Center for Biosecurity

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Hearing on the Threat of Bioterrorism and the Spread of Infectious Diseases

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Mr. Chairman, Distinguished Members of the Committee:

Thank you for the opportunity to appear before you today to discuss the realities of the threat posed by biological weapons, our capabilities to secure an early warning of an attack, our potential for response and, finally, measures that might be taken nationally and internationally to lessen the probability of an attack.

It is generally agreed that the 21st century brings with it a new era in the biological sciences with advances in molecular biology and biotechnology that promise longer, healthier lives and the effective control, perhaps elimination of a host of acute and chronic diseases. The prospects are bright but there is a dark side—the possibility that infectious agents might be developed and produced as offensive weapons; that new or emergent infections, like HIV/AIDS, might overwhelm available preventive and therapeutic measures or that laboratory scientists, perhaps inadvertently, might create and release a new and lethal agent. These concerns are as relevant to Europe, to Africa, to Asia as they are to America. In today's world of rapid travel and large migrant populations, epidemic disease, wherever it occurs and of whatever origin, threatens the security of all nations. We are, today, ill-prepared to deal with these challenges.

Throughout the 45 years of my professional career, my principal concern has been the control of infectious diseases both in the United States and abroad. My experience has included 20 years with the Centers for Disease Control, including assignments as Chief of Surveillance and Chief of the Epidemic Intelligence Serve; 11 years with WHO as Director of the Smallpox Eradication Program; and 16 years as Chairman of the Pan-American Health Organization's Technical Advisory Group which counseled PAHO experts on the design and development of the polio eradication program. Enormous strides in epidemic disease control have been made over the past quarter century and more is promised. Four years ago, however, it became apparent to me that these accomplishments and more were jeopardized by the growing threat of biological weapons as well as by new and emergent infections. This led to our founding three years ago of the Hopkins Center for Civilian Biodefense Studies. Our energies are directed ultimately toward preventing biological disasters that potentially could become global in scope, such as epidemic smallpox could readily be and which AIDS is rapidly becoming.

The Threat from Biological Weapons

Nothing in the realm of natural catastrophes or man-made disasters rivals the complex problems of response that would follow a bioweapons attack against a civilian population. The consequence of such an attack would be an epidemic and, in this country, we have had little experience in coping with epidemics. In fact, no city has had to deal with a truly serious epidemic accompanied by large numbers of cases and deaths since the 1918 influenza epidemic, more than two generations ago.

Senators Hart and Rudman, chairs of the United States Commission on National Security in the Twenty-first Century, singled out bioweapons as perhaps the greatest threat that the U.S. might face in the next century. Admiral Stansfield Turner pointed out that, besides nuclear weapons, the only other weapons with the capacity to take the nation past the "point of non-recovery" are the biological ones.

The Dark Winter scenario dramatizes the catastrophic potential of smallpox as a weapon. It is, of course, not the only possible organism that might be used. In 1993, the Office of Technology Assessment estimated that 100 kilograms of anthrax released upwind of a large American city - the model being Washington, DC - could cause between 130,000 and 3 million deaths, depending on the weather and other variables. This degree of carnage is in the same range as that forecast for a hydrogen bomb. Although there is legitimate concern as well about the possible use of chemical weapons, they are far less effective pound for pound and extremely difficult to deploy over large areas. Ten grams of anthrax can produce as many casualties as a ton of a chemical nerve agent.

The insidious manner by which a biological attack would unfold is itself alarming. The fact of an attack using an explosive or chemical weapon would be recognized immediately and resources summoned quickly to deal with the consequences and to begin to remediate the situation. A biological agent would, in all probability, be released clandestinely as an aerosol spray, odorless and invisible, which would drift slowly throughout a building or across a city. Not until days to weeks later would people begin to fall ill; new cases would continue to occur over a period of one to several weeks. Some of those exposed, in all likelihood, would be hundreds of miles away when they develop symptoms—in other cities, in other countries. Thus, the consequence of the attack would extend well beyond the immediate area of release.

Biological weapons have not been used since WW II but this is not because of concern that they might not work. The U.S. program was abandoned in 1969 not for technical but for political reasons. As Gradon Carter has pointed out, the utility of bioweapons had been demonstrated by all possible means short of war. By the 1960s, the U.S. knew how to grow and process many microorganisms in a form usable for mass casualty biological weapons. Trials that modeled dispersion of simulant agents as aerosols were conducted in many cities and scores of tests with live biological agents using animals as targets were performed at the Johnson Atoll from 1963 to 1969. There is now no doubt and there was then no doubt, of the capacity of these weapons to cause widespread casualties. A World Health Organization (WHO) analysis, now 30 years old, supported the belief that biological weapons are strategic, population-destroying weapons. Since then, the technology needed to create and disperse these weapons has advanced significantly.

The year 1972 was a significant one in the history of bioweapons. That year, the Biological Weapons Convention was agreed upon, calling for all signatory countries to cease research on biological weapons and to destroy existing stocks. The Soviet Union and Iraq were both parties to the Convention. The Soviet Union, however, began immediately to greatly expand and modernize its existing biological weapons program and to develop genetically engineered pathogens and other organisms that could serve as strategic weapons. A new organization was created called Biopreparat. Ostensibly a civilian operation, it recruited some of the most capable of Russian biologists. At its peak, it employed over 30,000 persons. There was also a military program of at least 15,000 people and an agricultural program making crop pathogens that employed 10,000 people. The overall complement of staff was equivalent in size to that of its nuclear program. Biopreparat's agenda included the manipulation of viruses and micro-organisms to render them capable of surviving delivery on missile warheads; the development of particularly virulent strains of organisms that are resistant to vaccines and antibiotics; the creation of peptides that could alter moods and heart biorhythms; and the manufacture of tons of anthrax, as well as smallpox virus and antibiotic-resistant strains of plague.

Although the Soviet program was of prodigious size and sophistication, the infrastructure that is actually necessary to make a biological weapon is, in fact, comparatively simple and inexpensive, especially compared to that required to make a nuclear weapon. To make one kilogram of plutonium requires 100 tons of uranium ore; a substantial quantity of specialized equipment; and an enormous facility readily visible from the air. A biological weapon can be produced with the same equipment one uses to produce an ordinary vaccine; it can be readily housed in a building the size of a two-car garage;

nothing on the exterior would identify its use. Moreover, the room and the equipment could be sufficiently cleansed within 24 hours so that no one, on inspection, would be able to determine whether it had been used to make vaccines or biological weapons.

The intelligence agencies have estimated that at least a dozen states possess or are actively seeking an offensive biological weapons capacity. Most of these states are those named by the State Department as sponsors of terrorism. Expertise for operating these facilities is readily available from now poorly funded laboratories of the Russian biological weapons complex. For these countries, biological weapons have a special appeal. They are inexpensive, they occupy little volume, they are readily transportable from place to place and they are capable of being disseminated covertly so that attribution may be impossible.

It is also important to appreciate that the technologies needed to build biological weapons are available in the open literature and on the Internet. This is not knowledge that is limited to a few hundred scientists isolated in a laboratory in the western desert. There are many scientists who have this knowledge and are capable of putting together a biological weapon. Some have argued that preparing a biological weapon is complicated and have been mistakenly reassured by the failure of Aum Shinrikyo's efforts to aerosolize anthrax throughout Tokyo. In fact, although the sect did include some with experience in microbiology, those who actually worked on the project were not well-trained microbiologists. Nonetheless, they came very close to succeeding.

Implications of Advances in Biotechnology

A key reason for being concerned about biological weapons is the remarkable progress now being made in biotechnology and genomics research. Bioscience is moving at a much faster pace than did physics in the 1950s, partly because of computers and the more ready accessibility of knowledge, and partly because of the money that is being invested by large corporations in the biological sciences. In 1998, the U.S. biotechnology industry employed 150,000 people and had a market capitalization of $97 billion with product sales of $13.4 billion. Last April, the Harvard Business Review predicted that the ability to manipulate the genetic codes of living things will dwarf the business transformation propelled by the Internet. Indeed, it is generally acknowledged that the life sciences will be the most important technology of this century.

But, as the understanding of molecular biology increases and as we develop the ability to manipulate cellular processes, we are also creating the tools and knowledge for building more powerful and more diverse weapons. When we discover why a particular virus or bacteria is especially virulent or why it has become resistant to antibiotics, we create an opening for building a new drug or a new vaccine. At the same time, we facilitate the creation of tools needed to build more virulent weapons.

The Effects of a Biological Weapons Attack

The consequences of a biological weapon attack would be an epidemic, most likely following an unannounced attack. In all probability, we would know that something had happened only when people started appearing in the emergency rooms and doctors' offices with strange maladies. Depending on the biological agent and its incubation period, it could be days or weeks after release of the organism before people first became ill. Identification of the cause could be problematical. American physicians today are not trained to diagnose illnesses due to the pathogens thought to be the ones most likely to be used as bioweapons. Few physicians have ever seen cases of anthrax or smallpox or pneumonic plague.

It is difficult to imagine how the public might respond in today's world to a fast-moving lethal epidemic. In recent decades, there have been few such epidemics in industrialized cities. One of the more recent occurred in India in 1994. Plague broke out in the diamond-polishing district of Surat. It was reported by the media as a deadly, mysterious fever, possibly plague. Within hours, panic reigned. People began streaming from the city. Many in the medical community were among the first to leave. Eventually half a million fled, leaving the city a ghost town. It is estimated that India lost some two billion dollars in lost trade, embargoes, and production as a consequence of this outbreak. How many actually died of plague is still not clear but the total was not more than 50.

Epidemics have the potential to spread internationally as we have observed with the HIV/AIDS epidemic. The disease is contagious but it is not easily transmitted from one person to another. Nevertheless, it spread across the globe and is changing the population demographics in some African countries to a degree comparable to that caused by the Black Death of the 1300s, which killed a third of the European population.

Addressing the Biological Weapons Threat

The status of national preparations to deal with bioterrorism is difficult to summarize. The diverse initiatives taken by different agencies of government are not well-coordinated, even within the agencies themselves and many have been designed with little comprehension of what is implied for the civilian population when a biological weapon is used. Beginning in 1995, when the first Presidential Decision Directive was issued, preparations to respond to terrorism focussed almost exclusively on training and equipping "first response" teams to counter the effects of a nuclear or conventional explosive device or a chemical attack. Training programs in 120 cities were targeted to include police, fire and emergency rescue personnel in a "lights and sirens" type of response and special full-time units of the National Guard were constituted whose function is not clear but certainly have little to do with bioterrorism.

Not for several years was there a beginning comprehension that the consequences of use of a biological weapon would be an epidemic and that those first detecting its presence and those primarily responsible for controlling the disease would be public health personnel and physicians. Accordingly, in most cities, public health, medical and hospital personnel were not included either in planning or training. Finally, in FY99, significant funds began to be made available to the Department of Health and Human Services, primarily the Centers for Disease Control (CDC), whose traditional responsibility, with state and local health departments, has been the surveillance and control of infectious diseases. Some two years ago an Office dealing with Bioterrorism was established at CDC; modest funds began to be made available to the states for development of programs both for response and surveillance; stockpiles of antibiotics were procured; smallpox vaccine was ordered; and a national network of laboratories was established that is capable of diagnosing the organisms of principal concern. Unfortunately, little has yet been done to provide for the training of public health and medical professionals and hospitals remain woefully unprepared.

Current Vulnerabilities

We are today ill-prepared to deal with an epidemic of any sort. There is, as yet, no comprehensive national plan nor an agreed strategy for dealing with the problem of biological weapons. There is little interagency coordination at the federal level and nationally funded programs appear to be as often competitive as cooperative. Particularly serious are the vulnerabilities in our medical health care system and our public health infrastructure.

Hospitals

When Americans are seriously ill, they expect to be cared for in hospitals. If the hospitals became overwhelmed and were paralyzed by chaos, it would have serious implications for public morale and for the potential for containing an epidemic, let alone treating those who were already sick. The likelihood of public anxiety rising to civil disorder would rise substantially.

Hospitals are under serious pressure today. Of the 5000 hospitals in the U.S., 30% are losing money; over the last decade, 1000 have closed because of financial reasons. They face a host of regulatory issues including those dealing with health insurance portability, safer needles, medical and medication error reduction, limits on medical device reuse, ergonomic standards for employees, requirements for patient restraints and seclusion, and many more. At the same time, the numbers of the uninsured are increasing and the population is aging and in need of more medical services. The hospitals have struggled to become ever more efficient but, in their quest to eliminate inefficiencies, they have basically wiped out their surge capacity. Even minor increases in patient demand, such as that of the 1999 brief and mild flu season strained most hospitals.

This lack of elasticity is also seen in the pharmaceutical field as companies have focussed on just-in-time production and delivery. The result is that reserve supplies are few and temporary problems in production are regularly manifested in country-wide spot shortages of such as antibiotics and other critical drugs.

There is an increasing shortage of emergency rooms what with the loss of a thousand hospitals in the past decade and a desire on the part of hospitals to close ERs, if possible, because of their drain on resources. The amount of time that Baltimore's hospitals have been on "diversion" of ambulances because of over crowding has doubled every year for the past three years. Ventilators to aid respiration are in short supply. Baltimore, home to two major medical centers and medical schools, could not handle an acute situation that produced as many as 50 casualties requiring ventilators. A handful of highly contagious patients would cause havoc, there being in the Baltimore-Washington area, no more than 100 beds in negative pressure rooms that could handle highly contagious patients.

However, the most intractable problem for hospitals is likely to be staffing. As we have been told, only half of all nurses work in hospitals and the average age of a nurse in America is 53. More are now retiring than are being recruited to the field. Hospital administrators report that, even if they had more open beds, they doubt that they would have staff to care for the patients.

The Public Health System

The public health system is in even worse shape. Public health is a long-neglected stepchild to modern medicine. It is a sector that has been understaffed and under funded for several decades.

It is believed that, in most states, there is ample authority for public health officials to respond aggressively and effectively to protect the public health. However, many of the relevant laws were written between the time of the Civil War and the 1930s. A more critical problem is knowing what to do and how to do it. With sharp reductions in the number of cases of the major infectious diseases, processes and knowledge about when and how to use quarantine and isolation procedures, how to organize large-scale vaccination programs and how to communicate effectively with a concerned public have been lost.

A major problem is that there really is no public health "system" for dealing with infectious diseases in this country, but, rather, a fragmented pattern of activities. The federal system, which for the most part is in the federal Centers for Disease Control and Prevention is itself comprised of a number of Centers and activities that are themselves independent fiefdoms. State and local health departments reflect a similar pattern and there is a major disconnect between the public health and medicine. Doctors rarely communicate with local public health officials and often, when they try to do so, they find no one with needed competence. In New York City, a city with one of the best public health departments in the country, the report of two cases of encephalitis to the health department led to the unraveling of the West Nile epidemic. This was a laudable and important response. However, it was later discovered that at the time the first two cases were reported, there were 20 other patients already hospitalized with encephalitis, a clearly recognizable and legally reportable disease.

In most areas, public health is not treated as an emergency service as are police, fire and utilities. The concept of a 24 hour per day, 7 day per week "hot line" is little known. Yet, public health officials will be the ones who will be obliged to organize a response to an epidemic, to communicate with the public and to orchestrate a city and state's response resources

Increasing Preparedness

What can be done to diminish our vulnerability to bioweapons.

First, we have got to better prepare our public health and medical care services to respond to outbreaks and epidemics and to mass casualty situations whatever their origin. They are at the core of any response and yet, only recently have they

even begun to be involved in the necessary planning and training activities. Significant resources will be required for this purpose, perhaps one billion dollars per year or more Although a large sum, this would represent less than 10% of government expenditures for counter-terrorist activities. This investment, however, would serve a far broader utility than bioterroism alone.

Second, we need to mount a robust research and development program for bio-defense. It would seem logical for this to be a joint DOD-DHHS effort. We need to engage the genius of the universities, the pharmaceutical firms and the biotechnology companies, few of whom are now involved. The bioscience community does not have a history of engagement with defense projects and, by and large, they have not been eager to work with government in this field. For this to happen will require inventive structures and incentives. Three areas of research and development would be especially important: (1) More definitive, rapid, automated means of diagnosing major pathogens, basically building microchips that could identify specific pathogens by deciphering the molecular genomes. (2) Mechanisms for being able to rapidly develop and produce new antibiotics and antiviral drugs for new and emergent diseases. (3) Mechanisms for enhancing the immune response generally, so as to get beyond the one organism-one drug approach.

Third, public health has to identify those critical capacities that are needed to fight epidemics of contagious disease. These include surveillance and reporting systems, particularly the ability to track an epidemic once it occurs. But what we must do, even in normal times, is to track outbreaks once they are identified. Communications systems that connect health care providers and the public health system are critical.

Fourth, in cooperation with WHO and other countries, we need to strengthen greatly our intelligence gathering capability. A focus on international surveillance and on scientist-to-scientist communication will be necessary if we are to have an early warning about the possible development and production of biological weapons by rogue nations or groups and, likewise, to have the earliest possible warning and longest possible lead time to develop drugs and vaccines to deal with new or emergent organisms.

Fifth, a concerted effort by the medical, public health and, broadly, the biological sciences community to condemn participation in research or development of biological weapons is clearly indicated. Such a response would provide no certain guarantees that misbehavior would not occur but then, there is as yet no other satisfactory deterrent to deal with these troublesome weapons.

Summary

Biological weapons are a significant threat, and because of the rapidly growing power of biotechnology and biological knowledge, the urgency and the diversity of this threat will only increase. The nature of biological weapons and the epidemics that they could create is such that preventing them will be far more challenging than preventing the catastrophic use of chemical or nuclear weapons. It is going to be hard to detect biological weapons production facilities, it is going to be hard to track the weapons before they are used, and it is going to be very hard to interdict them before they are released.

If we do nothing more than strengthen the public health and medical care systems, we can significantly decrease the suffering and death that would follow a bioweapons attack. By being able to mitigate the consequences of such an attack, we can make ourselves less attractive targets to would-be perpetrators. As important, we could improve the everyday functioning of the health care and the public health system for the general good.