



**CONNECTICUT ENVIRONMENTAL HEALTH ASSOCIATION  
2021 YANKEE CONFERENCE**

# Safety of Dairy Products: Where the Risks Lie

Dennis D'Amico

University of Connecticut

July 16, 2019



**UCONN**

# CDC Foodborne illness estimates: Dairy 1998-2008

- ~18% of bacterial illnesses (1<sup>st</sup>)
  - ~14% of all illnesses (2<sup>nd</sup> behind leafy vegetables)
- ~16% of hospitalizations (1<sup>st</sup>)
- ~10% of deaths (2<sup>nd</sup> behind poultry)
- “The prominence of dairy ...reflects a relatively high number of ... outbreaks associated with raw milk compared with the quantity ...consumed ...”
- The largest outbreak in the study was 1,644 *Campylobacter* spp.– associated illnesses resulting from the consumption of pasteurized milk



# Changing landscape

- Consumers of unpasteurized milk and cheese are a small proportion of the US population
  - 2% and 4.9%, respectively
  - vs. 70.2% and 84.9%, respectively for pasteurized
- Access to unpasteurized milk and cheese is increasing



# The Great **MILK DEBATE** **RAW** or **PASTEURIZED?**



## TOP 5 REASONS TO DRINK RAW MILK

- #1. Superior Nutrition
- #2. Numerous Health Benefits
- #3. Better Animal Health
- #4. Delicious!
- #5. Supports Local Farmers

NOURISHEDANDNURTURED.LIFE.COM

# 27 Benefits of Drinking Raw Milk



# INSTANT POT Raw Milk Yogurt



the  
fastest  
healthiest  
yogurt!

TRADITIONAL  
Cooking School  
By GNO WEGELINS

# Raw Milk May Pose Health Risk



What's a building block in the food pyramid that's important for building and maintaining bone mass? It's milk.

Whether it's from cows, goats, sheep,

RAW MILK  
KNOW THE RAW FACTS

Many people choose raw milk thinking it will improve their health, but it can cause serious illness in anyone. Outbreaks linked to raw milk have doubled in the past five years.

A white plastic jug of raw milk.

## THE DANGERS OF RAW MILK

Pasteurizing milk **DOES NOT** cause lactose intolerance and allergic reactions. Both raw milk and pasteurized milk can cause allergic reactions in people sensitive to milk proteins.

Raw milk **DOES NOT** kill dangerous pathogens by itself.

Pasteurization **DOES NOT** reduce milk's nutritional value.

Pasteurization **DOES NOT** mean that it is safe to leave milk out of the refrigerator for extended time, particularly after it has been opened.

**Pasteurization DOES kill harmful bacteria.**

**Pasteurization DOES save lives.**



**Table 1:** Summary of microbiological hazards associated with raw cow milk

Organism	Shed directly in milk <sup>#</sup>	Severity of illness <sup>§</sup>	Implicated in foodborne illness
<i>Bacillus cereus</i>	×	Moderate	++
<i>Campylobacter jejuni/coli</i>	✓	Severe <sup>^</sup>	++
<i>Clostridium perfringens</i>	×	Severe <sup>^</sup>	+
<i>Coxiella burnetii</i>	✓	-	+
<i>Cryptosporidium parvum</i>	×	Severe <sup>^</sup>	+
Enterohaemorrhagic <i>E. coli</i>	✓	Severe	++
<i>Listeria monocytogenes</i>	✓	Severe <sup>^</sup>	++
<i>Salmonella</i> spp.	✓	Serious	++
<i>Staphylococcus aureus</i>	✓	Moderate	++
<i>Streptococcus</i> spp.	✓	-	+
<i>Toxoplasma gondii</i>	✓	-	++
<i>Yersinia enterocolitica</i>	✓	Serious	+

**Key:**

# Transmission through udder; mastitis etc  
<sup>^</sup> Susceptible sub-populations

- No data/unknown  
<sup>§</sup> Based on ICMSF (2002)

+ Rare  
 ++ More common



**Table 2:** Summary of prevalence data for pathogens in raw cow milk

Organism	International data
<i>Campylobacter jejuni</i>	0 – 40%
<i>Enterohaemorrhagic Escherichia coli</i> (EHEC)	0 – 33.5%
<i>Listeria monocytogenes</i>	1 – 60%
<i>Salmonella</i> spp.	0 – 11.8%

- Mean prevalence across studies is closer to 4-5%
  - Staph. aureus is closer to 20-30%
- Varies by country, region, state, farm, and over time
- Often sporadic contamination events



# Regulations

- 21 CFR Section 1240.61 - Mandatory pasteurization for all milk and milk products in final package form intended for direct human consumption
- State regs and oversight differ

Code	Availability to Consumer	Population Totals (2016)	Jurisdiction Count (2016)	Proportion of Total Population (2016)
R	Legal off-farm sales in retail stores, at farm markets, or both	88,365,997	12	27.3%
F	Farm-gate sales legal, but no off-farm sales	101,403,352	15	31.4%
H	Herdshares permitted by law or policy. Sales illegal.	56,547,195	10	17.5%
P	Farm-gate sales legal with "pet food" license	51,949,345	5	16.1%
I	Both herdshares and sales illegal.	24,861,624	9	7.7%
<b>Total:</b>		<b>323,127,513</b>	<b>51</b>	<b>100%</b>

# Regulations: Cheese

- 1949: As determined by Standard of Identity<sup>1</sup>
  - If using raw or heat-treated milk the resulting cheese must be cured according to the individual standard
    - typically no less than 60 days at  $\geq 35^{\circ}\text{F}$
- >30 varieties could be legally made from raw milk
  - Gruyere  $\geq 90$  days
  - Parmesan  $\geq 10$  months
  - Cheddar  $\geq 60$  days at  $\geq 35\text{F}$
  - Semi-soft  $\geq 60$  days at  $\geq 35\text{F}$
  - Soft-ripened  $\geq 60$  days at  $\geq 35\text{F}$



# CDC: Nonpasteurized (Raw) Dairy Products, Disease Outbreaks, and State Laws—United States, 1993–2006

- Most outbreaks linked to pasteurized products were norovirus
- Most outbreaks linked to raw products were *Campylobacter*
- Estimated 150x greater outbreak risk per unit from raw products
  - Disproportionality affect the young (<20 years old)
    - 60% of people in raw outbreaks were
    - 23% in outbreaks linked to pasteurized products
- 75% of outbreaks linked to raw were in states with legal sales



# CDC: Increased Outbreaks Associated with Nonpasteurized Milk, United States, 2007–2012

- Average annual # of outbreaks was 4x higher than 1993-2006
- *Campylobacter* spp. was the most common- 81% outbreaks
- 81% of outbreaks were reported in states where the sale of raw milk was legal
- 59% of outbreaks involved at least one child younger than 5
- 71% - milk obtained from dairy farm



Legal status of raw milk sales (no. states)	State (no. outbreaks)	Dairy farm	Licensed or commercial milk seller	Cow or herd share	Other‡	Not reported	Total
Allowed on farms and at retail stores separate from farms (legal, 12 states)	Pennsylvania (17), Washington (5), Utah (5), South Carolina (5), California (3), Idaho (1), Arizona (1), Connecticut (1)	21	7	1	3	6	38
Restricted to farms (legal, 14 states)	Minnesota (6), New York (6), Wisconsin (3), Kansas (2), Massachusetts (1), Nebraska (1), Missouri (2)	16	2	1	0	2	21
Allowed on farm and at retail stores if standards met (legal, 1 state)	Vermont (4)	4	0	0	0	0	4
Only at farmer's markets (legal, 1 state)	0	0	0	0	0	0	0
Prohibited but allows cow or herd share (1 state)	Colorado (3)	1	0	2	0	0	3
Prohibited, including cow or herd share (illegal, 20 states)	Ohio (4), Michigan (4), North Dakota (2), Iowa (1), Indiana (1), Georgia (1), Alaska (1), Tennessee (1)	6	0	4	0	5	15
On-farm sales allowed only from farms with 2 producing cows, 9 producing sheep, and/or 9 producing goats (legal, 1 state)	0	0	0	0	0	0	0
<b>Total</b>		<b>48</b>	<b>9</b>	<b>8</b>	<b>3</b>	<b>13</b>	<b>81</b>

**Dairy-related illnesses and hospitalizations from 87 outbreaks, National Outbreak Reporting System, United States, 2009–2014\***

Pathogen	Outbreaks associated with milk and cheese consumption, N = 87†					
	Pasteurized			Unpasteurized		
	Outbreaks	Illnesses	Hospitalizations	Outbreaks	Illnesses	Hospitalizations
STEC	0	0	0	14‡	99	42
<i>Salmonella</i> spp.	0	0	0	8§	83	29
<i>Listeria monocytogenes</i>	10	100	87	1	1	1
<i>Campylobacter</i> spp.	1	2	0	53‡§	465	56
Overall	11	102	87	76	648	128

- Estimated >800x more likely to experience illness from raw products
- “Outbreak-related illnesses will increase steadily as ... consumption grows”
- 94% of deaths were *Listeria*

TABLE 1. Count of *Campylobacter fetus subsp. jejuni* of milk, whey, curd and cheese during various stages of manufacture of Cheddar cheese<sup>a</sup>.

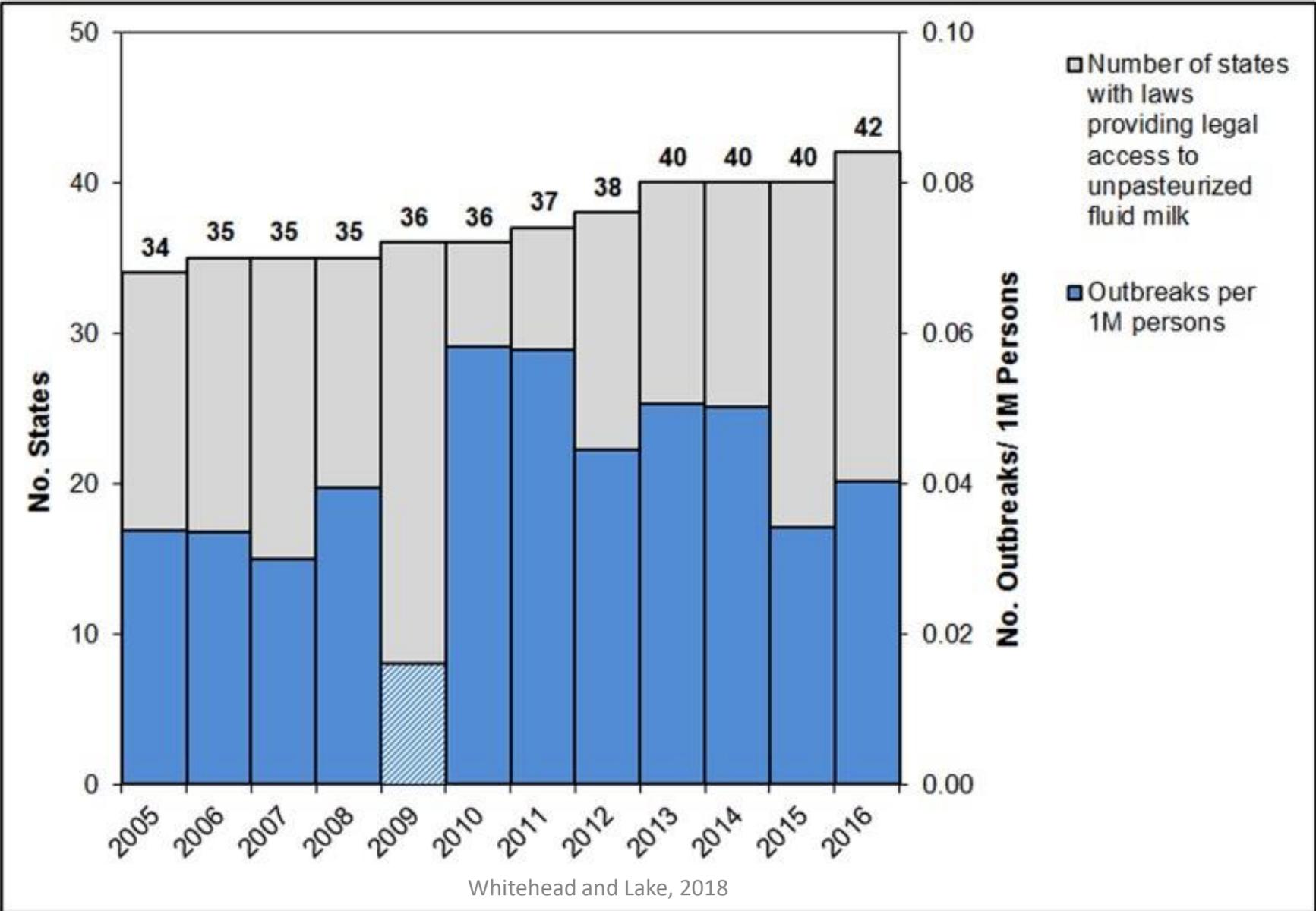
Sample	Strains of <i>C. fetus subsp. jejuni</i> used					
	6		29428		18177	
Milk, just after inoculation with <i>Campylobacter</i>	$4.6 \times 10^{5b}$	$4.3 \times 10^3$	$4.6 \times 10^5$	$9.3 \times 10^3$	$>2.4 \times 10^6$	$2.3 \times 10^3$
	$8.9 \times 10^{5c}$	$9.6 \times 10^3$	$1.2 \times 10^6$	$2.1 \times 10^4$	$1.4 \times 10^6$	$3.0 \times 10^3$
Milk, just before adding rennet	$2.4 \times 10^5$	$2.1 \times 10^4$	$2.4 \times 10^5$	$9.3 \times 10^3$	$>2.4 \times 10^6$	$9.3 \times 10^2$
	$2.5 \times 10^5$	$8.5 \times 10^3$	$5.4 \times 10^5$	$3.0 \times 10^3$	$1.2 \times 10^6$	$2.1 \times 10^3$
Whey, at time of draining	$2.3 \times 10^4$	$2.3 \times 10^3$	$9.3 \times 10^2$	$2.3 \times 10^2$	$2.3 \times 10^3$	$2.3 \times 10^1$
	$1.2 \times 10^5$	$7.0 \times 10^2$	$8.7 \times 10^4$	$4.2 \times 10^2$	$1.7 \times 10^3$	$1.0 \times 10^2$
Curd, at time of draining whey	$4.6 \times 10^5$	$9.3 \times 10^4$	$9.3 \times 10^4$	$2.4 \times 10^4$	$9.3 \times 10^4$	$2.3 \times 10^3$
	$2.8 \times 10^6$	$2.5 \times 10^4$	$2.1 \times 10^6$	$2.4 \times 10^4$	$2.6 \times 10^5$	$6.8 \times 10^3$
Curd, after salting, before pressing	$>2.4 \times 10^6$	$4.3 \times 10^4$	$4.3 \times 10^4$	$4.3 \times 10^4$	$2.4 \times 10^5$	$9.3 \times 10^3$
	$2.7 \times 10^6$	$2.3 \times 10^4$	$2.2 \times 10^6$	$2.0 \times 10^4$	$4.3 \times 10^5$	$2.8 \times 10^3$
Cheese, after 15 d curing	$<0.3$	4.0	$<0.3$	$<0.3$	4.0	$<0.3$
	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$
Cheese, after 30 d curing	$<0.3$	$<0.3$	$<0.3$	$<0.3$	$<0.3$	$<0.3$
	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$
Cheese, after 60 d curing	$<0.3$	$<0.3$	$<0.3$	$<0.3$	$<0.3$	$<0.3$
	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$	$< 1$

# Recent Trends in Unpasteurized Fluid Milk Outbreaks, Legalization, and Consumption in the United States

- 2005-2016

	Outbreaks	Illnesses	Hospitalizations	Deaths	Deaths/1000 Illnesses
Reported outbreaks (all)	10,965	208,734	10,585	233	1.1
Outbreaks with ID'd food vehicles	5,236	116,239	7,297	185	1.6
Dairy foods (all)	232	4,986	469	23	4.6
Pasteurized dairy	31	2,225	120	17	7.6
Pasteurized processed dairy	25	322	100	13	40
Pasteurized fluid milk	6	1,903	20	4	2.1
Unpasteurized dairy	184	2,415	332	5	2.1
Unpasteurized processed dairy	32	680	156	3	4.4
Unpasteurized fluid milk	152	1,735	176	2	1.2

# States permitting legal access to unpasteurized fluid milk compared to outbreak rates in the United States, 2005-2016.

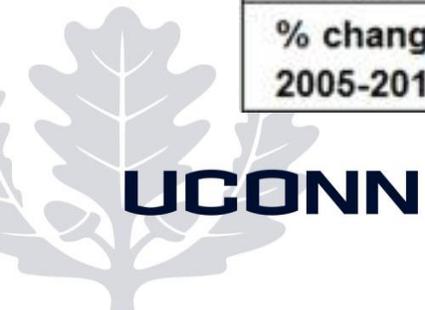


Whitehead and Lake, 2018

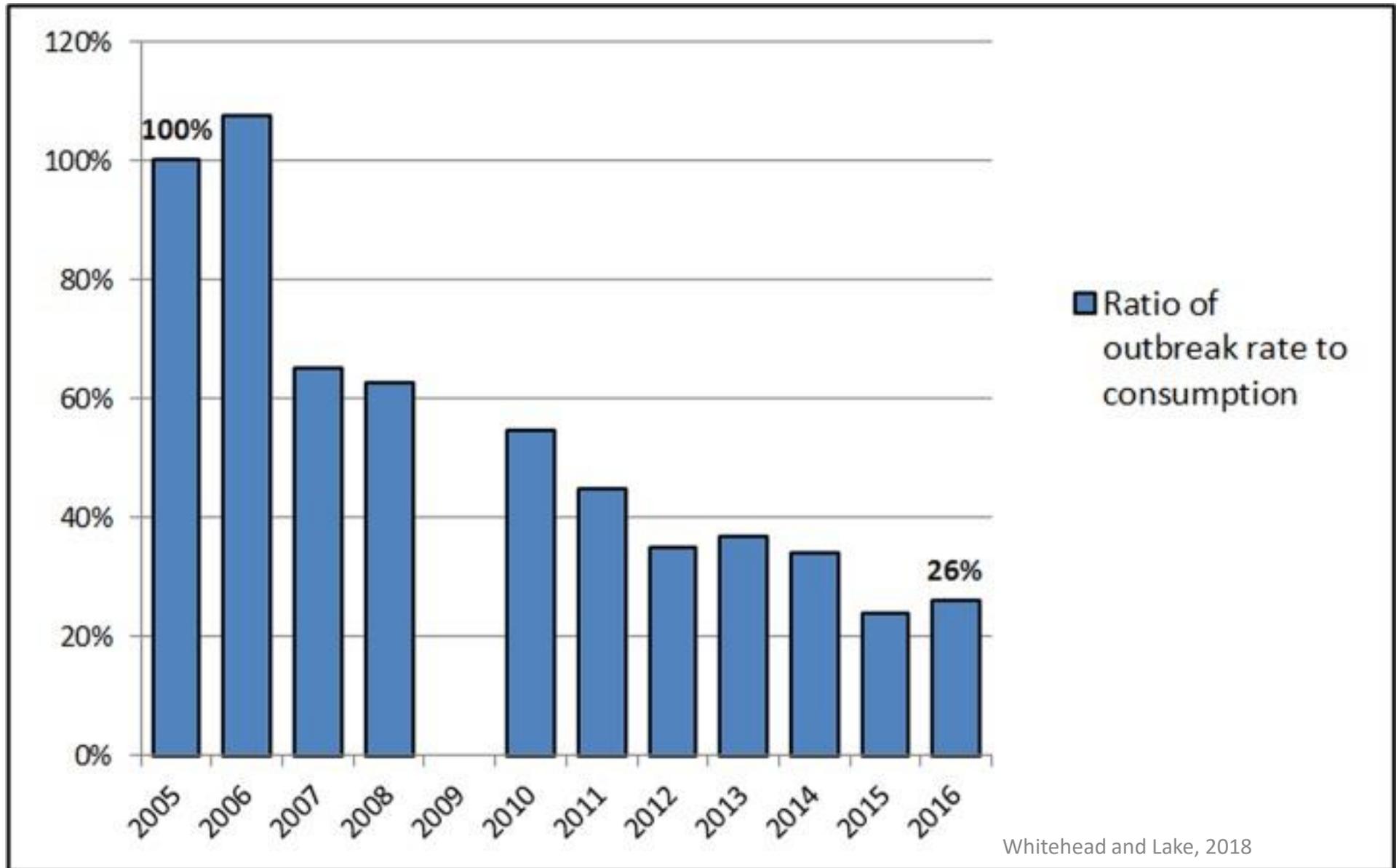


Number of licenses and permits issued to unpasteurized milk farms in nine U.S. states, 2005-2016. Estimates indicated by square brackets.

Year	State (Legal Status)									Annual total licences	% change from 2005
	CA (R)	CO (H)	FL (P)	MA (F)	ME (R)	NY (F)	TX (F)	UT (F)	WA (R)		
2005	2	7	4	7	16	10	22	2	6	76	0
2006	2	4	5	11	15	12	13	2	6	70	-8%
2007	2	7	8	12	18	23	17	2	[14]	103	+36%
2008	2	20	11	13	29	[26]	28	2	22	153	+101%
2009	2	16	23	15	38	[29]	44	2	[25]	194	+155%
2010	3	28	42	29	42	32	33	2	28	239	+214%
2011	3	22	68	34	50	37	42	3	[30]	289	+280%
2012	3	17	61	31	57	[38]	42	4	[32]	285	+275%
2013	5	19	[66]	32	60	40	48	4	34	308	+305%
2014	5	18	72	30	60	44	52	6	45	332	+337%
2015	5	12	77	28	64	40	44	8	42	320	+321%
2016	5	20	84	30	67	48	44	10	39	347	+357%
% change 2005-2016	+150%	+186%	+2700%	+329%	+319%	+380%	+100%	+400%	+550%		



Estimated trend in outbreak rate controlling for population growth and estimated consumption rate, 2005-2016, scaled to show values relative to 2005.

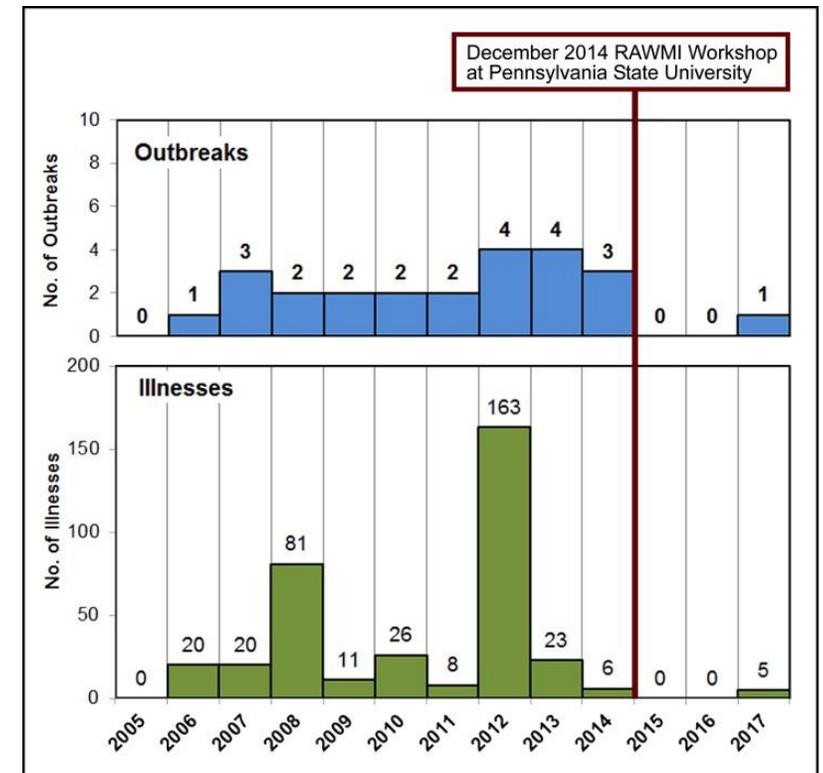


# Risk reduction

- Does increasing oversight reduce risk?
- Should we be helping or just prohibiting?

A collage of images related to raw milk. It includes a cow in a field, a cow in a barn, a cow in a field, a hand milking a cow, and a person in a lab coat working with a milk sample. A central text box reads "IS ALL RAW MILK DANGEROUS? TWO TYPES OF RAW MILK RAWMILKINSTITUTE.ORG".

IS ALL RAW MILK DANGEROUS?  
**TWO TYPES OF RAW MILK**  
RAWMILKINSTITUTE.ORG



# RAWMI Risk Analysis and Management Plan

- *Risk assessment and mitigation measures for the following risks*
  1. Animal introduction onto farm (transportation and trade risks)
  2. Herd health
  3. Milk handling and management
  4. Environmental management
  5. Feed sources
  6. Human factors
  7. Nutritional management of the dairy cow, goat, sheep, or other lactating mammals
  8. Management of freshened animals and new offspring
  9. Management of bulls
- *Procedures, protocols, and documentation*
  1. Testing procedures for indicator bacteria including coliforms and SPC
  2. Testing procedures for potential bacteria including *Salmonella*, *Listeria monocytogenes*, *Campylobacter* and *E. coli O157:H7*
  3. Checklists that document annual, monthly, weekly and daily management practices
  4. Protocols for action steps in the event of substandard results



# CCP



## Test and Hold Procedure



**Reference:**

Test Protocol and Results, Item 2

**Risk Reduction:**

Ensure that no products are sold without a prior negative pathogen test result confirmation from an AOAC accredited third-party lab.

**Frequency:**

24 hours a day, 7 days a week

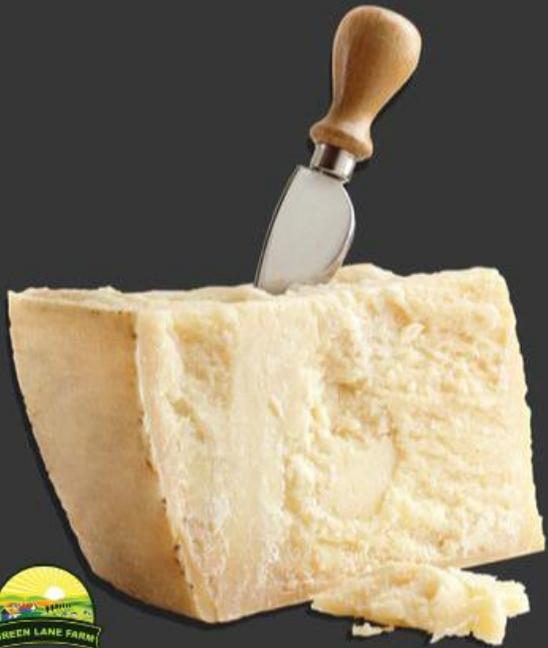
**Remediation:**

If fluid milk is positive for E. coli O157:H7, Campylobacter, Salmonella or Listeria Monocytogenes; or if the coliforms are greater than 100, all product is to be red tagged. Investigate root cause(s) of contamination and revise the CCP and SOP infrastructure for its implementation. President, Dairy Manager, and Creamery Manager will be notified by Eurofins for any positive results. Further action taken is based on

# CHEESE

milk's leap toward  
**IMMORTALITY.**

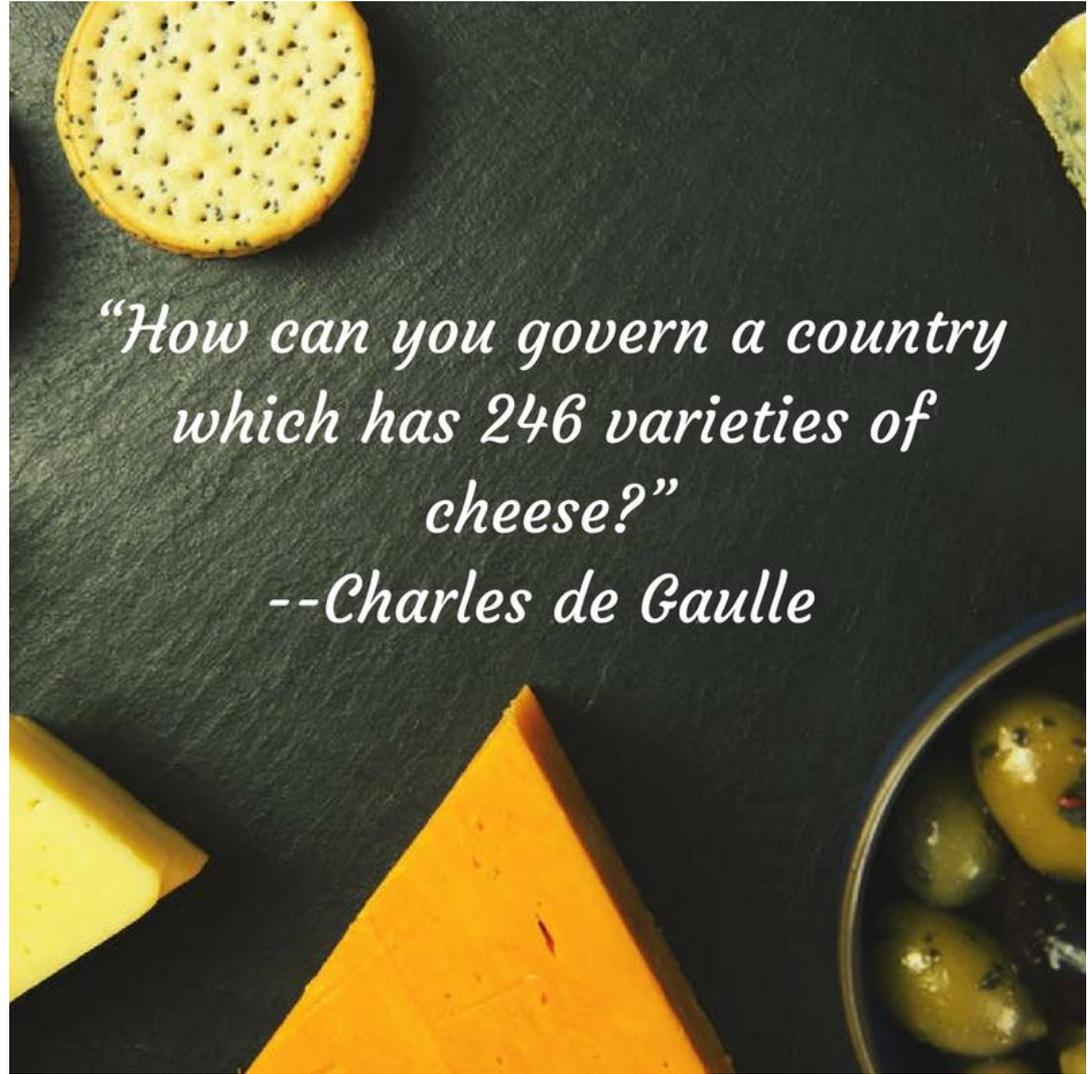
-Clifton Fadiman



#greenlanefarm

*"How can you govern a country  
which has 246 varieties of  
cheese?"*

*--Charles de Gaulle*



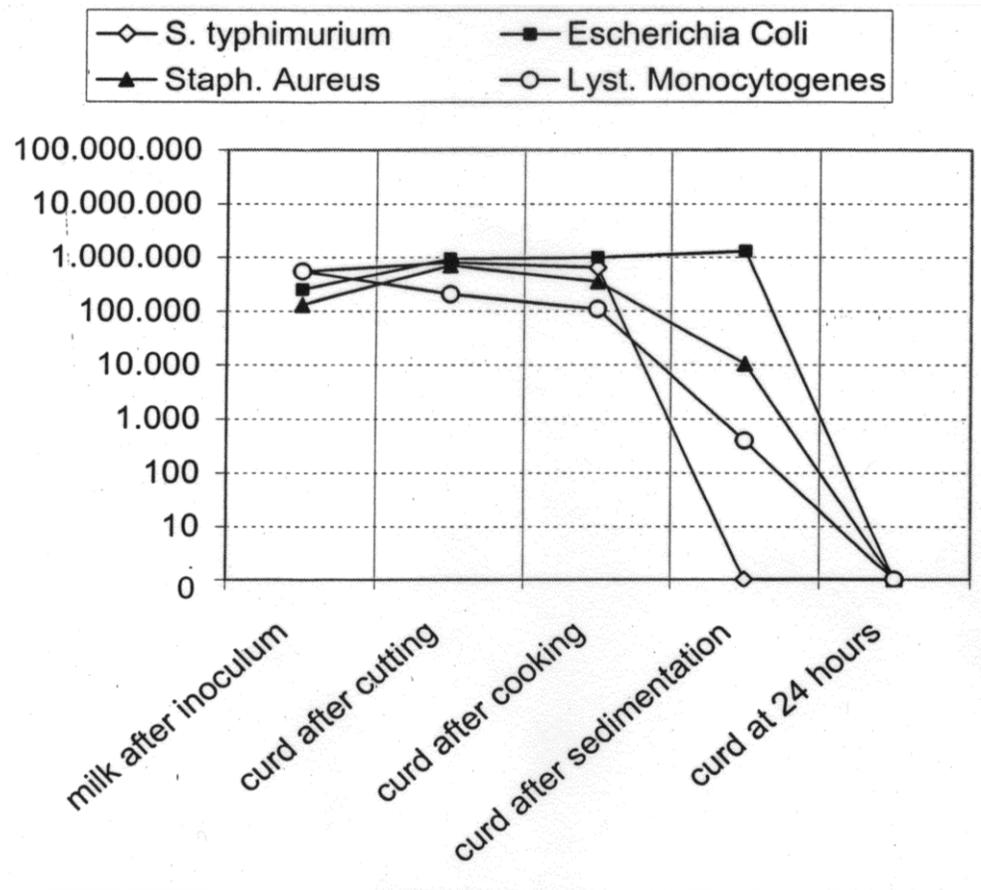
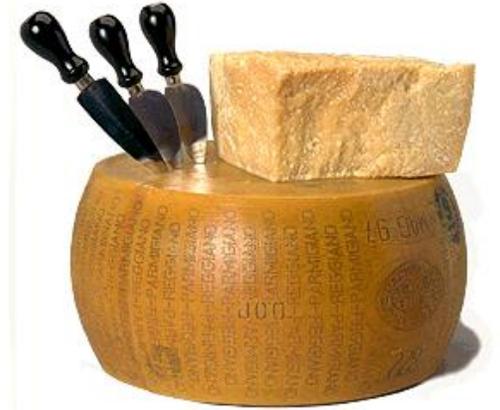
# Raw milk cheese risk continuum

- Risk varies due to effects of:
  - processing techniques: curd cooking, acidification, salting
  - intrinsic characteristics:  $A_w$ , moisture, pH, salt content
- 1. Very low risk:** combination of factors eliminate pathogens that may be present in raw milk
- 2. Low risk:** pathogens if present in raw milk may survive, product does not support growth
- 3. Moderate to High risk:** limited factors, if any, that inhibit survival and growth of pathogens



# Very low risk: Parmigiano Reggiano

- Cooking and pressing of curd at high temps (53-56°C) inactivates pathogens



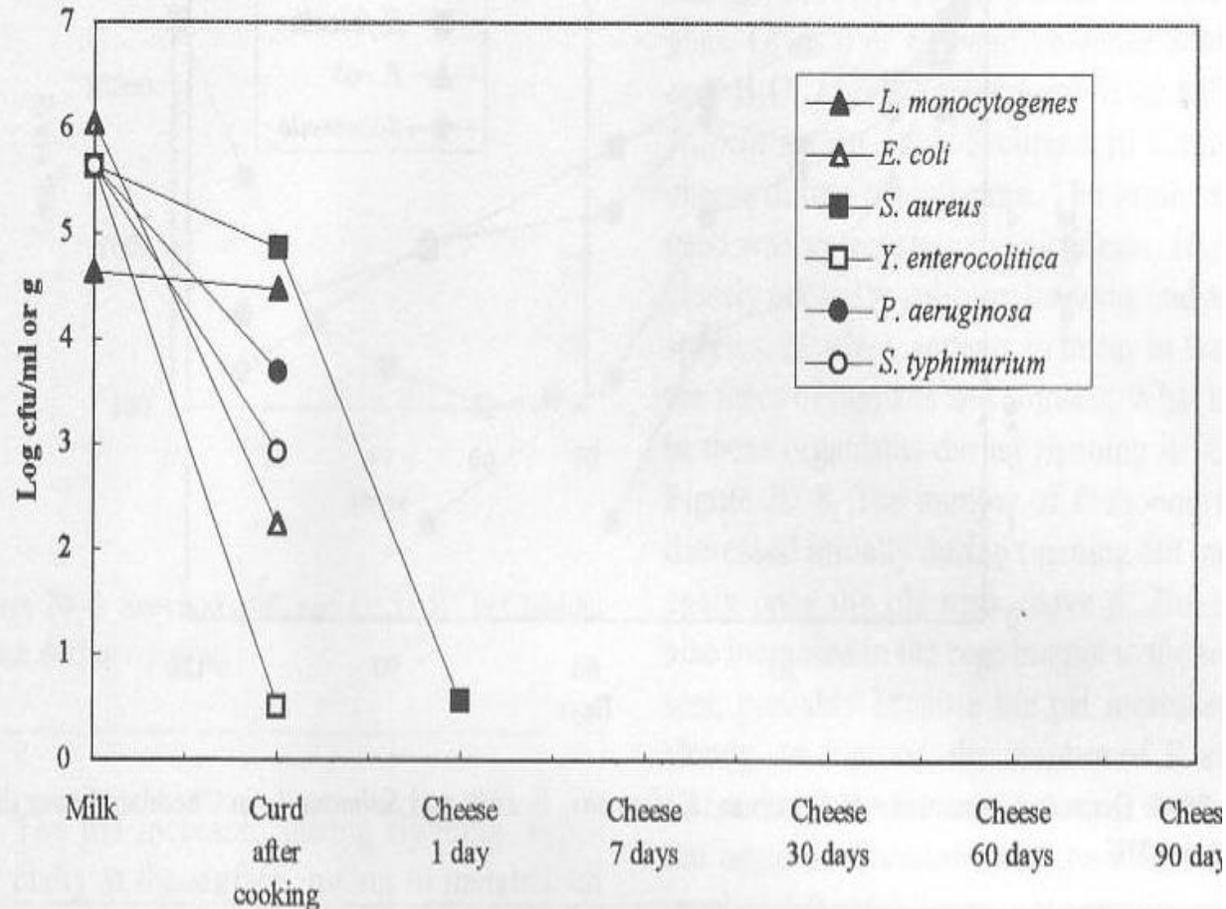
- Additional hurdles:
  - $a_w$ : 0.9
  - moderate salt content
  - extensive aging
    - 9-12 months

# Very low risk: Emmental



- High temp., long duration curd cook and pressing

Emmental cheese

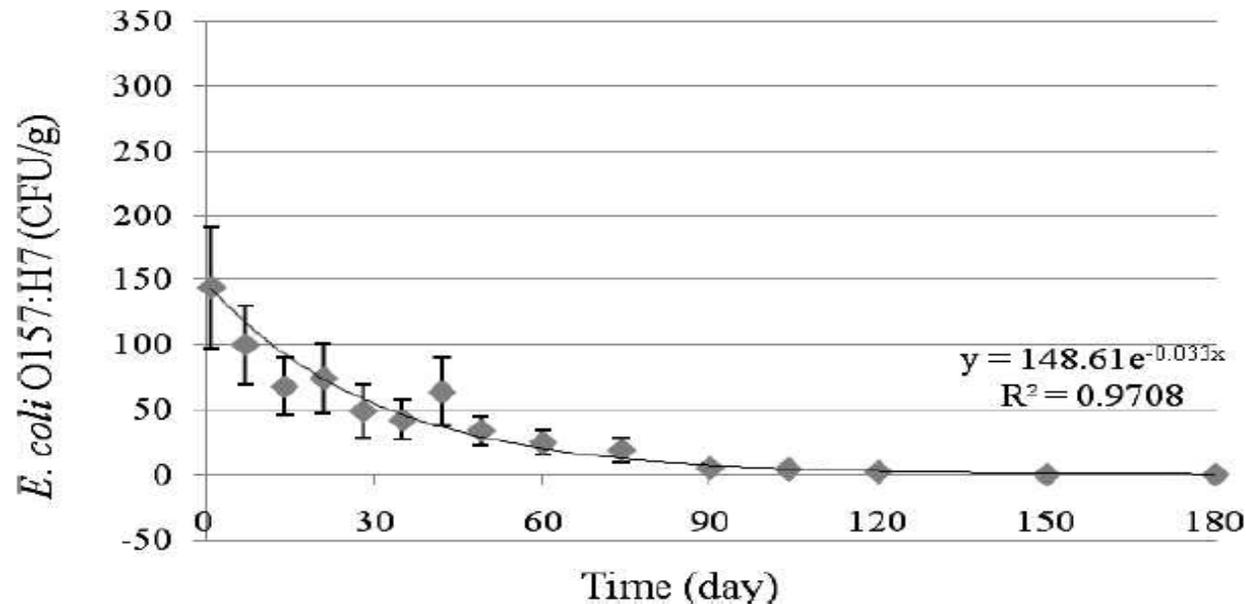


- Additional hurdles:
  - pH: 5.2
  - Low moisture (~35%)
  - Extended aging

# Low risk: Cheddar



- No high temp. curd cooking
  - Decrease in pathogen counts over 60-90 days aging

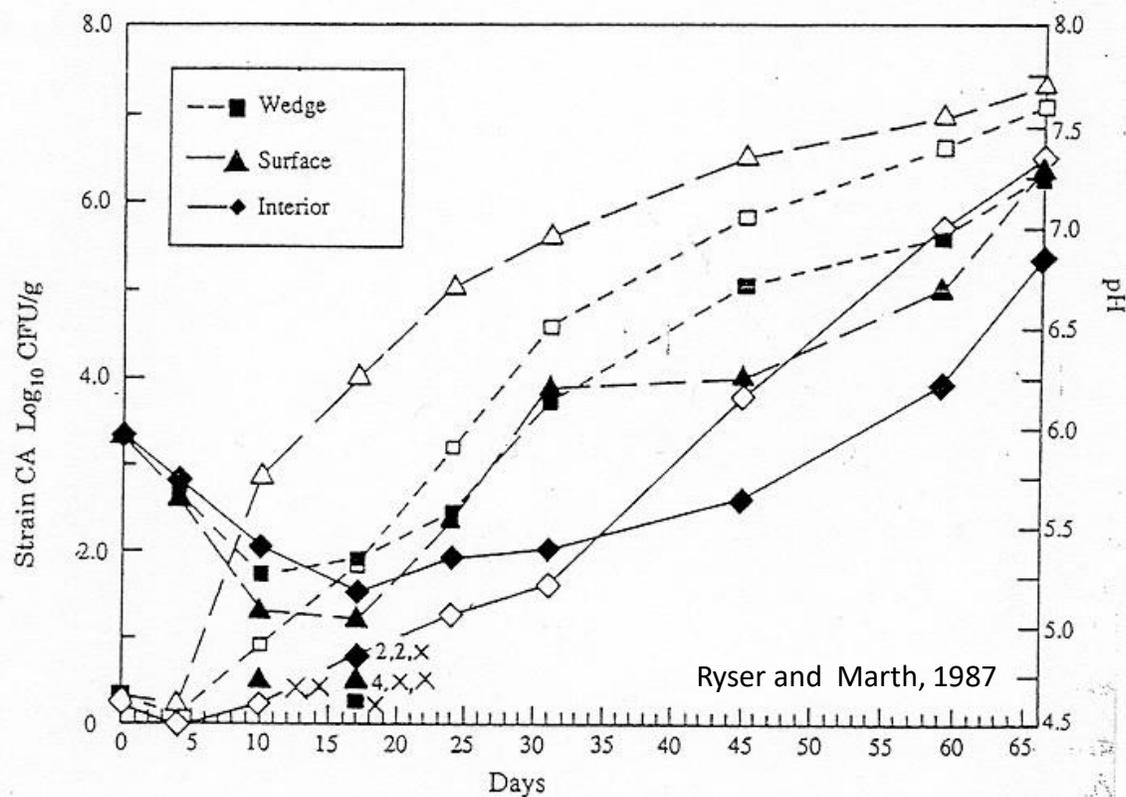


- Additional hurdles:
  - pH: 5.2
  - Low moisture (~37%)

FIGURE 1. Counts (mean  $\pm$  SEM) of *Escherichia coli* O157:H7 during the aging of stirred-curd Cheddar cheese (all strains combined).

# Moderate to High risk: Camembert

- Surface flora growth increases pH ( $\sim 4.6 \rightarrow 7.5$ )
- Promotes growth in core and on surface <sup>1,2,3,4,5</sup>
- 60 day aging inadvertently contributes to risk



- 1: Back et al., 1993;
- 2: D'Amico et al., 2008;
- 3: Gay and Amgar, 2005;
- 4: Genigeorgis et al., 1991;
- 5: Ryser and Marth, 1987.

# Moderate to High risk: Queso fresco

- No starter culture, high pH ( $\geq 6$ ); low salt
- High moisture ( $>50\%$ ); high  $a_w$  ( $\sim 0.98$ )

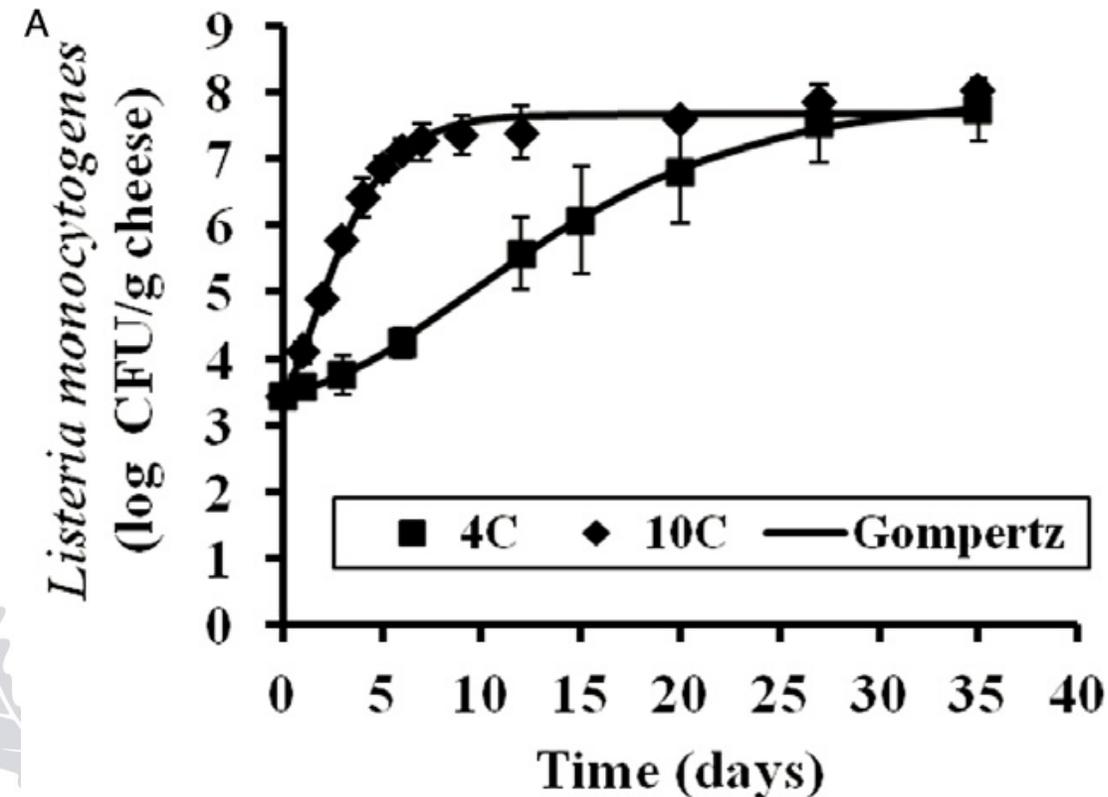


FIG. 1. (A) GROWTH OF *LISTERIA MONOCYTOGENES* INOCULATED IN QUESO FRESCO CURDS, FORMED INTO A CHEESE BLOCK, SLICED AND STORED AT 4 OR 10C. (Legget et al., 2012. Journal of Food Safety 32: 236–245)

# FDA Microbiological Surveillance Sampling: FY14-16

## Raw Milk Cheese Aged 60 Days

- 1,606 raw milk cheese samples collected and tested
  - 473 (29 %) were domestic
  - 1,133 (71 %) were of international origin
- 63% semi-soft cheese; 32.5% hard
- *Salmonella*, *Listeria monocytogenes*, *E. coli* O157:H7 and Shiga toxin-producing *E. coli*, as well as for generic *E. coli*



# FDA Microbiological Surveillance Sampling: FY14-16

## Raw Milk Cheese Aged 60 Days

- *E. coli* O157:H7: 0%
- Shiga toxin-producing *E. coli*: 0.68%
  - Only 1 was pathogenic (*E. coli* O111:H8) for a rate of 0.06%
- *Salmonella*: 0.19 %
  - All imports (2 from France, and 1 from Italy)
- *L. monocytogenes*: 0.62 % (could be environmental)
  - 5 domestic, with 3/5 collected at a single firm
  - 5 imports (4 from France, 1 from Italy)

# FDA Microbiological Surveillance Sampling: FY14-16

## Raw Milk Cheese Aged 60 Days

- *L. monocytogenes* in cheeses, particularly semi-soft varieties, remains a concern
  - The FDA believes this contamination rate may be related to product handling practices or procedures
  - FDA plans to continue to work with the cheese industry to identify and correct practices that lead to *L. monocytogenes* contamination in cheese



# Listeriosis and cheese

- Listeriosis
  - Hospitalization rate: ~94%
  - Case fatality rate: ~15-20%
- CDC: 2008-2018
  - Most listeriosis outbreaks linked to:
    - Soft cheese
    - Cheese made with pasteurized milk

Year	Food Vehicle
2009	
2009	mexican style cheese, pasteurized
2011	ackawi cheese, pasteurized; pasteurized
2010	mexican style cheese, pasteurized
2011	mexican style cheese, pasteurized
2011	blue-veined cheese, unpasteurized
2009	mexican-style cheese
2012	ricotta salata cheese
2013	
2013	cheese-le frere
2013	latin style soft cheese
2013	mexican style cheese, pasteurized
2008	mexican style cheese, pasteurized
2014	mexican style cheese, pasteurized
2015	american cheese, pasteurized
2016	artisanal soft cheese, unpasteurized
2017	cheese, pasteurized
2017	queso fresco, unspecified
2014	mexican cheese (queso fresco and/or other)
2017	artisanal soft cheese, pasteurized
2018	mexican-style cheese



# Listeria Outbreak Linked to Queso Fresco Made by El Abuelito Cheese Inc.

[Español \(Spanish\)](#)



Food Safety Alert



Centers for Disease Control and Prevention  
CDC 24/7: Saving Lives, Protecting People™

Posted May 14, 2021

This outbreak is over. Even when there are no ongoing outbreaks, do not eat soft cheeses like queso fresco, unless they are labeled “made with pasteurized milk.” This is especially important for people who are at higher risk for *Listeria* illness.

## Fast Facts

- Illnesses: 13
- Hospitalizations: 12
- Deaths: 1
- [States](#): 4
- Recall: Yes
- Investigation status: Closed



Queso fresco



# Cheese outbreaks in US: 1998-2011

- Past. milk: 44 outbreaks, 987 illnesses
  - Mostly Norovirus and *Listeria*
- Raw milk: 38 outbreaks, 816 illnesses
  - 13 imported from Mexico
  - 20 linked to soft cheeses: Queso Fresco or Hispanic-style
    - rest were homemade, fresh, curds, etc.
  - 3 linked to cheese aged  $\geq 60$  days
    - Concerns go beyond use of raw milk



# 2010: *E. coli* O157:H7 outbreaks

- Gouda: 38 illnesses, 15 hospitalizations
  - O157 also in Cheddar
  - *L. monocytogenes* in cheeses and on cheese mill
  - Major deficiencies in plant design, traffic control, GMPs, etc.
  - cheeses packaged prior to 60 days
- Mold-ripened soft cheese: 8 illnesses
  - *L. monocytogenes* also found on floor and in cheese
  - contaminated water, lack of GMPs, poor hygiene, etc.
  - Accumulation of manure, mud and straw on floor



# “Vulto Creamery shut down because owner did not ‘understand’”

- Vulto test records show that 54 out of 198 environmental swabs taken from various locations, including food contact surfaces, tested positive for Listeria
- did not conduct an investigation to identify source or point of entry/harborage at the facility
- did not conduct microbial testing of finished products after finding positive Listeria on food contact surfaces
- repeatedly found Listeria throughout the facility, even after re-cleaning and re-sanitizing.
- Failure to use a procedure for equipment and utensil cleaning and sanitizing that has been shown to provide adequate treatment

## Multistate Outbreak of Listeriosis Linked to Soft Raw Milk Cheese Made by Vulto Creamery (Final Update)

Posted May 3, 2017 1:30 PM ET

This outbreak appears to be over. However, *Listeria* remains an important cause of serious, life-threatening human illness in the United States. For more information about *Listeria* and steps that people can take to reduce their risk of infection, visit [CDC's Listeria webpage](#).

### Highlights

- [Read the Recall & Advice to Consumers and Retailers>>](#)
- This outbreak appears to be over. However, CDC recommends that consumers do not eat, restaurants do not serve, and retailers do not sell recalled raw milk cheeses made by Vulto Creamery.
- On March 10, 2017, Vulto Creamery [recalled](#)  all lots of its raw milk cheeses.
  - The raw milk cheeses were distributed nationwide, with most being sold at retail locations in the northeastern and Mid-Atlantic states; California; Chicago; Portland, Oregon; and Washington, D.C.
- CDC, public health and regulatory officials in several states, and the U.S. Food and Drug Administration (FDA) investigated a multistate outbreak of *Listeria monocytogenes* infections (listeriosis).

### At a Glance:

- **Case Count:** [8](#)
- **States:** [4](#)
- **Deaths:** [2](#)
- **Hospitalizations:** [8](#)
- **Recall:** [Yes](#)



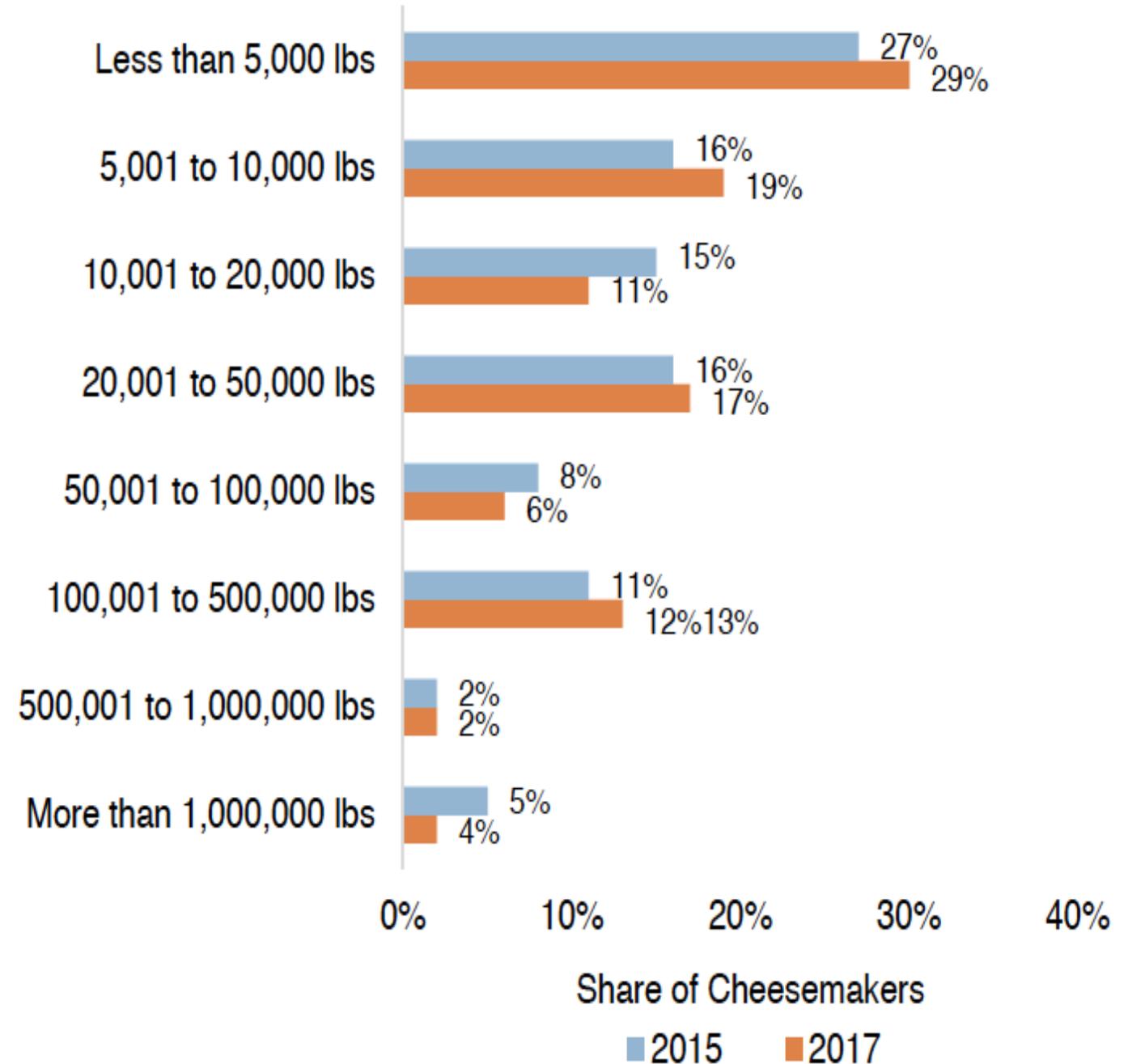
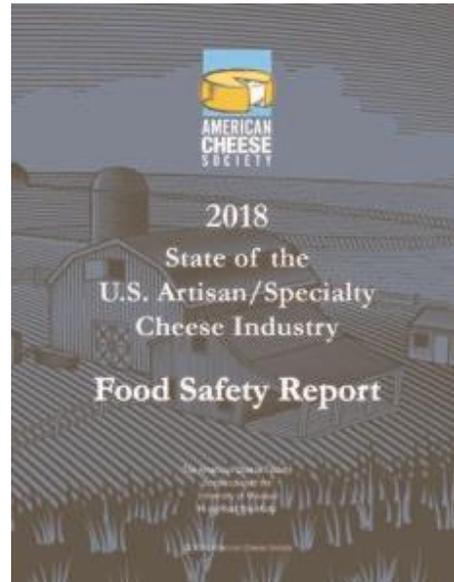
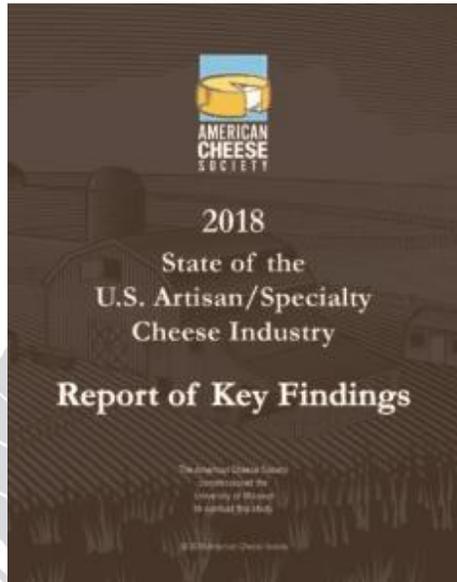
# Artisan cheese renaissance

- Increase in # and size of artisan operations
  - 1980: very few
  - 2000: ~200
  - 2020: ~1000
- Artisan operations are often considered higher risk
  - lack of resources, capital and technical expertise
  - Farmstead: increased risk of an adjacent farm
  - making higher risk cheeses, use of raw milk

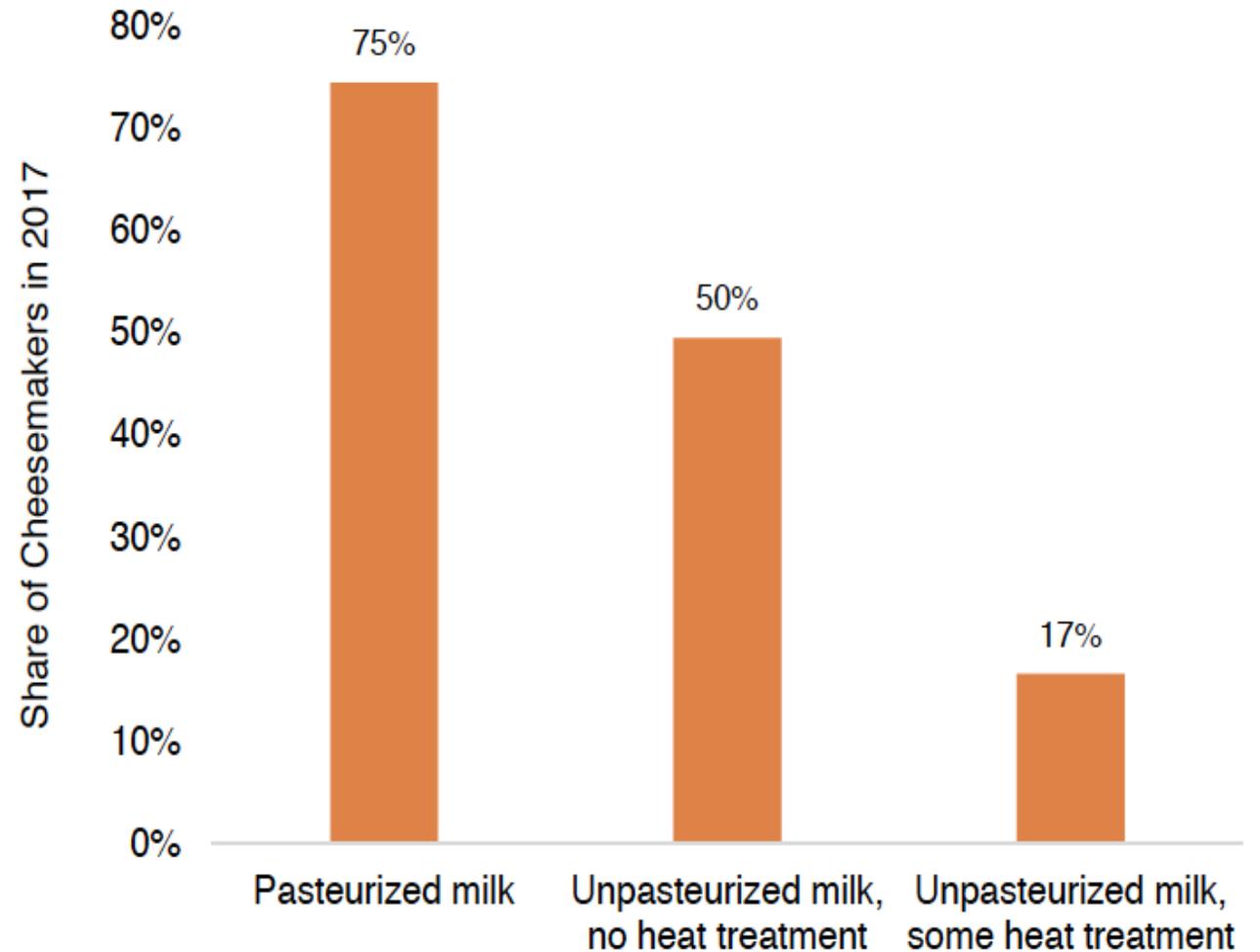
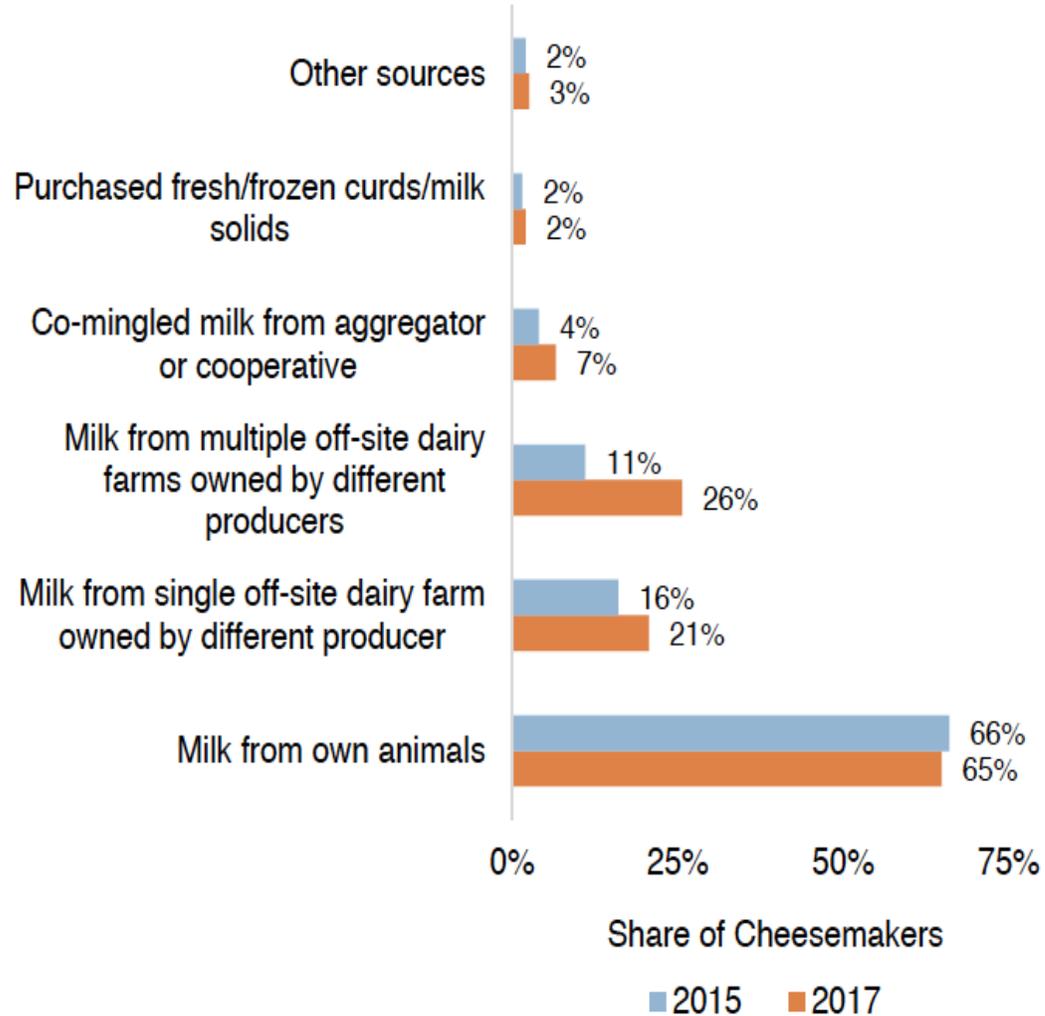


# Most are very small

- Production volume
  - ~75% make <50,000 lb
  - ~50% make <10,000 lb
  - ~30% make <5,000 lb

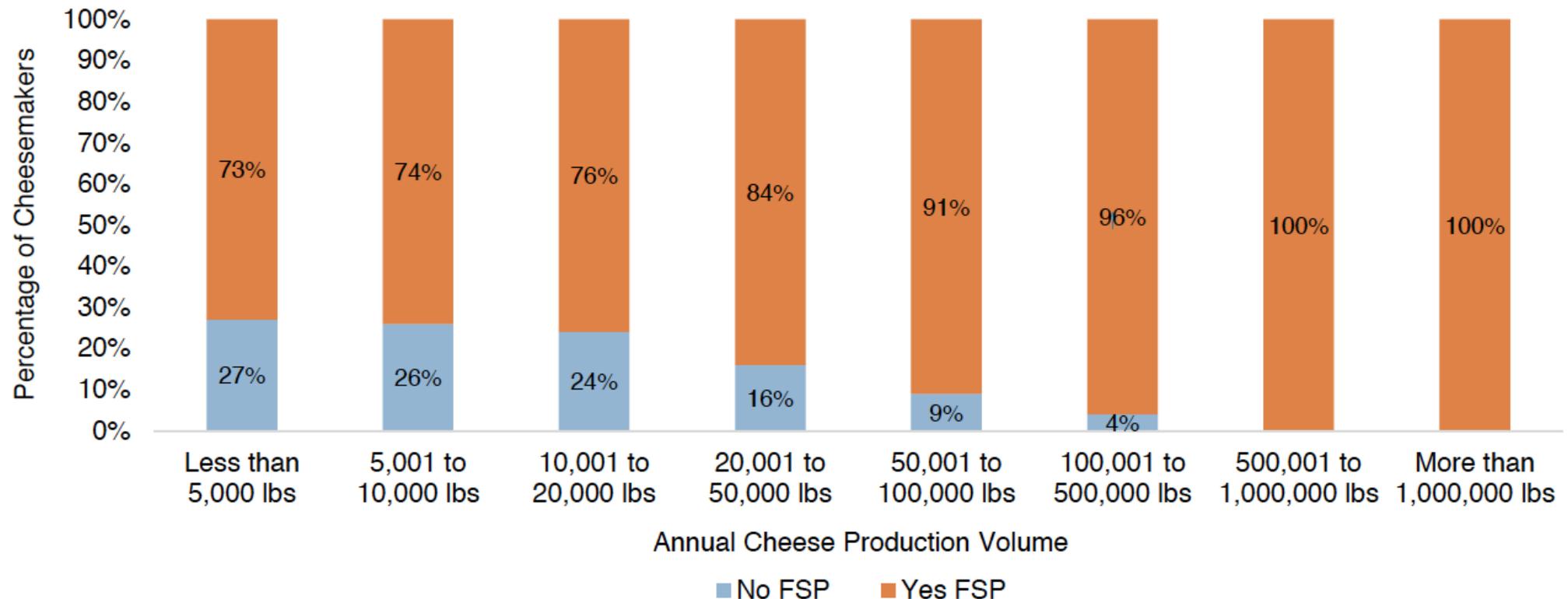


# Milk source and heat treatment



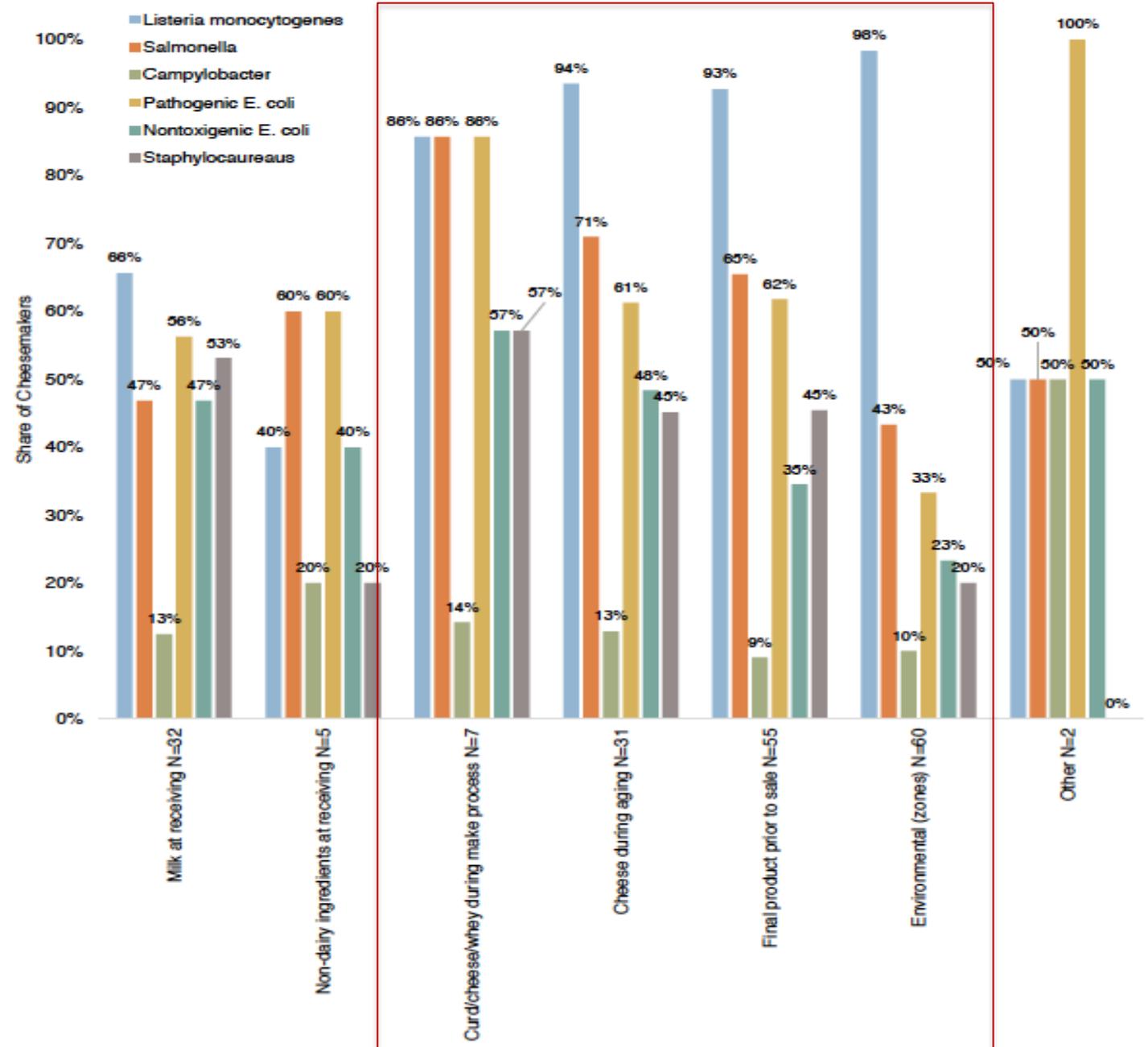
- 2018: 81.5% reported having a Food Safety Plan
  - Up from 59% in 2016
- Smaller businesses were less likely to have an FSP
  - 62% in 2016 for producers making <5000 lb

**Exhibit 4.2 — Businesses Operating with a Food Safety Plan in 2018 by 2017 Annual Cheese Production Volume, N=200**



# Testing

- 45% reported some pathogen testing
- Environment and finished product most common
  - followed by aging and milk
- *Listeria* most common



# My Observations

- Considerable variation between facilities
  - general hygiene, facility condition, and knowledge
  - Implementation of FSP
- Environmental *Listeria* is not uncommon, but controllable
  - mostly floors and drains, aging rooms
- Recurrent positives due to lack of corrective actions



# My Observations

- Most common risks:
  - Lack of food safety knowledge and culture
  - Lack of hygienic zoning and control between rooms
    - improper traffic flow and facility design
  - Lack of food safety plans and supporting programs
  - Limited environmental monitoring
  - General need for facility repair and updating
    - Eroding floors, unhygienic equipment
- Need for education and outreach

## Food Safety Basics for Artisan Cheesemakers



START 

NC STATE  
UNIVERSITY

COVID-19 UPDATES

RESOURCES

search ncsu.edu



## Food Safety Education and Training

 THINK AND DO  
THE EXTRAORDINARY  
Support the College →

About

Programs and Certifications

Workshops

Courses

## Environmental Monitoring in the Dairy Industry

CONTACT US →

REGISTER →

Highlights

The American Cheese Society's

## Best Practices Guide for Cheesemakers

Published February 15, 2017



# Questions?

