Supplement to *Hospital Infection Control* and *Hospital Employee Health*

BIOTERRORISM WATCH

Preparing for and responding to biological, chemical and nuclear disasters

THOMSON AMERICAN HEALTH CONSULTANTS

IN THIS ISSUE

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Syndromic surveillance: Wave of the future for bioterrorism preparedness

Old walls between hospitals, public health are coming down

The threat of bioterrorism and the continuing emergence of new infectious agents have spurred the development of syndromic surveillance systems, which may detect clusters of cases much earlier than traditional methods. What does that buy you? Time.

"Syndromic surveillance is trying to pick up a day, two days, even hours in some instances, of a larger pattern of indicators that suggest the need for a public health investigation," says **Daniel Sosin**, MD, MPH, director of the division of public health surveillance and informatics at the Centers for Disease Control and Prevention (CDC).

Syndromic surveillance systems typically use health-related data that precede diagnosis but may signal an outbreak that warrants public health response. Some surveillance systems use the International Classification of Diseases (ICD) diagnostic codes with a set of syndromes caused by the major bioterrorism agents.

Other systems abstract data from emergency department logs, 911 calls, or nurse call lines. Syndromic surveillance systems often draw on data sources that already exist, but have not been designed specifically for public health surveillance purposes. "Clinical providers always have and will continue to have a major role in disease reporting and public health surveillance," Sosin says. "Probably, still the most important surveillance system we have is the telephone. The health care provider says, 'I'm seeing something unusual; are you seeing something in the community?' That direct connection between a clinician [and the public health department] will continue to be important."

The CDC began trialing such programs in 1999, setting up enhanced syndromic surveillance activities for high-profile community events such as national political conventions. As part of those efforts, the CDC has identified syndrome categories indicative of the clinical presentations of several critical bioterrorism-associated conditions.[1] **(See table of syndromes, pp. 11-13.)** The Department of Defense's ESSENCE program (Electronic Surveillance System for the Early Notification of Community-based Epidemics) also uses broad syndrome groups using ICD codes that approximate natural infectious disease outbreaks or

bioterrorism.[2] These syndrome groups currently are under routine surveillance at military medical treatment facilities. Other public health agencies also have developed syndrome-based definitions and code groupings according to their own data sources and surveillance goals.

The idea is not to create a national system, but guide local health departments in creation of syndromic surveillance programs that are appropriate for their resources and community needs, Sosin says. "Public health truly is local. The identification of public health threats day in and day out has to happen at the local health department. Different local health departments have different risk scenarios; the threat is different in different jurisdictions; and they have different resources to respond. So the thresholds will and should vary. We have a lot to learn yet. It isn't appropriate that we go out with a single model and tell everybody to do it," he explains.

To assist in the continued development of these systems, the CDC has posted a draft framework document that can be used for evaluating or creating syndromic surveillance programs.[3] The model and several other CDC documents on syndromic surveillance have been posted on a web site for comment and review. **(See editor's note, p. 13.)** Eventually, such systems in one form or another are expected to be adopted throughout the nation, further bringing down the traditional walls between infection control and public health.

It will be important that the surveillance systems are designed to capture the best data from both a clinical and public health viewpoint. Therefore, infection control professionals (ICPs) should consider participating if syndromic surveillance systems are being developed by their local public health departments.

"An important thing about these guidelines and this framework is that if they are employed, then we are not going to send hospital epidemiologists on wild-goose chases," says **J. Marc Overhage**, MD, PhD, an advisor to CDC on the issue and professor of medicine at Indiana University School of Medicine in Indianapolis. "Ensuring the quality of the process up front is going to be very critical for ICPs so that they are not chasing shadows. In some of the bioterrorism surveillance systems, there is a little bit of that going on today. These guidelines bring some rigor and some thoughtfulness to these systems in advance so ICPs are not subjected to bad systems that add unnecessary work."

The CDC concedes that the utility of the new systems for early detection and response to outbreaks has not been well established. Significant costs may be incurred in developing and managing these surveillance systems and investigating false alarms, the CDC framework draft states. That makes it even more important that there is two-way communication between public health agencies and the clinical community.

Ideally, the clinicians and laboratories report cases and clusters of cases of unusual diseases, while health departments provide consultation on case diagnosis and management, alerts, surveillance summaries, and clinical and public health recommendations and policies.

"[Syndromic surveillance systems] should

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Text-Based Syndrome Case Definitions & Associated Category A Conditions

Syndrome	Definition	Category A Condition
Botulism-like	ACUTE condition that may represent exposure to botulinum toxin ACUTE paralytic conditions consistent with botulism: cranial nerve VI (lateral rectus) palsy, ptosis, dilated pupils, decreased gag reflex, media rectus palsy. ACUTE descending motor paralysis (including muscles of respiration) ACUTE symptoms consistent with botulism: diplopia, dry mouth, dysphagia, difficulty focusing to a near point.	Botulism
Hemorrhagic Illness	SPECIFIC diagnosis of any virus that causes viral hemorrhagic fever (VHF): yellow fever, dengue, Rift Valley fever, Crimean-Congo HF, Kyasanur Forest disease, Omsk HF, Hantaan, Junin, Machupo, Lassa, Marburg, Ebola ACUTE condition with multiple organ involvement that may be consistent with exposure to any virus that causes VHF ACUTE blood abnormalities consistent with VHF: leukopenia, neutropenia, thrombocytopenia, decreased clotting factors, albuminuria	VHF
Lymphadenitis	ACUTE regional lymph node swelling and/ or infection (painful bubo- particularly in groin, axilla or neck)	Plague (Bubonic)
Localized Cutaneous Lesion	SPECIFIC diagnosis of localized cutaneous lesion/ ulcer consistent with cutaneous anthrax or tularemia ACUTE localized edema and/ or cutaneous lesion/ vesicle, ulcer, eschar that may be consistent with cutaneous anthrax or tularemia INCLUDES insect bites EXCLUDES any lesion disseminated over the body or generalized rash EXCLUDES diabetic ulcer and ulcer associated with peripheral vascular disease	Anthrax (cutaneous) Tularemia
Gastrointestinal	ACUTE infection of the upper and/ or lower gastrointestinal (GI) tract SPECIFIC diagnosis of acute GI distress such as Salmonella gastroenteritis ACUTE non-specific symptoms of GI distress such as nausea, vomiting, or diarrhea EXCLUDES any chronic conditions such as inflammatory bowel syndrome	Anthrax (gastrointestinal)

(Continued on next page)

become valuable tools for infection control practitioners if they meet the standards that are set out [in the framework document]," Overhage points out. "Part of the goal of the framework is to develop systems that are robust enough that the conclusions can be trusted, and the ICP can say, 'Here's something I should at least look at, if not worry about.' They don't have to do all the legwork to find that thing."

While the systems can detect the signs of a bioterrorism attack, such marriages between public health and clinical care also will be helpful as

Syndrome	Definition	Category A Condition
Respiratory	ACUTE infection of the upper and/ or lower respiratory tract (from the oropharynx to the lungs, includes otitis media) SPECIFIC diagnosis of acute respiratory tract infection (RTI) such as pneumonia due to parainfluenza virus ACUTE non-specific diagnosis of RTI such as sinusitis, pharyngitis, laryngitis ACUTE non-specific symptoms of RTI such as cough, stridor, shortness of breath, throat pain EXCLUDES chronic conditions such as chronic bronchitis, asthma without acute exacerbation, chronic sinusitis, allergic conditions (Note: INCLUDE *acute exacerbation* of chronic illnesses.)	Anthrax (inhalational) Tularemia Plague (pneumonic)
Neurological	ACUTE neurological infection of the central nervous system (CNS) SPECIFIC diagnosis of acute CNS infection such as pneumoccocal meningitis, viral encephailitis ACUTE non-specific diagnosis of CNS infection such as meningitis not otherwise specified (NOS), encephailitis NOS, encephalopathy NOS ACUTE non-specific symptoms of CNS infection such as meningismus, delerium EXCLUDES any chronic, hereditary or degenerative conditions of the CNS such as obstructive hydrocephalus, Parkinson's, Alzheimer's	Not applicable
Rash	ACUTE condition that may present as consistent with smallpox (macules, papules, vesicles predominantly of face/arms/legs) SPECIFIC diagnosis of acute rash such as chicken pox in person > XX years of age (base age cut-off on data interpretation) or smallpox ACUTE non-specific diagnosis of rash compatible with infectious disease, such as viral exanthem EXCLUDES allergic or inflammatory skin conditions such as contact or seborrheaic dermatitis, rosacea EXCLUDES rash NOS, rash due to poison ivy, sunburn, and eczema	Smallpox
Specific Infection	ACUTE infection of known cause not covered in other syndrome groups, usually has more generalized symptoms (i.e., not just respiratory or gastrointestinal) INCLUDES septicemia from known bacteria INCLUDES other febrile illnesses such as scarlet fever	Not applicable

(Continued on next page)

the traditional boundaries within the health system continue to blur and disappear.

"Lengths of stay are becoming dramatically shorter," Overhage says. "Our average length of stay at the hospital is 2.3 days. That patient goes home, but they still have an infection, are still being treated with antibiotics. They just became a public health problem instead of a hospital problem. There really is that interface; that hand-off happens all the time now. It will increasingly happen as we do not even admit patients to the hospital, but manage them [from the onset] as an outpatient."

But syndromic surveillance systems still are in

Syndrome	Definition	Category A Condition
Fever	ACUTE potentially febrile illness of origin not specified INCLUDES fever and septicemia not otherwise specified INCLUDES unspecified viral illness even though unknown if fever is present EXCLUDE entry in this syndrome category if more specific diagnostic code is present allowing same patient visit to be categorized as respiratory, neurological or gastrointestinal illness syndrome	Not applicable
Severe Illness or Death potentially due to infectious disease	ACUTE onset of shock or coma from potentially infectious causes EXCLUDES shock from trauma INCLUDES SUDDEN death, death in emergency room, intrauterine deaths, fetal death, spontaneous abortion, and still births EXCLUDES induced fetal abortions, deaths of unknown cause, and unattended deaths	Not applicable

Source: Centers for Disease Control and Prevention, Atlanta.

a phase of relative infancy, and must await the development of more sophisticated models. For example, syndromic surveillance systems for bioterrorism are limited in their ability for early detection of single cases or small outbreaks. In such cases, early clinical manifestations of diseases that may be due to terrorism are common and nonspecific. Individual case detection and follow-up investigation of all people with nonspecific syndromes that could be due to one of the terrorism agents would put unreasonable demands on public health staff, the CDC framework draft emphasizes.

"At this stage, syndromic surveillance is most useful for large outbreaks, the catastrophic kinds of events," Sosin explains. "It is very important to us to detect [those] at an early stage, so it doesn't diminish the potential role of syndromic surveillance. But for detecting 11 cases of inhalational anthrax, it is not very practical; because at the early stages, it presents like an upper-respiratory infection that is fairly common. We don't want to be triggering public health investigations based on very small numbers and individual cases."

That situation might improve over time, as researchers identify health indicators that are more specific to particular bioterrorism agents. "It will take some time to decipher, to learn what indicators are more sensitive, more specific, and more closely aligned to the kinds of events we are trying to detect," he says. "Improvements in the data sources and improvements in our detection and analytical methods could help us do a better job of weeding out the noise from the signals we want to respond to."

(*Editor's note: The CDC encourages review and comment on its syndromic surveillance framework document at* www.cdc.gov/epo/dphsi/syndromic.htm. *If you would like to share comments, suggestions, and relevant examples that could be used to strengthen the CDC framework document, send them to Daniel M. Sosin, MD, MPH, Director, Division of Public Health Surveillance and Informatics Epidemiology Program Office, Centers for Disease Control and Prevention, Mailstop K-77, 4771 Buford Highway N.E., Atlanta, GA 30341-3717.)*

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1. Centers for Disease Control and Prevention. *Syndrome Definitions for Diseases Associated with Critical Bioterrorism-Associated Agents.* Atlanta; 2003. Web: www.bt.cdc.gov/surveillance/syndromedef/index.asp.
2. Centers for Disease Control and Prevention. *Draft Framework for Evaluating Syndromic Surveillance Systems for Bioterrorism Preparedness.* Atlanta; 2003. Web: www.cdc.gov/epo/dphsi/syndromic/framework.htm.
3. Department of Defense, Global Emerging Infections System. *ESSENCE: Electronic Surveillance System for the Early Notification of Community-based Epidemics.* Washington, DC. Web: www.geis.ha.osd.mil/geis/surveillanceactivities/essence/essence.asp. ■

Hospitals lack medical equipment for bioterror

Alliances may be solution to vent shortage

While most urban hospitals across the country reported participating in basic planning and coordination activities for bioterrorism response, they do not have the medical equipment to handle the number of patients that would be likely to result from a bioterrorism incident, according to a report by the General Accounting Office (GAO).[1]

Hospitals reported they lacked the equipment needed for a large influx of patients. For instance, if a large number of patients with severe respiratory problems associated with anthrax or botulism arrived at a hospital, a comparable number of ventilators would be required to treat them. Yet half of the hospitals reported having fewer than six ventilators per 100 staffed beds.

Almost all hospitals reported participating in a local, state, or regional interagency disaster preparedness committee. In addition, most hospitals reported having provided at least some training to their personnel on identification and diagnosis of disease caused by biological agents considered likely to be used in a bioterrorism attack, such as anthrax or botulism. In contrast, fewer than half of hospitals have conducted drills or exercises simulating response to a bioterrorism incident.

To obtain information on the extent of hospital bioterrorism preparedness, the GAO conducted a survey between May and September 2002, of 2,041 urban hospitals across the country that have emergency departments (EDs). Overall, 1,482 (73%) of the hospitals responded to the survey. In general, larger hospitals reported more planning and training activities than smaller hospitals. The resources that hospitals and their EDs would require for responding to a large-scale bioterrorism attack are far greater than those needed for everyday use. The specific equipment, supplies, and facilities needed could vary depending upon what type of attack occurred, but many scenarios anticipate the demand for health care could quickly outstrip the ability of hospitals to respond.

Regional plans can help address capacity deficiencies by providing for the sharing among hospitals and other community and state agencies and organizations of resources that, while adequate for everyday needs, may be in short supply on a local level in an emergency. Many of the capabilities required for responding to a large-scale bioterrorism attack are required for responses to naturally occurring disease outbreaks. Such a dual-use response infrastructure improves the capacity of local public health agencies to respond to all hazards, the GAO reported.

Reference

1. General Accounting Office. *Most Urban Hospitals Have Emergency Plans but Lack Certain Capacities for Bioterrorism Response.* Web: www.gao.gov/new.items/d03924.pdf. ■

Smallpox vaccine may confer immunity to HIV

Cross-immunity between disparate viruses

Could smallpox — the historic scourge of mankind and still the most feared of the bioterror agents — be a major weapon against the global HIV epidemic? Might fire be fought with fire? As provocative as that sounds, a bioterrorism researcher is building a case that smallpox historically may have blocked the emergence of HIV and vaccinia may now provide the basis for a vaccine against the AIDS virus.

An epidemiological review of the emergence of HIV-1 in Sub-Saharan Africa and the eradication of smallpox in the same region suggests a correlation between the two, implying the possibility of a cross-immunity between these widely disparate viruses, says **Raymond S. Weinstein**, MD, a researcher at the National Center for Biodefense at George Mason University in Manassas, VA.[1]

As smallpox was eliminated as a natural disease and human immunity waned, HIV was no longer held in check and began to emerge and infect the human population, he theorizes.

Studies that have looked a the emergence of HIV-1 and HIV-2 support the theory. Both variations of HIV probably first appeared around 1940 (plus or minus 20 years), he notes.

"What are the chances of two different viruses emerging in two different locations within the same decade that are derived from viruses that have been around for thousands of millennia?" he asks *Bioterrorism Watch*. "It's an awfully big coincidence. However, if you [postulate] that smallpox was suppressing the emergence of HIV — which actually did exist in extremely low numbers — then you can see that stopping the

[smallpox] immunizations and loss of immunity to smallpox is what allowed HIV to spread."

Weinstein has tested the hypothesize in one study involving 20 volunteers and now is attempting to replicate the results in a larger group of 60 test subjects. The researcher and colleagues are testing the susceptibility to HIV-1 infection in peripheral blood mononuclear cells (PBMCs) from subjects recently immunized with the vaccinia virus.

"The hardest part is finding the subjects and getting them together to get fresh blood because it doesn't work with frozen blood," he says. "We found that [PBMC] cells from individuals that were vaccinated within the previous three to nine months were resistant to infection with HIV. We don't know yet what the mechanism is, but it may be that in patients who haven't been infected it may prevent infection. Or some patients may get infected, but [smallpox vaccination] prevents progression [of HIV]."

Results demonstrate that immunization resulted in a fourfold reduction in viral replication with macrophage- (CCR5) tropic HIV-1, but not with T-cell- (CXCR4) tropic virus. This reduction in R5-HIV replication was further enhanced when autologous serum was added to the cell cultures. Since the vast majority of new HIV-1 infections are with an R5 tropic strain, these findings suggest that vaccinia immunization might be a new useful tool in the fight against the worldwide HIV pandemic, Weinstein emphasizes.

In particular, evolutionary pressure from naturally occurring smallpox disease appears to have spurred the development of a genetic mutation called CCR5 Delta 32, he explains.

"People who have that mutation are resistant to HIV. They are not just long-term survivors, but people who have multiple exposures and never become infected. It was the constant pressure from smallpox that [prompted] the success of that [mutation] It started as a single mutation somewhere between 800 and 1200 years ago in Northern Europe," Weinstein says.

"Now, one out of 10 people has it. It protected them against smallpox, but now that there is no smallpox, we are finding that it protects them against HIV, too," he adds.

CE/CME *questions*

5. Syndromic surveillance systems may use which of the following data sources?
   A. diagnostic codes
   B. emergency department logs
   C. nurse call lines
   D. all of the above
6. According to Raymond Weinstein, MD, historic evidence and ongoing studies suggest that smallpox and HIV may have:
   A. cross-immunity
   B. evolved from the same virus
   C. been originally developed as bioweapons
   D. all of the above
7. Standard (universal) precautions as practiced with any other mass-casualty incidents (trauma, chemical, biological, etc.) is generally sufficient for protection from radioactive contamination.
   A. true
   B. false
8. According to a GAO survey, which piece of equipment would be in particularly short supply if large influx of patients with severe respiratory problems arrived at a typical urban hospital?
   A. heart monitors
   B. stethoscopes
   C. X-ray equipment
   D. ventilators

If the findings are borne out in subsequent peer-reviewed studies, the possibility exists for an HIV vaccine or treatment based on the vaccina virus (cowpox) vaccine commonly used for smallpox. Also, the researchers are looking at the possibility of eventually using — as yet unapproved — smallpox vaccines that use nonreplicating vaccina for immunization of immunocompromised people.

Reference

1. Weinstein RS, Alibek K, Weinstein MM, et al. Protection against HIV-1 infection in vitro by prior immunization with vaccinia virus. Plenary address abstract. Presented at the First International Conference — Crossing Boundaries: Medical Biodefense and Civilian Medicine. Arlington, VA; November 2003. ■

COMING IN FUTURE MONTHS

- CDC conference on emerging infections
- Laboratory security
- Genetic alteration of pathogens
- Anthrax vaccine: Is it safe?
- Maximize resources with partnerships

Health workers fear nuclear terrorism

Follow standard precautions, decontaminate pts

Hospitals and public health agencies should prepare for the unique features of radiological terrorism, such as mass casualties with blast injuries combined with burns, the Centers for Disease Control and Prevention (CDC) recommends. In guidance posted on its bioterrorism web site on Dec. 31, 2003, the CDC emphasized health care workers may be particularly fearful of radiation incidents and possible exposures.

"While patient care is a top hospital priority, it is vital that hospital personnel are protected from injury and disease while doing their job," the CDC added. "During a mass casualty radiological event, it is likely that hospital personnel will be concerned about radiation contamination. To alleviate their concern, hospital personnel should be educated about the potential health effects resulting from radiation exposure, learn what personal protective equipment they will need for precautionary measures and be trained so they can respond effectively to a radiological incident."

Standard (universal) precautions as practiced with any other mass casualty incidents (trauma, chemical, biological, etc.) generally is sufficient for protection from radioactive contamination. In a particular note about use of masks, the CDC said surgical masks should be adequate if N95 respirators are not available. The respirators should be available in hospitals because they already are recommended for health care worker protection against severe acute respiratory syndrome, TB, and certain other infectious diseases.

"Experience in human decontamination indicates that careful procedures for removing clothing and decontaminating patients prevents aerosolization of radioactive particles, and dosimetry of health care workers using surgical masks has not found evidence of contamination," the CDC stated.

(Editor's note: To see Interim Guidelines for Hospital Response to Mass Casualties from a Radiological Incident, *go to: www.bt.cdc.gov/radiation/pdf/MassCasualtiesGuidelines.pdf.)* ■

CE/CME answers

5. D **6. A** **7. A** **8. D**

CE/CME instructions

Physicians and nurses participate in this CE/CME program by reading the issue, using the provided references for further research, and studying the questions. Participants should select what they believe to be the correct answers, then refer to answer key to test their knowledge.

To clarify confusion surrounding any questions answered incorrectly, please consult the source material. After completing this semester's activity in June/July 2004, you must complete the evaluation form that will be provided and return it in the reply envelope to receive a certificate of completion. When your evaluation is received, a certificate will be mailed to you. ■

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. ■