

What is Known about CDC Foodborne and Milkborne Outbreaks Prior to 2020?

1. **Neither pasteurized nor raw milk is risk-free:** *Journal of Epidemiology and Global Health* study for CDC data compiled from **2005-2020** (Stephenson, Coleman, and Azzolina 2024)
 - CDC data included **3,807 milkborne illnesses:**
2,111 pasteurized milk cases with 4 deaths and
1,696 raw milk cases with 1 confirmed death.
2. **More illnesses and deaths** were associated with **leafy greens (16,434 illnesses, 23 deaths), oysters (2,408, 2), and pasteurized milk (2,111, 4)** than **raw milk (1,696, 1 confirmed death (campylobacteriosis))** as per **appended Table 1**.
3. **Salmonellosis burden of illness** from CDC (2005-2020; Stephenson et al., 2024) exceeded **23,066 cases**, predominantly associated with **foods other than raw milk** (see Figure 1).

i. leafy greens	iv. turkey	vii. root vegetables	
ii. chicken	v. beef	viii. nuts	
iii. pork	vi. melons	ix. sprouts	x. tropical fruits.
- Less than 1% of salmonellosis burden of illness was associated with raw milk.**
 - For **unbiased** outbreak investigations, these **more likely sources of salmonellosis** above must be addressed using **valid systematic methods** such as **root cause analysis** adopted by FDA (see 2024 [International Association of Food Protection webinar](#)).
4. **No salmonellosis outbreaks** were associated with raw milk in **TN** from 2005-2020; TN reported 1 raw milk outbreak in this period (9 ill, 5 hospitalized and recovered, no deaths associated with Shiga toxigenic *E. coli* in 2013). TN and many other states had few outbreaks associated with raw milk in this 16-year period (see **appended Figure 2**), and **no state had increasing rates of illness** (see **appended Figure 3**).
5. **No child died from consuming raw milk in recent decades**, and recent peer-reviewed scientific evidence does not link raw milk to mortality (Stephenson, Coleman, and Azzolina 2024).
6. **Studies** with one same data source, CDC NORS, over different time periods (Langer et al. 2012; Mungai, et al., 2015; Costard et al. 2017; Whitehead and Lake, 2018; Koski et al. 2022; Stephenson et al., 2024) are inconsistent, largely due to invalid and biased assumptions for some studies (Stephenson et al., 2024). Many claims are misleading and inconsistent with the body of evidence.

What is Known from Risk Assessments and a Systematic Review?

1. **FDA/USDA** determined **both pasteurized and raw milks high risk** of severe listeriosis: **pasteurized milk with high risk of severe listeriosis per annum** and **unpasteurized milk with high risk per serving** (FDA/FSIS, 2003).
2. **Significantly higher risks** of severe listeriosis and death associated with **pasteurized** than raw milk for North America (2007-2020) using rigorous systematic review procedures (Sebastianski et al. 2022). Further, these authors reported **pasteurized, NOT raw dairy, was associated with 12 premature deliveries, a miscarriage, and 7 fetal deaths or stillbirths**, as well as 17 deaths.
3. **Raw milk, even at retail, can be safely produced** (see **appended Figure 4 for CA and Figure 5 for NY**)
 - **Estimated risk per serving for one farm's retail raw milk between 2016 and 2020** is consistent with **<1 illness** in more than **20 million retail raw milk servings**.

- **Increasing demand and retail sales** are **not** associated with **increasing rates** or **burdens of illness** (Stephenson et al., 2024).
- 4. **Independent studies** (Latorre et al. 2011; Stasiewicz et al. 2014; Coleman et al. 2023) documented evidence consistent with **lower risk for raw milk** and **higher risk for pasteurized milk likely due to the loss of the natural competing microbiota**.
- 5. The **body of evidence** from epidemiology, microbiology, and risk assessment is **inconsistent** with the **common assumption that raw milk is “inherently dangerous”** because it may contain pathogens. The same is true for pasteurized milk, oysters, and leafy greens with similar or higher burdens of illness.
- 6. The **reality for the 21st century** is that **detection of pathogens** in raw milk is **uncommon** (Dietert et al., 2022), **none** of the **pathogens** contributing to raw milk illnesses **grow in raw milk** stored at the **proper temperature** (Coleman et al. 2023), and **illness and mortality** are **NOT increasing** with **increasing access** to raw milk (Stephenson, Coleman, and Azzolina 2024).

What is Known about Milkborne Benefits and Risks?

1. The available evidence from **peer-reviewed studies** in the journals **Applied Microbiology** (Dietert et al. 2022) and **PLOS ONE** (Coleman et al. 2023) are **inconsistent** with the assumption that raw milk is “inherently dangerous” and the **claim that ‘risks exceed benefits’**.
 - **Cornell University Emeritus Professor of Immunology Rodney Dietert** and colleagues (Dietert et al., 2022) mapped **extensive** evidence of **benefits** and **some** evidence of **risks** for **both pasteurized and raw milks** from humans and cows
2. **‘Blind side’ for pasteurization**
 - a. Just as **FDA Commissioner Makary** noted a **‘blind side’**, a failure to consider downsides to antibiotics (now understood to “**carpet bomb the microbiota**”), downsides exist for **‘pro-pasteurization bias’** including an **epidemic of intolerance, inflammatory, and non-communicable disease**. **Pasteurizing raw breastmilk** (Coleman et al., 2021) and **raw bovine milk** (Dietert et al., 2024) **imposes loss of benefits** of the plethora of bioactive components of raw milk, particularly the natural microbiota.
 - b. The body of evidence supports **raw milk** with its **dense and diverse natural microbiota** (Oikonomou et al. 2020) as a **healthful food** that **suppresses growth of pathogens** at proper refrigeration temperatures (Coleman et al., 2023) and is **beneficial to gut, immune, nervous, and respiratory systems of children and adults** (Dietert et al., 2022).
 - c. Multiple studies document that **microbes in mammalian milks, breastmilk and cow milk** (Wu et al. 2019; Oikonomou et al. 2020; Coleman et al., 2021), do **not** arise from **feces**, a common source of pathogen contamination for **other foods** contributing to **99% of the burden of salmonellosis**.

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Table and Figures based on CDC NORS Dataset for 2005-2020

Table 1. Burdens of illness from foodborne outbreaks for four foods over years 2005-2020

	Pathogens (numbers ill by pathogen)	Illnesses	Deaths
Leafy Greens	Norovirus, <i>E. coli</i> STEC, <i>Cyclospora</i> , <i>Salmonella</i>	16,434	23
Oysters	Norovirus, <i>Vibrio</i> , <i>Campylobacter</i> , <i>E. coli</i> STEC, <i>Salmonella</i> , <i>Giardia</i> , Hepatitis, Sapovirus, <i>Staphylococcus</i>	2,408	2
Pasteurized Milk	<i>Campylobacter</i> (1,873) , <i>Yersinia</i> (125), Norovirus (33), <i>Salmonella</i> (24), <i>L. monocytogenes</i> (5), <i>E. coli</i> STEC (3), other hazards (48)	2,111	4
Raw Milk	<i>Campylobacter</i> (1,570) , <i>E. coli</i> STEC (267), <i>Salmonella</i> (162), <i>Cryptosporidium</i> (35)	1,696	1 confirmed

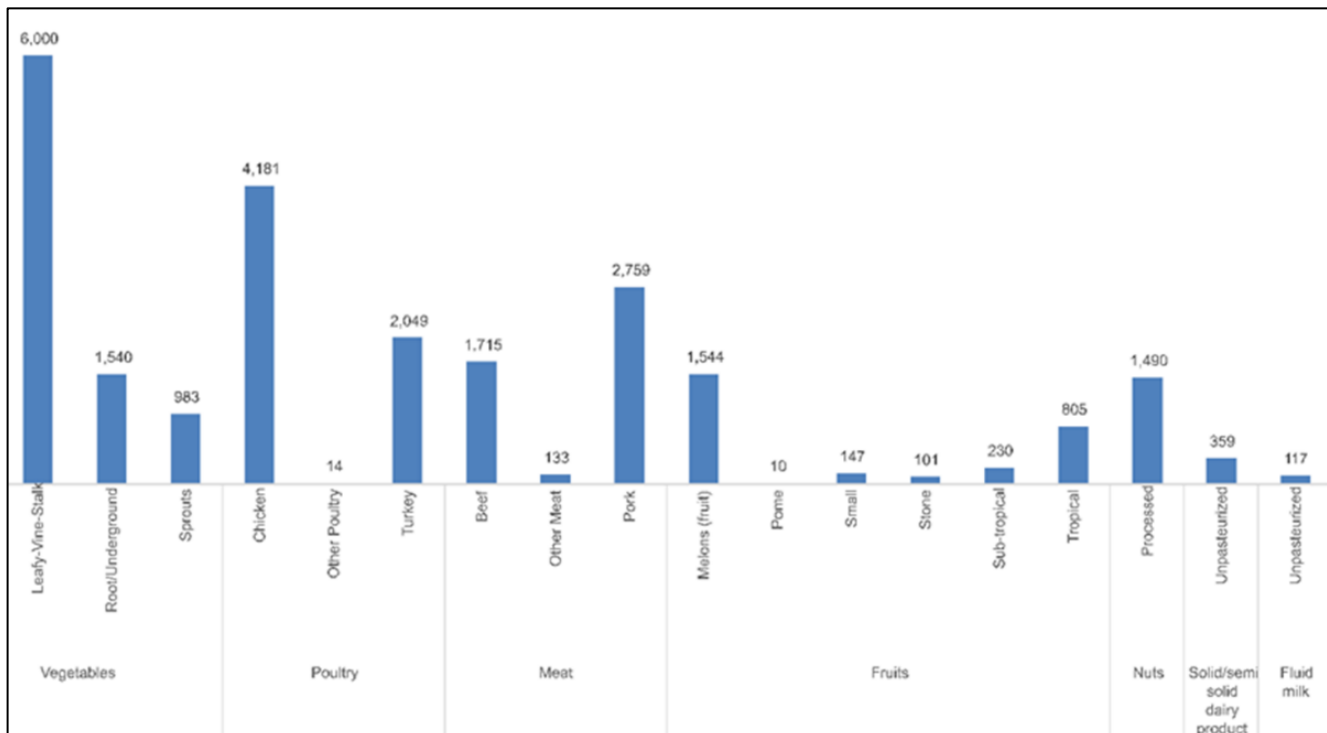


Figure 1. Major foodborne sources of salmonellosis disease burden (CDC NORS 2005-2020). Note that an additional 24 salmonellosis cases and 1 hospitalization were associated with pasteurized milk in this period for outbreaks that were not coded with IFSAC food groupings. (Stephenson et al., 2024, Fig. 7d)

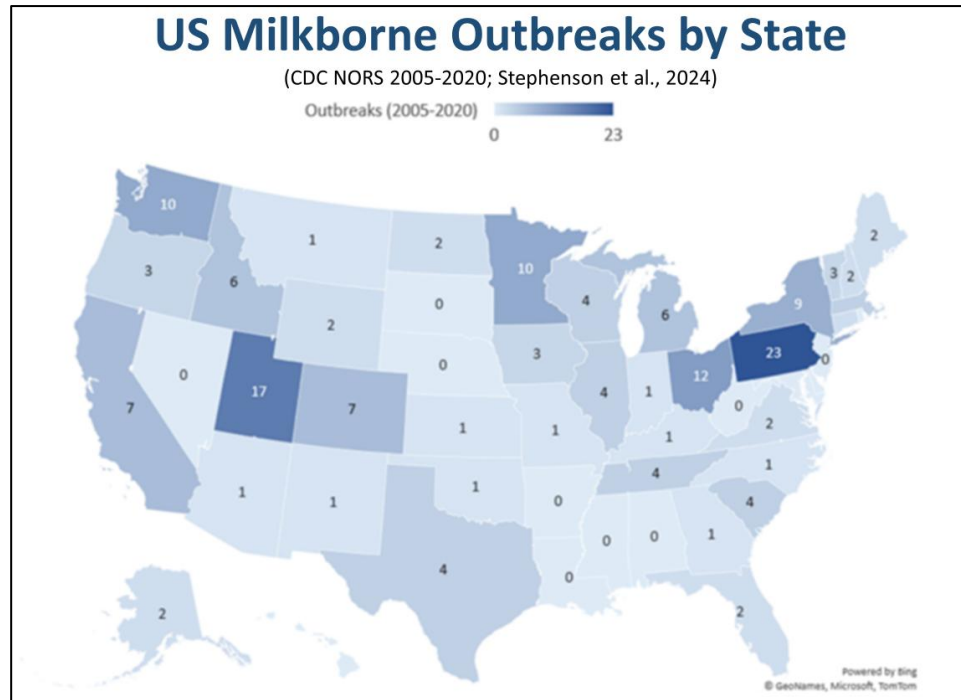


Figure 2. Most states including CA and NY have documented less than 10 outbreaks associated with raw milk in the past 16 years (CDC data for 2005-2020; Stephenson et al., 2024, Fig. 9).

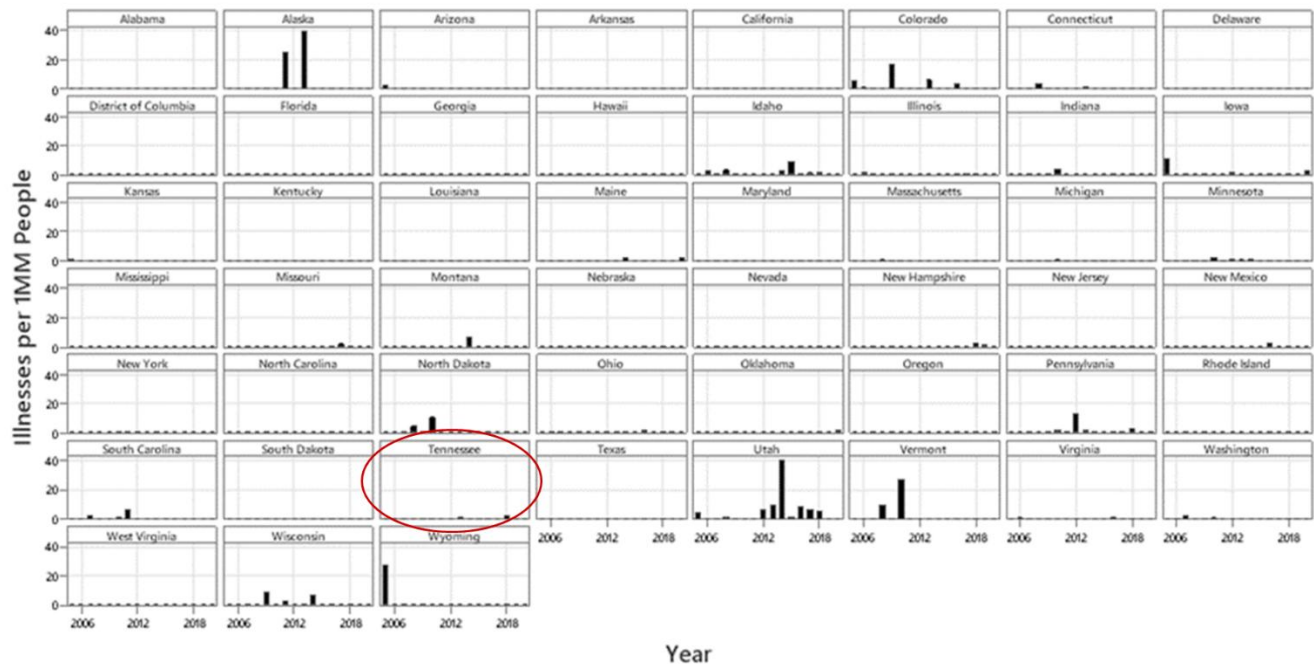


Figure 3. No states including TN have documented increasing rates of illness associated with raw milk (CDC data for 2005-2020; Stephenson et al., 2024, Fig. 13a).

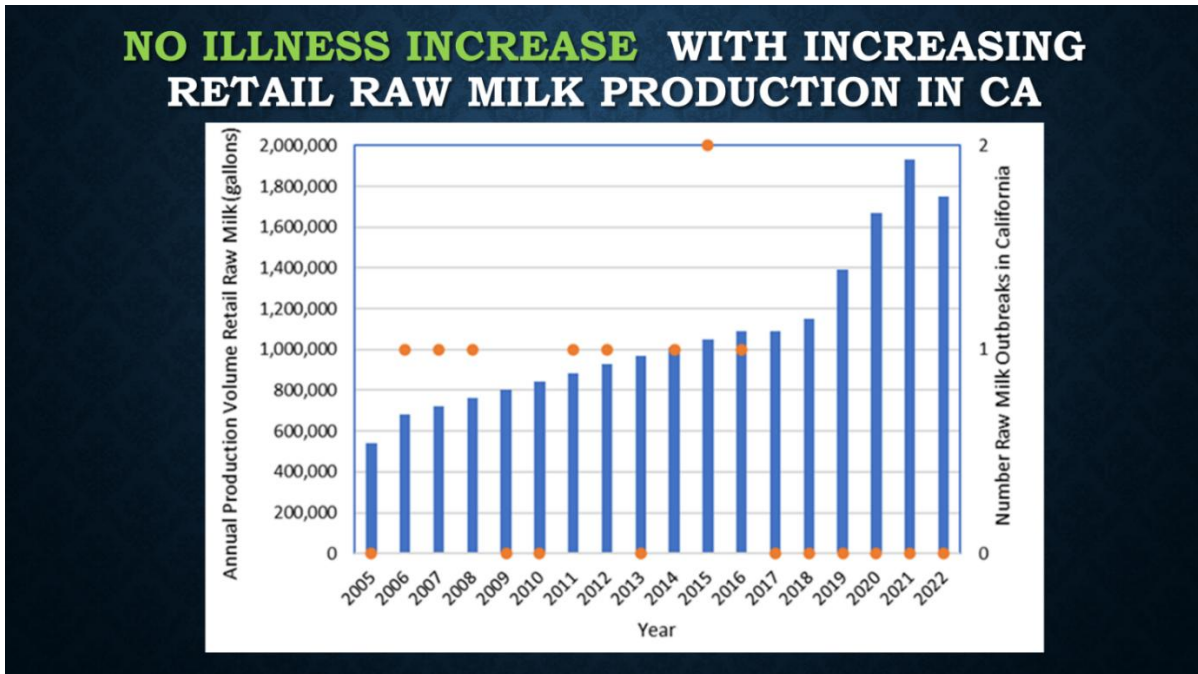


Figure 4. Increasing sales of retail raw milk in California (blue bars) are not linked with increasing illness (orange circles for outbreaks) (Coleman and North, 2023, upper panel Figure 2).

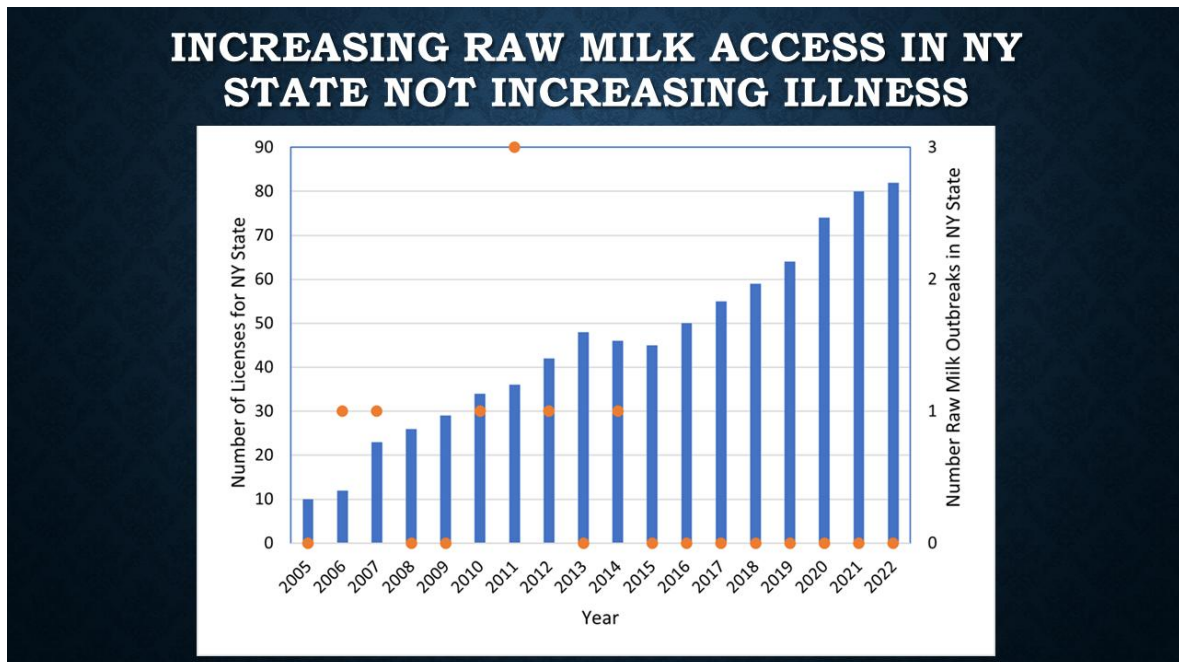


Figure 5. Increasing numbers of licenses for on farm sales of raw milk in NY (blue bars) are not linked with increasing illness (orange circles for outbreaks) (Coleman and North, 2023, lower panel Figure 2).

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