Building A Global Bio-Defense Shield

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Yanzhong Huang, Ph.D.
Whitehead School of Diplomacy
Seton Hall University

The Emerging and Reemerging Infectious Disease

In hindsight, the 1970s marked the peak of a golden era of public health. With the widespread use of antibiotics, vaccines, pesticides, and other powerful antimicrobials, many formerly formidable infectious diseases became easier to prevent or cure. This progress in modern medicine, in conjunction with a vigorous worldwide public health campaign against infectious diseases and striking improvements in water treatment and food preparation techniques, led to a significant decline of communicable or infectious diseases and dramatic improvement in the quality of human life. In 1977, the last case of smallpox was reported in Somalia. For the first time, a major disease has been completely vanquished. This nurtured a strong belief in the human ability to leave the age of infectious disease permanently behind. This rosy view of human's ability to combat microbes was reflected in the WHO "Health for All, 2000" (HFA-2000) accord. Signed by member states in 1978, it envisioned that most of the world's population would live long lives ended only by the chronics by the millennium.

By the turn of the century, however, this expectation of final human triumph failed to materialize (Garrett 1995). Infectious diseases remain the leading cause of death in the world. Of 57 million deaths in 2002, about 18.2 million (32.1%) were due to infectious diseases (World Health Report, 2004). Over the past twenty-five years, thirty new diseases have been identified, among them the deadly HIV/AIDS and Ebola. Since its beginning, the HIV/AIDS epidemic has led to the infection of nearly 70 million people worldwide. The fact that around 25 million have already died from AIDS-related illnesses makes HIV/AIDS the most devastating pandemic since the bubonic plague in the 14th century ("Black Death"), which led to approximately 25 million deaths in Europe alone. Meanwhile, despite the invention and introduction of new and powerful antimicrobials, old infectious diseases die hard. Polio, already eliminated from the western hemisphere, was targeted by the WHO and its partners for next global eradication by the year 2000. The job has proved to be much tougher than expected: the virus is still hanging on in the Indian subcontinent, west and central Africa, and the horn of Africa, despite the significant drop of polio cases (Roberts 2004). To complicate human battle against infectious disease, the new century saw the reemergence of certain "eradicated" diseases in new, and more potent forms, such as malaria and tuberculosis. TB, for example, has made a comeback in the past 10 years. Researchers have calculated that 8-10 million people catch the disease every year, with three million dying from it. The WHO predicts that by 2020 nearly one billion people will be newly infected with TB, of them 70m will die. Worse, Drug-resistant tuberculosis has now been found in virtually every country surveyed. Recent data show that more than 10 percent of people with tuberculosis are infected with strains of *Mycobacterium tuberculosis* resistant to at least one of the four first-line anti-TB drugs.

Factors in the Emergence of Infectious Diseases

Multiple factors contribute to emergence of new or re-emergence of previously known diseases (Morse 1995) including:

Ecological/environmental changes (including those due to economic development and land use). Ecological factors and economic development usually precipitate emergence of infectious disease by placing people in contact with a natural reservoir or host for an infection hitherto unfamiliar but usually already present. Building dams and diversion of water by canalization and irrigation, for example, have been implicated in increased rates of schistosomiasis.

Changes in human demographics and behavior. Population growth and migration (due to poverty, social inequality, war or civil conflict) and other human behaviors (such as sexual and drug use) have exposed people to new environmental sources of infectious agents, insects and animals, which contributed to the rise and spread of infections (e.g., HIV and other STDs).

International travel/commerce. The rapid worldwide movement of people and goods makes it increasingly difficult to isolate disease geographically. As shown in the SARS outbreak, illness now race abroad by jet, arriving in people who clear customs before they even feel feverish (most U.S. cities are within a 36-hour commercial flight of any part of the globe, or less than the incubation period of many infectious diseases).

Technology and industry. While changes in food processing/packaging and globalization of food supplies have increased the danger of food contamination and facilitated the spread of infectious diseases (e.g., BCE), medical technology (e.g., organ or tissue transportation; blood transfusion; widespread use of antibiotics and other drugs) increased the chances of exposing to vector-borne infectious diseases (e.g., transfusion-associated hepatitis and HIV) and caused opportunistic infections in immunosuppressed patients.

Microbial adaptation and change. Microbes are not biologically stationary targets; they can infect new hosts, adapt by developing drug resistant strains (e.g., W-strain of TB), or mutate rapidly to yield new variants (e.g., influenza).

Lack of political will/state capacity. Lack of political will and/or state capacity (shortage of resources, poor governance) can lead to curtailment, deterioration, even breakdown in public health programs (e.g., sanitation, surveillance, and vector control measures). It led to the rapid spread of HIV/AIDS in China and the resurgence of diphtheria in the former Soviet Union.

Intent on harm (See below “Bioterrorism”)

Global Impact of Infectious Disease

The spread of infectious disease is challenging social-political stability, economic development and national security. In his case study of HIV/AIDS in South Africa, Price-Smith suggests that infectious diseases strains the functional capacity of the state by contributing to increasing lawlessness, a stagnant or contracting economy, diminishing government efficacy and responsiveness to societal demands, declining revenue in the form of taxes (Price-Smith 2003). A study by Ted Gurr et al. finds strong correlation between public health status and political instability (i.e., revolutionary wars, ethnic conflicts, genocides, and disruptive regime transitions). In fact, the 2003 SARS epidemic was not simply a public health problem; it caused the most severe socio-political crisis for the Chinese leadership since the 1989 Tiananmen crackdown (Huang 2003).

The impact is not confined within territorial borders. Disease, whether naturally occurring or deliberately caused, does not respect territorial borders. As we have seen in the recent SARS epidemic, there is no longer a sharp distinction between domestic and international health. The end of Cold War only highlights the importance of health as a threat to international security. A 2000 report of the U.S. National Intelligence Council (NIC) concludes that while the persistent infectious disease burden may aggravate or provoke social fragmentation, economic decay, and political polarization in the hardest hit countries in the developing world, new and reemerging infectious diseases are likely to have a disruptive impact on global economic, social, and political dynamics.

Bioterrorism: What Makes It Increasingly A Global Threat?[1]

Bioterrorism involves the deliberate use of infectious disease. Unlike conventional biological warfare, it is conducted mainly by non-state actors and the attack often occurs in a civilian setting. Unlike conventional terrorism, the impact of a bioterrorist assault is not immediate but can be delayed for days, even weeks due to the incubation interval between exposure and the appearance of symptoms. It might prove difficult to ever identify the perpetrators or the site of release – or even to determine whether the disease outbreak was intentional or naturally occurring.

Thus far, there has never been a major bioterrorist attack. Yet there are good arguments pointing to an increasing danger of a major bioterrorist attack. First, the motivations of terrorism appear to be changing in a way that makes mass-casualty attacks more likely. In an earlier era, radicals had described their grievances through ideological lenses like anarchism, Marxism, Nazism, or nationalist-separatism. Since the 1980s, they have been increasingly justifying their actions in terms of religious principles. Like those responsible for the attacks against the World Trade Center and the Pentagon, fanatic religious fundamentalists are less interested in concrete political goals and more focused on retribution or eradication of what they define as evil. A willingness to engage in acts of indiscriminate violence, to embrace a culture of death, combined with the symbolism of biological weapons (the horror of using living things to destroy human life), could

1 This section is adapted from a speech entitled "How likely is a Biological Armageddon?", made at the global health forum at the Whitehead School of Diplomacy, Seton Hall University, March 23, 2004. Please contact the author for reference information.

confer BWs an almost mystical quality and make them attractive to potential perpetrators. This is especially the case when they believe that traditional shootings and hijackings no longer attract sufficient media coverage or political attention and that a more lethal and dramatic form of violence is needed to achieve their ends. The guaranteed public sensation of a biological agent is an ominous temptation to extremists. Indeed, even a hoax might cause serious disruption and casualties if large-scale panic ensued. There were indications that the terrorists who conducted the 9/11 attack had considered using biological weapons. Captured documents also show al-Qaeda is trying to produce biological weapons. American forces in Afghanistan, for example, discovered a half-finished laboratory near Kandahar, which was believed to be used to produce anthrax.

Second, many microbial organisms, including anthrax and plague, are commonly found in nature. The rise of varied natural disease outbreaks in an age of globalization means that opportunities for access to dangerous pathogens are fairly routine. Some of them can be used as BWs. In a 2003 conference organized by Institute of Medicine of the National Academies, Nobel Laureate Joshua Lederberg confirmed that the SARS virus, like anthrax and smallpox, could potentially be weaponized. It is thus not farfetched to image terrorist groups intent on inflicting large number of casualties send several "superspreaders" infected with deadly viruses to a country like United States, setting off a major epidemic. Unlike suicide bombers, the perpetrators can use the incubation interval to avoid being identified when coming to the States, and they can keep infecting more and more people in different locations without being caught while wreaking havoc. During the SARS outbreak, an index case unknowingly caused 44 deaths in Toronto. Imagine what would happen when one, or several perpetrators infected with a deadly, new virus, or, worse, a mix of several viruses, travel across United States deliberately spreading the disease. As David Heyman of the Center for Strategic and International Studies (CSIS) has pointed out, an intentional release is more likely to spread faster, since terrorists would likely introduce a pathogen in many locations simultaneously. A bioterrorist attack with the U.S. as the main target does not need to be triggered in the target country. Instead, in an age of globalization, bioterrorists may choose to release biological agents in countries with strong economic and business links with the target country.

Third, advances in biotechnology make it easier to overcome the technological barriers that still inhibit the acquisition of biological weapons. Rapid advances in biotechnology may make large-scale destruction more possible by allowing for more controlled and deadly biological agents with greater effectiveness in actual use, making them a more viable and reliable weapon. Biotechnology may also increase the virulence of potential BW pathogens or allow for a longer shelf-life or novel ways of dissemination. According to Ken Alibek, the former head of Soviet biowarfare program, the disease-causing parts of Ebola virus have been spliced into smallpox in Russia which would give the haemorrhages and high mortality rate of Ebola virus plus the very high contagiousness of smallpox. If this is true, any effective response to the attack would be delayed because such a genetically engineered virus can initially be taken to be smallpox, and smallpox vaccine may be ineffective in immunizing the people potentially at risk. While scientists may disagree over whether such an attack is currently possible, it is sobering to recall that the Aum Shinrikyo sect was reported to be attempting to splice botulinum toxin genes into E. coli as part of efforts to develop their biological weapons of choice.

Perhaps equally important, the diffusion of biological-related technology is opening the realm of BWs up further to non-state actors. The nature of the anthrax spores in Senator Tom Daschle's office shows that whoever sent them seems to have had access to disturbingly sophisticated equipment, which allegedly treated the spores with a chemical additive to allow them to stay suspended longer in the air. Only three countries, Russia, Iraq and the United States, were known to have developed such an additive. The diffusion of biotechnologies also means that the scientific expertise required to produce and disperse lethal organisms is no longer within the reach of only the most sophisticated laboratories. Information about how to obtain and prepare bioweapons is increasingly available through the Internet, the open scientific literature, and other sources. Unlike the nuclear realm in which a weapons program requires an enormous infrastructure, the production of biological weapons requires only a modest amount of readily procurable equipment, comparatively little space, and few personnel. Furthermore, much of the technology associated with BWs has civilian applications. This allows terrorist groups to produce certain agents in a facility that may appear to serve legitimate biological-related research purposes.

Finally, most countries, including the Untied States, are not well prepared for the growing threat of bioterorism. To the extent that successful nuclear deterrence is based on the threats of retaliation, in the case of BWs threats of retaliation are hardly credible: because the very nature of bioterrorism, it will be more difficult to trace the attack, to identify perpetrators, some of whom may be unconcerned about retaliation. After the anthrax attack, for example, the FBI interviewed 5,000 people and took the bizarre step of naming a government scientist, as a "person of interest" in the case without actually accusing him of anything. Since traditional deterrence does not work well, biological defense becomes essential. This means building an effective response system so that health workers and bureaucrats, the first responders of bioterrorism, are able to recognize an illness that is out of the ordinary, to provide timely diagnosis and treatment, as well as to report this recognition to upper level authorities in order to mitigate and ameliorate the consequences of a bioterrorist attack. This ability to diminish demonstrably the gains of a potential attack, in turn, strengthens the state's capability for "deterrence by denial" – the capability to deter terrorists by convincing them that biological defenses are credible and that an attack would be unlikely to succeed. Unfortunately, in most countries the capacity for "deterrence by denial" remains weak. Currently there are no reliable detection systems at airports, subways, or other places in urban areas, so terrorists will be able to strike any target they desire. In a recent national survey, few physicians reported that their practices were "well-prepared" for bioterrorism. The nonprofit organization, Trust for America's Health, spent a year assessing the post-9/11 activities of departments of health nationwide. It used 10 markers for readiness. So far, no state has met all 10. Four have achieved seven, and another five states, including New York, reached six.

In short, despite the lack of large-scale bioterrorist attack, world leaders confront a watershed regarding biological weapons terror. New developments are making a large-scale attack more likely. The only way to defend this nation against the bioterrorist assault is by getting prepared.

Addressing the Threat: Recommendations to L20 Leaders

Given the magnitude of the threat and its important social-political, economic, and security implications, it becomes imperative for national governments to beef up state capacity in disease prevention and control. This involves the building of four "core capacities" for early detection, rapid assessments and recommendations for prevention and treatment, information sharing, and the implementation of needed measures.

1) *Preparedness planning and readiness assessment*. In the planning process, a comprehensive and integrated approach is the key. For example, while it is important to prioritize pathogens and prophylactic measures, the presence of multiple threats to a nation's health often entail the need to address a full list of infectious diseases rather than focus on a single disease (e.g., smallpox) or a single tool for preparedness (e.g., vaccination). Moreover, given the dual use feature of biological agents and the need to build strong health infrastructure for biodefense, the approach requires national governments to comprehensively address the public health systems preparedness for bioterrorism *and* other infectious disease outbreaks. Integrating bio-defense with the existing public health system is not only cost-efficient, but also essential in ensuring sufficient resources to prepare for the next disease outbreak.
2) *Surveillance and laboratory capacities.* A nation's surveillance network is considered the first line of defense in identifying emerging infectious diseases and their sources and in providing essential information for developing and assessing prevention and control efforts. Countries should therefore be encouraged to commit resources to build a functioning disease surveillance network with sufficient resources (adequate funding, trained epidemiologic and laboratory staff) to conduct needed tests, to improve the study infectious diseases, and to engage government agencies at different levels in complementary activities.
3) *Risk communications and health information*. To the extent that strengthening surveillance and laboratory capacities aims at improving "sensitivity" (early recognition), risk communication focuses on horizontal and vertical "connectivity." Horizontally, a national's capacity to respond to disease outbreak requires open and effective communication between multidisciplinary groups (clinicians, researchers, epidemiologists, and public health officials) in multiple sectors (civilian vs. military, prevention vs. treatment, government vs. non-government). Vertically, effective crisis management depends in part on the ability of clinicians (physicians, nurses, nurse practitioners, and respiratory therapists) and public health officials to utilize available technologies and information systems (phones, computers, databases) to formulate reports to local, state and federal agencies in a timely manner. But vertical communication is not just a "bottom-up" process, it also entails the need to publicize the presence of a disease outbreak through media outlets (newspapers, television, radio, and the internet) in a way that reduces potential panic and fear and minimizes disturbing effects.

3) *Education and training*. This involves training investigators and health personnel to possess the needed knowledge and skills to define specific characteristics of discipline-related biological agents (e.g., epidemiology, virulence), to recognize and/or distinguish clinical presentations, symptoms, unusual occurrences and clusters of the select biological agents, to define and describe professional roles (function, responsibility, and chain of command), to effectively treat and provide prophylaxis for populations at risk, and/or know how to handle biological agents safely. It also involves training airport and federal personnel who had direct contact with passengers to recognize symptoms of infectious disease.

But health system capabilities cannot be built simply from within. The building of above "core" capacities itself hinges upon sustained leadership attention and a functioning state apparatus that is willing and capable to effectively engage public health sector. As shown in the SARS epidemic, it will be difficult to obtain accurate information about outbreak, particularly from countries dependent upon foreign investment or tourism or both, without a political system that rewards whistle blowers and punish laggards. Similarly, the appearance of reemerging diseases in the developing world (cholera in Africa) is often a sign of state failure to provide essential public goods and services. A number of important steps should therefore be undertaken to increase accountability and responsiveness:

1) *Placing public health in general and infectious disease threats in particular high on the policy agenda.* This means not only committing a significant amount of attention and resources to disease prevention and control, but also balancing the needs for political, social, and economic development. For developing countries, this often entails redefining the role of the state in the development process. The government should realize that economic development does not trickle down; single-minded pursuit of economic growth will only result in growing social injustice that will only threaten the sustainability of economic development. While it is important to relax structural/policy constraints on public health financing, more attention should therefore be given to the weak, the poor, and the pariah (e.g., elderly people, women and children, rural peasants, unemployed people, migrant labor, inner city residents, and social outcasts), which are at particularly high-risk for infectious diseases. To ensure social demands are channeled into the state policymaking regime in a consistent, systematic, and timely manner, governments (especially those in the developing world) should seriously consider broadening their formal channels of participation in the policy process through a better rule of law, more democracy, and a more robust civil society (e.g., NGOs promoting public health, independent social research, and a free media). A government-only approach would be highly unlikely to succeed.
2) *Reinvigorating health-related state apparatus*. The state may need to redefine incentives and mechanisms in the public health sector to address some fundamental problems in the health system, including the decrepit and deteriorating state of health care, the rising costs of health insurance, overcrowding and staff shortages. But having a clear chain of communication or command is equally important to avoid delay or distortion of information flow and ensure effective policy implementation in combating infectious disease. The

state should therefore consider streamlining a bloated bureaucracy, enhancing capabilities of regulatory control, and facilitating interagency coordination in policy process. This makes it worthwhile for national governments to establish a national level committee in charge of policy coordination or to promote a dialogue that involves not only health experts but also officials in other sectors (agriculture, police, education, even those involved in foreign policy and security policy process).

But beefing up state capacity also means building more effective partnerships and institutions internationally. This is especially the case for developing countries, where purely endogenous solutions are unlikely to be successful because infectious diseases reduce state capacity just when ever-increasing capacity is needed to tackle the challenges. For the developed nations, partnership with developing nations in infectious disease control is not just based on humanitarian concerns. It is in their national interest to emphasize international health, given the global spread of infectious disease and biotechnical know-how, and its socio-political, economic and security implications. L20 leaders may consider taking the following steps toward an effective international cooperation and partnership:

1) *Promote transparency and accountability*. Incentives to cover up disease outbreaks exist in almost every country, and this has been demonstrated in the 1918 Influenza Pandemic (see Barry 2004), the 2003 SARS crisis, and the 2004 bird flu outbreak in Southeast Asia. Deliberate cover-up may be caused by the need to avoid a social panic or to protect a particular industry (tourism or poultry exports). It is thus worthwhile to establish an international fund that pledges economic subsidies and needed vaccines/drugs to affected countries in the event of an outbreak. Alternatively, L20 leaders can encourage the growth of NGOs and community-based groups (CBOs) as a source of discipline (overseeing government behavior) and information (exposing cover-up).
2) *Enhance the global health governance structure*. Efforts can be made to support the initiative to increase the authority of UN agencies such as WHO and FAO, allowing them to play a more active role in investigating global health threats, in increasing government responsiveness, and in facilitating the international dialogue on global health problems. L20 leaders may also act to improve international control of dangerous pathogens by putting into place international standards for the secure storage and transport of biological stocks that could be weaponized, either within the BWC (Biological and Toxin Weapons Convention) framework or in a new forum.
3) *Improve coordination of response and resources* in areas such as placing restrictions on travel, airport-based screening, tracking down people exposed, and deployment of health personnel and drugs to affected countries.
4) *Encourage partnerships between public and private actors* by providing incentives (in terms of intellectual property, tax breaks, liability) to the development of drugs to combat organisms predominantly in poor countries
5) *Collaboration in science* to facilitate specimen acquisition, rapid identification of causative agent, and development of diagnostic tests.

6) Developing international training or exchange programs between related government agencies (e.g., the U.S. FDA and State Food and Drug Administration in China) to enhance regulatory oversight on food and medicine.

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