Escherichia coli O157:H7 Infection Associated with Drinking Raw Milk --- Washington and Oregon, November--December 2005

During the week of December 5, 2005, public health officials in Clark County, Washington, were notified of four county residents with laboratory-confirmed Escherichia coli O157:H7 infection. All four residents reported having consumed raw (i.e., unpasteurized) milk obtained from a farm in neighboring Cowlitz County, Washington. The farm participated in a cow-share program, in which persons purchase interests in, or shares of, dairy cows in return for a portion of the milk produced.* The farm had five dairy cows and regularly provided raw milk to shareholders. Although the sale of raw milk and cow-share agreements are illegal in certain states, they are legal in Washington; however, Washington farms that provide raw milk to consumers must be licensed, meet state milk-production and processing standards, and pass health and sanitation inspections by the state department of agriculture (1). The Cowlitz County farm was not licensed. This report summarizes the investigation of E. coli O157:H7 cases associated with the farm and reinforces previous warnings about the health hazards of consuming raw milk.

The farm's shareholder list, obtained through a court order, was used to conduct a retrospective cohort study to identify risks for infection. During December 16--19, 2005, shareholders were interviewed by telephone using a standard questionnaire to collect information regarding their milk consumption since November 20, 2005. Forty-three of the 45 families who held shares in the dairy cows from the farm were interviewed; information regarding 157 persons was collected. A case was defined as either 1) laboratory-confirmed E. coli O157:H7 infection or 2) diarrhea with abdominal cramping or blood in a person with illness onset during November 20--December 13, 2005, who was a customer of the farm. Additional cases in the community were identified using faxed health alerts and media releases to notify health-care providers, infection-control practitioners, neighboring public health agencies, and the public of the cluster of illnesses.

Eighteen cases were identified among the 43 families who were interviewed, and eight (44%) of these were laboratory confirmed. Dates of illness onset ranged from November 29 to December 13, 2005 (Figure). Patients were residents of two southwest Washington counties and one northwest Oregon county. The median age was 9 years (range: 1--47 years); nine (50%) were female. Among the 18 patients, 17 (94%) reported diarrhea, 13 (72%) bloody diarrhea, and 13 (72%) abdominal cramps. Five patients (28%), aged 1--13 years, were hospitalized; four of these had hemolytic uremic syndrome (HUS). Seventeen patients were farm shareholders or children of shareholders; one patient, a child aged 10 years, was a friend
Of 140 persons who reported consuming raw milk from the farm, 18 (13%) became ill; among the 157 persons for whom information was obtained, no illness was reported among those who did not consume raw milk. Among 102 of 140 exposed persons who provided information about their raw milk consumption during November 20--December 13, the relative risk for illness increased with the average number of cups of milk consumed daily. The dose-response trend for average daily consumption was statistically significant (p=0.008 by expanded Mantel-Haenszel chi-square test), with attack rates of 3.6% for 0--0.9 cups of milk, 6.7% for 1--1.9 cups, 14.3% for 2--2.9 cups, and 37.5% for ≥3 cups. Visiting the farm and consumption of raw milk products from other sources were not associated with illness.

Pulsed-field gel electrophoresis (PFGE) was used to analyze *E. coli* O157:H7 isolates from stool samples from eight patients; seven (88.0%) isolates had PFGE patterns that were indistinguishable (pattern A), and one isolate from an Oregon patient had a PFGE pattern that differed from pattern A by one band.

*E. coli* O157:H7 also was isolated from raw milk samples obtained from the farm and one shareholder. In addition, *E. coli* O157:H7 was isolated from seven environmental samples collected from the floor of the farm milking parlor. All *E. coli* O157:H7 isolates from milk and environmental samples had PFGE pattern A. No *E. coli* O157:H7 was isolated from stool samples of any of the farm's five cows.

During inspections of the farm, officials from the Washington State Department of Agriculture (WSDA) noted mud and manure accumulation in the entrance to the milking parlor and on the rubber mats covering the dirt floors of the parlor. The bucket used for milk collection had direct contact with these surfaces. Inspectors also noted inadequate hand-washing facilities and improper procedures for cleaning milking equipment and handling fresh milk.

On December 9, 2005, the farm contacted shareholders and advised them to discard any remaining raw milk. After a court order was obtained by the Cowlitz County Health Department and an embargo was placed by WSDA, the farm discontinued sales of raw milk on December 13, 2005. No additional reports of illness associated with the farm have been received.

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**Editorial Note:**

*E. coli* O157:H7 causes an estimated 73,000 illnesses and 61 deaths annually in the United States (2). Approximately 8% of reported infections lead to HUS, particularly in children aged <5 years and older adults (3); 4% of patients with HUS die (4). Raw milk is an
important vehicle of transmission of *E. coli* O157:H7 and other pathogens, including *Mycobacterium bovis*, *Listeria monocytogenes*, and *Campylobacter*, *Brucella*, and *Salmonella* species (5,6). During 1988--2005, a total of 33 outbreaks of *Campylobacter* species, *E. coli* O157:H7, and *Salmonella* species infections associated with raw milk consumption were reported to CDC (7).

Several findings from this investigation indicate that consumption of raw milk was the cause of the outbreak: 1) all ill persons drank raw milk; 2) the illness risk increased with the amount of milk consumed; 3) *E. coli* O157:H7 was isolated from raw milk samples and environmental samples collected from the milking-parlor floor; and 4) PFGE patterns of isolates from patient, milk, and environmental samples were indistinguishable. Investigators found several factors that might have contributed to contamination of milk at the farm, although previous outbreaks have demonstrated that even raw milk collected using stringent hygiene methods might be contaminated with pathogens (9).

Although many consumers are aware that raw milk can contain pathogens, some believe that it has potential benefits (e.g., vitamins that are present naturally rather than added, enhanced fertility, and protection against tooth decay). However, the validity of any health or nutritional benefits from consuming raw milk has not been proven scientifically (6).

Raw milk is a well-documented cause of enteric infections and was first recognized as one approximately 100 years ago (6). Pathogens that infect humans, including *E. coli* O157:H7, are shed in the feces of cows and can contaminate milk during the milking process. Using standard hygiene practices during milking (e.g., washing hands, keeping equipment clean, and keeping the milking area separated from other areas) can reduce but not eliminate the risk for milk contamination. Pasteurization decreases the number of pathogenic organisms, prevents transmission of pathogens, and has been determined to improve the safety of raw milk more than other measures, including certification of raw milk (8). Because raw milk certification has failed to prevent many raw-milk--associated infections in the past, consumers should not assume that certified raw milk is free of pathogens (9). To prevent *E. coli* O157:H7 and other infections, consumers should not drink raw milk.

In Washington, cow-share programs and the regulated sale of raw milk are legal; however, the Cowlitz County farm was not licensed, and it did not follow applicable sanitation and public health safety regulations. As a result of this outbreak, WSDA revised regulations to help ensure that milk producers who sell pasteurized milk and those who sell raw milk through cow-share programs obtain the appropriate state licenses and comply with milk-processing sanitation and public health guidelines. As of February 2007, raw milk could be sold legally in 27 states, including Washington. During 1973--1992, a total of 40 (87%) of the 46 reported raw-milk--associated illness outbreaks occurred in states in which the intrastate sale of raw milk was legal (5). State milk regulations and methods for their enforcement should be reviewed and strengthened to minimize the hazards of raw milk.

Early in the 20th century, widespread adoption of the pasteurization process led to substantial reductions in milk-associated disease, a milestone in the history of food safety (10). In the 21st century, more effective consumer education regarding the hazards of drinking raw milk
is needed to further reduce milk-associated diseases.

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References


* In a cow-share agreement, a person who does not own, house, or care for the milking cow signs a contract or an agreement with the owner of the cow, pays an initial contract fee, and pays a monthly fee for the boarding and care of the cow. Depending on state law, the person might subsequently have partial ownership in the cow. In exchange for the fees, the person has the right to receive on a weekly basis a certain amount of unpasteurized milk, milk products, or both produced from the cow. The person can either pick up the unpasteurized milk at the farm or pay someone else to pick it up and deliver it or can pay a fee to the owner of the cow to have the products delivered.

Figure
FIGURE. Number of persons reported with *Escherichia coli* O157:H7 infections who were customers of a Cowlitz County, Washington, farm, by date of illness onset and state of residence—Washington and Oregon, November–December 2005

* n = 17. Although 18 cases were identified during the investigation, for one patient who was asymptomatic, date of illness onset could not be established.

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