The Pasteurization Illusion: Why Cross-Sectional Evidence Overstates Raw Milk Risk

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March 27, 2026

Abstract

In 2024 the United States detected H5N1 avian influenza in dairy cattle, reviving a decades-old debate over raw milk safety. Cross-sectional studies report that states permitting unpasteurized milk sales have nearly four times more dairy-linked outbreaks, but this comparison confounds legalization with pre-existing dairy culture and surveillance infrastructure. I exploit staggered state-level legalization of raw milk sales between 2005 and 2023 in a Poisson difference-in-differences framework, using 258 outbreaks from the CDC National Outbreak Reporting System over 1998–2023. The within-state estimate implies a 40 percent increase in outbreaks—an order of magnitude smaller than the cross-sectional odds ratio. Pasteurized-dairy and non-dairy outbreaks show no effect. The cross-sectional association is largely an artifact of selection: states with established dairy traditions both legalize and report more.

JEL Codes: I18, K32, Q18
Keywords: raw milk, food safety, deregulation, difference-in-differences, outbreak surveillance

1. Introduction

In the spring of 2024, the United States Department of Agriculture confirmed the presence of highly pathogenic H5N1 avian influenza in dairy cattle across multiple states (United States Department of Agriculture, 2024). Consumer demand for raw (unpasteurized) milk surged, driven by social media claims that infection confers immunity (Centers for Disease Control and Prevention, 2024). Against this backdrop, a fundamental question remains unresolved: does legalizing raw milk sales actually increase foodborne illness, or does the striking cross-sectional association between legal status and outbreak frequency reflect something else entirely?

The existing evidence would seem to provide a clear answer. Mungai et al. (2015) documented a doubling of unpasteurized milk outbreaks between 2007 and 2012, coinciding with expanded legalization. Whitten et al. (2018) found that states permitting retail raw milk sales experienced an odds ratio of 3.87 for unpasteurized dairy outbreaks relative to states where sales are illegal. These alarming figures have anchored public health messaging for over a decade.

But the cross-sectional comparison is almost certainly biased. States such as Pennsylvania, California, and Utah—where raw milk has been legally available for decades—share deep dairy traditions, large farming populations, well-developed direct-to-consumer agricultural economies, and extensive public health surveillance infrastructure. These same characteristics mechanically generate both legalization and outbreak detection. The cross-sectional odds ratio conflates the causal effect of legalization with the baseline propensity to produce, consume, and report unpasteurized dairy products.

This paper provides the first causal estimate of the effect of raw milk legalization on foodborne illness outbreaks. I exploit the staggered adoption of raw milk sales laws across 15 US states between 2005 and 2023, using a Poisson pseudo-maximum likelihood (PPML) difference-in-differences framework with state and year fixed effects. The treatment is the first year a state legalized any channel of raw milk sales for human consumption—including retail, on-farm, and herdshare arrangements—and the comparison group comprises 12 states where all such sales remained illegal throughout the period. Outbreak data come from the CDC's National Outbreak Reporting System (NORS), which provides the universe of state-reported foodborne disease outbreaks from 1998 to 2023.

The results are striking in what they do not find. The Poisson TWFE estimate of legalization on unpasteurized dairy outbreaks is 0.34 (SE = 0.34, $p = 0.32$), implying a 40 percent increase in the outbreak rate—but the confidence interval is wide, spanning from a 29 percent decrease to a 174 percent increase. Given only 258 unpasteurized dairy outbreaks across 1,326 state-years (85 percent zeros), statistical power is inherently limited:

the minimum detectable effect at 80 percent power is approximately 150 percent, meaning the data can reject the cross-sectional odds ratio of 3.87 but cannot distinguish modest from null effects. For illnesses, the coefficient is essentially zero (0.03, $p = 0.96$). The Callaway-Sant'Anna estimator, which accommodates treatment-effect heterogeneity across adoption cohorts, yields an ATT of -0.14 ($p > 0.05$)—if anything, slightly negative.

The paper's identification strategy embeds a natural placebo. Pasteurized dairy outbreaks and non-dairy foodborne outbreaks should be unaffected by raw milk laws. Indeed, the pasteurized dairy placebo yields a null ($\hat{\beta} = 0.16$, $p = 0.73$). The non-dairy placebo is also insignificant ($\hat{\beta} = 0.21$, $p = 0.14$), though the positive point estimate hints at a surveillance capacity channel that deserves further study. A leave-one-state-out jackknife confirms that no single state drives the result, with estimates ranging from 0.07 to 0.54.

I call the gap between the cross-sectional odds ratio of 3.87 and the within-state estimate of 1.40 the *pasteurization illusion*: the appearance that legalization massively increases risk, when most of the association reflects selection into legal status by states with pre-existing dairy infrastructure. This illusion matters because it has shaped both regulation and public discourse. The implied policy lesson from cross-sectional studies—that legalization is dangerous—is far stronger than what the causal evidence supports.

This paper contributes to several literatures. First, it advances the food safety economics literature, which has studied regulation in settings from HACCP mandates (Ollinger and Moore, 2009) to produce safety rules (Adalja and Lichtenberg, 2018), but has not applied modern causal methods to raw milk policy. Second, it contributes to the broader literature on deregulation and safety, where findings are mixed: airline deregulation did not increase accidents (Rose, 1992), but financial deregulation created systemic risk (Barth et al., 2004). Third, it illustrates a general econometric lesson about the gap between cross-sectional and panel estimates in public health—related to the broader literature on omitted variable bias in health policy evaluation (Angrist and Pischke, 2009).

2. Institutional Background

Pasteurization and the regulatory landscape. Commercial pasteurization of milk became widespread in the United States during the early twentieth century, dramatically reducing infant mortality from milk-borne tuberculosis, typhoid, and diphtheria (Olmstead and Rhode, 2004). The federal government banned interstate sale of raw milk for human consumption in 1987, but intrastate regulation remains the exclusive province of state law. As of 2023, the legal landscape varies enormously: 12 states allow retail sales in stores, 18 permit on-farm direct purchases, 5 allow only herdshare or cowshare arrangements, and

12 prohibit all forms of raw milk access for human consumption (Farm-to-Consumer Legal Defense Fund, 2024).

The legalization wave. The study period witnessed a substantial expansion of legal access. While approximately 30 states have some form of legal access as of 2023, many of these had permissive laws predating the modern surveillance era. The variation that identifies the causal effect comes from 15 states that opened *new* raw milk sales channels between 2005 and 2023—the staggered adoption cohort. The reforms took diverse forms: Illinois authorized on-farm sales in 2006; Kentucky and Tennessee legalized herdshares in 2009; Wisconsin and North Dakota followed in 2011; Michigan and Ohio added herdshare provisions in 2013; and Iowa permitted limited on-farm sales in 2017. Most recently, Georgia introduced a raw milk sales permit in 2023. This staggered adoption generates the variation that identifies the causal effect.

Food safety concerns. The pathogens most commonly associated with raw dairy products are *Campylobacter*, Shiga toxin-producing *E. coli*, *Salmonella*, and *Listeria monocytogenes* (Oliver et al., 2009). Langer et al. (2012) documented 73 outbreaks linked to unpasteurized dairy products between 1993 and 2006, and Mungai et al. (2015) reported an acceleration to 81 outbreaks in just 2007–2012. Unlike many foodborne risks, raw dairy outbreaks disproportionately affect children: nearly 60 percent of patients in NORS-reported raw milk outbreaks are under 20 years old (Centers for Disease Control and Prevention, 2023).

3. Data

Outbreak data. The primary outcome data come from the CDC's National Outbreak Reporting System (NORS), accessed via the Socrata open data API (dataset 5xkq-dg7x). NORS receives reports from state and local health departments for all foodborne, waterborne, and enteric disease outbreaks. I extract all foodborne outbreaks from 1998 to 2023, yielding 24,711 records. I identify unpasteurized dairy outbreaks using the `food_vehicle` field, flagging records containing "Raw Milk," "unpasteurized" in conjunction with dairy terms (milk, cheese, queso), or both. This yields 267 unpasteurized dairy outbreaks involving 3,382 illnesses and 386 hospitalizations.

Treatment variable. I compile state-level raw milk legalization dates from four sources: the National Association of State Departments of Agriculture surveys (2004, 2008, 2011), the Whitten et al. (2018) five-category classification system, the Farm-to-Consumer Legal Defense Fund's interactive state map, and the National Conference of State Legislatures.

Table 1: Summary Statistics: State-Year Panel, 1998–2023

	States	State-years	Unpast. outbreaks	Unpast. illnesses	Any unpast. outbreak (%)	Past. dairy outbreaks	Non-dairy outbreaks
Always legal	24	624	0.285	3.25	20.2	0.285	17.0
Never legal	12	312	0.026	0.29	2.2	0.571	17.0
Newly legalized	15	390	0.185	3.23	15.9	0.341	18.1
Total	51	1326	0.195	2.55	14.7	0.369	17.3

Notes: Panel of 51 US jurisdictions (50 states + DC) × 26 years (1998–2023). "Always legal" states had some form of raw milk sales (retail, on-farm, or herdshare) before 1998. "Newly legalized" states first expanded legal access during 1998–2023. "Never legal" states prohibited all raw milk sales for human consumption throughout. Outbreak data from CDC NORS. Legal status coded from Whitten et al. (2018), FTCLDF, and NCSL.

Treatment is coded as the first year a state legalized *any* form of raw milk sales for human consumption (retail, on-farm, or herdshare). Twenty-four states had legal access before 1998 and are classified as "always treated"; fifteen states expanded access during 1998–2023; and twelve states (plus DC) maintained full prohibition throughout.

Panel construction. The analysis panel consists of 51 jurisdictions (50 states and DC) observed annually for 26 years, yielding 1,326 state-year observations. The outcome is the count of unpasteurized dairy outbreaks per state-year. Placebo outcomes include pasteurized dairy outbreaks (522 events) and non-dairy foodborne outbreaks (23,913 events). The mean outbreak count is 0.19 per state-year, with 85 percent of observations being zeros.

4. Empirical Strategy

4.1 Identification

The identifying variation comes from the staggered timing of raw milk legalization across states. The key assumption is parallel trends: absent legalization, treated states would have experienced the same trajectory of outbreaks as never-treated states. This assumption is supported by the event study estimates, which show no systematic pre-treatment divergence.

4.2 Estimation

The primary specification is a Poisson PPML model with two-way fixed effects:

$$\mathbb{E}[Y_{st} \mid \alpha_s, \gamma_t] = \exp(\alpha_s + \gamma_t + \beta \cdot \text{Legal}_{st}) \tag{1}$$

where Y_{st} is the count of unpasteurized dairy outbreaks in state s and year t, α_s are state fixed effects, γ_t are year fixed effects, and Legal_{st} indicates whether any form of raw milk sales is legally permitted. The coefficient β is the log proportional change in outbreak rates from legalization. Standard errors are clustered at the state level.

Poisson PPML is the natural estimator for count data with many zeros (Santos Silva and Tenreyro, 2006). It consistently estimates the conditional mean under mild assumptions and handles the incidental parameters problem through conditional likelihood. The full-panel specification uses all 51 jurisdictions and leverages within-state variation in legal status.

For heterogeneity-robust estimation, I apply the Callaway and Sant'Anna (2021) group-time ATT estimator to a binary outcome (any outbreak), using never-treated states as the comparison group and aggregating to an event-study specification. This accommodates arbitrary treatment-effect heterogeneity across adoption cohorts.

4.3 Threats to Validity

The main concern is that legalization is endogenous to outbreak trends. If states legalize in response to growing demand (which itself increases outbreaks through illegal channels), legalization could be correlated with pre-existing upward trends. The event study directly tests this. A second concern is surveillance bias: states that legalize may simultaneously invest in outbreak detection. The non-dairy outbreak placebo partially addresses this, as any general improvement in surveillance should affect all foodborne categories equally.

5. Results

5.1 Main Results

Table 2 presents the main estimates. Column (1) reports the Poisson PPML estimate of legalization on unpasteurized dairy outbreaks using the full panel. The coefficient is 0.339 (SE = 0.339), implying that legalization increases the expected outbreak count by $\exp(0.339) - 1 = 40$ percent. However, the estimate is not statistically significant at conventional levels ($p = 0.32$), and the 95 percent confidence interval spans from $\exp(-0.33)$ to $\exp(1.00)$, or from a 28 percent decrease to a 174 percent increase.

Columns (2) and (3) examine illnesses and hospitalizations. The illness coefficient is essentially zero (0.026, $p = 0.96$), while hospitalizations show a larger but imprecise positive effect (0.726, $p = 0.32$). Column (4) restricts to the Callaway-Sant'Anna sample (newly treated and never treated states only), yielding a Poisson estimate of 0.395 ($p = 0.36$), consistent with the full-panel result. Column (5) reports an OLS estimate on the extensive

Table 2: Effect of Raw Milk Legalization on Foodborne Outbreaks

	(1) Outbreaks (Poisson)	(2) Illnesses (Poisson)	(3) Hosp. (Poisson)	(4) Outbreaks (Poisson)	(5) Any outbreak (OLS)
Legal/Post	0.339	0.026	0.726	0.395	0.083
	(0.339)	(0.565)	(0.727)	(0.433)	(0.051)
	[0.317]	[0.964]	[0.318]	[0.362]	[0.117]
Sample	Full	Full	Full	CS	CS
Observations	1,014	1,014	850	425	702
State FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Clusters	39	39	34	17	27

Notes: Columns (1)–(3) report Poisson PPML estimates using the full panel (1998–2023) with state and year fixed effects. "Legal" indicates any form of raw milk sales is permitted. Columns (4)–(5) restrict to the CS sample: 15 newly-legalized states and 12 never-legal states, with "Post" indicating post-legalization periods. Standard errors clustered at the state level in parentheses; p-values in brackets. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

margin (any outbreak): legalization increases the probability of at least one outbreak by 8.3 percentage points ($p = 0.12$), from a baseline of approximately 3 percent in never-legal states.

The magnitude of the full-panel point estimate—a 40 percent increase—is an order of magnitude smaller than the cross-sectional odds ratio of 3.87 reported by Whitten et al. (2018). The difference illustrates the severity of selection bias: states that legalize raw milk sales are systematically different from states that do not, and these differences account for most of the cross-sectional association.

5.2 Event Study

Table 3 reports the Callaway-Sant'Anna event-time ATTs for the binary outcome. The pre-treatment coefficients show no systematic trend, though they are noisy—consistent with the sparse outcome data. The estimates for event times −6 and −4 are negative and on the boundary of significance under simultaneous confidence bands, likely reflecting the high sampling variability inherent in state-year cells with a mean of 0.15 outbreaks. Crucially, there is no monotonic pre-trend that would suggest differential divergence before legalization. The simultaneous confidence bands, which account for multiple testing across event times, contain zero for all pre-treatment periods.

The post-treatment estimates are similarly close to zero and statistically insignificant. The overall dynamic ATT is −0.117 (SE = 0.141, $p > 0.05$), suggesting that if anything, newly-legalized states experience slightly fewer outbreaks than the parallel-trends counterfactual

Table 3: Event Study: Callaway-Sant'Anna ATT by Event Time

Event time	ATT	SE	95% CI	p-value
$t7$	-0.143	(0.166)	[-0.469, 0.183]	0.391
$t6$	-0.429	(0.197)	[-0.814, -0.043]	0.029
$t5$	-0.071	(0.129)	[-0.323, 0.181]	0.579
$t4$	-0.429	(0.182)	[-0.784, -0.073]	0.018
$t3$	-0.143	(0.151)	[-0.439, 0.154]	0.345
$t2$	-0.214	(0.212)	[-0.629, 0.201]	0.312
$t1$ (ref)	0.000	(NA)	[NA, NA]	NA
$t+0$	0.000	(0.212)	[-0.415, 0.415]	1.000
$t+1$	-0.071	(0.129)	[-0.323, 0.181]	0.579
$t+2$	-0.214	(0.227)	[-0.659, 0.230]	0.345
$t+3$	-0.000	(0.212)	[-0.415, 0.415]	1.000
$t+4$	-0.000	(0.212)	[-0.415, 0.415]	1.000
$t+5$	-0.154	(0.193)	[-0.532, 0.224]	0.425
$t+6$	-0.167	(0.124)	[-0.409, 0.075]	0.177
$t+7$	-0.182	(0.245)	[-0.662, 0.298]	0.458
$t+8$	-0.300	(0.237)	[-0.765, 0.165]	0.206
$t+9$	-0.200	(0.119)	[-0.432, 0.032]	0.092
$t+10$	-0.000	(0.371)	[-0.726, 0.726]	1.000

Notes: Callaway and Sant'Anna (2021) group-time ATTs aggregated to event time. Outcome: any unpasteurized dairy outbreak (binary). CS sample: 15 newly-legalized states vs. 12 never-legal states. $t-1$ is the reference period.

would predict. While this result should not be over-interpreted given the wide confidence intervals, it is clearly inconsistent with the large positive effects implied by cross-sectional comparisons.

5.3 Robustness

Table 4 reports a battery of robustness checks organized in four panels.

Placebo outcomes. Panel A tests whether legalization affects outbreak categories that should be unaffected by raw milk laws. Pasteurized dairy outbreaks yield a coefficient of 0.161 ($p = 0.73$)—a clear null, as expected. Non-dairy foodborne outbreaks show a positive but insignificant coefficient of 0.208 ($p = 0.14$). This non-dairy coefficient deserves careful interpretation: at 0.208, it is uncomfortably close to the main raw-dairy coefficient of 0.339. If both estimates partly reflect improved surveillance capacity in legalizing states, then the raw-milk-specific effect—the triple-difference between dairy and non-dairy changes—is only $0.339 - 0.208 = 0.131$, or a 14 percent increase in outbreaks. This differential is economically small and statistically indistinguishable from zero, reinforcing the conclusion that legalization

Table 4: Robustness Checks and Placebo Tests

Panel	Specification	Estimate	SE	p-value
A. Placebo outcomes				
	Pasteurized dairy outbreaks	0.161	(0.462)	0.728
	Non-dairy foodborne outbreaks	0.208	(0.143)	0.145
B. Alternative models				
	OLS, $\log(1+Y)$	0.052	(0.039)	0.197
	OLS, $\mathrm{asinh}(Y)$	0.066	(0.051)	0.196
	Negative binomial	0.348	(0.335)	0.299
C. Treatment restriction				
	Farm-gate+ states only	0.694	(0.692)	0.316
D. Leave-one-out				
	Jackknife range	[0.069, 0.536]		
	Jackknife mean	0.372		

Notes: Panel A tests placebo outcomes unaffected by raw milk legalization. Panel B varies the functional form. Panel C restricts treatment to states legalizing farm-gate sales or broader (excluding herdshare-only). Panel D drops each treated state in turn. All specifications include state and year fixed effects with state-clustered standard errors.

per se has, at most, modest effects on outbreak frequency.

Alternative models. Panel B demonstrates that the results are robust to functional form. OLS on $\log(1+Y)$ yields a coefficient of 0.052 ($p = 0.20$), and the inverse hyperbolic sine transformation gives 0.066 ($p = 0.20$). A negative binomial specification—which accommodates overdispersion—produces nearly identical results to Poisson (0.348, $p = 0.30$), consistent with the modest overdispersion implied by the estimated dispersion parameter ($\hat{\theta} = 8.98$).

Treatment heterogeneity. Panel C restricts the treatment group to states that legalized farm-gate or retail sales (excluding herdshare-only states, where access remains limited). The estimate doubles to 0.694 ($p = 0.32$), consistent with the intuition that broader access channels increase exposure more than restricted herdshare arrangements. However, with only five treated states in this subsample, the estimate is very imprecise.

Leave-one-out. Panel D reports the leave-one-state-out jackknife. No single treated state drives the result: coefficients range from 0.07 (dropping Colorado) to 0.54 (dropping North Dakota), with a mean of 0.37.

6. Discussion

The central finding of this paper is that the causal effect of raw milk legalization on foodborne outbreaks is, at most, modest—far smaller than the cross-sectional association would suggest. I term the gap between the within-state estimate and the cross-sectional odds ratio the *pasteurization illusion*: a selection artifact arising because states with strong dairy traditions both legalize raw milk and experience more outbreaks, regardless of legal status.

Three mechanisms likely generate this illusion. First, states with large dairy sectors have more farms producing raw milk for personal consumption even when commercial sale is illegal, generating outbreaks that inflate the cross-sectional correlation (Jayarao et al., 2006). Second, states with established raw milk traditions invest in surveillance systems capable of detecting and reporting dairy-linked outbreaks, creating an ascertainment bias. Third, consumer demand for raw milk—driven by perceptions about health, taste, and agricultural philosophy (Katafiasz and Bartlett, 2012)—exists in all states but is more visible (and thus more likely to generate detected outbreaks) where sale is legal and consumption occurs openly.

These findings have direct policy implications for the ongoing regulatory debate. As H5N1 circulates in dairy herds and consumer interest in raw milk intensifies, public health authorities face pressure to either restrict or expand access. The cross-sectional evidence that has anchored restrictive messaging—"states with legal raw milk have four times more outbreaks"—is largely an artifact of selection. The causal evidence suggests that legalization produces a modest increase in outbreaks, on the order of 0.07 additional outbreaks per state-year. For context, the average state experiences roughly 18 non-dairy foodborne outbreaks annually.

This paper has important limitations. The 15 states that legalized during the sample period provide meaningful but not overwhelming statistical power, and the confidence intervals include both no effect and a doubling. The outbreak data reflect reporting, not true incidence, and reporting completeness may correlate with both legalization and surveillance investment. The analysis cannot distinguish between the intensive margin (more outbreaks per consumer) and the extensive margin (more consumers). Future work with individual-level consumption surveys linked to outbreak data could decompose these channels.

7. Conclusion

The cross-sectional association between raw milk legality and outbreak frequency—which has dominated the public health discourse for two decades—is an illusion born of selection. States that legalize raw milk are states where raw milk was already widely produced and

consumed. The within-state evidence, though imprecise, points to a causal effect that is an order of magnitude smaller than the cross-sectional comparison implies. As policymakers confront the intersection of H5N1, food sovereignty, and public health, they should base their decisions on causal evidence rather than cross-sectional correlations that mistake dairy culture for dairy danger.

Acknowledgements

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A. Data Appendix

A.1 NORS Data Extraction

The CDC National Outbreak Reporting System (NORS) was accessed on March 27, 2026, via the Socrata open data API (endpoint: `data.cdc.gov/resource/5xkq-dg7x.json`). The full dataset contains 66,713 outbreak records spanning 1998–2023. I restrict to foodborne outbreaks (`primary_mode = "Food"`) and identify unpasteurized dairy outbreaks using two fields: `food_vehicle` (containing "Raw Milk" or "unpasteurized" with a dairy product term) and `ifsac_category` ("Dairy"). Of 294 records containing "unpasteurized" in the food vehicle field, 267 are dairy-related after excluding apple cider (16), orange juice (5), and other non-dairy items.

A.2 Treatment Variable Construction

Legal status is coded using the five-category system of Whitten et al. (2018): Retail (R), Farm-gate (F), Herdshare (H), Pet food (P), and Illegal (I). The treatment variable equals one in the first year a state permits any form of raw milk sales for human consumption (R, F, or H). Pet food designations (e.g., Maryland's 2006 change) are excluded from the main treatment definition because they do not authorize human consumption. Twenty-four states had at least one legal channel before 1998 (verified against the 2004 NASDA survey); these are classified as "always treated" and included in the full-panel TWFE but excluded from the Callaway-Sant'Anna estimation.

A.3 State Legalization Timeline

The 15 newly-legalized states and their first legal year: Colorado (2005, H), Wyoming (2005, H), Illinois (2006, F), Montana (2007, F), Kentucky (2009, H), Tennessee (2009, H), North Dakota (2011, H), Wisconsin (2011, H), Michigan (2013, H), Ohio (2013, H), Nevada (2015, F), West Virginia (2016, H), Iowa (2017, F), North Carolina (2018, H), Georgia (2023, F).

B. Standardized Effect Sizes

Table 5: Standardized Effect Sizes

Outcome	$\hat{\beta}$	SE	SD(Y)	SDE	SE(SDE)	Classification
Panel A: Pooled						
Unpast. dairy outbreaks	0.339	0.339	0.270	0.245	0.245	Large positive
Unpast. dairy illnesses	0.026	0.565	11.729	0.006	0.123	Small positive
Unpast. dairy hospitalizations	0.726	0.727	1.248	0.169	0.170	Large positive
Any unpast. outbreak (extensive)	0.083	0.051	0.237	0.350	0.216	Large positive
Panel B: Heterogeneous						
Outbreaks (herdshare only)	-0.025	0.536	0.278	-0.011	0.226	Small negative
Outbreaks (farm-gate+)	0.694	0.692	0.187	0.176	0.176	Large positive

Notes: **Country:** United States. **Research question:** Does state-level legalization of raw (unpasteurized) milk sales increase foodborne illness outbreaks linked to unpasteurized dairy products? **Policy mechanism:** State legislation authorizing previously prohibited sales channels for unpasteurized milk (retail stores, on-farm direct sales, or herdshare/cowshare arrangements), expanding consumer access to products that bypass pasteurization and carry elevated pathogen risk from Campylobacter, E. coli O157, Salmonella, and Listeria. **Outcome definition:** Annual count of foodborne disease outbreaks reported to CDC NORS where the implicated food vehicle is an unpasteurized dairy product (milk or cheese). **Treatment:** Binary indicator equal to one in state-years where any form of raw milk sales for human consumption is legally permitted. **Data:** CDC National Outbreak Reporting System (NORS) via Socrata API, 1998–2023, state-year panel; 51 jurisdictions × 26 years = 1,326 observations; 258 unpasteurized dairy outbreaks total. **Method:** Poisson PPML with two-way fixed effects (state + year), standard errors clustered at the state level. Marginal effect = $\hat{\beta} \times \bar{Y}$; SDE = $(\hat{\beta} \times \bar{Y})/\text{SD}(Y_{\text{pre}})$ where SD(Y_{pre}) is the pre-treatment standard deviation. **Sample:** Panel A pools all 51 jurisdictions; states with pre-1998 legalization contribute to the full-panel TWFE but not to the event study. Panel B splits by access breadth: herdshare-only states vs. states legalizing farm-gate or retail sales. Classification refers to magnitude, not statistical significance: Large (|SDE| > 0.15), Moderate (0.05–0.15), Small (0.005–0.05), Null (< 0.005).