

WASHINGTON ROUNDTABLE
ON SCIENCE & PUBLIC POLICY

**Pandemics and
National Security**

by

Harvey Rubin

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*Pandemics and National Security**

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May 30, 2006

Jeff Kueter: Good afternoon everyone and welcome to this discussion of Pandemics and National Security. I am Jeff Kueter, the President of the George Marshall Institute, and it is my pleasure to welcome you to this latest installment of the Washington Roundtable on Science and Public Policy. The Washington Roundtable is designed to bring scientists together with the public policy community here in Washington, D.C. to discuss issues of importance, whether they deal with national security, the environment or other topics of interest.

Today's talk by Dr. Harvey Rubin certainly fits those criteria. The question of how the United States will cope with the next influenza epidemic is one that has perplexed policymakers for many years, but it has become a particularly acute interest with the rise of the avian flu in Asia. The Spanish flu pandemic of 1918, for example, killed 50 to 100 million people worldwide and the influenza deaths far exceeded the total combat mortality during World War I, a fact that probably isn't appreciated by the general public. We asked Dr. Rubin to join us today to explore the potential for pandemic disruptions in the United States and to discuss strategies for anticipating and coping with the health and economic impacts resulting from epidemic diseases.

Dr. Rubin is a Professor of Medicine, Microbiology and Computer Science at the University of Pennsylvania. He is also the Director of the Institute for Strategic Threat Analysis and Response there, the ISTAR group, which I hope he talks about in his presentation. This is a multidisciplinary shop at Penn that brings together a unique and creative set of energies to deal with this new security environment that we find ourselves confronting today. Please join me in welcoming Dr. Rubin.

Dr. Harvey Rubin: Thank you, Jeff, for inviting me and thank you all for coming to lunch. I will try to fulfill what Jeff set out for me to do, to talk about the national strategic issues of pandemics and then, I hope, offer a unique solution. Comments from you about whether we are on the right track on that or not would be greatly appreciated.

I want to start with the definition of national security. There isn't a single good definition of national security, but I am going to take a quotation from Richard Ullman, Professor of International Relations at Princeton University. He wrote a paper in 1983

* The views expressed by the author are solely those of the author and may not represent those of any institution with which he is affiliated.

called *Redefining Security* and I think his definition fits nicely with the notion of national security that we are considering here today. National security threats are “actions that can degrade the quality of life for the inhabitants of a state or significantly narrow the range of policy options available to the government or private citizens of a state.” The key phrase is “actions that can degrade the quality of life.” Notice that there is no mention of nuclear weapons or borders or boundaries. This is a much more global issue and, in fact, this broadened definition of national security has become quite commonplace. *The Global Infectious Disease Threat and Its Implications for the United States* is a report published in 2000 by the National Intelligence Council, and a recently unclassified CIA document entitled *The Darker Bioweapons Future* includes the following statement: “the effects of engineered biological agents could be worse than any disease known....” There has been a lot of interest in synthetic biology and how that might play out on the national security stage. So we will talk about pandemics in the broadest sense at first, and then focus on influenza.

Here are some realities about pandemic. We are living in a world that is now rife with pandemics; it is not just avian flu, which is, by the way, at the current time, a pandemic among birds, not among humans. Approximately 40 million people worldwide are infected with HIV, which killed 3.9 million in 2005. This certainly meets any definition of pandemic that you care to offer. In Russia Vladimir Putin is offering financial incentives for Russian women to have more children. The reason is that their death rate now exceeds their birth rate. Mostly this is secondary to cardiovascular diseases and trauma, but HIV and tuberculosis are clearly on the increase. In the G-8 conference this summer in St. Petersburg, Putin there will be a special session on preventing and controlling infectious diseases.

There are some pandemics that you probably don't hear about. There is a cholera pandemic in the world that started in 1961 in Indonesia, swept through South America and is now killing a couple hundred thousand people a year. Malaria, still kills about two million people a year and infects about 300 million more. Malaria is clearly a pandemic and it presents many issues relating to national security, not only for our military but also for our allies overseas.

Another pandemic that you may not have heard about is hepatitis C. Three percent of the world's population or 170 million people are chronically infected with the hepatitis C virus. About four million new people will be infected every year, eighty percent of whom will progress to chronic infection, cirrhosis and liver cancer. This is a very serious issue and not just in Southeast Asia; it is an issue in this country and certainly an issue among any first responders, since it is a blood-borne disease.

And then there is the disease that I work on in my laboratory, tuberculosis. One third of the world is infected with tuberculosis and TB kills more people than any other bacterial infection in the world, hands down.

One of the most daunting challenges of the 21st century is the detection and control of pandemics and infectious diseases that might lead to pandemics. The problem clearly calls for solutions that integrate new ideas in science and technology with social and political realities. You can't solve this problem just by political will, you can't solve it just by scientific will, and you can't solve it just by technological will. There has to be a very creative constellation of solutions because there is a dense interplay between international security and tracking, preventing, detecting and treating naturally occurring diseases as well as intentionally released diseases on the global dimension. As I mentioned, there is the potential use of existing infectious diseases as bioweapons and also the nefarious use of any new engineered infections. Engineering new infectious agents has become a reality with the advent of new molecular biological techniques. This is a completely new field of biology where you can now synthesize very large segments of DNA and you can effectively synthesize infectious agents. You don't have to isolate the organism, because all the DNA bases are out there on the World Wide Web.

We need superb vigilance in laboratory biosafety. This goes to biosafety and effectively biosecurity as well. To put all of this together, we have to maintain and enhance the positive roles of modern molecular biology in the developing world. It is not enough to put ironclad constraints on the use and release of recombinant DNA and recombinant organisms without thinking about the effect it might have on the developing world. Finally but not least, we have to stimulate the creation and dissemination of new knowledge in an open environment. So imagine trying to put all these things together in one package: it is a daunting issue. In fact it was clearly raised in the *2006 National Security Strategy* that just came out about a month ago: "Public health challenges like pandemics (HIV/AIDS) avian influenza) ... recognize no borders. The risks to social order are so great that traditional public health approaches may be inadequate, *necessitating new strategies and response* (italics added)." We will talk about some of those new strategies and responses.

But now we can focus on avian flu. Some of the information that follows is from the people at the Department of Homeland Security (DHS), who are obviously taking this very seriously. You can pick up any one of your favorite magazines, a scientific magazine, a business magazine, you name it, and everybody is worried about the avian flu. So we can talk about the realities of the avian flu for a short while.

DHS Critical Infrastructure Priorities

This next slide is from a recent DHS presentation and they gave me permission to use the graphic. The goal for Homeland Security (and for complete disclosure, I do some consulting for Homeland Security) is to ensure the continuity of operations for essential services and to maintain critical infrastructure operations as "near normal" as possible for social and economic well being.

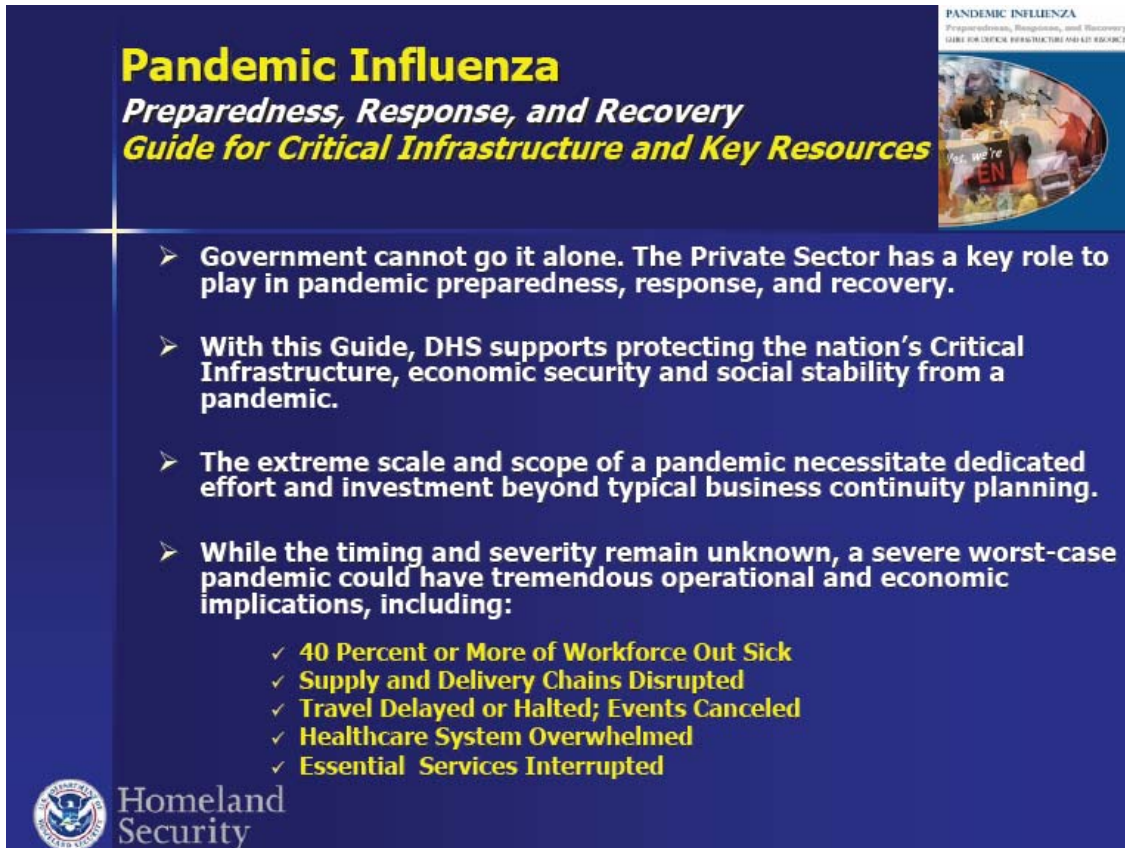


Figure 1

Homeland Security has very rationally recognized that there is a role for Homeland Security and a role for Health and Human Services. Interagency cooperation and public-private partnerships are absolutely critical to the most efficient protection, preparedness, response and recovery in the event of a pandemic.

And when it comes to the preparedness, response and recovery part, the government recognizes that it can’t go it alone; the private sector has to step up to the plate. 80 percent of the infrastructure, as you know, is in the private sector’s hands anyway. DHS has put out a guide, Health and Human Services has put out a guide, the city of Philadelphia has put out a guide, the city of San Francisco has put out a guide – just about everybody has a guide. The real goal now is to integrate all those guides and make a working plan for the private sector and the local, state and federal governments as well.

We had the opportunity to help write part of the analysis by the Congressional Budget Office (CBO) entitled *A Potential Influenza Pandemic: Possible Macroeconomic Effects and Policy Issues*. This came out in December 2005 and I was privileged to be asked to provide input to the report. Other outside contributors to the CBO team were Marc Lipsitch, Christina Mills, William Nordhaus and Peter Palese. I will summarize what the Congressional Budget Office found

The CBO had two sets of model parameters: one was for a severe pandemic, similar to the 1918 flu that could infect 90 million people in the United States with two million deaths and the other for a milder pandemic. You may not remember this, but we actually had influenza pandemics in 1957 and 1968. They just didn't kill that many people; people got sick, but it wasn't nearly the 1918 flu story. When the mild pandemic parameters are used, seventy-five million people are infected with 100,000 deaths. Both scenarios presume that an adequate viral vaccine is not ready at the beginning of the pandemic and that probably will be true because you need to have the strain of virus that is causing the pandemic to make the appropriate vaccine. If there is ever a human pandemic, the H5N1 virus that is circulating out there in birds is probably not the strain that you want to make the vaccine against. So the parameters are based on the fact that we can't intercept the pandemic with a vaccine.

The CBO report looked at both the demand side and the supply side in the short run and then some long-term supply side effects. On the supply side, the immediate impact will be a run on medical services. The surge capacity of your local hospital is going to be totally overwhelmed, especially in a severe pandemic. Hospitals, clinics and doctors' offices would be swamped and effective biosurveillance would be difficult. In other words, we are going to lose track of patients at some point if there is a severe pandemic. Not only will the facilities be overrun in terms of people showing up, but the staff manning those facilities will be in short supply. There will be a real supply-side issue in terms of workers in the health care system. The care for non-acute issues, such as elective surgery, will stop immediately.

As the pandemic progresses, international travel may be curtailed and people will start avoiding so-called "flu hot-spots." There may be some governmental restrictions on travel. It would be unlikely, according to the CBO, that complete cessation of domestic and international air travel would be instituted. As a point of reference, in the SARS outbreak in April 2003, airline passenger arrivals in Hong Kong decreased by nearly two-thirds compared to just a month before. So it is clear that both domestic and international travel will dwindle.

How will individuals respond? It is believed that there will be some self-quarantine or self-isolation. Keep in mind that there is a difference between quarantine and isolation: isolation takes place when you have the disease and you are told to stay away from other people whereas quarantine is when you are told to stay away from other individuals if you have potentially been exposed to the disease but before you are symptomatic. Certainly non-essential activities that require social contact will be sharply cut, leading to significant declines in retail trade. People would start avoiding public places such as shopping malls, places of worship, and public transportation systems. Here is one of the important issues: schools might close. If schools are closed, children stay home and that affects the workforce immediately.

There would be a general slowdown in economic activity that would reduce the gross domestic product. Business confidence would decline and the supply of labor would be restricted because of illness, mortality and absenteeism. Supply chains would be strained as transportation systems were shut down or disrupted, and arrears and default rates on consumer and business debt would probably rise. It seems quite likely that the stock market will be impacted, falling initially and then rebounding later, much as it was in Hong Kong after the SARS episode. But to what degree would these effects occur?

Under a severe pandemic scenario, the CBO calculated the supply-side impact using a rough estimate of the loss of employee workdays with an estimate of average productivity per worker. On an average, thirty percent of the workers in each sector would become ill and of those, 2.5 percent would die, except for the farm sector where it was presumed to be a little bit less intense, with only one-tenth of the workers affected and the survivors missing only one week of work, and the mortality about the same. Those who survived would miss three weeks of work, either because they were sick, because they feared the risk of infection at work, or because they needed to care for family or friends.

Table A-1.

Assumptions Underlying Estimates of the Supply-Side Impact of an Avian Flu Pandemic

Economic Sector	Gross Attack Rate (Percent)		Weeks Out of Work		Case Fatality Rate (Percent)	
	Severe	Mild	Severe	Mild	Severe	Mild
Nonfarm Business	30	25	3	0.75	2.5	1.14
Farm	10	5	1	0.25	2.5	1.14
Household	30	25	3	0.75	2.5	1.14
Nonprofit Institutions	30	25	3	0.75	2.5	1.14
Government	30	25	3	0.75	2.5	1.14

Source: Congressional Budget Office.

Note: The gross attack rate is the percentage of the population that is infected with a disease. The case fatality rate is the percentage of infected persons who eventually die from the disease or complications.

Table A-1 shows some of the numbers. Under these assumptions the GDP would be more than three percent lower in the year that the pandemic occurs.

We can also talk about the demand side. The Congressional Budget Office examined the gross domestic product by industry and assumed slightly different declines for different industries. The amount of the demand side effect depends on the kind of social contacts that people have in that particular industry; for example, restaurants, lodging and recreation would all suffer severely. Other industries, including retail trade,

were assumed to suffer a smaller decline in demand. The only industry that actually has an increase on the demand side is the health care industry; that would have an increase on the demand side.

Table A-2.

Assumed Declines in Demand, by Industry, in the Event of an Avian Flu Pandemic

(Percent)

	Severe Scenario	Mild Scenario
Private Industries		
Agriculture	10	3
Mining	10	3
Utilities	0	0
Construction	10	3
Manufacturing	10	3
Wholesale trade	10	3
Retail trade	10	3
Transportation and warehousing		
Air	67	17
Rail	67	17
Transit	67	17
Information (Published, broadcast)	0	0
Finance	0	0
Professional and business services	0	0
Education/health care		
Education	0	0
Health care	-15	-4
Arts/entertainment/accommodation/food		
Arts and recreation	80	20
Accommodation	80	20
Food service	80	20
Other services except government	5	1
Government		
Federal	0	0
State and local	0	0

Source: Congressional Budget Office.

Note: The severe scenario describes a pandemic that is similar to the 1918-1919 Spanish flu outbreak. It incorporates the assumption that a particularly virulent strain of influenza infects roughly 90 million people in the United States and kills more than 2 million of them. The mild scenario describes a pandemic that resembles the outbreaks of 1957 to 1958 and 1968 to 1969. It incorporates the assumption that 75 million people become infected and about 100,000 of them die from the illness or complications.

Table A-2 shows the declines in demand by industry in a severe scenario. Agriculture declines by 10 percent, construction, 10 percent, transportation, around 70 percent, finance, zero percent – this is all because we believe that people could work from home in some of these industries – and the government actually zero

from home in some of these industries – and the government actually zero percent. So when you combine all those industries, it is about 2 percent on the gross domestic product on the demand side. When you add the demand side to the supply side, there is about a 5 percent decrease in gross domestic product in the year of the pandemic, and depending on what number you look at, that is somewhere around the hundreds of billions of dollars range. That’s enough to get people’s attention.

There are certainly long-term effects, and the long-term effects of the pandemic really depend on the effect on the labor force once the pandemic is over. If the labor force affected is mostly the young workers in their prime that would have a completely different effect than if the pandemic chiefly attacks the very young and the very old. Seasonal flu, mainly affects the young and the old, but it turns out that H5N1 and certainly the 1918 flu affect the relatively healthy middle-aged population rather than the old and the young group. This is believed to be related to a “cytokine storm” which takes place when people have a robust and strong immune reaction to the infection.

A number of different long-term scenarios are played out in this Congressional Budget Office report. If you look at a total labor force of about 150 million people and the growth of the labor force averaging 1.6 percent (as during the 1948-2005 period) with a mortality of 2.5 percent, you would lose more than one million people or .75 percent from the entire labor population. This is equivalent to stopping the economy by about a half a year.

Current Policies and Options for the Future

Preparedness for a flu pandemic lies within the nation’s overall capacity to address public health emergencies. Options for addressing potential pandemics in the near and long future fall into four broad categories:

- detecting and controlling viruses at their source
- developing and using vaccines to prevent diseases
- developing and using treatments with antiviral drugs and other medications
- building the capacity of the health care system (facilities, equipment, and people) to deliver care

So how does one do that? What are the policy issues? The CBO – and I agree – believes that preparedness for a flu pandemic really lies in the nation’s overall capacity to address public health issues. We have to be able to detect and take control of the viruses at their source, we have to be able to develop and use vaccines to prevent the disease; we have to be able to develop and use treatments, anti-viral drugs; and we have to build a capacity in general of the whole health care system to deliver care. It sounds very simple, but it is very, very hard. It takes political will and it takes money. There is a tremendous barrier to developing an effective vaccine, not just scientifically,

but in policy as well. So let me tell you how vaccines are developed, briefly. Vaccine production follows an annual cycle; for seasonal flu, we go through this every single year. We don't have a single flu vaccine, because the flu virus mutates ever so slightly every year. This is annual cycle:

1) The CDC and the World Health Organization run through surveillance programs all over the world to try to find out which flu is circulating and then start looking at which one could be responsible for that seasonal influenza.

2) Once the laboratories and the CDC and the World Health Organization decide on the strain that is the best candidate, they develop the seed strain and they provide this to the manufacturers who have been licensed by the FDA to manufacture vaccines.

3) Then the vaccine makers report back to the World Health Organization and the FDA the suitability for vaccine production. But what if the virus is so virulent that it kills all the egg cells?

4) Sometime between February and March, the FDA announces the selected strains to be included in the vaccine for the upcoming flu season and the manufacturers go to work. Remember, this is in March; the flu season will start in the following fall and they had better start making enough vaccine to provide for either seasonal flu or a potential pandemic, hundreds of millions of doses. It is a moving target every year.

Things go wrong; experience in the spring of 2000 and spring of 2004 show us that much can, and does, disrupt the annual cycle. The lengthy egg-based manufacturing process means that production cannot be scaled up quickly if flu vaccine demand is higher than predicted. Further, the demand is hard to predict and can depend on many things, such as the timing and media coverage of the current flu season and the severity of previous flu seasons. There is a very interesting study that shows that if influenza is written about in newspapers, the demand for the vaccine goes up. If newspapers report that the seasonal flu is coming, the demand goes up even before the flu season starts, so it is very emotional; people will respond to what they read in the newspapers. Then there is the so-called "free rider" effect. People may choose not to get vaccinated if they believe that everyone with whom they come in contact will be vaccinated. We never know how much that "free rider" effect is going to play into the demand side. So predicting demand is very, very difficult.

Furthermore, we can't store the vaccine from year to year. The manufacturing process is prone to contamination; we saw that several years ago. The government accounts for less than 20 percent of the market for flu vaccine. If there are shortages, then the CDC recommends that the vaccine be given only to priority groups. If I am going to go take care of patients, I am in a priority group. People over sixty and children fall into a priority group. There is a study showing that if children are vaccinated,

we get a much better protective effect of the population. But then some priority groups might say, “I am not insured, I can’t afford it and I am not going to pay for it.”

How do we solve this problem of pandemics and emerging infectious diseases, flu, malaria, tuberculosis, Ebola, cholera, you name it? Why isn’t there a solution to this problem? We have been dealing with this problem of infections literally from the first recorded history. There hasn’t yet been a solution and I think the *2006 National Security Strategy* is exactly right: new strategies and new responses have to be generated. So we are going to propose a new strategy. I think we need an international treaty or Compact and I am going to call it “The International Compact on Infectious Diseases.” I would propose four major components in this Compact.

First of all, we have to establish and maintain international standards for surveillance and reporting of infectious diseases using advanced information technology to ensure timeliness, interoperability and security. This recommendation would significantly expand the International Health Regulations (IHRs) revised in 2005 that were unanimously adopted by the World Health Assembly and which were supposed to go into effect in June 2007. But there is late-breaking news – the International Health Regulations system is to be established immediately because of the recently reported outbreak of H5N1 in families in Indonesia.

The second point is we have to establish and maintain international standards for best laboratory practices. This will minimize accidents and miscalculations and maximize biosafety. It will minimize nefarious uses of the technology while maximizing biosecurity. This is absolutely critical and is a very important component of any international compact on infectious diseases.

Point three is we have to build and maintain facilities for the production of vaccines and therapeutics expressly for emerging and reemerging infections. Let’s build international facilities whose sole purpose is to make enough vaccines and drugs for the world, hundreds and hundreds of millions of doses, that will be overseen by an international community of scholars and businessmen and multinational officials. These international facilities would be awarded to the bidder that puts together the most convincing offer, and the winner will be supported and supplied by with additional funding provided by member states. The organizational structure would remove many of the economic and legal constraints on the production and distribution of drugs and vaccines for specific infections of concern.

And finally point four, we need to establish and maintain a network of international research center for emerging and re-emerging infections, awarded again to the countries with the most convincing offer, with additional funding by member states. The research centers would foster a culture of research responsibility internationally and would serve as the nucleus for safe applications of modern molecular biology globally.

So there are two notions here; one is the notion of a culture of responsibility. I have the privilege to serve on the National Science Advisory Board for Biosecurity (NSABB) where we are generating ideas for codes of conduct for the appropriate use of modern molecular biology, a “Hippocratic Oath” for biological scientists if you will.

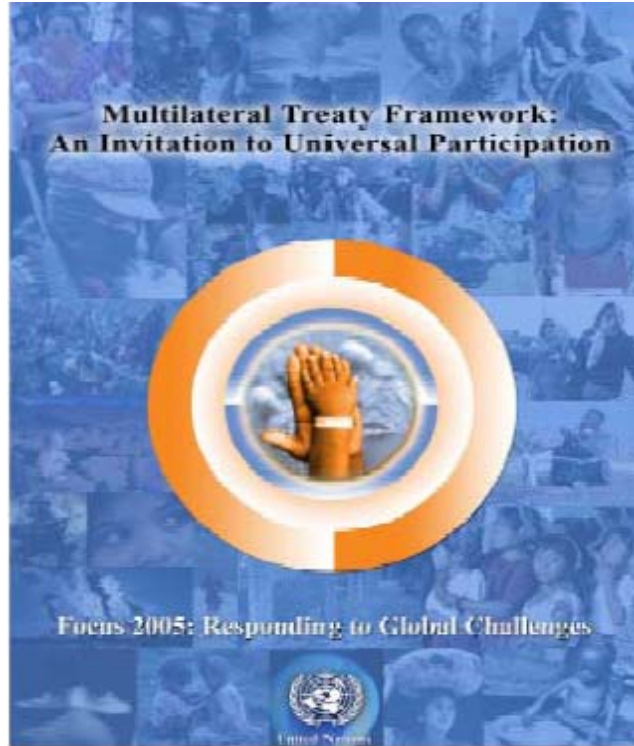


Figure 2

You might say, “There must already be an international treaty on this. You just told us that a third of the world is infected with tuberculosis; three percent have hepatitis C; millions of people are dying of malaria. Billions of people could die of pandemic flu. There has got to be an international treaty.” So maybe you are right. We scoured around for international treaties, and this is just from the United Nations Multilateral Treaty Framework – An Invitation to Universal Participation (Figure 2).

Table A-3.

Human Rights

1. International Covenant on Economic, Social and Cultural Rights (New York, 1966)
2. International Covenant on Civil and Political Rights (New York, 1966)
3. Optional Protocol to the International Covenant on Civil and Political Rights (New York, 1966)
4. Convention on the Prevention and Punishment of the Crime of Genocide (New York, 1948)
5. Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (New York, 1984)
6. Optional Protocol to the Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (New York, 2002)
7. International Convention on the Protection of the Rights of All Migrant Workers and Members of their Families (New York, 1990)

8. Optional Protocol to the Convention on the Rights of the Child on the involvement of children in armed conflict (New York, 2000)
9. Optional Protocol to the Convention on the Rights of the Child on the sale of children, child prostitution and child pornography (New York, 2000)

Refugees

10. Convention Relating to the Status of Refugees (Geneva, 1951)
11. Protocol Relating to the Status of Refugees (New York, 1967)

Penal Matters

12. Rome Statute of the International Criminal Court (Rome, 1998)
13. Agreement on the Privileges and Immunities of the International Criminal Court (New York, 2002)
14. Convention on the Safety of United Nations and Associated Personnel (New York, 1994)

Terrorism

15. International Convention for the Suppression of Terrorist Bombings (New York, 1997)
16. International Convention for the Suppression of the Financing of Terrorism (New York, 1999)
17. International Convention for the Suppression of Acts of Nuclear Terrorism (New York, 2005)

Organized Crime and Corruption

18. United Nations Convention against Transnational Organized Crime (New York, 2000)
19. Protocol to Prevent, Suppress and Punish Trafficking in Persons, Especially Women and Children, supplementing the United Nations Convention against Transnational Organized Crime (New York, 2000)
20. Protocol against the Smuggling of Migrants by Land, Sea and Air, supplementing the United Nations Convention against Transnational Organized Crime (New York, 2000)
21. Protocol against the Illicit Manufacturing of and Trafficking in Firearms, Their Parts and Components and Ammunition, supplementing the United Nations Convention against Transnational Organized Crime (New York, 2001)
22. United Nations Convention against Corruption (New York, 2003)

Environment

23. Kyoto Protocol to the United Nations Framework Convention on Climate Change (Kyoto, 1997)
24. Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (Rotterdam, 1998)
25. Stockholm Convention on Persistent Organic Pollutants (Stockholm, 2001)
26. Cartagena Protocol on Biosafety to the Convention on Biological Diversity (Montreal, 2000)

Law of the Sea

27. United Nations Convention on the Law of the Sea (Montego Bay, 1982) and Agreement relating to the implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994)
28. Comprehensive Nuclear-Test-Ban Treaty (New York, 1996)
29. Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (Oslo, 1997)

Law of Treaties

30. Vienna Convention on the Law of Treaties (Vienna, 1969)

Health

31. WHO Framework Convention on Tobacco Control (Geneva, 21 May 2003)

There are treaties on human rights, refugees, penal matters, terrorism, organized crime and corruption, the environment, the law of the sea, disarmament and on the law of treaties; there is a Treaty of Treaties (Table A-3). But there is only one public health treaty, the very recent 2003 Framework Convention on Tobacco Control – which the US has signed but not ratified yet. Not one on infectious diseases. That is hard to believe.

Now that is not to say that nothing is going on. There are many very, very important things going on and I will just mention a few. There is a review coming up of the Biological Weapons Convention and this is some of the review's language:

"... shall, in accordance with its constitutional processes, take any necessary measures to prohibit and prevent the development, production, stockpiling, acquisition or retention of the agents, toxins, weapons, equipment and means of delivery specified in Article I of the Convention, within the territory of such State, under its jurisdiction or under its control anywhere." (Sixth Review Conference, Nov. 20–Dec 8, 2006)

The second thing is International Health Regulations:

"States Parties to the IHR(2005) are required to develop, strengthen and maintain core surveillance and response capacities to detect, assess, notify and report public health events to WHO and respond to public health risks and public health emergencies. WHO, in turn, is to collaborate with States Parties to evaluate their public health capacities, facilitate technical cooperation, logistical support and the mobilization of financial resources for building capacity in surveillance and response."

The National Biosurveillance Integration System (NBIS), part of the Department of Homeland Security is making a serious attempt to do this reporting and surveillance.

On the level of biosecurity, biosafety and biodevelopment, there is the U.S. National Science Advisory Board for Biosecurity and the Kampala Compact, the so-called global bargain for biosecurity and bioscience (2005) which, again, is very recent. UNSCR 1540 defines general principles and effective measures to prevent the proliferation of nuclear, chemical and biological weapons as well as their means of delivery, "export control." Again, this is a biosecurity treaty dealing basically with export issues. For vaccine production: there is project Bioshield, a billion dollars that is put aside for the development of vaccines and new agents.

What are the steps to developing our Compact for Infectious Diseases? We need to pull together all the collaborating members: government agencies, international agencies, NGOs, the academic sector, the private sector and of course any individuals who might be interested in working on this thing. We have to establish and international, interdisciplinary working groups for each of these four recommendations:

- State of the art IT for interoperable, timely and secure surveillance and reporting
- Laboratory best practices
- Production facilities
- Research center

In each of these areas, there are experts who really know how to do this, but they need to be brought together in a single, focused group that will hop across boundaries. And of course, we need to come up with a draft. I think this is something that could be accomplished within six months if we have the right group working on it. It is a hugely ambitious project and I thank Jeff and the Marshall Institute for this opportunity to talk to you about it – this is the kind of thing that we have to do as a nation. We have to take the lead in this. And if we don't take the lead in this, it is not going to happen.

So that is the end of my prepared remarks. I welcome questions and challenges. Please let me know what you think. Thank you very much.

Questions and answers.

Question: What is the chance of developing an “all-purpose” vaccine that recognizes certain features of the virus and protects at least halfway against infection?

Rubin: That's a great question. There are sequences that are known to be highly conserved, such as the M2 protein, and there are parts of other highly conserved proteins in the virus. People are working on what is called a “universal vaccine.” I think realistically it may be still a few years away. There is no question that we could get a universal vaccine if we just had, again, the political will and the financial will.

Question: What about technology that gets away from chicken eggs?

Rubin: Absolutely. This will be a synthetic vaccine that would get away from chicken eggs and allow it to grow more rapidly. This is something that is within our technology; this is not something that is undoable.

Question: What percentage of the population has to be vaccinated to prevent the spread of influenza?

Rubin: That is a really good question. We don't know. There are a number of models that depend on issues such as transportation networks and human networks. Not every community is going to be the same. The community in Philadelphia and New York would be different from a farm community in Iowa, so there is no single answer to that. But the mathematical models are just being developed to look at that question.

Question: In your “Current Policies and Options for the Future,” you said one of the options was detecting and controlling viruses at their sources. Missing from our current options are the zoonoses (animal diseases), looking for the zoonoses, find out where they are, how they can potentially affect us. I find that also missing from your framework.

Rubin: When I said surveillance, I don't just mean human surveillance. That's an excellent point. Where do these infectious diseases reside when they are not causing pandemics or even outbreaks? The animal population is absolutely a key issue.

Question: Your points one and two are very well taken. As for your proposals three and four, I am afraid that once you turn it over to the United Nations, you may get a result you don't like. Suppose they want to put the facility in Somalia or Zimbabwe. How would you feel about that?

Rubin: I think the premise of the comment that I would turn it over to the United Nations isn't necessarily true. However to answer your question about having production or research facilities in Somalia or Rwanda; it is not clear to me that that is necessarily off the table.

Question: You have said there is no market in the U.S. for vaccines. Your proposal is taking any incentive for the market out on an international level. But there are several U.S. companies that have been searching for AIDS vaccines for years and years. So I am concerned about the economic reality, if you take all incentive for private industry out of this.

Rubin: Standing here in front of the picture of Mrs. Reagan in the Republican Capitol Hill Club, how could I dare suggest taking out the market incentive? I didn't mean to imply that and I am sorry if that's how it came out. There is a market for vaccines and in particular for HIV vaccines and lots of other vaccines and it should not be off the table. I think we will have to be very creative in this international facility on how we build in some market incentive. We are developing the business case for this Compact which we will publish in the near future.

Question: You keep focusing on vaccines, in some sense trying to prevent the spread of diseases, which is very difficult. Look at something like HIV where treatment is getting a lot better; people are surviving HIV a lot more. And given that a lot of people may get sick with the flu, if we could treat them effectively, I am sure that

Rubin: Can I ask you a personal question? How old are you?

Question: Thirty-six.

Rubin: Did you ever have the measles? Mumps? Chicken pox? You would be amazed at what vaccines have done in my lifetime, not in yours. You are already past the time when we realized that childhood diseases can be controlled through vaccination: measles, mumps, chicken pox, meningitis. It is amazing what vaccines have done. Clearly our HIV drugs now have turned HIV into a chronic disease rather than a rapidly fatal one that I remember at the beginning of the HIV pandemic. We need small molecule drugs, for sure, no question about it.

Question: I am not arguing that point; I was just saying that you made one point in your presentation about the need to have basic hospital preparedness and surge capacity, so I am just talking about treatment when vaccines aren't available. It seems that our current plan really puts all the eggs in the vaccine basket. Congress funded \$350 billion; if you just gave that to hospitals, it would be about \$70,000 per hospital, really not much.

Rubin: I take care of people with infectious diseases and I was on service about a month ago. We had a young man come in who had influenza B, not even influenza A. He came into our medical intensive care unit and we shipped him down to the surgical intensive care unit because we wanted to give him something called extracorporeal membrane oxygenation (ECMO). This one gentleman consumed I can't tell you how many hours and dollars worth of hospital facilities. And that was one case. So you are right; we desperately need surge capacity, both in the pre-hospital stage when people come in, the worried well, as well as during a disaster. We would never be able to take care of people with avian influenza the way we took care of this guy with influenza B. It would be impossible.

Question: It seems that our system is set up to drive surge capacity out. We want the hospital to operate with every bed filled all the time or it is considered waste. What can we do to build surge capacity?

Rubin: You are right. I am privileged to be co-chair of the City of Philadelphia's review plan and one of our committees is to look at how do you find the flexible surge capacity, at least in an urban situation. There are definite plans. In Philadelphia, we have the Delaware Valley Healthcare Council where hospitals actually talk to one another and have been planning for this very thing. There are a lot of very smart people working on surge capacity, because everybody, Homeland Security, Health and Human Services, everybody recognizes that that is a major, serious problem. It is not just only flu; it is any disaster that happens in a local environment. We need to know how to do this.

Jeff Kueter: Thank you, Dr. Rubin.

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