Raw Milk Outbreaks in Colorado 2006-2010

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Objectives

• Discuss epidemiology of recent raw milk outbreaks in Colorado
• Discuss cow share operations and environmental findings
• Discuss ongoing public health considerations
Raw Milk is a Risky Food

- Numerous raw milk outbreaks documented by CDC
- Potential Sources of contamination
  - Environmental contamination
  - Contamination during milk handling / processing
  - Udder contamination from infected animal
Pathogenic Agents in Milk

- Campylobacter
- STEC
- Salmonella
- Listeria spp
- Staphylococcus aureus
- Clostridium perfringens
- Shigella spp

Langer, et al EID Vol 18 No 3 March 2012
Cow shares

• Federal level: Illegal to sell raw milk for consumer use across state lines
• Sale of raw milk is illegal in Colorado
• Cow share operations are permitted
  – Purchase shares in a cow
  – Dairy manager operates herd
  – Shareholders (owners) receive raw milk
Colorado cow share statute  
Colorado Revised Statute 25-5.5-117

- Cow shares may distribute raw milk to shareholders
- Recipients may not distribute further
- Prominent warning label on milk container or delivered with milk
- Must register with CDPHE
- Not inspected by CDPHE
- No requirements for milk testing
- Cow share operator may not make claims that imply endorsement by CDPHE
Methods of Investigations in Raw Milk Outbreaks in Colorado

• Epidemiology
  – Case finding
  – Cohort study

• Laboratory
  – Human
  – Milk

• Environmental
  – Site visits
Comparison of raw milk outbreaks in Colorado, pre and post cow share statute

<table>
<thead>
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<tbody>
<tr>
<td>Outbreaks</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>Total Illness</td>
<td>33</td>
<td>143</td>
</tr>
<tr>
<td>Outbreaks/Year</td>
<td>0.2</td>
<td>0.8</td>
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<tr>
<td>Ill/Outbreak</td>
<td>~17</td>
<td>~29</td>
</tr>
</tbody>
</table>
Larimer County 2005-06

- *Campylobacter jejuni*
- Cow share with 27 households
- 22 cases, 6 lab confirmed
- 31% of all interviewed were ill (22/71)
- Median age of cases 18 years (range 2-74 yrs)
- No evidence of major problems at dairy
- Milk testing found very low bacterial counts
- People still became ill
Environmental

- Operator did change one practice after learning of a shareholder illness
- Previously he milked multiple cows at once using an in-line milker
- Milking claws automatically fall off of cow when milk flow is diminished
- Claws could potentially fall onto cow deck before suction is turned off by the operator
Larimer County – January 2006

• Operator did recognize this as a potential for contamination

• Started milking one cow at a time so he could monitor more closely
Montrose County 2009

- 3 Campylobacter cases ascertained through routine disease surveillance

- 3 contiguous Western Colorado counties

- Public Health makes unannounced visit to the dairy
- Many concerning sanitary findings
- Dairy closed by Public Health Order
Results

- 159 (76%) shareholder households interviewed
  - representing 372 household members
- 81 cases identified
  - 12 confirmed
  - 69 probable
- 50 of the 151 (31%) households that had received product had at least one ill person who met case definition
Campylobacter Outbreak Associated with Raw Milk from Cow Share, Colorado, 2009 (N = 81)

Outbreak detected
Public health visits diary
Dairy closed by PH order
Dairy re-opened

Date of Onset
Number of Cases

Confirmed
Probable
Case-Patient Demographics (N=81)

Median age (range) 32 years (1–79)

Female 36 (47%)

One person hospitalized

All recovered
Cohort Study

- List of 208 shareholders and consumers obtained from dairy manager
- Attempted to call all persons
- Informed shareholders to discard milk
- Asked about illness and foods eaten from dairy
Dose Response Relationship
Includes primary cases and well persons (n=349)

<table>
<thead>
<tr>
<th>Milk Servings</th>
<th>Ill</th>
<th>Well</th>
<th>Odds ratio</th>
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<tbody>
<tr>
<td>None</td>
<td>10</td>
<td>65</td>
<td>Ref.</td>
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<tr>
<td>&lt; 1 cup/day</td>
<td>11</td>
<td>95</td>
<td>0.75</td>
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<tr>
<td>1-2 cups/day</td>
<td>26</td>
<td>100</td>
<td>1.69</td>
</tr>
<tr>
<td>&gt; 2 cups/day</td>
<td>11</td>
<td>31</td>
<td>2.31</td>
</tr>
</tbody>
</table>

Mantel-Haenszel chi square linear trend = 5.50
p=0.02
Laboratory Results

Human specimens
• 6 patient isolates received at state lab
• All confirmed *Campylobacter jejuni*
• Identical Pulse Field Gel Electrophoresis (PFGE) patterns
• No recent matches with CDC database

Milk testing
• Collected after outbreak identified
• Culture negative for *Campylobacter*
Environmental Findings

• Per dairy website:
  – Operating standards “closely match the requirements of a Grade A dairy and could if necessary meet the scrutiny of the Colorado Department of Health”
Grade A Dairy
Milking Parlor
Boulder County 2010

- June 23rd – 39 y.o. male Campylobacter case on CEDRS
- “My toddler son and I drank raw goat milk and got sick”
- “We obtained it from a friend”.
- Registered goat share in Longmont
Boulder County 2010

• 35 households interviewed
  – 80% response rate
  – 71% were actual shareholders

• Information gathered from a total of 82 individuals
Results of Epi Investigation

- 11 confirmed cases
- 19 probable cases
- 87% were a primary case
- 13% secondary spread of infection
- Mean age: 32 years
- Range: 4-73 years
- 45% female
Billy Goat Dairy Outbreak
Boulder County, CO
Gastrointestinal Illness Onset (N=30)
June 2010

Onset Date

Number of Cases

- E. coli and Campy Conf
- E. coli Conf
- Campy Confirmed
- Probable

6/23/2010 – Outbreak detected through routine surveillance
6/30/2010 – Public Health Order issued to dairy
6/25/2009 – Public health visit to dairy
7/14/2010 – Public Health Order lifted
Boulder County 2010

Unannounced visit by CDPHE and Boulder County to collect milk specimens, check refrigeration temperature, standard sanitation guidelines
Environmental

- Milk was warm—57°F at 4 pm
- Milking apparatus fell on barn floor, was not cleaned before re-attaching to teat
- Infected teats on three goats being milked
- No hand washing sinks in milking area—employee observed washing hands in standing water
- Milk in system > hour before being placed in jars
- Milk not labeled as “raw”
Summary

- Illnesses will continue to be identified likely due to consumption of raw milk
- Epidemiologic data
  - Continue to monitor for raw milk consumption
  - Dose-response relationship
- Environmental data
  - Significant sanitary issues at dairies
- Laboratory data
  - Identify PFGE patterns for identifying common sources of exposure
Limitations

• Milk cultures may be negative as sampling occurs after outbreak

• Relative risk for milk may not statistically significant
  – Dose-response relationship may be significant even when relative risk is not
Conclusions

• Public must understand that unpasteurized milk is a risky food
• Raw milk outbreaks will continue to occur
• Cow share operators should strive to meet minimum sanitary standards for milk production
• Raw milk must be properly labeled
Public Health Considerations

• Unpasteurized milk via cow shares can travel far
  – Implications for outbreak detection
  – Case finding during outbreaks
• Significant public health costs associated with outbreak investigation
  – Multiple agencies involved
  – Assess costs during outbreak investigation
• Considerations of vulnerable populations (children)
Acknowledgements

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Larimer County Health Department
Montrose County Health and Human Services
Mesa County Health Department
Milk for Further Distribution
Sample Case Definitions

• Confirmed
  – Culture-confirmed organism
  – Consumed products from and implicated dairy, and
  – Onset within a specified time period

• Probable
  – Compatible GI illness, and
  – Onset within specified time period, and
  – Epi-linked to confirmed case, or
  – Consumed products from dairy $\leq 10$ days before onset
Colorado Grade A Dairy Standards

• Operating standards continued:

• Milking Parlor:
  • The milking parlor will have adequate lighting, properly distributed.
  • There will be adequate ventilation to prevent condensation and to minimize odors.
  • Gutters and floors will be made of good quality concrete and graded to drain.
  • Walls and ceilings will be made of a suitably impervious material to ensure they are easily cleaned.
  • Any feed storage area will be separated from the milking parlor by dust-tight doors.
  • All areas of the milking parlor will be kept clean, free of manure and in good repair.
Resources for Raw Milk Information

- New and improved CDC website for Raw Milk: