

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH  
INFECTIOUS DISEASES BRANCH INVESTIGATIVE SUMMARY



CA EPI 12-02: Outbreak of *Campylobacter jejuni* Infections Associated with the Consumption of Commercially Available Raw Milk in California  
February 14, 2013

## Summary

From January through April 2012, 33 persons with *Campylobacter jejuni* infection who reported consuming commercially available unpasteurized (raw) milk prior to illness onset were identified in California. Extensive interviews with case-patients, along with investigations conducted by the California Department of Food and Agriculture and the CDPH Food and Drug Branch and laboratory test results from environmental samples determined that raw milk from two commercial dairies, Organic Pastures and Claravale Farm, was the source of illness for nine patients with available *Campylobacter* isolates. As a result of this investigation, both dairies issued quarantine and recall of their products. This investigation involved coordination of effort between local and state agencies, and highlights the health risks of consuming raw milk.

## Introduction

In January 2012, the County of San Luis Obispo Public Health Department reported to the California Department of Public Health (CDPH) Infectious Diseases Branch (IDB) three cases of *Campylobacter jejuni* infection (two co-infected with *Yersinia enterocolitica*) in patients who reported drinking Organic Pastures Dairy Company (OPDC) brand raw milk. These three case-patients were not household contacts and did not know each other. They purchased the raw milk on separate days from a retail store and a local farmer's market; dates of illness onset were January 1, 16, and 23, 2012. This information suggested a possible ongoing outbreak.

In collaboration with CDPH Food and Drug Branch (FDB) and the California Department of Food and Agriculture (CDFA), we conducted an investigation to:

- determine if there was a link between illness and raw milk consumption, through enhanced surveillance, patient interviews, traceback, and molecular typing of human and dairy isolates;
- prevent further illnesses from occurring by identifying and addressing potential sources of contamination.

## Methods

### Epidemiologic Investigation

Most California local health jurisdictions (LHJs) do not routinely interview their *Campylobacter* patients due to the high volume of cases (approximately 5000 cases identified in California per year). Therefore an epidemiological investigation comparing risk factors among cases with risk factors among controls or with population food survey data was not feasible. The main purpose of the epidemiological investigation was to identify campylobacteriosis cases early enough to obtain clinical isolates for pulsed-field gel electrophoresis (PFGE) analysis in order to assess whether the case-patients were infected with a common strain of *Campylobacter*.

For the purposes of this investigation, a confirmed case-patient was defined as a person with culture-confirmed *Campylobacter* infection with a history of commercial raw dairy product consumption in the week before illness onset. A standardized questionnaire was developed that asked details about the illness, as well as other exposures prior to illness onset, including travel and exposure to sources previously associated with *Campylobacter* infection, such as poultry, raw seafood, raw milk products, and pets.

In early February 2012, CDPH IDB sent an email to the local health officers and communicable disease controllers requesting that any persons with campylobacteriosis or other enteric gastroenteritis (such as *Salmonella* or Shiga toxin producing *Escherichia coli* [*E. coli*] infection) with exposure to raw milk prior to onset of illness identified through routine surveillance be immediately reported to IDB. In addition, LHJs were asked to report any case of yersiniosis promptly to IDB for further follow up. This period of enhanced passive surveillance applied to enteric pathogens with collection dates between January 1 and February 14, 2012. Case-patients identified in this manner were interviewed using a standardized questionnaire either by a LHJ or IDB epidemiologist. In addition, LHJs were requested to collect raw dairy products from the patient's home and case-patient isolates whenever available for additional testing.

In addition, selected counties were requested to interview all of their *Campylobacter* case-patients with illness onsets between March 1 and April 30 with a standardized supplemental questionnaire to further enhance case-finding and to establish a better characterization of exposures among campylobacteriosis patients. These LHJs were a convenience sample of jurisdictions in northern California where many of the identified case-patients resided; this included jurisdictions in the California Emerging Infections Program catchment area (Alameda, Contra Costa, and San Francisco counties, and the City of Berkeley), and counties that were already routinely interviewing patients with campylobacteriosis. In order to reduce the burden on these selected LHJs, the administration of the supplemental questionnaire was limited to patients who were non-Hispanic and less than 65 years of age, as the case-patients who had been identified to date had been young and non-Hispanic.

## Laboratory Investigation

Clinical laboratories are not required to send *Campylobacter* isolates to a public health laboratory for additional testing, and isolates are discarded soon after identification. Attempts were made to collect *Campylobacter* isolates from patients meeting the case definition as rapidly as possible before they were discarded. Available isolates were sent to the CDPH Microbial Diseases Laboratory (MDL) for PFGE analysis. In addition, CDPH MDL performed PFGE analysis on isolates from a selected number of *Campylobacter* patients with no history of raw dairy product exposure to serve as a comparison group. Only one clinical *Yersinia enterocolitica* isolate was available for additional testing, and was sent to MDL for PFGE analysis.

The Food and Drug Laboratory Branch (FDLB) and the CDFA laboratory tested bottles of raw milk collected from case-patients' homes and products and environmental samples from the implicated dairies. These isolates were forwarded to MDL for PFGE analysis.

## Environmental Investigation

There are two certified raw milk dairies in California with milk and other dairy products sold in retail locations throughout California. OPDC is a licensed raw milk dairy located in Fresno County. Claravale Farm is a smaller licensed raw milk dairy located in San Benito County.

Details of the CDFA and CDPH Food and Drug Branch (FDB) investigation may be obtained from those agencies. CDFA and CDPH FDB investigation included the collection of environmental samples from both dairies, including raw dairy products and fresh cattle manure from the pasture.

## **Results**

### Epidemiologic Investigation

From January through May, 2012, a total of 33 people with *Campylobacter* infection were identified who reported consuming commercial raw milk prior to illness onset. Case-patients were residents of Contra Costa, Fresno, Los Angeles, Marin (6), Monterey (2), Nevada, Orange, San Diego, San Francisco (3), San Luis Obispo (3), San Mateo (3), Santa Clara (2), Santa Cruz (7) counties, and the City of Pasadena. Illness onset dates ranged from January 1 to April 29, 2012 (Figure). The median age was 14 years (range, 9 months- 66 years); 68% were male. One person was hospitalized; there were no deaths.

In March, a patient with *E. coli* O121:H19 infection died from complications of hemolytic uremic syndrome. Her mother reported to the LHJ that the case-patient had consumed commercially available raw milk prior to illness onset. However, since the patient had

expired, this could not be confirmed, and her isolate did not match any other isolate in the California PFGE database. Otherwise, there were no other patients identified during this time with other enteric bacterial pathogen infections who reported consuming raw milk prior to illness onset other than for the two patients who were co-infected with *Campylobacter* and *Yersinia*.

Of the 33 case-patients meeting the case definition, eleven reported drinking OPDC brand milk, 19 drank Claravale Farm brand milk, and three could not recall the specific brand of raw milk or drank both brands. The initial phase of enhanced passive surveillance in January and February resulted in the identification of eleven patients. In response to the subsequent request for enhanced surveillance, eleven LHJs (Alameda, Berkeley, Contra Costa, Marin, Monterey, San Diego, San Francisco, San Luis Obispo, San Mateo, Santa Clara, and Santa Cruz) identified 430 patients with confirmed *Campylobacter* infections with onset or collection dates between March 1 and April 30. Of these, 276 were reached for interview, and 22 (8%) reported commercial raw milk exposure. This is higher than the observed rate of raw milk exposure in the general population of 3.2% (2006-07 FoodNet population survey data for California, non-Hispanic persons 65 years or younger)<sup>1</sup>.

During the course of this investigation information was received that Claravale Farm dairy had temporarily suspended deliveries of raw milk in February due to customer complaints. In April, a pediatric practice identified several patients with *Campylobacter* infection or gastrointestinal illness who reported a history of commercial raw milk consumption.

### Laboratory Investigation

MDL completed PFGE analysis on nine *Campylobacter* isolates from patients who reported drinking raw milk. All nine had the same primary enzyme (SmaI) pattern DBRS16.0024. However, the isolates from four patients who drank the Claravale product only, along with one patient who drank both products had the same secondary enzyme (KpnI) pattern DBRK02.1142. The pattern combination DBRS16.0024/DBRK02.1142 is very uncommon and had not previously been seen in the PulseNet *Campylobacter* database. Isolates from three patients who drank the OPDC brand milk all had the KpnI pattern DBRK02.0022 which is different from the KpnI pattern DBRK02.1142 above. The isolate from a fourth patient who drank OPDC brand milk, with an onset date of April 10 had a KpnI pattern DBRK02.0529, which differed by three bands but is still considered per CDC to be related to the KpnI pattern DBRK02.0022. *Campylobacter* has a tendency to mutate, even within the course of an outbreak.

Nine *Campylobacter* isolates from patients without a history of raw milk exposure have had PFGE testing completed to determine the background pattern variability among *Campylobacter* isolates in California. All nine had different SmaI/KpnI patterns.

<sup>1</sup> : <http://www.cdc.gov/foodnet/surveys/FNExpAtl03022011.pdf>

The CDPH FDLB isolated *E. coli* O157:H7 from an unopened bottle of Claravale Farm brand raw milk collected in February from a patient's home. The PFGE pattern associated with this isolate was unique, and did not match any human isolates in the PulseNet database. In addition, both *E. coli* O2:H27 (Shiga toxin 2 producing) and *E. coli* O116:H12 (Shiga toxin 1 producing) were recovered from raw milk collected on March 14, 2012 from Claravale Farm dairy. A sample of cream collected from Claravale Farm dairy on March 14, 2012 yielded *Campylobacter jejuni* with PFGE pattern combination DBRS16.0024/DBRK02.1142. An environmental swab collected from the dairy on April 23, 2012 also yielded *Campylobacter jejuni* with pattern combination DBRS16.0024/DBRK02.1142. This pattern matches that of the five patients above who drank Claravale brand raw milk.

Raw cream and butter samples collected on May 1, 2012 from OPDC by FDB and CDFA yielded *Campylobacter jejuni* with PFGE pattern combination DBRS16.0024/DBRK02.0022. This pattern matches that of the three patients above who drank OPDC brand raw milk. Cream samples from the dairy also yielded PFGE pattern combination DBRS16.0024 / DBRK02.1209 which is very similar to DBRS16.0024/DBRK02.0022. Cow feces collected from OPDC yielded *Campylobacter jejuni* with pattern combination DBRS16.0085 / DBRK02.0215, which did not match any human isolate.

The *Yersinia enterocolitica* isolate from a patient in San Mateo did not match any other isolate in the database; however, strain-typing of *Y. enterocolitica* is infrequently done.

### Environmental Investigation

Details of the CDFA and FDB investigation are under separate cover. IDB worked closely with both agencies in sharing relevant epidemiologic information and facilitating the testing of laboratory isolates.

On March 19, CDFA issued a statewide recall and quarantine of Claravale Farm brand raw milk and cream due to the finding of *Campylobacter* in raw cream:

[http://www.cdfa.ca.gov/egov/press\\_releases/Press\\_Release.asp?PRnum=12-008](http://www.cdfa.ca.gov/egov/press_releases/Press_Release.asp?PRnum=12-008)

The quarantine was lifted on March 29, and distribution of Claravale Farm dairy products has since resumed.

On May 10, CDFA issued a statewide recall and quarantine of Organic Pastures Dairy Company brand raw milk, skim milk, cream and butter, based on the laboratory and epidemiologic findings.

[http://www.cdfa.ca.gov/egov/Press\\_Releases/Press\\_Release.asp?PRnum=12-018](http://www.cdfa.ca.gov/egov/Press_Releases/Press_Release.asp?PRnum=12-018)

This quarantine has also been lifted and distribution of OPDC products has resumed.

## Discussion

From January through April 2012, 33 California residents with *Campylobacter jejuni* infection who reported consuming a commercially available raw dairy product were identified. Extensive interviews with case-patients, along with investigations conducted by CDFA and CDPH FDB, and laboratory test results from environmental samples supported unpasteurized raw milk from two commercial dairies as the source of illness for nine patients who had *Campylobacter* isolates available for PFGE testing. Given that commercial raw milk was widely distributed, it is likely that many more persons were exposed to contaminated product, became ill but not tested, or, like the remaining 24 patients identified above, had *Campylobacter* cultured but did not have their isolates saved for further testing.

The laboratory investigation, in particular, helped to delineate the presence of two separate but concurrent outbreaks of *Campylobacter* associated with both of the commercial raw milk dairies in California. Five patients who had consumed Claravale Farm brand raw milk were infected by the same rare strain of *Campylobacter* that was subsequently isolated from a Claravale Farm sample of cream. Four patients who had consumed OPDC milk were infected by the same or related strain of *Campylobacter* that was subsequently isolated from OPDC samples of cream and butter.

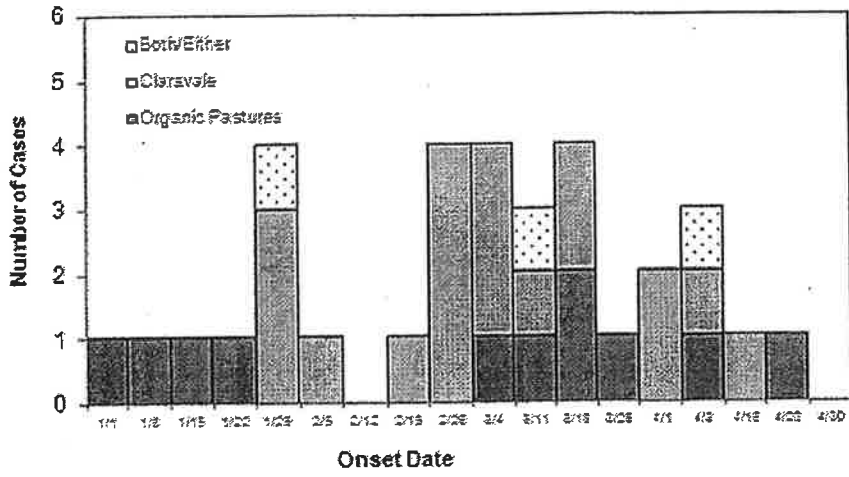
There are limitations to the laboratory investigation. PFGE testing for *Campylobacter* isolates is not routinely conducted; therefore, clusters are generally not identified through PFGE, and the PFGE database for *Campylobacter* is relatively small. Nonetheless, given that *C. jejuni* populations show high genetic diversity, the discriminatory power of PFGE for *C. jejuni* is high, especially when using two enzymes. The finding that the nine background *Campylobacter* isolates had different PFGE patterns underscores this fact, and lend further credence to the finding that the illness associated with Claravale and those associated with OPDC were caused by distinct strains of *Campylobacter*.

The epidemiologic, environmental, and laboratory investigations strongly support the presence of two concurrent outbreaks occurring in January-April of 2012, caused by two distinct strains of *Campylobacter* and associated with the consumption of commercially available raw milk. As a result of this investigation, both dairies issued quarantine and recall of their products. This investigation involved coordination of effort between local and state agencies, and highlights the health risks of consuming raw milk.

## Recommendations

- Maintain surveillance for additional cases of *Campylobacter* associated with raw dairy products
- Continue public health education efforts regarding the risk of infection with consuming raw dairy products

Figure. *Campylobacter* Illnesses Associated with Raw Milk  
 by Week of Onset, January to May 2012 (N=33)  
 (as of 5/30/12)



131