

# The Age of Pandemics

By Larry Brilliant

Source: The Wall Street Journal, May 2, 2009

The threat of deadly new viruses is on the rise due to population growth, climate change and increased contact between humans and animals. What the world needs to do to prepare.

In 1967, the country's surgeon general, William Stewart, famously said, "The time has come to close the book on infectious diseases. We have basically wiped out infection in the United States." This premature victory declaration, perhaps based on early public health victories over 19th-century infectious diseases, has entered the lore of epidemiologists who know that, if anything, the time has come to open the book to a new and dangerous chapter on 21st-century communicable diseases.

Indeed, to the epidemiological community, the Influenza Pandemic of 2009 is one of the most widely anticipated diseases in history. Epidemiologists have been shouting from rooftops that a pandemic (or, a world-wide epidemic) of influenza is overdue, and that it is not a matter of "if" but "when." The current pathogen creating the threat is actually a mixture of viral genetic elements from all over the globe that have sorted, shifted, sorted, shifted, drifted and recombined to form this worrisome virus.

No one knows if the 2009 swine flu will behave like the 1918 Spanish flu that killed 50 million to 100 million world-wide, or like the 1957 Asian flu and 1968 Hong Kong flu that killed far fewer. This 2009 flu may weaken and lose its virulence, or strengthen and gain virulence — we just do not know.

Here's the good news: Compared with a few years ago, the world is somewhat better prepared to deal with pandemic influenza. There have been training meetings, table-top exercises, dry runs and preparedness drills at virtually every level of government and civil society. World Health Organization member states have agreed on a set of regulations that require all members to report the status of diseases of global significance within their borders. We have two effective antiviral drugs, at least for the time being. There have been some breakthroughs to reduce the time required to get effective vaccines into the field, and there is even a small chance that last year's seasonal vaccine will help protect lives from H1N1. In the U.S. at least, influenza surveillance has improved.

Here's the bad news: Today, we remain underprepared for any pandemic or major outbreak, whether it comes from newly emerging infectious diseases, bioterror attack or laboratory accident. We do not have the best general disease surveillance systems or "surge" capacity in our hospitals and health-care facilities. We do not have enough beds, respirators or seasoned public-health staff (many of whom, because of the financial meltdown, ironically got pink slips from their state and county health departments days or even hours before WHO declared we are at a Phase 5 alert, one step short of its highest global level). We not only need to retain the public-health people we have, we quickly need to train a new generation of 21st-century workers who know both the old diseases and have mastered the computer and other digital technologies and genomic advances to keep them ahead of the newest emerging threats.

And there is worse news: The 2009 swine flu will not be the last and may not be the worst pandemic that we will face in the coming years. Indeed, we might be entering an Age of Pandemics.

In our lifetimes, or our children's lifetimes, we will face a broad array of dangerous emerging 21st-century diseases, man-made or natural, brand-new or old, newly resistant to our current vaccines and antiviral drugs. You can bet on it.

One of the top scientists in the world did bet on it. A few years ago, Lord Martin Rees, who holds three of the most distinguished titles in the scientific world (Astronomer Royal; Master of Trinity College, Cambridge; and head of the 350-year-old Royal Society, London) offered a \$1,000 wager that bioterror or bioerror would unleash a catastrophic

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event claiming one million lives in the next two decades. Lord Rees said: "There's real concern about whether our civilization can be safeguarded without us sacrificing too much in terms of privacy, diversity and individualism."

Risks from bioterror are unpredictable, of course, but I think it's fair to say that world-wide access to infectious agents and basic biological know-how has grown more rapidly than even the exponential growth of computing power. According to Moore's law, the number of transistors on a chip doubles in 18 to 24 months — or, said another way, the "bang for the buck" in computers doubles in less than two years.

The technologies supporting bioterror have exploded even faster than computing power. The cost of genomic sequencing, as one example of a supporting technology, has gone down from the nearly \$1 billion it cost for the first full human DNA sequences to the low thousands for consumers in the coming years. Genetic engineering of viruses is much less complex and far less expensive than sequencing human DNA. Bioterror weapons are cheap and do not need huge labs or government support. They are the poor man's WMD.

Naturally occurring diseases with pandemic potential are much more ubiquitous and more certain to occur. Over the last decades, we have seen more than three dozen new infectious diseases appear, some of which could kill millions of people with one or two unlucky gene mutations or one or two unfavorable environmental changes. The risks of pandemics only increase as the human population grows, the world loses greenbelts, uninhabited land disappears and more humans hunt and eat wild animals.

Most pathogenic viruses that affect humans have originated in animals and jumped to humans; for that reason, we call them "zoonoses." They account for 60% of all infectious diseases, and 75% of all emerging infections.

Some of these diseases are well-known: bird flu, SARS, HIV/AIDS, West Nile, Monkey-pox and Ebola. Some are brand-new, like the arenavirus that was first found only a few months ago when it caused a handful of deaths in Africa and was genetically sequenced and identified by Ian Lipkin at Columbia University. He believes there may be as many as one million viruses that remain to be discovered.

Why are more new viruses with pandemic potential jumping from their traditional animal hosts to humans now? If I had to choose a single word answer it would be: "modernity." If I had two more words, I would add "human irresponsibility." And of course so much of this peril is made much worse by the Great Exacerbator — climate change and global warming.

Increasingly, humans push every conceivable barrier, and we now occupy more land that was historically the province of animals than ever before. More humans come in contact with animals and their viruses because there is less rain forest, jungle and wild lands separating them. Partly driven by poverty and lack of access to other food sources, Africans last year consumed nearly 700 million wild animals, about two billion kilograms of "bush meat." Scientists like Nathan Wolfe of the Global Viral Forecasting Initiative are taking matching blood specimens from the bush-meat hunters and the animals they kill, in an attempt to predict which virus will jump next.

If sub-Saharan Africa is the hotspot for blood-borne diseases, the Mekong area bounded by China, Myanmar, Laos, Thailand and Cambodia is the hotspot for respiratory diseases like SARS or pandemic bird flu. In these countries, the issue is not poverty but relative prosperity that has led to increased raising of cattle and chickens, and increased meat consumption. In China, the numbers of chickens raised for food has increased 1,000-fold over the past few decades. In parts of Southeast Asia, humans and chickens — and pigs — live so close together, exchanging viruses, it looks almost like a science experiment.

As climate change causes sea levels to rise and aquifers to dip dangerously into salty water, agricultural lands yield fewer

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calories of food per acre. That leads farmers to cut down jungle, creating deforested areas which once served as barriers to the zoonotic viruses that each day have more opportunities to jump from bats and rodents and monkeys and civet cats to humans. As temperatures rise and seashores change, animals head inland and to higher ground, moving into heavily populated human areas. Soon there will be human climate refugees on the move into land once thought inhabitable. All of these changes increase the potential for humans and animals to exchange new viruses.

I chair the National Biosurveillance Advisory Subcommittee, created by a presidential directive in 2008, comprising some of the smartest and most dedicated public health professionals I have ever met. We've been working to understand our national capability to respond to these emerging threats. Our first report will be released shortly. I can't prerelease it, but its contents will come as no surprise. We are concerned that the nation and the world do not have adequate "early warning" or bio-surveillance capabilities. We are recommending that governments need far better early warning systems for potential pandemics and other epidemic threats. We are also emphasizing that public health be restored to a position of respect and be given resources commensurate with its duty to protect us all from these and other threats to our health.

In the 1970s I had the great good fortune that my first job out of medical school was to be the junior-most member of the WHO's smallpox-eradication program in India. I was, in Silicon Valley terms, the third or fourth "hire" for the team that would create history and eradicate smallpox from India and South Asia. I stayed in India for nearly a decade and went back at the end of the program to turn off the lights and document this amazing success story, the only disease in history to be eradicated.

Smallpox killed 500 million people in the 20th century alone. The global smallpox program cost \$150 million total in 1965 dollars; each year, in addition to lives saved from ending this terrible disease, the U.S. reaps economic benefits exceeding \$2 billion from eliminating routine vaccination and the handful of very serious adverse consequences, including three or four vaccine-caused deaths, airport checkpoints (remember those little yellow cards?) and the loss of time away from work and school.

In analyzing the effect of loss of travel and trade in addition to the health-care costs of a possible bird-flu pandemic, Bank of Montreal chief economist Sherry Cooper estimated the global costs of a "mild" pandemic to be 2% of global GDP, which in 2005 dollars was \$1.1 trillion. There is a stark contrast between savings in lives and treasure from investing in public health and prevention, increasing training programs, funding the research that leads to better vaccines, more lab capacity, improved antivirals and early warning systems — and the human and economic costs of not acting in time. The business community should be at the front of the line, advocating for prevention and public health, one of the history's best investments by any criteria.

There is hope for some good news on that front: Another disease may soon join be checked off the list of human scourges. Because of the dedicated staff of WHO and Unicef, and the generosity of Rotary International, the Bill and Melinda Gates Foundation and others, polio, with only 1,500 cases in the world last year, may soon follow smallpox into the dustbin of history. The Carter Center has also brought Guinea worm close to its demise as well.

That is either one, two or three diseases that could be ticked off the list of humanity's worst afflictions, with great savings in lives, health and wealth. Reducing the number of terrible forms of suffering is what we all want, but I fear that if we don't take seriously the factors that could make the next decade the Age of Pandemics, we will start moving backward, adding lethal diseases to that list — instead of subtracting them.

Larry Brilliant, an epidemiologist, is chairman of the National Biosurveillance Advisory Subcommittee and chief philanthropy evangelist at Google. He will soon begin work as president of the Skoll Urgent Threats Fund.

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