. These men were shipped all over the country and many to Europe ensuring the world widespread of this infection.
3. Newspaper censorship to maintain morale among both the military and civilian population brought about little or any public information or even acknowledgment in the early and containable phases of this pandemic.
4. In the civilian community even in the major cities of the east and west coast, there was an astounding lack of doctors and nurses as well as public health officials to initially contain, isolate and, as much as possible, treat the condition.
5. There were huge public gatherings for mobilization, war bond parades and at the war's end, celebrations for the end of the war.

In general, it can be said that the United States' mobilization in War World I enhanced the spread of this deadly disease, the Spanish Flu of 1918, and allowed it to become a world pandemic.

I would like to describe the biology of the Influenza virus. This will be based on what we know at this point in history rather than what was known at the time. In fact, very little was known. The concept of virus, that is, an organism which is infinitesimally small (not visible in a light microscope) and is not able to live freely without its parasite lifestyle on other cells, was little known. There was some concept of very small invisible particles that could pass through ceramic filters and still be infective. In fact, yellow fever was identified just a decade earlier as such as "filterable virus" by Walter Reed. Bacteria are also microorganisms, which are much larger than viruses and can live freely. They contain all the metabolic mechanism for such independent life, such as cell membranes, cytoplasm organelles and genetic material. Bacteria were on the way to being well understood in 1918 and had been identified as the cause of many human illnesses. Initially, it was thought that bacteria were the cause of the Spanish flu. In fact, a particular bacteria then called *Bacterium influenza* or Pfeiffer's Bacillus, was identified in the lung secretions of many who had died of a pneumonia complication of the Influenza. This, in turns out, was actually an opportunistic organism, that is, once an individual was sufficiently debilitated by the flu, particular types of bacteria which were abundant in the world surrounding the individual took over and became pathogenic and, in some cases, brought about the eventual demise of the affected individual. These were opportunistic and not the cause nor the reason for the infectivity of the Spanish Flu.

Influenza virus is a separate family of viruses called Orthomyxovirus Family. The single species in this is the Influenza virus. There are 3 types of Influenza virus named A, B and C. A is the pathogen or the significant one. This virus contains Ribonucleic Acid as its genetic material rather than DNA, which mammalian cells contain as their genetic blueprints. The genetic material is contained within the virus particle in the center in 7 strands. In essence, there are 7 chromosomes. The virus particle's external surface is covered by cellular projections, which are visible only in electron microscope. These are umbrella shaped and are 2 kinds, one is called the Hemagglutinin Antigen (protein structure) and the other is called the Neuraminidase Protein Structure. The hemagglutinin is what allows the cell to attach to the membrane of cells of the respiratory system in birds and mammals. The neuraminidase is what dissolves the host cell membranes and allows the virus particle to enter the cell. Once in the cell, it acts as a parasite. It takes over the genetic and protein producing mechanism of the host cell itself to reproduce hundreds or thousands of similar virus particles and then causes the cell to bulge and explode and in the process, of course, die. Then thousands of virus particles are spread from the original infected cell to the many other potential host cells. They undergo a similar parasitic takeover and reproduction. At this point, the person affected with the flu is infectious, that is, is able to spread the disease to other individuals. The mechanism of spread of this disease is singular, that is, by the spread of droplet particles in coughing and breathing. Particles are able to be infective only for a few hours unless they are inhaled immediately by the next victim. It could be on hands, doorknobs, or other places

and then transferred to the mucous membranes of the next victim, but the most significant method of transmission is aerosol, that is, breathing.

As you can see, close quarters, limited ventilation, high humidity, sharing the air, lack of hand washing, and lack of masks ensure the disease to be spread rapidly.

The clinical manifestations of Influenza are well known. Between 24 and 72 hours after infection the disease manifests itself. By then, the disease has undergone at least 100 generations of cellular reproduction. The clinical findings are headache, fever, malaise, inflammation and swelling of mucous membranes, coughing, immediate pneumonia, and in some cases secondary pneumonia with opportunistic organisms, and or brain inflammation.

The ordinary case fatality rate for Influenza is approximately a third to a tenth of one percent, 114,000 are hospitalized yearly, 25 to 50 million clinical cases of the condition occur on a yearly basis.

Influenza epidemics and pandemics have occurred since 1918. In an ordinary annual Influenza epidemic up to 36,000 people in the United States alone succumb to this condition. This makes it actually the sixth most significant cause of mortality in the United States. That's fairly important. During the 1918 pandemic, the case fatality rate increased to about 3 percent, or 30 times as much. In some areas, the case fatality rate was up to 50%. In 1918, 500,000 people died in the United States from this condition and between 20 to 50 million are estimated to have died worldwide. Literally half of all living humans were affected by the disease because of this incredible infectivity and efficiency of transfer in affected individuals. In that one year more people died than the combined battle death toll of World War I, World War II, the Korean War and the Vietnam War.

Most flu fatalities in modern times occur in people young and old because of the naive immune system of the younger children as well as a decreased resistance in the older individuals. The Spanish outbreak killed, as I said, 500,000 people in the United States, many of these were young, healthy individuals between the ages of 18 and 30, usually the population which is not affected or affected significantly. (see handout)

There are some non-pulmonary complications of influenza. One is myositis, which is a condition associated with muscle aches or pains. It generally resolves. The second complication is encephalopathy, which means involvement of the central nervous system. This was first described in 1915 by a Viennese physician Otto VonEconomo. It is also known as Encephalitis Lethargica. It is an enduring complication of the Influenza, probably from virus directly infecting the brain and central nervous system tissue. It brings about, as the name implies, a lethargy and a lack of interest in activities and may in some cases be fatal. One theory of history is that President Wilson was afflicted with this complication of the Spanish Flu.

One of the interesting features of this particular family of viruses is their very high mutation rate. Being an RNA virus, some of the usual protections from mutation are abrogated. It is a characteristic of the Influenza virus that it changes rapidly. Viral epidemics (the annual recurrence of Influenza) are different from year-to-year due to these mutations. That means that a flu vaccine shot from one year does not protect from the flu virus of the following season. A mutation in the usual case is called genetic drift and occurs simply because of errors in reproduction, in the parasitic lifestyle of this organism. Most and, in fact, the vast majority of such mutations are inefficient or useless and, in fact, in many cases are lethal (to themselves). Every so often, however, a favorable mutation occurs allowing the new virus particle to be more deadly, more infective or more efficient, in which case using the Darwinian principle of natural selection, it becomes the more prevalent form and is reproduced more efficiently and becomes the most significant form of the disease. It is these mutations in the neuraminidase and hemagglutinin structure protein that makes one year's vaccine useless against the following year's virus.

A second mechanism of mutation is called antigenic shift. This is a significant (not simply gene but a complete chromosome) change from a parent virus to its generation. This occurs from a reassortment when several kinds of Influenza virus infect a single organism. An example of this would be if a human was infected with avian flu. This is a condition which has very little infectivity from bird to human, but once it affects a human, it is uniformly lethal (case fatality rate is approximately 70%). If a human were infected simultaneously with both the bird flu and a much less virulent but efficiently spread human Influenza, the chromosome or gene from the efficiently spread organism could be transferred to the highly lethal organism and produce a "super-flu," that is, one with both highly efficient transmission (infectivity) and high lethality.

Varieties of the Influenza type A virus are named by the particular chemical structure of both the hemagglutinin and the neuraminidase projections. The original Spanish Flu is entitled H1N1. The Avian flu infecting Asian birds and a few humans with lethal consequences is called H5N1. There are about 10 variations of both the H and the N protein structure.

The ordinary treatment of Influenza is primarily by prevention, that is, by the annual flu shots and isolation of individuals who are showing signs of Influenza. This would mean wearing masks, good hand washing technique and, once identified, isolation techniques.

Treatment for the Influenza once it occurs, is really depending on the severity and extent of the infection. General measures include controlling temperature, cough suppressant and analgesia for general muscle aches and pain as well as headache.

If the patient develops a primary pneumonia (that is, without secondary bacterial infection), treatment with an antiviral (Tamiflu, etc.) and respiratory support even to the point requiring intubation and a ventilator, may be necessary. Antibiotics for prevention of opportunistic bacteria are also indicated.

Obviously, treatment of complicated flu is difficult and expensive. It requires an intensive care unit in a hospital if a patient goes on to have either primary pneumonia or secondary bacterial infection. A pandemic would be expected to easily overwhelm current hospital bed capacity. This is exactly what happened in 1918.

The first evidence from the records of the 1918 Spanish flu occurs in February. It is reported in Haskell County, Kansas. A country doctor, who turned out to be a relatively good medical historian, documents about 50 cases. This is a rural area, exclusively a farm economy with close contact between man and animals. On March 4, 1918, an army private on leave with his family in Haskell County returned to Camp Funston in Kansas. This is now known as Camp Riley. The disease was highly infectious (contagious but was not highly lethal). Several thousand reported cases of influenza occurred at Camp Funston. There were only a few deaths. From there, the disease seemed to go underground or become dormant in the United States. However, this may be a phenomenon of the censorship in the news that I have spoken of previously. It seemed in the next month to become rampant in Spain. Spain was not directly involved in World War I and had no newspaper censorship; consequently, it was well reported. Again, it was not a particularly lethal but it was a very infective form of Influenza and because of the newspaper and radio reports, this disease, at that time and in fact for all time, became known as Spanish Influenza. From Spain, it propagated through Europe including the battle zones. It, in many cases, interrupted and delayed the battle plans but it was not particularly deadly. It crested in Europe in June and then seemed to disappear without a trace throughout the rest of the summer.

In late August of 1918, in Boston, sailors in transit from the war zone seemed to have brought the second wave of this disease to the American City. This time it seems to have mutated sufficiently to become a killer. On August 28, there were 8 reported cases in Boston of the flu; on August 29, 58; and on August 30, 81. That's the day the first patient was admitted to Boston Hospital. One week later, 8 had died of the disease; another week later, 52 died; the following week 600 died.

On August 8, the disease was first reported at Fort Devens, Massachusetts. Within a week an epidemic out of control occurred, 50,000 men were infected. There were 100 deaths per day by October 1 and the medical facilities and hospitals of that fort were clearly overwhelmed. There were makeshift hospitals and makeshift morgues throughout the month of October. On September 23, it was evident that this was a significant infectious disease involving the Army. Public health doctors at that time indicated the disease was a greater killer of soldiers than actual battle injuries. To that point, there had been very few infectious diseases among the newly mobilized American troops and a Blue Ribbon Study Team was named by the Surgeon General of the United States, William Gorgas, involving the most prominent infectious disease scientists in the United States at that time to study the situation in Fort Devens.

From Boston and Fort Devens, the more lethal form of the Influenza spread throughout the East Coast, then throughout the country, the continent and the world. In Philadelphia,

on September 11, a ship arrived at the Philadelphia Navy yard with reportedly 16 sailors affected with the flu. Because of censorship, it was not reported to the public and no public health safety measures were introduced. Nine days later, there was a huge Liberty Bond Sale Parade that occurred in Philadelphia with more than 100,000 people attending. Within a week, Philadelphia became the hardest hit city in all North America.

It took 2 weeks for the municipal public health authorities to be mobilized. By October 3, all schools, churches and pool halls were closed. Proclamations and, in fact, laws were enacted against coughing and spitting in public. On October 1, there were 635 cases of Influenza reported, probably an underestimate because of censorship. On October 5, 2000 had died in that week; on October 10, 4,500 had died. A total of 11,000 perished from the 1918 Influenza epidemic in Philadelphia alone. Not only hospital facilities, doctors and nurses and public health facilities but also mortuary, undertakers, and graveyard facilities were overwhelmed. This was a prelude to a pandemic that raced throughout the world affecting every major city in the United States and, in fact, veritably every major city in the world. Very few places were isolated or protected from the Influenza epidemic and those that were, employed stringent isolation. An example of this was American Samoa where because of completely interdicted travel, not a single case of Influenza was reported.

Even isolated villages in Asia, India, Africa, and the Pacific Northwest were devastated and, in some cases, completely destroyed in the fall and early winter of 1918.

As I stated previously, scientists in that year had no idea what the cause of this illness might be. The germ theory of disease was already well established, that is, that in many cases germs caused disease. We understood to some degree bacteria but only to a slight degree viruses. At the height of the Philadelphia epidemic, it was announced the cause of the Influenza had been detected. It was a bacteria called Pfeiffer's Bacillus, which we now know as Hemophilus Influenza, a bacteria. This was an error. It was not the cause of the disease.

The disease ran a course of 3 outbreaks, the last of which was in February, March and April of 1919. Thereafter, it seemed to have disappeared from the face of the earth. There still was Influenza, which was still highly infective, but much less lethal.

Since the year 1918, scientists have discovered a great deal about the Spanish Influenza. In the early 30s, Paul Lewis and Richard Schope discovered that swine were the reservoir for the Spanish Flu and still harbor the descendants of that 1918 killer. The progeny of the 1918 flu were actually responsible for the swine flu pandemic in 1968. British researchers made a connection between the 1918 flu pandemic and the virus which they were able to isolate using ferret experiments. Apparently ferrets seem to have basically the same physiology and infectivity, at least for this virus, as humans and were a valuable study animal.

Jeffery Taubenberger and Anne Reid in the 1990s were able to decode the genetic sequence of the 1918 flu virus from formalin preserved lung tissue in paraffin cubes that

had been stored in the Armed Forces Institute of Pathology in Washington, D.C. They used modern molecular biology techniques, decoding the RNA sequences of the original 1918 virus giving us the precise genetic fingerprint which allows us to follow the spread of the disease throughout the world. The 1918 virus was identified as the H1N1 variety no longer found in the wild.

Yohan B. Hultin, a San Francisco pathologist, in the early 1950s, reasoned that the actual live virus from the 1918 Spanish Flu should be detectable and, in fact, should be able to be recovered and grown from the tissue of 1918 victims that had lain buried in the Alaskan permafrost. An early expedition to the Brevig peninsula and the Village of Teller yielded disappointing results. Dr. Hultin returned to that area in 1995 and using modern techniques, was able to exhume other victims of the 1918 pandemic and indeed was able to recover the actual live H1N1 virus from that era, allowing further identification of the original disease.

There is a curious phenomenon about our collective memory of the 1918 Spanish Flu. By all rights, it was a horrible societal experience. The medical descriptions are as disturbing as any of the worst visitations of plague on the human population in our history. However, very few people know about the 1918 epidemic. Part of this is because of the war years censorship, part because by the horrors of trench warfare were well known and perhaps people were weary from such descriptions. Still, it is hard to find information in popular literature about something that was obviously a shared horrible experience. Many of our prominent writers were alive during this time but failed to mention it in their work, such as Hemingway, F. Scott Fitzgerald or Faulkner. Mary McCarthy as a 9-year-old child lost both of her parents to the Influenza, became an orphan and was raised by relatives, but does not mention it. Katherine Anne Porter, who was a newspaper writer in Denver during the 1918 pandemic, contracted the flu but survived. Her fiancé, however, succumbed to this condition. In her writing alone do we find any significant mention of the Influenza, a novella called *Pale Horse Pale Rider*.

In answering the question, how could the modern world have heard so little of a worldwide scourge that killed upwards of 30 to 50 million people is answered by Journalist H. L. Mencken, who offered his theory in 1956, "The epidemic is seldom mentioned, and most Americans have apparently forgotten it. This is not surprising. The human mind always tries to expunge the intolerable from memory, just as it tries to conceal it while current." Others point to an international pre-occupation with World War I and its outcome as obliterating all competing concerns. Finally, some speculate that the 1918 flu hit with such deadly force and over such a relatively short period of time that clear-eyed historical perspective was not possible.

Confronted with the question of whether such an event could happen again, modern virologists respond with a sobering, "Yes."

As I have noted previously, antigenic drift changes flu virus from year-to-year, but antigenic shift could occur when a flu virus from a bird and a flu virus from a human combine inside a pig or a human and result in a new, virulent strain. Scientists speculate

that such a scenario sets the scene for pandemics such as those that occurred in 1957 (the Asian flu, which killed 70,000 Americans) and the 1968 Hong Kong flu (which resulted in the deaths of 28,000 Americans).

The responsibility for tracking emerging Influenzas and predicting which ones pose a serious threat to human populations fall to government organizations such as the Centers for Disease Control and the National Institutes of Health, as well as the Food and Drug Administration. These agencies combine forces with the World Health Organization and attempt the tricky task of flu forecasting. An international surveillance network of flu trackers records and disburses data regarding outbreaks in various species from all over the globe. The Wall Street Journal last week had an article some of you might have seen that compares increased Google searches about flu to actual public health reports. It suggests a two week head start may be possible in reporting a flu outbreak.

In conclusion, let me say that it was interesting to study Spanish Flu Pandemic. I have to admit that in my medical studies it was really never made clear the key questions of what is unique about the Spanish Influenza Virus and if it could happen again. Quite frankly except for the research data and public health records, information about this pandemic is hard to find for the reasons I have described.

In terms of recommendations for the future, during flu season, which is upon us now, get your flu shot, wash your hands, stay away from individuals showing signs of Influenza and pay attention to public health announcements and recommendations regarding the flu. And, finally, **GET YOUR FLU SHOT!!!**