PUBLIC HEALTH REFERENCE SHEET
Anthrax

Name	*Bacillus anthracis*
Reservoir & Transmission	Soil, domestic and wild animals cutaneous, inhalation, ingestion, or injection of spores found infected animal parts, biting and non-biting flies
Incubation Period	Cutaneous: 2–6 days, range 1–12 days Inhalation: 1–43 days, up to 8 weeks after exposure Ingestion (Gastrointestinal or Oropharyngeal): 1–6 days Injection: 1–10 days Meningeal: unknown
Common Symptoms	Depends on type of disease (see below)
Gold Standard Diagnostic Test	Culturing *B. anthracis* from clinical specimens (including blood cultures), before starting antibiotic or antitoxin therapy
Risk Groups	Veterinarians, workers involved in industrial processing of hide, wool, or bone; agricultural and wildlife; emergency response
Geographic Significance	Most common in Central and South America, sub-Saharan Africa, Central and Southwestern Asia, and Southern and Eastern Europe

What is anthrax?
Anthrax is a serious disease caused by a spore-forming, gram-positive, rod-shaped bacteria, *Bacillus anthracis.* The bacterium exists in nature in two forms: as a dormant spore or an active growing cell (vegetative form). The spores are tolerant to extremes of temperature, humidity, and ultraviolet light, and survive for up to decades in the environment without nutrients or water. When a spore enters a mammal host, the internal environment of the host—rich in water, sugars, and amino acids—induces that spore to germinate into a vegetative cell that leads to disease. Anthrax is a Category A Bioterrorism agent/disease.

Clinical forms of anthrax include 1) Cutaneous (skin), 2) Inhalation (lung), 3) Ingestion (gastrointestinal or oropharyngeal), 4) Injection (i.e., heroin drug use), and 5) Meningeal.

What is the occurrence of anthrax?
Anthrax is rare in the United States where livestock are vaccinated but does occur in wild and domestic grazing animals like cattle or deer.

How is anthrax transmitted?
Anthrax is not contagious; it is not known to spread from one person to another. Humans can become infected with anthrax when spores enter the body. Spores that enter the body can be activated and become anthrax bacteria, which can multiply and spread in the body, produce toxins, and cause severe illness. For all clinical forms of anthrax, symptoms can appear within 7 days of contact with the spore. For inhalation anthrax, symptoms can appear up to 2 months later.

- Cutaneous Anthrax: spores enter a cut or scrape in the skin (handling contaminated animal products; could occur with an intentional aerosol attack with *B. anthracis*). Cutaneous Anthrax is the most common and considered least dangerous form of anthrax infection. With early antibiotic treatment, most cases are cured. Without treatment, case fatality rate is 5%–20%.

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- Inhalation Anthrax: breathing in spores (during industrial processing of contaminated wool, animal hide or hair; of most concern following an intentional aerosol attack (bioterrorist release) with *B. anthracis*). Inhalation Anthrax is the deadliest form of anthrax infection. With appropriate treatment, about 50% of cases survive. Without treatment, case fatality rate greater than 85%.

- Ingestion Anthrax: eating food or drinking water that is contaminated with vegetative bacteria (raw or undercooked meat from infected animals) more so than aerosolized spores; with treatment, 60% of cases survive; case fatality rate is estimated at 40%. There are 2 subtypes:
    - Gastrointestinal (when anthrax spores germinate in the lower gastrointestinal tract)
    - Oropharyngeal (when anthrax spores germinate in the oropharynx)

- Injection Anthrax: injecting drugs (reported in heroin users). An Injection Anthrax infection may be deep under the skin or in the muscle and spread throughout the body faster and be harder to recognize and treat. Case fatality rate is 20–30%.

- Meningeal: may be a primary manifestation or may complicate any form of anthrax. Most patients with anthrax meningitis have cerebral spinal fluid (CSF) abnormalities consistent with bacterial meningitis, and the CSF is often described as hemorrhagic.

What are the signs and symptoms of anthrax?
Signs of systemic involvement from the dissemination of either the bacteria and/or its toxins can occur with all types of anthrax and include fever or hypothermia, tachycardia, tachypnea, hypotension, and leukocytosis. One or more of these signs are usually present in patients with inhalation anthrax, ingestion anthrax, and injection anthrax and may be present in up to a third of patients with cutaneous anthrax.

- Cutaneous Anthrax: a group of painless small blisters or bumps that may itch and develop into a painless ulcer with a depressed black center (eschar), swelling around the sore. Sores are most often on the face, neck, arms, or hand.

- Inhalation Anthrax: biphasic illness with initial fever, headache, muscle aches, fatigue, mild cough, or chest pain. If untreated, over 3–4 days, disease progresses to respiratory distress, shortness of breath, hypoxemia, cyanosis, diaphoresis, and shock. X-ray evidence of mediastinal widening is present in the majority of cases, and pulmonary infiltrates or pleural effusions are usually observed.

- Ingestion Anthrax: fewer specific symptoms such as fever, fatigue, and headache are common. Cervical lymphadenopathy, altered mental status, and ascites may be observed.
    - Gastrointestinal: initial symptoms nausea and vomiting. May progress rapidly to bloody diarrhea, abdominal pain, swelling of abdomen and shock.
    - Oropharyngeal: fever, ulcers in the back of the mouth and throat, severe sore throat, difficulty or painful swallowing, hoarseness, and swelling of neck or lymph nodes.

- Injection Anthrax: Inflammation or abscess at the injection site may progress to cellulitis or necrotizing fasciitis, or to sepsis without extensive local infection. Fever is not a prominent feature, and pain is less severe than with other serious soft tissue infections. Compartment syndrome may be present. Not all cases have localized injection-related lesions; some cases

presented with features more typical of systemic anthrax infection, including hemorrhagic meningitis and multiorgan failure and coagulopathy.

- Meningeal Anthrax: Primary symptoms include fever, headache (often severe), nausea, vomiting, fatigue. Meningeal signs include altered mental status and other neurological signs (e.g., seizures, focal signs).

How is anthrax diagnosed?
Cutaneous, inhalation, ingestion, and meningeal anthrax can be diagnosed using a combination of microbiology and pathology testing methods. Specimens should be collected for any patient with symptoms compatible with anthrax, with or without a confirmed epidemiological link to a known or high-risk exposure.

Prior to sending specimens, consult with the state health department and contact the Centers for Disease Control and Prevention (CDC) Emergency Operations Center: **call 1-770-488-7100** for an anthrax testing consultation.

How is anthrax treated?
Antibiotics and antitoxins can treat all clinical forms of anthrax. The antibiotics ciprofloxacin or doxycycline can prevent anthrax from developing in people who have been exposed but have not developed symptoms.

Emergency Use Instructions for antibiotic post-exposure prophylaxis of anthrax:
Ciprofloxacin: https://www.cdc.gov/anthrax/public-health/cipro-eui-hcp.html
Doxycycline: https://www.cdc.gov/anthrax/public-health/doxy-eui-hcp.html

Antitoxin may be used after anthrax toxins have been released in the body.

How can anthrax be prevented?
The licensed anthrax vaccine (Anthrax Vaccine Absorbed) helps protect people from anthrax and can help prevent anthrax from developing in people who have been exposed but have not developed symptoms. https://www.cdc.gov/vaccines/vpd/anthrax/hcp/recommendations.html

Pre-exposure anthrax vaccination: recommended for three groups of adults 18–65 years of age who may be at risk for occupational exposure to anthrax, which include laboratory workers who work with anthrax, individuals who handle infected animals, certain U.S. military personnel.

Post-exposure anthrax vaccination: recommended for previously unvaccinated people 18 years or older who have been exposed to aerosolized *Bacillus anthracis* spores.

Bioterrorism: Considerations for anthrax vaccine adsorbed (AVA) post-exposure prioritization final at https://www.cdc.gov/anthrax/pdf/ava-post-event-prioritization-guidance.pdf.

What are some public health considerations?
- Specify the clinical form(s) of the disease.
- Document the anatomical site of infection.
- Document the source of infection if known.
- Note the patient's anthrax immunization history.

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Bioterrorism: Anthrax can be weaponized. In 2001, anthrax was deliberately spread through the U.S. postal system in letters containing anthrax powder. *Bacillus anthracis* is a Tier 1 agent that presents the greatest risk of deliberate misuse with significant potential for mass casualties or devastating effect to the economy, critical infrastructure, or public confidence and poses a severe threat to public health and safety.

References:

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