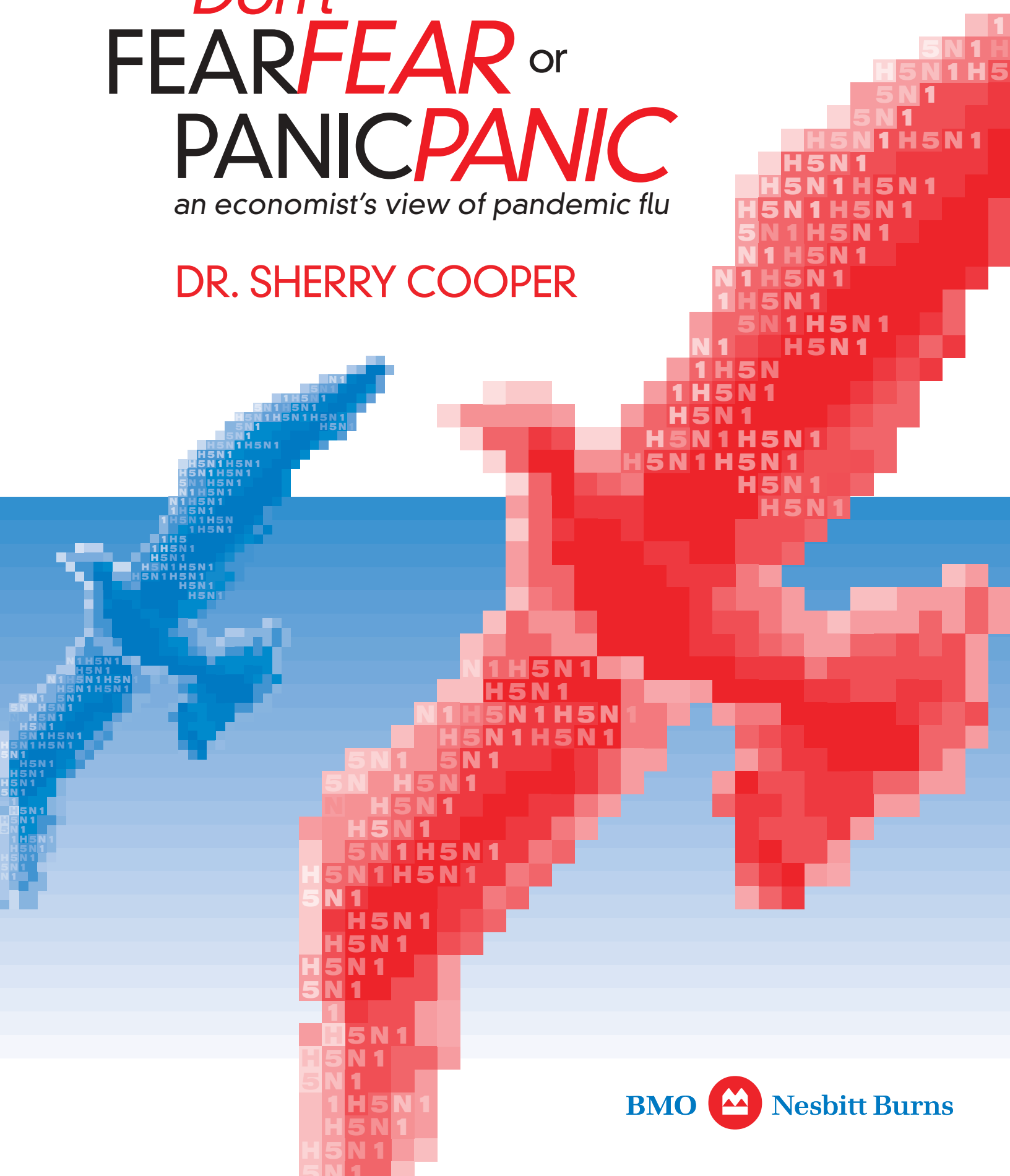


*Don't*  
**FEAR***FEAR* or  
**PANIC***PANIC*  
*an economist's view of pandemic flu*

**DR. SHERRY COOPER**



# Don't FEAR FEAR or PANIC PANIC

*an economist's view of pandemic flu*



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## Introduction

Dr. Michael Osterholm has stated to me directly that he believes there is a 100% probability of a global Influenza-A pandemic.

New cases of human H5N1 virus, better known as avian or bird flu, are surfacing quite regularly now in Indonesia, and possibly through much of the rest of Asia. Bird flu is now endemic in the bird population of some Asian countries, and most experts believe it can no longer be extinguished, particularly given that it is carried by asymptomatic ducks and wild migratory birds. These birds, which are nearly impossible to fully monitor and cull, are the source of Type A influenza. Recently, chickens have also been found to be asymptomatic carriers. But, countries such as Vietnam, Cambodia, Thailand and Indonesia do not have the resources to detect and cull all diseased birds.

It is currently flu season in Asia, and will soon be in Europe and North America. No one knows if H5N1 will become as virulent and contagious in people as it is in birds. What we do know is that this flu virus is mutating and has a remarkable ability to evolve and jump species. It is far more potent today than it was in earlier cases in 1997. This has led to a sense of inevitability—most experts are convinced that, even if this particular flu virus does not explode into a pandemic, another one will.

Dr. Michael Osterholm, Director of the Center for Infectious Disease Research and Policy (CIDRAP) and Associate Director of the Department of Homeland Security-funded National Center for Food Protection and Defense, is a noted authority on bioterrorism and pandemics. He has stated to me directly that he believes there is a 100% probability of a global Influenza-A pandemic. He does not, however, know when or where. While uncertain, Dr. Osterholm believes the next Influenza-A pandemic will evolve from H5N1.

In Asia, the H5N1 strain of bird flu has swept through poultry populations in large swaths since 2003, with fatalities recorded in Vietnam, Thailand, Cambodia and Indonesia. We know that there is likely to have been numerous unreported human fatalities, as many in rural regions might not have made it to a hospital. For example, there are no reported human deaths in all of China, though there have been reportedly 55 outbreaks of avian flu in birds since December 2003. In 1997, when the disease first emerged in a form lethal to humans in Hong Kong, the response was immediate—the entire Hong Kong poultry population of 1.5 million birds was promptly destroyed. But it stretches credulity to believe that there have been no human cases of H5N1 in rural China where birds, pigs and people live in close contact. Information out of China was slow to arrive in the early days of SARS as well.

In July, avian flu spread to the bird populations of Russia and Kazakhstan, and it is now at the border of Europe. Just recently, it has been reported in Romania and Turkey. Hundreds of millions of birds have died or been culled, and poultry production and trade have been significantly disrupted. Avian flu has now infected migratory birds, chickens and

ducks, and has moved on to such mammals as pigs, tigers and even domesticated cats.

The virus has mutated since the first bird cases were detected in southern China in 1996-1997, and has become far more virulent and deadly. It can kill infected chickens in a span of less than one day. It can kill ducks in one-to-two days, and it has a very high death rate in humans, currently around 50% in the affected regions. This is 10 times the case fatality rate of the horrific 1918 pandemic, although others might have recovered from the disease without ever being reported.

It can kill infected chickens in a span of less than one day. It can kill ducks in one-to-two days, and it has a very high death rate in humans, currently around 50% in the affected regions.

There has been a rapid evolution of H5N1 in wild migrating birds. These birds, moving from north to south, are spreading the disease from species to species. Bird migration networks could carry the virus around the world. The fact that it has now spread beyond these birds means that it cannot be eradicated any longer by culling.

In the past four months, many thousands of wild migratory birds of multiple species have died. Before this, infected wild birds did not get sick en masse. So, the virus is continuing to evolve as a lethal pathogen and appears to be spreading globally. The more the virus extends its range, the greater the chance of mutation to allow easier human transmissibility.

### Catching Media Attention

As the waters of Hurricanes Katrina and Rita recede, many in the United States are finally waking up to the risk of pandemic flu. The White House is particularly concerned that it be on top of this potential natural disaster, as its poor response to Katrina has markedly damaged the President's already-low approval rating.

Health officials have warned for years that virulent bird flu could kill millions of people, but few in Washington have seemed alarmed. After a closed-door briefing led by Michael Leavitt, the Secretary of Health and Human Services (HHS), and other senior government health officials in late September, fear of an outbreak swept Washington. The day after the briefing, the Senate added \$3.9 billion for flu preparations into a Pentagon appropriations bill. The Bush administration is preparing to ask Congress to spend somewhere between \$6 billion and \$10 billion on vaccines and antiviral medicines, according to officials in Congress and the administration.

Mr. Leavitt warned that an outbreak of pandemic flu could cause 100,000 to 2 million deaths and as many as 10 million hospitalizations in the United States with costs exceeding \$450 billion as a worst-case scenario. Those numbers have been presented publicly many times before. But hearing them in closed session apparently gave them urgency and rattled Congress and the White House.



Mr. Leavitt listed steps that must be taken to prevent a flu pandemic. First, there must be an effective global surveillance program for the disease. Second, the United States must construct its own comprehensive disease surveillance system. And third, more antiviral drugs like Tamiflu, made by Roche Laboratories of Switzerland, and Relenza, made by GlaxoSmithKline (GSK) of the U.K., must be made available.

*"But we're more ready today than we were yesterday. And we'll be more prepared tomorrow than we are today."*

— Michael Leavitt,  
HHS Secretary

The U.S. government has purchased a reported 4.3 million courses of Tamiflu, said a spokeswoman for HHS, and wants to have a national stockpile of 133 million courses readily available. A course includes two capsules per day for five days, although many question if just one course will be sufficient. Many experts suggest that far more than one course of the drug would be needed to preclude infection. Taking the drug preventively might require two doses a day for several months, if it works at all.

Finally, the government is underwriting research that will speed the creation of vaccines, which currently takes about half a year to be manufactured.

Thirty-two Democratic senators sent a letter to President Bush on October 4<sup>th</sup> expressing "grave concern that the nation is dangerously unprepared for the serious threat of avian influenza". The letter went on to state that it was past time for the administration to finish its flu plan, which has been under review for a year.

Mr. Leavitt acknowledged that the U.S. is not prepared for a pandemic flu outbreak. On October 8<sup>th</sup>, he began a visit to Thailand, Vietnam, Laos and Cambodia, the countries most likely to be the source of an avian flu outbreak, to talk to health ministers there about a coordinated surveillance of outbreaks.

"No one in the world is ready for it," Mr. Leavitt said. "But we're more ready today than we were yesterday. And we'll be more prepared tomorrow than we are today."

There has been a spate of avian flu coverage in the U.S. media in just the past week. The *New York Times* reported on October 8<sup>th</sup> that they have received a draft copy of the *Pandemic Influenza Strategic Plan* of the United States, which has been years in the making and is slated to be released later this month. Those who have read the 381-page plan, conclude that the U.S. is currently unprepared for an influenza pandemic. The government is well aware of its deficiencies in vaccine and antiviral stock-piling capability, and it is not clearly delineated who is in charge of the overall preparedness and response process. The plan does describe the responsibilities of top health officials in each phase of a spreading pandemic, starting with planning and surveillance efforts and ending with coordination with the Department of Defense. While the plan is an important milestone, the U.S. is well behind other countries, such as Japan, the U.K. and Canada, in its preparedness work. U.S. attention will now turn to what has been going on in Asia for almost a decade.



## Asia—The Ideal Milieu for Nascent Pandemic

In many places in Asia, birds, pigs (and other mammals) and people live in very close proximity, allowing for the mixing and mutation of viruses, which is technically called “reassortment” and “recombination”. A potentially pandemic strain of influenza can occur through reassortment as the genes between avian and human strains of influenza are ‘mixed together or reorganized’, which can occur during coinfection with both strains. The host for this coinfection might be pigs, known to be a great ‘mixing vessel’ because pigs can support the growth of both avian and human viruses, or it might be humans directly. Recombination is the process of individual, independent mutations, which we know continues to happen. Recently, a team of scientists discovered evidence suggest-

ing that during the 1918 pandemic, the virus mutated on its own in birds, gaining the ability to spread from human to human, without mixing with another virus. The 1918 virus did not have a mammalian intermediary like the 1957 and 1968 viruses, and was far more deadly. So far, the H5N1 virus is following an evolutionary path similar to the 1918 virus.

There are enormous numbers of people, pigs and poultry in Asia, and all have increased dramatically since 1968, the date of the last influenza pandemic—a relatively mild one (*Table 1*). The life cycle of a chicken is very short—encompassing only six weeks from hatching to harvest. So the 13 billion chickens in China in 2004, noted in the table, really amount to many times that number over a given year. There is no other region

in the world that is so adept at creating Influenza-A pandemics than emerging Asia. It is very unlikely that a human pandemic would begin in Europe or elsewhere in the developed world, even if birds there are infected with H5N1.

According to the March 2005 National Academy of Science’s Institute of Medicine flu report, the **“current ongoing epidemic of H5N1 avian influenza in Asia is unprecedented in its scale, in its spread, and in the economic losses it has caused”**. And that was written more than six months ago. H5N1 outbreaks have occurred in 12 countries in Asia (*Map*). These are generally very poor countries (excepting Japan) without the resources for surveillance, prompt detection, and the provision of compensation for widespread culling. They do not have the money to purchase adequate stores of the antiviral drug, oseltamivir, known commercially as Tamiflu, and it is in short supply. The quantities that more than 30 countries and many individuals and businesses have ordered are far beyond the annual production capacity of Roche for the drug. It is, therefore, extremely difficult to implement measures that would control a continent-wide epidemic.

We know that this is a novel virus to which there is no human immunity. We also know that the virus is capable of causing serious human illness

TABLE 1

	1968	2004
People	790 million	1.3 billion
Pigs	5.2 million	508 million
Poultry	12.3 million	13 billion

Source: CIDRAP, Dr. Michael Osterholm

There is no other region in the world that is so adept at creating Influenza-A pandemics than emerging Asia.

# Avian Flu Outbreaks

Outbreaks of highly Pathogenic Avian influenza*	Human Cases/Deaths**	Poultry Population (000s : 2003 est)	Human Pop. in regular contact with Poultry (2002 est)
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<b>RUSSIA</b>	50	-	3.4m	-
<b>KAZAKHSTAN</b>	1	-	24.8m	-
<b>MONGOLIA</b>	1	-	750	-
<b>JAPAN</b>	8	-	2.8m	-
<b>SOUTH KOREA</b>	19	-	1m	-
<b>CHINA</b>	55	-	47m	-
<b>HONG KONG</b>	4	20/7	-	-
<b>LAOS</b>	1	-	231	2.9m to 3.8m
<b>VIETNAM</b>	1,838	91/41	2.5m	36.5m to 48.6m
<b>CAMBODIA</b>	15	4/4	240	5.8m to 7.7m
<b>THAILAND</b>	1,135	17/12	2m	22.3m to 29.7m
<b>MALAYSIA</b>	10	-	1.83m	-
<b>INDONESIA</b>	216	11/7	13m	89m to 119m



According to the March 2005 National Academy of Science's Institute of Medicine flu report, the "current ongoing epidemic of H5N1 avian influenza in Asia is unprecedented in its scale, in its spread, and in the economic losses it has caused."

\* (as of Oct. 7, 2005) \*\* (May '97- Oct. 7, '05)  
Sources: Financial Times, BMO Nesbitt Burns, OIE



The surveillance of both human and animal cases in Southeast Asia has been limited, making early detection of a pandemic more difficult.

and death. To date, there is no proof that the virus is capable of spreading efficiently from person to person. The likelihood that the virus will develop the capacity to spread this way is directly related to the number of both human and animal cases. According to a September 2005 report of the Center for Biosecurity of the University of Pittsburgh Medical Center, "With each new infection, there are new opportunities for the H5N1 to develop into a virus easily transmissible from person to person. Since 2004, the number of cases of H5N1 influenza virus in birds has increased dramatically."

Since 2004, there have been more than 3,000 distinct outbreaks of highly pathogenic H5N1. Indonesia has reported scores of infections in chicken flocks across the sprawling country, but in the past has said it could not afford to carry out mass culls, an action the United Nations suggests as the best way to prevent the virus' spread. Indonesia is under immense financial and economic pressure resulting from the tsunami, the sharp rise in gasoline prices and, more recently, the Bali bombings and the earthquake in Aceh province. The government was recently forced to raise government-subsidized gasoline prices because the federal coffers were running dry.

On September 20<sup>th</sup>, the Indonesian government issued a 21-day state of high alert against the disease, assigning 44 state-owned hospitals to treat avian influenza patients at no charge. All individuals with symptoms of the disease—including high fever, coughing and breathing difficulties—could be forcibly admitted to hospitals.

Indonesia reversed course and said it will now cull any bird farm that is more than 20% infected. But, 30 million households keep 200 million chickens in their backyards, creating nearly insurmountable logistical problems. Plus, we know that partial culling is not effective.

Indonesian Health Minister Siti Fadillah Supari said 500,000 capsules of Tamiflu are now available. She said that the medicine—enough to treat 50,000 people with one course each—has been provided by donor countries and agencies. But, there are currently waiting lists for large quantities of Tamiflu capsules, should the Indonesian government decide to ramp up purchases.

The surveillance of both human and animal cases in Southeast Asia has been limited, making early detection of a pandemic more difficult. The virus is rapidly expanding the range of species it kills and becoming better adapted to mammalian hosts. In the lab, it kills ferrets and mice. Tigers, leopards and domesticated cats have contracted the disease by eating infected chickens. Most of them died. Overall, there have been over 120 reported cases of human infection of H5N1 in four Asian countries since late 2003, with over 60 deaths reported. Certainly these figures underestimate the number of human cases, as many may have gone undetected or unreported.



## Grasping Pandemic Influenza

A pandemic is an epidemic that becomes very widespread and infects a whole region, a continent or—most likely with global travel—the world. Influenza pandemics are known to attack three or four times each century. They occur when a novel influenza strain emerges with the following characteristics: it is readily transmissible between humans; it is genetically unique so that the human population lacks a pre-existing immunity; and it is highly virulent. Each pandemic is unique, so the mortality rate of the next one cannot be predicted with a “single-risk predictive model”, as some have tried. Some believe these models, such as the one used by the U.S. Centers for Disease Control and Prevention (CDC), generally underestimate the death toll.

At least 10 pandemics have been recorded in the past 300 years. The world hasn't suffered one since 1968. It killed an estimated one-to-four million people worldwide—most studies suggest the number was at the lower end of that range. Earlier, there was also another mild episode in 1957, with roughly the same number of deaths.

TABLE 2



### Influenza Pandemics of the 20th Century: Global Impact

Year	Strain	Estimated Deaths	Global Population
1918 (Spanish flu)	H1N1	50-100 million	1.75 billion
1957 (Asian flu)	H2N2	1-4 million	2.75 billion
1968 (Hong Kong flu)	H3N2	1-4 million	3.65 billion

Sources: CLSA, Bio Economic Research Associates (bio-era), BMO Nesbitt Burns

The real killer-flu pandemic was in 1918, the so-called Spanish flu. It did not originate in Spain, although it did devastating damage there. In the 1918 flu pandemic, an H1N1 strain infected 200 million to 1 billion people. According to a detailed country-by-country study published in the **Bulletin of Medical History**, an estimated 50 million to 100 million people died globally. Not surprisingly, estimates of mortality rates vary widely—I have seen estimates range from 20 million to 100 million. Over the period from 1918 to 1920, roughly half the global population was infected in three separate waves, several

months apart—the middle one being the worst. The fatality rate was about 3% of those infected, killing about 500,000 people in the U.S. and nearly 60,000 in Canada. This makes the Canadian death toll from SARS, at 44, seem almost trivial. Moreover, in 1918, the global population was only 1.75 billion (*Table 2*). Today, the world's population is an estimated 6.4 billion.

The death rate was highest among young healthy adults, aged 20 to 40, and among pregnant women, for reasons described in the next section. A summary of thirteen studies in 1918-1919 involving pregnant women demonstrated that the case-fatality rate ranged from 23% to 71%, a 55% median. If the woman survived, the fetus invariably did not.

### No Ordinary Flu

Pandemic flu is very different from the ordinary winter flu that hits the elderly and infants hardest (*Table 3*). The term 'flu' is generally misused

TABLE 3



## Key Differences Between Annual Flu and Pandemic Flu

### Annual Flu

Occurs every year during the winter months.

Affects 5-20 percent of the U.S. population.

Globally, kills 500,000–1 million people each year, 36,000–40,000 in the U.S.

Most people recover within a week or two.

Deaths generally confined to “at risk” groups, such as the elderly (over 65 years of age); the young (children aged 6-23 months); those with existing medical conditions like lung diseases, diabetes, cancer, kidney, or heart problems; and people with compromised immune systems.

Vaccination is effective because the virus strain in circulation each winter can be fairly reliably predicted.

Antiviral drugs are available for those who become seriously ill.

### Pandemic Flu

Occurs three to four times a century and can take place in any season.

Experts predict an infection rate of 15-50 percent of the population, depending on the virulence of the virus strain.

The worst pandemic of the last century—the “Spanish Flu” of 1918—killed 500,000 in the U.S. and 50 million worldwide.

Usually associated with a higher severity of illness and, consequently, a higher risk of death.

All age groups may be at risk for infection, not just “at risk” groups. Otherwise fit adults could be high risk, based on the 1918 pandemic. Then, adults under age 40 (a key segment of the workforce and of the fertile population) were disproportionately killed due to the cytokine storm.

A vaccine against pandemic flu will not be available at the start of a pandemic. New strains of virus must be accurately identified, and producing an effective vaccine could take six months.

Antiviral drugs will be in limited supply, and their effectiveness will only be known definitively once the pandemic is underway.

Sources: Trust for America’s Health, BMO Nesbitt Burns

to define virtually any respiratory symptom. It is often confused with the common cold. According to the CDC, ordinary influenza infects roughly 5%-to-20% of Americans each year—about 200,000 annually are hospitalized with the disease and about 38,000 die, mostly elderly. This reflects a mortality rate of about 0.1% for those infected.

In Canada, ordinary influenza infects 10%-to-25% of the population each year. Health Canada estimates that 700 to 2,500 die annually, mostly the elderly. The fatality rate is lower in Canada than in the United States. Canada is highly ranked in the world in vaccine doses per 1,000 people. Unlike the U.S., Canada is self-sufficient in domestic vaccine production.

The disproportionate death of healthy young adults in the 1918 pandemic resulted from a ‘cytokine storm’, an event in which cytokine production causes enormous lung and other organ damage. Cytokines are regulatory proteins, such as the interleukins and lymphokines, that are released by cells of the immune system and act as intercellular mediators in the generation of an immune response. People with the strongest immune systems produce the most cytokine and, hence, have the highest fatality rates. Millions experienced acute respiratory distress syndrome, an immunological condition in which disease-fighting cells overwhelm the lungs in their battle against the virus so much that the

lung cells become collateral damage, and the victim suffocates. According to Dr. Osterholm, we cannot handle this condition much more effectively today than we could in 1918, even in intensive care units.

Current studies of H5N1 cases in Southeast Asia, as well as the clinical picture and epidemiology of the virus, indicate a similar cytokine-storm phenomenon, which would disproportionately kill the most economically productive age group.

## And If That Isn't Scary Enough

Dr. Robert Webster of St. Jude Children's Research Hospital in Memphis has studied flu viruses for 40 years and has never seen anything like this. "This virus, right from scratch, is probably the worst influenza virus, in terms of being highly pathogenic, that I've ever seen or worked with," Webster says.

With the known deaths so far, many public health experts fear a catastrophe. So far, this virus cannot efficiently pass from birds to people, let alone from one person to the next. "It can make that first step across, but then it doesn't spread easily from human to human," says Webster. "Thank God. Or else we'd be in big trouble."

**Dr. Webster though, similar to Dr. Osterholm and many others, believes that the H5N1 virus, which is not yet transmissible among humans, "will learn to do it".**

### The Potential Human Cost

Estimates of potential human deaths today vary widely: These estimates are highly contentious and are subject to enormous dispute. In late September, Dr. David Nabarro, the newly appointed UN co-ordinator for global bird flu preparations, warned that a pandemic could kill up to 150 million people (and admitted that plans for the United Nations' own staff are still only now being finalized). His estimate set off a flurry of controversy, as many in the public-health world estimate the number of deaths would be much smaller. Soon after Dr. Nabarro's statement, the influenza spokesman for the WHO, Dick Thompson, said "We're not going to know how lethal the next pandemic is going to be until the pandemic begins." The WHO's best estimate for a pandemic scenario for the current global population, modelled on the mild pandemic of 1968, projects a global death toll of 2 million to 7.4 million.

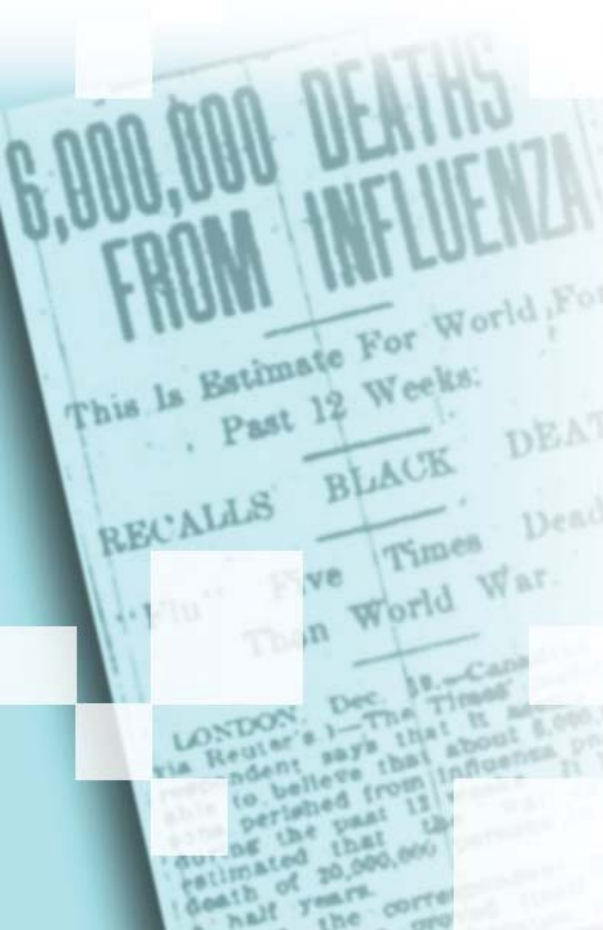
These estimates, however, have been criticized since the emergence of the H5N1 virus, which to date is far more virulent than the 1968 virus. However, an avian-influenza virus is expected to lose pathogenicity once it acquires the transmissibility necessary to trigger a pandemic.

Dr. Osterholm bases his death-toll estimates on the 1918 pandemic experience—these would be 30 million to 384 million worldwide, with roughly 1.7 million in the U.S., and about 200,000 in Canada. These numbers seem to jibe with the U.S. plan's worst-case scenario.

The deaths come in waves, extending the crisis and raising the panic. These death toll estimates, even the conservative ones, are staggering. They demand attention, action and coordination, and they demand it now.

Too much energy seems to be expended in quibbling over the number of deaths rather than devising and practicing response plans. As Canadian

Too much energy seems to be expended in quibbling over the number of deaths rather than devising and practicing response plans.





Press medical reporter Helen Branswell points out, whatever the numbers, the situation will likely be extremely difficult and economically colossal. Martin Meltzer, health economist at the CDC suggests, "The point isn't the exact number (of deaths). The point is: Imagine a lot of people ill in a very short space of time. More than you've ever seen."

### What Can Be Done?

Dr. Klaus Stöhr, project leader of the Global Pandemic Project at the WHO, says we have not been so close to a pandemic since 1968. **We are watching it unfold in slow motion for the first time in history, and for the first time in history, we might be able to do something meaningful about it. Detection, containment and prevention are critical.**

Unfortunately, the prospect of controlling the disease in birds in Asia is bleak. Thus, it will continue to spread to mammals, risking the possibility of reassortment and gradual mutation. While roughly 120 cases of avian flu in humans have been reported, with deaths in excess of 60 since 2003, the WHO authorities say that far more people than those reported in hospitals have died. The WHO has expert missions in all of the affected countries. They believe that more human deaths will occur. International reporting and collaboration are essential and must be established *before* a crisis. And, rich countries must help poor countries to report, detect, and contain the disease.

**Once a pandemic virus emerges, it is too late to begin planning or to begin collaboration. There will be only a 20-to-30 day window between emergence and pandemic. Dr. Stöhr suggests that antiviral prophylaxis of 80% of the surrounding population within 20 days would be required to slow or stem the spread of disease. It takes 4-to-5 days for the patient to become symptomatic and go to the hospital. In the interim, the virus is highly contagious and spreading fast.**

Then it takes time for sampling, testing and diagnosis. Field investigation to determine if the virus were contracted from a bird, mammal or a human also takes time. That relies on the ability of local health officials across the region to spot the disease and report it quickly—a huge challenge given problems with health care and reluctance to disclose information in many countries. Thus, the intervention period is really only 10-to-14 days.

The Philippine government, for instance, has no Tamiflu stockpile, China has covered up disease outbreaks in the past, and many countries in the region have just begun the first stage of pandemic planning. As the window for action is narrow, the WHO has set up an emergency stockpile of Tamiflu to be used in the event of an outbreak in Asia, adding to its current stockpile of 80,000 courses. Roche is donating 1 million courses by early 2006 and 3 million courses by mid-2006.

Once a pandemic virus emerges, it is too late to begin planning or to begin collaboration.



A host of companies around the world are busily at work developing a vaccine.

The WHO suggests that the virus would travel the globe in 3-to-4 months, but with today's air travel, it could occur much faster. Dr. Sanjay Gupta (CNN) suggests that the virus would travel the globe in a matter of days, and the draft U.S. pandemic plan suggests weeks. A large number of cities and countries would be infected virtually simultaneously. Authorities might be able to slow the spread through immediate travel screening and masks, but the spread would be inevitable. The Deputy Commissioner of the New York City Department of Health and Mental Hygiene, Dr. Isaac Weisfuse, is working under the assumption that he can't keep the pandemic from coming and he can't stop it from spreading. NYC is, arguably, one of the better-prepared cities as health officials have been actively planning for bioterrorism since the anthrax event in 2001.

## Vaccines

Most experts suggest potential vaccines and other preventative and curative measures will have little effectiveness in the early stages of the pandemic and cannot be manufactured quickly enough to make a large difference. Current standard vaccines, grown in hens' eggs, take about six months to produce. New breakthroughs allow the use of "reverse genetics" to develop a prototype vaccine virus.

Not only would the development of a vaccine take months, but production capacity constraints would limit its distribution to enough people to slow the spread. Many experts suggest that two doses of vaccine per person would be needed to assure immunity. The WHO suggests that about 25%-to-30% of the population could become infected. (Others quote estimates of 35%-to-50%.)

A host of companies around the world are busily at work developing a vaccine. The problems are enormous, involving the type of viral strain that might impact humans, delays in the production process, and strength of the immune response. Obviously, no clinical trials can be done on humans for H5N1, but lab tests on animals have shown some success. **The WHO has made it clear that these vaccines are no sure-fire panacea, and has warned of shortages in production capacity of pandemic flu vaccines, not to mention the issues of getting the vaccine to those who need it most, especially in the emerging economies of East Asia.**

GSK is gearing up to apply for preliminary European regulatory approval for a vaccine by the end of this year. Chiron of the U.S. and Sanofi Pasteur of France are also having some success. ID Biomedical (IDB), a Vancouver-based firm recently purchased by GSK, and Sanofi Pasteur produce flu vaccines for Canada. ID Biomedical entered into a 10-year contract in 2001 with the Government of Canada, requiring the development, in Canada, of sufficient vaccine production infrastructure to produce up to eight million doses per month, in the event of a pandemic. The contract also states that IDB must ensure a secure Canadian supply of all raw



## The Shrinking Vaccine Manufacturing Industry

**In 1976, 37 U.S. companies manufactured vaccines in the United States. In 2002, there were only three. Reasons given for the decline are mostly economic:**

- Vaccine production can take decades of research and development and, according to industry estimates, costs about \$800 million per licensed vaccine.
- Concerns about liability impact manufacturers' decisions to avoid vaccine production, especially after the significant compensation claims that followed the swine flu immunization program in the mid-1970s. A bill introduced this summer in the U.S. Senate would give liability protection to drug companies that produce either biodefense drugs or countermeasures to combat pandemic flu.
- Some companies also cite insufficient market size as reason to stay out of the vaccine market, due to the current low incidence of many diseases in the U.S., such as tuberculosis. The flu vaccine demand is particularly seen as unstable due to the unpredictability of the size and scope of the market each year.
- There are only two manufacturers currently licensed to produce influenza vaccines in the U.S., and a third overseas manufacturer who supplies vaccine to the U.S. One of the U.S.-licensed manufacturers produces inactivated influenza vaccine and one manufacturer produces the live, attenuated vaccine administered through nasal spray. However, as awareness of H5N1 has grown over the course of 2005, an increasing number of companies have moved towards developing an H5N1 vaccine.

Sources: Trust for America's Health, BMO Nesbitt Burns

materials necessary for vaccine production, including a regular supply of fertilized hens' eggs—the medium in which the influenza vaccine is grown. IDB currently has the capacity to produce six million doses of pandemic vaccine per month, if necessary.

The United States, however, has little domestic vaccine-production capability (*Table 4*). That is why trouble with the Chiron order last winter caused a U.S. shortage of the flu shot (*Table 5*). MedImmune of Maryland has produced an inhaled vaccine for healthy people between 5-to-49 years old. And, in late August, Novavax of Pennsylvania reported positive results on an H5N1 pandemic influenza vaccine. The National Institute of Allergy and Infectious Diseases (NIAID) has contracted with Sanofi Pasteur to supply two million doses of vaccine. Chiron has also received a U.S. contract to develop an H5N1 vaccine for testing. The value of the contract was not disclosed.

The White House called a meeting on October 7<sup>th</sup> with vaccine manufacturers looking for ways to quickly step up production in the United States. The U.S. draft pandemic plan calls for domestic vaccine pro-



## Flu Vaccine Crisis of 2004

The October 2004 announcement that approximately half of the expected flu vaccine for the U.S. would not be available heightened public awareness about the fragility of the public health system's vaccine development system and national readiness for a fast-moving influenza epidemic.

In early October, Chiron Corporation announced it would not be able to meet demand for its flu vaccine after problems at a British plant halted production of millions of doses. The dose shortage highlighted the fact that the U.S. relies on very few manufacturers to deliver the country's "projected need of 100 million doses." As a result, CDC officials were forced to encourage changes in the nation's distribution procedures, reserving doses only for the populations most in need. Germany ultimately made vaccines available to the U.S. from their domestic supply.

The shortage resulted in a focus of media and public attention on the issue, long lines at health clinics around the country, and calls for incentives, liability reforms, and other measures to encourage a broader range of vaccine producers.

Source: Trust for America's Health

duction capacity of 600 million doses within six months, more than 10 times the present capacity. Many suggest that such a monumental task would require the government to buy vaccines and assure manufacturers a profit, as well as assume full liability in the event of law suits related to side effects.

The current annual international capacity for influenza vaccine production using egg culture is enough to cover approximately 5% of the global population. Almost all of the world's influenza vaccine is produced in only nine countries, representing only 12% of the world's population. This would require pro-

ducing countries to share supply with others, which many believe would be very uneven given the short supply in most places. Dr. Osterholm and others question whether production capacity of vaccines will increase significantly in the next several years.

The medical community worldwide remains extremely cautious about the effectiveness and availability of pandemic flu vaccines. The virus is evolving, constantly mutating, so only guesswork can be used to create the relevant vaccine. Also, the Sanofi Pasteur vaccine seems to be effective only in large doses (evidently, six times the normal dose of flu vaccine). And, of course, the timing, capacity and transport issues remain. Most experts estimate that even after the appropriate H5N1 strain is identified and regulatory approvals have been expedited, it would take roughly six months for mass production (and even then, quantities would likely be insufficient in the event of a full-scale pandemic). Moreover, the issues of who and when to vaccinate remain unanswered and are highly contentious.

## Antiviral Medications

Another palliative measure for pandemic flu could be antiviral drugs that are now approved for adult use (they are not approved for use in small children). Two such medications, technically called neuraminidase inhibitors (similar to antiretrovirals used in the treatment of HIV/AIDS), are capable of attacking enzymes in flu viruses to limit their abil-

TABLE 6



## Existing and Planned Stockpiles of Vaccines and Antiviral Drugs

(based on publicly-available data as of mid-2005)

Country	Product	Comments
Australia	Tamiflu	3.9 million five-day treatment courses.
Canada	Tamiflu	Federal government plans to purchase 9.6 million doses; provinces and territories plan another 6.4 million doses.
	H5N1 vaccine	"Several thousand" doses ordered for clinical testing.
China	H5N1 vaccine	Developing and testing H5N1 vaccine; planned stockpile levels unknown.
France	Tamiflu	13 million five-day treatment courses.
	H5N1 vaccine	2 million doses.
Hong Kong	Tamiflu	2.7 million doses stockpiled; additional purchases planned to reach 18 million doses in 2007.
	Relenza	300,000 doses stockpiled; additional purchases planned to reach 2 million doses in 2007.
Italy	H5N1 vaccine	2 million doses ordered.
Japan	Tamiflu	Plans to stockpile 20 million doses.
Netherlands	Tamiflu	220,000 doses stockpiled; 5 million doses ordered.
New Zealand	Tamiflu	835,000 doses ordered; to be delivered by year-end.
United States	Tamiflu	Approximately 4 million courses stockpiled.
	H5N1 vaccine	8,000 doses delivered for clinical trials; 2 million doses ordered.
United Kingdom	Tamiflu	14.6 million courses; delivered over the next 2 years.

Sources: CLSA, Bio Economic Research Associates (bio-era), Financial Times, BMO Nesbitt Burns

ity to multiply in the body. These medicines, known in the marketplace as Tamiflu (capsules, by far the most popular, manufactured by Roche) and Relenza (inhaled through the mouth, with dramatically less commercial success, by GSK) were created more than five years ago for the treatment of seasonal flu and have shown some effectiveness in reducing symptoms.

There are problems, however, as both GSK and Roche have been hit by litigation by the companies that first developed the drugs—Biota of Australia for Relenza and Gilead of the U.S. for Tamiflu. Tamiflu has received the most publicity and Roche has orders from more than 30 governments building stockpiles (*Table 6*). Roche has also committed to opening a production facility for Tamiflu in the U.S., but production will not begin until next year.



Tamiflu stockpiles could be depleted quickly and Roche is already operating at full capacity. Roche has reportedly doubled its capacity to produce Tamiflu in 2004 and again this year, and is planning a similar increase in 2006. In addition, the company's risk exposure in expanding production capacity is compounded by the fact that the additional capacity is for a 'one-off' purpose (that might never materialize).


Roche is under intense pressure from governments to allow production of generic versions of Tamiflu. But the company and outside experts

TABLE 7

## Some Companies on the Forefront

Wildlife	Poultry Production	Public Health Monitoring, Surveillance	Sanitary Measures	Vaccines, Antiviral Drugs	Patient Care
					
<b>Measures</b>	<b>Measures</b>	<b>Measures</b>	<b>Measures</b>	<b>Measures</b>	<b>Measures</b>
Better understanding/identification of transport vectors Flyway monitoring Restricting wild animal trade Wildlife disease surveillance and reporting Targeting wildlife vaccinations?	Operational and sanitary improvements Targeted vaccination Monitoring of wildlife contacts Improved animal waste and water quality systems Government inspection and testing for border control and biosecurity	Protection of poultry workers Rapid diagnostic tests Communications improvements Biosecurity screening Better understanding and identification of transmission modes	Increased use of: - Masks - Gloves - Antimicrobials - Other medical supplies	Government stockpiling and direct sales of vaccines and antiviral drugs Advanced vaccine development and production technologies	Hospitals Home care
<b>Companies</b>	<b>Companies</b>	<b>Companies</b>	<b>Companies</b>	<b>Companies</b>	<b>Companies</b>
Wildlife disease reporting: - USDA APHIS - OIE Telemetry/satellite tracking: - Service Argos Inc. (US) - TeleVilt (SWE)	Tracking and identity preservation Livestock diagnostic testing: - Hong Kong DNA Chips Ltd. (HK) - Guildhay Ltd (UK) - Idexx Laboratories Ltd. (US) Livestock biosecurity and vaccines: - Intervet (NL) - Sinsui (JP) - Schering-Plough Animal Health (US) - Fort Dodge Animal Health (US) - DuPont Animal Health Solutions (US)	Rapid diagnostic test kits and chips: - Affymetrix (US) - CombiMatrix (US) - ZymeTx Inc (US) Communications applications: - MedDay AB (SWE)	Medical supplies: - Johnson & Johnson (US) - 3M (US) - Cathay Industries (CHN) - Shanghai Gangkai (CHN) - Pengxin Yuan Holdings (CHN)	Vaccines: - Sanofi Pasteur (FR) - ID Biomedical (CAN) - Chiron (US) - MedImmune (US) - Novavax (US) - Wyeth (US) - Solvay (BE) Antiviral drugs: - Roche (CHE) - GlaxoSmithKline (US) - Gilead (US) - BioCryst Pharm. (US) - Biota (AU) DNA vaccines: - PowderMed (UK) - Crucell (NL)	Hospitals: - HCA Corp (US) - Health Management Associates (US) - Tenet Healthcare Corp (US) Medical Supplies: - Becton Dickinson (US) - Tyco International (US) - Abbott Laboratories (US) - Kimberly-Clark (US) - 3M (US)

Sources: CLSA, Bio Economic Research Associates (bio-era), BMO Nesbitt Burns



According to the WHO, if Roche worked at full capacity for the next 10 years and every pill were stockpiled, there would still only be enough Tamiflu for 20% of the world's population.

state that the production process is so complex that it could take at least two years for other firms to start manufacturing the drug. Although Roche is not in favour of allowing production of generic versions of Tamiflu, its own facilities cannot meet global demand. According to the WHO, if Roche worked at full capacity for the next 10 years and every pill were stockpiled, there would still only be enough Tamiflu for 20% of the world's population.

Tamiflu sales reached \$450 million in the first half of 2005 and will increase further as Roche expands its production capacity. A five-day treatment course of Tamiflu can sell for more than \$60. Roche reportedly sells it to governments for less than half that price. However, poor countries are unlikely to be able to afford anything more than a few dollars per course.

Many question the efficacy of Tamiflu, and even if another antiviral like Relenza were efficacious, it too, would be in short supply. Relenza is a nasal spray, available in limited quantities, that accounts for less than 1% of the current global market for antiviral drugs. Few governments have chosen to stockpile Relenza.

**See Table 7 for a list of companies worldwide that are involved in the prevention, mitigation, and treatment of avian flu. This is not a recommended list of companies to invest in. Most of these companies are not covered by our research department. This is simply a list of business participants. Before considering these for investment purposes, a careful review of the global research literature would be prudent.**

It is likely that the first to be given antivirals or to be vaccinated would be health-care workers, paramedics, ambulance drivers and other employees who provide key community services such as police, fire and rescue teams, the National Guard, and the armed services. In the U.S. draft plan, the military are not mentioned, but beyond them, the first in line for essential medicines, according to the *New York Times* article (October 8<sup>th</sup>, 2005), would be "workers in plants making the vaccines and drugs, as well as medical personnel working directly with those sickened by the disease. Next are the elderly and severely ill. Then come pregnant women, transplant and AIDS patients, and parents of infants. Finally, the police, firefighters and government leaders." This suggests HHS and NIH don't yet buy the story of a cytokine storm.

One can only imagine the furor and upset caused by giving potentially life-saving medication to only one member of a family. The priority list of vaccine or antiviral allocation raises ethical and legal questions, not to mention distribution and security issues. Speculation of riots at distribution centres does not appear to be far-fetched. A black market in these drugs might also evolve, so law enforcement and military assistance might well be necessary.

## Unlike Any Other Natural Disaster

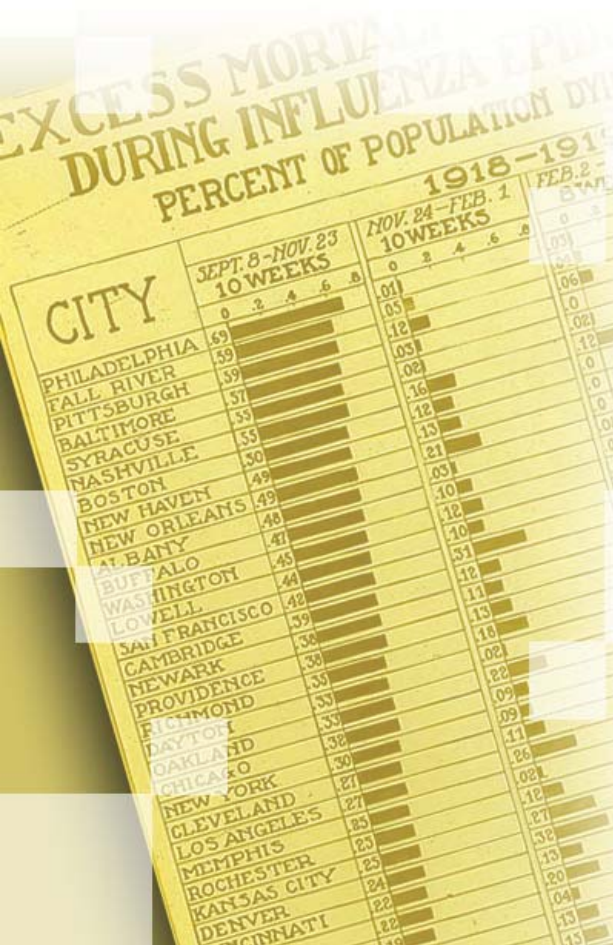
In the case of a global pandemic, disruption is magnified by its pervasiveness.

Clearly, any pandemic would be highly disruptive and disturbing. It would likely unfold in stages, which means protracted uncertainty, and it would happen in many cities in many countries at roughly the same time—it would be pervasive. In the words of Dr. Robert Shapiro, former U.S. Under Secretary of Commerce for Economic Affairs, **protracted and pervasive disasters take a huge toll on economic activity**. Unlike the tragedies of September 11<sup>th</sup>, SARS, the Madrid, London or Bali bombings, the tsunami or Hurricanes Katrina and Rita, a pervasive and protracted disaster is not solely limited to distributive effects where some sectors are seriously hurt for some time (for example, firms in or near the World Trade Center, trains and subways in London and Madrid, tourism in all of these regions, and oil refineries, production and trade in Louisiana), while others are advantaged (for example, companies associated with the rebuilding of the region and medical supply companies). These **occasional and local disasters** generally have only a modest effect on GDP growth over a relatively short time period, say a year. This was evident in the resiliency of the U.S., and European economies suffering these disasters. Even East-Asian stock markets recovered quickly from the tsunami.

Following local and short-lived disasters, most people quickly return to life as normal, particularly those outside of the immediate locale. Most assume it won't happen to them and quickly ignore or forget the event. Some businesses and workers are highly disadvantaged, but others benefit. There are winners and losers.

In the case of a global pandemic, disruption is magnified by its pervasiveness. Supply chains are broken. People everywhere are frightened. Every business is in emergency mode. Financial markets are destabilized and some might not even function for some, hopefully, brief period. Gold prices will jump as investors seek a financial haven. Central banks will add liquidity, but that only helps if bond markets are functioning, banks are making loans, and people are there to apply for these loans. Gold and Treasury bonds are traditional safe havens and both rose in the wake of the September 11<sup>th</sup> terrorist attack. While gold prices might rise, other commodity prices will fall as global growth slowed, particularly in Asia. Clearly, the overall functioning of the global economy will be attenuated for some period of time, depending on the severity of the pandemic. Some experts suggest the pandemic could last for 12-to-18 months and hit most regions of the world.

At the first hint of a pandemic, governments, central banks and global public health organizations would attempt to calm fears and put plans in place. Even if they refrain from closing borders or limiting air travel, opting for screening at airports and other travel entry points, people would likely choose not to travel. Many would hunker down in their homes—some might attempt to get to deserted or less-populated places. New Yorkers





might head for the Hamptons, Torontonians for their cottages and farms, but to no avail. Once a pandemic flu strain is unleashed, there is no way to prevent the spread of the disease. Unlike during the day or two before Hurricane Katrina hit land, there would be nowhere to safely evacuate. And remaining near a hospital or auxiliary medical facility might well be prudent. Schools would likely close—many businesses as well.

Medical directors at many large corporations have been urging pandemic-continuity planning for some time.

### Businesses Must Plan for Themselves

Businesses would be confronted with, say, 25% absenteeism, maybe more, as many workers take ill, stay home to take care of children or family members or refuse to go to work, especially in heavily populated office towers. Business-continuity planning is essential—companies must help to protect employees' health, and they will need to work with health officials to minimize disruption. **But leaning on government will not be enough.**

Many businesses are multi-national, under the auspices of numerous national, state/provincial, and local governmental authorities. Already, many corporations are developing pandemic-specific emergency plans, focussing first on their Asian employees and businesses, and then on the rest of the world. Table 8 contains a list of steps that companies should take in their planning recommended by a number of public health organizations. Actions to protect your own health, recommended by the CDC, are in Table 9.

Medical directors at many large corporations have been urging pandemic continuity planning for some time. A growing number of companies have realized the need to launch their own contingency plans to cover their staff and customers. Corning in Upstate New York, as an example, is close to deciding whether it should buy (or at least order) stockpiles of antiviral drugs as part of a broader plan. Deutsche Bank reports it has already drawn up plans, and HSBC, with its large Asian presence, says flu plans will be ready by year-end. A spokesperson for HSBC has reportedly said that this includes staff repatriation, and more call centres and shift-working in different parts of the world to cope with the changing workload as customers seek online services if they are unable to travel. Telecommuting would also help as people work from home. The Internet would be an invaluable source of commerce, information and news—but while we could pay bills online, the purchase of goods would be limited by delivery problems.

Financial institutions and large corporations in the OECD are making preparations. Bird flu is definitely now a threat on the business radar screen. Even small businesses must prepare, particularly those that provide essential goods and services such as food, fuel, electricity and medical and pharmacological products.

People will need to be informed, providing new and huge markets for Internet news along with print and broadcast media. All of these com-



# 10 Steps Your Business Can Take

**Here Is What You Can Do Now To Maintain Business Continuity. Keep In Mind That Many Strategies Take Time To Implement.**

1. Check that existing contingency plans are applicable to a pandemic.
2. In particular, check to see that core business activities can be sustained over several months.
3. Plan accordingly for interruptions of essential governmental services like sanitation, water, power, and disruptions to the food supply.
4. Identify your company's essential functions and the individuals who perform them. The absence of these individuals could seriously impair business continuity. Build in the training redundancy necessary to ensure that their work can be done in the event of an absentee rate of at least 25-30 percent.
5. Maintain a healthy work environment by ensuring adequate air circulation and posting tips on how to stop the spread of germs at work. Promote hand and respiratory hygiene. Ensure wide and easy availability of alcohol-based hand sanitizer products.
6. Determine which outside activities are critical to maintaining operations and develop alternatives in case they cannot function normally. For example, what transportation systems are needed to provide essential materials? Does the business operate on "just in time" inventory or is there typically some reserve?
7. Establish or expand policies and tools that enable employees to work from home with appropriate security and network access to applications.
8. Expand online and self-service options for customers and business partners.
9. **Tell the workforce about the threat of pandemic flu and the steps the company is taking to prepare for it. In emergencies, employees demonstrate an increased tendency to listen to their employer, so clear and frequent communication is essential.**
10. Update sick leave and family and medical leave policies and communicate with employees about the importance of staying away from the workplace if they become ill. Concern about lost wages is the largest deterrent to self-quarantine.

Sources: Trust for America's Health, BMO Nesbitt Burns

munication businesses must protect their employees and assure that they have adequate sources of food, water and other essentials. Unfortunately, this will not be easy.

## Shortages Emerge Everywhere

At the first sign of a pandemic, there would be a run on indispensable items such as food, water, and power. People would also attempt to stock up on essential medications and medical products such as insulin,



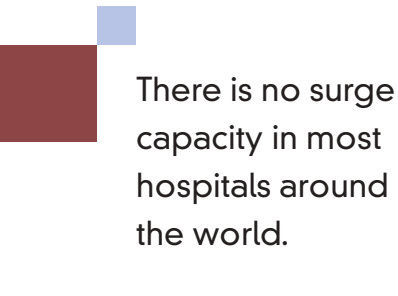
## Protecting Your Health

**Flu is caused by viruses that infect the nose, throat, and lungs, and is generally spread from person to person when an infected person coughs or sneezes. An effective vaccine, when available, will be the best safeguard against pandemic flu. In addition, the following simple, common-sense precautions can also help. Recommended by the Centers for Disease Control and Prevention, these precautions should be communicated to the workforce and posted in common areas:**

- Avoid close contact with people who are sick. If you are sick, keep your distance from others to protect them from getting sick, too.
- Stay home when you're sick or have flu symptoms. Get plenty of rest and check with a health care provider as needed.
- Cover your mouth and nose with a tissue when coughing or sneezing. It may prevent those around you from getting sick.
- Clean your hands. Washing your hands often will help protect you against germs. When soap and water are not available, use alcohol-based disposable hand wipes or gel sanitizers.
- Avoid touching your eyes, nose or mouth. Germs are often spread when a person touches something that is contaminated with germs and then touches his or her eyes, nose or mouth.
- Practice other good health habits. Get plenty of sleep, be physically active, manage stress, drink plenty of fluids, eat nutritious foods, and avoid smoking, which may increase the risk of serious consequences if you do contract the flu.

Source: Trust for America's Health

heart drugs, and many other prescription drugs, home-use dialysis machines, respirators, ventilators, gloves, masks, anti-bacterial hand soap and so many more. With today's global supply chain, shortages would soon develop. For example, only two American companies produce health-care particulate respirator and surgical face masks. 3M is one of them, but it does not produce masks in the U.S. and it uses Chinese rayon in their production. Face masks would fly off the shelves and restocking would be impossible. Black markets in face masks (as an example) would develop and crime would become a serious problem. The military and National Guard, as well as police and fire fighters, would be needed to maintain the peace, and yet their ranks will be depleted by illness.



There is no surge capacity in most hospitals around the world.

There is already a shortage of some key antibiotics, pediatric chemotherapy drugs, respirators, sub-dermal needles and syringes, and crematory support. Corpse management would be a huge issue, a glimpse of which we saw in New Orleans. The casket manufacturing industry has virtually no spare capacity and some inputs come from Asia. Refrigerated trucks would be seconded for the dead, but that would only exacerbate the delivery and storage of food products like milk, meat, fish and eggs.

There is no surge capacity in most hospitals around the world. Other facilities, from gymnasiums to warehouses to hotels to sports stadiums, would have to be quickly refitted and provided with staffing—but, there would be no excess health-care workers from other regions to come to the rescue—no available hospital beds. Indeed, recovered victims, who would then have immunity, might be enlisted and trained to help the sick or do other essential work. There would be no one to send donations, as the money would be needed everywhere.

Mental health care should be integrated with physical care and provided for the community at large. At first remotely, and later in person, children and adults will need counselling for Post Traumatic Stress Disorder and bereavement. Few would be untouched by loss of friends or family.

Nonessential medical services and surgery would be cancelled. Medical testing for non-influenza conditions would cease. So where will the cancer testing, biopsies and chemotherapies and radiation occur? What about heart surgery, maternity wards, prenatal care, and infant ICUs? What about visitations and hospices for terminally ill patients? The medical questions are endless—we got a taste of this during the 2003 SARS outbreak in Toronto.

We estimate that ordinary influenza costs the U.S. economy roughly \$10-to-\$12 billion annually in direct medical costs and loss of productivity. Bad as that is, a pandemic flu could kill over half a million in the U.S., hospitalize more than 2 million, and cost the U.S. economy a staggering \$70-to-\$167 billion, according to early CDC studies. The cost to Canada would be around C\$8-to-C\$18 billion. Those figures could be much larger. Other countries around the world could face similar to more disastrous numbers.

**With the U.S. the engine of global growth, slowing trade and U.S. activity would slow economic activity worldwide.** As discussed in our earlier report, the repercussions on global trade would be devastating. Given that virtually all major economies have a trade surplus with the U.S., trade disruptions would shutter manufacturing plants and curtail global demand for most commodities. To the extent that business could create its own internal stockpiles, similar to Wal-Mart and Home Depot during Hurricane Katrina, business could go on and demand for essentials could be satisfied, but these possibilities will be limited and must be carefully planned in advance.



Ironically, despite the slowdown in economic activity, unemployment, as we measure it, would be very low. Indeed, there would be labour shortages and involuntary unemployment. The currently unemployed, self-employed and uninsured will look to government for assistance. This will tax the resources of already stretched governments at all levels, and global agencies will be called on for help. But those bodies are already underfunded and understaffed. The WHO, for example, has only 12 employees in Geneva working on the H5N1 pandemic.


### **Investors Beware**

Tourism and hospitality industries would suffer an enormous blow—the same for airlines and most other transportation sectors. This means reduced demand for oil and gasoline. Large gatherings of people—including concerts, plays, movies, conferences and sporting events—would be cancelled. And the retail sector would be hit as most discretionary spending and trips to shopping centres would be dramatically curtailed. Other front-line casualties would include the leisure sector, gaming, racetracks and theme parks like Disney's. Life insurers and re-insurers could throw their actuarial tables out the window.

To the extent that a disproportionate share of 20-to-40 year olds would die, housing markets would weaken in response to excess supply, and all related building, real estate, decorating, and furnishing companies would suffer. Property values would fall, and some would be had later at bargain-basement prices.

Banks and other lenders would see a marked decline in mortgage and consumer lending. Commercial and corporate lending activity would likely slow at first as well. Loan losses could well increase sharply as households lose income earners and businesses in many sectors are hit badly. Banks would continue their essential business and trading operations, increasing the demand for remote access and online banking. Investment banks, financial planners, mutual fund companies and other institutional, corporate or private-client money managers would be under enormous pressure to minimize risk and wait out the pandemic as best as possible. Clearly, at the end of the crisis, there would be many bargains to be had, but only those in a strong financial position going into the disaster would be in a position to invest in underpriced real and financial assets.

Given that household debt-to-income levels are at record highs in the U.S. and Canada, active savings out of income are the lowest in history, and exposure to real estate has never been higher, many families are in a financially precarious position. As Alan Greenspan says, given all of the risk out there, reducing debt and spending relative to income is prudent. Investing in blue-chip income-producing companies is judicious as well. Adding to precautionary savings and avoiding, as much as possible, the forced sale of assets at markedly depressed prices should be a goal.



Tourism and hospitality industries would suffer an enormous blow.






TABLE 10




## Pandemic Planning

	United States	United Kingdom	Canada
<b>Leadership</b>	No government-wide coordination mechanism has been in place; Secretary of HHS receives daily briefings; within HHS divided authority between pandemic preparedness (Office of the Assistant Secretary for Health) and pandemic response (Office of the Assistant Secretary for Emergency Preparedness).  Guidance provided to states for planning purposes; no release or systematic review of local plans.	Cabinet-level office coordinates government-wide and “civil society” efforts.  Department of Health leads public health and National Health Service response.  Similar plans adopted and coordinated with Scotland, Wales, and Northern Ireland.	Pandemic Influenza Committee co-chaired by federal government and provincial representative to coordinate national efforts.
<b>Planning</b>	Draft plan released August 2004 for public comment; no timeline for finalized plan.	Plan effective March 2005.	Plan effective February 2004.
<b>Vaccine Development</b>	NIH-funded research on pandemic vaccine; initial contracts for building potential vaccine stockpile.  Significant portion of U.S. vaccine supply manufactured abroad.	Research being conducted on potential vaccines.  Prototype “dossier” for regulatory approval of pandemic vaccine in development.  Discussions with manufacturers regarding optimizing capacity.  Most U.K. vaccine production occurs in the U.K.	Canadian government has contracted for reserve production capacity for a pandemic vaccine with a Canadian manufacturing facility. The vaccine will be produced and supplied within the country.
<b>Vaccine Planning</b>	Priority groups for vaccination identified in draft plan.	Priority groups for vaccination identified in plan.	Priority groups for vaccination identified in plan.
<b>Antiviral Planning</b>	Enough antiviral for less than 4.4 million people.  HHS planning to have stockpile of 20 million courses of antiviral.	Courses to cover 25 percent of the U.K. population have been ordered.  Updated plan as of Sept. 2005.	Courses ordered to cover five percent of the Canadian population.  Priority groups for antiviral treatment identified.
<b>Health Care System Surge Capacity Planning</b>	Planning guidance provided for health care system.	U.K. has integrated health care system through National Health Service and local Primary Care Trusts, under direct leadership of U.K. Department of Health.	Checklist of activities issued for surge capacity preparation.
<b>Communications Planning</b>	Outline of steps to prepare communications tools and mechanisms.	Specific professional (provider), public and media communications messages and activities identified by stage of pandemic.	Checklist of activities by stage of pandemic issued.


Sources: Trust for America’s Health, Financial Times, BMO Nesbitt Burns

The poultry industry would be another victim of pandemic, already hit hard in Asia as hundreds of millions of birds have been culled—in the event of a full-fledged crisis, consumption of poultry and eggs would plummet. That hurts companies such as YUM Brands, owner of KFC, a wildly popular fast-food business in Asia, not to mention businesses such as Perdue Farms, ConAgra, Tyson, Foster Farms, Maple Leaf Prime Poultry, and related agribusinesses and feed and grain businesses. This could also affect the farm equipment and machinery market.

Some sectors could benefit from a pandemic in terms of revenue growth and profitability, as well as changing patterns of consumer and busi-



Putting actual numbers on the loss of life, productivity, growth and development is nothing more than a guessing game.



ness behaviour. Telecommunications and tech businesses that cater to telecommuting could see enhanced demand for their products and services. Large and small businesses would likely boost their virtual private networks (VPNs) and increase use of videoconferencing to conduct business. Increased telecommuting would benefit Internet Protocol (IP) service providers, perhaps along with Internet telephony providers such as Skype Communications which has agreed to be bought by eBay, and traditional wireline and wireless carriers. Cable-TV companies offering home connections via broadband could also benefit as service providers. Equipment suppliers that may gain additional revenue from increased networking include Huawei Technologies and giant gearmaker Cisco Systems. The same is true for Alcatel, the industry's leader in broadband access equipment, which has a strong presence in Asia and has been in China for many years. Another equipment company with relationships throughout Asia, Lucent Technologies, may see business increase.

Pharmaceutical companies and other businesses at the forefront of pandemic control and response are listed in Table 7. These and all of the businesses and sectors mentioned above should be approached with caution and reliable investment research. Of course, predicting the precise impact of a potential avian-flu pandemic on the global stock markets is fraught with risk and uncertainty, but this discussion is illustrative of what could happen. Given that it is uncertain if a pandemic will occur, as well as when and where, investors must assess the fundamentals of these sectors and companies rather than just the pandemic effects.

**The full effect of pandemic on inflation (for goods and services in short supply) and deflation (as demand for some goods and services plunge), and commensurate movements in interest rates, gold prices, currencies and stock prices would depend on the length and severity of the pandemic.** To be sure, however, this would not be the end of the world. Most likely, 95%-to-99% of the population would survive. Depending on the hardest hit age range, though, demographics could shift sharply. If H5N1 results in a cytokine storm, the average age of the already aging population would increase and birth rates would be reduced for a generation. It would also create sustained labour shortages in the industrial world as the baby boomers retire and the group next in line would be smaller.

But all of this is uncertain—if, when, and where still remain unknowable and, in many ways, imponderable. Putting actual numbers on the loss of life, productivity, growth and development is nothing more than a guessing game. It ranges from “dodged that bullet”, to manageable, to bad, to disastrous, to catastrophic.

### Finally Out of the Closet

In an indication of just how serious the pandemic threat might be, President Bush publicly spoke of it during a press conference on October 4<sup>th</sup>.



He told the media that he was working to prepare the country for a possible deadly outbreak of avian flu. He said he had weighed whether to quarantine parts of the country (which experts say would not work) and also whether to employ the military for the difficult task of enforcing such a quarantine (which led very quickly to fears of marshal law).

However, quarantines would likely have limited, if any, purpose, as experts say that Influenza-A is highly communicable and infected people will be contagious before they have symptoms.

The President stressed that his administration was thinking about a potential outbreak and that they are working to put plans in place.

Just like Hurricane Katrina, an influenza pandemic would be a “predictable surprise”. Mr. Bush evidently wants to get out in front of this disaster. Unfortunately, it probably means that the White House and administration advisors believe the likelihood of pandemic is fairly meaningful.

Until Mr. Bush’s comments, bird flu did not receive extensive public attention in the United States or Canada. But the White House clearly intends to raise public awareness and promote readiness, as well as demonstrate preparedness. The President raised the possibility of aborted air travel and closed borders.

In response to Hurricanes Katrina and Rita, President Bush had already brought up the delicate question of giving the military a larger role in responding to domestic disasters, which rankled some governors who are commanders of their state’s National Guards.

During a recent address to the United Nations General Assembly, the President also proposed an “international partnership” to combat the disease in his effort to raise public awareness and ensure maximum efforts to quickly report any instances of the disease to the WHO.

The President is encouraging potential vaccine manufacturers to be poised to react urgently. The United States last month ordered \$100 million worth of a promising vaccine from Sanofi Pasteur.

**When Tommy Thompson, then Secretary of HHS, resigned last December, he was asked what health threat worried him most. He cited the avian flu.**


## **Planning and Communication**

Surveillance, planning and preparation are essential to rapid effective response and containment. Once the disease is easily transmissible among humans, the stockpiles of efficacious antivirals and vaccines will be crucial. But this requires more research, enlarged productive capacity and money, lots of it. The emerging economies can’t afford


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it—this is especially true and vital in Asia. The rich countries have been slow to respond (*Table 10*). Most avoid proactive initiative beyond their own borders.

But this is a global issue, where the spread of disease in birds or pigs in Cambodia or Indonesia could profoundly impact the major cities around the world. It is also a local issue, requiring the authority to close schools, distribute medications that are in short supply and provide surge capacity in hospitals and elsewhere. Businesses, as well, must plan for their own continuity of service and the safety of their workers. The coordination of these efforts locally, nationally, and globally in both the private and public sectors is unprecedented and extremely demanding.



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Governments and businesses in Asia and some of the OECD countries are devising and beginning to implement response plans. Progress is still far too slow to satisfy the WHO, but significant research and development projects are underway. Rapid response is key to containment. Critically important are the communications to individuals before and during a pandemic. Awareness is key to preparedness, vigilance, tolerance of inconvenience, and cautionary action. There is a positive value to fear.

Being human, most people would rather forget about this threat or deny it exists. This is especially so given the timing and probability of the threat is uncertain, and few have ever experienced it before. Hardly anyone alive today is a veteran of the 1918 pandemic. Many remember the milder pandemics and assume that all others would be as manageable.

Just as residents of New Orleans had lived through lesser hurricanes, and therefore ignored or denied the risk of a monster hurricane, many react similarly to the threat of a flu pandemic. Scientists cannot pinpoint the probability of a flu pandemic happening or its timing and mortality rate. Estimates of potential loss of life vary widely, and although we are closer to a pandemic now than any time since 1968, absolute uncertainty, coupled with the profound potential of danger, seems to cause inertia and paralysis. This makes it especially difficult for those public health officials and leaders who are charged with assuring public safety. It is difficult to get the attention of a weary and preoccupied public, particularly following the natural and terrorist disasters of the past four years.