

BIOTERRORISM



WATCH

Preparing for and responding to biological, chemical and nuclear disasters

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Bioterror game finds nations reticent to share smallpox vaccine post-attack

Grim aftermath: Nearly 90,000 dead, smallpox back in the wild

A coordinated smallpox attack on international transportation hubs quickly would divide the world into “the haves and the have nots,” exerting extraordinary pressure on world leaders to withhold their vaccine stocks to protect their own populations, a bioterrorism war game revealed.

The Atlantic Storm exercise — which used former world leaders to play the roles of presidents and prime ministers — underscored that terrorists might be able to create massive chaos and divide the global community through a smallpox attack. Held recently in Washington, DC, the exercise was organized by the Center for Biosecurity of the University of Pittsburgh Medical Center (UPMC), the Center for Transatlantic Relations of Johns Hopkins University in Baltimore, and the Transatlantic Biosecurity Network.

As the mock smallpox attacks unfolded, Atlantic Storm world leaders debated the availability of vaccine in their countries and were surprised to learn there was wide disparity even among industrialized nations. Sufficient supplies to vaccinate their respective entire populations are held in the United States, the United Kingdom, France, Germany, and the Netherlands. However, Italy and Sweden, for example, have enough smallpox vaccine for only about 10% of their populations.

“There absolutely is not enough [smallpox vaccine],” says **Bradley T. Smith**, PhD, one of the organizers of the Atlantic Storm exercise and a fellow at the UPMC Center for Biosecurity.

“There are only about 700 million doses of smallpox vaccine in the world. That will cover about 10% of the global population. Even within Europe and North America, there are definite haves and have nots. The United States has about 100% coverage, but Canada has about 20%.”

As a result, the leaders found themselves in a high-stakes game where their national and international priorities might be at cross-purposes. “One of the lessons here is when nations have a limited supply of a critical resource — be it smallpox vaccine, antibiotics, or some other drug — that severely limits their strategic options to share

and work together," Smith says. "You have to start making these incredibly challenging decisions about who you're going to help and who you can't help."

Game outcome: Smallpox reintroduced

Though the distinguished players were courageous in their decisions, nearly 90,000 people died worldwide and wild smallpox was reintroduced into the undeveloped world in the aftermath.

"By the end of February 2005, we proposed, based on talking with experts, that it was likely that smallpox could be on its way to being re-established in the developing world," Smith tells

Bioterrorism Watch. "That would have huge implications for global economy and trade. You would constantly be having new smallpox re-importations from travel and trade back to the developed world — even if they were all vaccinated."

Organizers plan to publish a complete analysis of the findings in the coming months, but drew some preliminary conclusion at game's end. (See findings, p. 11.)

The cast of players was extraordinary, with former U.S. Secretary of State Madeleine Albright playing the U.S. president. Many other distinguished international leaders assumed roles similar to the ones they held in real life. With a spectacularly successful terrorist attack under way as the game began, the leaders found themselves under intense pressure to both protect their national interest and aid a world on the brink of catastrophe.

"There are domestic political pressures that are going to very strongly impact national leaders," Smith says. "For a nation like the United States or Germany — that has all of the resources it needs — there is going to be very strong domestic pressure to make sure that it takes care of itself first before it starts helping even close allies."

"Regardless of whether it makes good public health sense or not. These pressures may be underappreciated in the public health community. We wanted to raise this issue to get people talking about it more and being more realistic about what might happen during a crisis like this," he adds.

A worst-case scenario

In the exercise, seed stocks of smallpox virus have been obtained by a terrorist group called Al-Jihad Al-Jadid from a bioweapons facility in the former Soviet Union. Though smallpox is known to be only in the hands of the United States and Russia, this aspect of the scenario has long been the subject of concern and speculation.

Based on reports from Russian scientists, smallpox stocks are believed to exist in at least two and possibly three of the former biological weapons laboratories in the former Soviet Union. Many of those who once worked in these laboratories now are working in other countries, but little information is available as to where they are or what they are doing.¹

Returning to the Atlantic Storm scenario, the Al-Jadid terrorists received microbiological training at Indian and U.S. universities. The terrorist group combined this knowledge with publicly available technical information to develop dry

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Editor: **Gary Evans**, (706) 310-0252.

Vice President/Group Publisher: **Brenda Mooney**, (404) 262-5403, (brenda.mooney@thomson.com).

Editorial Group Head: **Coles McKagen**, (404) 262-5420, (coles.mckagen@thomson.com).

Senior Production Editor: **Ann Duncan**.

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Editorial Questions

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powder preparations of the viruses. Then, with their own microbiology training, the terrorist group was able to acquire all the required laboratory equipment to grow and process the Variola major seed stock they had acquired into a relatively high-quality dry powder that then was used in the attacks. The attacks were carried out by vaccinated terrorists who walked throughout the target locations for several hours during periods of peak occupancy. A commercially available dry powder dispenser the size of a small fire extinguisher hidden in a backpack was used to disseminate the agent, the scenario states. Is such viral processing and delivery far-fetched?

“Unfortunately it is not,” points out Smith,

who holds a PhD in molecular biology from the Massachusetts Institute of Technology. “The technology for aerosol dispersion for both dry powders and wet flurries of biologic mixtures — be they viruses or bacteria — is actually a very common technology.”

Agriculture includes an entire subindustry of sprayers and foggers and other devices to make slurries and mixtures that can be sprayed over acres of land, he added. The scenario’s use of a powder medium is similarly grounded in reality. “There is a whole industry in the biotechnology world that is developing dry powders for measles vaccine, other viral vaccines and drug delivery.”

Though the lessons of bioterrorism certainly

Take-home lessons of Atlantic Storm

Bioterrorism forces international cooperation

A full analysis of the Atlantic Storm bioterrorism exercise, held in Washington, DC, Jan. 14, is forthcoming, but organizers cited these initial conclusions after the project:

1. Bioterrorism response is perhaps the clearest example of why homeland security efforts must have a robust international dimension.

- It is in the explicit interest of nations that their neighbors and allies are able to prevent and, if necessary, respond effectively to large epidemics.

Uncontrolled contagious disease in other nations will spread across borders, with great potential to threaten populations, disrupt societies, and destabilize economies.

2. Bioterrorism necessitates that public health and national security communities be integrated in ways that take the traditional security emphasis on territorial defense and add to that a 21st century focus on societal resilience.

- There have been promising beginnings to transatlantic cooperation in this area, but they have largely been ad hoc achievements rather than integrated elements of a more comprehensive approach.

3. Effective international efforts on collaborative preparedness are critical, but will be challenging, because great differences exist between nations to prevent and prepare for bioterror attacks.

- Uncoordinated or unilateral responses could help one nation at the expense of many others.
- In the area of biodefense, nations of the transatlantic community are divided into “have” and “have not” nations.

- It is unclear to what extent treaty commitments or other international agreements would commit nations to support allies in aftermath of large-scale bioterrorist attacks. It also is unclear what actions key international institutions (such as EU, NATO, WHO, UN) could or would take to help nations respond to such a crisis.

4. After a large bioterrorist attack, unaffected nations will receive many urgent requests for assistance from affected nations asking for:

- Access to and sharing of domestic homeland security assets (e.g., vaccine stockpiles, antibiotics, scientific laboratories).
- Extensive sharing of situational and technical information in a real-time, ongoing basis.
- Agreements on what actions related to international commerce and travel will (and won’t) be taken to stop international spread of disease while avoiding the negative economic repercussions that travel and commerce interruptions would cause.

5. In the nations of the transatlantic community, the numbers of lives lost and the level of large-scale economic disruption and civil havoc that would follow a serious biological attacks will greatly depend on:

- How effectively and quickly leaders communicate with the public and how well the public has been included in preparation for such attacks.
- How well large-scale interventions are coordinated with other relevant nations, because biodefense is likely to be ineffective without international cooperation.

6. Recovery will depend on how quickly:

- The extent of the outbreak is understood and infected people are identified.
- Drugs and vaccines are administered to the people in affected regions.
- New drugs or vaccines are developed to respond to an attack with a novel bioagent. ■

caution against underestimating any enemies, the next phase of Atlantic Storm certainly is a worst-case scenario. Presumably to force global involvement in the game, the scenario calls for multiple smallpox attacks in the same day.

The exercise begins with simultaneous outbreaks of smallpox in Istanbul, Frankfurt, and Rotterdam, with attacks in the United States surfacing later in the day. The attack sites all are among the busiest airports and public transportation centers in the world, including Los Angeles International Airport and New York City's Penn Station.

While the sheer scale of such an attack may be unlikely, the transmission ratio selected for the scenario actually was a relatively conservative 1-3. The Centers for Disease Control and Prevention (CDC) has criticized media depictions and movies where one smallpox case may infect as many as 20 other people.

"We tried very hard to be conservative in our estimates, making sure that these were things that a broad array of CDC and public health officials would agree with," Smith says. "Frankly, it's a big enough problem as it is — with conservative estimates."

Ring strategy, mass vaccination considered

The Atlantic Storm leaders debated the issue of surrounding first cases with ring vaccination or opting for mass vaccination of whole populations. This led to discussions of which countries would be willing or politically able to share vaccine.

"We wanted to see what that conversation was about," he adds. "In reality, there is going to be a tipping point. At what point is it still feasible to do ring vaccination vs. switching to mass vaccination? All of these countries plans on paper at least say they are going to do ring vaccination, but if it gets very difficult or some unspecified trigger is met, they have the option of going to mass vaccination."

Acting as the U.S. president, Madeleine Albright expressed doubts as to whether the American people would be willing to give away a portion of the U.S. stockpile to European countries whose governments had been less than supportive of U.S. policies in the recent past. As the day went on, the number of reported smallpox cases grew rapidly, and the number of countries whose populations were affected also increased.

Cases were reported in Canada and Mexico, as well as in countries throughout Europe. A debate

ensued about the advisability of closing borders, quarantining cities, and limiting the movement of people and goods.

Participants wanted the World Health Organization (WHO) to manage the distribution of available smallpox vaccine. Providing the reality check was former WHO Director-General **Gro Harlem Brundtland**. Playing that role in the game, she told participants the WHO has a budget "about as big as that of a middle-sized English hospital."

The WHO consists of 172 member nations but is dependent on them for its resources.

"All of the leaders in this scenario were looking to WHO as an honest broker," Smith says. "That was something they immediately gravitated toward. I think what that means is that WHO should maybe get more resources and authority than it currently has. I think many people would agree it does not have the resources to manage a global distribution campaign of smallpox vaccine."

In reality, the WHO continues to move forward on establishing a global smallpox vaccine reserve. With smallpox eradicated in the wild, the consequences of an intentional release of smallpox must be considered, according to a report presented recently to the executive board of the WHO.

"Population immunity following mass vaccination during the eradication era has waned, leaving much of the world's population vulnerable," the WHO report states. "The greatest fear is that, in the absence of global capacity to contain an outbreak rapidly, smallpox might re-establish endemicity, undoing one of public health's greatest achievements."

The WHO report notes that such a vaccine reserve would be a logical way to enhance international response capacity, as most countries are not in a position to build and maintain their own supplies of smallpox vaccine.

The WHO is considering doubling its current stock of 2.5 million doses in Geneva and is asking world member nations to provide another 200 million doses. The United States has pledged 20 million doses of smallpox vaccine to the WHO global stockpile.

The Atlantic Storm exercise certainly underscored the need for a global smallpox vaccine stock, but it raised larger questions that would remain unanswered by that specific remedy. It is easy to imagine similar scenarios involving vaccine and resources for pandemic flu or another biological agent.

"The bigger lesson is regardless of whether [the

question is] smallpox vaccine, ventilators, doctors, nurses, or antibiotics, there are no preexisting systems in place for nations to work together and share limited and valuable medical resources," Smith notes. "Unfortunately, there are just none in place."

Indeed, despite the existence of treaties and alliances, no clear partnerships exist when it comes to bioterrorism. The European Union has considered creating stockpiles of smallpox vaccine and other critical supplies but has not reached agreement on the distribution process.

"It was too difficult politically to develop a decision-making process that could be used in a crisis," Smith adds. "For example, could the UK actually agree to share with Germany or France or whatever. They just shelved the whole concept. And this is a union, countries that have the same currency and have no border controls. Yet on this critical security issue, they could not come to agreement."

Reference

1. Alibek K, Handelman S. *Biohazard: The Chilling True Story of the Largest Covert Biological Weapons Program in the World — Told from Inside by the Man Who Ran It*. New York City: Random House; 1999. ■

Hospitals unprepared for a surge of child victims

U.S. schools vulnerable to attack

Media images of the smallest victims of terrorism and natural disasters are seared in the collective memory. Terrorist attacks on Russian schoolchildren and the tsunami disaster in Asia have shown that a horrific surge of pediatric patients is a possibility for today's health care system.

"General emergency departments — those that take care of mixed populations [of] children as well as adults — are going to be challenged by having very large numbers of children with limited numbers of pediatric supplies," said **Michael Shannon**, MD, chief of emergency medicine and director of the center for biopreparedness at Children's Hospital Boston.

"Remembering that an effective response at the hospital involves not only the emergency department, but the entire hospital, many hospitals will

find themselves not as prepared as they should be for many pediatric casualties," he added.

Shannon spoke at a web-assisted conference call on health care system surge capacity sponsored by the Agency for Healthcare Research and Quality (AHRQ) in Rockville, MD.

The Oct. 26, 2004, conference dealt with the health care system's ability to rapidly expand beyond normal services to meet the increased demand for qualified personnel, medical care and public health in the event of bioterrorism or other large-scale public health emergency. (**See related story, p. 14.**) An influx of pediatric patients presents myriad challenges, he noted.

"In creating surge capacity plans for children, it's important to keep in mind and consider every potential type of disaster, terrorist or otherwise," Shannon said. "So the all-hazards approach — which has become a new way of thinking in disaster response over the last few years — is particularly important."

Schools must be involved in plans

Surge capacity plans for pediatric plans must involve area schools, where children spend most of their waking hours. Shannon cited two distinct scenarios that must be considered in making surge capacity plans that involve schools.

"The first, of course, would be a tragedy in which the school is a specific target for a terrorist event or a disaster of some type," he said.

"The second would be when the disaster occurs in the community; but while school is in session, and in such a situation, there is going to be potentially communication disruption, chaos on the street, unruly traffic, potentially even mass evacuation. It's important to ask the question: Who will be taking care of the children? Who will be the contact? Who is in charge? Who will supervise that evacuation?" Shannon asks.

The necessity for such planning was painfully driven home last September, when terrorists targeted a school in Beslan, Russia. When it was over, 340 people were dead — more than half of them children. The attack sets a disturbing precedent because most U.S. schools are vulnerable to both terrorism and natural disasters.

"We've spent the last year investigating school districts around the country, and it continues to concern, if not frighten me, how few really are prepared for disasters of any type," he said.

While recommending the federal government issue a disaster planning template for schools,

Shannon acknowledged that there is no one-size-fits-all solution. A comprehensive disaster plan for a school really must bear in mind the unique population and architecture of the school.

In general, however, creating school-sensitive emergency response plans should begin by establishing lines of communication between public health, clinical care, principals, and school nurses. From his work in the area, Shannon finds that school officials generally are more prepared to get

the children out then shelter them within.

“We’ve found in virtually every school district that we’ve examined that again there is an evacuation plan, but there is rarely a sheltering and/or a lockdown plan,” he said. “Those are equally important when thinking about disasters. If the disaster is outdoors — if there’s a cloud plume of some type that’s going toward the school — there’s nothing more important than keeping the children safe in the school.”

Feds envision temporary medical station network

Rapid deployment to boost local response

Federal health officials are developing a system of temporary health care facilities called “contingency stations” to prepare an overburdened health care system for a mass casualty event.

The first wave of stations is designed to be assembled within existing structures such as gymnasiums. Public health officials envision a network of the stations eventually could be available in various regions of the country, enabling local officials to rapidly increase health care capacity in the event of a disaster or attack.

“As we build out the advance-capability ones, they will actually have walls and tents and floors,” noted **Robert Claypool**, MD, deputy chief medical officer in the office of emergency preparedness in the U.S. Department of Health and Human Services. “The ones that we have — that we’re building initially — will actually go into another facility like a school or gymnasium.”

Claypool spoke at a web-assisted conference call on health care system surge capacity sponsored by the Agency for Healthcare Research and Quality in Rockville, MD. The Oct. 26, 2004, conference dealt with the health care system’s ability to rapidly expand beyond normal services to meet the increased demand for qualified personnel, medical care, and public health in the event of bioterrorism or other large-scale public health emergency.

Four of the stations, which can be designed to accommodate 250 hospital beds, were built last year. Depending on funding, the number of stations will be increased gradually.

“Our goal is eventually to get these sited around the country in every one of the health emergency

service regions,” Claypool said.

In California, for example, having two stations available in the north and two in the south of the state may be sufficient to rapidly reach any city.

“If we could do that, then we should be able to get a contingency station to [for example], the San Diego area, hopefully within a matter of hours,” he said. “It may take a bit longer, but that’s what we will be shooting at. This is such a new concept, it’s going to have to be fleshed out as we test this.”

The public health system is interested in using the stations for quarantine as well as treatment. For example, a station could be set up inside an airport hanger to house a planeload of passengers who had been quarantined due to an infectious disease risk.

“In the event that there is 747 that needs to be quarantined, you need to take the people and put them someplace. You can’t have them sitting on a tarmac for 24, 48, 72 hours,” he said. “So what we’re looking for is to be able to project one of these 250-bed capability units to fill in a hanger. Our target to get to there would be within four hours. In terms of supporting a medical event, we’re probably talking somewhat longer. That will have to be determined as we go out. But it would probably be in the ballpark of 24 to 48 hours.”

In addition to treating adult patients, the stations will have pediatric beds, equipment and formulations, he said. Staffing is an unresolved issue. The basic 50-bed unit would need at least two physicians and a support staff “in the 20s” of nurses, assistants, technicians, and the like. Local volunteers inevitably will be needed.

“Although it will be a federally developed system, it’s going to be used locally to support local and regional needs,” he said. “It isn’t going to be an independently staffed organization. So we’ll look for continued [medical] input to do that. How do we staff these? I don’t know; that’s a big challenge for us.” ■

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In terms of attack or disaster management, injured and frightened children simply are more difficult to care for than adults. "All of the first responders — EMS, fire, police — are going to have a more difficult time when they're taking care of many injured or traumatized children," he said. "[They will be] challenged by taking care of frightened children or children who are very small, particularly while wearing cumbersome personal protective equipment. If there are events involving an infectious agent or chemical agent with contaminated patients, it will be important to effectively triage those victims, usually out of doors, out of the facility so that the campus itself doesn't become contaminated."

As a practical matter during medical triage, expect that information will be gleaned less easily from the pediatric patient.

"It takes 10 minutes to triage and screen [an adult] victim before you give them their antibiotic or antidote, it will take twice as long for a child," Shannon said. "Because that child is unable to provide details of that history. And so there has to be someone or there has to be some means of determining whether this child really can receive this antidote or antibiotic or if there's a contraindication of some type."

The specific challenges of triaging and treating pediatric victims would depend on the agent used, and Shannon had no shortage of stark images to reinforce that point. "If there were a chemical event with large numbers of contaminated children — children 2 and 3 years old, frightened, unable to speak, difficult to console — [they will be] quite a challenge for anyone to assess," he said. "On the other hand, [following] a radiologic event, children are much more susceptible to the consequences, particularly development of cancer."

Pediatricians have long emphasized that children are not "little adults," and thus treatment is not simply a matter of dosing down. "Children have an immature immune system, which means that they are less able to resist an infection," he said.

Moreover, providing trauma treatment to an injured child — for example, after an attack involving explosives — would be fraught with challenges, he added.

"In the field of emergency medicine, we talk about the 'golden hour of trauma' — all the things that must be done effectively, efficiently, completely in one hour," Shannon said. "When you try to do those things in young children, you find

CE/CME questions

1. According to Bradley T. Smith, PhD, there are approximately how many doses of smallpox vaccine in the world?
A. 100 million
B. 500 million
C. 700 million
2. The Atlantic Storm bioterrorism exercise participants wanted which organization to manage the distribution of available smallpox vaccine?
A. North Atlantic Treaty Organization
B. World Health Organization
C. Red Cross
D. Doctors without Borders
3. Concerning disaster drills and schools, Michael Shannon, MD, said school officials generally are more prepared to shelter the children within the school than evacuate them.
A. true
B. false
4. Federal health officials are developing a system of temporary health care facilities called "contingency stations" to prepare for a mass-casualty event. In addition to treatment, what other contingency do planners foresee for the stations?
A. quarantine sites
B. strategic planning centers
C. housing for health care workers
D. all of the above

Answer Key: 1. C; 2. B; 3. B; 4. A

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that it's quite difficult. Things as simple as starting an intravenous line in an infant, really are more difficult than you think, particularly if that's not part of your skill set. [Therefore], taking in large numbers of children who are victims of a blast injury is going to be quite challenging, and many will miss that golden hour."

In particular, the health care system overall is not well prepared for burn patient management, he noted.

Children have much less body fluid reserves than adults so that the fluid loss that occurs with major burns is going to be even worse. "We know that burn victims are susceptible to infection; children will be even more susceptible to that infection," Shannon noted.

Of course, long term, the mental health toll will be a substantial one for the children who survive. "There will be just enormous needs in terms of the mental health response and recovery since we know that disasters of any type — natural, terrorist, or otherwise — lead to psychological trauma, which can be enduring," Shannon said. "Who will take the lead on creating those teams, identifying those children or parents or staff in the post-event period to make sure that everyone is healthy?" ■

New bioterror vaccines are getting in the pipeline

The federal government has awarded \$232 million to fund research and development of new vaccines against three potential agents of bioterrorism: smallpox, plague, and tularemia. The National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH), will administer the contracts.

The funding responds to a key objective of the NIAID biodefense research agenda, which emphasizes the development of new and improved medical products against "Category A" agents — those considered by the Centers for Disease Control and Prevention (CDC) to pose the greatest threat to national security.

The smallpox awards continue advanced development work that began in 2003 on two modified vaccinia Ankara (MVA) vaccine candidates. These contracts will support larger scale manufacturing of the vaccines as well as further safety and effectiveness studies in animals and humans.

The tularemia and plague awards will fund early-stage product development of the respective vaccines, which will include dosage formulation, pilot batch production, and initial clinical assessment. All four contracts are for purchases of vaccine lots intended for research use.

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Any future purchases of additional vaccines for stockpiling in the event of an emergency will depend on the results of the research currently under way.

NIAID awarded two contracts totaling up to \$177 million for advanced development of MVA vaccines against smallpox. MVA is a highly weakened form of the vaccinia virus that cannot replicate in human cells.

Previous NIAID research has demonstrated that MVA nearly is as effective as the standard smallpox vaccine, making it a promising candidate for use in children and pregnant women as well as people with weakened immune systems or skin conditions such as eczema. The new contracts will allow the companies to continue the work they began under contracts awarded in 2003. ■

CE/CME objectives

After reading each issue of *Bioterrorism Watch*, the infection control professional will be able to do the following:

- identify the particular clinical, legal or educational issue related to bioterrorism;
- describe how the issue affects health care providers, hospitals, or the health care industry in general;
- cite solutions to the problems associated with bioterrorism, based on guidelines from the federal Centers for Disease Control and Prevention or other authorities, and/or based on independent recommendations from clinicians and bioterrorism experts. ■