Raw Milk and Public Health in Pennsylvania

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with assistance from

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Raw milk = unpasteurized milk
Organization of the talk

• Laws, regulations, warning labels
• Linking raw milk to human illness
• History of outbreaks
• Recent outbreaks
• Raw milk testing
• Challenges
Laws, regulations and Warning labels
11 States where retail sale of raw milk is legal

<table>
<thead>
<tr>
<th>State</th>
</tr>
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<tbody>
<tr>
<td>Arizona</td>
</tr>
<tr>
<td>California</td>
</tr>
<tr>
<td>Connecticut</td>
</tr>
<tr>
<td>Idaho</td>
</tr>
<tr>
<td>Maine</td>
</tr>
<tr>
<td>New Hampshire</td>
</tr>
<tr>
<td>New Mexico</td>
</tr>
<tr>
<td>Oregon (goat and sheep milk only)</td>
</tr>
<tr>
<td>Pennsylvania</td>
</tr>
<tr>
<td>South Carolina</td>
</tr>
<tr>
<td>Washington</td>
</tr>
</tbody>
</table>
State-by-State Review of Raw Milk Laws*

June 21, 2013

* Other forms of raw milk distribution may also be allowed in any particular state. The map shows the highest level of access allowed.
** Although raw milk sales for human consumption are illegal, there is no law either legalizing or prohibiting herd shares. State is aware herd share programs currently exist and has taken no action to try to stop them.

Raw milk permits in Pennsylvania

- Pennsylvania Department of Agriculture (PDA) issues permits for retail sale of:
  - raw milk
  - raw-milk cheese (aged ≥60 days)*
- Permit holders:
  - 48 in 2005 → 116 in 2009 → 158 in 2013
- Interstate sales of raw milk have been banned by the U.S. Food and Drug Administration since 1987

• “Raw milk has not been processed to remove pathogens that can cause illness.

• The consumption of raw milk may significantly increase the risk of foodborne illness in persons who consume it—particularly with respect to certain highly-susceptible populations such as
  • preschool-age children,
  • older adults,
  • pregnant women,
  • persons experiencing illness, and
  • other people with weakened immune systems.”
“Although warning labels and signs or government-issued permits are prudent where the sale of nonpasteurized dairy products is legal, they... do not seem to reduce the incidence of outbreaks involving nonpasteurized dairy products to the degree that pasteurization does”*

Linking raw milk to human illness
Elizabeth Hunt’s raw beverage report
  • Queries PA NEDSS for consumption of
    • raw milk
    • soft cheese
  • Report is run 1 - 2 times/week

Bulk tank milk testing for pathogens
  • PFGE to compare pathogens from milk and humans
History of outbreaks
Raw milk outbreaks in Pennsylvania*

- 2007–2013, 19 outbreaks
  - 14 (74%) caused by *Campylobacter*
  - 5 (26%) caused by *Salmonella*
Recent outbreaks
2012 *Campylobacter* Outbreak
2012 *Campylobacter* Outbreak*

- 148 illnesses in Maryland, West Virginia, New Jersey and Pennsylvania.
- Largest raw-milk outbreak in Pennsylvania in the last two decades
- Outbreak source: dairy in southcentral Pennsylvania (largest raw milk purveyor in the state) with
  - Pennsylvania Department of Agriculture raw milk permit and
  - minimal deficiencies during inspection

2013 *Campylobacter* outbreak

- Same dairy as 2012 outbreak
  - 6 confirmed and 2 probable cases

- Different PFGE pattern combination
Salmonella outbreaks

• 2007 (2 involving the same southcentral Pennsylvania dairy)
• 2012 (1 involving a southeastern Pennsylvania dairy)
• 2013 (2 involving the same northeastern Pennsylvania dairy)
• All 5 outbreaks: S. Typhimurium
2012 outbreak
*Salmonella* Typhimurium
JPXX01.0146
2012 *Salmonella* Typhimurium JPXX01.0146 outbreak

- 28 Confirmed cases
- 6 Probable cases

- Very common PFGE pattern combination
  - XbaI pattern JPXX01.0146
  - BlnI pattern JPXA26.0174
History of S. Typhimurium JPXX01.0146 in PA
Unique feature of outbreak isolates: multidrug resistance

<table>
<thead>
<tr>
<th>Parameter</th>
<th>2012 Outbreak</th>
<th>Previously Tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient isolates tested by CDC NARMS</td>
<td>3</td>
<td>27*</td>
</tr>
<tr>
<td>Number resistant to antimicrobial agents from 4 different classes**</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Pansusceptible</td>
<td>0</td>
<td>26</td>
</tr>
</tbody>
</table>

*1 isolate was resistant only to kanamycin

** Resistant to streptomycin, chloramphenicol, sulfisoxazole, tetracycline
Unique feature of outbreak-associated strain of 
*S. Typhimurium* JPXX01.0146

Multidrug resistance
Raw milk testing by PA DOH

- Outbreak strain (S. Typhimurium JPXX01.0146) was isolated from 5 of 20 unopened containers of raw milk pulled from store shelves.
2013 S. Typhimurium JPXX01.0302 outbreak
Sporadic PFGE pattern combination

- XbaI pattern JPXX01.0302
- BlnI pattern JPXA26.0183
History of S. Typhimurium JPXX01.0302 in Pennsylvania
2013 S. Typhimurium JPXX01.0302 outbreaks

• Two outbreaks, same dairy
  • July
  • August - September
• 27/42 (64%) children and teens
• Median age = 13
• 11 reported raw milk exposure
• 22 denied raw milk exposure
• 1 secondary exposure
• 8 (20%) could not be reached for interviews
Raw milk testing

- PDA’s two attempts to sample bulk tank milk from the dairy failed because the tank was empty
- Testing of milk from a sick patient (1 unopened gallon and 1 opened gallon) →
  - *Salmonella* Typhimurium JPXX01.0302 (PA DOH lab)
  - No *Salmonella* (PDA lab)
Unique feature of the outbreak strain: MLVA pattern
# MLVA distinguishes PA & national outbreaks of JPXX01.0146

<table>
<thead>
<tr>
<th>MLVA TYPE</th>
<th>Number of isolates</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>59 (2 PA)</td>
</tr>
<tr>
<td>A3-1</td>
<td>9 (1 PA)</td>
</tr>
<tr>
<td>A4-1</td>
<td>2</td>
</tr>
<tr>
<td>A4-3</td>
<td>32 (31 PA, 1 NJ/raw milk expos.)</td>
</tr>
<tr>
<td>A5-1</td>
<td>7</td>
</tr>
<tr>
<td>B1</td>
<td>3</td>
</tr>
<tr>
<td>C</td>
<td>16</td>
</tr>
<tr>
<td>A3-2, A5-2, A6, A7, B2-1, B2-2, D1, D2-1, D2-2, E</td>
<td>10 (one of each pattern) (1 PA)</td>
</tr>
</tbody>
</table>
MLVA Type A4-3 and raw milk exposure
“Makes me wonder if there is a lot more raw milk consumption among cases that interviews are not eliciting; we know there’s considerable hostility among raw milk advocates toward government and in some focused outbreaks we’ve had resistance to the process of obtaining individual case data.” (Andre Weltman, epi)
WE WANT FOOD FREEDOM

RAW MILK HEALS

I DRINK RAW MILK ARREST ME!

Pennsylvania Department of Health
Routine testing of raw milk from bulk tanks by Pennsylvania Department of Agriculture
Pennsylvania Department of AGRICULTURE
Bureau of Food Safety and Laboratory Services

www.agriculture.state.pa.us

Guidance Document
PERMITS ALLOWING THE SALE OF RAW MILK FOR HUMAN CONSUMPTION
(Issued 11/21/11)
## Raw milk testing standards*

<table>
<thead>
<tr>
<th>Type of Standard</th>
<th>Standard</th>
</tr>
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<tbody>
<tr>
<td>Temperature**</td>
<td>Milk must be cooled to 4°C or less within 2 hours of milking</td>
</tr>
<tr>
<td>Bacterial Count**</td>
<td>≤ 20,000 per ml</td>
</tr>
<tr>
<td>Coliform Count**</td>
<td>≤ 10 per ml</td>
</tr>
<tr>
<td>Somatic Cell Count*</td>
<td>≤ 750,000 per ml</td>
</tr>
<tr>
<td>Pathogenic Bacteria (Salmonella, Listeria monocytogenes, Campylobacter, E. coli O157:H7)**</td>
<td>“There shall be no pathogenic bacteria present” in a bulk tank sample.</td>
</tr>
</tbody>
</table>


**Test at least twice each month  
***Test every six months  
(by a dairy laboratory approved by the Pennsylvania Department of Agriculture)
If milk tests positive for pathogenic bacteria*

- Permit holder shall
  - immediately cease sale of raw milk for human consumption

- Sale of raw milk can resume when
  - 2 consecutive samples collected at least 1 day apart test negative for bacterial pathogens and
  - PDA has approved resumption

Raw milk testing during an outbreak

• Pennsylvania Department of Health

• Pennsylvania Department of Agriculture
Enrichment 1 (3-5 replicates)

- 200 ml thoroughly mixed milk
  + 200 ml 2X lactose broth

35°C, 24 hr
*Salmonella* PCR

Selection and Differentiation; Enrichment 2

- HE
- XLD
- Chromagar

- 5 ml culture + 45 ml RV broth

42°C, 24 hr

Selection and Differentiation

- HE
- XLD
- Chromagar

**HE** = Hektoen enteric agar  
**XLD** = Xylose lysine desoxycholate agar  
**RV** = Rappaport-Vassiliadis *Salmonella* Enrichment Broth  
**Chromagar** = R & F *Salmonella* (includes *S. Typhi*) Chromogenic Plating Medium
PA Dept. of Ag Isolation of *Salmonella* from raw milk

**Enrichment 1**
- 25 ml thoroughly mixed milk
  + 225 ml BPW
- 35°C, 18-24 hr

**Enrichment 2**
- 1 ml Enrichment 1 + TT broth supplemented with Brilliant Green and I₂KI
  - 42°C, 6-8 hr
- 0.1 ml Enrichment 1 + RV broth
  - 42°C, 6-8 hr

**Enrichment 3**
- 1 ml Enrichment 2 + M broth
  - 42°C, 18-24 hr
  - VIDAS SLM
- Re-incubate Enrichment 2
  - 42°C, 12-16 hr

**Selection and Differentiation**
- HE
- XLD
- BS

**Notes**
- BPW = Buffered peptone water
- TT = Tetrathionate
- HE = Hektoen enteric agar
- XLD = Xylose lysine desoxycholate agar
- RV = Rappaport-Vassiliadis Salmonella Enrichment Broth
- BS = Bismuth sulfite agar
### Main PA DOH/PDA procedural differences

<table>
<thead>
<tr>
<th>Parameter</th>
<th>PA DOH (Modified BAM*)</th>
<th>PDA (BAM*)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of milk tested</td>
<td>200 ml</td>
<td>25 ml</td>
</tr>
<tr>
<td>Detection</td>
<td>PCR</td>
<td>ELISA (VIDAS SLM)</td>
</tr>
<tr>
<td>Selection, Differentiation</td>
<td>HE, XLD, Chromagar</td>
<td>HE, XLD, BS</td>
</tr>
</tbody>
</table>

*BAM = Bacteriological Analytical Manual, FDA*

http://www.fda.gov/Food/FoodScienceResearch/LaboratoryMethods/ucm114664.htm
Notable features of PA DOH procedure

• 8 X greater sample volume (200 ml vs. 25 ml)
• PCR results guide focus of testing
• Chromagar
  • Improved suppression of normal flora
  • Improved contrast between *Salmonella* colonies and normal flora colonies
  • Improved combination of sensitivity and specificity
PA DOH Enrichment 1 plated on Chromagar*: *Salmonella* present

Photograph courtesy of Barry Perry

*Chromagar = R & F *Salmonella* (includes *S. Typhi*) Chromogenic Plating Medium
PA DOH Enrichment 2 plated on Chromagar*: *Salmonella* present

*Chromagar = R & F *Salmonella* (includes *S. Typhi*) Chromogenic Plating Medium

Photograph courtesy of Barry Perry
Raw milk-associated challenges

• Illegal purchases by out-of-state residents for re-sale in another state
• Reluctance to acknowledge raw milk consumption
• Protection of raw milk dairies by loyal customers
• Different pathogen isolation procedures in place at PA DOH, PDA and certified dairy testing labs
Web Resources


Food Safety and Raw Milk

"Back to nature"—that's what many Americans are trying to do with the foods that they buy and eat. They are shopping at farmers' markets, picking organic foods at their grocery stores, participating in food cooperatives (or co-ops), and some are even growing their own food. Many people are trying to eat foods that are produced with minimal processing.

However, milk and products made from milk (including certain cheeses, ice cream, and yogurt) are foods that, when consumed raw, can pose severe health risks. Milk and products made from milk need minimal processing, called pasteurization, which can be done by heating the milk briefly (for example, heating it to 161 °F for about 20 seconds), to kill disease-causing germs (e.g., Salmonella, Escherichia coli 0157, Campylobacter) that can be found in raw milk.

Real-Life Raw Milk Stories

Three people tell their stories of how the decision to bring raw milk into their home led to illness and other consequences.

More »

Many studies have shown that pasteurization does not significantly change the nutritional value of milk—pasteurized milk is rich in proteins, carbohydrates, and other nutrients. Heat slightly affects a few of the vitamins found in milk—thiamine, vitamin B12, and vitamin C—but milk is only a minor source of these vitamins.

www.foodsafety.gov/keep/types/milk/index.html

Milk, Cheese, and Dairy Products

Myths About Raw Milk

Pasteurization is a process that kills harmful bacteria by heating milk to a specific temperature for a set period of time. Some people continue to believe that pasteurization harms milk and that raw milk is a safer healthier alternative.

Raw milk can harbor dangerous microorganisms, such as Salmonella, E. coli, and Listeria, that can pose serious health risks to you and your family.

www.realrawmilkfacts.com/