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Inhalation Anthrax Associated With Dried Animal Hides—Pennsylvania and New York City, 2006

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ON FEBRUARY 21, 2006, THE PENNSYLVANIA Department of Health (PDOH) reported to CDC and the New York City (NYC) Department of Health and Mental Hygiene (DOHMH) a case of inhalation anthrax in a man who resided in New York City. This report summarizes the joint epidemiologic and environmental investigation conducted by local, state, and federal public health, animal health, and law enforcement authorities in Pennsylvania and NYC to determine the source of exposure and identify other persons who were potentially at risk.

On February 16, the patient had traveled from NYC to northern Pennsylvania for a performance with his dance troupe. He collapsed later that evening with rigors and was admitted to a local hospital, where he reported a 3-day history of shortness of breath, dry cough, and malaise. A chest radiograph revealed bilateral infiltrates and pleural effusions.

On February 17, the patient was transferred to a tertiary care center because of worsening respiratory status. All four blood culture bottles grew gram-positive rods. Isolates were sent to the PDOH laboratory and confirmed on February 21 as *Bacillus anthracis* by polymerase chain reaction and susceptibility to lysis by gamma phage. On February 22, CDC identified the isolate as *B. anthracis* genotype 1 by multiple-locus variable-number tandem repeat analysis.[1] Isolates were susceptible to all antimicrobials tested. Preliminary anti-protective antigen (PA) antibody testing by enzyme-linked immunosorbent assay was below the lower limit of quantification of the assay,[2] consistent with early infection. Anti-PA IgG was detectable in the patient's plasma on February 22 and reached a four-fold elevation above the assay reactivity threshold by February 23, thus confirming seroconversion. As of March 14, the patient remained hospitalized in Pennsylvania.

The joint epidemiologic and environmental investigation sought to (1) determine the source of exposure, (2) identify other persons who were exposed and required postexposure prophylaxis, (3) enhance surveillance for additional cases through outreach to the medical community, and (4) provide frequent updates as soon as available and consistent messages regarding risk to the public.

Interviews were conducted with the patient, his family, and his colleagues. The patient made traditional African drums by using hard-dried animal hides (e.g., air-dried until brittle enough to crack) obtained in NYC from importers who primarily sold African goat and cow hides. Making the drums involved soaking hides for 1 hour in water and then scraping hair from the hides with a razor, which reportedly generated a large amount of aerosolized dust in the patient's workspace as the hides dried. The man did not wear any personal protective equipment (e.g., mask or gloves) while working. After working on the hides, he usually returned home to his apartment and immediately removed his clothing and showered.

On December 20, 2005, after a 3-week trip to Côte d'Ivoire, the patient returned to NYC with four hard-dried goat hides wrapped in a plastic bag. He transported them in his van to his storage facility workspace, a windowless unit (12 ft×10 ft×30 ft) with no operating air conditioning or window ventilation. The man did not take the hides to his home. He worked on the last of these hides on February 12, 2006, and cleaned the workspace on February 15.

To confirm the hypothesis that the primary source of exposure to aerosolized *B. anthracis* spores occurred in the workspace and to determine whether the patient's home and van were contaminated, a targeted environmental evaluation was conducted by CDC and NYCDOHMH. Surface wet swab, wet wipe, and vacuum samples were obtained at locations selected to maximize the possibility of detecting *B. anthracis* spores in the patient's residence, van, and workspace. Samples were sent to NYCDOHMH and CDC laboratories, both of which confirmed the presence of *B. anthracis* by culture and polymerase chain reaction; samples sent to CDC were identified as genotype 1 by multiple-locus variable-number tandem repeat analysis. All samples from the workspace were positive for *B. anthracis*, including those from an inactive air conditioning vent 12 feet above the floor. Consistent with secondary contamination, some samples from the patient's apartment (e.g., shoes and entryway) and van (e.g., floorboard) tested positive for *B. anthracis*; others were negative (e.g., most surfaces above ground level). Environmental and epidemiologic findings suggested that the patient's primary exposure to aerosolized *B. anthracis* spores resulted from scraping a contaminated hide in his workspace.

Postexposure prophylaxis for inhalation anthrax was recommended for four persons who had been present in the patient's workspace during procedures that generated aerosols from the animal hides and hair (e.g., mechanical hide manipulation with a razor or sweeping/vacuuming of hairs). As of March 14, interviews and enhanced surveillance had not identified additional cases of suspected or confirmed anthrax. NYCDOHMH provided regular updates on the status of the investigation and informed the public that other persons in the patient's apartment build-

ing or the storage facility where the patient's workspace was located had no risk of contracting inhalation anthrax.

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CDC Editorial Note: This report describes the first case of naturally acquired inhalation anthrax in the United States since 1976.[3] Coordinated epidemiologic and environmental investigations and laboratory analyses indicated that the likely source of infection for this patient was exposure to *B. anthracis* spore–containing aerosols produced by mechanical scraping of a contaminated animal hide in a nonventilated workspace.

B. anthracis spores are present in soil in much of the world, causing infection in herbivorous mammals (e.g., cattle, sheep, goats, or antelope) when they ingest spores from soil. Anthrax can occur in humans exposed to infected animals or tissues such as hides or fur. Anthrax in humans takes one of three forms: cutaneous, gastrointestinal, or inhalation.

Industrial processing of animal hair or hides accounted for 153 (65%) of 236 anthrax cases reported to CDC during 1955-1999 (CDC, unpublished data, 2001). Commercial products made from animal hair or hides accounted for an additional five (2%) cases. The majority of these 158 cases were cutaneous anthrax; only 10 (6%) cases were inhalation anthrax. Improvements in industrial hygiene and introduction of practices such as improved ventilation, decreased use of imported animal materials, and vaccination of at-risk workers helped limit the incidence of industrial inhalation anthrax.[4,5] In contrast, anthrax associated with the handling of individual animal hides is rare.[4] One case of cutaneous anthrax reported in the United States was associated with a goat hide drum purchased in Haiti.[6,7] No reported cases of inhalation anthrax in the United States have been associated with finished animal hide drums.

The U.S. Department of Agriculture regulates the importation of animal products, including animal hides,* although these regulations are not specific to, nor are, in general, the hide import disinfection procedures evaluated for, *B. anthracis*. The safest way to eliminate risk for inhalation anthrax from animal hides or hair is to work only with hides that have been tanned or otherwise treated to render *B. anthracis* spores nonviable. Air drying does not destroy *B. anthracis* spores. If hard-dried hides are used, certain precautions can minimize but not necessarily eliminate exposures to *B. anthracis*, including (1) regularly washing hands thoroughly with soap and warm water, (2) wearing durable protective gloves and a designated pair of shoes in the workspace, and (3) working in a well-ventilated workspace. Spores on hides and tools can be inactivated by heating them to an internal temperature of 158°F (70°C) or by placing them in boiling water for ≥30 minutes.[8] Clothes worn during work should be removed before leaving the workspace and laundered. The workspace should be cleaned using a high-efficiency particulate air vacuum. Workers should avoid vigorously shaking or beating hides, dry sweeping, using compressed air, and working in areas where other persons might be present. CDC does not routinely recommend prophylaxis for persons who have had contact with animal hide drums or animal hides. Drum makers, drum owners, or drummers should report new skin lesions or serious respiratory illnesses to their health-care providers and describe any contact with animal hide drums or animal hides.

A priority for local, state, and federal agencies involved in this investigation was providing updates on the investigation as soon as available and frequent outreach to the public and medical community and to persons who resided in the patient's apartment building or worked at the storage facility. Risk communication emphasized the patient's natural exposure, the rarity of inhalation anthrax, and that exposure risk was limited to persons in the patient's workspace during aerosol-generating procedures. Risk messages also highlighted the absence of any documented risk for inhalation anthrax from environmental contamination of the patient's apartment and workspace, playing or owning African drums, or attending African dance performances.

After the initial diagnosis of inhalation anthrax was made, the rapid epidemiologic response and environmental investigations by public health, animal health, and law enforcement authorities contributed to a prompt understanding of the patient's exposure and possible risk to others. The coordinated responses were critical to minimizing risk for exposure and infection and alleviating concern among the public.

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Enterovirus Surveillance—United States, 2002-2004

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1 figure, 2 tables omitted

ENTEROVIRUSES ARE COMMON VIRUSES associated with diverse clinical syndromes, ranging from minor febrile illness to severe, potentially fatal conditions (e.g., aseptic meningitis, encephalitis, paralysis, myocarditis, and neonatal enteroviral sepsis).[1,2] A total of 68 enterovirus serotypes are recognized, including 65 nonpolio enteroviruses.[1,2] Individual serotypes have different temporal patterns of circulation and can be associated with different clinical manifestations.[2,3] This report describes trends in reported enterovirus infections in the United States during 2002-2004, including widespread circulation of two serotypes, echovirus 9 and echovirus 30, commonly associated with aseptic meningitis outbreaks. Monitoring circulating enteroviruses helped identify these two serotypes as primary causes of aseptic meningitis outbreaks in 2003.[4] Increased state laboratory participation and timely reporting by all laboratories to CDC would further increase the public health utility of enterovirus surveillance.

Other than paralytic poliomyelitis, diseases associated with enterovirus infections are not nationally notifiable in the United States. To help public health officials recognize and control outbreaks of enteroviral disease, the National Enterovirus Surveillance System (NESS) monitors temporal and geographic trends in circulating enteroviruses in the United States. Enterovirus detections, characterized by serotype, specimen type, collection date, and basic demographic information, are reported monthly to CDC by participating laboratories. NESS is a voluntary, passive surveillance system, and the number of participating state laboratories varies from year to year.

During 2002-2004, a total of 24 laboratories, including 22 public health laboratories, one private laboratory, and the CDC Enterovirus Laboratory, reported 4,123 enterovirus detections in 46 states and Puerto Rico. Twenty-one states reported results directly from state public health laboratories, whereas 25 states and Puerto Rico reported results indirectly, either through the private laboratory or the CDC Enterovirus Laboratory. Four states and the District of Columbia did not report any enterovirus detections to NESS. Seven laboratories, an increase from three during 2000-2001, used genomic sequencing for enterovirus typing; 17 laboratories used traditional antigenic methods of serotype detection (neutralization reaction or immunofluorescence assay). Enterovirus serotype was identified in 3,630 (88%) reports and was unknown for 493 (12%) reports.

The two predominant enteroviruses, echoviruses 9 and 30, accounted for more than half of all enterovirus detections in the United States during 2002-2004. Echovirus 9 accounted for 21.5%, 41.0%, and 18.9% of detections with known serotypes during 2002, 2003, and 2004, respectively. Echovirus 30 was uncommon in 2002 (3.3%) but accounted for 32.4% of reports with known serotypes in 2003 and 40.3% in 2004. Echovirus 7 was the most common enterovirus in 2002 (22.5% of reports with known serotypes) but rarely was reported in 2003 and 2004. Coxsackievirus B1 was the third most commonly reported enterovirus in 2002 and 2003 (10.8% and 4.6%, respectively), and coxsackievirus A9 was the third most common serotype (6.9%) in 2004. Other nonpolio enteroviruses were reported infrequently, and no polioviruses were reported. During 2002-2004, echovirus 9 was detected in 41 states and Puerto Rico, echovirus 30 in 38 states and Puerto Rico, and echovirus 7 in 24 states. Three states (Georgia, Illinois, and New York) accounted for 528 (47.8%) of the echovirus 9 detections. The majority (536 [50.7%]) of echovirus 30 detections were from Arizona, Florida, and Texas, and more than half of echovirus 7 detections (98 [54.0%]) were from Minnesota and Texas.

Cerebrospinal fluid was the most common source for enterovirus detection (2,483 [63.1%] of 3,932 reports with known specimen type), followed by respiratory specimens (562 [14.3%]) and stool or rectal-swab specimens (517 [13.1%]). The age of source patients ranged from <1 month to 95 years (median: 7 years). Children aged <1 year accounted for 953 (27.4%) of 3,481 enterovirus detections for which age of source patient was known. Consistent with the established summer-fall seasonality of enterovirus circulation,[2,3] the majority of enterovirus detections (2,983 [72.5%] of 4,115 records for which month of specimen collection was known) were reported during June-October of 2002, 2003, and 2004.

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CDC Editorial Note: Monitoring circulating enteroviruses is important because individual serotypes have different temporal patterns of circulation and the changes in predominant serotypes can be accompanied by large-scale outbreaks of enteroviral illnesses.[3] Serotype-based enterovirus surveillance in the United States has five objectives. First, NESS data help public health practitioners determine long-term patterns of circulation for individual enteroviruses.[3] Second, the data are used for interpreting trends in enteroviral diseases, such as aseptic meningitis, by associating them with circulating serotypes[5] and can be helpful for studying the association of enteroviruses with