# Summary report of the March 2010 *Campylobacter* outbreak involving consumption of raw milk

## Introduction

The Foodborne Program of the Michigan Department of Community Health (MDCH) was first notified of two households with *Campylobacter* cases in Washtenaw and Wayne Counties by MDCH Region 2 South Epidemiologist on March 17, 2010. A Wayne Co. resident had made a complaint to the Van Buren Cass District Health Department (VBCDHD) on March 16, 2010, about potentially contaminated unpasteurized milk that she had obtained from a church in Wyandotte. The unpasteurized milk was distributed to cow-share members at this church drop-site by the Family Farms Co-operative (FFC) in Vandalia, Cass County, Michigan. FFC operates a cow-share program where members own part of a cow and in return receive unpasteurized dairy products. The Wayne Co. resident related that the milk was picked up by the FFC at an Indiana Amish farm, called Forest Grove Dairy, in Middlebury, IN. FFC then distributed the milk at various drop-sites in SE Michigan. VBCDHD referred the call to Wayne County Health Department. The complainant, [redacted] reported that [redacted] members, herself included, became ill on March 8, 2010, with gastroenteritis after consuming raw milk; symptoms included fever, abdominal cramps, and diarrhea. The Wayne Co. resident took [redacted] to the doctor on March 12, 2010. One of the [redacted] stool specimens tested positive for *Campylobacter*; the other [redacted] test result was negative.

The second report of *Campylobacter* illness came from a Washtenaw Co. [redacted] with two confirmed cases and three others ill with similar symptoms. The [redacted] had made kefir from unpasteurized FFC milk she had obtained from a FFC drop-site in Ann Arbor. The Washtenaw [redacted] informed the Washtenaw Public Health Department that the Co-op was aware of people reporting illness from drinking the milk; FFC had suspended distribution on Friday, March 12th until they felt the milk was safe to drink. The FFC owner had notified Co-op members that he was having the milk tested.

MDCH contacted the Michigan Department of Agriculture (MDA), Food and Dairy Division the afternoon of March 17th. Because more than one health jurisdiction was involved, MDCH took the lead in the public health investigation. Neighboring states in Illinois and Indiana were notified on March 17, 2010, about the *Campylobacter* outbreak in Michigan. Objectives of the public health investigation included determining the scope and source of the campylobacter outbreak, case finding, and identifying what other products may be implicated with illness.

## Background

An estimated 2.4 million cases of *Campylobacter* infections occur each year in the US (Mead et al. 1999). Symptoms of *Campylobacter* infection include diarrhea (frequently bloody), abdominal pain, malaise, fever, nausea, and/or vomiting (Heymann 2008). The incubation period is 2–5 days (range 1–10 days) and symptoms last 1–2 weeks. Some adults may experience prolonged illness or relapse, but most people recover uneventfully. Children under the age of five, young adults, and males have a higher incidence of illness. An estimated 100 deaths occur annually in the U.S. from *Campylobacter* infection. Outbreaks with a common source are infrequent but when they do occur, they are usually linked to the consumption of undercooked poultry, unpasteurized dairy, or

nonchlorinated water. Historically, most *Campylobacter* cases in Michigan have been sporadic cases.

Michigan's dairy laws going back 50 years have stated that any milk sold to the public must be pasteurized. In 2001 the Michigan Grade A Milk Law (Act No. 266) was amended to say that "Only pasteurized milk and milk products shall be offered for sale or sold, directly or indirectly, to the final consumer..." (MDA 2001). MDA and FDA investigated FFC in 2007 for distributing unpasteurized dairy products. In the 2007 investigation of FFC, MDA was advised the language of the law is not clear and thus not enforceable in a court of law. Ultimately FFC was not charged and a settlement between FFC and the MDA was reached on April 20, 2007, whereby FFC could distribute raw dairy products only to cow/herd share members consistent with current Michigan law (but not on the premises of any licensed food establishment). Nationally the FDA has required that all milk packaged for human consumption be pasteurized before being delivered for introduction into interstate commerce.

**Epidemiologic Investigation: Methods**

*Case finding and data collection*

Active surveillance for *Campylobacter* was initiated at the state and local levels. The Michigan Disease Surveillance System was monitored for additional *Campylobacter* cases between February 1 and March 31, 2010. The MDCH Regional Epidemiologists were asked to make the request of their respective local health departments that confirmed and probable *Campylobacter* cases within this time interval be recontacted and asked specifically if they drank raw milk prior to their illness. Also at this time local health departments were asked to classify any 2010 *Campylobacter* antigen positive lab reports as probable cases instead of closing them out as 'not a case.' Local health departments also worked with existing cases to identify other dairy co-op members who were ill. MDCH epi developed a supplemental questionnaire specific to questions about the consumption of raw dairy products supplied by the dairy co-op. The list of dairy products was taken from a FFC receipt from one of the [redacted] with ill [redacted] members. Unpasteurized dairy items distributed by FFC included milk, cream, sour cream, buttermilk, yogurt, kefir, butter, and cheese. On March 22, 2010, the supplemental questionnaire was sent to MDCH Regional epidemiologists for distribution to local health departments with *Campylobacter* cases who were reporting raw milk consumption.

Outbreak cases were defined as a culture-confirmed *Campylobacter* case whose illness occurred between March 1 and March 31, 2010, and who reported exposure to unpasteurized dairy products within 7 days prior to illness. Probable outbreak cases were those individuals with diarrheal illness between March 1 and March 31, 2010, and who (1) were epidemiologically linked to a confirmed *Campylobacter* case, or (2) had a positive test result from an antigen-based non-culture test and who also had an exposure to unpasteurized dairy products. Local health department communicable disease nurses interviewed cases or the guardian of child cases by telephone; the nurses collected information on other family members who also had diarrheal illness after drinking raw milk.

*Communications*

On March 19, 2010, MDCH released a public health alert regarding the *Campylobacter* illness among people who had consumed raw milk from FFC. MDCH posted a report March 23, 2010, on the Foodborne Outbreak listserv about the *Campylobacter* investigation advising neighboring state health departments to look for additional cases based on the distribution area for the Indiana Forest Grove Dairy. The FDA issued a press release on March 25, 2010, to alert consumers to the outbreak of campylobacteriosis associated with drinking raw milk. The FDA press release acknowledged the collaboration of MDCH, the Illinois Department of Public Health, the Indiana State Board of Animal Health, and the Indiana State Health Department in the investigation. The specific raw dairy questionnaire and updates of the investigation were posted to the secure Michigan Health Alert Network for the public health community to access 24/7 during the course of the active investigation.

**Epidemiological Investigation: Results**

Between March 1 and March 31, 2010, 25 raw milk related cases of diarrheal illness were reported to public health in Michigan. Of these, 13 were culture-confirmed *Campylobacter* infections and 5 of the 13 were typed as *Campylobacter jejuni*. All 13 *Campylobacter* cases were interviewed with the MDSS questionnaire and four cases were re-interviewed with the supplemental questionnaire. The 13 confirmed cases came from six jurisdictions (Detroit, Macomb, Monroe, Oakland, Washtenaw, and Wayne Counties), in regions 2N and 2S. Ages of cases ranged from 1.5 to 55 years with a median age of 6 years; 38.4% were less than 5 years old (Table 1). Males comprised 69% of the cases. No hospitalizations were reported among the confirmed cases. The three most predominant symptoms of the *Campylobacter* cases were diarrhea (100%; 61.5% with bloody diarrhea); fever (92.3%); and abdominal pain (76.9%). None of the local health departments reported probable outbreak-related cases in MDSS. Five of the 12 probable cases were adults (ages not available for all). Ages for seven of the eight probable child cases ranged from 1.5 to 15 years.

Illness onset dates for confirmed cases ranged from March 1–12 (Fig. 1); one case missing an onset date had a specimen collection date of March 18, which may indicate an onset date later than March 12. Duration of illness ranged from 2–13 days, with a median time of 5 days (average duration = 6 days). Two cases were still symptomatic at the time of their interviews on 3/16. For children <19 years, the median duration was slightly longer at 6 days (average duration = 6 days). Incubation times could not be calculated for most of the cases due to the frequent consumption of milk. One exception was the individual who drank raw milk once on Feb 28, 2010; his onset was March 5th, giving him an incubation period of 5 days.

Attack rates of diarrheal illness in households with campylobacter cases ranged from 14.3 to 88.9% of [redacted] members in each household (Table 2). The average household attack rate for diarrheal illness was 48.7%.

**Table 1**. Demographics and Signs and Symptoms among *Campylobacter* Cases (n=13)

| Signs and Symptoms | Frequency (%) |
|---|---|
| Age groups (years) | |
| 0–4 | 5 (38.4) |
| 5–18 | 4 (30.8) |
| 19–55 | 4 (30.8) |
| Average age (years) | 17.4 |
| Median age | 6 |
| Gender (males) | 9 (69) |
| Symptoms | |
| Abdominal pain | 10 (76.9) |
| Body aches | 4 (30.8) |
| Chills | 7 (53.8) |
| Diarrhea | 13 (100) |
| Bloody diarrhea | 8 (61.5) |
| Fatigue | 10 (76.9) |
| Headache | 2 (15.4) |
| Nausea | 3 (23.1) |
| Vomiting | 1 (7.7) |
| Fever | 12 (92.3) |
| Av temperature (°F) | 101.9 |
| Duration of illness (days) | |
| Average | 6 |
| Median | 5 |
| Range | 2-13 |
| Hospitalized | 0 (0) |

Figure 1.

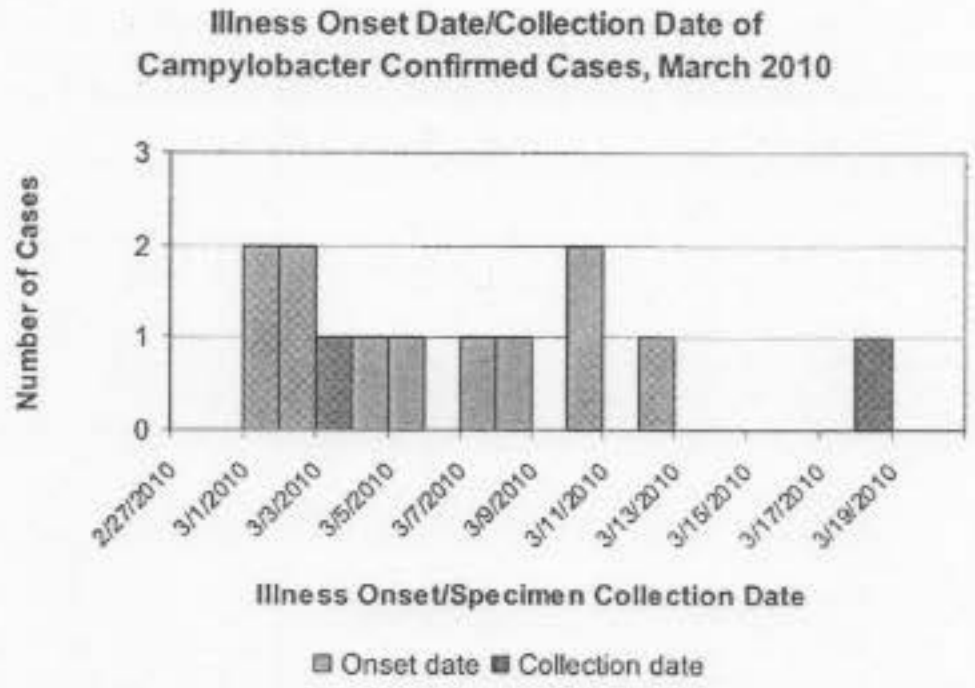

**Table 2.** Household attack rates of *Campylobacter* illness

| Household | No. ill | No. in HH | HH Attack rate (%) |
|---|---|---|---|
| A | [redacted] | [redacted] | 22.2 |
| B | [redacted] | [redacted] | 75.0 |
| C | [redacted] | [redacted] | 33.3 |
| D | [redacted] | [redacted] | 83.3 |
| E | [redacted] | [redacted] | 14.3 |
| F | [redacted] | [redacted] | 50.0 |
| G | [redacted] | [redacted] | 66.7 |
| H | [redacted] | [redacted] | 20.0 |
| I | [redacted] | [redacted] | 88.9 |
| J | [redacted] | [redacted] | 33.3 |
| Totals | 25 | 51 | 48.7 |

*Analysis*

Nine households with confirmed *Campylobacter* cases reported picking up raw milk for home consumption; a tenth had the raw milk at [redacted]. Eleven of the 13 *Campylobacter* cases drank the raw milk directly and two consumed the milk as kefir, which was made at home from the raw milk. Three households bought other food items from FFC, such as ground beef, eggs, kielbasa sausage, and cheddar cheese. Two of the three households specifically stated [redacted] only had the raw milk. In the third household, the [redacted] was sure that [redacted] had the raw milk and did not know whether he ate the cheddar cheese. Of the four people who responded to the specific questionnaire, in addition to drinking raw milk one person also consumed Colby cheese, butter and yogurt and a second person ate cheddar cheese.

The rates of *Campylobacter* illness in Michigan in previous years were compared with 2010 rates. The table below shows the rates of *Campylobacter* illness per 100,000 population for the first three months of the last five years. The *Campylobacter* rate in March 2010 is twice as high as those of the previous four years.

Table 3. Campylobacter rates in Michigan for January to March from 2006-2010

| 2006 | Rate* | 2007 | Rate* | 2008 | Rate* | 2009 | Rate* | 2010 | Rate* |
|---|---|---|---|---|---|---|---|---|---|
| **Jan-06** | 0.56 | **Jan-07** | 0.44 | **Jan-08** | 0.58 | **Jan-09** | 0.54 | **Jan-10** | 0.59 |
| **Feb-06** | 0.4 | **Feb-07** | 0.42 | **Feb-08** | 0.49 | **Feb-09** | 0.31 | **Feb-10** | 0.59 |
| **Mar-06** | 0.45 | **Mar-07** | 0.46 | **Mar-08** | 0.47 | **Mar-09** | 0.43 | **Mar-10** | 0.92 |

*Rate per 100,000 population.

To determine the frequency of raw milk consumption in the general population, we looked at population survey data. The 2002 national FoodNet survey indicates that 3.5% of the U.S. population consumes raw milk. According to the 2002 Michigan Behavioral Risk Factor Survey, an estimated 1.8% of Michigan adults consume raw milk. We compared the reports of raw milk consumption in Michigan *Campylobacter* cases (confirmed, probable, and suspect cases) from March 1–23, 2009 with those of March 1–23, 2010. Between March 1 and March 23, 2009, 25 cases of *Campylobacter* were reported through the Michigan Disease Surveillance System (MDSS). Of the 25, 2 were lost to follow-up and had no epi history available. One case reported consuming unpasteurized cheese while traveling internationally. No cases reported drinking

unpasteurized milk on the open-ended questionnaire (0%). The 2010 MDSS export produced 83 records between March 1 and March 23. Of the 83, 34 did not have any epi history available (many of these were very recently entered cases). Of the remaining 49 cases, 12 denied raw dairy consumption, and another 12 (the outbreak cases) reported consuming raw milk (24%); for 25 cases their raw milk consumption status was unknown. Of note, among the March 2009 *Campylobacter* cases, 20% were children 17 years and younger compared with 36% of the cases in March 2010. Analysis was performed March 23, 2010.

To test if there was a statistically significant difference when comparing the 2009 and 2010 frequencies of raw milk consumption among *Campylobacter* cases, a chi-square test was calculated. The chi-square statistic was 6.759, with a $p$ value of 0.007 (two-sided Fisher's exact test). The comparison of 0% raw milk consumption reported in March 2009 with 24% reported in March 2010 is consistent with other evidence from this investigation that shows a strong relationship between the consumption of raw milk and *Campylobacter* illness. Since the start of the outbreak, health departments had been asking *Campylobacter* cases whether they drank unpasteurized dairy prior to their illness; this enhanced surveillance yielded one additional outbreak case.

**Environmental Investigation: Methods**

MDA notified the U.S. Food and Drug Administration District Office in Detroit of the *Campylobacter* investigation underway implicating FFC on March 16th, after having been notified directly by the VanBuren-Cass County District Health Department.

Upon notification of the *Campylobacter* cases on March 16th, the MDA requested that samples of any unpasteurized milk still available at households of the ill[redacted] be collected and submitted for testing. MDA provided the following guidelines regarding the collection of milk samples: keep milk in the original container and refrigerated (do not open unopened containers), label the container with the name of the household, transport milk in a cooler, maintain chain of custody, sample should be at least 50 mL or ¼ cup of milk, and complete the MDCH Laboratories specimen submission form.

On the regulatory side FDA took the lead, due to the interstate distribution of the unpasteurized dairy products. MDA determined that although it did not regulate the cooperative, the FFC did have a license to operate a warehouse/freezer. An MDA Food Inspector inspected the warehouse/freezer that housed other food products distributed and sold by FFC on March 24, 2010.

On March 24, 2010, MDA requested the following information from the attorney, Mr. Bemis, spokesperson and legal counsel for FFC: FFC distribution point locations and delivery dates for the last two weeks of February and the first half of March, source information for products FFC was selling or distributing for the traceback investigation, and the names of FFC cow-share members who received raw milk and other food products for a trace-forward investigation. Mr. Bemis informed MDA on March 24th that FFC had distributed its own questionnaire that day by email to all cow-share members asking about illness. In this email FFC offered to pick up any leftover milk samples from those households with illness.

**Environmental Investigation: Results**

All 13 confirmed cases reported raw milk consumption (two indirectly through homemade kefir); 12 cases indicated that the raw milk they consumed was distributed by the FFC in Vandalia, Michigan. In the follow-up interview one case declined to name the source of the raw milk he had consumed, although notes in MDSS from the first interview say "unpasteurized milk from Family Farm." The implicated raw milk was picked up by confirmed *Campylobacter* cases at several distribution points in SE Michigan: St. Elizabeth's Church, Goodell Street, Wyandotte; Sunward Cohousing, Little Lakes Dr, Ann Arbor; Great Oaks Housing Coop Little Lakes Drive, Ann Arbor; Birmingham Unitarian Church, West Bloomfield; and Family Coop Housing, Ann Arbor. Two dairy pick-up dates were reported by cases: February 25 and March 5, 2010. One case reported having consumed raw milk at [redacted] and was able to verify with the host that the milk was distributed by FFC. An additional 12 were probable cases that were epi-linked to confirmed household members and to the consumption of raw milk distributed by FFC.

On March 24, 2010, FFC provided MDA a list of the distribution points, both in Michigan and out of state; delivery dates for the last two weeks of February and the first half of March; and the list of food products FFC distributed between February 15 and March 22. As per the FFC email sent to co-op members (date unknown), FFC did not distribute unpasteurized milk on March 12 in Ann Arbor and Birmingham, MI, nor on March 15 to Downer's Grove and Elgin in Illinois. FFC also notified their client base that they had milk and well water tested for *Campylobacter*: "One of the milk samples was negative for the pathogenic versions of staph, strep, e coli, listeria, and salmonella. The second milk sample and both water samples were negative for campylobacter." FFC resumed deliveries to Ann Arbor and Wyandotte, MI, on March 19, 2010 after the sample of raw milk submitted by the FFC to a private laboratory tested negative for Camplylobacter. A list of FFC members was not received by MDA.

**MDCH Laboratory: Methods**

*Clinical isolates*

MDCH sent out a request March 22, 2010, to LHDs with case patients asking for assistance in obtaining from hospitals in their jurisdictions any clinical isolates of *Campylobacter* associated with the outbreak. Ordinarily clinical labs are not required to submit clinical isolates of *Campylobacter*, hence a special request had to be made to obtain isolates for further characterization and to perform PFGE fingerprinting.

*Dairy Samples*

A total of seven raw dairy samples (six were milk and one jar of cream) from five different households were collected under chain of custody and submitted to the MDCH Bureau of Laboratories for testing. The first samples were delivered to the State Lab on March 17, 2010, from two Wayne Co. households with *Campylobacter* cases. The seven samples represent dairy products distributed by the Family Farms Co-op on 2/26/2010 and 3/5/2010. Because *Campylobacter* is a difficult organism to culture, additional advanced testing techniques external to MDCH were also pursued. Two of the samples were shipped to the CDC National *Campylobacter* Reference Lab on April 1, 2010. Four other samples (previously intact) were shipped the weekend of March 27-28, 2010 to IEH

Laboratories in Washington State, an independent A2LA accredited laboratory that frequently offers analytical and consulting services to the food industry and has supported other recent public health investigations.

**MDCH Laboratory: Results**

*Clinical isolates*

One clinical isolate of an outbreak case was available for further characterization and sent to BOL; BOL forwarded it to the National *Campylobacter* reference Lab at the CDC on May 3, 2010, to determine if it was a match with any other outbreaks occurring nationally. All other clinical isolates were destroyed within a week of test results before they could be sent to BOL.

*Dairy samples*

All seven unpasteurized dairy samples cultured at BOL were negative. The CDC National Campylobacter Reference (CDC NCR) Laboratory performed enrichment on the two Michigan milk samples, and cultured the enrichment broths on mCCDA selective plates, as described in the FDA BAM manual. The culture plates were negative for growth of any organisms, including *Campylobacter*. DNA extractions were performed on the enrichment broths. The DNA extracts were tested in a *Campylobacter* genus-specific conventional PCR assay and a real-time multiplex PCR assay that targets *Campylobacter* genus, differentiates *C. jejuni* and *C. coli*, and has an internal amplification control to detect inhibition. The *Campylobacter* genus-specific PCR assay was negative for the presence of *Campylobacter* DNA. The real-time PCR assay was also negative for the presence of DNA from *Campylobacter* genus, *C. jejuni*, and *C. coli*. The internal amplification control did amplify, indicating that the PCR reactions were not inhibited and the negative results were true negatives. The IEH Lab also performed the FDA BAM method on the dairy samples and all four samples sent to IEH were negative.

**Discussion**

At least 25 people in SE Michigan, mostly children, became ill from drinking raw milk distributed by FFC in February and March of 2010. It is believed that both Indiana (three confirmed and two probable cases) and Illinois (two confirmed cases) had *Campylobacter* cases related to this outbreak. (At the time of the FDA press release, outbreak investigations were underway in Indiana and Illinois, and no confirmed cases in these neighbor states were announced in the March 26, 2010 press release.) Interstate communications worked well in alerting neighboring states of our outbreak investigation.

We were unable to confirm the presence of *Campylobacter* in any of the seven unpasteurized dairy products that were collected for testing, despite having the samples tested in three labs. By the time the milk samples were sent to the CDC Reference Lab and the IEH Lab, the samples were more than one month old. It is not uncommon to be unable to isolate *Campylobacter* from implicated raw milk (CDC MMWR 1983). Having a courier system in place to rapidly transport fragile food specimens to BOL would increase the likelihood of obtaining a positive result.

No clinical isolates from any of the confirmed cases remained to be sent to the State Lab for further characterization. Unlike *Salmonella* and *E coli*, hospitals only send

*Campylobacter* isolates to the State Lab if notified by public health to do so; otherwise their specimens are discarded. Requests to hospitals for *Campylobacter* isolates need to be made as soon as possible in an outbreak investigation.

A case-control study was not performed as the only food in common was raw milk.

It is important to consider whether enhanced surveillance for *Campylobacter* cases at the start of the investigation, the press release, and/or the switch to including antigen positive test results as probable *Campylobacter* cases had an impact on the number of *Campylobacter* cases reported in the first three months of 2010. Enhanced surveillance of existing *Campylobacter* cases reported to MDSS yielded one additional outbreak case when he was specifically asked whether he had consumed any unpasteurized dairy. Most of the case interviews included in the analysis had already taken place prior to March 19, 2010 (date of the public health release). Only one case had an illness onset date that occurred after the date of the public health release. FFC did contact their co-op members to alert them to the illness and advised any one ill to see their physician. Of the 2009 *Campylobacter* cases exported from MDSS, 2/25 (8%) had only antigen test results, whereas 20/71 or 28% of the 2010 cases have only antigen test results; these 2010 antigen positive cases were categorized as probable cases.

Before pasteurization, dairy products harbored many deadly pathogens including *Mycobacterium tuberculosis, Corynebacterium diphtheriae,* and *Brucella.* In 1938, prior to pasteurization laws in the United States, outbreaks resulting from the consumption of raw milk comprised 25% of all food- and water-borne disease outbreaks (FDA 2009). Food- and water-borne outbreaks associated with milk and fluid milk products are considerably fewer today (<1%) compared with 1938. Today, however, unpasteurized dairy products can carry *Salmonella, E coli, Yersinia, Listeria,* and *Campylobacter.* From 1998 to 2008, 85 outbreaks of human infections linked to the consumption of raw milk were reported to CDC (FDA 2010). These outbreaks included a total of 1,614 reported illnesses, 187 hospitalizations, and 2 deaths. These figures are likely underestimates, as not all cases of foodborne illness are recognized and reported.

Campylobacteriosis is one of the most commonly reported bacterial diseases among foodborne illnesses (Mead et al. 1999). *Campylobacter* is also the predominant pathogen linked to raw milk associated foodborne disease outbreaks (Headrick et al. 1998). Drinking raw, unpasteurized milk or consuming unpasteurized dairy products are important risk factors for contracting a foodborne illness. Public health investigators should always ask foodborne illness cases whether they have recently consumed any unpasteurized dairy products. It is of concern to the public health community that consumers are seeking out unpasteurized raw milk for its flavor and alleged claims that it is healthier.

Cow-share programs have found a way to circumvent state laws that prohibit the sale of raw milk by offering joint ownership of the animals. When someone joins a cow-share cooperative, they 'buy' a share of a cow and pay a fee for boarding the cow; in exchange they receive raw milk from the dairy. Farms or cooperatives 'selling' raw milk in Michigan, where the sale of raw milk is illegal, are not licensed, not inspected in accordance with the FDA Pasteurized Milk Ordinance, and thus can not label their milk as Grade A milk.

Although *Campylobacter* is not a reportable illness at the CDC, it is a reportable disease in Michigan. On-going public messaging about the risks of consuming unpasteurized dairy foods will be necessary if we are to reduce the incidence of milkborne-associated illnesses such as *Campylobacter*.

**References**


Mead PS, Slutsker L, Dietz V, et al. 1999. Food-related illness and death in the United States. Emerg Infect Dis 5 (5):607–625.

Heymann DL (Editor) 2008. Control of Communicable Diseases Manual. 19th ed. American Public Health Association.

Michigan Department of Agriculture. 2001. Grade A Milk Law of 2001 (Act No. 266, Public Acts 2001). Access date: July 19, 2010. http://www.michigan.gov/documents/mda/MDA_2001PA266Complete_251568_7.pdf.

Food and Drug Administration. 2009. Grade A Pasteurized Milk Ordinance. Access date 20100721. http://www.fda.gov/downloads/Food/FoodSafety/Product-SpecificInformation/MilkSafety/NationalConferenceonInterstateMilkShipmentsNCIMSModelDocuments/UCM209789.pdf.

Food and Drug Administration. 2010. Public Health Agencies Warn of Outbreaks Related to Drinking Raw Milk. March 26, 2010. http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm206311.htm.

Headrick ML, Korangy S, Bean NH et al. 1998. The epidemiology of raw milk-associated foodborne disease outbreaks reported in the United States, 1973 through 1992. Am J Public Health 88: 1219–1221.