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Date: October 2, 2008

To: The Record

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Center for Infectious Diseases  
850 Marina Bay Parkway  
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Richmond, CA 98404

Subject: CA EPI 08-10: Campylobacteriosis among Persons Consuming  
Unpasteurized Milk from a Cow-Leasing Program, Del Norte  
County, May–June 2008

We are pleased to provide the following report on this investigation, which was undertaken by the Del Norte County Public Health Department in collaboration with the California Department of Public Health, the California Department of Food and Agriculture, the U.S. Department of Agriculture, and the U.S. Centers for Disease Control and Prevention.

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To The Record  
Page 2  
October 2, 2008

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To The Record  
Page 3  
October 2, 2008

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To The Record  
Page 4  
October 2, 2008

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To The Record  
Page 5  
October 2, 2008

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## **Campylobacteriosis among Persons Consuming Unpasteurized Milk from a Cow-Leasing Program, Del Norte County, May–June 2008**

### **Summary**

In May and June 2008, a cluster of campylobacteriosis cases occurred in Del Norte County, California. An investigation was performed to determine the source and extent of the outbreak and prevent additional cases from occurring. Sixteen patients had illness that met the case definition. Illness onset dates ranged from May 7 to June 5. The median age of patients was 48 years (range, 4 to 70 years). Two patients were hospitalized; there were no deaths. One hospitalized patient was diagnosed with acute motor axonal neuropathy, a form of Guillain-Barré Syndrome. Four patients had confirmation of *Campylobacter* infection by stool culture. Prior to their illness, 15 of the 16 patients had consumed unpasteurized milk from a cow-leasing program run by a local dairy farm. The remaining patient was a dairy employee who worked directly with dairy cattle at this farm. A specimen of milk that had been partially consumed by two of the patients prior to their illness was positive for *Campylobacter jejuni* DNA by polymerase chain reaction (PCR). The cow-leasing program voluntarily closed on June 15, 2008.

### **Introduction**

On July 14, 2008, Dr. Thomas Martinelli, County Health Officer for Del Norte County, California, contacted the Division of Communicable Disease Control (DCDC), Center for Infectious Diseases (CID), California Department of Public Health (CDPH), to report four cases of laboratory-confirmed campylobacteriosis and five additional cases of diarrhea in residents of Del Norte County. Onset dates ranged from mid-May to early June 2008. Eight of the nine patients were members of a cow-leasing program run by a local dairy farm, Dairy A, which provided unpasteurized milk to its members. The ninth patient worked directly with dairy cattle at Dairy A. Dr. Martinelli had first learned about the outbreak on June 15, 2008, when he was notified about a person who had consumed unpasteurized milk from the cow-leasing program, developed symptoms of acute gastroenteritis, and was subsequently hospitalized with acute motor axonal neuropathy (AMAN), a form of Guillain-Barré Syndrome (GBS). Guillain-Barré Syndrome is an uncommon neurologic disorder that can be triggered by campylobacteriosis.

Dairy A is an organic dairy farm located in Del Norte County. The farm started a cow-leasing program in the fall of 2005. Members of this program reportedly purchased a “share” in a dairy cow. In return, members traveled to Dairy A to collect unpasteurized milk from a spigot connected to one of the dairy’s two bulk tanks (refrigerated tanks where unpasteurized milk is stored). According to Dairy A’s records, as of July 8, 2008, approximately 115 households from Del Norte County were members of this cow-leasing program. Dairy A’s membership roll listed no households in other counties or

states. On June 15, when Dairy A heard of a share program member who was hospitalized, it voluntarily shut down the cow-leasing program.

Del Norte County Health Department (DNCHD) had already initiated case-finding efforts before notifying CDPH about the outbreak. Dr. Martinelli accepted DCDC's offer to provide and coordinate additional assistance with the investigation. Dr. Amy Karon, CDC Epidemic Intelligence Service Officer assigned to the CDPH Infectious Diseases Branch, served as lead CDPH investigator and point person to coordinate assistance by the CDPH Microbial Diseases Laboratory; the California Department of Food and Agriculture (CDFA); the U.S. Centers for Disease Control and Prevention (CDC); and the United States Department of Agriculture (USDA). The goals of the investigation were to determine the source and extent of the outbreak, prevent additional cases from occurring, and recommend measures to prevent similar future outbreaks.

## Methods

### *Case Finding*

A case was defined as 1) laboratory-confirmed *Campylobacter* infection, or 2) diarrhea, or abdominal cramps and fever, in a resident of Del Norte County during May–June 2008, who reported exposure to Dairy A.

To identify cases, DNCHD asked the sole local microbiology laboratory, located at Sutter Coast Hospital, to notify them of all *Campylobacter* patient isolates during May–June 2008, and sent a letter about the outbreak to Del Norte County healthcare providers, asking them to report all suspected cases of bacterial gastroenteritis to DNCHD. To identify additional outbreak cases, DNCHD telephoned the 115 households listed on Dairy A's current cow-leasing program membership roll (dated July 8, 2008). If no one answered the telephone, DNCHD left a message requesting a call back if any member of the household had experienced gastrointestinal illness in May or June.

The CDPH Infectious Diseases Branch reviewed provider-reported data (Confidential Morbidity Reports) on *Campylobacter* cases in Del Norte County for 2005–2008, reviewed Sutter Coast Hospital laboratory data for patients with isolation of *Campylobacter* from stool specimens since March 1, 2007, and interviewed these patients to determine whether they recalled consuming unpasteurized milk during the week prior to their illness or had other potential risk factors for campylobacteriosis.

Stool specimens from two patients with no previous stool culture and the most recent dates of illness onset were sent to the CDPH Microbial Diseases Laboratory for culture. Serum specimens were obtained from seven patients who did not have a stool test and were forwarded to CDC. CDC tests these sera for *Campylobacter* antibodies using an experimental enzyme-linked immunosorbent assay (ELISA) which is un-validated and for research purposes only. The results would not be intended for individual patient

diagnosis or treatment but rather to give additional information, if any, about this group of patients' recent exposure to *Campylobacter*. Patients were verbally notified of this fact at the time that they were requested to provide blood specimens.

#### *Site Visits and Environmental Testing*

On June 25, DNCHD made a site visit to Dairy A to confirm that the cow-leasing program had been shut down. On July 17, three days after CDPH was notified about the outbreak, two unpasteurized milk samples, one from each of Dairy A's two bulk tanks, were collected for culture by CDFA. A 6-week-old refrigerated sample of unpasteurized milk from Dairy A that had been saved in a patient's household was forwarded to the USDA Agricultural Research Service in Albany, California for testing. Two patients from that household, including the patient with GBS, reported consuming some of this milk three days prior to their illness onset. The USDA laboratory used enrichment culture and polymerase chain reaction (PCR) to test this sample for *Campylobacter*.

### **Results**

#### *Case Finding*

For May-June 2008, DNCHD identified 16 cases. Four cases had stool cultures positive for *Campylobacter jejuni/coli* group by Sutter Coast Hospital laboratory, and 12 cases were identified by calling households that were members of the cow-leasing program of Dairy A. There were no cases identified through local providers.

Among the 16 patients, dates of illness onset ranged from May 7 to June 5, 2008 (Figure 1), and age ranged from 4 to 70 years (median: 48 years); 50% were female. Symptoms included diarrhea (100%), abdominal cramps (80%), fever (46%), bloody stool (20%), and vomiting (20%). Two patients were hospitalized, and one patient had a form of Guillain-Barré Syndrome. No patients died. Among the four culture-confirmed cases, symptom onset dates ranged from May 10 to 28. Three of the four culture-confirmed patients drank unpasteurized milk from Dairy A; the fourth patient was the Dairy A employee.

DNCHD interviewed 88 (77%) of the 115 households that were members of Dairy A's cow-leasing program. These interviews identified 15 persons from 10 households with illness that met the case definition (household-based attack rate: 10/88 = 11%). Three of these 15 were already laboratory-confirmed. Five households had one ill member, and five had two ill members. Among households with two ill members, patients' dates of illness onset occurred on the same day (n=2), within one day (n=1), or within two days of one another (n=2). All 15 patients reported having recently consumed unpasteurized milk from Dairy A. Four patients had consumed the milk for the first time within 2–5 days prior to illness onset; two consumed it several times per month, most recently 2–4 days before symptom onset; two consumed it for the first time 15 days

before illness onset, and the remaining seven had consumed it on a daily basis for months to years.

The patient diagnosed with a form of Guillain-Barré Syndrome consumed unpasteurized milk from Dairy A for the first time on June 1. On June 4, she developed diarrhea, abdominal cramps, fever, and vomiting. These symptoms resolved by June 8. On June 12, she developed burning pain in her legs. On June 14, she was hospitalized with progressive paresis. The patient was placed on a mechanical ventilator and remained on the ventilator until September 16, 2008. A nerve biopsy showed acute motor axonal neuropathy (AMAN), a form of Guillain-Barré Syndrome. No stool culture was performed before the patient received antibiotics. A stool culture performed approximately one week after initiation of antibiotic therapy was negative.

The 16th case, identified through Sutter Coast Hospital laboratory, occurred in a Dairy A employee who denied drinking unpasteurized milk but worked with cattle at the dairy. This patient developed diarrhea and abdominal cramps on May 28. His stool test was positive for *Campylobacter jejuni/coli* group.

Patient isolates were routinely discarded before the outbreak was reported, and thus were not available for speciation and further laboratory testing. Cultures of the two patient stool specimens by the Microbial Diseases Laboratory were negative; both specimens had been obtained approximately six weeks after illness onset. Since the CDC serology test is un-validated and for research purposes only, the CDC laboratory recommended comparison serology testing of available sera by another research laboratory.

Sutter Coast Hospital microbiology laboratory reported nine *Campylobacter* isolates from Del Norte County residents during the 14-month period from March 1, 2007 to April 30, 2008, an average of 0.6 isolates per month. There were no isolates during May 2007, and no temporal clustering of isolates except for four specimens collected within a 39-day period in July and August, 2007. In contrast, the four specimens from the Dairy A-associated cluster in May and June, 2008 were collected within a 16-day period. The Infectious Diseases Branch interviewed eight of the nine historical patients; one patient, whose stool specimen was collected on February 24, 2008, recalled having consumed unpasteurized milk from Dairy A during the week prior to her illness onset. The patient's family stated that they were not members of the cow-leasing program, but had been given the unpasteurized milk by a friend who was a member. The patient and her parents consumed the milk; both parents remained well. None had previously consumed unpasteurized milk.

From the Confidential Morbidity Reports that came to CDPH, six cases of campylobacteriosis from Del Norte County were reported by healthcare providers during January 1, 2005–July 15, 2008: three in 2005, and three in 2007.

### *Site Visits and Environmental Testing*

The site visit made by DNCHD on June 25 confirmed that the cow-leasing program remained closed.

The two milk samples collected and cultured on July 17 by CDFA were negative for *Campylobacter*.

The 6-week-old refrigerated sample of unpasteurized milk that was tested by USDA was noted to be curdled. This sample was negative for *Campylobacter* by enrichment culture, but positive for *Campylobacter jejuni* DNA by PCR: PCR and multilocus sequence typing identified two genes (*aspA* and *waaV*) specific for *Campylobacter jejuni*. Distinct sequences were identified from the *waaV* gene, indicating that multiple *C. jejuni* strains were present in the sample.

### **Discussion**

Campylobacteriosis is a common cause of bacterial gastroenteritis worldwide and the most common foodborne infection in California (1). Illness usually occurs two to five days after exposure and infection. Typical symptoms include diarrhea, frequently with bloody stools; abdominal cramps; fever; nausea; and vomiting (2). Complications are uncommon and include relapsing diarrheal illness, reactive arthritis, meningitis, and Guillain-Barré Syndrome. Poultry and cattle are major reservoirs for *Campylobacter* species. Apparently healthy cattle often shed *Campylobacter* intermittently (3), and *Campylobacter* is commonly isolated from bulk tank (unpasteurized) milk (4-6). During 1973–1992, 57% of unpasteurized milk-associated outbreaks reported to CDC were caused by *Campylobacter* (7). Drinking unpasteurized milk from cow-leasing programs has caused a previous campylobacteriosis outbreak (8), and an outbreak of *E. coli* O157:H7 infection (9). Outbreaks of campylobacteriosis have also been associated with drinking certified unpasteurized milk (10,11), unpasteurized milk served during community events (12,13) and school field trips to dairy farms (14-16), and, among farmers, with drinking unpasteurized milk from one's own dairy herd (17).

A cluster of campylobacteriosis cases occurred in Del Norte County in May–June 2008. The cluster included four culture-confirmed cases that occurred within a 16-day period in this county in May. Three of these patients had consumed unpasteurized milk from Dairy A prior to their illness, and the fourth patient worked with cattle at Dairy A. Local historical laboratory data indicate that it is unusual for Del Norte County to have more than one or two patients with positive *Campylobacter* stool culture in a 30-day period. Therefore, the occurrence of four laboratory-confirmed campylobacteriosis cases within 16 days, all with exposures linked to Dairy A, supports the conclusion that this was an outbreak of campylobacteriosis associated with Dairy A. Interviews of households in the Dairy A cow-leasing program identified twelve additional patients who reported acute diarrheal illness in May and early June after consuming unpasteurized milk from Dairy

A. While four of these patients became ill right after drinking this unpasteurized milk for the first time, seven patients became ill even though they had been drinking it daily for months to years.

Of concern was the patient who was hospitalized with GBS, an uncommon neurologic disorder that can be triggered by bacterial and viral infections, including campylobacteriosis (18,19). The patient in this outbreak was specifically diagnosed with acute motor axonal neuropathy (AMAN), the form of GBS that is most frequently associated with preceding *Campylobacter* infection (20). According to CDC, GBS "occurs when a person's immune system is 'triggered' to attack the body's own nerves resulting in paralysis that lasts several weeks and usually requires intensive care. It is estimated that approximately one in every 1,000 reported *Campylobacter* illnesses leads to Guillain-Barré syndrome, and as many as 40% of Guillain-Barré syndrome cases in this country may be triggered by campylobacteriosis." (21) The patient with GBS in this outbreak developed acute febrile gastroenteritis three days after drinking unpasteurized milk from Dairy A for the first time, and then was hospitalized 10 days later with GBS symptoms. Both the timing of the gastrointestinal illness and the onset of GBS symptoms were well within the expected time of onset after exposure to *Campylobacter*, which is two to five days for onset of gastrointestinal illness and one to four weeks for onset of neurologic symptoms. PCR and multisequence DNA typing indicated the presence of *Campylobacter jejuni* DNA in a sample of the unpasteurized milk that had been partially consumed by the patient with GBS and by one other patient.

The available epidemiologic and laboratory data support the conclusion that this cluster of acute diarrheal illness in Del Norte County was an outbreak of *C. jejuni* infections caused by consumption of unpasteurized milk from Dairy A. However, the findings of this investigation are subject to at least two limitations. First, the four patient isolates were discarded before the outbreak was detected, and therefore, additional laboratory testing could not be performed to further confirm the common link between these four cases. Second, milk samples were not collected nor cultured until six weeks after the suspected exposure period, and therefore viable *Campylobacter* was not recovered from these milk samples.

In California, it is unlawful for any person to sell, give away, deliver, or knowingly purchase or receive any milk or product of milk that does not conform to applicable standards as specified by the California Food and Agricultural Code (22). These standards help to decrease, but do not eliminate, the risk that pathogenic bacteria may be present in unpasteurized milk. Consumers should therefore be informed that consuming any type of unpasteurized milk or unpasteurized milk product could cause bacterial gastrointestinal infection and, uncommonly, could result in potentially serious illness.

### **Recommendations**

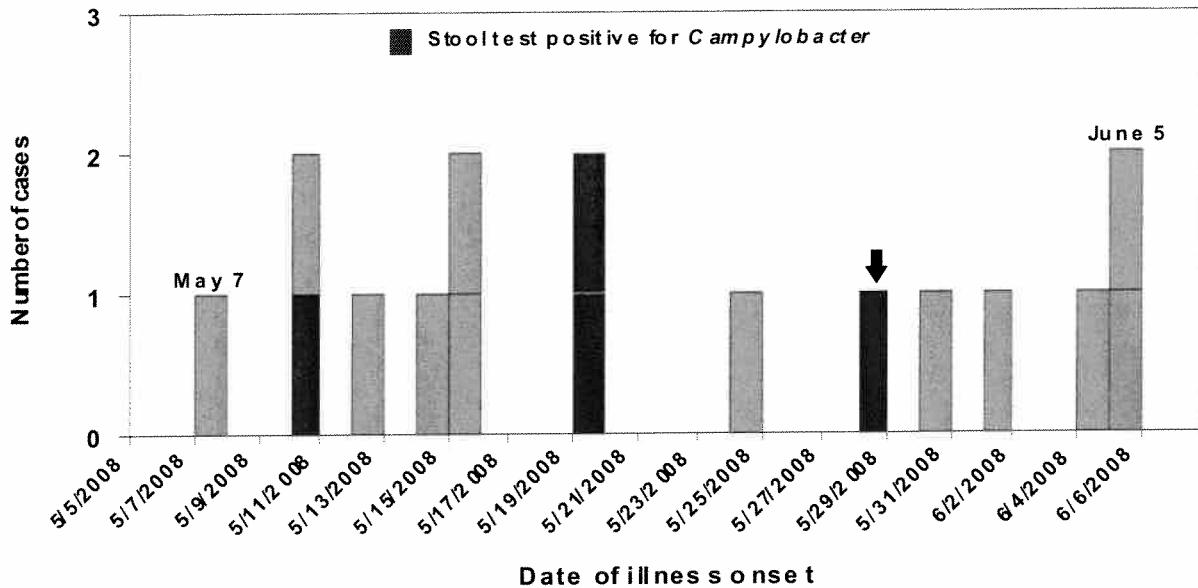
1. Continue public education efforts regarding health risks associated with consuming unpasteurized milk and unpasteurized milk products.
2. Evaluate strategies for enhancing surveillance and public health response to campylobacteriosis outbreaks in California.
3. Survey all California dairies for cow-leasing programs, and consider measures to prevent similar future outbreaks.

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**Figure 1.** Outbreak of acute diarrheal illness in Del Norte County in May and June, 2008. Four cases (black fill) were positive for *Campylobacter jejuni/coli* group by stool culture. All patients consumed unpasteurized milk from Dairy A two to fifteen days prior to illness onset, except the patient referenced by the black arrow. This patient worked with cattle at Dairy A prior to illness onset.