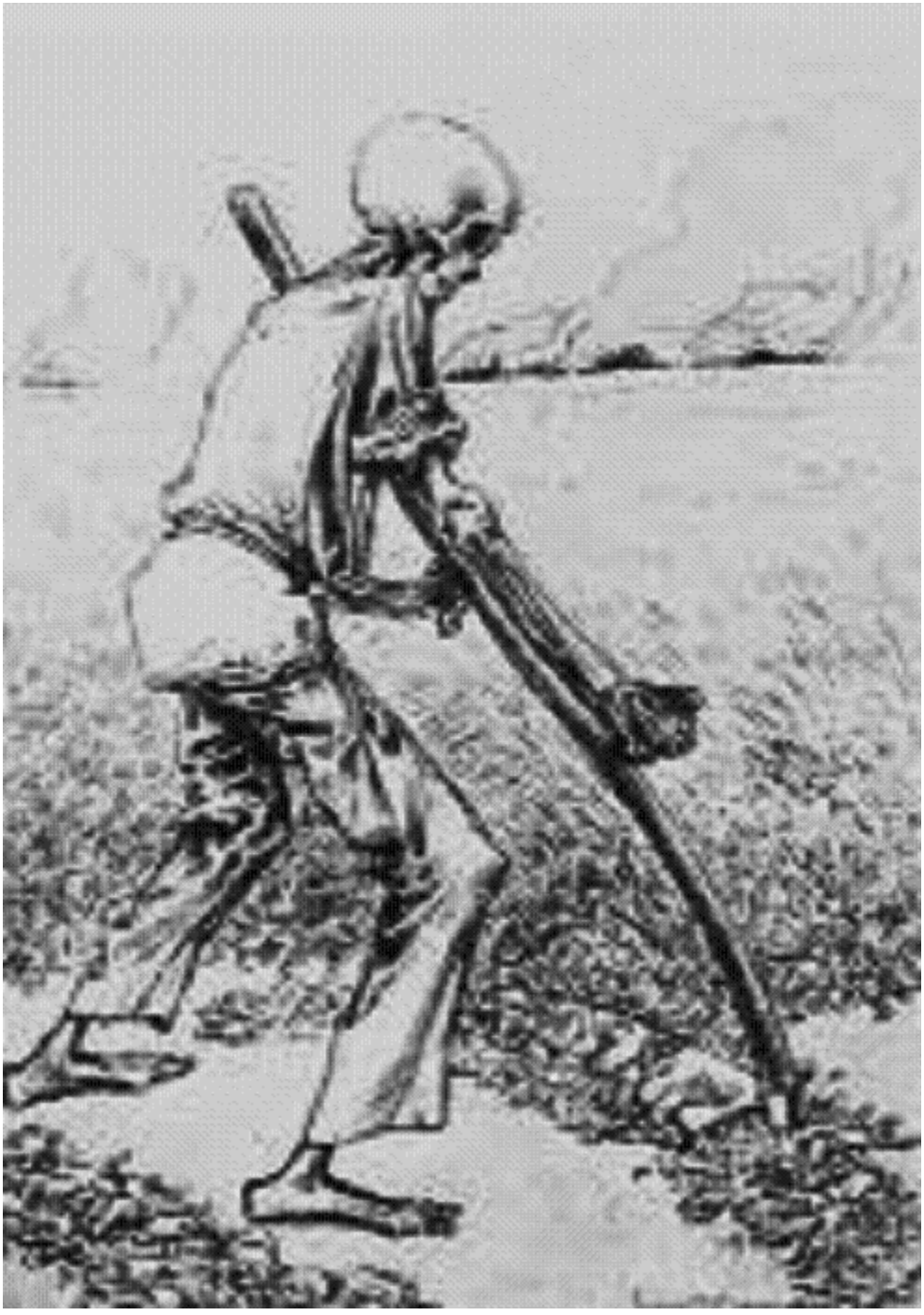
Preparing for the Coming Influenza Pandemic



Grattan Woodson, MD, FACP

By Grattan Woodson, MD, FACP
Medical Director,
The Druid Oaks Health Center
Decatur, GA USA

(404) 298-9951 www.DruidOHC.com

About the cover: The Grim Reaper by Louis Raemaekers

Introduction

An extraordinary event is happening right now in Southeast Asia that has the potential to affect humanity in ways thought banished years ago. Scientists are closely monitoring what looks like the birth of a super strain of one of man's oldest and most persistent nemesis, the influenza virus. This new strain has the potential to kill hundreds of millions given the right conditions. According to the World Health Organization and the US Centers for Disease Control and Prevention, the required conditions are now in place. We stand on the verge of a once in a 100-year influenza pandemic that is an event quite different from our routine seasonal flu. Pandemic flu spreads like wildfire through the human race leaving death, chaos, and civil disorder in its wake.

This monograph is dedicated to, and written for my patients. I wrote it both to inform them about this health threat and to provide them with some practical guidance on how they can survive the pandemic.

While it is certain that we will have another influenza pandemic and probably soon. What is not known is whether the pandemic will be of the major variety resembling the 1918 flu or a minor one more like the 1958 flu pandemic. My advice is to prepare for the worst and hope for the best.

The first few sections of this monograph deal with topics related to the influenza virus, with special attention on the 1918 Spanish Flu, which was the last major pandemic. What happened then is the best source of information on what could happen now. Given the predictable effect a major pandemic will have on society and essential services, several prudent suggestions are provided for you to consider taking before the pandemic sets in.

During a major pandemic, many ordinary people will find themselves responsible for providing medical care to loved ones and friends. Under usual circumstances patients this sick would be hospitalized but during a major pandemic, that option is not likely to be available. To assist you in this heroic lifesaving task, I have included advice on how to provide home care to very sick or even dying influenza patients.

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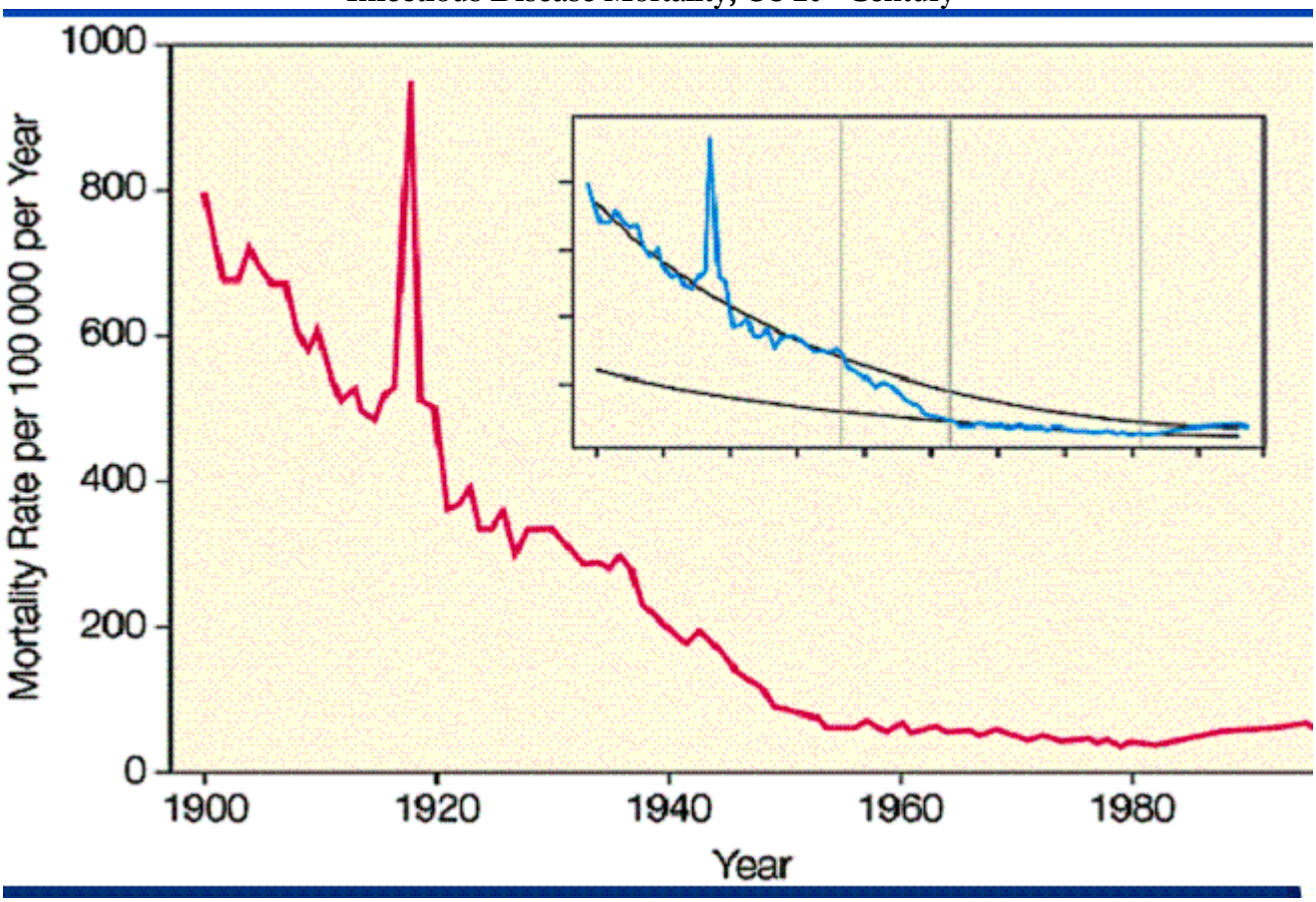
Information about the Coming Avian Influenza Pandemic

A highly virulent and deadly new influenza virus strain is emerging in Southeast Asia that is of great concern to health administrators and infectious disease specialists. The new virus is called H5N1 avian influenza virus type A. Many infectious disease experts think we are on the verge of a major worldwide influenza pandemic of similar severity to the 1918 Spanish Flu. Pandemics are simply worldwide epidemics. During flu pandemics, a higher than usual percentage of the population becomes infected and more people die from these infections than occurs during the usual annual flu season. Pandemics occur because a new influenza virus makes its way from birds or swine to humans resulting in a strain for which we have very little immunity.

Infectious Disease Mortality, US 20th Century*



The impact of 1918 flu pandemic can be clearly seen as a spike up in US mortality
***Armstong, etal. JAMA 1999;281:61-66**

There are major pandemics and minor ones. Minor ones are more common and much less severe than major ones but still a lot worse than routine flu outbreaks we experience each winter. All pandemics infect many times more people than happens with the seasonal flu but during major pandemics the death rates also soar into the tens of millions or even higher.

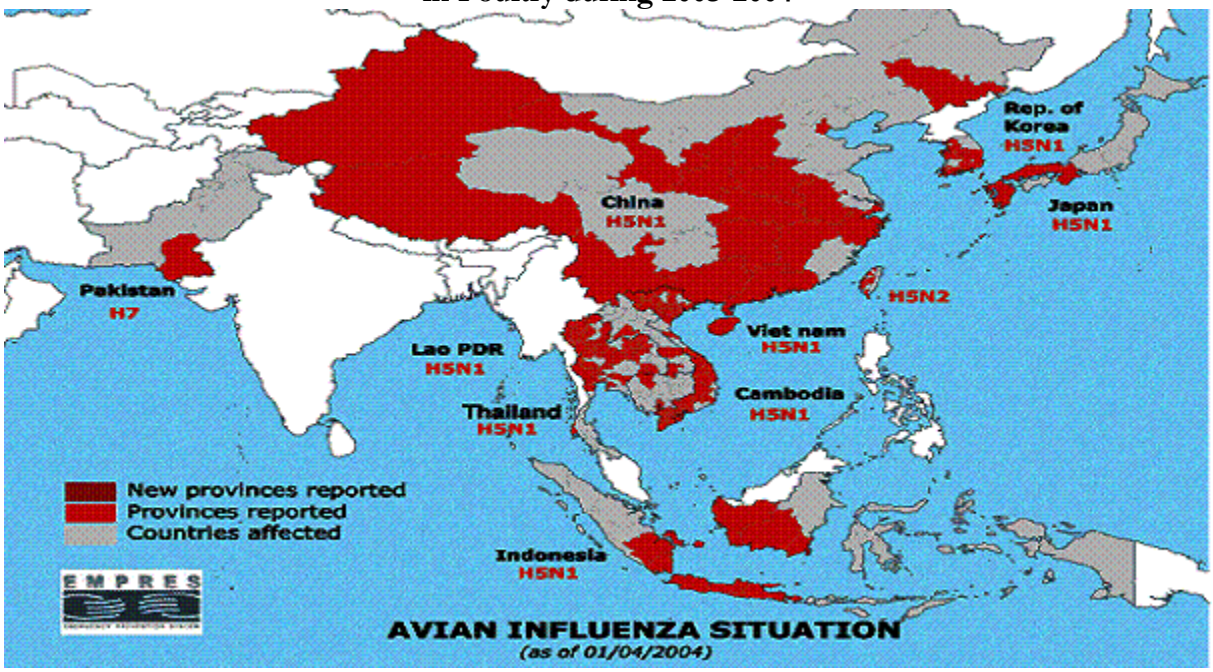
I became aware of the potential threat of an avian influenza pandemic last year. One of the most surprising things I learned was that influenza pandemics are regular events. They have an almost predictable periodicity of 3 per century. In fact, over the last 400 years there have been 12 flu pandemics recorded. Every 100 years or so a major pandemic occurs that is so severe it dwarfs everything else by comparison. The last one of these events was in 1918; the Spanish flu.

During that pandemic, 5 to 10 times as many people as usual became severely ill with flu and many millions died from their infection. The percentage of the population that becomes ill with flu symptoms is known as the

clinical attack rate. It is interesting to me that studies of influenza antibody levels in people before and after influenza epidemics reveal that the percentage of patients with blood evidence of having had the flu is twice as high as the reported clinical attack rate for the epidemic. Another words, for every person who gets sick with the flu there is another person who contracts the virus but has no or very few symptoms of the illness.

The medical term for the percentage of those who become ill and die is the **case fatality rate**. The case fatality rate hovers around 0.2% to 0.35% during the usual winter flu season. During minor pandemics, this rate can increase up to 3 or 4 times but during a major pandemic the case fatality rate is increased by 10 to 50 times.

H5N1 Avian Influenza Outbreaks in Poultry during 2003-2004



In May of 2005, H5N1 avian influenza was reported in India where it was associated with several human cases. In that same month, it was reported in China with the source being wild birds that had flown in from SE Asia. In June 2005, the first human case was reported from Indonesia. Graphic Source: CDC

Most flu experts predict that it is only a mater of time before the virus becomes communicable between people so that is really not the burning question. According to the World Health Organization guidelines for pandemics, as of June 2005 we are in Phase 0, level 2. This places us two steps away from the beginning of a worldwide pandemic.

Epidemics and Influenza Pandemics

An epidemic is defined as an infectious illness that spreads so quickly that the number of new cases rises in an exponential manner rather than just increasing linearly. This means that during epidemics, the number of new cases doesn't just go up by ones or twos each day. During an epidemic, the number of new cases doubles every few days.

A pandemic is an epidemic that spreads across the globe affecting every continent rather than being confined to one geographic area. While there are many causes of serious epidemics like cholera and ebola virus, the only cause of global pandemics that I am aware of is influenza. There are several reasons for flu's exalted status as the only pandemic human virus.

WHO International Influenza Pandemic Phases

Phase 0: The Inter-Pandemic Phase
The time between two influenza pandemics. The longest period known was 39 years (1918-1958)
Phase 0, Level 1: Novel Virus Alert
A novel influenza strain has been identified in a human.
Phase 0, Level 2: Human Infection Confirmed
Confirmation that the novel strain has infected two or more persons but the ability for the strain to pass rapidly from person-to-person is not confirmed or is questionable.[1]
Phase 0, Level 3: Pandemic Alert – Person-to-Person Spread Confirmed
The person-to-person spread of the virus is confirmed within a community with at least one of the outbreaks lasting for more than 2 weeks.
Phase 1: Confirmation of the Onset of a Pandemic
The novel virus is confirmed to be causing several outbreaks in one country and has spread to other countries. The mortality and morbidity of the infection is serious in at least one segment of the population.
Phase 2: Regional and Multi-Regional Epidemics
Outbreaks and epidemics are occurring in multiple countries
Phase 3: End of the First Wave Pandemic
The first pandemic wave is likely to taper off with a change in season. The hiatus between the first and second pandemic wave is variable and could last from 3 to 9 months.
Phase 4: Confirmation of Beginning of a Second Pandemic Wave
The lethality of the second and subsequent waves depends on there being enough time to manufacture and administer an effective vaccine before the wave begins.
Phase 5: Confirmation of the End of the Pandemic
Once the number of susceptible persons falls below a threshold, the pandemic will cease.
Source: WHO

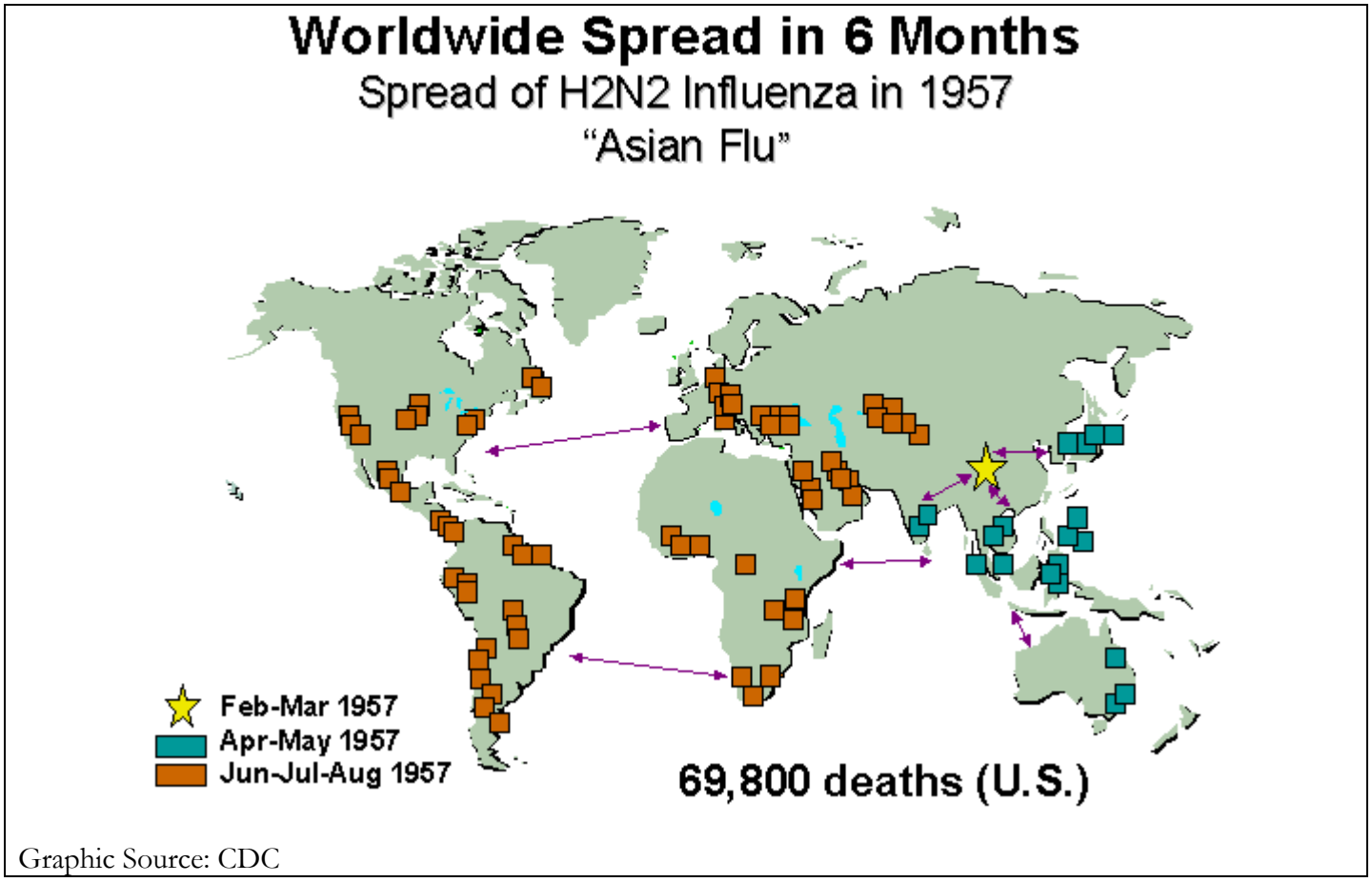
One of the most important reason's for influenza's success as a human invader is its **virulence** or infectiousness. The virulence of an organism is determined by how easily it is transmitted from one person to another. Infecting agents that can cause illness after a small exposure are more virulent than one that requires a larger exposure. Virulence is increased when infection can be passed between people without any direct contact. The most common way for flu to be transmitted is by breathing air contaminated with virus. Coughing is how the virus gets into the air in the first place. Flu can also be transmitted by direct contact with someone ill with the disease. This includes shaking their hand or even touching something that the sick person previously touched. Under the right conditions, flu can remain infectious for days outside of the human body, living on surfaces like counter tops or doorknobs. Transfer of the virus can occur when a susceptible person touches a contaminated surface.

Another determinate of virulence is the proportion of the population that is susceptible or vulnerable to infection by the organism. With respect to influenza, virtually 100% of the human population is susceptible to a new strain however; remember during seasonal and pandemic flu events, fully half the susceptible patients who contract the flu have no or few symptoms.

Influenza causes pandemics because it scores so highly in all these causes of virulence. These characteristics of influenza help explain why this organism can quickly spread from one region of the globe to another. Even during the relatively primitive travel conditions existing in 1918 it only took 6 weeks for epidemic influenza to spread from the US to Europe and Africa. Imagine how fast the next pandemic virus will move across the globe

[1] We have been at Phase 0, level 2 since 2003 when H5N1 appeared in Southeast Asia, especially Vietnam. Since then there have been an increasing number of cases and deaths. The first recognized human infection with H5N1 flu occurred in 1997 in Hong Kong. About a dozen people died in that episode and all deaths were tied to poultry. No new cases occurred until the virus resurfaced in Vietnam in 2003.

given the many thousands of passengers traveling internationally by air every day! Taking this into account, the British Government's Health Protection Agency predicts in their Influenza Pandemic Contingency Plan that once the first case of pandemic flu reaches Hong Kong it will take only 2 to 4 weeks for the pandemic strain to arrive in the United Kingdom.



Graphic Source: CDC

A feature of influenza pandemics not well appreciated generally is that they occur in waves. The 1918 Spanish flu (H1N1) was associated with three waves while the 1958 Asian flu (H2N2) and 1968 Hong Kong flu (H3N2) pandemics have two distinct waves each. The reason for this wave behavior is not known but some have speculated that it is due to a change in the season of the year. The timing of a wave may also be related to a genetic change or mutation in the new strain of influenza virus. In past pandemics, the time between two waves was 3 to 9 months. A point to keep in mind about pandemic waves is that the second wave can be much more severe than the first or third wave of the series. During the 1918 pandemic, the deadly second wave was responsible for > 90% of the deaths for the entire pandemic.

While the typical flu season predictably occurs from November through March, during pandemics, flu can vary from this script. The first wave of the 1918 flu occurred in the spring of that year ending in March. That flu was very severe by usual standards but the second wave beginning 6 months later in September was the most fatal. The third wave occurred during the following winter/spring and was the mildest of all. It is of note that pandemics end simply because all or most susceptible persons within the population have contracted the infection and have either died or developed immunity.

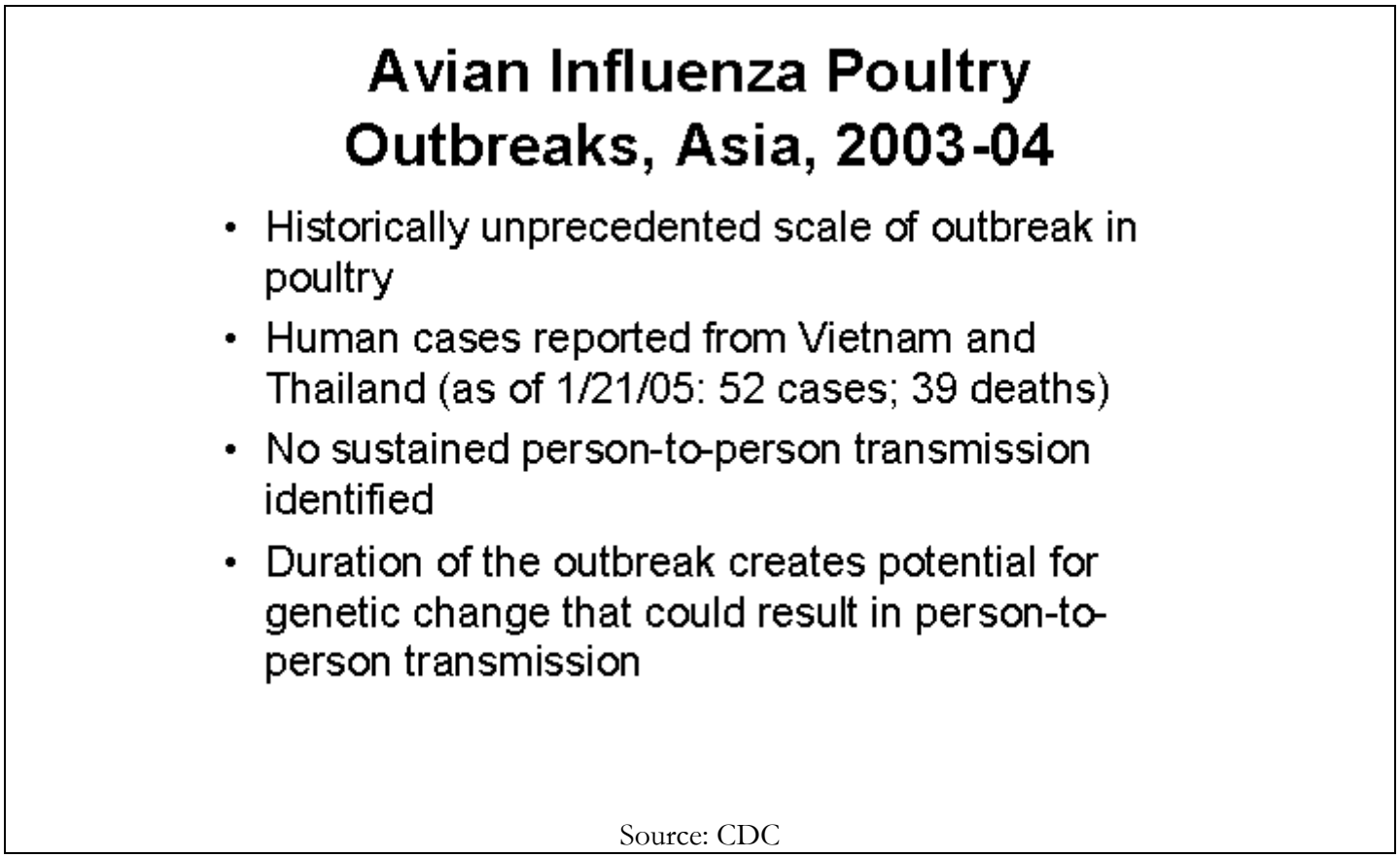
During pandemics, a major difference compared with seasonal flu that is the highest death rates are among the healthy 20 to 30 year old adults. This is in contrast with the seasonal flu that strikes the very old, the young, and the infirm the hardest. Of course, the usual victims of seasonal flu are not spared during pandemics. On the contrary, death rates are much higher for every age and risk group during pandemics compared with seasonal flu.

The point here is that the age 20 to 30 year group, usually immune to the ravages of seasonal flu, experiences the highest death rates of any group during pandemic years. Ironically, one possible explanation for this pandemic observation may relate to the increased health and vigor of this groups immune system.

What Makes the H5N1 Avian Flu so Fearsome?

The reason for the present state of alert among world health authorities is the belief that we are witnessing the development of a 1918-type major flu pandemic in Southeast Asia. In essence, a once in a 100-year major flu pandemic due to the emergence of a H5N1 Influenza virus type A.

On average there are two minor pandemics for every one major pandemic. The minor pandemics are associated with lower clinical attack and case fatality rates than associated with major pandemics. For instance, the 1958 pandemic was associated with three times as many deaths than seen for seasonal flu but during the 1968 flu pandemic, there were only a few more deaths than would be expected. It has now been 37 years since the last flu pandemic suggesting that statistically at least, we are due for another one soon.



Source: CDC

What makes avian influenza H5N1 so troubling to the medical community? It is its stunning killing ability, a statistic known as the **lethality** of the disease. The 1918 flu, like most pandemics, infected 40% to 50% of the world's population or approximately 640 million persons at the time. If we assume that approximately 80 million people died during the 1918 influenza pandemic[2], this results in case fatality rate of about 12.5% of those infected. What is so worrisome to the influenza experts at the US CDC and WHO is the case fatality rate for humans that become infected with the strain presently brewing in Southeast Asia has been about 50%.

[2] For a variety of reasons explained in the next section of this monograph, in my opinion the best estimate of the worldwide number of deaths attributable to the 1918 influenza pandemic is 80,000,000.

Right now, the virus is confined mostly to birds but has adapted to tigers and pigs. The humans infected have all been the result of contact with infected poultry during processing, cooking, or eating. Close attention is being given for any sign that H5H1 avian influenza has recombined with one of the more tame human flu strains. When this event occurs, a development that influenza experts predict is imminent, the new viral offspring would gain the ability to spread directly from person-to-person. This development would signal the beginning of the pandemic.

Last year, a report of what was believed to be the first documented case of person-to-person transmission of avian flu was reported in the New England Journal of Medicine.[3] There have been no subsequent reports of this over the last 12 months so we can reasonably conclude that this was a one-time event rather than the signaling the beginning of the next pandemic.

The prime focus of the medical community today is how lethal will this new hybrid virus be. It is not likely to be as lethal as native H5N1 avian flu is but will probably be a lot worse than routine seasonal flu. While no one can predict this in advance, it seems logical to assume that there is 1 in 3 chance that the offspring virus will have a worldwide clinical attack rate of 35% and 50% and a case fatality rate of 3% to 10%. If this proves to be the case, the effect on humanity and society will be traumatic in ways thought impossible today in light of advances in technology and medicine since 1918.

The nightmare or worst case scenario surrounding H5N1 avian influenza comes from the concern that the case fatality rate that the offspring will inherit is much more like its avian parent than its human. If this happens, then we can expect a medical and social disaster the likes of which have not been seen since the plague swept Europe in the 1600s.

In the opinion of Dr. Michael Osterholm, PhD,[4] writing in the New England Journal of Medicine, the most likely scenario if we have a major pandemic, is for an event that approximates the death toll seen during 1918 Spanish Flu.[5] On the other hand, if reassortment of H5N1 avian flu with human influenza results in a pandemic of the minor variety this would not represent the dire threat to humanity or lead to any significant disruption in our social or economic life.

Right now, we are dealing with probabilities and expert estimates since no one can say for certain what the outcome of a combination between H5N1 avian influenza and human influenza will be. On a purely statistical basis, there is a 1 in 3 chance the next pandemic will be of the major variety. Estimates by government agencies tend to focus on the hoped for 2 in 3 chance that the next pandemic will be of the minor variety.[6],[7] No doubt these sanguine estimates are affected by government policies, politics, and fears of upsetting the public.

These influences may explain why government predictions for the clinical attack rate is at the low end for pandemics and why the case fatality rates are the same as those seen during seasonal influenza. Higher and more realistic morbidity and mortality estimates are beginning to emerge in the press and in television and radio interviews of influenza experts. The Secretary of the US DHHS made an interesting comment at a news conference he gave just before departing his office early 2005. He said that one of the things he was very concerned about was a worldwide influenza pandemic that could result in the deaths of 30 to 70 million people. Officially however, the government is standing by their rosy scenarios.

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[3] K Ungchusak etal., Probable person-to-person transmission of avian influenza A (H5N1) N Engl J Med 2005;352:333-40.

[4] Director of the Center for Infectious Disease Research and Policy, the associate director of the National Center for Food Protection and Defense, and a professor of public health at the University of Minnesota, Minneapolis

[5] M Osterholm, Preparing for the next pandemic., N Engl J Med 2005;352:1839-1842

[6] Draft Pandemic Influenza Preparedness and Response Plan, DHHS, August 2004

[7] UK Health Protection Agency Pandemic Plan for Influenza Feb 2005

A Comparison of Estimates for Influenza Pandemic Mortality and Morbidity

As you might imagine a number of government, non-governmental organizations, and private epidemiologists are studying this issue and have published reports on the impact of the next pandemic on humanity. When trying to project the effect of a pandemic, the key statistics to predict are the case fatality rate and the clinical attack rate. This is because the number of deaths during a pandemic is the simple arithmetic product of these two rates. The formula for the number of deaths due to a pandemic is:

Number of Deaths = **Case Fatality Rate** x **Clinical Attack Rate**

Where: **Deaths** is the number of people who die, the **Case Fatality Rate** is the percent of patients with the illness who die from the illness, and the **Clinical Attack Rate** is the percentage of the population who develops influenza with symptoms of infection. The number of deaths increases as either one of these key pandemic statistics increases and vice versa.

Pandemic years are associated with many more cases of influenza and a higher case fatality rate than that seen in seasonal flu outbreaks. It is common to encounter clinical attack rate ranges for seasonal flu of 5% to 15% in the literature. For pandemic flu, clinical attack rates are reported in the range of 25% to 50%. Case fatality rates are more difficult statistics to come by. They are available for recent pandemic and seasonal flu in the developed nations but unavailable for past pandemics and present seasonal flu in undeveloped nations.

The most reliable pandemic statistic is the number of deaths for the developed nations. Even this statistic may have been subject to political meddling by US authorities in the years following the 1918 event. The number of worldwide dead due to the 1918 pandemic was initially reported as 20,000,000. This statistic stood for 20 years until being replaced by a more scientifically based estimate of 40,000,000 in the 1940s. The most recent estimate of worldwide deaths during the 1918 pandemic is 60,000,000 to 100,000,000. It is of interest that despite being replaced by estimates using improved epidemiologic methods and better data, the discredited statistics from 1920 and 1940 are often used in modern day publications on pandemics and even within otherwise authoritative government or scientific reports.

By using the simple calculation for predicting the number of deaths based on fatality and attack rates and with the application of common sense, we can thoroughly investigate the validity of projections made by others regarding the impact of the next pandemic. In the tables below, several conventions are used to explore the relationship between various combinations of case fatality rate, clinical attack rate, and the number of deaths during influenza epidemics and pandemics. If the data used for construction of the table is known, it is labeled a **statistic**. If the data is a variable used in combination with a statistic, it is labeled an **estimate**. A value obtained as the result of a calculation using a statistic and an estimate is labeled a **prediction**.

In order to obtain some prospective, before reviewing the official and private pandemic estimates, it is instructive to review the mortality and morbidity associated with the seasonal influenza. The figure for average expected number of deaths due to seasonal influenza for 2005 used by the US Department of Health and Human Services is 36,000.[6]

Using the US DHHS death statistic coupled with the range of clinical attack rate estimates it is possible to make a prediction of case fatality rate for each estimate within the range. Using clinical attack rate estimates of 5% to 15% results in a prediction of corresponding case fatality rates during seasonal influenza in the US of 0.08% to 0.25%. The number of deaths worldwide is also provided using the same methods.

Case Fatality Rate Prediction for Seasonal Flu for US and World

World Pop 2005 = 6,600,000,000

US Population 2005 = 296,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	Number of Deaths in USA Statistic	World Deaths* Prediction
0.25%	5%	36,000	1,080,000
0.17%	8%	36,000	1,080,000
0.13%	10%	36,000	1,080,000
0.10%	13%	36,000	1,080,000
0.08%	15%	36,000	1,080,000

* Projection for world death rates based the formula: US death rate x 30

The Health Protection Agency in the UK expects 12,000 deaths each year due to seasonal influenza in Great Britain. They state that the case fatality rate for non-pandemic or seasonal flu is 0.375%. This corresponds to a predicted clinical attack rate of 6%. Applying these rates to the world's population leads to prediction of 1.5 million deaths each year.

Clinical Attack Rate Prediction for Seasonal Flu for the UK

UK Population 2005= 51,700,000

World Population 2005 = 6,600,000,000

Case Fatality Rate Statistic	Clinical Attack Rate Prediction	Number of Deaths in UK Statistic	World Deaths* Prediction
0.375%	6%	12,000	1,531,915

* Projection based upon case fatality and clinical attack rates in UK as applied to the world population

The analytical method employed here using the data provided by the governments of US and UK result in a range for the predicted number annual flu deaths worldwide of 1,080,000 to 1,532,000. The estimate would agree more closely if Osterholm's estimate of annual US deaths of 50,000 were used rather than the official number (50,000 x 30 = 1,500,000). This range, while wide, remains sufficient for our purposes.

The case fatality rate occurring during the major 1918 and minor 1958 pandemics can be predicted using a range of clinical attack rates appropriate for pandemics together with the published statistic for US dead in the pandemic. It is revealing to compare these results with the rates seen during the seasonal flu above and with the predictions provided by the US DHHS and UK HPA for the next pandemic. During the 1918 pandemic there were 675,000 US deaths while in the minor pandemic of 1958 the US death toll was 70,000.

US Case Fatality Rate Predictions for the 1918 Pandemic

US Population 1918 = 100,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	Number of Deaths in USA Statistic
2.7%	25%	675,000
1.9%	35%	675,000
1.4%	50%	675,000

US Case Fatality Rate Predictions for the 1958 Pandemic

US Population 1958 = 174,889,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	Number of Deaths in USA Statistic
0.16%	25%	70,000
0.11%	35%	70,000

The Health Protection Agency in the UK is responsible for preparing a plan for protecting the country from the next influenza pandemic. The HPA provides estimates of clinical attack and case fatality rates for the UK that can be extrapolated to the world population.

It is of interest that HPA provides the public with their best-case scenario of the number of UK deaths expected during the next pandemic. Specifically they state that the "fewest number of deaths from a major pandemic" will be 48,469 deaths (4 x the seasonal death number).

Disappointingly, this prediction is calculated by using the seasonal flu case fatality rate of 0.375% times the average clinical attack rate seen for the three 20th-century pandemics of 25%. In my view, public health pandemic planning based upon this optimistic estimate will be of little value. At least

Mortality Prediction for the UK and Worldwide for the Next Pandemic*

UK Population 2005 = 51,700,000			
World Population 2005 = 6,600,000,000			
Case Fatality Rate Estimate	Clinical Attack Rate Estimate	Number of Deaths in UK Prediction	World Deaths Prediction
0.375%	25%	48,469	6,187,500
1.000%	25%	129,250	16,500,000
1.500%	25%	193,875	24,750,000
2.500%	25%	323,125	41,250,000
1.000%	50%	258,500	33,000,000
1.500%	50%	387,750	49,500,000
2.500%	50%	646,250	82,500,000

*Adapted from the UK Health Protection Agency Pandemic Plan for Influenza Feb 2005

they do honestly characterize this prediction of deaths as the lowest number expected and also provide a range of much more realistic predictions if indeed much less sanguine.

In the US, the Department of Health and Human Services has prepared a draft US Pandemic Influenza Preparedness and Response Plan that was published in August 2004. In this planning document, the DHHS also provides predictions on flu morbidity and mortality that they state are likely to occur during the next pandemic.[6] These estimates can also lend themselves to extrapolation to the world as a whole.

US DHHS Mortality and Morbidity Estimates for the US and Worldwide for the Next Pandemic*

US Population 2005 = 296,000,000			
World Population 2005 = 6,600,000,000			
Case Fatality Rate Estimate	Clinical Attack Rate Estimate	US Deaths Estimate	World Deaths Estimate
0.20%	15%	89,000	1,984,459
0.20%	35%	207,000	4,615,541

*Adapted from the US Pandemic Influenza Preparedness and Response Plan: - DRAFT Aug 2004

Inspection of the US DHHS projections reveals that the unexpectedly low death number is due to the case fatality rates used. Like in the UK, the US used the case fatality rates seen during seasonal influenza in the US rather than that seen in either minor or major pandemics. Unlike the British, the US estimate does not characterize these predictions as the lowest expected number of deaths. In my opinion, these factors weaken the credibility of the US estimates and are of great concern if the US DHHS is actually using these predictions as the basis for their pandemic planning. If so, I fear that we will be woefully unprepared for even a more responsible best-case prediction for a major pandemic not to mention anything worse.

In Osterholm's recent New England Journal of Medicine article on influenza, he provides an estimate of the clinical attack rate and number of deaths the US and world can expect from the next pandemic.[5]

Osterholm's Pandemic Case Fatality Rate Prediction for the US

US Population 2005 = 296,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	Number of Deaths in USA Estimate
2.30%	25%	1,700,000
1.64%	35%	1,700,000
1.15%	50%	1,700,000

Osterholm used the simple expedient of extrapolating the same death rates observed during the 1918 pandemic to the present adjusted for the increase in population. For the worldwide death number, his range of 180 million to 360 million is based on the current best estimate of world deaths during the 1918 event of 60 to 100 million deaths.

Knowing what we do about clinical attack and case fatality rates that are expected in pandemics, we can perform a validity test on the three commonly used estimates of total number of deaths that occurred during the 1918 pandemic. The method used here is to simply use the three published death statistics coupled with a fixed range of clinical attack rate estimates typical for pandemics. The three rates chosen were 25%, 35%, and 50%. The three death statistics include the original estimate of 20

Osterholm's Pandemic Case Fatality Rate Prediction Worldwide

World Population 2005 = 6,600,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	Deaths Worldwide Estimate
10.91%	25%	180,000,000
7.79%	35%	180,000,000
5.45%	50%	180,000,000
21.82%	25%	360,000,000
15.58%	35%	360,000,000
10.91%	50%	360,000,000

million from the 1920s, the later estimate of 40 million from the 1940s and the most recent estimate of 60-100 million (= 80,000,000). Using this estimate and statistic, the case fatality rates were calculated using the formula:

Case Fatality Rate = (Death Estimate ÷ Population) x Clinical Attack Rate

Case Fatality Rate Prediction for the 1918 Pandemic Using the 20,000,000 Worldwide Death Statistic

Using Various Case Fatality and Clinical Attack Rate Scenarios

World Pop 1918 = 1,600,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	1918 World Death Estimates Statistic
5.0%	25%	20,000,000
3.6%	35%	20,000,000
2.5%	50%	20,000,000

Case Fatality Rate Prediction for the 1918 Pandemic Using the 40,000,000 Worldwide Death Statistic

Using Various Case Fatality and Clinical Attack Rate Scenarios
World Pop 1918 = 1,600,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	1918 World Death Estimates Statistic
10.0%	25%	40,000,000
7.1%	35%	40,000,000
5.0%	50%	40,000,000

Case Fatality Rate Prediction for the 1918 Pandemic Using the 80,000,000 Worldwide Death Statistic

Various Case Fatality and Clinical Attack Rate Scenarios
World Pop 1918 = 1,600,000,000

Case Fatality Rate Prediction	Clinical Attack Rate Estimate	1918 World Death Estimates Statistic
20.0%	25%	80,000,000
14.3%	35%	80,000,000
10.0%	50%	80,000,000

Several conclusions occur to me after conducting the above exercise. First, the method used by Osterholm provides a more reliable estimate of the likely impact of the next pandemic than those provided by the government sources. Therefore it makes more sense to rely on Osterholm's predictions as the best guide for what to expect if we experience a major pandemic. If the next pandemic is of the minor variety, then there is little chance for any major disruption of civil society or any of its institutions. This is not to say that the number of deaths will be inconsequential or that the medical systems worldwide will not experience temporary overcapacity and shortages. But this is not the issue and never has been. This critical issue is not how to cope with a minor pandemic but rather how to cope with a major event.

Surviving a major pandemic in part depends upon having a realistic view of the likely impact such an event will have on humanity and the society in which each of us lives. For these reasons Osterholm's predictions make the most sense and are the ones that we should be using for our pandemic planning and preparation.

Lastly, in my view, the gross underestimate of the impact of the next pandemic on the US by the Department of Health and Human Services suggests a number of unsavory possibilities. Since they have access to the best-educated and brightest epidemiologists and medical scientists, the reason for their less than robust prediction is not for lack of information or analytic ability. Suffice it to say that their performance so far does not bode well for them being a reliable source of information as the pandemic progresses.

It is likely that the forces and motives operating within the US Government that leads to this treatment of the truth is most likely a feature shared by other national governments as well. This view is supported by the similarity between the flawed method used both the UK and US for their mortality predictions for the next pandemic.

Issues Affecting Medical Treatment of Avian Influenza

Vaccination

Vaccination is the most effective method of protecting against this infection. Overall, vaccination is considered 70% effective in prevention of influenza. The most commonly employed method of flu vaccine manufacture entails growing live virus in fertilized chicken eggs and then separating the viral particles from the egg. The particles are inactivated by heat, blended, and then mixed with sterile water to produce a specific concentration of killed viral particle proteins.

Purified killed influenza vaccine is proven to be safe and effective for producing protection against flu infection. After vaccination, the body's immune system recognizes these viral proteins as foreign invaders and mounts a vigorous campaign to destroy them. Vaccination leads to the formation of immune system cells that make antibodies against the virus and others that search out and destroy the virus directly.

These cells remain on alert in various locations of the body as well as circulating in the blood. They remain on guard for any sign that influenza has invaded the body. If the strain of influenza for which these cells are targeted is detected, they are called into action, multiply rapidly, and quickly mount a usually successful defense against the flu.

One common misconception about flu vaccination is that it prevents infection with flu entirely. This is not so. Flu infection occurs even if you have been successfully vaccinated against that strain of flu. What happens when a vaccinated person develops the flu is that instead of experiencing a serious and in some cases life threatening illness, the resulting infection is much milder and shorter in duration resembling a cold more than the flu. Some vaccinated patients have no symptoms at all when they contract the flu.

Manufactures of flu vaccine have already begun brewing the strains of the virus planned for the 2005-6 flu season and the US has ordered 90 million doses. This number of doses is enough vaccine to immunize the Americans that fit the CDC's recommended list for flu vaccination. This includes the very young, the elderly, the infirm, healthcare workers, public safety officers and all adults age 50 and older. There is very little vaccine earmarked for healthy teens or younger adults.

It takes 6 to 8 months to make a batch of vaccine using the chicken egg method and the capacity to manufacture vaccines has been in decline here and abroad for two decades. Today, world influenza vaccine capacity is just 300 million doses which is only enough to protect 5% of the world's population. Most of the world's influenza manufacturing capacity is in Europe (Great Britain and France) with a relatively small percentage in the US, Canada, and Japan.

Obviously with the worlds population now exceeding 6.6 billion, when the next pandemic occurs there is not going to be enough vaccine to go around. Recent studies show that young healthy adults become immune with a reduced (half) dose of killed flu protein if it is given combined with an **adjuvant,** a substance that stimulates the immune response to a protein.

So by mixing the vaccine supply with an adjuvant, we could roughly double the current supply but even that would not be nearly enough to protect the world's population. This fact has been discussed and some have advocated that the world's flu vaccine be shared more equitably between the developed (G8) countries that are now slated to get 90% of the vaccine output and the rest of the world. It does not appear that there will be a marked increase in vaccine manufacturing capacity or sharing of the limited vaccine supply. The ramifications of this lack of vaccine availability could have major world political and economic consequences extending many years into the future.

In March 2005, Sanofi Pasture, the French vaccine manufacturer, released the first vaccine made for humans directed against the avian influenza A H5N1 virus for testing and evaluation by virology laboratories. Additional testing of adjuvants to extend the vaccine supply is also underway. While vaccine production using fertilized eggs takes 6 to 8 months under the best of circumstances, it has been more difficult than usual with the H5N1 strain because it is so lethal that it kills chicken embryo before there is enough time raise a good yield of vial particles. New methods of producing vaccines are needed and are being discussed and in some cases developed.

The Sanofi Pasture H5N1 avian flu vaccine is unlikely to be of use against the virus that eventually evolves as a human threat. Influenza experts predict that when the avian influenza combines with human influenza, *the*

offspring will be antigenically different from either parent virus. This means vaccines that target either parent viruses will be ineffective against the offspring. Since it is impossible to predict what the recombined flu will look like before it emerges, the planned vaccine for next season is highly unlikely to provide any protection against the pandemic avian influenza strain.

While vaccination is our best hope of avoiding catastrophe, it is pretty certain that none will be available when the first wave of the pandemic spreads across the globe. This means that in all likelihood, the first wave will be characterized with a high rate of infection and many deaths. The time between the first and second wave is crucial because there needs to be enough time for the flu manufacturers to brew enough vaccine to protect as many of the remaining susceptible population as possible. Patients, who contract the flu during the first wave and live, will in all likelihood be immune from the pandemic strain, so they won't need to be vaccinated. This includes those who become infected with pandemic flu, become ill, and are successfully treated with the anti-flu antibiotic Tamiflu or Relenza.

Anti-Viral Drugs

Over the course of the pandemic, predictions are that 25% to 50% of the population will become sick. There is an anti-viral antibiotic tablet, Tamiflu®, oseltamivir, manufactured by Roche Pharmaceuticals that is effective against Avian Influenza H5N1. The World Health Organization has recommended that every country establish a stockpile of enough drugs to treat 20% of its citizens in preparation for a possible Avian Influenza pandemic. Most of the developed nations have begun to do so.

The wholesale cost of Tamiflu is about $25 for a 5-day treatment course (10 tablets), a price that places it out of reach for the less developed nations to establish a Tamiflu stockpile. Manufacturing capacity for Tamiflu is also limited and manufacture of this Roche product takes place almost entirely in Europe. Most of the G8 countries have already placed their orders with Roche and governmental demand has been so great that this product was unavailable for a while in the spring of 2005 but as of June 2005, some Tamiflu has begun to trickle back into the retail chain but supplies remain tight.

Tamiflu works best if it is taken early in the course of the disease symptoms (within the first 48 hours of the illness). It might be useful even if started later but this is not established. I plan to administer it to very sick patients no matter how long they have had symptoms as long as there is hope they can survive.

It is also possible to prevent the flu by taking Tamiflu tablets at or immediately after exposure to the flu. While this strategy works, it requires the continuous use of the one tablet daily until the pandemic is past.
Under conditions of severe shortage of Tamiflu that we are likely to face during a pandemic, using the drug in this way is unwise. The strategy I plan to follow is to wait until flu symptoms are present before beginning Tamiflu treatment. The recommended does is one tablet twice daily for 5 days. A worrisome US National Institute of Health study published in the July 2005 issue of the Journal of Infectious Disease reported that mice experimentally infected with the H5N1 avian flu strain required 10 days of Tamiflu treatment to prevent relapse and death instead of the currently recommended 5 day course of treatment. If this proves true for the pandemic virus it means that treatment for 10 instead of 5 days with Tamiflu would be needed which is a problem since the current stock of this drug would go only half as far thought initially.

Since half the population who contract influenza have no or only few symptoms of the disease, even if you don't take Tamiflu in the preventive regimen you still have a 50% chance of not getting sick. By reserving the drug for those who become ill with flu, you will be able to effectively treat a much larger number of patients than if the drug is used in its preventive mode.

One recent development reported in May 2005 is the detection of some strains of H5N1 avian influenza that have crossed over from birds to humans in South East Asia that are developing resistance to Tamiflu.

While this is a disturbing observation, it does not mean that when pandemic flu arrives here it will be totally resistant to Tamiflu treatment. This is unlikely to be the case. It is likely however that some strains of the virus will carry this resistance factor meaning that some patients infected by those strains will not respond as well to Tamiflu treatment as expected.

There is a second anti-influenza antibiotic that might be effective against H5N1 avian flu, Relenza®, zanamivir, but this has not been established. Relenza is also very expensive. Avian flu has been found to be resistant to the other older anti-influenza drugs like amantadine. So, other than a specific vaccine that has not yet been developed and the anti-viral drug Tamifu and possibly Relenza, there really isn't much else that can be done medically to prepare for this event.

A Major Pandemic will Likely Disrupt Essential Public Services and Supplies

In the event of a major pandemic with a case fatality rate exceeds the 5%, it is my opinion that there will be a temporary breakdown in food delivery, the electric and water utility service, and possibly even public order in major urban areas worldwide. This prediction is based on several factors. First is the marked expansion in the human population since the last major pandemic. In 1918, our population was 1.6 billion and today it is 6.6 billion. Only 17% of the world's inhabitants lived in urban environments in 1918 and at the time there were only 15 cities with more than a 1,000,000 inhabitants. Today slightly less than half of humanity lives in urban settings that occupy only 3% of the earth's surface area and there are over 400 cities with a population of over 1,000,000 residents.[8]

High population density is a well-known and understood factor favoring epidemic spread of virulent organisms including influenza. The world has never faced a major pandemic with its population so large or so geographically concentrated. This factor alone makes predicting the magnitude of the impact of a major pandemic difficult. The difficulty is not in predicting whether these population factors will worsen or lessen the severity of the pandemic. There is no question that it will worsen it, but by how much, we don't know.

Cities are dependent on outside sources for critical supplies including food, power, and water. The provision of these essential goods and services requires the highly coordinated efforts of a large number of people. During a major pandemic, these activities are likely to be interrupted by widespread illness and death. The interdependent nature of modern society increases the risk that a systematic failure could occur due to a domino effect precipitated by the failures of one or two key institutions or resources. Another words, a failure of one critical system leads to the failure of another and so on until the entire system collapses.

Taken together, these factors are likely to result in the temporary disruption in the basic supplies and services we all now take for granted and the resulting chaos would likely be accompanied by a period of temporary anarchy especially within large urban centers.

Practical Pre-Pandemic Preparations for Individuals

At the present time (July 2005) my estimate is that when H5N1 avian flu crosses over there is a 1 out of 3 chance of a major pandemic and a 2 out of 3 chance of a minor one. The most likely time for this to happen now is between December 2005 and March 2006. If we have a major event, it would be prudent to plan to be self-reliant for about three months.

Get Your Will in Order

Lets face it; you might not make it through a major pandemic. It is likely that one in forty won't. So, get your will in order. Make sure you have a plan for those surviving that will see them through.

[8] United Nations, World Urbanization Prospects, The 1999 Revision.

Life Insurance
If you need to, buy more life insurance now since it takes time to get a policy. If nothing happens, you can always cancel it later. You may wish to consider buying a life insurance policy for your spouse and children. It would be prudent to select only the bluest of blue chip insurers, as the economic impact of a major pandemic will not be predictable. Also, if a pandemic happens and a lot of folks die, the cost of life insurance in the future will be higher.

Get a Flu Shot and a Pneumovax Vaccination
Even though the recipe for the 2005-6-flu season does not include protection against the avian flu, be sure to get one anyway. The reason for this is that many experts predict that the most likely time for the pandemic to begin is during the regular flu season. If you have the flu shot, it will protect you against the seasonal flu and prevent you from developing it during the same time that pandemic flu is circulating in your community. Also, you do not want to come down with flu twice in the same year. Since pandemic flu is so different antigenically than seasonal flu, this could happen and if it does, your chances of surviving the second infection are not very good especially if you are still weakened by the first one. You can protect yourself from pneumococcal pneumonia by getting a Pneumovax vaccination. This will be important in the event that we experience a major flu pandemic.

Food Security
Food supplies are likely to become limited in the event of a major pandemic. Storing a supply of canned meat and fish, dried beans, and rice is a prudent consideration. Consider basics like salt, sugar, cooking oil, and multiple vitamins as well. If food shipments are interrupted to the urban centers, it won't be very long before food is gone from the grocery shelves. If you have any doubt about this, think back to what happens when there is a threat of an ice or snowstorm.

Electricity Service
The power grid is fragile in the US especially on the east and west coasts. Despite the brown and black outs of 2003, not much has been done to improve the vulnerability of the power grid, the energy bill passage in July 2005 notwithstanding. The grid is literally interconnected such that what happens in one part has an impact in another. While the grid has some built-in automatic circuit breakers designed to isolate a power overload condition before it spreads and causes a widespread blackout. For the most part, the system is operator dependent.

Much of the power production in the US is coal fired and these units depend upon regular delivery of coal by rail. Power industry guidelines call for the plants to keep at least a 25-day coal stockpile to ensure uninterrupted power production in the event of a coal supply disruption. If a critical number of system engineers employed by the plant, the railroad, or the coalmine become ill, die, or are otherwise absent as a result of the pandemic; this would result in the shutting down of that plant if coal supplies run out. Nuclear plants could be shut down if the number of plant personnel fell below a predefined threshold for safe operation of the plant.

Since plant and grid repair and restart crews would also be affected in a similar manner to the engineers, the time to bring the shutdown system back up will also be more prolonged than under normal conditions. If enough plants are affected, this raises the chances of brown or black outs affecting large regions of the US that could be quit prolonged.

The interruption in electric power service could last a month or two at most. One way to cope with this is by having a small number of key battery operated devices like lighting, flashlights, and a radio. Nickel Metal Hydride (NiMH) rechargeable batteries are now available that are a much-improved rechargeable battery compared with what was available in the past. Good selections of excellent battery chargers that use solar power for energy are now available. These chargers can be coupled with a photovoltaic (solar power) module that will reliably and quickly (if big enough) charge your NiMH batteries over and over again. Good NiMH

batteries, various chargers, and a selection of small PV modules suitable for this purpose can be purchased from Real Goods at www.realgoods.com.

Water Service

Public water systems employ a host of professional and operational staff that would be expected to experience illness at the average rate of the community as a whole. So, absenteeism could affect service reliability as would loss of power due to a brown or blackout as these utilities use electric pumps to pressurize their systems. If water service is interrupted for a time, remember to wait a while before drinking the water once service is restored because it may be contaminated with bacteria initially.

It would be prudent to have some potable water available for use in an emergency. Tap water can be stored in 55-gallon drums. Make sure the drum you purchase is new or if not, that it is OK for storage of potable (drinkable) water rather than one that held toxic chemicals. You might also consider how you could divert rainwater from your downspouts for storage and drinking. Water collected from the roof will need to be purified before drinking because it could be contaminated.

Communications Services

Local TV and Radio broadcasts will probably cease if there is a regional power failure in your area as will cable TV. Satellite TV may remain active but you will need an alternative source of power to operate your system to view it since your power will be out. Landline telephone systems have an excellent record of remaining operational even during power failures. In the event of a widespread prolonged blackout, they will not be able to continue to function for very long. Cell phone towers have a small backup power capability but this won't last long. So if the grid fails, all phones service will as well.

A good quality battery operated radio capable of receiving AM, FM, and Short Wave stations would be a smart way to keep up with local and world events in the event that the usual methods were impaired. Even if there are no operative local or regional news broadcasts, someone somewhere will be on the air reporting the news and providing information of interest to flu survivors. It will be comforting having access to this information should a major pandemic come to pass.

Find a Rural Refuge

During the Spanish Flu pandemic being away from centers of population was safer but even small communities were hit hard so it was no guarantee. There was some flu in just about every community so living in a rural area is not going to be enough. Reverse quarantines, where the community kept outsiders from entering and bringing the fly with them did work occasionally in 1918. Some small communities might try this approach but for there to be any hope of success, it will need to be very strict and be started at the beginning of a pandemic or it will not work.

One lesson from major epidemics with high death rates is that these events almost always lead to civil disorder. In the event of a major pandemic, it would be wise to ride out the storm away from cities or other major population centers. It is probable that food and water will be easier to obtain in the country and people less likely to be hostile compared with what can be imagined to occur in the major metropolitan areas under similar circumstances.

If you plan to leave the city for the country, you may want to do so early in the pandemic. In the event that your city has the misfortune to be one of the first areas affected by the pandemic and the federal government elects to impose quarantines as a means of containing the spread of the pandemic (a strategy sure to fail), then you might find the road out of town blocked if you wait too long before decamping.

Hospital and Healthcare Services
In the event of a major pandemic, healthcare services and especially hospital services will be rapidly overwhelmed. It is likely that the healthcare system will be the first societal institution to collapse under the strain with recovery not expected until after the return of other essential utilities and services. While it is true that the first victims of the flu will get excellent treatment including hospitalization and even ventilators if required. Before long though, all the available resources will become exhausted.

In order to reduce healthcare costs, hospitals have significantly reduced the number of available patient beds and nursing staff. In fact it is a common occurrence today for hospitals to be "on bypass" when it comes to accepting critically ill patients in their emergency rooms via ambulance. This happens when every ICU and CCU bed is already occupied in the hospital. During a routine flu season these days, the number of patients hospitalized in critical condition is such that all these critical care beds and available ventilators in many US cities are fully occupied for weeks each year. So you can imagine that if the number of critically ill patients presenting to the hospital emergency department with pulmonary failure from influenza suddenly increased exponentially over those expected with the seasonal flu, the chances of getting an ICU bed or ventilator would not be good. Once the pandemic settles in, the hospitals will be full including waiting rooms and hallways. The medical staff will be sick themselves, some will be dead. The hospital will quickly run out of supplies such that there will be a shortage of everything from drugs, IV fluids, to body bags. So, in my opinion, it would be unwise to remain in the city so you can take advantage of the healthcare system in case you become ill.

The Flu Survival Kit
Under the circumstances, having a supply of over-the-counter products and select prescription drugs on hand useful for the home treatment of cases of severe influenza is prudent. For instance, simple household items that will be very useful include ibuprofen, acetaminophen, table sugar, and table salt. It will also be helpful to have on hand, and know how to use a thermometer, an automatic blood pressure and pulse monitor. In the following discussion I will provide you with advice on how these simple items can be used very effectively for the home care of flu sufferers. In order to obtain the prescription drugs needed for the home care of the flu, please call the office at 404.298.9951 and for us to mail you a "**Flu Survival Kit**". The kit includes a list of useful items included in this monograph and a prescription in your name with medication for treatment of one person.

Simple Medical Skills Required
Caregivers need to learn how to obtain vital signs like pulse, blood pressure, temperature and respiratory rate. It will also be very useful to be able to use an automated blood pressure monitor to measure blood pressure. If you need help learning how to do these, my staff will be happy to help you develop these simple skills. All you need to do is ask.

OTC products to have on hand for home treatment of one person with severe influenza
Table salt: 1 lb
Table sugar: 10 lbs
Baking soda: 6 oz
Tums Ex: 500 tablets
Acetaminophen 500mg #100 tablets
Ibuprofen 200mg # 100 tablets
Caffeinated tea, dry loose: 1 lb
Electronic thermometer: #2[9]
Automatic blood pressure monitor[10]
Notebook for recording vital signs and fluid intake and output
Kitchen measuring cup with 500 cc (two cup) capacity

[9] Thermometers break so have more than one on hand.
[10] I recommend the hand pumped automatic BP monitor rather than ones with electric pumps.

Diphenhydramine (Benadryl) 25mg capsules # 60: 1 tablet every 4 hours as needed for nasal congestion, allergy, or itching.

Prescription products for home treatment of one person with severe influenza
Tamiflu 75mg # 20: take two tablets daily for 5 (or 10) days for flu[11]
Promethazine (Phenergan) 25mg tablets # 60: take ½ to 1 tablet every 4 hrs as needed for nausea
Hydrocodone with acetaminophen (Lortab-5) # 60 (5mg/325mg): ½ to 1 tablet every 4 hrs as needed for cough or pain
Diazepam (Valium) 5mg # 60: ½ to 1 tablet twice daily as needed for anxiety, muscle aches, or insomnia

Symptoms of Influenza

The influenza virus usually enters the body through the respiratory tract but can also gain access through the intestinal tract. The virus causes a variety of symptoms with fever, sore throat, cough, runny nose and general aches and pains as the leading ones. In addition to these principal symptoms many also experience headache, nausea, abdominal cramps and diarrhea.

US solders ill with pandemic flu in France during the fall of 1918

These symptoms could be due to some other infectious agent or even the influenza virus but not the pandemic strain since it is possible that both endemic (routine seasonal flu varieties) and pandemic strains could both be circulating in the community at the same time if the pandemic flu appeared during the November-March flu

[11] Tamiflu is expensive costing about $200 for 20 tablets. If you have insurance, you will still pay stiff co-pay. All the other prescription drugs are generic and not expensive.

season. In fact, this scenario is what looks to be the most likely time for the pandemic to begin. The best guess for the start of the pandemic at this point is between December 2005 and April 2006.

There are several ways to tell the difference between the flu and less severe illnesses. First of all, unless the flu is circulating in the community, then your illness is probably not flu because it tends to occur in epidemics that are easy to spot epidemiologically. If the world is in the mists of a major pandemic, you will have no problem knowing about it. Just tune into CNN, as it is likely to be wall-to-wall pandemic coverage 24/7. Another clue to whether or not someone has flu is that flu is much worse than simple cold viruses or most other causes of respiratory or gastrointestinal infections (GI). The fever and body aches are really quite remarkable and often associated with strong shivering.

When flu affects the GI tract it presents with nausea, vomiting and diarrhea. Patients with flu are really sick and often are so weak they have a hard time getting up out of bed without help. So, one way to tell the difference between the flu and other infections is that the flu is really severe and tends to affect the respiratory track most often but can also cause severe gastroenteritis (nausea, vomiting, and diarrhea).

Patient prognosis during pandemic influenza

One thing that is different about a major pandemic is just how hard it hits patients and how rapidly it kills. Patients affected by the flu can be broadly categorized into 3 prognostic types. The first type has a poor prognosis no matter what is done for them. The second might survive if there was full access to high technology medical care and resources. The third type is highly likely to recover from the flu as long as they are provided with consistent low-technology supportive measures that can be administered in home settings.

Type 1 patients have the poorest prognosis and almost all will die within 2 or 3 days of the development of their first symptoms. The cause of death in these patients during the 1918 flu was massive respiratory failure from overwhelming lung destroying viral pneumonia. There was no effective treatment for this in 1918 and there is none today despite all the advances in medicine that has occurred over the last 90 years. Signs and symptoms of type 1 patients include rapid onset of severe shortness of breath, cyanosis (bluish discoloration of the skin of the hands, feet, and around the mouth and spreading centrally), or bleeding from the lungs, stomach and rectum.

Type 2 patients are similar to type 1 patients except they do not die after 3 days. Some but not many of these patients would survive if they had access to and ICU, ventilators and expert medical care but if we have a severe pandemic, those resources will not be widely available. Even if they had access to these services, many of them would die anyway. Remember, no matter what you do, they are likely to pass away in a week to 10 days after becoming ill.

Type 3 patients make up the majority of those that become ill with influenza. Fortunately, these patients have a good prognosis if they receive timely and diligent supportive care that can be provided well in a non-medical setting such as the home. Most of these pandemic flu victims will be severely ill and weakened by the infection such that they will be too ill to get out of bed. Many type 3 patients will be completely dependent on others for care. Without simple care, some of these patients will die from preventable causes like dehydration but with simple care, most of these patients will recover. No matter how good the care provided, some type 3 patients will die. This is not your fault. This happens usually because they develop a serious secondary condition that actually becomes the cause of death. Examples of these secondary conditions include bacterial pneumonia, stroke, and heart attack. There is nothing you can do but keep doing the best you can and let nature take its course.

In my opinion, as a general rule, provide everyone with the same level of supportive care. This is a rationale course because it is not always possible to predict who will survive and who will not especially early in the course of the flu.

Using scarce resources wisely
Patients in extremis, which means they are near death at the time they are encountered, should not be disturbed unless there is something that you can do to make them more comfortable. Fortunately, patients in extremis are usually already unconscious and beyond suffering.

If medical supplies are in short supply, especially like the anti-influenza antibiotic Tamiflu, the decision on how to ration these resources is best made by health professionals if they are available. If not, my suggestion is to concentrate your efforts and precious supplies on those with the best chance of survival, i.e., type 3 patients. In a severe pandemic it is unwise to use limited medical resources on critically ill type 1 or 2 patients, as they are unlikely to survive. So my advice is to focus your greatest efforts on type 3 patients where the prognosis is good for a complete recovery.

Supportive Treatment of Influenza
Home Flu Treatment Advice for the Laymen
Caring for severely ill flu patients is something that everyone is capable of doing. You can do this. No medical skill is required. The skills needed are the same parents use to care for their young children or adult children use to care for their elderly parents. The basic principals are to keep the patient clean, dry, and warm. They need a soft place to lie down and they need to be comforted and told that they are going to be OK and reassured that you will be there for them. The most important medical treatment is to make sure they have plenty of fluids. Dehydration must be prevented, as this can be fatal in a patient who would otherwise survive.

Fever, body aches, chills, sore throat, and headache: Ibuprofen and/or acetaminophen are used to lower fever and help the patient feel better. The above symptoms respond well to these drugs. Use these products for above symptoms of flu according to my instructions, not the bottle label. Don't under dose the patient. Many people take doses that are ineffective for fear of taking too much. Remember that acetaminophen can be used at the same time and in full doses as ibuprofen because they are in different drug classes and have different drug side effects. Combination treatment with both has an additive effect of benefit without increasing risk. The dose of ibuprofen I recommend you use is 2 to 4 tablets (400mg to 800mg) every four hours.[12] For acetaminophen, the dose is two 500mg tablets 4 times daily. Do not exceed these doses for either drug. This is the maximum for both.

A very high fever (> 104 F) can cause seizures and brain damage and must be avoided. Using tepid water sponge baths works well for a high fever. Ibuprofen and acetaminophen are very good at lowering temperature. Studies show that the body's natural defenses are better able to fight infection with some fever (say up to 101 F), so maybe we shouldn't try to completely suppress the temperature to normal (98.5 F).

Gargling with hot salt water is a good treatment for sore throat. Hot caffeinated tea is also very helpful for headache, sore throat, and cough. We are taking advantage of the pharmacologic effect of caffeine, long recognized as an excellent herbal therapy for these problems. Hot or cold tea is also a mild stimulant that improves the sense of the patient's wellbeing. Sore throats also respond well to ibuprofen or acetaminophen.

Food: Eating is not really important because the patient will be breaking down their own muscle and fat for energy. The flu takes your appetite away so the patient probably won't be hungry. If the patient is hungry and asks for food, this is great as it is a real sign of improvement. By all means feed the patient at that point but your food selection needs to be appropriate. Specific directions on how to feed patients recovering from severe flu are provided below.

[12] For the purposes of this guide, ibuprofen means aspirin, Advil, Aleve, ibuprofen, or nuprin since they are all alike. Acetaminophen (Tylenol) is not an aspirin.

Identifying Dehydration: Preventing dehydration in flu victims will save more lives than all the other treatments combined. When patients have a fever or diarrhea, they loose much more water from the body than is commonly appreciated. Symptoms of dehydration include weakness, headache, and fainting. Signs of dehydration include dryness of the mouth, decreased saliva, lack or very decreased urine that is dark and highly concentrated, sunken eyes, loss of skin tugor (the elasticity of the skin),low blood pressure especially upon sitting up or rising from the sitting to the standing position and tachycardia (fast pulse) when laying or sitting up.

Fever is an especially easy way to become dehydrated with no one even noticing. That is because the loss of body fluid occurs through the skin and quickly evaporates. This is called insensible loss and great quantities of fluid can escape a patient this way quickly. The smaller the body size and the higher the temperature, the faster this can happen. Water in the form of vapor is also lost through the breath. So when the patient is short of breath leading and breathing rapidly, this is another source of hidden fluid loss.

If you detect or suspect that dehydration is developing, administer fluids by mouth. If the patient is too ill to drink, someone should sit with the patient giving him or her fluids drop by drop if needed. Work up to using a teaspoon if possible. Don't stop until the patient has been able to keep down at least quart of fluids. This could take several hours so be patient. It will have a dramatic effect on sick patient's wellbeing and will be very rewarding to those of you who persist because you just saved a life. After the first quart, the patient should begin to urinate again. This is a good prognostic sign and when this happens you can assume you have restored their fluid level back to a safer level. "Safer" should not be confused with safe. Don't stop there. With sick patients like these, you really need to "push the fluids" so don't let your guard down.

Fluids: What will be much appreciated by a sick patient, especially if they are dehydrated, is a simple **Basic Fluid Solution** (BFS) made from water, sugar and salt. This will be very refreshing for the patient and will quickly revive them. Fluids can be served cool or hot depending on the climate, patient symptoms, and fever status. A patient with a high fever should probably not be given hot fluids because it will raise the temperature further. A patient with a sore throat will get relief from a hot beverage. A patient hot with fever might prefer cool or even cold beverage. If it is cold outside especially if the patient is cold, use hot fluids. You can drink the BFS plain or flavor it with just about anything like citrus, mint, or herbs.

The BFS Formula

BFS is simply homemade IV fluids for oral use.

The formula is:

4 cups of clean water
3 tablespoons of sugar or honey
¼ tsp table salt[13,14]

If juice is available, you can substitute 1 cup of it for 1 cup of the water and cut the sweetener in half. Boil the solution to purify it if needed. Administering fluids to the sick in your charge will be one of the main activities day in and day out until the crisis passes. Try and get 2 to 3 quarts of fluids down the patient every day at a minimum.

Keep a record on every patient

It will be very useful for you to write down certain information of the patient or patients you are taking care of at home. Devote a section of the notebook to each patient you are taking care of. Keep the record in chronological order day by day. Keep as accurate and careful records as you can. Don't worry about keeping a perfect record; just keep one that is good enough.

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[13] The above BFS formula is excellent for treatment of dehydration due to all causes. If the patient has become dehydrated because of diarrhea, you can substitute the salt in the formula with ½ tsp of baking soda (if available) because diarrhea leads to loss of alkali.

[14] Don't use more salt or baking soda in the BFS formula. I am already recommending the maximum dose of these.

Symptom or Sign	Likely Assessment	Remedy[15]
Low urine output	Dehydration	Push fluids
High pulse rate (>80 but especially > 90)	Dehydration or fever	Push fluids
Shortness of breath	Pneumonia	Push fluids
Shaking chills and shivers	Viremia (virus in the blood) or pneumonia	Keep warm
Cyanosis (skin turns blue)	Respiratory failure, death likely	Keep as comfortable as possible. Give hydrocodone with promethazine for comfort, give diazepam for anxiety
Bleeding from mouth, coughing up blood, passing red blood per rectum. Severe bruising.	A severe blood clotting abnormality has occurred due to the virus (DIC) . Death is likely	Keep as comfortable as possible. Give hydrocodone with promethazine for comfort, give diazepam for anxiety
Vomiting	Virus affecting GI tract	Use promethazine for vomiting, push fluids
Diarrhea	Virus affecting GI tract	Push fluids, clear liquid diet
Severe stomach cramps	Virus affecting GI tract	Use hydrocodone and promethazine for comfort
Headache		Ibuprofen and/or acetaminophen or hydrocodone if very severe
Fever		Ibuprofen, acetaminophen, push fluids, keep warm or cool, consider tepid water baths if > 102 F. OK if <101 as this may help kill virus.
Sore throat		Gargle with hot salt water, drink hot tea or hot water, ibuprofen and or acetaminophen.
Cough		Push fluids, drink hot tea for affect on breathing tubes, use hydrocodone ½ tablet with or without ½ promethazine to suppress cough if needed

Each day start with the patient's vital signs. Include their temperature, pulse rate, breathing rate, and blood pressure. Repeat the vital signs routinely 4 times daily (for instance at 0800, 1200, 1600, and 2000). These **vital signs** should be measured more often in very sick patients. You can get a really clear picture of how the patient is doing using these simple measurements.

It is very important to keep up with the patient's fluid intake and their output so record the fluid they are taking in and passing out in a notebook. Intake is pretty easy since you are giving them the fluids but output can be difficult to accurately record. Have the patients to save all their urine by urinating in a bucket, pot, or basin instead of the toilet. Measure the urine output using the kitchen-measuring cup. The amount taken in is always

[15] Are these the right treatments for this symptom in every case? Of course not! I am providing you with my best guess of how to manage the average very sick flu patient but not every very sick flu patient. I recognize that for some like those with ADRS for instance, these suggestions will not be helpful and would be considered harmful under usual circumstances. You will not be able to tell when you are dealing with one of these rare patients. So, what should you do? For most patients, following the advice will do a lot of good and makes the most sense under these unique circumstances. All you can do is the best you can do. So do that with a satisfied mind.

more than the amount passed out because of the insensible losses described above (loss through he skin and in the breath). If the patient is incontinent of urine, just indicate in the record that the patient was incontinent of a small, medium or large amount of urine. For our purposes, large is good, small is bad.

By recognizing the symptoms a patient has or the signs of the disease in the body, you can use the chart below to guide your treatment. Here's how.

Diet Recommendations

The Clear Liquid Diet: A clear liquid diet is used to treat certain intestinal diseases, especially infectious diarrhea. Patients suffering from diarrheal illnesses often experience abdominal cramping and frequent, loose stools if they eat solid foods. In addition, a great deal of water and minerals (sodium, chloride, and potassium) are lost in the watery portion of the diarrheal stool; if you are not careful this can lead to dehydration. Patients with diarrhea have to drink considerably more fluid than usual to prevent the dehydration. This is especially important if the patient also has a fever, which in itself leads to increased loss of body water through the skin as perspiration.

In most cases, patients with diarrhea can tolerate a clear liquid diet without cramping or diarrhea. This is because the small intestine can absorb water, minerals, and sugars pretty well even when infected. The diet starts off with clear liquids only. As symptoms abate, the diet slowly adds simple-to-digest, low-residue foods, one step at a time. Don't advance to the next step until the patient is completely symptom-free in the present step. As the patient progresses through each step, if the cramps and diarrhea return, drop back to the previous step they tolerated.

This same Clear Liquid Diet approach is the one to use for patients who have been ill with the flu and have been too ill to eat. They will have been on Step one already so when they become hungry, begin them on Step 2 and advance them through the steps as above.

Step 1: Basic Fluid Solution (BFS), Water, fruit juice, Jell-O, Gatorade or PowerAid, ginger ale, Sprite, tea

Step 2: Add white toast (no butter or margarine), white rice, and cream of wheat, soda crackers, and potatoes without the skin

Step 3: To Steps 1 and 2 add canned fruit and chicken noodle soup

Step 4: To Steps 1 through 3 add poached eggs and baked chicken breast without skin, canned fish or meat.[16]

Step 5: To Steps 1 through 4 add milk and other dairy products, margarine or butter, raw fruits and vegetables and high-fiber whole grain products

Advanced Home Treatment Considerations for Health Professionals

If you have access to Tamiflu, the dose is one tablet twice daily for 5 days. It is best to begin Tamiflu within two days of the beginning of symptoms but might be useful when used even later in the course.

Tamiflu Re-Administration Strategy: Tamiflu is excreted unchanged almost entirely in the urine. If Tamiflu supplies are limited as they most certainly will be, consider giving the patient two Tamiflu tablets at the same time, collect the patient's urine and re-administer it to the patient via naso-gastric (NG) tube or orally. If managed carefully, this approach means that you can completely treat a patient with only 2 Tamiflu tablets.

[16] Sick patients break down their muscle tissue for needed protein and calories. This is fine as long as it does not go on for long. It is important to begin feeding the patient high quality animal protein as soon as they can tolerate it to help them maintain their strength.

To replace fluids using this method, dilute the urine to a specific gravity (SG) of 1.010 with plain water to reduce the electrolyte concentration and raise the pH of the urine to 7.4 by addition crushed CaCo3 (Tums) tablets to the solution and add sugar for glucose calories. Cool and flavor with citrus to improve palatability and administer orally or by NG tube.

Consider using homemade NG tubes by adapting any source of small gage plastic tubing. Urine should be administered as a cool beverage and as fresh as possible to reduce odor and taste from urea breakdown. Urine is non-toxic. Most of the toxic things are metabolized by the liver and excreted in the bile. Don't worry about urea, it is readily reabsorbed by the body and excreted back into the urine over and over again. It is non-toxic and will all come out once the urine is no longer being re-administered to the patient.
Management of Dehydration Using Urine SG: Urine specific gravity is best measured using a hand held refractometer. You can also use a urine dipstick to estimate SG. Urine SG is an excellent objective measure of the state of patient's hydration given normal renal function. Urine SG ranges from 1.000 (distilled water) to 1.035 (really concentrated). Normal kidneys can easily concentrate urine to 1.020 or above without difficulty after a typical overnight fast. Patients with chronic renal insufficiency are not able to concentrate urine much above 1.010. A clinically dehydrated patient with a urine SG of 1.010 is diagnostic of renal failure.
Recommendation: Adjust the rate of oral fluid administration to maintain the urine SG between 1.010 and 1.020.

How to Find Out More about the Avian Flu and Influenza Pandemics

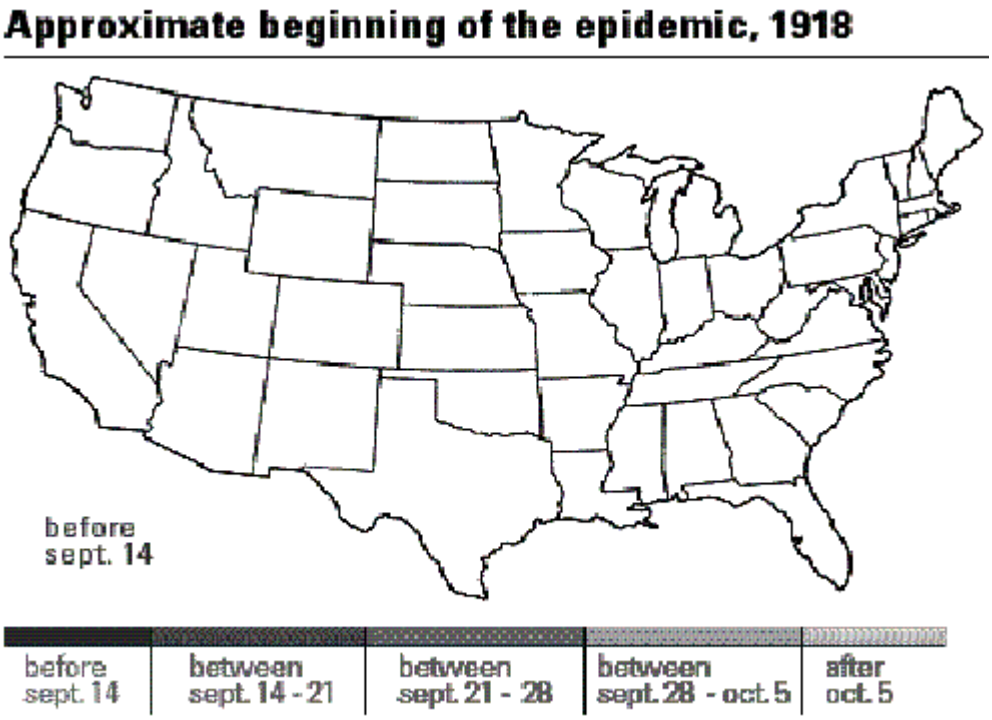
Medical scientists around the world are closely monitoring the situation in Southeast Asia and regularly make reports that are published in the medical, scientific and lay press. You can follow these reports best using the Internet. To start, use the Google News service at www.google.com to search for articles relating to "avian Influenza". This is one of the best ways to keep up-to-date on what is happening in Southeast Asia, which is the most likely place for the pandemic to begin.

One of the most informative sources of information is the recent documentary about the 1918 Spanish Flu written by John Barry entitled, The Great Influenza. This book is widely available in bookstores and on www.Amazom.com. This excellent work chronicled the worldwide epidemic from start to finish and provided me with a new perspective on just how serious influenza can be when the conditions are right as they are today. What I found most interesting in Barry's book were the many first hand accounts of how the pandemic struck the US and the world and just how devastating the illness was. The total inability of our institutions to stand up to the stress placed upon it by the 1918 pandemic was particularly enlightening for me.

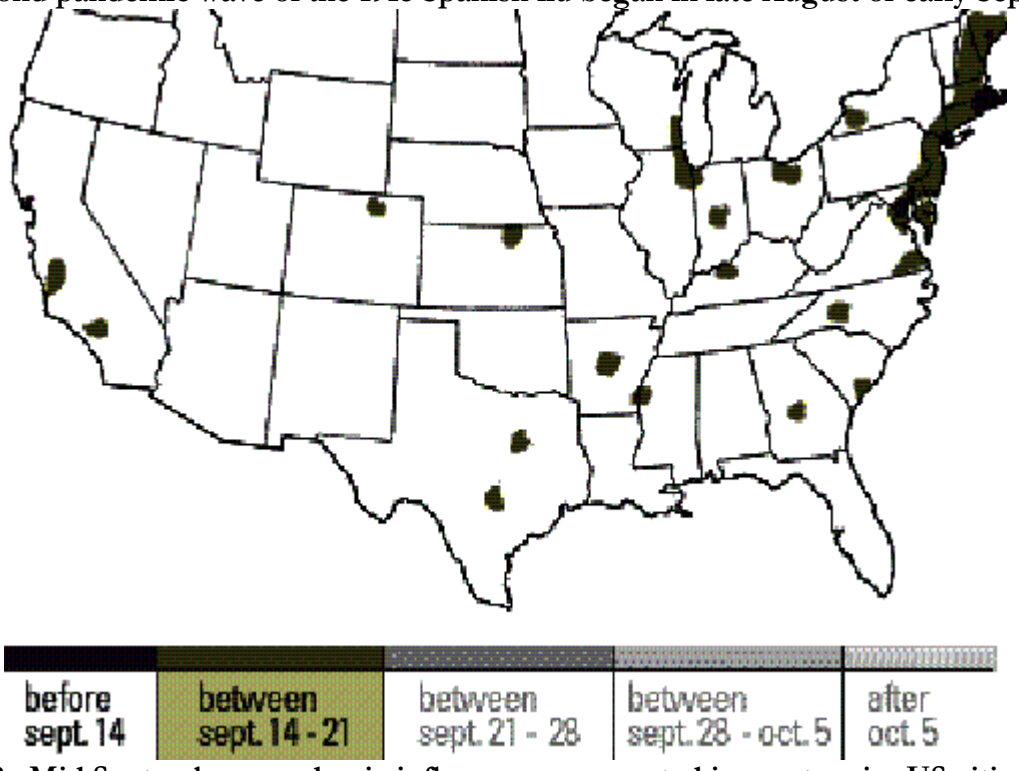
I also recommend you read about the 1918 flu pandemic since we could be on the verge of a similar event. Start by using Google to search for "1918 Spanish Flu". You will find a lot of information about that event. By learning more about the 1918 event, you will be able to fill in many of the details about this developing crisis we may be facing today. For those of you who remain in doubt about how serious a crisis this actually is, researching this issue on your own should help you develop a better appreciation of the situation.

Acknowledgement: I wish to thank Michelle Elrod, my intrepid proofreader who spent long hours correcting the myriads of typos.

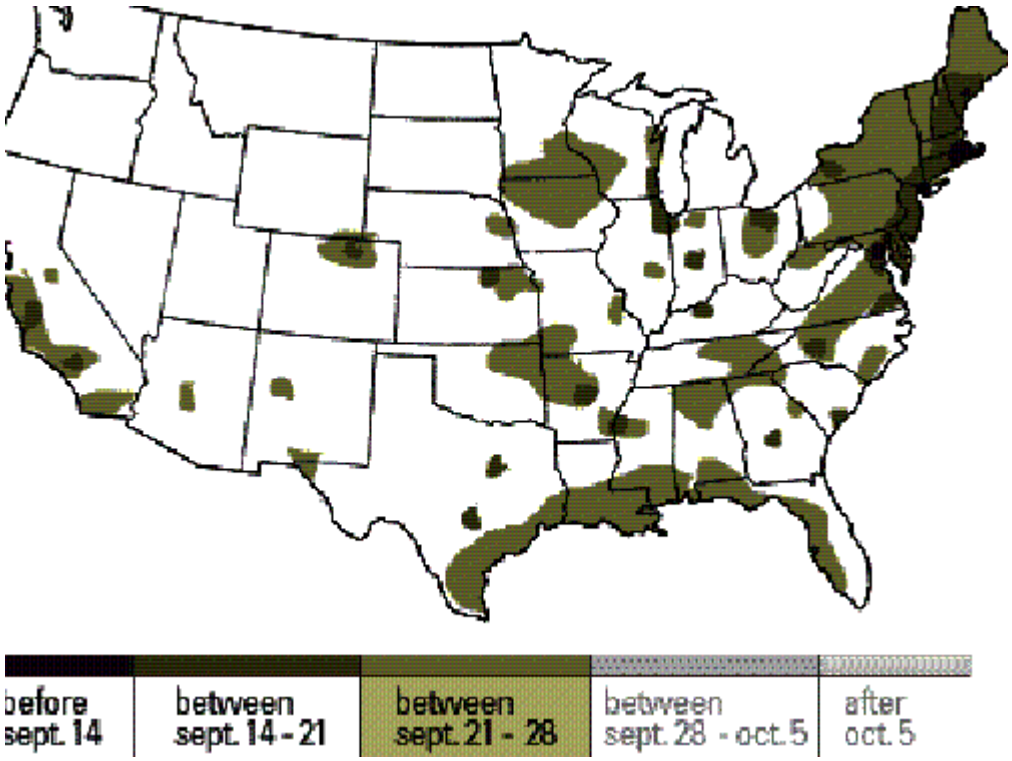
Spread of the 1918 pandemic across the US



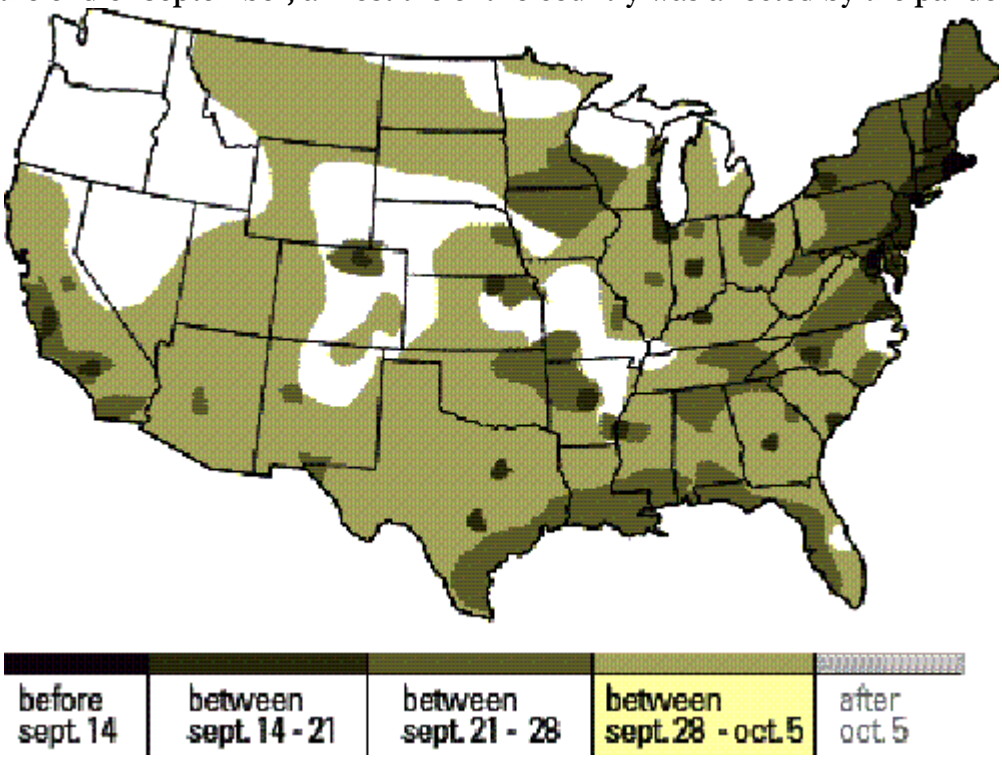
The second pandemic wave of the 1918 Spanish flu began in late August or early September



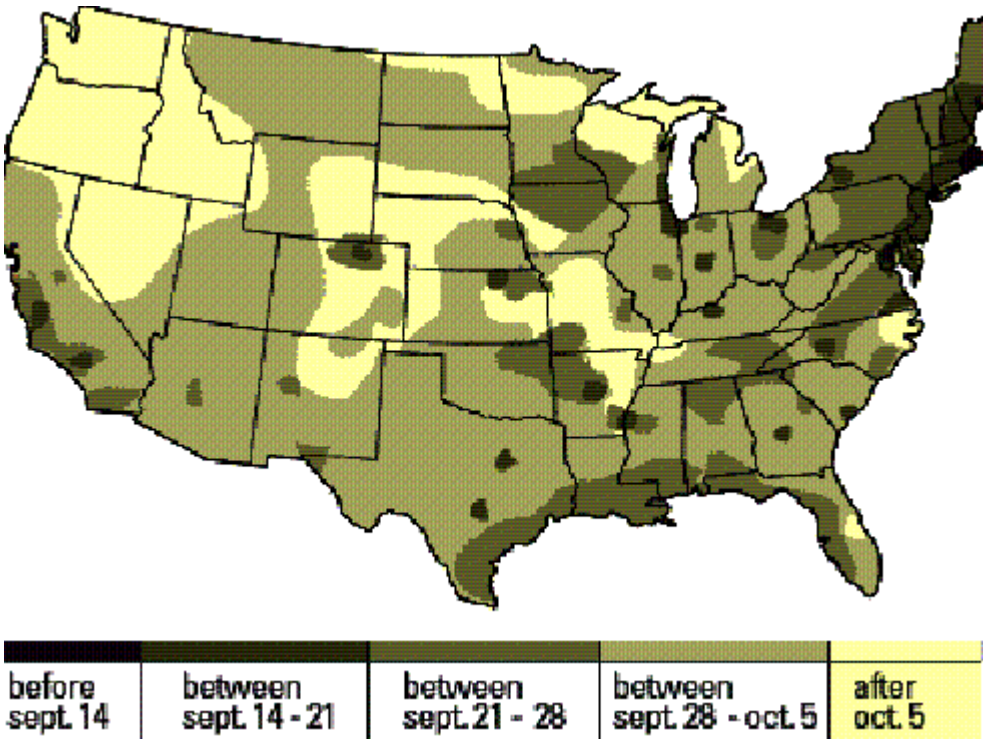
By Mid September, pandemic influenza was reported in most major US cities



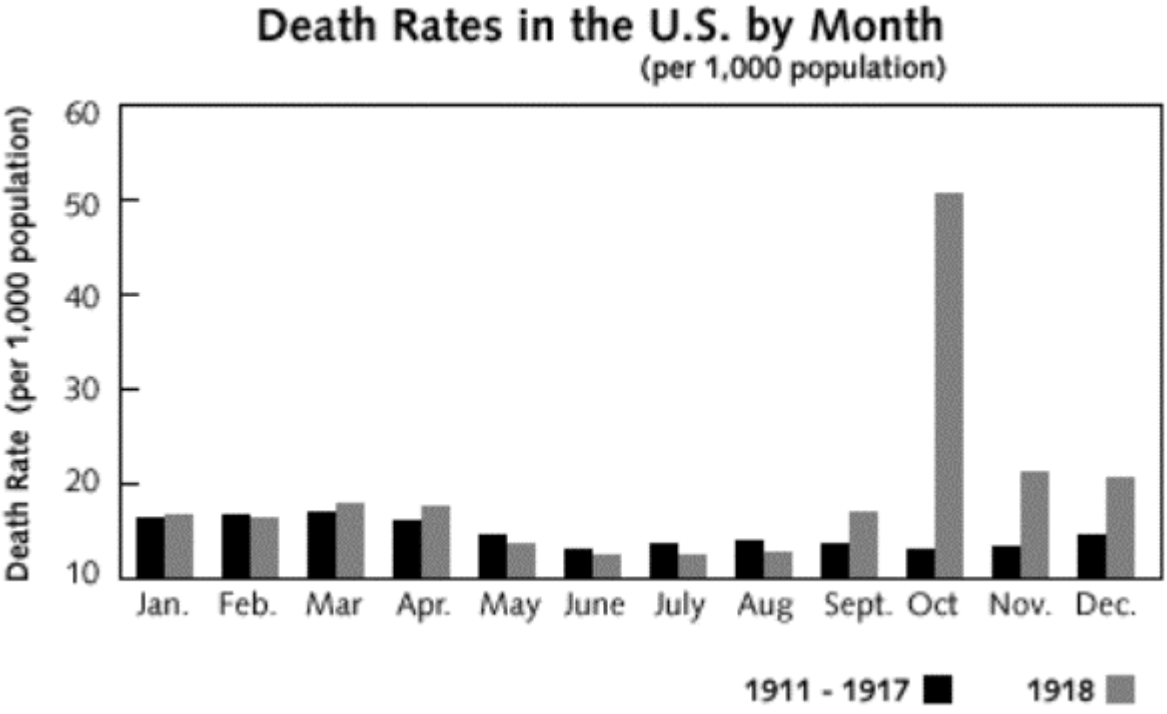
By the end of September, almost the entire country was affected by the pandemic



October 5th was the approximate end of the 2and pandemic wave. Most of the deaths were recorded in that month but many actually occurred in September.



The first pandemic wave began in January 1918 and ended in April. The second wave began in September and ended in October. The third began in December ending March 1919.



A Doctor's Letter to a Friend During the Height of the 1918 Pandemic
Published in the British Medical Journal, December 22, 1979

In September 1918, the second pandemic influenza wave was making its way through the America. Military bases were especially hard hit by the pandemic in the US. Below is a reprint of a letter from a recently recruited military doctor assigned to a US Army base in Massachusetts, Camp Deven. This was a training base for new recruits and was one of the worst affected by the flu. The letter is important for it's clear description of the rapid course of the illness, how this pandemic flu differed so greatly from the usual seasonal variety, and how the medical resources of the camp had become exhausted by the shear number of cases and the high case fatality rate. The letter was found in 1959 in a trunk among other papers given to the Department of Epidemiology of the University of Michigan. Dr. N. R. Grist published this letter in the British Medical Journal in the December 22, 1979 issue as part of an article on the 1918 pandemic.

Camp Devens, Mass.
Surgical Ward No 16
29 September 1918
(Base Hospital)

My dear Burt-
It is more than likely that you would be interested in the news of this place, for there is a possibility that you will be assigned here for duty, so having a minute between rounds I will try to tell you a little about the situation here as I have seen it in the last week.

As you know I have not seen much Pneumonia in the last few years in Detroit, so when I came here I was somewhat behind in the niceties of the Army way of intricate Diagnosis. Also to make it good, I have had for the last week an exacerbation of my old "Ear Rot" as Artie Ogle calls it, and could not use a Stethoscope at all, but had to get by on my ability to "spot" ' em thru my general knowledge of Pneumonias. I did well enough, and finally found an old Phonendoscope that I pieced together, and from then on was all right. You know the Army regulations require very close locations etc.

Camp Devens is near Boston, and has about 50,000 men, or did have before this epidemic broke loose. It also has the Base Hospital for the Div. of the N. East. This epidemic started about four weeks ago, and has developed so rapidly that the camp is demoralized and all ordinary work is held up till it has passed. All assembleges of soldiers taboo.

These men start with what appears to be an ordinary attack of LaGrippe or Influenza, and when brought to the Hosp. they very rapidly develop the most viscous type of Pneumonia that has ever been seen. Two hours after admission they have the Mahogany spots over the cheek bones, and a few hours later you can begin to see the Cyanosis extending from their ears and spreading all over the face, until it is hard to distinguish the coloured men from the white. It is only a matter of a few hours then until death comes, and it is simply a struggle for air until they suffocate. It is horrible. One can stand it to see one, two or twenty men die, but to see these poor devils dropping like flies sort of gets on your nerves. We have been averaging about 100 deaths per day, and still keeping it up. There is no doubt in my mind that there is a new mixed infection here, but what I dont know. My total time is taken up hunting Rales, rales dry or moist, sibilant or crepitant or any other of the hundred things that one may find in the chest, they all mean but one thing here -Pneumonia-and that means in about all cases death.

The normal number of resident Drs. here is about 25 and that has been increased to over 250, all of whom (of course excepting me) have temporary orders-"Return to your proper Station on completion of work". Mine says "Permanent Duty", but I have been in the Army just long enough to learn that it doesn't always mean what it says. So I dont know what will happen to me at the end of this.

We have lost an outrageous number of Nurses and Drs., and the little town of Ayer is a sight. It takes Special trains to carry away the dead. For several days there were no coffins and the bodies piled up something fierce, we used to go down to the morgue (which is just back of my ward) and look at the boys laid out in long rows. It beats any sight they ever had in France after a battle. An extra long barracks has been vacated for the use of the Morgue, and it would make any man sit up and take notice to walk down the long

lines of dead soldiers all dressed and laid out in double rows. We have no relief here, you get up in the morning at 5:30 and work steady till about 9.30 P.M., sleep, then go at it again. Some of the men of course have been here all the time, and they are ***TIRED****.*

If this letter seems somewhat disconnected overlook it, for I have been called away from it a dozen times the last time just now by the Officer of the Day, who came in to tell me that they have not as yet found at any of the autopsies any case beyond the red hepatitis stage. It kills them before they get that far.

I don't wish you any hard luck Old Man but I do wish you were here for a while at least. It's more comfortable when one has a friend about. The men here are all good fellows, but I get so damned sick o Pneumonia that when I go to eat I want to find some fellow who will not "Talk Shop" but there ain't none nohow. We eat it live it, sleep it, and dream it, to say nothing of breathing it 16 hours a day. I would be very grateful indeed if you would drop me a line or two once in a while, and I will promise you that if you ever get into a fix like this, I will do the same for you.

Each man here gets a ward with about 150 beds, (Mine has 168) and has an Asst. Chief to boss him, and you can imagine what the paper work alone is - fierce,-- and the Govt. demands all paper work be kept up in good shape. I have only four day nurses and five night nurses (female) a ward-master, and four orderlies. So you can see that we are busy. I write this in piecemeal fashion. It may be a long time before I can get another letter to you, but will try.

This letter will give you an idea of the monthly report, which has to be in Monday. I have mine most ready now. My Boss was in just now and gave me a lot more work to do so I will have to close this.

Good By old Pal,
"God be with you till we meet again"
Keep the Bouells open.
(Sgd) Roy.

Grattan Woodson, MD FACP obtained his MD at the Medical College of Georgia in 1980 and completed his internal medicine training at an affiliate of Columbia University College of Physicians and Surgeons in New York, New York in 1983. He joined the full-time faculty of Emory University School of Medicine where he taught internal medicine and worked as a diagnostician at Emory Clinic. In 1985 at Emory, he began his osteoporosis research career, which continues to be one of his major interests. In 1986, he co-founded the Atlanta Center for Medicine, a private internal medicine group practice and in 1989 he began the Osteoporosis Center of Atlanta. Dr. Woodson is best known for his work in osteoporosis. He formed Druid Oaks Health Center, the first an integrally informed Internal Medicine practice in Atlanta with Dr. Tim Watts and Ms. Tina Lewis, MMSc, PA-C in 2005.

Dr. Woodson first became concerned about avian influenza after learning about the first human cases in Hong Kong in 1997. His interest increased significantly when the disease re-emerged in Southeast Asia in 2003. As the disease has evolved it became evident to him that the likelihood of a worldwide influenza pandemic similar to the devastating 1918 Spanish Flu was increasing. In order to prepare his patients for a catastrophic event that most would think inconceivable today, Dr. Woodson has authored this monograph.