Anthrax in the air?

Medical & Public Health Response to Environmental Biological Agent Detectors

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The continued threat of bioterrorism and emerging infectious diseases such as SARS, West Nile Virus, and influenza requires new methods of detecting infectious agents and diseases. Two types of federally-funded environmental biological agent detectors have been installed and activated in the San Francisco Bay Area. The BioWatch program continuously collects outdoor air samples, screening the environment for specific aerosolized biological agents. The Biohazard Detection System (BDS) operates within the United States Postal Service, testing envelopes for anthrax. Both BioWatch and BDS utilize Polymerase Chain Reaction (PCR) technology, but their test characteristics are still unknown. However, a positive test would require a highly coordinated, effective medical and public health response. Individual health professionals may provide important medical management and advice for affected patients. Educating and preparing physicians and other health professionals for an infectious disease emergency can save many lives.

In the fall of 2001, *Bacillus anthracis* spores were intentionally sent within envelopes through the United States Postal Service (USPS) mail system. 22 persons were infected—11 cases of inhalation anthrax and 11 cases of cutaneous anthrax. 5 persons died, all from inhalation anthrax. While there have been no intentional anthrax attacks since 2001, the United States military has continued international activities. The possibility of a discrete, domestic bioterrorist act persist. An intentional release of an infectious agent could inflict thousands of deaths in the San Francisco Bay Area, disrupting the lives of millions more. While the United States has spent enormous resources building its military infrastructure, its public health systems and medical providers have only begun preparing for infectious disease emergencies and public health disasters.

The traditional method for detecting infectious outbreaks or epidemics relies primarily on physicians diagnosing symptomatic disease. After a physician diagnoses (or suspects) a concerning case, the physician should notify the local health department. If there is an increase or unusual cluster of cases, public health officials may launch an investigation. Medical diagnosis by astute clinicians continues to serve as the most reliable and sensitive method of detecting concerning diseases.

Detecting an infectious agent in the environment may facilitate earlier and more effective health interventions. Responding to an infectious agent before significant exposure or during the incubation period can prevent the onset of symptoms. Localizing the agent to a specific area helps define the exposure geographically. Two types of federally-funded environmental biological agent detectors have been installed and activated in the San Francisco Bay Area. The BioWatch program continuously collects outdoor air samples, screening the environment for several harmful aerosolized biological agents. The Biohazard Detection System (BDS) operates within the United States Postal Service Mail Processing and Distribution Center, testing envelopes for anthrax.

The BioWatch program began analyzing air samples in major urban areas in 2003. Specialized BioWatch air sampling devices are mounted on existing outdoor air quality monitors. The air sampling filters are

retrieved and transported daily to a local CDC-coordinated laboratory for PCR analysis. If a biological pathogen is detected, the laboratory performs a second PCR test for confirmation. A culture may also be initiated to assess viability and antimicrobial sensitivities. A confirmed positive result would initiate a BioWatch response from local, state, and federal agencies. There have been several positive BioWatch results in the first two years of this nationwide program. However, the signals reflected the background prevalence of naturally-occurring organisms in the environment. These BioWatch signals suggest a high sensitivity for detecting biological agents, but also illustrate that the system does not specifically detect only intentional bioterrorist attacks. While public health departments nationwide have begun developing local response plans for a positive BioWatch signal, the Department of Homeland Security is already planning for additional outdoor monitors and new indoor monitors for selected buildings and events.

The United States Postal Service is deploying Biohazard Detection Systems (BDS) within its Mail Processing and Distribution Centers throughout the nation to protect its employees and mail system from anthrax. The only Processing and Distribution Center in San Francisco, located on 1300 Evans Avenue in the Bayview district, implemented eleven BDS devices on its mail processing machines in October 2004. BDS samples the air from envelopes, then PCR technology within the BDS device detects the presence of anthrax. Fortunately, there have been no positive BDS signals in the first months of the BDS program nationwide. However, testing many envelopes for an extended period of time may eventually result in a false positive or a true positive result. Any positive signal for BDS would activate a building alarm, evacuation, public health, and other emergency response.

A positive signal from BioWatch or BDS would elicit an enormous public health, law enforcement, and other emergency services response. Local and national news media will report quickly, visible by the recent, highly publicized false alarm in a Pentagon mail facility. The Department of Defense uses a biological detection system similar to BDS for its mail system. In March 2005, a positive signal from the Pentagon detectors activated a disorganized emergency response and national news coverage, resulting in widespread unrest among the public. The signal was later determined to be a false alarm. The San Francisco Department of Public Health is collaborating closely with the USPS and emergency responders to develop an effective city-wide response plan. The response plan includes evacuation, personal decontamination, mass prophylaxis, risk communication, hospital and health provider alerts, and mobilization of the Strategic National Stockpile of antibiotic medications, if necessary. Preparing the public health and medical response to an unpredictable, massive bioterrorism attack is difficult—thus, collaborating with community physicians is crucial.

Office-based and hospital-based physicians have an important role after the detection of a bioterrorism agent in the air or within the mail system. Many patients will be concerned about exposure risks. Some may seek appropriate decontamination and prophylactic antibiotics. The event may precipitate anxiety-related mental health disorders. Because the public health system and local hospitals may be quickly overwhelmed, community physicians should provide appropriate medical advice and medical management for their patients after a bioterrorism attack. If a BDS Alert occurs at the United States Postal Service Mail Processing and Distribution Center, employees inside the facility would undergo evacuation and appropriate decontamination with soap and water. The USPS would distribute a 10 day supply of ciprofloxacin tablets or doxycycline for exposed employees. Employees will be instructed to begin taking the antibiotics only if confirmatory tests from the State Laboratory are positive. Employees and visitors who left the Mail Processing and Distribution Center at 1300 Evans Avenue within 90 minutes before the BDS alarm would be instructed to remove and bag their clothes, shower with soap and water, then consult their community health provider. A health professional should prescribe prophylactic antibiotics if a patient meets the criteria for a potential exposure to confirmed anthrax. The San Francisco Department of Public Health will provide immediate notification to hospital emergency departments, and additional guidance to physicians and hospitals through its Health Alerts and internet website www.sfdph.org.

Physicians and other health professionals can prepare themselves for their important roles during a bioterrorism threat. As BDS continues and new BioWatch monitors are deployed in the San Francisco Bay Area, more patients may ask their physicians questions about biological agents and detectors. The USPS and San Francisco Department of Public Health have begun educating the USPS Mail Processing and Distribution Center employees about the BDS devices and public health response. Employees are instructed to contact their physician if they have questions regarding their medical conditions or other precautions to taking either ciprofloxacin or doxycycline. If a patient has contraindications or precautions to taking either antibiotic, physicians should clearly explain the medical issues. Written information may help employees remember their pertinent medical issues during the anxious moments after a biological threat.

Major disasters can inflict significant morbidity. An intentional biological attack may cause deadly implications for thousands of people. Environmental biological agent detectors are new tools for early detection of and response to infectious disease outbreaks. These detectors are not perfect, but will nevertheless be increasingly activated across the nation. Working together, public health and medical professionals must seize these opportunities to prepare for a coordinated response that saves lives.

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