

## Outbreak of Shiga Toxin–Producing *Escherichia coli* O111 Infections Associated with a Correctional Facility Dairy — Colorado, 2010

On April 20, 2010, the Colorado Department of Public Health and Environment (CDPHE) was notified by correctional authorities regarding three inmates with bloody diarrhea at a minimum-security correctional facility. The facility, which houses approximately 500 inmates, is a designated work center where inmates are employed or receive vocational training. Approximately 70 inmates work at an onsite dairy, which provides milk to all state-run correctional facilities in Colorado. CDPHE immediately began an investigation and was later assisted by the High Plains Intermountain Center for Agricultural Health and Safety at Colorado State University and by CDC. This report describes the results of the investigation, which determined that the illnesses were caused by Shiga toxin–producing *Escherichia coli* O111 (STEC O111) infections. During April–July, 10 inmates at the facility received a diagnosis of laboratory-confirmed STEC O111 infection, and a retrospective prevalence study of 100 inmates found that, during March–April, 14 other inmates had experienced diarrheal illness suspected of being STEC O111 infection. Pulsed-field gel electrophoresis (PFGE) testing indicated that STEC O111 isolates from inmates matched STEC O111 isolates from cattle at the onsite dairy. An environmental investigation determined that inmates employed at the dairy might have acquired STEC O111 infection on the job or transported contaminated clothing or other items into the main correctional facility and kitchen, thereby exposing other inmates. To prevent similar outbreaks in correctional facilities, authorities should consult with public health officials to design and implement effective infection control measures.

### Epidemiologic and Environmental Investigations

On April 21, stool specimens from the initial three inmates reported as ill tested positive for Shiga toxin at a reference clinical laboratory and subsequently were identified as STEC O111 at the state public health laboratory. CDPHE and correctional

facility health staff members conducted surveillance for other persons with recent illness through cell checks and interviews with all food-service workers, resulting in identification of five additional laboratory-confirmed STEC O111 cases. A confirmed case was defined as STEC O111 isolated from an inmate's stool specimen. Illness onset dates for the eight inmates with confirmed STEC O111 ranged from April 11 to April 22 (Figure).

Of the eight inmates with confirmed STEC O111, six had indistinguishable PFGE patterns, and two had patterns differing by one band. The inmates were housed in four different living units at the correctional facility, and each had a different job. No staff members reported symptoms consistent with STEC infection, and diarrheal illness was not reported at other Colorado correctional facilities.

On April 27, CDPHE conducted a retrospective illness prevalence study among 100 inmates (approximately 20% of the inmate population); all 100 inmates had the option to refuse to participate in the study and could refuse to answer any questions. A number generator was used to systematically select every fifth inmate listed on the census of inmates residing at the correctional facility. The goal of the study was to determine the timeframe of the outbreak, estimate the total number of cases, and identify the source and mechanism of spread to prevent further cases of STEC O111. A suspected case in the prevalence study was defined as diarrheal illness

### INSIDE

153 Outbreak of Cryptosporidiosis Associated with a Firefighting Response — Indiana and Michigan, June 2011

157 Vital Signs: Preventing *Clostridium difficile* Infections

163 Announcements

165 QuickStats



with onset after March 1, characterized by three or more loose stools within 24 hours, and lasting  $\geq 2$  days. Fourteen inmates reported symptoms that met the definition for a suspected case (four other inmates met the definition but were eliminated from the findings because they also were among those inmates with laboratory-confirmed STEC O111). Illness onset dates for the 14 inmates ranged from March 14 to April 23 (Figure). No common food exposures or living units were found among the 14 inmates identified in the prevalence study; however, two of the 14 inmates worked at the onsite dairy.

CDPHE staff also inspected the correctional facility's kitchens and living areas and identified the following conditions conducive to STEC O111 transmission: poor adherence to standard food-service protocols and hygiene practices, including food handlers working while ill with diarrhea; inconsistent availability of hand soap throughout the facility; dairy employees wearing soiled work clothes into the kitchen and living areas; and transport of potentially fecally contaminated lunch coolers and water containers from the dairy into the kitchen. CDPHE hypothesized that the outbreak was associated with environmental contamination and propagated by person-to-person transmission, possibly through food preparation. On learning of these results, the correctional facility immediately implemented the following public health recommendations: 1) prohibiting potentially contaminated material (e.g., lunch coolers, water containers, and work clothing from the dairy) in the kitchen area, 2) excluding from work all food handlers reporting diarrheal illness since April 1, 3) requiring food

handlers with a confirmed STEC O111 test result to have two consecutive negative stool specimens before returning to work, and 4) limiting transfers of inmates to other facilities until they were cleared by the medical staff.

In July, two additional inmates received diagnoses of laboratory-confirmed STEC O111 matching the predominant outbreak strain. This prompted further investigation, including testing of dairy environmental surfaces and cattle feces for STEC at the U.S. Department of Agriculture's Agricultural Research Service Laboratory in Nebraska. A convenience sample of 100 dairy cattle fecal specimens was collected; three specimens tested positive for STEC O111:H8 and matched the PFGE pattern for eight of the 10 human isolates. Based on these results, investigators suspected that animal-to-human STEC O111 transmission might be occurring at the correctional facility dairy and that fecally contaminated items might be transported unknowingly into the main facility by dairy workers and security personnel.

In October, after initiating a new occupational health program, CDPHE collaborated with the High Plains Intermountain Center for Agricultural Health and Safety and CDC to identify transmission pathways of STEC O111 between the dairy and the correctional facility and provide recommendations for prevention. Investigators identified considerable contact with animals in the dairy and inconsistent implementation of infection control practices. Some workers washed their hands infrequently, consumed food and beverages in contaminated areas, and did not wear proper personal

The *MMWR* series of publications is published by the Office of Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

**Suggested citation:** Centers for Disease Control and Prevention. [Article title]. *MMWR* 2012;61:[inclusive page numbers].

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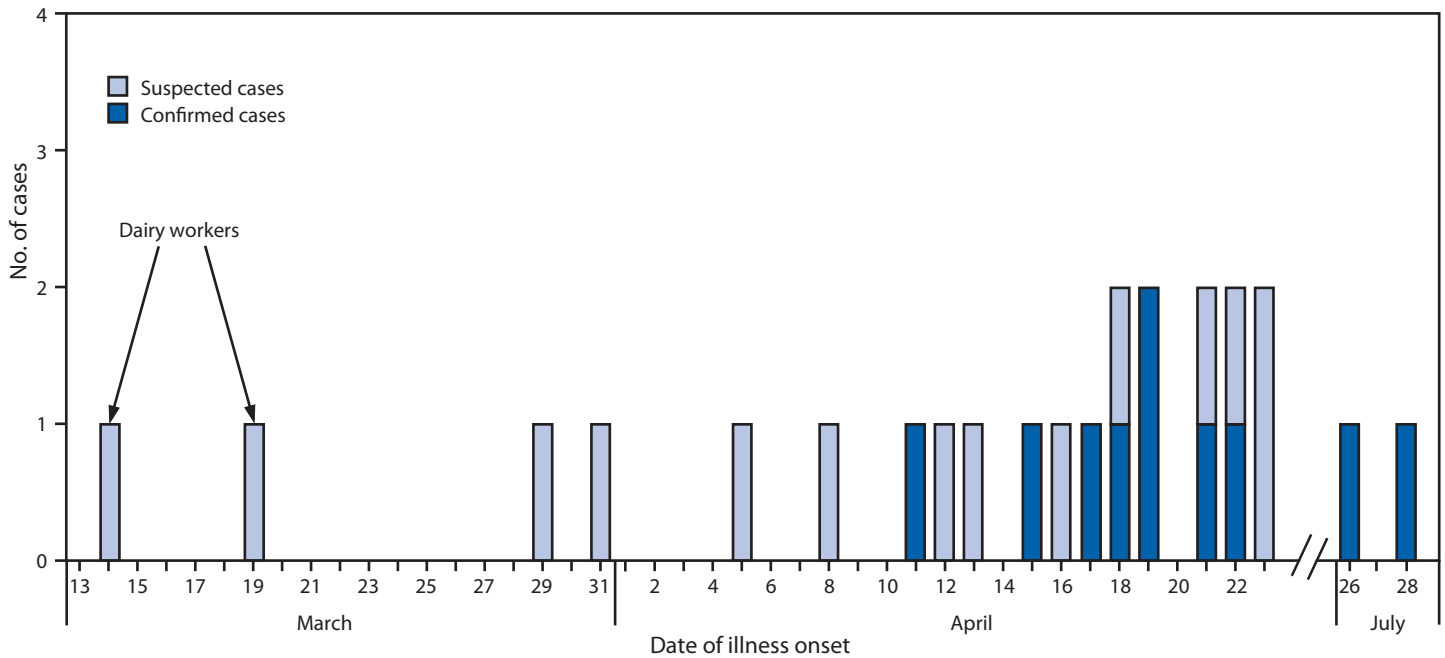
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**FIGURE.** Number of confirmed (n = 10) and suspected (n = 14) cases of Shiga toxin–producing *Escherichia coli* O111 infection associated with a correctional facility dairy, by date of illness onset — Colorado, March–July 2010



protective equipment (e.g., boots, gloves, and coveralls). Even when such clothing was worn, some workers would move through contaminated areas to access the main facility after changing their clothing, thus risking recontamination. Investigators concluded that numerous transmission pathways between the cattle and the workers existed, as well as the potential for transport of contaminated clothing and other items into the main facility.

### Control Measures

Recommendations for controlling the transmission of infectious diseases were developed, taking into consideration the correctional facility environment, space limitations, security, and substance-control restrictions (e.g., alcohol-based hand sanitizers often are prohibited in correctional settings because of the potential for misuse [1]). Recommendations included 1) ensuring consistent use of proper personal protective equipment; 2) providing training on transmission pathways, recognizing illness, and appropriate precautions when working with animals; 3) modifying work flow patterns and designating contaminated, transition, and clean areas; and 4) implementing hygiene practices (e.g., hand washing, consuming food only in designated areas, and not wearing contaminated clothing in the kitchen and main facility) to reduce the likelihood of disease transmission. Recommendations also were made regarding facility infrastructure, including eliminating the need to reenter the contaminated area before exiting the dairy,

providing additional hand washing and shower facilities, and providing separate laundry services for contaminated dairy clothing. The facility has reported no additional cases of STEC O111 since July 2010.

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### Editorial Note

This report describes the investigation of a prolonged outbreak of STEC O111 infections in a correctional facility. Although enteric pathogen outbreaks have been reported in correctional facilities, most have been attributed to foodborne and person-to-person transmission of bacterial and viral agents (2). Contact with animals in a correctional facility dairy resulting in human illness, or illness resulting from inmate exposure to environmental contamination transferred from a dairy have not been reported previously.

**What is already known on this topic?**

Shiga toxin–producing *Escherichia coli* (STEC) has been reported to have caused illness in correctional facilities. Typically, STEC O111 outbreaks are caused by ingestion of contaminated food or water. STEC O111 also can infect cattle and other ruminant animals, and human contact with infected animals or their environment can cause human illness.

**What is added by this report?**

An outbreak of STEC O111 at a correctional facility in Colorado was associated with an onsite dairy. Ten inmates had laboratory-confirmed infection, including eight with the same strain found in fecal specimens from dairy cows, suggesting that inmates employed at the dairy might have acquired STEC O111 infection on the job or transported contaminated items into contact with other inmates. Several conditions conducive to STEC O111 transmission were found, including poor adherence to standard food-service protocols and other infection control and hygiene practices.

**What are the implications for public health practice?**

Dairy operations are a source of STEC O111 infection. A correctional facility that operates a dairy should institute infection control practices and employee training programs that reduce the risk for acquiring and transmitting STEC.

Approximately 100 serotypes of STEC infection have been associated with human disease (3,4). Many reported illnesses are caused by ingestion of contaminated food or water; however, direct transmission of STEC from ruminant animals and their environment via the fecal-oral route can occur (4,5). Healthy cattle are the best-known animal reservoir for STEC (4,6,7). Persons with occupational exposure to cattle also might be at increased risk for STEC exposure (8).

During 2000–2009, STEC O157 was the most common type of STEC infection reported in Colorado (CDPHE, unpublished data, 2012). However, beginning in 2010, non-O157 STEC infections have been reported more frequently than STEC O157 infections, likely because more types of STEC can be identified as a result of advances in laboratory testing techniques. In 2010, a total of 25 STEC O111 infections in Colorado residents were reported to CDPHE, including the 10 confirmed cases described in this report.

Infection control is important to protect the health of incarcerated populations. The investigation described in this report found that, because of inadequate infection control policies and poor hygienic practices, inmates at the correctional facility were at increased risk for acquiring STEC O111. To prevent disease outbreaks in other correctional facilities, public health officials should consider environmental and occupational health factors and work with correctional authorities to ensure appropriate measures are implemented.

**Acknowledgments**

William Ray, Alicia Cronquist, MPH, Joyce Knutsen, Karen Xavier, Hugh Maguire, PhD, Laura Gillim-Ross, PhD, Kristin Mayo, Mary Kate Cichon, Henry Colonna, Aaron Doussett, MS, Ken Gershman, MD, Elisabeth Lawaczek, DVM, Tracy Woodall, DVM, Jennifer Sadlowski, MSPH, Ashley Grajczyk, MPH, Teresa Martinez, Colorado Dept of Public Health and Environment; Judy Beeman, Colorado Dept of Corrections; Jennifer Ward, Mark Korbitz, MS, Bart Evans, MBA, Pueblo City-County Health Dept; Marigny Klaber, MS, El Paso County Public Health; Michael Miller, MA, Otero County Health Dept, Colorado. Jaime La Brie, Jennifer McGhee, MS, Agricultural Research Svc Laboratory, US Dept of Agriculture. Christa Hale, DVM, Jeff McCollum, DVM, EIS officers, CDC.

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U.S. Government Printing Office: 2012-523-043/02002 Region IV ISSN: 0149-2195