Preparing for and Responding to Bioterrorism

Information for the Public Health Workforce

Anthrax

Developed by
Jennifer Brennan Braden, MD, MPH
Preparing for and Responding to Bioterrorism: Information for the Public Health Workforce

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*This manual and the accompanying MS Powerpoint® slides are current as of Dec 2002. Please refer to http://nwcphp.org/bttrain/ for updates to the material.
Acknowledgements

This manual and the accompanying MS PowerPoint® slides were prepared for the purpose of educating the public health workforce in relevant aspects of bioterrorism preparedness and response. Instructors are encouraged to freely use portions or all of the material for its intended purpose.

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Preventing for and Responding to Bioterrorism: Information for the Public Health Workforce is intended to provide public health employees with a basic understanding of bioterrorism preparedness and response and how their work fits into the overall response. The course was designed by the Northwest Center for Public Health Practice in Seattle, Washington, and Public Health – Seattle & King County's Communicable Disease, Epidemiology & Immunization section.

The target audience for the course includes public health leaders and medical examiners, clinical, communicable disease, environmental health, public information, technical and support staff, and other public health professional staff. Health officers may also want to review the more detailed modules on diseases of bioterrorism in Preparing for and Responding to Bioterrorism: Information for Primary Care Clinicians: Northwest Center for Public Health Practice (available at http://nwcphp.org/btrain). Public health workers are a very heterogeneous group, and the level of detailed knowledge needed in the different aspects of bioterrorism preparedness and response will vary by job description and community. Therefore, the curriculum is divided into modules, described in Appendix A.
The course incorporates information from a variety of sources, including the Centers for Disease Control and Prevention, the United States Army Medical Research Institute in Infectious Disease (USAMRIID), the Working Group on Civilian Biodefense, the Federal Emergency Management Agency, Public Health – Seattle & King County, and the Washington State Department of Health, among others (a complete list of references is given at the end of the manual). The curriculum reflects the core competencies and capacities outlined in the following documents:


Center for Health Policy, Columbia University School of Nursing. Core public health worker competencies for emergency preparedness and response, April 2001: http://cpmcnet.columbia.edu/dept/nursing/institute-centers/chphsr/


The course is not copyrighted and may be used freely for the education of public health employees and other biological emergency response partners.

Course materials will be updated on an as-needed basis with new information (e.g., guidelines and consensus statements, research study results) as it becomes available. For the most current version of the curriculum, please refer to: http://nwcphp.org/bttrain.
How to Use This Manual

This manual provides the instructor with additional useful information related to the accompanying MS PowerPoint® slides. The manual and slides are divided into six topic areas: Introduction to Bioterrorism, Emergency Response Planning, Diseases of Bioterrorist Potential, Health Surveillance and Epidemiologic Investigation, Consequence Management, and Communications. Links to Web sites of interest are included in the lower right-hand corner of some slides and can be accessed by clicking the link while in the “Slide Show” view. Blocks of material in the manual are periodically summarized in the “Key Point” sections, to assist the instructor in deciding what material to include in a particular presentation. A Summary of Key Points is indicated in bold, at the beginning of each module.

The level of detailed knowledge required may vary for some topics by job duties. Therefore, less detailed custom shows are included in the Emergency Response Planning and Diseases of Bioterrorist Potential: Overview modules for those workers without planning oversight or health care responsibilities, respectively. In addition, there are three Consequence Management modules: for public health leaders, for public health professionals, and for other public health staff (see Appendix A).
Diseases of Bioterrorist Potential

Summary of Key Points
(Listed in slide 25)

1. The most likely presentation of anthrax in a BT attack is **inhalational** disease; cutaneous disease is also possible.
2. Early in the course of illness, inhalational anthrax is not easily distinguished from an influenza-like illness due to other causes.
3. Antibiotic prophylaxis can be used to prevent development of disease in infected persons.
4. Anthrax is not transmitted person to person.

**Slide 1:** Curriculum Title

**Slide 2:** Acknowledgements

**Slide 3:** Module Title

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The learning objectives for this module are:

1. Describe the epidemiology, mode of transmission and presenting symptoms of disease caused by the CDC-defined Category A agents
2. Identify the infection control and prophylactic measures to implement in the event of a suspected or confirmed Category A case or outbreak
Overview (Slide 5)

The causative agent of anthrax is *Bacillus anthracis*, a gram positive, spore-forming bacteria. Anthrax is primarily a disease of herbivores (e.g., sheep, cows), which acquire infection via exposure to *B. anthracis* spores in soil. Humans acquire infection through contact with infected animals or contaminated animal products; hence hunters and textile workers (‘woolsorter’s disease’) have historically been high-risk groups. The last U.S. case of inhalational anthrax, prior to the 2001 outbreak, occurred in a home craftsman and was acquired from imported animal-origin yarn (Suffin et al., Hum Pathol 1978 Sep;9(5):594-7).

Animal vaccination programs have dramatically decreased the number of animal deaths due to anthrax. Industrial hygiene practices and restrictions on imported animal products helped to decrease the incidence of anthrax among humans in the United States. Cutaneous anthrax is the most common natural form of the disease (gastrointestinal anthrax is very rare), but inhalational anthrax is the most likely presentation in a BT attack.
Inhalational Anthrax: Acquisition of Infection (Slides 6-7)

The infectious dose of anthrax for humans is not precisely known. The anthrax outbreak of 2001 and historical data suggest that the infectious dose may vary, with increasing patient age and underlying medical conditions corresponding to increased susceptibility to infection. In addition, infection rates would also be expected to vary according to the preparation method and the ability of a particular preparation of anthrax spores to remain aerosolized in respirable particles. Because anthrax prepared for use as a weapon may employ particularly virulent organisms, the infectious dose may be lower than in naturally occurring infection. Inhalational anthrax follows the deposition of 1 to 5 µm spore-bearing particles into alveolar spaces (the spore is approximately 1 µm. The greatest risk for contracting inhalational anthrax after an aerosol attack occurs after primary aerosolization (i.e., before particles hit the ground, probably within one day, depending on environmental conditions and the chemical properties of the aerosol). Secondary aerosolization is thought to be unlikely, since these particles will be primarily large in size (> 5µm) and require much energy to be re-suspended.

Re-aerosolization is dependent on several factors, including the characteristics of the aerosolized particles, the environmental surfaces, and human and mechanical activity occurring in the affected area.
Key Points (Slides 8-14)

1. Inhalational anthrax begins with a nonspecific “flu-like” prodrome followed within two to five days by a rapid progression to respiratory failure, shock, and possibly death.

2. Although historically most cases were fatal, early and aggressive treatment can improve patient outcome.

3. The cutaneous anthrax lesion progresses from a papule to a painless black eschar with surrounding edema.

4. Nasal swabs are of limited utility in epidemiologic investigations for defining the extent and patterns of exposure among populations, but do not provide information useful in the clinical management of patients.

Case Definition (Slides 8-10)

The case definition for anthrax is found in slides 8 and 9. The clinical presentation of disease may differ from typical in a biological attack, depending on the concentration and route of exposure and the presence of engineered or otherwise modified organisms. The case definition used following a biological attack, therefore, may need to be modified.

In the 2001 anthrax outbreak, gastrointestinal symptoms proved to be as common in the initial presentation as respiratory symptoms (9/10 cases had a cough; 9/10 cases had nausea or vomiting). All cases had an abnormal chest radiograph (x-ray), but only 7/10 had the classic mediastinal widening. Findings on chest x-ray consistent with a pneumonia-like picture (consolidation, infiltrates, pleural effusion) were as, or more, common than mediastinal widening (7/10 had mediastinal widening, 8/10 had pleural effusions). Computed tomography (CT) scan of the chest was a more sensitive test for abnormalities in the chest cavity. The clinical features of inhalational anthrax summarized in slides 11 and 12 incorporate information gained from the 2001 outbreak.
Slide 10 lists laboratory criteria for the diagnosis of anthrax. Nasal swabs are neither sensitive nor specific for anthrax infection and are not useful in clinical case management. They are of limited utility in epidemiologic investigations for defining the extent and patterns of exposure among populations, but do not provide information useful in the clinical management of patients. Confirmatory testing for anthrax should be performed under Biosafety Level 2 (BSL-2) conditions.
Inhalational Anthrax: Clinical features (Slides 11-12)

The next two slides summarize the clinical features of inhalational anthrax. The incubation period ranges from 1-43 days and may be relatively short if the inhaled dose is very high, or greater than a month under some circumstances, such as low inoculum or premature discontinuation of treatment. Typically, symptoms appear two to five days after exposure. The first stage of illness consists of nonspecific flu-like symptoms and lasts hours to a few days. The second stage comes on abruptly and progresses quickly. Historically, cases were nearly always fatal. Outcome in the 2001 anthrax outbreak was better than previously observed with a 45% case fatality rate (5 deaths/11 cases)(slide 16). Several possible reasons exist for the improved survival rate observed, including differences in host resistance (most cases were middle-aged and relatively healthy), early recognition and initiation of treatment, the use of a combination of antibiotics effective against anthrax, and better supportive care.
**Cutaneous anthrax** (Slides 13-14)

Cutaneous anthrax is the most common naturally occurring form of anthrax and may occur in a BT attack (as was seen in the 2001 “anthrax letter” cases). The clinical presentation is summarized in slide 13. The photo on the right shows an anthrax eschar (necrotic ulcer).

Slide 14 shows four stages of a cutaneous anthrax lesion.

On day seven, there is a depressed black eschar with minimal erythema and swelling. By day 10-12, the eschar is drying, and the edema and erythema have disappeared. The photo in the right lower corner of the slide shows another anthrax lesion on day 15; there is an area of hard necrosis that is beginning to separate from the surrounding tissue.
BT-Related Anthrax (Slides 15-17)

Key Points

1. Symptoms, signs, and epidemiologic clues can help determine the likelihood of anthrax in a patient with flu-like illness.

2. The differential diagnosis for inhalational anthrax includes influenza, other community-acquired respiratory tract illnesses, and pneumonia.

Slide 15 shows the epidemiological curve (graph of cases by date of onset and location) for the 2001 bioterrorism-associated anthrax cases. The y-axis indicates the number of cases (cutaneous and inhalational); the x-axis, the date of illness onset for each case (September 17-November 14); the colored blocks denote the location of the cases (New York City, District of Columbia, New Jersey, Florida, Connecticut); and the white arrows denote inhalational anthrax cases.

The curve illustrates several epidemiological clues of a BT incident:

- Claims* by a terrorist or aggressor of a release of anthrax (The letters contained a threat of anthrax exposure.)
- Illness in persons with a common ventilation system or other exposure (All but two of the cases were postal workers, mail handlers, or sorters or individuals who processed, handled, or received letters containing B. anthracis spores.)
- Cluster of cases with a similar or unusual syndrome
- Severe disease
- Atypical route of transmission (inhalational vs. cutaneous)
Differential Diagnosis (Slide 16)

The differential diagnosis for inhalational anthrax includes influenza and other influenza-like illnesses and other causes of community-acquired pneumonia. Slide 16 compares signs and symptoms of the first 10 inhalational anthrax letter cases with laboratory-confirmed influenza and influenza-like illness (ILI) from other causes [MMWR. November 9, 2001;50(44)]. There are no specific clinical signs or symptoms that differentiate inhalational anthrax from influenza-like illness, but some patterns can be observed. Sore throat and rhinorrhea were relatively uncommon in the 10 inhalational anthrax cases, but are fairly common in ILI from other causes. On the other hand, nausea/vomiting, shortness of breath, and chest discomfort were fairly common among the inhalational anthrax cases, but are uncommon in ILI due to other causes.

Outcome in the 2001 anthrax outbreak was better than previously observed with a 45% case fatality rate (5 deaths/11 cases)(slide 17).
Anthrax Treatment and Post-Exposure Prophylaxis
(Slides 18-22)

Key Points

1. Antibiotic treatment and prophylaxis for anthrax should be continued for at least 60 days to prevent the development of disease from germinating spores.

2. Inhalational anthrax is not transmitted person to person, and thus, only standard precautions are necessary.

3. Dressings used to cover cutaneous lesions should be treated as biohazard waste.

Isolation of inhalational anthrax cases is not necessary, due to the lack of person-person transmission. There is a theoretical possibility of transmission of infection from cutaneous anthrax lesions, therefore covering the area with a dressing that is then disposed of as biohazard waste is recommended. A shorter course of antibiotic therapy (7-10 days) can be given in cases of naturally occurring cutaneous anthrax without potential aerosol exposure. In the context of bioterrorism, however, an unrecognized aerosol exposure is possible, and thus, treatment is recommended for the entire 60 days. Intravenous antibiotics is indicated for more extensive disease, head, and neck lesions, and signs and symptoms of systemic infection.
Post-exposure prophylaxis (PEP) is outlined in slides 19-22. Antibiotic prophylaxis should be continued for at least 60 days. Animal studies have demonstrated viable spores in mediastinal lymph nodes as far out as 100 days post-exposure. The limited data available to assess the magnitude of risk beyond 60 days, led CDC to offer an additional 40 days of PEP to those exposed during the 2001 anthrax outbreak. The CDC program for use of the anthrax vaccine as additional prophylaxis in individuals exposed during the 2001 outbreak is outlined in slides 20-22. Both of the additional options are considered investigational.
Anthrax Vaccine (Slides 23-24)

An anthrax vaccine is available through CDC under investigational new drug protocol (although in limited supply) for the post-exposure prophylaxis of persons exposed to anthrax in the setting of a biological attack. The vaccine is routinely recommended for persons processing *B. anthracis* cultures or other workers engaged in activities with high potential for *B. anthracis* aerosol production. The human vaccine is created from a cell-free filtrate of *B. anthracis* culture and is different from the live-virus animal vaccine, not considered sufficiently safe for humans. Primary vaccination consists of three subcutaneous injections at 0, 2, and 4 weeks, and three booster vaccinations at 6, 12, and 18 months. To maintain immunity, the manufacturer recommends an annual booster injection.
Side effects of the vaccine are usually mild and self-limited. The anthrax vaccine was suggested as a possible cause of illness in Persian Gulf War veterans, but a CDC evaluation did not find a specific association between anthrax vaccination and self-reported illness. An Institute of Medicine Report (Gulf War and Health: Volume 1. Depleted Uranium, Pyridostigmine Bromide, Sarin, and Vaccines, 2000) concluded that there is “inadequate/insufficient evidence to determine whether an association does or does not exist between anthrax vaccination and long-term adverse health effects.”

**Summary of Key Points** (Slide 25)

**Case Reports**
Slide 26 contains links to reports describing anthrax outbreaks.
Resources (Slides 27-29)

- Centers for Disease Control & Prevention


- Johns Hopkins Center for Civilian Biodefense Studies [http://www.hopkins-biodefense.org](http://www.hopkins-biodefense.org)


- St. Louis University Center for the Study of Bioterrorism and Emerging Infections [http://bioterrorism.slu.edu](http://bioterrorism.slu.edu)

- Public Health - Seattle & King County [http://www.metrokc.gov/health](http://www.metrokc.gov/health)

  - Communicable Disease Epidemiology
    - (206) 361-2914 OR
    - (877) 539-4344 (24 hour emergency)

- Association for Professionals in Infection Control [http://www.apic.org/bioterror](http://www.apic.org/bioterror)

- MMWR Rec & Rep: Case definitions under public health surveillance. 1997;46(RR-10):1-55
General Bioterrorism Information and Web Sites


Emergency Response Planning


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**Health Surveillance and Epidemiologic Investigation**

CDC. Case definitions under public health surveillance. MMWR; 1997:46(RR-10):1-55.


List of nationally notifiable infectious diseases.
http://www.cdc.gov/epo/dphsi/phs/infdis.htm


**Diseases of Bioterrorist Potential**

Advisory Committee on Immunization Practices (ACIP). Use of smallpox (vaccinia vaccine), June 2002: supplemental recommendation of the ACIP.

http://www.bt.cdc.gov/ncidod/hip/GUIDE/infectcont98.htm


CDC. Considerations for distinguishing influenza-like illness from inhalational anthrax. MMWR 2001;50(44):984-986.


Working Group on Civilian Biodefense Consensus Recommendations:

Anthrax


**Environmental Sampling and Decontamination**


CDC. Protecting investigators performing environmental sampling for *Bacillus anthracis*: personal protective equipment. http://www.bt.cdc.gov/DocumentsApp/Anthrax/Protective/Protective.asp


CDC. Use of onsite technologies for rapidly assessing environmental *Bacillus anthracis* contamination on surfaces in buildings. MMWR. 2001;50(48):1087.


Environmental Protection Agency. EPA’s role in responding to anthrax contamination. http://www.epa.gov/epahome/hiaanthrax.htm#FORRESPONDERS.


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**Consequence Management**


http://www.cdc.gov/ncidod/EID/eid.htm

CDC. Interim recommendations for the selection and use of protective clothing and respirators against biological agents  
http://www.bt.cdc.gov/Documents/App/Anthrax/Protective/10242001Protect.asp


http://www.journals.uchicago.edu/CID/journal/issues/v34n2/011333/011333.html

**Psychological Aftermath of Trauma**


http://www.psych.org

Department of Health and Human Services, Substance Abuse and Mental Health Services Administration Center for Mental Health Services. Disaster manual for mental health and human services workers in major disasters.  
http://www.mentalhealth.org/cmhs/EmergencyServices/fpubs.asp

**Communication and Informatics**

Agency for Toxic Substances and Disease Registry. A primer on health risk communication principles and practices.  
http://www.atsdr.cdc.gov/HEC/primer.html


Covello T, Peters RG, Wojtecki JG, Hyde RC. Risk communication, the West Nile Virus epidemic, and bioterrorism: responding to the communication challenges posed by the intentional or unintentional release of a pathogen in an urban setting. J Urban Health: Bulletin of the NY Academy of Medicine 2001;78(2):382-391.

Appendix A: Modules (MS® Powerpoint files)

**Introduction to Bioterrorism**
One module (33 slides)

**Emergency Response Planning**
One module, with one custom show for personnel without planning oversight responsibilities
- Public health leaders (36 slides)
- Other public health staff (24 slides)

**Diseases of Bioterrorist Potential**
Six modules

- Overview (25 slides, with 20-slide custom show for staff without health care responsibilities)
- Anthrax (29 slides)
- Smallpox (44 slides)
- Plague and Botulism (33 slides)
- Tularemia and VHF (38 slides)
- Environmental Sampling and Decontamination (43 slides)

**Health Surveillance & Epidemiologic Investigation**
One module (32 slides)

**Consequence Management**
Three modules
- Public health leaders (51 slides)
- Public health professional staff (51 slides)
- Other public health staff (30 slides)

**Communication & Informatics**
One module (42 slides)
Appendix B: Glossary

**Bulbar:** Referring to the cranial nerves

**Coagulopathy:** A disease affecting the coagulability (clotting) of the blood

**Confluent:** Joining, running together

**Conjunctivitis:** Inflammation of the conjunctiva; “red eye”

**Depigmentation:** Loss of pigmentation (color)

**Diplopia:** Double vision

**Dyspnea:** Shortness of breath

**Edema:** An accumulation of an excessive amount of watery fluid in cells or tissues

**Enanthem:** A mucous membrane eruption (rash)

**Epistaxis:** Nose bleed

**Erythema:** Redness

**Eschar:** A thick, coagulated crust or slough

**Exanthem:** A skin eruption (rash) occurring as a symptom of an acute viral or coccal disease

**HAZMAT:** Hazardous materials management; HAZMAT workers respond to discharges and/or releases of oil, chemical, biological, radiological, or other hazardous substances.

**Hematemesis:** Vomiting of blood

**Hemoptysis:** Coughing up blood

**Hemorrhagic mediastinitis:** Bloody inflammation in the chest cavity

**Hypotension:** Low blood pressure

**Indolent ulcer:** Chronic ulcer, showing no tendency to heal

**Leukocytosis:** Elevated white blood cell count

**Lymphadenitis:** Inflammation of a lymph node or lymph nodes
**Lymphadenopathy:** A disease process (e.g., swelling) affecting a lymph node or nodes

**Macule:** A small, discolored patch or spot on the skin, neither elevated above nor depressed below the skin's surface

**Malaise:** General ill feeling

**Myalgia:** Muscle aches

**Papule:** A small, circumscribed solid elevation on the skin

**Percutaneous:** Denoting the passage of substances through unbroken skin; passage through the skin by needle puncture

**Petechiae:** Pin-head sized hemorrhagic spots in the skin

**Pharyngitis:** Inflammation of the tissues of the pharynx; “Sore throat”

**Pleuropulmonary:** Relating to the pleura and the lungs

**Preauricular:** Anterior to the auricle of the ear

**Prodrome:** An early or premonitory symptom of a disease

**Prophylaxis:** Prevention of a disease, or of a process that can lead to disease

**Prostration:** A marked loss of strength, as in exhaustion

**Pustule:** A small circumscribed elevation of the skin, containing purulent material

**Sepsis:** The presence of various pus-forming and other pathogenic organisms, or their toxins, in the blood or tissues

**Stomatitis:** Inflammation of the mucous membrane of the mouth

**Vesicle:** A small, circumscribed elevation on the skin containing fluid (i.e., blister)

*Reference: Stedman’s Medical Dictionary, 26th Ed.*
In the wake of the 2001 anthrax attacks, thousands of people and organizations across the country have scrambled for information on how to protect themselves, their families, and their employees from anthrax and other potential agents of bioterrorism. Health officials have been flooded with requests to deliver presentations on bioterrorism preparedness and response at community forums, clinical conferences, business meetings, and other public venues. Potential instructors and trainers, however, have been handicapped by the lack of up-to-date, basic orientation resources on bioterrorism preparedness and response.

*Preparing for and Responding to Bioterrorism: Information for the Public Health Workforce* is a series of train-the-trainer resources that addresses the public health aspects of bioterrorism. It is scientifically accurate, up-to-date (as of the date of publication), and immediately relevant to the public health workforce. The series consists of thirteen PowerPoint™ slide sets, each accompanied by a detailed instructor’s manual. The slide sets cover emergency response planning, surveillance and epidemiologic response, diseases of bioterrorist potential, consequence management, and communication and informatics. They are flexible and can be customized for local community needs. Included in each slide set and instructor’s manual is a list of resources, references, and contacts for further information on bioterrorism preparedness and response—before, during, and after an incident.

We hope these resources will help the public health workforce to plan for and respond to public health emergencies, including a bioterrorist attack, and facilitate coordination between public health and other emergency responders.

Cover image: *Bacillus anthracis*

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