

**Outbreak of *Campylobacter jejuni* Infections Associated with
Consumption of Cheese Made from Raw Milk –
Western Kansas, 2007**



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Introduction

On October 26, 2007, the Kansas Department of Health and Environment (KDHE) was notified of a potential foodborne outbreak. Approximately 30 people from a rural community had reported diarrhea and vomiting to health workers at the county family health clinic.

The Community Health Nurse subsequently reported the outbreak to the KDHE Office of Surveillance and Epidemiology (OSE). Preliminary investigation indicated that the ill individuals had eaten at a Pioneer Day (a community celebration) held in the community school on October 20, 2007.

With the cooperation of the community and assistance from the local county health officials, KDHE initiated an investigation on October 29, 2007. The purpose of the investigation was to characterize the outbreak, identify the source of illness, and recommend and implement appropriate prevention and control measures.

Background

On October 20, Community X held a Pioneer Day. The occasion was hosted on the grounds of the community church and school. Activities included making butter, cheese and buffalo stew, horse-shoeing and horse-racing. The cheese was prepared from raw (unpasteurized) milk donated by a local dairy.

Most meals served at the Pioneer day were prepared in private homes. However, food items prepared at the event were also served, and samples of the cheese were also taken home. Bottled water was provided, but people also drank water from jugs filled from a hydrant on the premises. The water from the hydrant was for irrigation purposes only and had not been tested to ascertain its safety for drinking.

Several individuals indicated that they suspected that the illness was associated with food or water served at the event.

Methods

Epidemiologic Investigation

KDHE conducted a retrospective cohort study among members of Community X to assess the extent of the outbreak and to identify the source of illnesses. Study participants comprised all members of church X and were asked to complete a self-administered written questionnaire (Attachment 1). The surveys were distributed by local health department staff at a social gathering for the church members and collected the same day with the assistance of the church pastor.

A case for this outbreak was defined as any member of Community X who developed vomiting or diarrhea between October 20 and 30, 2007.

Completed questionnaires were analyzed using SAS[®] 9.13.¹ Aggregate descriptive analyses were performed and risk ratios (RR) and 95% confidence intervals (CI) were calculated to assess the association between exposures and subsequent illness.

Environmental Assessment

An environmental assessment was conducted. Samples of cheese left over from the event were collected for testing and milk from the dairy was taken 14 days after the event for testing. Water samples taken from the hydrant three weeks after the event were collected and tested by the Southwest Kansas Local Environmental Planning Group.

Laboratory Analysis

Stool specimens were collected from four ill people during the outbreak. Specimens were cultured for enteric bacteria at the county hospital laboratory, and isolates of three of the four specimens were also sent to the Kansas Department of Health and Environment Laboratories (KHDEL) for culture, antibiotic sensitivity testing, and PFGE analysis. The Minnesota Department of Agriculture Laboratory conducted analysis of the milk and cheese samples.

Results

Epidemiologic investigation

One hundred thirty questionnaires were collected from 150 individuals who were members of Community X (response rate 87%). Community X is a rural community where over 60% of the men are employed in manual labor such as farming or truck driving. Sixty-eight percent of the females are housewives. Among the 130 individuals, 68 (53%) met the case definition. Gender distribution was similar for cases and non-cases. The median age for cases was 25 years and 22 for non-cases. The age range for the study population was 0 to 75 years (Table 1).

Descriptive Epidemiology

TABLE 1: Characteristics of Study Population (n=130)

| | | Cases (n = 68) | Non-cases (n = 62) | Total (n = 130) |
|-------------|--------|-------------------|-----------------------|--------------------|
| | | No. (%) | No. (%) | No. (%) |
| Gender | Male | 31 (46) | 32 (52) | 64 (50) |
| | Female | 37 (54) | 29 (48) | 65 (50) |
| Age (years) | Median | 25 | 22 | 22 |
| | Range | 1 - 75 | 0 - 67 | 0 - 75 |

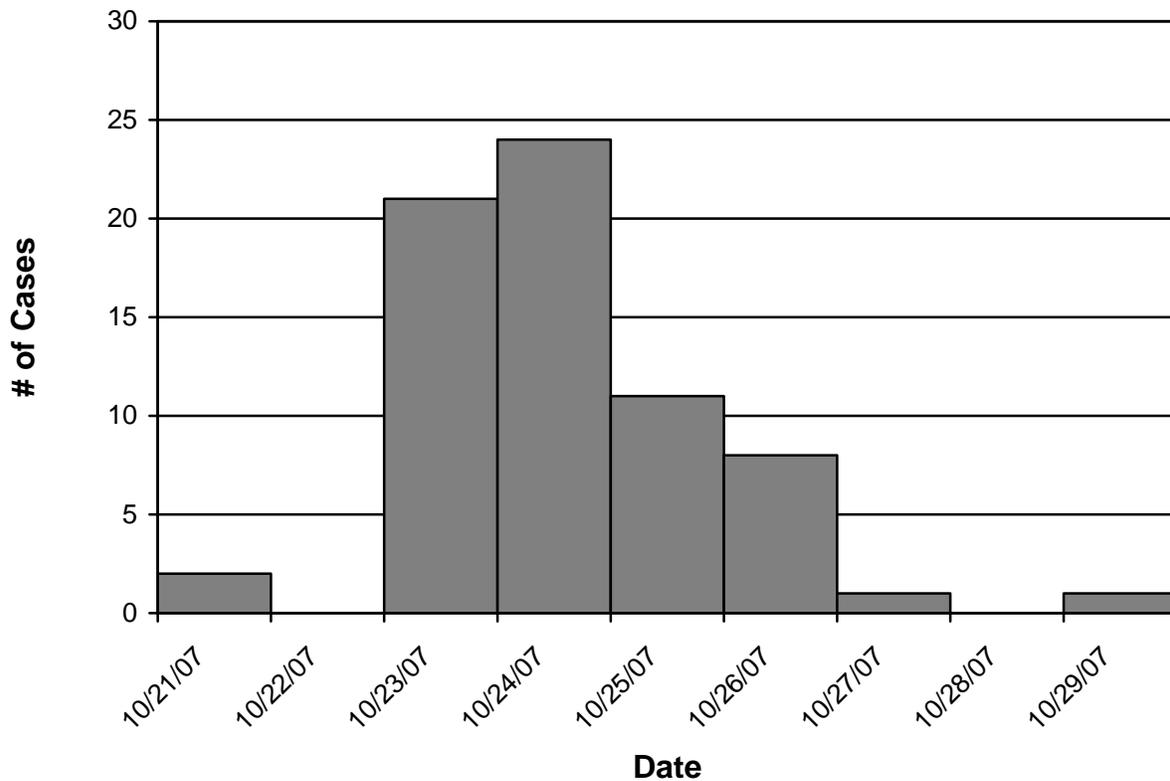
Among the 68 cases, diarrhea was the most frequently reported symptom, followed by abdominal cramps, fever and nausea. Nineteen people reported consulting a health provider, and two were hospitalized for their symptoms (Table 2).

TABLE 2: Features of Illness Reported by Cases (n = 68)

| Symptom | No. (% of Cases Reporting) |
|----------------------------|----------------------------|
| Diarrhea | 66 (97) |
| Abdominal cramps | 60 (88) |
| Fever | 54 (79) |
| Nausea | 38 (56) |
| Headache | 33 (49) |
| Dizziness | 22 (32) |
| Bloody Diarrhea | 18 (27) |
| Vomiting | 16 (24) |
| Health Care Results | |
| Visited a health provider | 19 (28) |
| Hospitalized | 2 (3) |
| Stool Specimen provided | 4 (6) |

Figure 1 shows that cases had onsets of illness ranging from 1 to 9 days after the Pioneer Day. Fifty-seven (86%) experienced illness within 5 days of exposure, with most cases reporting illness within 4 days, as shown by the highest peak.

FIGURE 1: Epidemic Curve



Exposure / Outcome Analysis

Among the exposures noted, only eating cheese made from raw milk at the Pioneer Day was statistically significant (RR = 14, 95%CI=2, 94).

TABLE 3 Association between reported exposure and subsequent illness

| Exposure | Exposed | | | Not exposed | | | RR | 95% CI |
|----------------------|-----------|-----------|-----------|-------------|-----------|----------|-------------|-----------------|
| | Ill | Not Ill | (%Ill) | Ill | Not Ill | (%Ill) | | |
| Attended Pioneer Day | 66 | 53 | 55 | 2 | 9 | 18 | 3.0 | 0.8-10.8 |
| Horseshoeing | 26 | 16 | 62 | 39 | 35 | 53 | 1.2 | 0.9-1.6 |
| Made cheese | 21 | 10 | 68 | 42 | 41 | 51 | 1.3 | 1.0-1.8 |
| Served meals | 10 | 9 | 53 | 54 | 42 | 56 | 0.9 | 0.6-1.5 |
| Made butter | 24 | 14 | 63 | 41 | 38 | 52 | 1.2 | 0.9-1.7 |
| Made stew | 6 | 4 | 60 | 57 | 47 | 55 | 1.1 | 0.6-1.9 |
| Ate apple cobbler | 32 | 20 | 62 | 33 | 31 | 52 | 1.2 | 0.9-1.6 |
| Ate chili | 60 | 46 | 57 | 6 | 8 | 43 | 1.3 | 0.7-2.4 |
| Ate cheese | 67 | 34 | 66 | 1 | 20 | 5 | 13.9 | 2.0-94.8 |
| Ate stew | 29 | 23 | 56 | 36 | 29 | 55 | 1.0 | 0.7-2.4 |
| Ate sauces | 5 | 3 | 63 | 50 | 40 | 56 | 1.1 | 0.6-2.0 |
| Ate biscuits | 42 | 20 | 68 | 25 | 31 | 45 | 1.5 | 1.0-2.1 |
| Ate butter | 37 | 18 | 67 | 29 | 32 | 46 | 1.4 | 1.0-1.9 |
| Ate vegetables | 43 | 32 | 57 | 21 | 20 | 51 | 1.1 | 0.8-1.6 |
| Ate potatoes | 16 | 17 | 48 | 44 | 34 | 56 | 0.7 | 0.6-1.3 |
| Had a drink | 63 | 47 | 57 | 2 | 7 | 22 | 2.6 | 0.8-8.8 |
| Drank bottled water | 14 | 9 | 61 | 19 | 17 | 53 | 1.2 | 0.7-1.8 |
| Drank jug water | 61 | 40 | 60 | 2 | 5 | 29 | 2.1 | 0.6-6.9 |
| Drank tea | 25 | 16 | 61 | 7 | 2 | 78 | 0.8 | 0.5-1.2 |

Laboratory Analysis

Campylobacter jejuni was cultured from all four stool specimens. Pulsed-field electrophoresis (PFGE) patterns for *Campylobacter jejuni* in two of the samples were found to be indistinguishable.

Laboratory test results for food and water samples were negative for bacteria.

Discussion

Campylobacter infection is one of the leading causes of gastrointestinal illness in all ages, causing up to 14% of diarrhea worldwide. It is estimated that 2.5 million cases occur each year, resulting in 13,000 hospitalizations and 124 deaths.² Many cases go unreported, as they may be asymptomatic, mild or self-limiting.

Symptoms of *Campylobacter* infection include diarrhea, vomiting, fever and abdominal cramping and usually appear within 2 to 5 days of exposure, lasting about one week. In less common instances, severe or prolonged illness or relapses can occur. Post-infectious syndromes, such as reactive arthritis and Guillian-Barre syndrome can also occur.

Large outbreaks have been associated with drinking fecally contaminated unpasteurized milk or water from shallow wells contaminated by animal feces.³ In 2006, unpasteurized milk or milk products were the vehicle identified in seven outbreaks of *Campylobacter* infection, which resulted in 100 cases, seven hospitalizations and one death.⁴ Milk and milk products are excellent vehicles for infection, because their fat content protects pathogens from gastric acid. Pasteurization minimizes pathogens in milk.⁵

The results of the epidemiologic study support the hypothesis that members of Community X became ill with *Campylobacter* infection after consuming cheese made from raw milk; eating cheese was significantly associated with illness. The risk of becoming ill was 14 times greater among those who reported eating the cheese than in those who did not. Laboratory analysis of stool specimens from four ill persons who reported eating cheese confirmed that they were infected with *Campylobacter jejuni*.

Strengths of the investigation

Because of the high response rate, the risk of illness could be directly assessed. Both human specimens and food samples were promptly collected, with the laboratory results of the human specimens confirming the cause of the outbreak. Most importantly, the cooperation of Community X, along with collaboration with partners at the county and state level, promoted a thorough and successful outbreak investigation.

Limitations of the investigation

Incomplete questionnaires led to exclusion of 5 individuals who might have met the case definition. Their exclusion may have altered the study findings. The cohort study was carried out two weeks after the event; it is possible some people did not correctly remember what they ate. Also, because members of the community already suspected the cheese as the source of the outbreak, it is possible more people reported eating it. This may have led to information bias.

Recommendations

To prevent future outbreaks of *Campylobacter* infection, educational efforts should make consumers aware of the risks associated with the consumption of raw milk and its products and

to have them avoid consumption of products containing raw milk. In addition, safe food preparation and handling techniques should be reviewed and understood by food handlers before group events where food would be served.

The current Kansas state regulations, which allow on-site sale and donation of unpasteurized (raw) milk, should be revised to prohibit the sale of unpasteurized milk or milk products.

Acknowledgements

Local health department staff
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Our Vision and Mission

As the state's environmental protection and public health agency, KDHE promotes responsible choices to protect the health and environment for all Kansans.

Through education, direct services, and the assessment of data and trends, coupled with policy development and enforcement, KDHE will improve health and quality of life. We prevent injuries, illness, and foster a safe and sustainable environment for the people of Kansas.

References:

¹ SAS Institute, Inc., Cary, NC, USA.

² Braam HP. Campylobacter enteritis. In: Heymann, DL, ed. *Control of Communicable Disease Manual*. 18th ed. Washington DC:APHA, 2004: 81-84

³ Mead PS, Slutsker L, Dietz V et al. Food-Related Illness and Death in the United States. **EID**,1999;5(5), September-October

⁴ Summary Statistics for Foodborne Outbreaks, CDC, 2006. Available at:
http://www.cdc.gov/foodborneoutbreaks/documents/2006_line_list/2006_line_list.pdf

⁵ Potter ME, Kaufman AF et al. Unpasteurized Milk- The Hazards of a Health Fetish. **JAMA** 1984; 252:2048.

Attachment 1
Gastrointestinal Illness Related to Pioneer Day, Kearny County, KS
October 20, 2007

Hello. The Kearny County Health Department and the Kansas Department of Health and Environment are investigating an outbreak of gastrointestinal illness related to the 'Pioneer Day' event. Your help is needed in determining the cause of illness. We request that you take a few minutes to fill out a separate questionnaire for each member of your family, whether or not he or she experienced illness. Please return the completed forms to the Head Pastor.

Thank you for your help in this matter.

Date form completed ____/____/____

Last Name _____ First Name _____ Age _____ Sex _____

Mailing Address _____ City _____ State _____ Zip Code _____

Phone (____) _____ Grade or occupation _____

SECTION 2

Did you attend the Pioneer Day Event held on Saturday, October 20th? YES NO

If YES, please continue.

If NO, please skip to SECTION 3.

Did you participate in any of these activities at the Pioneer Day?

Horseshoeing YES NO Making Butter YES NO

Making Cheese YES NO Making Stew YES NO

Meal Serving YES NO

Other _____

Did you eat any of the following food items at the Pioneer Day?

Apple Cobbler YES NO Biscuits YES NO

Chili YES NO Butter YES NO

Cheese YES NO Vegetables YES NO

Stew YES NO Potatoes YES NO

Sauces YES NO Drinks YES NO

Other _____

If you answered 'YES' to drinks, please select all that apply:

Bottled Water YES NO Jug Water YES NO

Other _____

Continue on back →

