Bioterrorism: Challenges for Public Health Action

Eric K. Noji, M.D., M.P.H.
Associate Director for Bio-Emergency Response
Bioterrorism Preparedness and Response Program
National Center for Infectious Diseases
Centers for Disease Control and Prevention
Definition of Biological Terrorism

The use or threatened use of biological or biologically-related toxins against civilians, with the objective of causing illness, death or FEAR.
Biological Terrorism - A New Trend?

- 1984: Oregon, Salmonella
- 1991: Minnesota, Ricin toxin
- 1994: Tokyo, Sarin and biological attacks
- 1995: Ohio, Yersinia pestis
- 1997: Washington DC, Anthrax hoax
- 1998: Nevada, nonlethal strain of B. anthracis
- 1999: Numerous Anthrax hoaxes
Anthrax Threats Reported to FBI

* first four months of 1999

Source: M. Lyons, CDC from FBI personal communication
Public Health Response to Bioterrorism

- Detection & surveillance
- Rapid laboratory diagnosis
- Epidemiologic investigations
- Implementation of control measures
Specific Role of Epidemiologist In Response to Bioterrorism

- Rapid on-scene response
- Knowledge of potential BT infectious diseases
- Rapid implementation of surveillance system
- Work closely with FBI and laboratory
- Rapid etiologic diagnosis
Critical Agents

• *B. anthracis* (anthrax)
• *Y. pestis* (plague)
• *F. tularensis* (tularemia)
• Filo and Arena viruses (viral hemorrhagic fevers)
• *Cl. botulinum* toxin (botulism)
• *V. major* (smallpox)
Why These Agents?

- Infectious via aerosol
- Organisms fairly stable in aerosol
- Susceptible civilian populations
- High morbidity and mortality
- Person-to-person transmission (smallpox, plague, VHF)
- Difficult to diagnose and/or treat
- Previous development for BW
Smallpox: Overview

- 1980 - Global eradication
- Humans were only known reservoir
- Person-to-person transmission (aerosol/contact)
- Up to 30% mortality in unvaccinated

CDC - Variola major
Smallpox: Clinical Features

- **Prodrome (incubation 7-17 days)**
  - Acute onset of fever, malaise, headache, backache, vomiting
  - Transient erythematous rash

- **Exanthem**
  - Begins face, hands, forearms
  - Spread to lower extremities then trunk over ~7 days
  - Synchronous progression: macules --> vesicles --> pustules --> scabs
  - Lesions on palms/soles
Epidemiological Pattern of Smallpox Weapon

- New foci of secondary infection
- “Contaminated” zone
- Zone of initial explosion
- “Infected” zone
Plague: Bubonic

• Incubation: 2-6 days
• Sudden onset HA, malaise, myalgia, fever, tender LNs
• Regional lymphadenitis (Buboes)
• Cutaneous findings
  – possible papule, vesicle, or pustule at inoculation site
  – Purpuric lesions - late

CDC
Plague: Pneumonic

- Incubation: 1-3 days
- Sudden onset HA, malaise, fever, myalgia, cough
- Pneumonia progresses rapidly to dyspnea, cyanosis, hemoptysis
- Death from respiratory collapse/sepsis
Anthrax: Inhalational

- Inhalation of spores
- Incubation: 1 to 43 days
- Initial symptoms (2-5 d)
  - Fever, cough, myalgia, malaise
- Terminal symptoms (1-2d)
  - High fever, dyspnea, cyanosis
  - Hemorrhagic mediastinitis/effusion
  - Rapid progression shock/death
- Mortality rate ~ 100% despite Rx

CDC
Public Health Response to Bioterrorism

- Detection & surveillance
- Rapid laboratory diagnosis
- Epidemiologic investigations
- Implementation of control measures
Public Health Role in Bioterrorism

“Detect and control the epidemic”
Bioterrorism

Surveillance

• Early, rapid recognition of unusual clinical syndromes or deaths & of increase above “expected levels” of common syndromes, diseases, or death

• Rapid etiologic diagnosis

• Rapid response
Bioterrorism Surveillance

- Key features
  - Real time data ➔ real time epidemiology
  - Syndrome-based reporting
  - Sentinel surveillance sites
  - Pro-active (high profile potential target events, ongoing surveillance in sentinel sites)
  - Reactive (monitoring and response)
  - Aberration Detection
BT: Timeliness is the Key to Success

- Go to the source
- Increase awareness of BT in medical community to improve rapid reporting of:
  - Suspect cases potentially BT-related unusual clusters of disease, in time or space unusual manifestations of disease or unusual disease or symptoms for the geographic area
Close Cooperation with clinicians, healthcare and first responder communities

- Emergency departments, urgent care centers
- Infection control units
- Physician networks, private offices
- Hospitals, HMOs
- Medical examiners
- Poison control
- Law enforcement, fire, other first responders
Bioterrorism: Potential Data Sources

- Laboratories
- ID Specialists
- Hospitals
- Physician’s offices
- Poison control centers
- Medical Examiners
- Death Certificates
- Police/Fire departments
- Other “first responders”
- Pharmacy data
Syndrome Surveillance

• The monitoring of illnesses based upon a constellation of symptoms and/or findings
• Provides an “early warning system” for outbreaks, emerging pathogens
• Highly sensitive, seasonal specificity varies
• E.g., Fairfax Hospital report
Likely BT Agents: Initial Symptoms

• Agents
  – Anthrax
  – Plague
  – Q-fever
  – Tularemia
  – Smallpox

• Initial Symptoms
  – Fever
  – Cough
  – Malaise
  – Headache
Examples of Syndromes for Surveillance

• Unexplained death w/ history of fever
• Meningitis, encephalitis or unexplained acute encephalopathy/delirium
• Botulism-like syndrome (cranial nerve impairment and weakness)
• Rash and fever
• Non-pneumonia respiratory tract infection w/ fever
• Diarrhea/Gastroenteritis
• Pneumonia
• Sepsis or non-traumatic shock
Ideal Sentinel Surveillance System

• Geographically representative
• Data categorized by syndrome
• Data computerized, readily available - “real time”
• Sensitive alert “thresholds” can be established, based on historical data
• Response protocols in place to evaluate causes of “alerts”
Recommendations

• It may not be prudent to await diagnostic laboratory confirmation
  – it may be necessary to initiate a response based upon the recognition of high-risk syndromes
  – develop mechanisms to evaluate institutional trends of high-risk syndromes
  – develop laboratory protocols for notification of infection control/hospital epidemiologist for “suspect” cultures or tests
Current Challenges

- Real-time transmission and analysis
- Identification of localized clusters
- Sustainability of surveillance system
- Development of response protocols
Unanswered Questions

• What is the threshold that initiates response
• What is the sensitivity and specificity of surveillance systems
• Usefulness and feasibility of aggregate data from hospital admissions, ICD-9 codes on a large scale
• Future: data electronically collected, integrated, evaluated and shared in a “real time” fashion (?)
The detection and control of saboteurs are the responsibilities of the FBI, but the recognition of epidemics caused by sabotage is particularly an epidemiologic function. Therefore, any plan of defense against biological warfare sabotage requires trained epidemiologists, alert to all possibilities and available for call at a moment’s notice anywhere in the country.”

Alexander Langmuir
Founder of CDC EIS Program
1952
Centers For Disease Control and Prevention
Bioterrorism Preparedness and Response Program (BPRP)
Atlanta, Georgia  30033

770-468-7100