Risk of salmonellosis from backyard poultry flocks, Seattle, WA, USA

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Urban Farming

- Historically, farming was conducted by the working class poor within city limits
- City ordinances moved animal agriculture large out of cities
- Resurgence of urban farming in major cities in the US and in other part of the world

Brinkley C. and Vitiello J Plan Hist 2014
SMC 23.42.052

Photos by Katherine B. Turner UW SPH

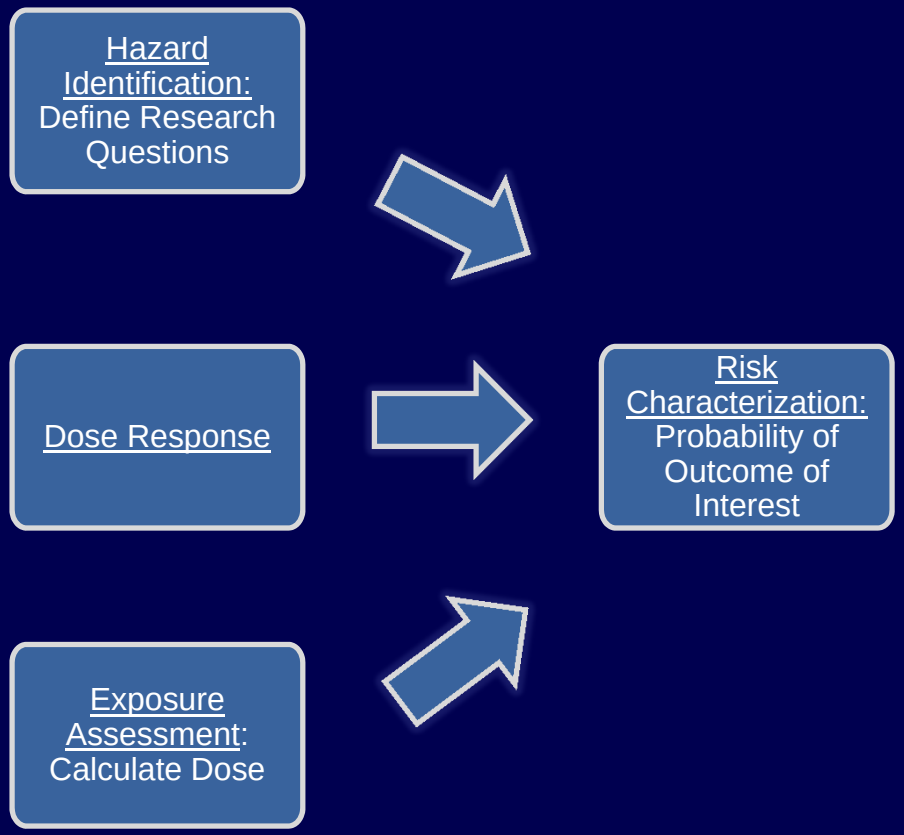
Poultry Contact and *Salmonella*

- **Poultry contact is a well recognized source of *Salmonella* exposure**
- **Over 53 outbreaks linked to live poultry contact**
  - **Baby poultry (chicks and ducklings) most commonly implicated**
- **No studies have attempted to quantify the risk associated with poultry contact**

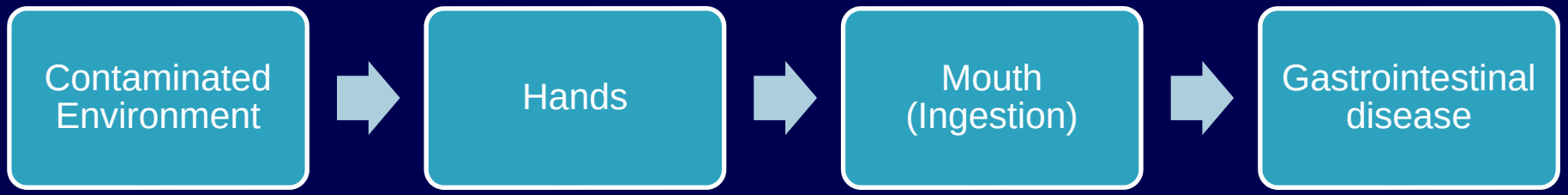
Blaser et al. EID 2016; Barton Behravesh et al. CID 2014

Study Objectives

1. To identify the prevalence of *Salmonella* in backyard flocks in Seattle, WA
2. To quantify the risk of salmonellosis to flock owners related to direct contact with backyard flocks



Methods: Backyard Poultry QMRA Exposure Pathway



Methods: Sampling Strategy

- Environmental samples
- Task observation
- Hand Swabs
- Cross-sectional survey

Photos by Katherine B. Turner UW SPH

Methods: Modeling Risk

- Model the risk of salmonellosis from direct contact with backyard chicken flocks in Seattle, Washington, USA
- Crystal Ball™ plug-in in Excel
  - 2-D Monte Carlo simulation with 1,001 and 401 trials for outer and inner loops respectively

Environmental and Exposure Assessment Results

Seattle Backyard flocks, n=50 n(%)	
Flock Characteristics	
Flock Size Mean(Range)	5.6 (2-21) chickens
Chickens	50 (100)
Other Poultry (not including pet birds)	2 (4)
Primary Caregiver Characteristics	
Age Mean(Range)	44.5 (30-75) years
White	47 (94)
Female	37 (74)
Seattle resident	44 (88)
Education Level of Primary Caregiver	
2-year college	5 (10)
College	18 (36)
Graduate	24 (48)
Doctoral	3 (6)

- **303 samples collected**
- **50 flocks sampled**
- **All samples were negative for *Salmonella***
- ***~8 hours of video* recorded between July and October of 2014**
- **Risky behaviors observed**

Risky Behaviors of Backyard Poultry Owners

Table 3. Public health practices: dichotomized for behaviour trends

	Always/Often/Sometimes No. (%)	Rarely or never no. (%)	*n*
(a) Wash hands after touching chickens or ducks or anything in the area where they live, using soap and water or hand sanitizer if soap and water are not available	49 (98)	1 (2)	50
(b) Wash clean cages, feed or water containers, or other poultry-related equipment inside your house or in areas where food is prepared	16 (32)	33 (66)	49
(c) Let live poultry inside your house, in bathrooms, or in areas where food or drink is prepared, served or stored, such as kitchens, or outdoor patios	12 (24)	38 (76)	50
(d) Snuggle or kiss baby chicks, touch your mouth or eat or drink or smoke around baby chicks	13 (26)	37 (74)	50
(e) Snuggle or kiss (adult) chickens, touch your mouth or eat or drink or smoke around chickens	11 (22)	39 (78)	50
(f) Eat raw or undercooked eggs, including restaurant dishes	25 (51)	24 (49)	49
(g) Eat eggs from your chickens that were dirty or cracked[a]	20 (42)	28 (58)	48
(h) Thoroughly wash hands and all food contact surfaces with soap and water after contact with raw eggs	43 (86)	7 (14)	50
(i) Allow children younger than 5 years of age to handle (or have other contact with) your chickens, especially chicks	27 (57)	20 (43)	47
(j) Wear a mask when cleaning the chicken coop	13 (28)	34 (72)	47

[a]Applies to dirty eggs, cracked eggs were reported as not being eaten in most surveys.

Kauber et al 2016

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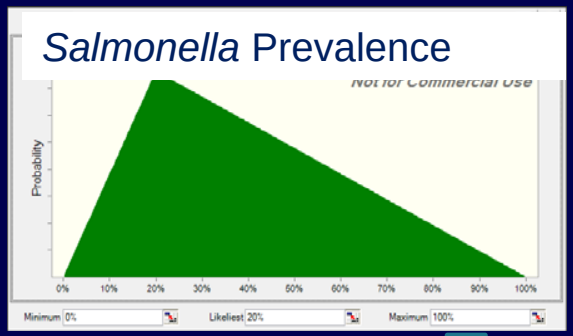
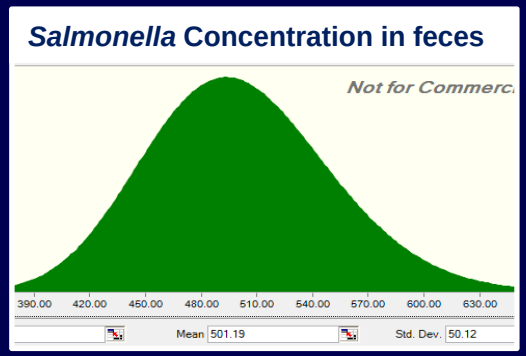
Kauber et al 2016

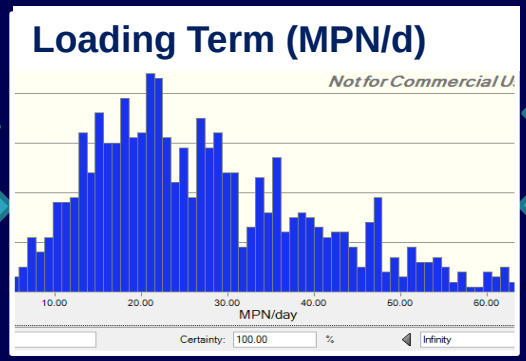
Estimating Dose

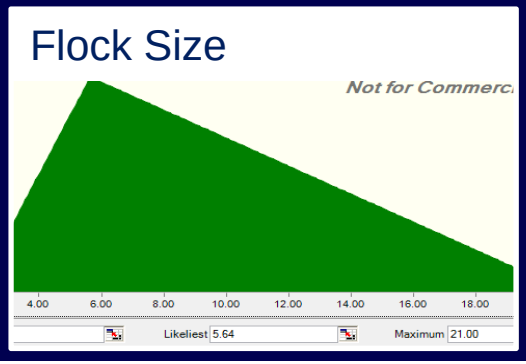
Part I: Determination of the Loading Term				
Flock size (# Birds)	Manure Production (g/bird/day)	Salmonella (MPN/g feces)	Salmonella prevalence	Loading Term (MPN/day)
5.64	86.18	501.1872336	20%	2327.52

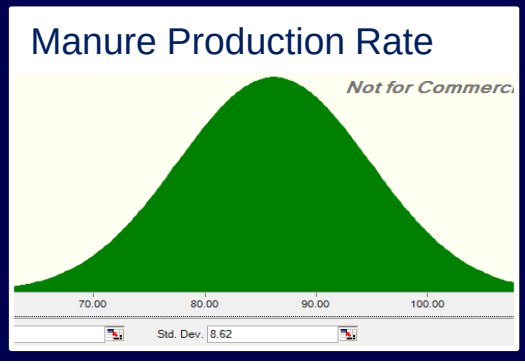
Integrating Parameter Distributions in Crystal Ball



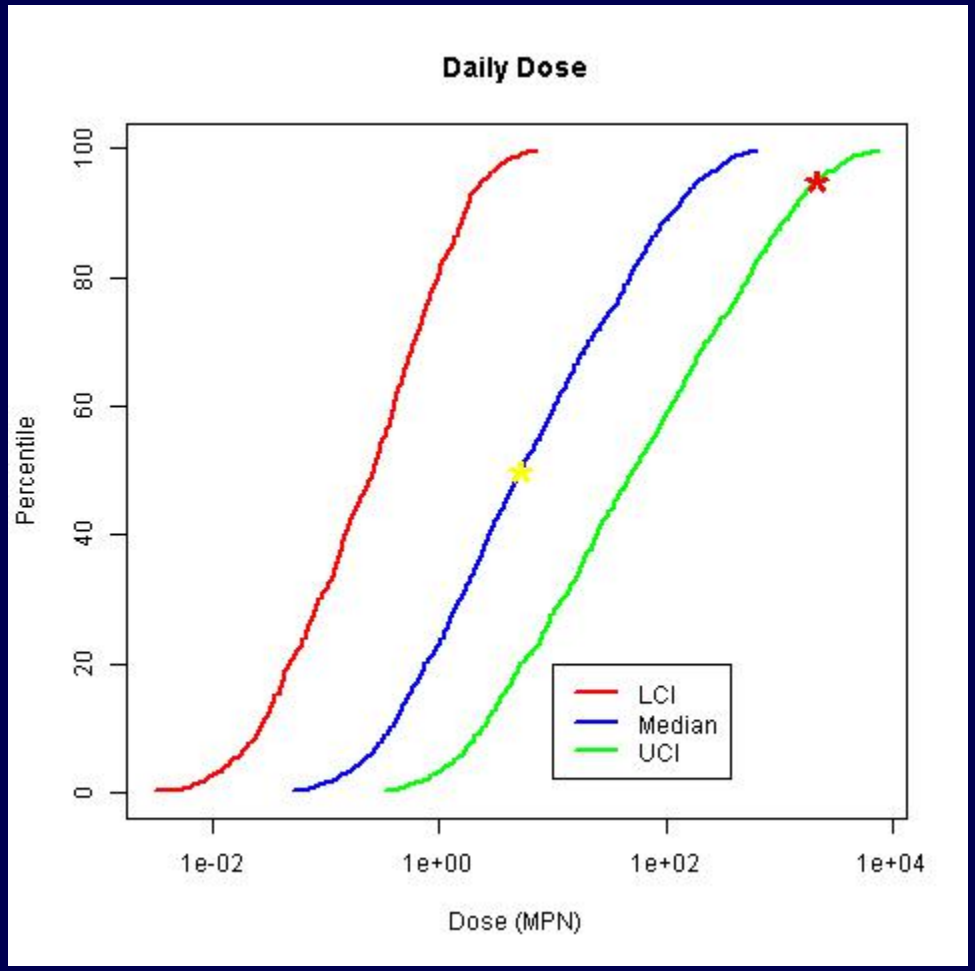




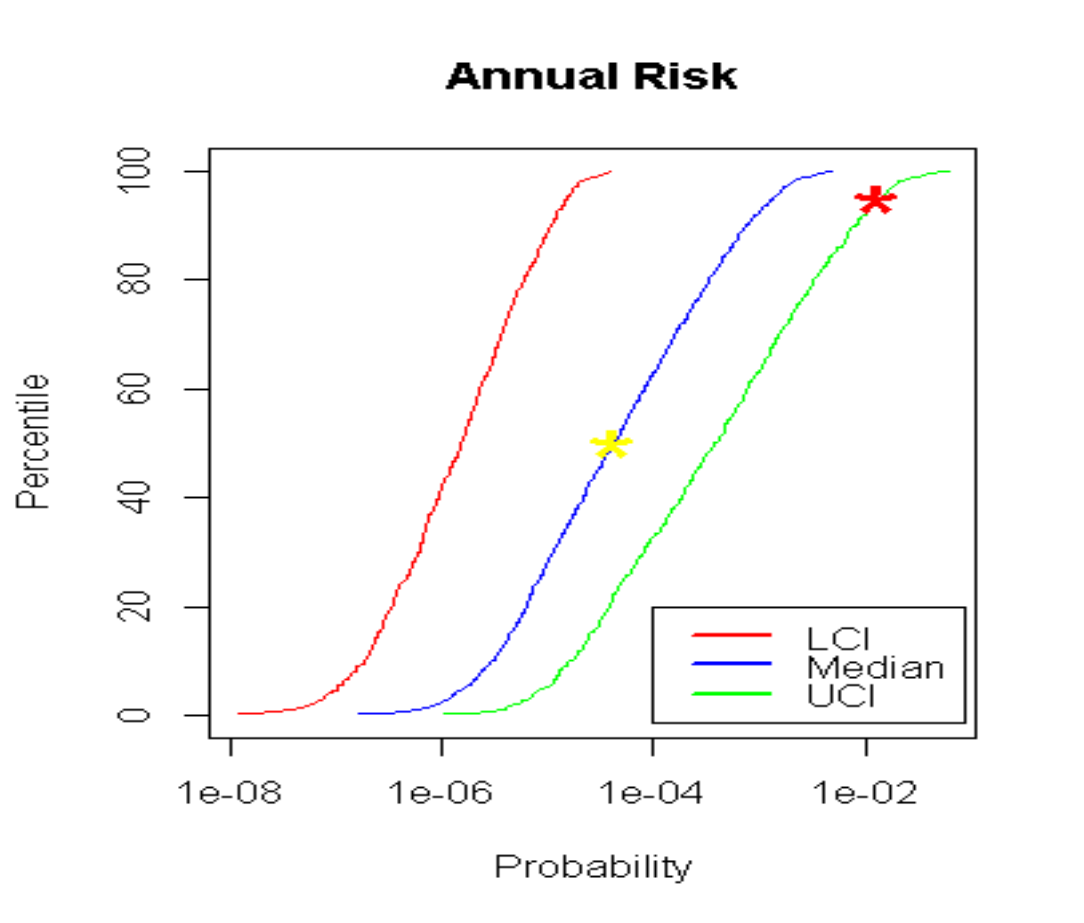




Probability of Salmonellosis from Backyard Flock Contact



Cumulative Risk of Salmonellosis from Backyard Flock Contact



Study Limitations

- Prevalence of *Salmonella* in backyard flocks in Seattle, WA extremely low
  - Sampling method and timing
- Estimated risk most applicable to adults

Study Summary

- Contact with live poultry presents a risk for zoonotic disease
- Task observation data suggests flock owners conduct behaviors that increase their risk of exposure

Public Health Implications

- Public health messaging remains unchanged
  - Wear appropriate personal protective equipment (PPE) at all times when working with birds
  - Execute good hand hygiene practices
  - Remain aware of the risk

Acknowledgements

- Backyard flock owners in the Seattle metropolitan area
- Pabilonia Lab (CSU)
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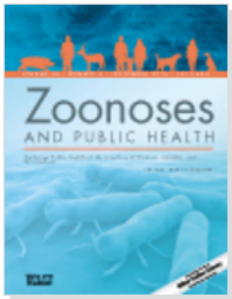

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Original Article

Salmonella Knowledge, Attitudes and Practices: A Survey of Backyard Poultry Owners Residing in Seattle, Washington and the Surrounding Metropolitan Area

K. Kauber, H. Fowler, B. Lipton, J. S. Meschke, P. Rabinowitz

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Thank you!

http://www.kingcounty.gov/healthservices/health/ehs/zoonotics/poultry.aspx

Questions??

Additional Slides

Modeling results estimates

Forecast	Upper Limit	Median	Lower Limit	Upper Limit 95th percentile
Dose (MPN/day)	0.265	5.17	50.8	2114
Annual Risk	1.50E-6	4.32E-5	3.75 E-4	1.38E-2

Hand Contamination and Self-Inoculation Rates

Part II: Salmonella Loading on Hands			
Contact Rate (S->H), per hr	Exposure time, hr	Transfer efficiency (S->H)	Load on hands (MPN/m2)
82.05	0.167	0.0367	132.34

Part III: Determination of Dose			
Contact Rate (H->M), per hr	Surface area of fingers, m2	transfer efficiency (H->M)	Dose (MPN)
10.9	0.0019	1	0.23

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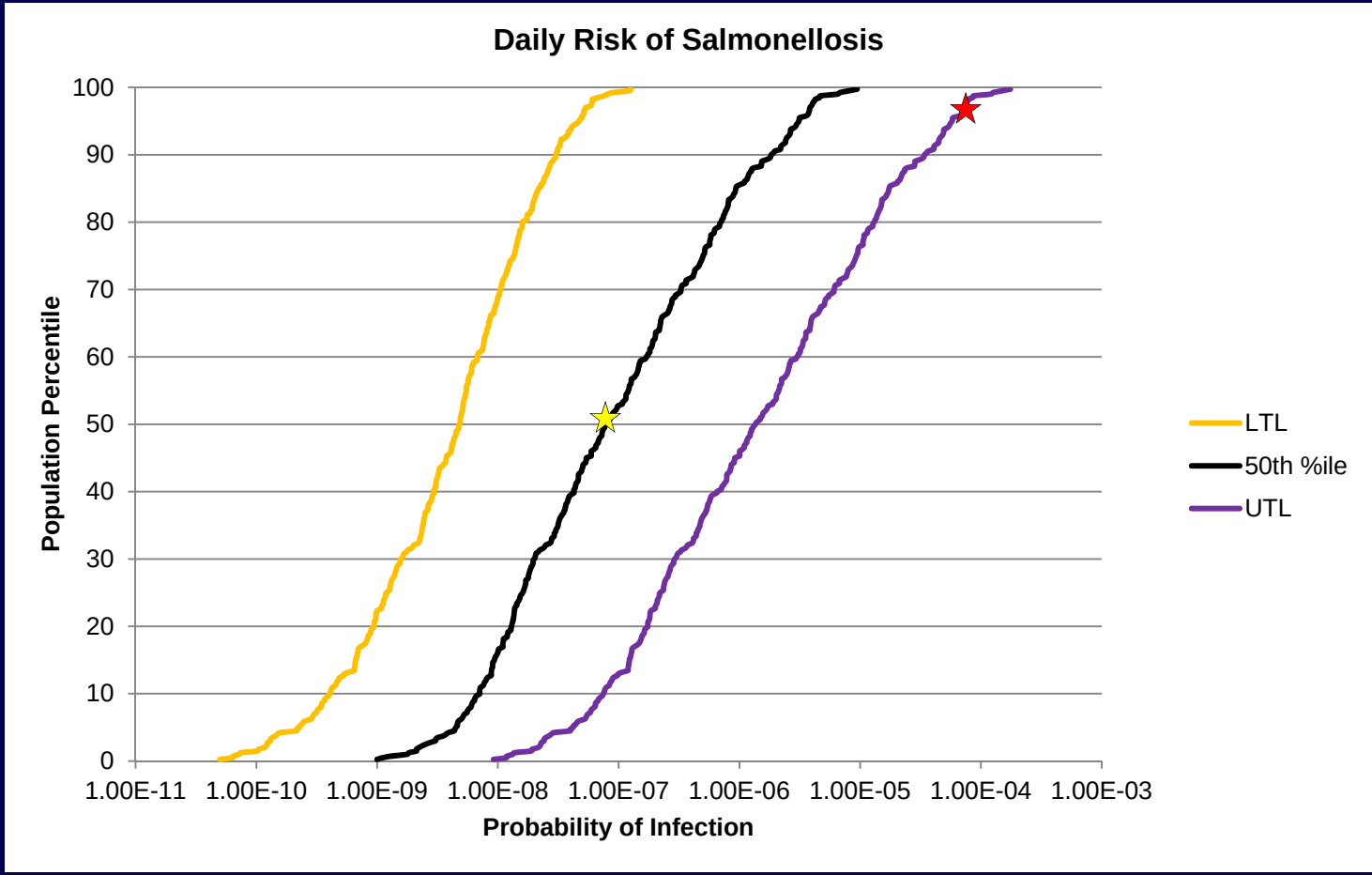

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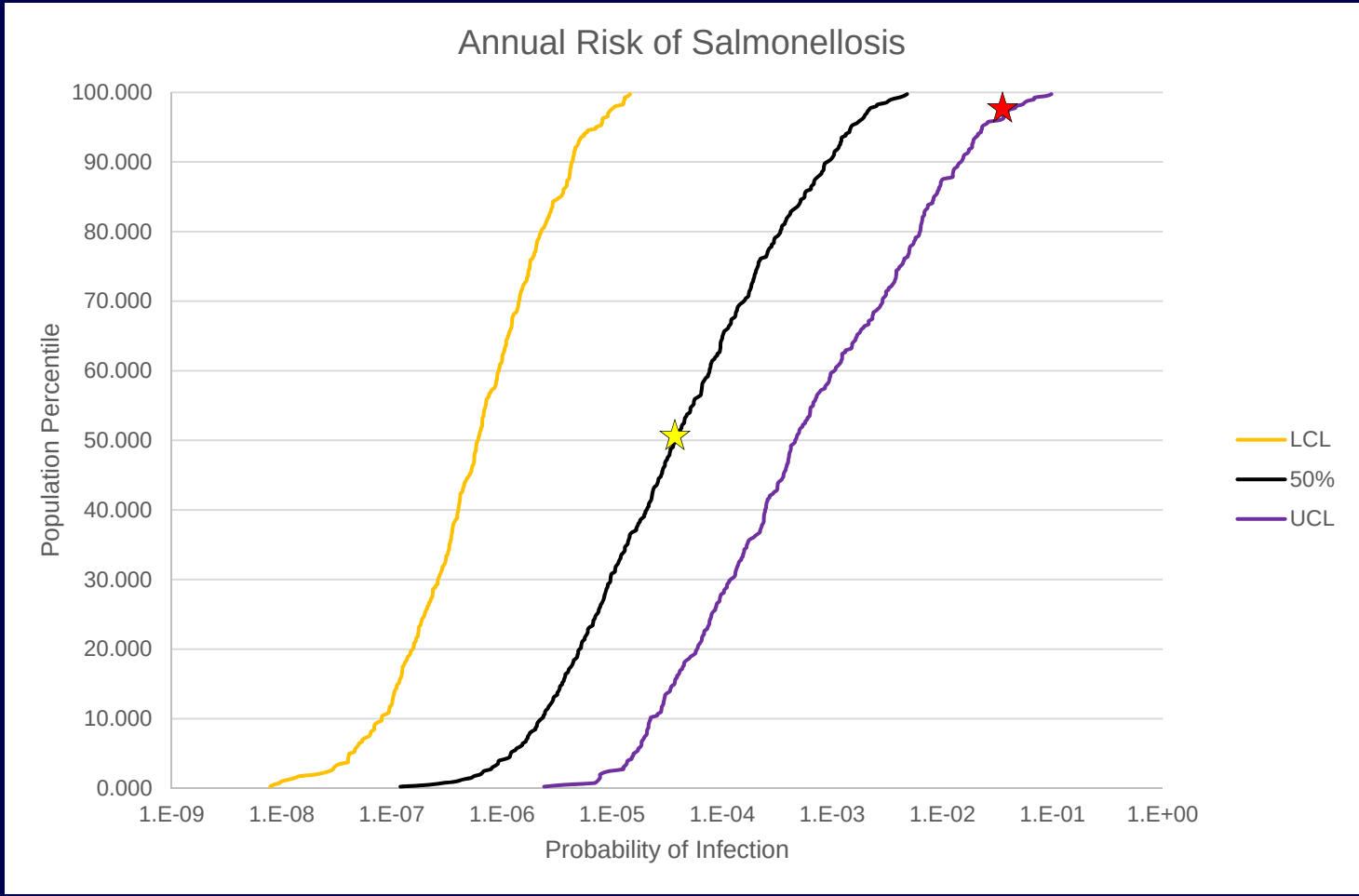

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