



EVIDENCE AND ANALYSIS DEBUNK SPECULATIONS ABOUT RAW MILK RISKS

Peg Coleman and Nick Azzolina

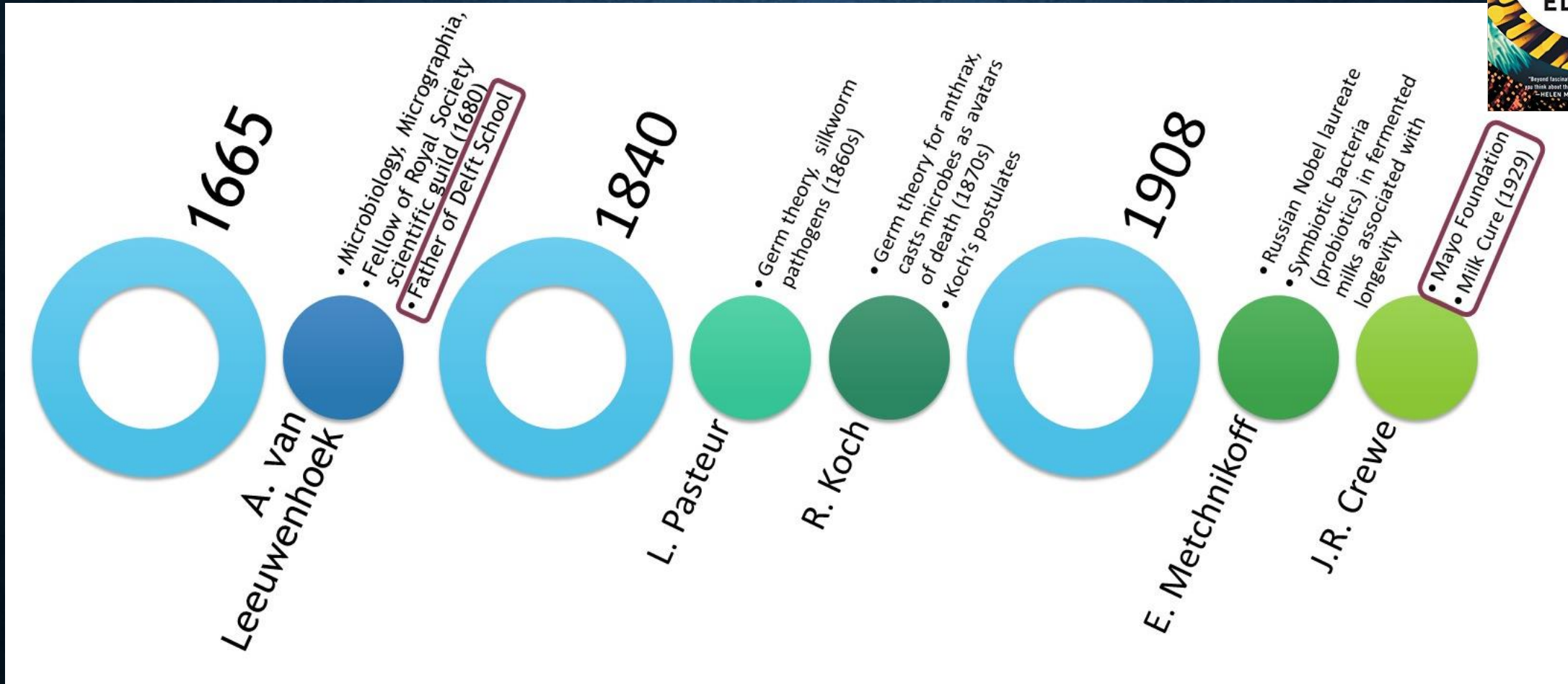
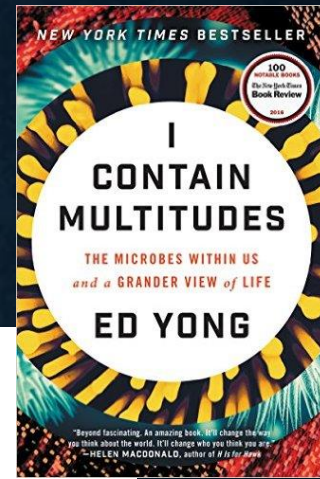
Society for Risk Analysis (SRA) 2019 – *Risk Analysis in the Data Analytics Era*

11 December 2019

OUTLINE

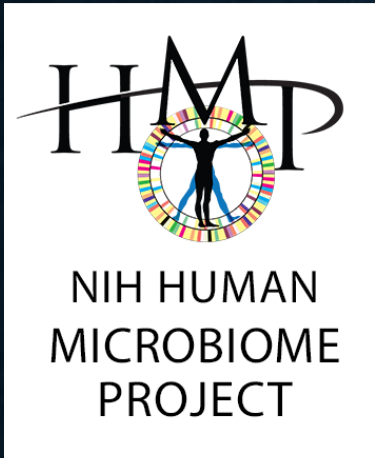
- Some history on disparate positions for raw and pasteurized milk in the US
- Testing a hypothesis based on US data reported by CDC
- Graphical analysis and multivariate Poisson regression
- Results
- Conclusion and next steps

EMERGENCE OF MICROBIAL ECOLOGY AS SCIENCE



North and Coleman (2017) SRA Webinar Series on Microbiota of Milks Project

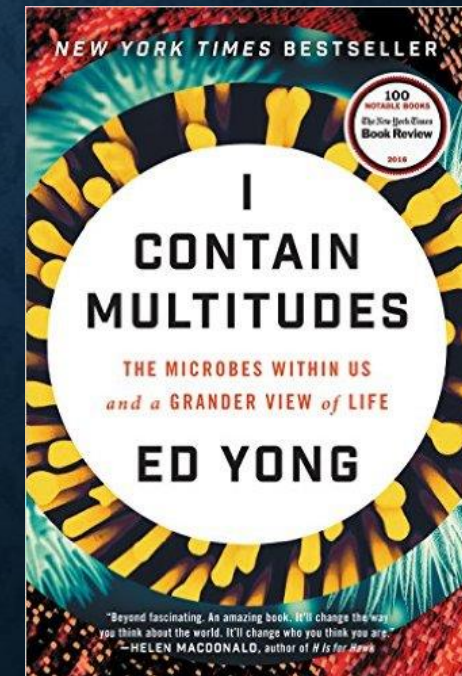
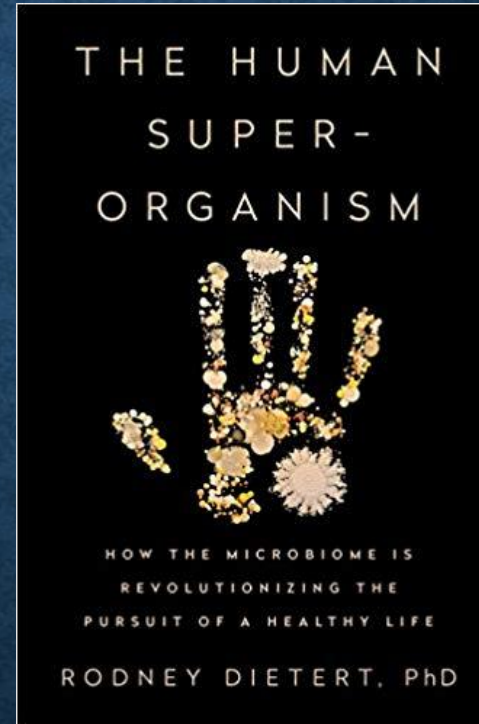
(<https://www.sra.org/upstateny/understanding-perceptions-benefits-and-risks-posed-microbiota-milks>)



FAST FORWARD, POST HMP

New Ecological Insights

- *Homo sapiens* incomplete without microbial partners
- All animals and plants **SUPERORGANISMS**
- Mammalian milks superfoods with dense and diverse microbiota essential to 'seed and feed' healthy superorganisms

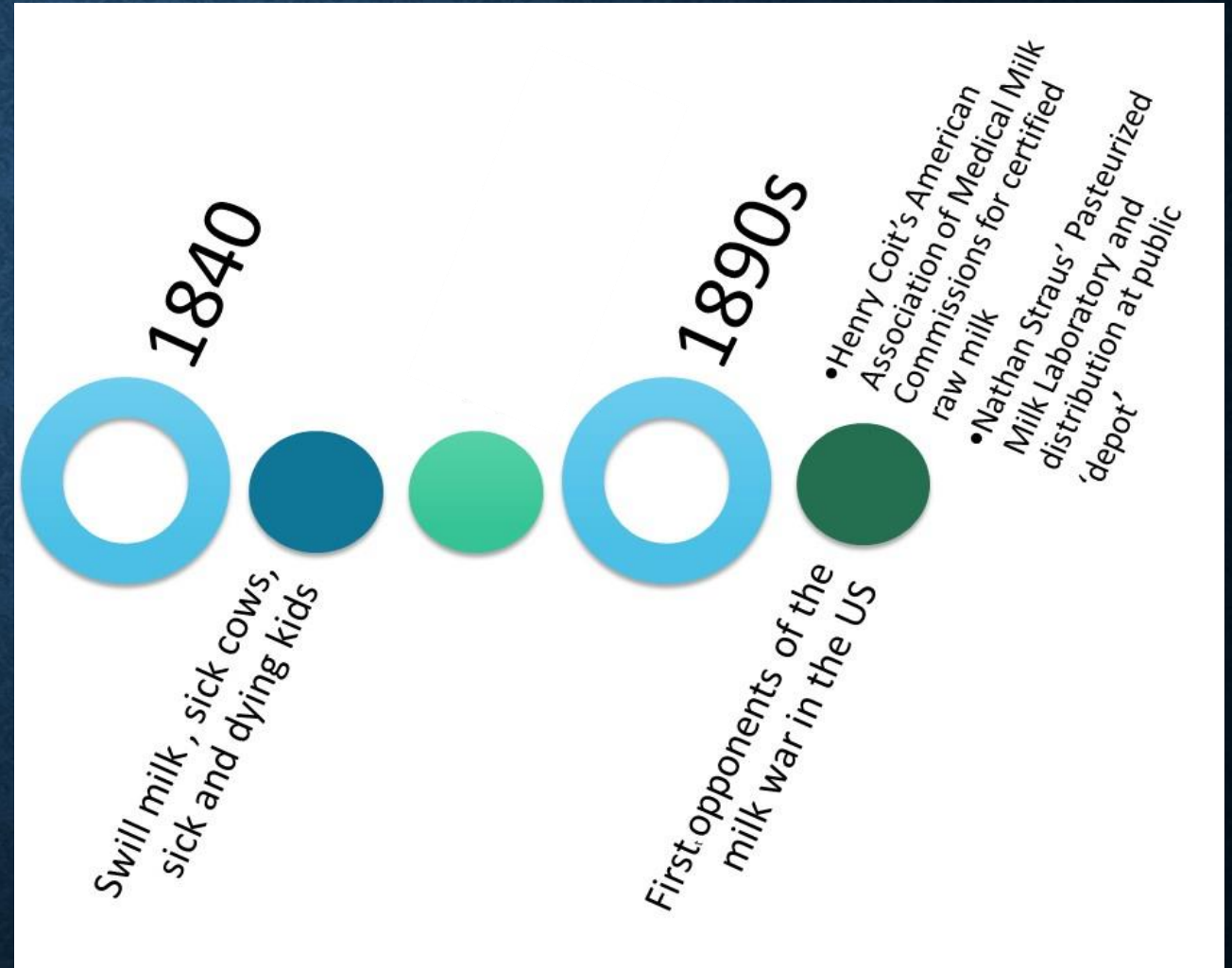


BACK TO 1840S: URBANIZATION OF US DAIRY INDUSTRY

<https://www.brownstoner.com/history/walkabout-the-great-milk-wars-part-1/>



A diseased cow, unable to stand, is pulled up to be milked. Distilleries kept a stable of such animals, fed them mash and whiskey slops. The milk made babies tipsy and often sick.



North and Coleman (2017) SRA Webinar Series on Microbiota of Milks Project

(<https://www.sra.org/upstateny/understanding-perceptions-benefits-and-risks-posed-microbiota-milks>)

COMMUNICATIONS FROM EARLY HISTORY NY CITY METROPOLITAN AREA (1890s)

Nathan Straus

- New York City Philanthropist
- Son died from contaminated milk
- Had no medical or scientific training
- Founded **Straus Pasteurized Milk Laboratory** (1892) that provided milk to urban children

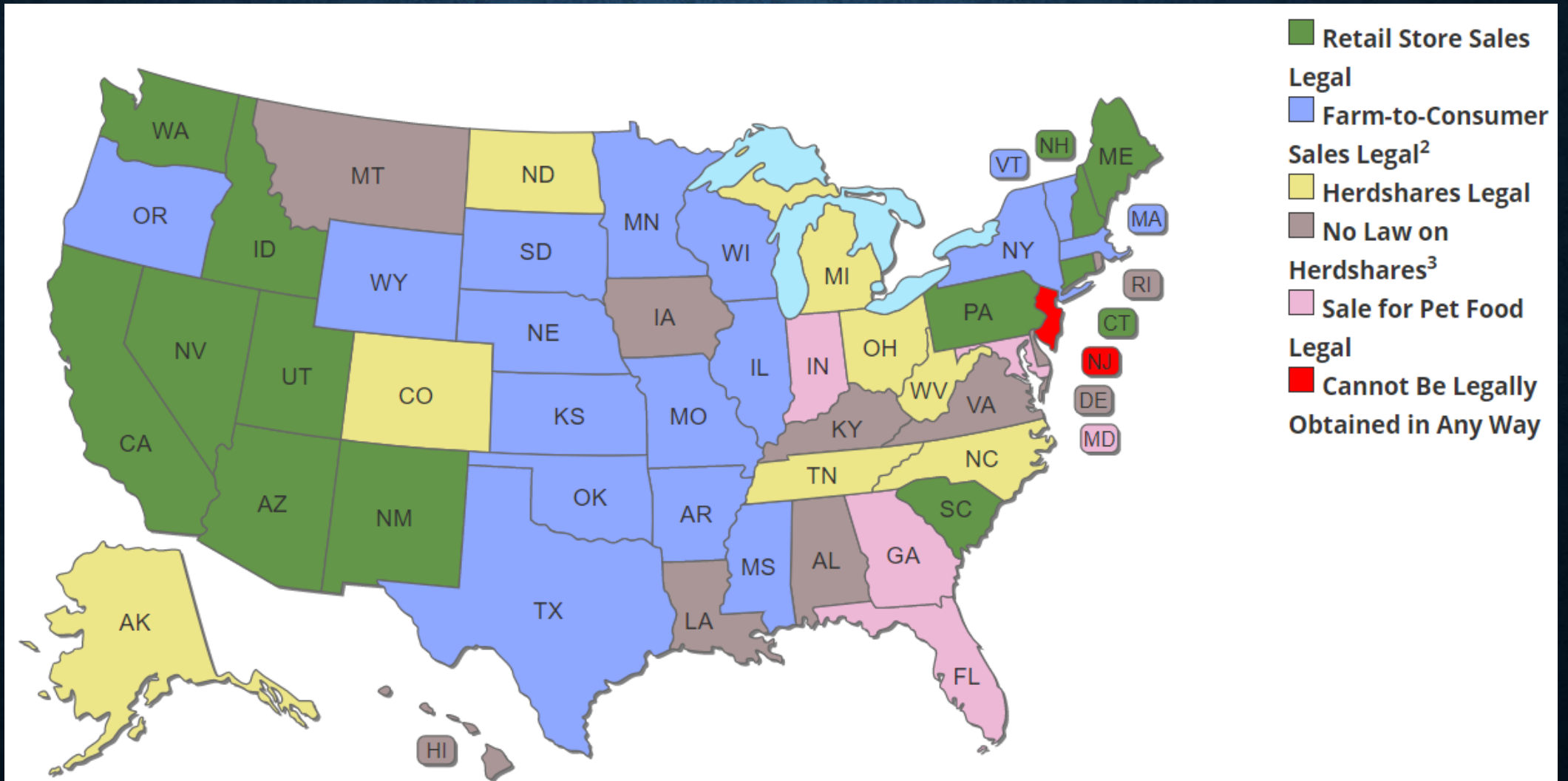
“Raw Milk Kills”

Henry L. Coit

- New Jersey Pediatrician
- Son died from contaminated milk
- Had physicians who were trained in dairy microbiology and sanitation supervise farm dairies
- Founded the **Association of American Medical Milk Commission** (1893)

“Dirty Milk Kills”

CURRENT LEGAL STATUS FOR RAW MILK ACCESS IN US STATES



SPECULATION FROM CDC MOTIVATES RE-ANALYSIS

- **“Legalization of the sale of unpasteurized {raw} milk in additional states would probably lead to more outbreaks and illnesses.”**
 - Mungai et al (2015, pg. 121) *Emerging Infectious Diseases* (CDC outbreak data from 2007 to 2012)
 - Statement widely cited in media and various journals as proven fact, not speculation
- Whitehead and Lake (2018) study analyzed CDC data from 2005 to 2016
- Epidemiologist’s critique of this study motivated the Raw Milk Institute to fund an independent re-analysis of the CDC data
- Dr. Nick Azzolina conducted re-analysis of the CDC data (graphical, Poisson regression)
 - Mungai’s speculation tested as hypothesis for significance of effects by formal statistical methods

STATISTICAL RE-ANALYSIS OF CDC DATA

- Graphical analysis of incidences rates and legal status over time
- Multivariate Poisson regression, controlling for population and evaluating the potential effects of the legal availability of raw milk on rates of outbreaks, illnesses, or hospitalizations.

- Conducted the entire analysis in the open-source statistical package, R
- Evaluated both fixed-effects and multilevel models

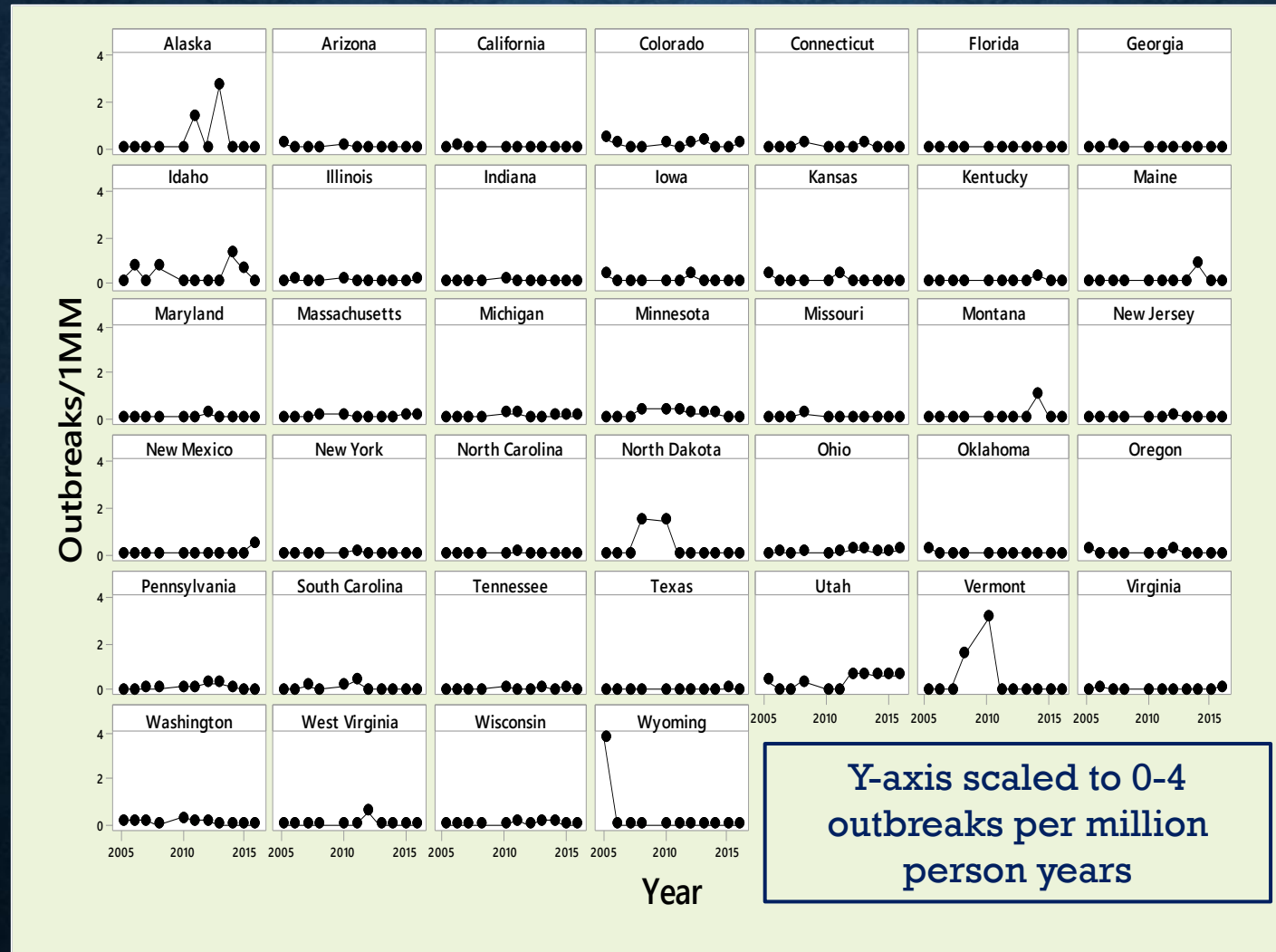
Model.01 = `glm(Outbreaks ~ Legal + State, offset=LPopulation)` [1]

Model.02 = `glm(Outbreaks ~ NLicense + State, offset=LPopulation)` [2]

Model.03 = `glmer(Outbreaks ~ Legal + (1|State), offset=LPopulation)` [3]

Model.04 = `glmer(Outbreaks ~ NLicense + (1|State), offset=LPopulation)` [4]

STATE-LEVEL SCATTERPLOTS: NO INCREASING TREND FOR OUTBREAKS VERIFIED BY MANN-KENDALL TEST FOR TREND



POISSON REGRESSION: LEGAL STATUS/NUMBER OF LICENSES NOT SIGNIFICANT

Parameter	Estimate	Std. Error	z value	Pr(> z)	Significance
(Intercept)	-16.862	0.341	-49.413	< 0.01	*
Legal	0.036	0.355	0.101	0.92	
Significance code: p -value ≤ 0.05 '**'					
Groups	Variance	Std. Dev.			
State (Intercept)	0.8183	0.9046			

Equation 3

- Full dataset
- 151 outbreaks from 39 states
- Legal status not significant from zero
- (p -value = 0.92)

Parameter	Estimate	Std. Error	z value	Pr(> z)	Significance
(Intercept)	-16.860	0.484	-34.832	< 0.01	*
NLicense	0.001	0.011	0.052	0.96	
Significance code: p -value ≤ 0.05 '**'					
Groups	Variance	Std.Dev.			
State (Intercept)	1.157	1.076			

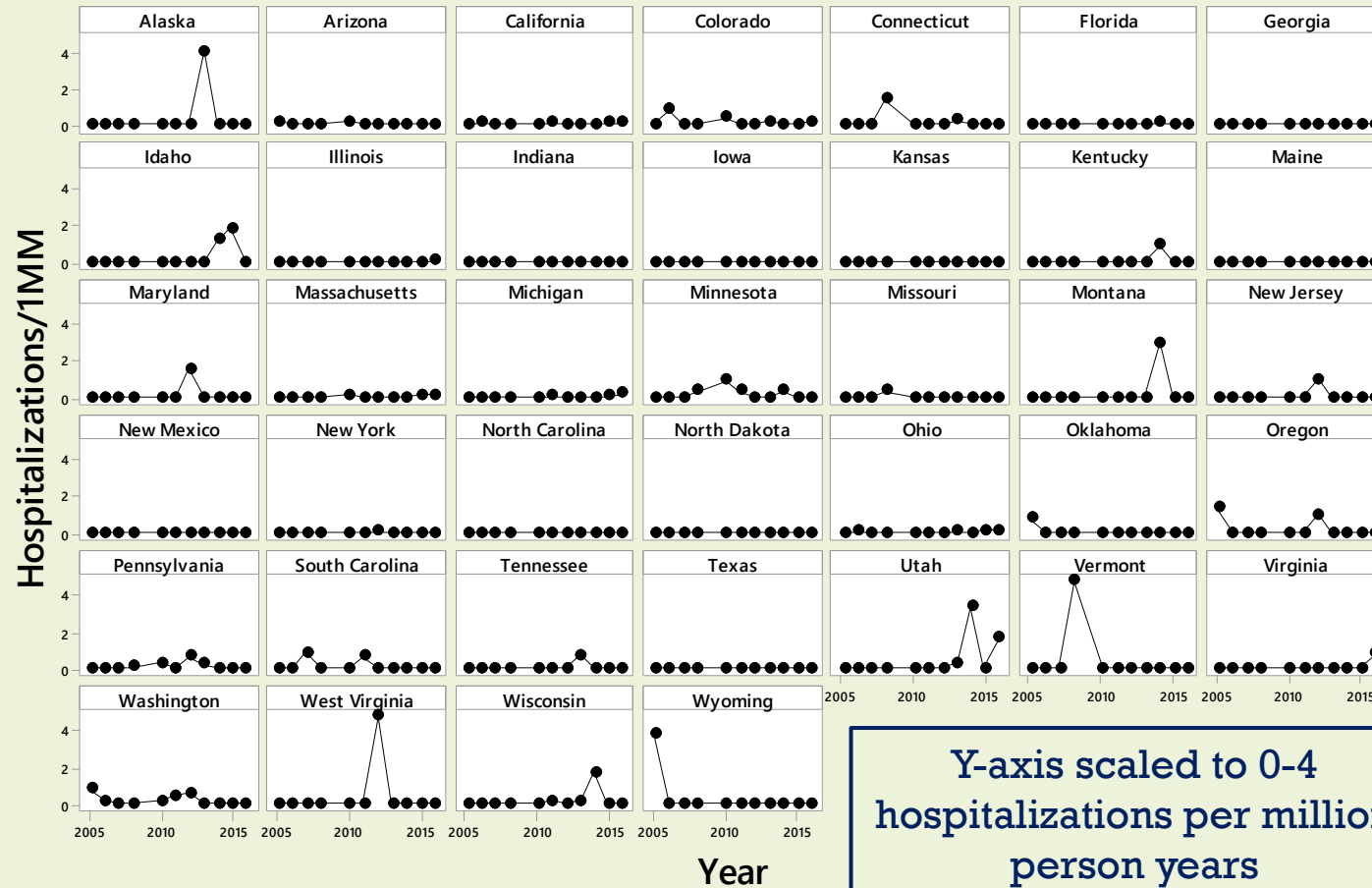
Equation 4

- Reduced dataset
- 56 outbreaks from 9 states
- No. licenses not significant from zero
- (p -value = 0.96)

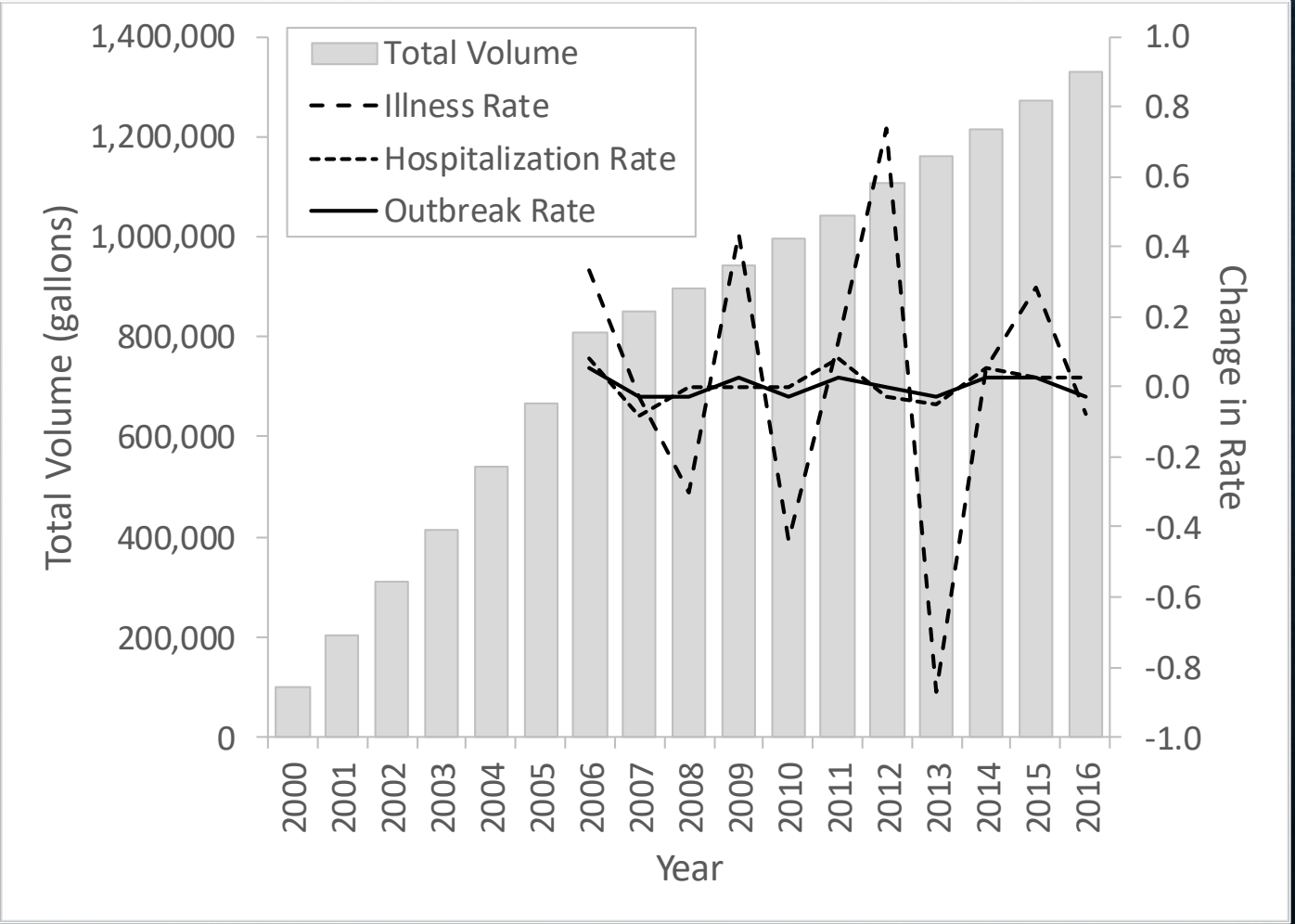
STATE-LEVEL SCATTERPLOTS: NO INCREASING TREND FOR ILLNESSES VERIFIED BY MANN-KENDALL TEST FOR TREND



STATE-LEVEL SCATTERPLOTS: NO INCREASING TREND FOR HOSPITALIZATIONS VERIFIED BY MANN-KENDALL TEST FOR TREND



RATES OF OUTBREAKS, ILLNESSES, HOSPITALIZATIONS FOR CALIFORNIA NOT INCREASING WITH PRODUCTION

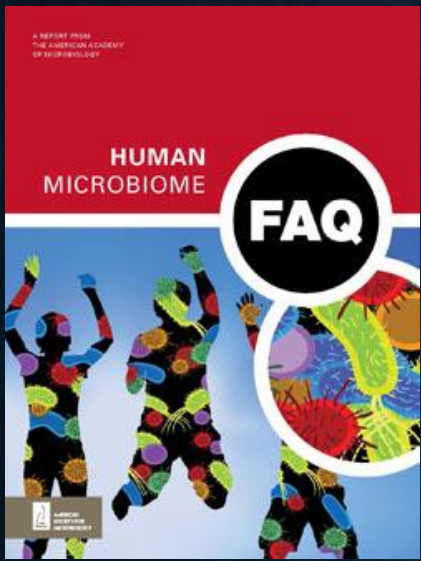


CONCLUSION

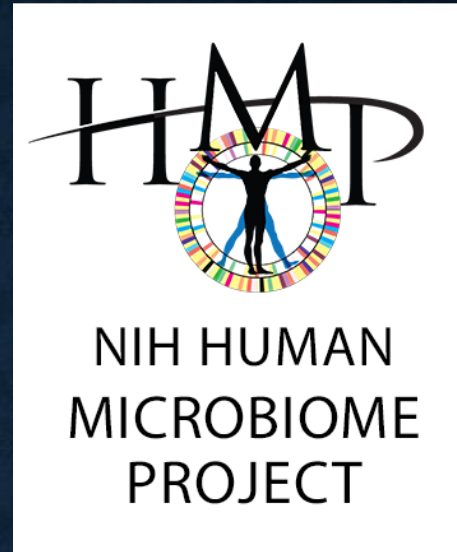
Controlling for state and population,
NO SIGNIFICANT RELATIONSHIPS
between either **LEGAL STATUS** of raw milk or
NUMBER OF LICENSES/PERMITS for raw
milk and increasing rates of outbreaks,
illnesses, or hospitalizations

NEXT STEPS

- Azzolina and Coleman (2019) manuscript on this work prepared with funding from the **WHOLE TRUTH, WHOLE MILK CAMPAIGN** through Upstate NY SRA
- Another manuscript on **BENEFITS AND RISKS** of **RAW AND PASTEURIZED MILKS** (?breastmilk? and bovine milk) in preparation from this campaign
 - **Pasteurized Donor Breastmilk** in NICUs around the world significantly **LOWER** benefits to most susceptible infants
- Upstate NY SRA **SEEKING PARTNERS** for organizing international workshop(s) to begin more formal analytic-deliberative process of the structured body of evidence on the microbiota of milks



ACKNOWLEDGMENTS



- Donors to the SRA Whole Truth, Whole Milk crowdfunding campaign
- Raw Milk Institute and the Board of Directors
- Upstate NY SRA members and webmaster Michele Stephenson



DISCLAIMER: The findings and conclusions in this presentation are those of the authors and do not represent the official position of the Centers for Disease Control and Prevention.

