Gastrointestinal Anthrax after an Animal-Hide Drumming Event — New Hampshire and Massachusetts, 2009

On December 24, 2009, a woman aged 24 years from New Hampshire was confirmed to have gastrointestinal anthrax on the basis of clinical findings and a *Bacillus anthracis* blood culture isolate. Her symptoms began on December 5. One day before symptom onset, she had participated in a drumming event at a community organization's building where animal-hide drums of multiple ages and origins were played. This report describes the case and subsequent investigation, which identified 84 persons potentially exposed to anthrax, including those persons at the drumming event and those who lived or worked at the event site. Review of New Hampshire disease surveillance data and clinical microbiology records for periods before and after the event identified no additional anthrax cases. Initial qualitative environmental testing of the event site yielded three positive samples (two from drum heads and one composite sample of three electrical outlets in the main drumming room). Wider, targeted, semi-quantitative environmental testing of the site and additional drums yielded six positive samples (two from one drum and four from environmental locations in the building). These results suggested that aerosolization of spores from drumheads had occurred. All isolates obtained from environmental and drum samples matched the patient's isolate by multiple-locus variable-number tandem repeat analysis using eight loci (MLVA-8). Public health agencies and persons with exposure to animal-hide drums should be aware of the potential, although remote, risk for anthrax exposure associated with these drums.

The patient was a woman aged 24 years from New Hampshire, previously in good health. On December 4, 2009, she participated in a public "drumming circle" inside a community organization's building. These drumming circles typically involved 30–40 persons from the local community sitting in a circle and drumming or dancing. They occurred monthly and lasted approximately 2 hours. Many attendees brought their own drums, although the community organization had dozens of drums stored in the basement for use during these events.

A total of 72 persons attended the December 4 event, and a total of 59 drums were present, including 17 drums that participants brought from home. Volunteers set up drums and prepared a vegetarian meal; participants ate dinner in the main drumming room (Figure) before beginning the drumming circle, which lasted 2 hours.

The next day, December 5, the patient had the onset of influenza-like symptoms, with fever, diaphoresis, and myalgias. Over the next several days, she noted increasing head, neck, and back pain but did not seek medical care. On December 12, she developed worsening nausea, vomiting, and abdominal cramps with dizziness. On December 14, she went to a local walk-in clinic and was transported immediately to a nearby hospital emergency department. There, she complained of vomiting, lower abdominal tenderness that radiated posteriorly, "hunger pains," and minimally productive cough, but reported not having diarrhea, shortness of breath, pleuritic pain, dysuria, vaginal bleeding, or foreign travel.

Physical examination revealed orthostasis, mild tachycardia, and costovertebral tenderness, but no fever. Abdominal examination showed distension, but active bowel sounds and no tenderness. Laboratory testing indicated a white blood cell count of 43,000/mm^3 (normal: 3,900–11,000/mm^3) with 68% neutrophils, a hematocrit of 62% (normal: 34%–46%), slight hyponatremia (133 mEq/L [normal: 134–146 mEq/L]), and a blood urea nitrogen of 31 mg/dL (normal: 6–26 mg/dL) with normal creatinine (1.0 mg/dL). She was admitted to the hospital, blood cultures were obtained, and she was treated with ertapenem. Chest radiograph showed lungs well aerated bilaterally, with no infiltrates. Abdominal computed tomography revealed massive ascites, two edematous small bowel segments with highly irregular appearance, and multiple prominent retroperitoneal lymph nodes. She was taken for exploratory laparotomy, followed by a partial bowel resection. After surgery she was stabilized, and, the next day, transferred to a referral hospital. Later review of the bowel pathology by CDC demonstrated a nematode (*Enterobius vermicularis*) infection of the small intestine and appendix.

While the patient recovered at the referral hospital, on December 24, the diagnosis of gastrointestinal anthrax was made when the Massachusetts

FIGURE. Drums placed in an event room of a community organization building before a meal and drumming circle event* — New Hampshire, December 4, 2009

* Arrow indicates the one drum that remained positive for *Bacillus anthracis* during both rounds of environmental sampling.

Department of Public Health identified gram-positive rods from two December 15 blood cultures as *B. anthracis*. The department informed the New Hampshire Department of Health and Human Services (NHDHHS), CDC, and, as a matter of routine, the Federal Bureau of Investigation. NHDHHS notified surrounding states and began an epidemiologic investigation into the source of this infection on December 24.

Because the patient was too ill to be interviewed, investigators interviewed her family and friends and later corroborated information with the patient after she was extubated on January 4, 2010. She was vegan and had participated occasionally in organic farming, most recently in September 2009. She had attended the drumming event on December 4, but had not participated in any previous such events. At the event, she drank bottled water she had brought from home and ate bagged bread that had been donated by a local bakery. She brought her own synthetic-head drum but also played one animal-hide drum, which, in a subsequent interview, she was not able to identify.

To identify other anthrax cases, NHDHHS queried statewide surveillance systems (Automated Hospital Emergency Department Data System and Vital Records Death Data) for clinical syndromes compatible with anthrax* for the period October 1, 2009 through February 3, 2010. Clinical microbiology laboratories in the New Hampshire Laboratory Response Network (LRN) were asked to review all gram-positive rod isolates from October 1, 2009 through December 26, 2009. Neither search identified additional cases.

On December 26, NHDHHS investigators performed an initial qualitative environmental sampling at the event site for the presence of *B. anthracis* spores. A total of 54 drums were sampled, one sample from each of 35 drums and two composite samples from seven drums, all from the site building's basement. In addition, samples were collected from two drums at the patient's home (the patient's synthetic drum and her mother's animal-hide drum, both used at the event) and 10 drums from a community member. Also, six environmental samples were collected from the event site. All samples were tested for *B. anthracis* at the New Hampshire Public Health Laboratory (NHPHL) using LRN protocol.

Three samples from the event site grew *B. anthracis* (two from drums and one from a composite sample of three electrical outlets in the room where the drumming circle took place) (Table). The patient denied direct contact with either of the contaminated drums during the event. One of the positive drums, estimated to be 10–15 years old, was made of cowhide, with hair

* Cutaneous (e.g., ulcer and swelling), gastrointestinal (e.g., fever, nausea, abdominal pain, and diarrhea), inhalation (e.g., fever, chest pain, dsypnea, and shortness of breath), and specific codes from the *International Classification of Diseases, Ninth Revision* (ICD-9).

TABLE. Results for *Bacillus anthracis* testing of specimens collected during first and second rounds of environmental sampling* during an epidemiologic investigation — New Hampshire and Massachusetts, December 2009–January 2010

Date	Type (No. of specimens)	Location of specimen	Results
First round testing (qualitative)†			
12/26/09	Drum (1)	Basement of event site	Positive
12/26/09	Drum (1)	Basement of event site	Positive
12/26/09	Composite of three electrical outlets (1)	Event room of event site	Positive
12/26/09	Drums (35)	Basement of event site	None detected
12/26/09	Composite of three electrical outlets (1)	Basement of event site	None detected
12/26/09	Air (3)	Basement and event room of event site	None detected
12/26/09	Floor (1)	Event room of event site	None detected
12/26/09	Drum (2)	Living room of patient's house	None detected
12/28/09	Drum (10)	Living room of community member	None detected
Second round testing (semi-quantitative)§			
01/07/10	Drum (1)	First drum head from previously positive double-headed drum in basement of event site	10^2 CFU¶/Sample
01/07/10	Drum (1)	Second drum head from previously positive double-headed drum in basement of event site	10^2 CFU/Sample
01/07/10	Environmental (1)	Baseboard heater of event room of event site	10^1 CFU/Sample
01/07/10	Environmental (1)	Upper surface of cabinets in community kitchen of event site	10^1 CFU/Sample
01/07/10	Environmental (1)	Computer screen from office of event site	10^1 CFU/Sample
01/07/10	Environmental (1)	Computer tower fan from office of event site	10^1 CFU/Sample
01/07/10	Environmental (8)	Basement food pantry of event site	None detected
01/07/10	Environmental (7)	Basement storage room of event site	None detected
01/07/10	Drum (1)	Previously positive drum in basement of event site	None detected
01/07/10	Environmental (1)	Community resource room of event site	None detected
01/07/10	Environmental (5)	Community kitchen of event site	None detected
01/07/10	Environmental (7)	Community living room of event site	None detected
01/07/10	Environmental (2)	Community bathroom of event site	None detected
01/07/10	Environmental (9)	Event room of event site	None detected
01/07/10	Environmental (1)	Office of event site	None detected
01/07/10	Environmental (1)	Private kitchen of event site	None detected
01/07/10	Environmental (1)	Private living room of event site	None detected
01/07/10	Environmental (3)	Private bathroom of event site	None detected
01/07/10	Environmental (1)	Private hallway of event site	None detected
01/07/10	Environmental (2)	Stairs to second floor of event site	None detected
01/07/10	Environmental (2)	Hallway of second floor of event site	None detected
01/07/10	Environmental (18)	Resident's rooms of event site	None detected
01/08/10	Drum (11)	Drop-off location for community drums	None detected

* The total number of drums tested during this investigation is not reflected in this table because some specimens represent a composite sample of two or more drums.
† Conducted by New Hampshire Department of Health and Human Services (NHDHHS).
§ Conducted by NHDHHS, Environmental Protection Agency, and CDC's National Institute for Occupational Safety and Health.
¶ Colony-forming units.

on the top and bottom surfaces. It was nearly 3 feet tall, had been purchased 3–4 years earlier at an estate sale, and was thought to have been manufactured in Mali. It was meant to be played with mallets and had been stored in the basement since 2007. During 2007–2009, it was played approximately once a month. The second contaminated drum was a much smaller, tambourine-like drum (6 inches in diameter and 2 inches wide) that had been bought at an antique shop 12–15 years earlier, stored in the basement for the preceding 9 years, and was played only rarely. Neither of these drums had been repaired or altered since they were acquired. Investigators quarantined the event site on December 28, 2009.

B. anthracis isolates from the patient, drums, and environment were sent to CDC for genotyping using MLVA-8. They were identical and mapped within cluster A1.a (*1*), with a combination of alleles that was unique in the CDC database.

The epidemiologic investigation of persons associated with the drumming event began December 28. NHDHHS attempted to contact all 210 persons considered potentially associated with the event (168 guests, four workers, 28 volunteers, eight residents, and two overnight guests). Of these 210 persons, 23 did not respond and 187 were interviewed. Of the 187 persons interviewed, 84 were considered potentially exposed (i.e., being at the event, setting up just

before the event, or living or working at the event site) and were offered postexposure prophylaxis (PEP) for anthrax, consisting of antimicrobial agents (oral doxycycline or ciprofloxacin for 60 days from last potential respiratory exposure) and anthrax vaccine adsorbed, the latter under an investigational new drug (IND) protocol.† Of the 84 persons offered PEP, one (1%) accepted antibiotics and vaccine, 36 (43%) accepted antibiotics, 26 (31%) declined, and 21 (25%) were lost to follow-up.

The New Hampshire Department of Environmental Services, the U.S. Environmental Protection Agency, and CDC's National Institute for Occupational Safety and Health collaborated to develop and conduct wider, targeted, semi-quantitative environmental testing that would provide *B. anthracis* spore surface contamination data to characterize the extent and type of contamination (i.e., by surface contact or potential aerosolization). On January 7 and 8, 2010, samples were taken from drums with previous positive results plus untested drums from the community that had been used at the event (i.e., persons brought their drums in to be tested) and the event site. NHPHL consulted and collaborated with New York City, Connecticut, Virginia, and Tennessee LRN laboratories to process and test 86 samples. The LRN environmental procedure used was semi-quantitative (i.e., it determined colony counts to assess heavy versus light bacterial load). Traditional microbiologic culture methods were performed, followed by confirmatory polymerase chain reaction (PCR) testing on suspicious colonies. The results of final testing revealed six positive samples from the event site (Table and Figure). MLVA-8 genotyping of all *B. anthracis* isolates from final testing matched previous isolates.

The patient was discharged from the hospital after nearly 2 months and was doing well at the time of this report. The community building, site of the drumming event, underwent remediation§ during which the two drums with positive results were properly disposed of. All drums with a result of "none detected" were returned to their owners, and the community building was reopened in April 2010.

† Additional information available at http://www.cdc.gov/vaccines/recs/acip/downloads/min-oct08.pdf.

§ Remediation of the building and positive drums included decontamination of all surfaces with a combination of scrubbing and rinsing with an amended bleach solution and HEPA-filtered vacuuming. Appropriate waste disposal protocols were followed, and post-remediation testing was performed.

Reported by

L Mayo, MD, Dartmouth-Hitchcock Medical Center, Lebanon; J Dionne-Odom, MD, EA Talbot, MD, C Adamski, MSN, C Bean, PhD, ER Daly, MPH, F Gao, MD, R Gougelet, MD, J Montero, MD, D Morse, MEd, J Smith, MPH, New Hampshire Dept of Health and Human Svcs; R Berry MS, F McGarry MSCE, M Wimsatt, MSCE, New Hampshire Dept of Environmental Svcs. L Stamm, MD, PhD, Massachusetts General Hospital, Boston; L Madoff, MD, C Gauthier, MA, Massachusetts Dept of Public Health. M Nalipinski, Environmental Protection Agency. AR Hoffmaster, PhD, SV Shadomy, DVM, NT Pesik, MD, TL Smith, MD, National Center for Zoonotic, Vector-Borne, and Enteric Diseases; LJ Rose, MS, National Center for Preparedness, Detection, and Control of Infectious Diseases; K Martinez, MSEE, National Institute for Occupational Safety and Health; SL Burrer, DVM, K Stauffer, DVM, EIS officers, CDC.

Editorial Note

The anthrax case described in this report is the first related to animal-hide drum exposures to involve the gastrointestinal form of the disease. The investigation suggests that the patient was exposed to *B. anthracis* spores aerosolized at the drumming event, which did not result in inhalation anthrax but did result in gastrointestinal anthrax. Infection through the gastrointestinal route might have occurred through direct aerosol exposure; animal studies have demonstrated that most inhaled spores are cleared from the respiratory tract and passed into the gastrointestinal tract (*2*). Additionally, intestinal lesions have been described in inhalation animal model studies (*2*). Alternatively, the patient could have consumed food or water contaminated with spores by aerosol, or through contact with persons who previously handled contaminated items. Environmental sampling results suggested that other persons present likely were exposed; however, no other anthrax cases were identified through follow-up with attendees of the drumming event or statewide surveillance systems review.

Gastrointestinal anthrax cases and exposures have been reported only rarely in the United States, including a case with both cutaneous and gastrointestinal involvement related to industrial exposure (*3*), and exposure through ingestion of contaminated meat from an animal with anthrax (*4*). Recent inhalation and cutaneous anthrax cases have occurred in drum makers working with animal hides contaminated with *B. anthracis* spores, including a 2006 inhalation anthrax case in New York City (*5*), cutaneous anthrax cases in 2007 in Connecticut (*6*), and a 2008

What is already known on this topic?

Cases of cutaneous and inhalation anthrax have been reported in persons who made or handled imported animal-hide drums or participated in drumming events where imported animal-hide drums contaminated with *Bacillus anthracis* spores were used.

What does this report add?

The anthrax case described is the first related to animal-hide drum exposures to involve the gastrointestinal form of the disease. The investigation suggests that the patient was exposed to *B. anthracis* spores aerosolized at a drumming event, which did not result in inhalation anthrax but did result in gastrointestinal anthrax.

What are the implications for public health practice?

When investigating any anthrax case, public health agencies should consider any exposure to animal-hide drums (making drum, playing drums, or participating in drumming events) as potential exposure sources. Detection of unknown gram-positive bacilli from patients with illnesses consistent with *B. anthracis* infection should result in immediate notification of the health-care provider, and health-care providers, laboratorians, and public health officials should ensure that a definitive diagnosis is reached promptly.

inhalation anthrax case in England (*7*). Widespread spore contamination was detected in the New York City and Connecticut drum makers' workspaces, with secondary contamination of their residences (*5,6*). In the English case, only one drum and two animal-hide pieces were contaminated (*7*). In 2006, a Scottish man died of inhalation anthrax after exposure to contaminated drums at a drumming workshop. Spores were detected at the workshop site, but his was the only anthrax case among the participants, and his history of acute myeloid leukemia in remission might have contributed to his disease.¶

The patient described in this report was the only person exposed at the drumming event who is known to have become ill. Whether underlying immunologic factors were present or her *Enterobius* infection contributed through mucosal injury remains unclear. Her case and the 2006 Scottish case might represent persons with unique susceptibilities to *B. anthracis*. She developed anthrax after exposure to environments with neither widespread nor a high level of contamination detected. Notably, the drums used at the event had long histories of use by other persons who were not known to develop anthrax. Other published reports of anthrax exist in persons for whom documented exposure was brief or to a low level of contamination. In some instances, like the case described in this report, several persons were exposed to either the same contaminated environments or articles, but did not acquire disease (*8*). The oral infectious dose for gastrointestinal anthrax in humans is not known. Whereas oral minimum ID50 dose estimates in humans or animal models range up to 10^{11} spores, the infectious dose by any route at which a small proportion of the population will be infected is much lower; for inhalation anthrax the ID2 might be as low as nine to 2,300 spores (*8,9*).

The risk for infection posed by handling animal-hide drums, or attending events where such drums are played, is difficult to quantify. Drumming circles are common activities, and given the extreme rarity of cases like the one reported here, the risk for infection must be considered to be very low. Because of livestock management practices and inspection at U.S. animal processing plants, animal hides originating in the United States are less likely to be contaminated with *B. anthracis* than hides or drums imported from areas of epizootic anthrax (*7*). Physicians treating patients with symptoms compatible with anthrax, such as unexplained fever, skin lesions, or serious respiratory or gastrointestinal illness, should be aware of the possible connection to animal-hide drums. When unknown gram-positive bacilli are detected in patients with illnesses consistent with *B. anthracis* infection, the health-care provider should be notified immediately, and health-care providers, laboratorians, and public health officials should ensure that a definitive diagnosis is reached promptly.

¶ Additional information available at http://www.nhsborders.org.uk/uploads/18645/anthrax_report_131207.pdf.

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Emergence of *Cryptococcus gattii* — Pacific Northwest, 2004–2010

Cryptococcus is a genus of fungi, of which two species, *Cryptococcus neoformans* and *Cryptococcus gattii,* cause nearly all human and animal cryptococcal infections. Whereas *C. neoformans* primarily affects persons infected with human immunodeficiency virus (HIV) worldwide, *C. gattii* primarily affects HIV-uninfected persons in tropical and subtropical regions (*1*). In December 2004, a case of human *C. gattii* infection was reported in Oregon, associated with an outbreak on Vancouver Island and in mainland British Columbia, Canada (*2*). A second *C. gattii* case was reported in Oregon in 2005, and 12 more cases were reported in 2006 and 2007. In 2008, in response to the emergence of *C. gattii* in the United States, CDC, state and local public health authorities, and the British Columbia Centre for Disease Control (BCCDC) formed the *Cryptococcus gattii* Public Health Working Group (*1*). States began collecting epidemiologic information on patients and sending isolates to CDC. By July 2010, a total of 60 human cases had been reported to CDC from four states (California, Idaho, Oregon, and Washington) in the Pacific Northwest. Among 52 patients for whom travel history was known, 46 (88%) said they had not traveled to British Columbia or any other *C. gattii*–endemic areas, suggesting they acquired the infection locally. Among 45 patients with known outcomes, nine (20%) died because of *C. gattii* infection, and six (13%) died with *C. gattii* infection. Physicians should consider *C. gattii* as a possible etiology of a cryptococcal infection among persons living in or traveling to the Pacific Northwest or traveling to other *C. gattii*–endemic areas.

Multilocus sequence typing subcategorizes *C. gattii* into four genotypes: VGI, VGII, VGIII, and VGIV. Further genetic analysis divides the VGII genotype into three subtypes: VGIIa, VGIIb, and VGIIc (*3*). Although VGII is the genotype most commonly associated with the outbreak in the United States and British Columbia, it is uncommon in other *C. gattii*–endemic parts of the world, where VGI is isolated most frequently (*3*).

During 1999, *C. gattii* began appearing in animals and humans on Vancouver Island and, beginning in 2004, among mainland British Columbia residents who had no exposure to Vancouver Island (*2,4*). By the end of 2007, a total of 218 human cases had been reported to BCCDC (*5*). Studies from British Columbia and elsewhere showed a median incubation period of 6–7 months, with a range of 2–13 months (*1*). The median age of patients in British Columbia was 59 years, with age-specific incidence highest among persons aged 70–79 years (*5*). Only 38% of patients had an identifiable immunosuppressive condition (*5*). Reported case-fatality rates either from or with *C. gattii* infection was 9% (*5*). Studies on Vancouver Island found *C. gattii* spores in the environment, often in association with trees and soil (*6*).

The two human infections reported from Oregon in 2004 and 2005 were from *C. gattii* subtypes VGIIa and VGIIc (*3*). The VGIIc subtype had not been found previously anywhere in the world; the VGIIa isolate was genetically distinct from the British Columbia VGIIa isolates (*4*). Neither patient had traveled to Vancouver Island or any other known *C. gattii*–endemic area. In early 2006, a resident of Orcas Island, Washington, developed *C. gattii* VGIIa infection with a strain indistinguishable from the British Columbia VGIIa strain (*7*).

In October 2009, the *C. gattii* Public Health Working Group formalized a surveillance system for *C. gattii* and housed it at CDC. The system includes standardized human and veterinary case report forms and isolate submission protocols. Standardized case report forms include questions about patient demographics, health history, and illness onset and course, and are completed

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