Update: Multistate Outbreak of *Eschericha coli* O157:H7 Infections from Hamburgers — Western United States, 1992–1993

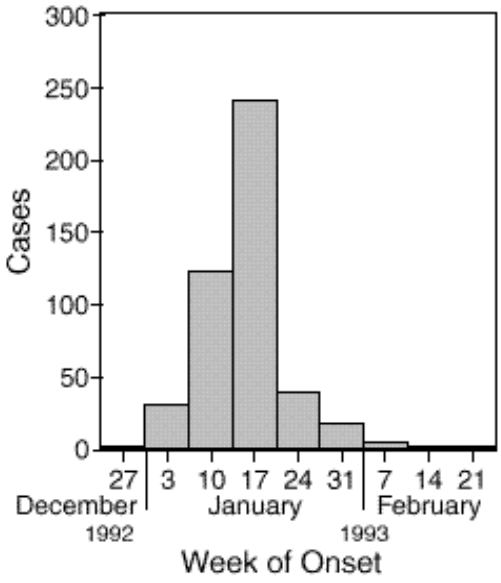
From November 15, 1992, through February 28, 1993, more than 500 laboratory-confirmed infections with *E. coli* O157:H7 and four associated deaths occurred in four states—Washington, Idaho, California, and Nevada. This report summarizes the find-ings from an ongoing investigation (1) that identified a multistate outbreak resulting from consumption of hamburgers from one restaurant chain.

Washington

On January 13, 1993, a physician reported to the Washington Department of Health a cluster of children with hemolytic uremic syndrome (HUS) and an increase in emergency room visits for bloody diarrhea. During January 16–17, a case-control study comparing 16 of the first cases of bloody diarrhea or postdiarrheal HUS identified with age- and neighborhood-matched controls implicated eating at chain A restaurants during the week before symptom onset (matched odds ratio [OR]=undefined; lower confidence limit=3.5). On January 18, a multistate recall of unused hamburger patties from chain A restaurants was initiated.

As a result of publicity and case-finding efforts, during January–February 1993, 602 patients with bloody diarrhea or HUS were reported to the state health depart-ment. A total of 477 persons had illnesses meeting the case definition of culture-confirmed *E. coli* O157:H7 infection or postdiarrheal HUS (Figure 1). Of the 477 persons, 52 (11%) had close contact with a person with confirmed *E. coli* O157:H72.

FIGURE 1. Cases of *Eschericha coli* O157:H7 meeting the case definition,* by week of onset of illness — Washington, December 27, 1992–February 21, 1993



*Culture-confirmed *E. coli* O157:H7 infection or postdiarrheal hemolytic uremic syndrome.

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infection during the week preceding onset of symptoms. Of the remaining 425 persons, 372 (88%) reported eating in a chain A restaurant during the 9 days preceding onset of symptoms. Of the 338 patients who recalled what they ate in a chain A restaurant, 312 (92%) reported eating a regular-sized hamburger patty. Onsets of illness peaked from January 17 through January 20. Of the 477 case-patients, 144 (30%) were hospitalized; 30 developed HUS, and three died. The median age of patients was 7.5 years (range: 0–74 years).

Idaho

Following the outbreak report from Washington, the Division of Health, Idaho Departmentof Health and Welfare, identified 14 persons with culture-confirmed *E. coli* O157:H7 infection, with illness onset dates from December 11, 1992, through February 16, 1993 (Figure 2A). Four persons were hospitalized; one developed HUS. During the week preceding illness onset, 13 (93%) had eaten at a chain A restaurant.

California

In late December, the San Diego County Department of Health Services was notified of a child with *E. coli* O157:H7 infection who subsequently died. Active surveillance and record review then identified eight other persons with *E. coli* O157:H7 infections or HUS from mid-November through mid-January 1993. Four of the nine reportedly had recently eaten at a chain A restaurant and four at a chain B restaurant in San Diego. After the Washington outbreak was reported, reviews of medical records at five hospitals revealed an overall 27% increase in visits or admissions for diarrhea during December 1992 and January 1993 compared with the same period 1 year earlier. A case was defined as postdiarrheal HUS, bloody diarrhea that was culture negative or not cultured, or any diarrheal illness in which stool culture yielded *E. coli* O157:H7, with onset from November 15, 1992, through January 31, 1993. Illnesses of 34 patients met the case definition (Figure 2B). The outbreak strain was identified in stool specimens of six patients. Fourteen persons were hospitalized, seven developed HUS, and one child died. The median age of case-patients was 10 years (range: 1–58 years). A case-control study of the first 25 case-patients identified and age- and sex-matched community controls implicated eating at a chain A restaurant in San Diego (matched OR=13; 95% confidence interval [CI]=1.7–99). A study comparing case-patients who ate at chain A restaurants with well meal companions implicated regular-sized hamburger patties (matched OR=undefined; lower confidence limit=1.3). Chain B was not statistically associated with illness.

Nevada

On January 22, after receiving a report of a child with HUS who had eaten at a local chain A restaurant, the Clark County (Las Vegas) Health District issued a press release requesting that persons with recent bloody diarrhea contact the health department. A case was defined as postdiarrheal HUS, bloody diarrhea that was culture negative or not cultured, or any diarrheal illness with a stool culture yielding the Washington strain of *E. coli* O157:H7, with onset from December 1, 1992, through February 7, 1993. Because local laboratories were not using sorbitol MacConkey (SMAC) medium to screen stools for *E. coli* O157:H7, this organism was not identified in any patient. After SMAC medium was distributed, the outbreak strain was detected in the stool of one patient 38 days after illness onset.

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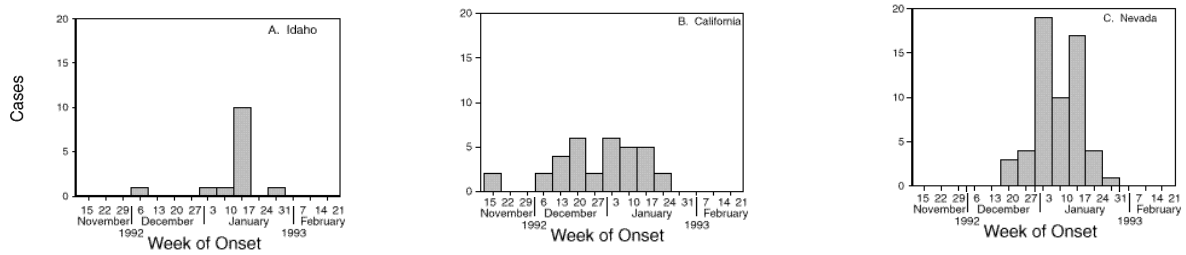
FIGURE 2. Cases of *Eschericha coli* O157:H7 meeting the case definition,* by week of onset of illness - Idaho, California, and Nevada, November 15, 1992-February 21, 1993



*For Idaho, a case was defined as culture-confirmed *E. coli* O157:H7 infection from December 11, 1992 through February 16, 1993; for California, a case was defined as postdiarrheal hemolytic uremic syndrome, bloody diarrhea that was culture negative or not cultured, or any diarrheal illness in which stool culture yielded *E. coli* O157:H7 from November 15, 1992, through January 31, 1993; for Nevada, a case was defined the same as for California except the outbreak strain of *E. coli* O157:H7 was specified and the onset dates were from December 1, 1992, through February 7, 1993.

Of 58 persons whose illnesses met the case definition (Figure 2C), nine were hospitalized; three developed HUS. The median age was 30.5 years (range: 0-83 years). Analysis of the first 21 patients identified and age- and sex-matched community controls implicated eating at a chain A restaurant during the week preceding illness onset (matched OR=undefined; lower confidence limit=4.9). A case-control study using well meal companions of case-patients also implicated eating hamburgers at chain A (matched OR=6.0; 95% CI=0.7-49.8).

Other Investigation Findings

During the outbreak, chain A restaurants in Washington linked with cases primarily were serving regular-sized hamburger patties produced on November 19, 1992; some of the same meat was used in ñjumboñ patties produced on November 20, 1992. The outbreak strain of *E. coli* O157:H7 was isolated from 11 lots of patties produced on those two dates; these lots had been distributed to restaurants in all states where illness occurred. Approximately 272,672 (20%) of the implicated patties were recovered by the recall.

A meat traceback by a CDC team identified five slaughter plants in the United States and one in Canada as the likely sources of carcasses used in the contaminated lots of meat and identified potential control points for reducing the likelihood of contamination. The animals slaughtered in domestic slaughter plants were traced to farms and auctions in six western states. No one slaughter plant or farm was identified as the source.

Further investigation of cases related to secondary transmission in families and child day care settings is ongoing.

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Editorial Note: *E. coli* O157:H7 is a pathogenic gram-negative bacterium first identified as a cause of illness in 1982 during an outbreak of severe bloody diarrhea traced to contaminated hamburgers (2). This pathogen has since emerged as an important cause of both bloody diarrhea and HUS, the most common cause of acute renal failure in children. Outbreak investigations have linked most cases with the consumption of undercooked ground beef, although other food vehicles, including roast beef, raw milk, and apple cider, also have been implicated (3). Preliminary data from a CDC 2-year, nationwide, multicenter study revealed that when stools were routinely cultured for *E. coli* O157:H7 that organism was isolated more frequently than Shigella in four of 10 participating hospitals and was isolated from 7.8% of all bloody stools, a higher rate than for any other pathogen.

Infection with *E. coli* O157:H7 often is not recognized because most clinical laboratories do not routinely culture stools for this organism on SMAC medium, and many clinicians are unaware of the spectrum of illnesses associated with infection (4). The usual clinical manifestations are diarrhea (often bloody) and abdominal cramps; fever is infrequent. Younger age groups and the elderly are at highest risk for clinical manifestations and complications. Illness usually resolves after 6-8 days, but 2%-7% of patients develop HUS, which is characterized by hemolytic anemia, thrombocytopenia,
renal failure, and a death rate of 3%-5%.

This report illustrates the difficulties in recognizing community outbreaks of *E. coli* O157:H7 in the absence of routine surveillance. Despite the magnitude of this outbreak, the problem may not have been recognized in three states if the epidemiologic link had not been established in Washington (1). Clinical laboratories should routinely culture stool specimens from persons with bloody diarrhea or HUS for *E. coli* O157:H7 using SMAC agar (5). When infections with *E. coli* O157:H7 are identified, they should be reported to local health departments for further evaluation and, if necessary, public health action to prevent further cases.

E. coli O157:H7 lives in the intestines of healthy cattle, and can contaminate meat during slaughter. CDC is collaborating with the U.S. Department of Agricultureís Food Safety Inspection Service to identify critical control points in processing as a component of a program to reduce the likelihood of pathogens such as *E. coli* O157:H7 entering the meat supply. Because slaughtering practices can result in contamination of raw meat with pathogens, and because the process of grinding beef may transfer pathogens from the surface of the meat to the interior, ground beef is likely to be internally contaminated. The optimal food protection practice is to cook ground beef thoroughly until the interior is no longer pink, and the juices are clear. In this outbreak, undercooking of hamburger patties likely played an important role. The Food and Drug Administration (FDA) has issued interim recommendations to increase the internal temperature for cooked hamburgers to 155 F (86.1 C) (FDA, personal communication, 1993).

Regulatory actions stimulated by the outbreak described in this report and the recovery of thousands of contaminated patties before they could be consumed emphasize the value of rapid public health

investigations of outbreaks. The public health impact and increasing frequency of isolation of this pathogen underscore the need for improved surveillance for infections caused by *E. coli* O157:H7 and for HUS to better define the epidemiology of *E. coli* O157:H7.

References

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3. Griffin PM, Tauxe RV. The epidemiology of infections caused by *Eschericha coli* O157:H7, other enterohemorrhagic *E. coli*, and the associated hemolytic uremic syndrome. Epidemiol Rev 1991;13:60-98.