A note from the author—
This month, I have decided to feature a great article from the Wall Street Journal regarding global health, more specifically, the most pressing global health threat today. I first provided some important background information about global health to help aid in a better understanding of the article below. Then, I provided additional information on pandemic influenza.

What is Global Health?
With the expansion of international aid, the term "global health" has become more common. But, what do we mean by "global health," as opposed to "public health" or "international health?" The table below (Kaplan JP et al. Lancet 2009, 373:1) attempts to draw out the primary distinctions between these three terms:

<table>
<thead>
<tr>
<th></th>
<th>Geography</th>
<th>Cooperation</th>
<th>Populations</th>
<th>Access</th>
<th>Disciplines</th>
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</thead>
<tbody>
<tr>
<td>Global Health</td>
<td>Health issues that transcend national boundaries</td>
<td>Global</td>
<td>Prevention and clinical care</td>
<td>Health equity among nations</td>
<td>Highly interdisciplinary and multidisciplinary</td>
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<td>International Health</td>
<td>Focus on issues outside of one's own country</td>
<td>Bi-national</td>
<td>Prevention and clinical care</td>
<td>Help other nations</td>
<td>Embraces a few disciplines</td>
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<td>Public Health</td>
<td>Focus on specific communities or countries</td>
<td>National</td>
<td>Prevention</td>
<td>Health equity within a nation or community</td>
<td>Multidisciplinary, particularly with health and social sciences</td>
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Why is Global Health important?
Global health plays an increasingly crucial role in both global security and the security of the U.S. population. As the world and its economies become increasingly globalized,
including extensive international travel and commerce, it is necessary to think about health in a global context. Rarely a week goes by without a headline about the emergence or re-emergence of an infectious disease or other health threat somewhere in the world. The 2007 World Health Report notes that, "since the 1970s, newly emerging diseases have been identified at the unprecedented rate of one or more per year." The Institute of Medicine's 2003 report Microbial Threats to Health stresses that the United States should enhance the global capacity for responding to infectious disease threats and should take a leadership role in promoting a comprehensive, global, real-time infectious disease surveillance system.

Rapid identification and control of emerging infectious diseases helps:
- Promote health abroad
- Prevent the international spread of disease
- Protect the health of the U.S. population

The large scope of potential global public health threats is recognized in the revised International Health Regulations (IHR [2005]) with its all-hazards approach to assessing serious public health threats. These regulations are designed to prevent the international spread of diseases, while minimizing interruption of world travel and trade. They encourage countries to work together to share information about known diseases and public health events of international concern.
How does the United States help improve global health?
Many U.S. Government (USG) agencies provide funding, human resources, and technical support to global health initiatives including:

- United Nations’ Millennium Development Goals
- WHO’s Global Polio Eradication Initiative
- President’s Emergency Plan for AIDS Relief (PEPFAR)
- Programs to address malaria, neglected tropical diseases, and tobacco use

The United States cooperates with other countries to address priority public health issues and prepare for and respond to emerging and pandemic diseases. In February 2010, the United States announced a new Global Health Initiative, which invests $63 billion over 6 years to help partner countries improve health outcomes, with a particular focus on improving the health of women, newborns, and children. In 2014, the Obama Administration launched the Global Health Security Agenda to accelerate progress toward a world safe and secure from infectious disease threats. As part of the Global Health Security Agenda, USG agencies are harnessing $5 billion to address Ebola preparedness overseas and at home, and are also working with other nations building capacity needed to prevent, detect, and respond to other infectious disease threats.

How does improved global health help the United States?
U.S. investments in improving health in developing countries provide significant public health benefits within the United States. Many global health issues can directly or indirectly impact the health of the United States. Outbreaks of infectious diseases, foodborne illnesses, or contaminated pharmaceuticals and other products, cannot only spread from country to country, but also impact trade and travel. The United States can also learn from the experiences of other countries. Standard health measures of life expectancy and chronic disease, including depression among adults, can be compared to other Organization for Economic and Co-operation and Development (OECD) member countries. For those countries with better health outcomes than the United States, health agencies within the United States can use these comparisons to identify ways to improve the Nation’s public health.
Emerging Issues in Global Health

Globally, the rate of deaths from noncommunicable causes, such as heart disease, stroke, and injuries, is growing. At the same time, the number of deaths from infectious diseases, such as malaria, tuberculosis, and vaccine-preventable diseases, is decreasing. Many developing countries must now deal with a “dual burden” of disease: they must continue to prevent and control infectious diseases, while also addressing the health threats from noncommunicable diseases and environmental health risks. As social and economic conditions in developing countries change and their health systems and surveillance improve, more focus will be needed to address noncommunicable diseases, mental health, substance abuse disorders, and, especially, injuries (both intentional and unintentional). Some countries are beginning to establish programs to address these issues. For example, Kenya has implemented programs for road traffic safety and violence prevention.

Expanding international trade introduces new health risks. A complex international distribution chain has resulted in potential international outbreaks due to foodborne infections, poor quality pharmaceuticals, and contaminated consumer goods. The world community is finding better ways to confront major health threats. WHO, through the 2005 IHR, proposes new guidance and promotes cooperation between developed and developing countries on emerging health issues of global importance.
The IHR require countries to develop appropriate surveillance and response capacities to address these health concerns. All of these issues will require enhanced U.S. collaboration with other countries to protect and promote better health for all.

Article from the Wall Street Journal

What Global Disease Threat Worries Public-Health Officials Most?
The CDC’s Thomas Frieden and Susan Desmond-Hellman of the Gates Foundation on preparing for a pandemic
Updated Nov. 21, 2016 11:01 p.m. ET

Infectious-disease outbreaks not only have the potential to destabilize societies, they pose a threat to international economies, as well.

What should public-health officials and businesses be doing to prepare? Physicians Thomas Frieden, the head of the Centers for Disease Control and Prevention, and Susan Desmond-Hellmann, chief executive of the Bill and Melinda Gates Foundation, sat down with Wall Street Journal Assistant Managing Editor Laura Landro to discuss this issue. Edited excerpts follow.

MS. LANDRO: I don’t know how many of you have seen the movie “Contagion.” How close are we to a scenario like that? Something that can’t be contained?

DR. FRIEDEN: Every year on average we identify one new pathogen. And every day on average, we at CDC start a new investigation that could detect a new pathogen. But frankly, pandemic influenza is what worries us most.
Bill Gates has said there are really only two things that could kill 10 million people around the world. Nuclear war and a biological event, either intentional or natural. It has happened before—in 1918 and 1919, 50 million to 100 million people were killed. Even the 1957 influenza pandemic, which most people haven’t heard of, cost 3% of the world’s gross domestic product. Even SARS, a relatively small outbreak, cost about $30 billion. We don’t know when the next one will come, where it will come from or what it will be. But we’re certain there will be a next one.

MS. LANDRO: How does the Gates Foundation see this in terms of the danger to the world? The idea that business will be disrupted, there will be all sorts of social unrest?

DR. DESMOND-HELLMANN: What we learned from Ebola is that there are a couple things that are underutilized and not ready. One is governance. Who makes the call when things happen? The second thing is having the right tools, which is why global health research-and-development is a big focus of our foundation.

And the last thing is, even though the world is worried about something really super scary like in “Contagion,” we all saw last summer how something like Zika, which wasn’t thought to be a big threat, actually is a particular threat for women who can get pregnant because it causes a catastrophic birth defect.

From a business standpoint, everyone in this room probably had young people who were going to travel on business who were concerned about their risk should they or their partner become pregnant. So understanding these new pathogens, understanding what we need to do from a governance standpoint, and having tools, starting with diagnostics so we can spot new pathogens, are a big focus.
MS. LANDRO: *What are the components of a global-health security agenda?*

DR. FRIEDEN: *We have to find things better, stop them faster and prevent them where possible. And for each of those three aspects of global health security, institutions need to be strengthened and tools need [to be developed].*

Everyone should have heard about something called the Joint External Evaluation. If you want to know if a country is ready to deal with an emergency from the health sector, currently there’s no way to really do that. So what we’ve done over the past few years is get a global consensus on an accountable, independent, objective and transparent public rating of all countries that agree to do it.

It holds the country accountable. It also holds the world accountable. If a poor country isn’t ready, we’re all at more risk. Let’s channel our assistance to close those gaps, because a blind spot anywhere is a vulnerability everywhere.
**Biggest Killer**

**MS. LANDRO:** Dr. Frieden, you did a public-health piece for the New England Journal of Medicine recently in which you said tobacco was still the largest cause of underlying disease in the world.

**DR. FRIEDEN:** Tobacco use continues to kill millions of people globally—in fact, more than infectious diseases combined. And it can be stopped. If you look at countries and communities that have taken tobacco prevention seriously, they’ve been able to drastically reduce tobacco use.

Mike Bloomberg and his foundation, along with the Gates Foundation, worked to come up with a very concrete set of policies to help countries drive down smoking rates. In New York City, we were able to help 400,000 people quit smoking in just a few years, saving over 100,000 lives and extending life expectancy by three years over just a few years.

**DR. DESMOND-HELLMANN:** It is a profoundly positive intervention. The other intervention we’ve invested in is nutrition. Globally, we see both overnutrition and undernutrition and poor nutrition. Very simple things like exclusive breast-feeding for six months, making sure pregnant women have access to good nutrition, understanding micronutrients and what’s needed—these kinds of global health interventions are incredibly cost-effective. That magic time of your first 1,000 days from conception isn’t just important for your stature, it’s important for your cognitive development. These are the kinds of things that emerging countries—and businesses working in those countries—are extremely interested in. Because that is your future workforce and your future consumers.

**DR. FRIEDEN:** And this is very relevant to health-care costs. A nonsmoker costs drastically less to care for than a smoker. An ex-smoker costs at least $1,000 less to care for each year than a smoker. In the U.S. today, there are 10 million fewer smokers
than there were in 2009. And if you think of the payoff, how much higher our health-care costs would be if that weren’t the case, it’s quite substantial.


**What is a Pandemic?**

A pandemic is the worldwide spread of a new disease.

An influenza pandemic occurs when a new influenza virus emerges and spreads around the world, and most people do not have immunity. Viruses that have caused past pandemics typically originated from animal influenza viruses.

Some aspects of influenza pandemics can appear similar to seasonal influenza while other characteristics may be quite different. For example, both seasonal and pandemic influenza can cause infections in all age groups, and most cases will result in self-limited illness in which the person recovers fully without treatment. However, typical seasonal influenza causes most of its deaths among the elderly while other severe cases occur most commonly in people with a variety of medical conditions.

By contrast, this H1N1 pandemic caused most of its severe or fatal disease in younger people, both those with chronic conditions as well as healthy persons, and caused many more cases of viral pneumonia than is normally seen with seasonal influenza.

For both seasonal and pandemic influenza, the total number of people who get severely ill can vary. However, the impact or severity tends to be higher in
pandemics in part because of the much larger number of people in the population who lack pre-existing immunity to the new virus. When a large portion of the population is infected, even if the proportion of those infected that go on to develop severe disease is small, the total number of severe cases can be quite large.

For both seasonal and pandemic influenza, the highest levels of activity would be expected to occur in the usual influenza season period for an area. (In the temperate climate zones, this is usually the winter months, for example). But as was seen with the current H1N1 pandemic, pandemics can have unusual epidemiological patterns and large outbreaks can occur in the summer months.

**What is Pandemic Influenza?**

Pandemic influenza is a global outbreak. An influenza pandemic occurs when a new flu virus emerges for which humans have little or no immunity, which allows the virus to spread easily from person to person worldwide.

Three influenza pandemics occurred during the 20th century: the 1918-19 “Spanish flu,” the 1957-58 “Asian flu,” and the 1968-69 pandemic or “Hong Kong flu.” In 2009, the World Health Organization (WHO) declared a global pandemic of H1N1 flu. This action was a reflection of the spread of the new H1N1 virus, not the severity of illness caused by the virus.

If a pandemic similar in virulence to the 1918 influenza strain were to occur, 2 million Americans could die and roughly 90 million would likely become ill. Worldwide, between 51 million and 81 million people could die, according to a study in *Lancet*.

An influenza pandemic is a global outbreak of a new influenza A virus that is very different from current and recently circulating human seasonal influenza A viruses. Pandemics happen when new (novel) influenza A viruses emerge which are able to infect people easily and spread from person to person in an efficient and sustained way.
Where do pandemic influenza viruses come from?
Different animals—including birds and pigs—are hosts to influenza A viruses that do not normally infect people. Influenza A viruses are constantly changing, making it possible on very rare occasions for non-human influenza viruses to change in such a way that they can infect people easily and spread efficiently from person to person.

How do influenza A viruses change to cause a pandemic?
Influenza A viruses are divided into subtypes based on two proteins on the surface of the virus: the hemagglutinin (H) and the neuraminidase (N). There are 18 different hemagglutinin subtypes and 11 different neuraminidase subtypes (H1 through H18 and N1 through N11). Theoretically, any combination of the 18 hemagglutinins and 11
neuraminidase proteins are possible, but not all have been found in animals and even fewer have been found to infect humans.

Influenza viruses can change in two different ways, one of which is called “antigenic shift” and can result in the emergence of a new influenza virus. Antigenic shift represents an abrupt, major change in an influenza A virus. This can result from direct infection of humans with a non-human influenza A virus, such as a virus circulating among birds or pigs. Antigenic shift also can happen when a non-human influenza A virus (for example an avian influenza virus) exchanges genetic information with other influenza A viruses in a process called genetic reassortment, and the resultant new virus is able to infect people. For example, an exchange of genes between a human influenza A virus and an avian influenza A virus can create a new influenza A virus with a hemagglutinin protein or both a hemagglutinin protein and a neuraminidase protein from an avian influenza A virus. If this new virus causes illness in infected people and can spread easily from person to person, an influenza pandemic can occur.

**What happens when a pandemic influenza virus emerges?**

When a pandemic influenza virus emerges, the virus can spread quickly because most people will not be immune and a vaccine might not be widely available to offer immediate protection. During the 2009 H1N1 pandemic, for example, a new H1N1 virus was first identified in April 2009. By June 2009, that novel H1N1 virus had spread
worldwide and the World Health Organization declared a pandemic. Spread of a pandemic influenza virus may occur in multiple disease "waves" that are separated by several months. As a pandemic influenza virus spreads, large numbers of people may need medical care worldwide. Schools, childcare centers, workplaces, and other places for mass gatherings may experience more absenteeism. Public health and healthcare systems can become overloaded, with elevated rates of hospitalizations and deaths. Other critical infrastructure, such as law enforcement, emergency medical services, and transportation industry may also be affected.

Will seasonal flu vaccines protect against pandemic flu?
It is unlikely that seasonal flu vaccines would protect against a pandemic influenza virus. Seasonal flu vaccines that are used annually protect against currently circulating human influenza A and B viruses. They are not designed to protect against new influenza A viruses. A pandemic influenza virus would be very different from circulating seasonal influenza A viruses and thus seasonal vaccines would not be expected to offer protection.

Are there vaccines to protect against pandemic flu?
The federal government has created a stockpile of some vaccines against select influenza A viruses with pandemic potential that could be used in the event of a pandemic, including vaccines against certain avian influenza A (e.g. H5N1 and H7N9) viruses. If a similar virus were to begin a pandemic, some vaccine would already be available.

The Department of Health and Human Services (HHS) is the lead agency for public health preparedness and medical response to an influenza pandemic. Within HHS, the Biomedical Advanced Research and Development Authority (BARDA) Influenza
Division is charged with the advanced development and procurement of medical and non-pharmaceutical countermeasures for pandemic influenza preparedness and response.

How long would it take to develop a new pandemic vaccine?
If a new pandemic influenza virus (not included in the pre-pandemic vaccine stockpile) were to emerge, it is likely that a vaccine would have to be developed against that virus in order for sufficient supply of vaccine to become available for everyone who wishes to be vaccinated. How long it would take to produce a pandemic flu vaccine would depend on many factors, including how long it would take to create a candidate vaccine virus (CVV) and what vaccine manufacturing process would be used.”
For seasonal influenza vaccine, it usually takes at least six months to produce large quantities of flu vaccine. During the 2009 H1N1 pandemic, it took about the same amount of time. CDC began developing a CVV to make monovalent (one component) H1N1pdm09 vaccine in mid-April. The first doses of vaccine were administered in early October and large quantities of vaccine became available in late November. Efforts are underway now to shorten the time it takes to produce influenza vaccines but because of the current amount of time needed to make flu vaccine, early supplies of pandemic vaccine might not be enough to meet demand, especially if most people need two doses of vaccine for protective immunity.

**How many doses of pandemic vaccine would each person need?**

People with no immunity against a new influenza virus may need two doses to be fully protected against that virus. The first dose primes the immune system and the second dose creates the protective response. During the 2009 H1N1 influenza pandemic, CDC recommended that two doses of the vaccine be given to children 6 months through 9 years of age in order to increase the immune response.

**What treatments are available for pandemic flu?**

During a flu pandemic, antiviral drugs would be an important tool to treat and prevent the spread of influenza illness. Antiviral drugs are medicines (pills, liquid or an inhaled powder) that fight against the influenza viruses infecting the respiratory tract. Antiviral drugs are recommended to treat seasonal influenza in people who are very sick or who are at high risk of serious flu complications. These same drugs may be useful for treating pandemic influenza, depending upon whether the pandemic influenza virus is susceptible or resistant to available antiviral drugs. Antiviral drugs are prescription drugs...
Are there novel influenza A viruses that are of extra concern in terms of their pandemic threat?
A novel influenza (flu) virus is an influenza A virus that has caused human infection and which is different from current human seasonal influenza A viruses. Any novel influenza A virus, such as those of avian or swine origin, has the potential to cause an influenza pandemic.

Some novel flu A viruses are believed to pose a greater pandemic threat and are more concerning to public health officials than others because they have already caused serious human illness and death and also have been able to spread in a limited manner from person to person. Novel influenza A viruses are of extra concern because of the potential impact they could have on public health if they gained the ability to spread from person-to-person easily and thus trigger an influenza pandemic. Examples of novel influenza A viruses of extra concern because of their potential to cause a severe pandemic include avian influenza A (H5N1) and avian influenza A (H7N9) viruses.
These two different avian influenza A viruses have caused sporadic human infections, some limited person to person spread and resulted in critical illness and death in people.

Influenza viruses that normally circulate in pigs also have infected people; these viruses include influenza A (H1N1v), (H1N2v) and (H3N2v). When influenza viruses that normally circulate in swine are found in people, they are called “variant” viruses; the “v” after the virus name indicates a variant virus. Limited, unsustained spread from person to person also has been detected with these viruses, but in general, these variant viruses have been associated with less severe illness and fewer deaths than avian influenza viruses. In general, human infections with H5N1, H7N9, H1N1v, H1N2v and H3N2v viruses have occurred rarely, but if these viruses were to change in such a way that they were able to infect humans easily and spread from person to person in a sustained manner, a flu pandemic could result.

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