Nationwide assessment of Water Quality Parameters and the Effects on Legionellosis

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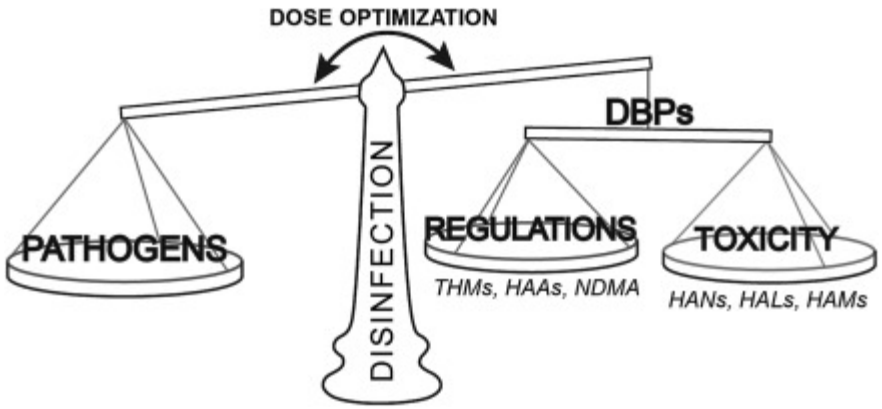
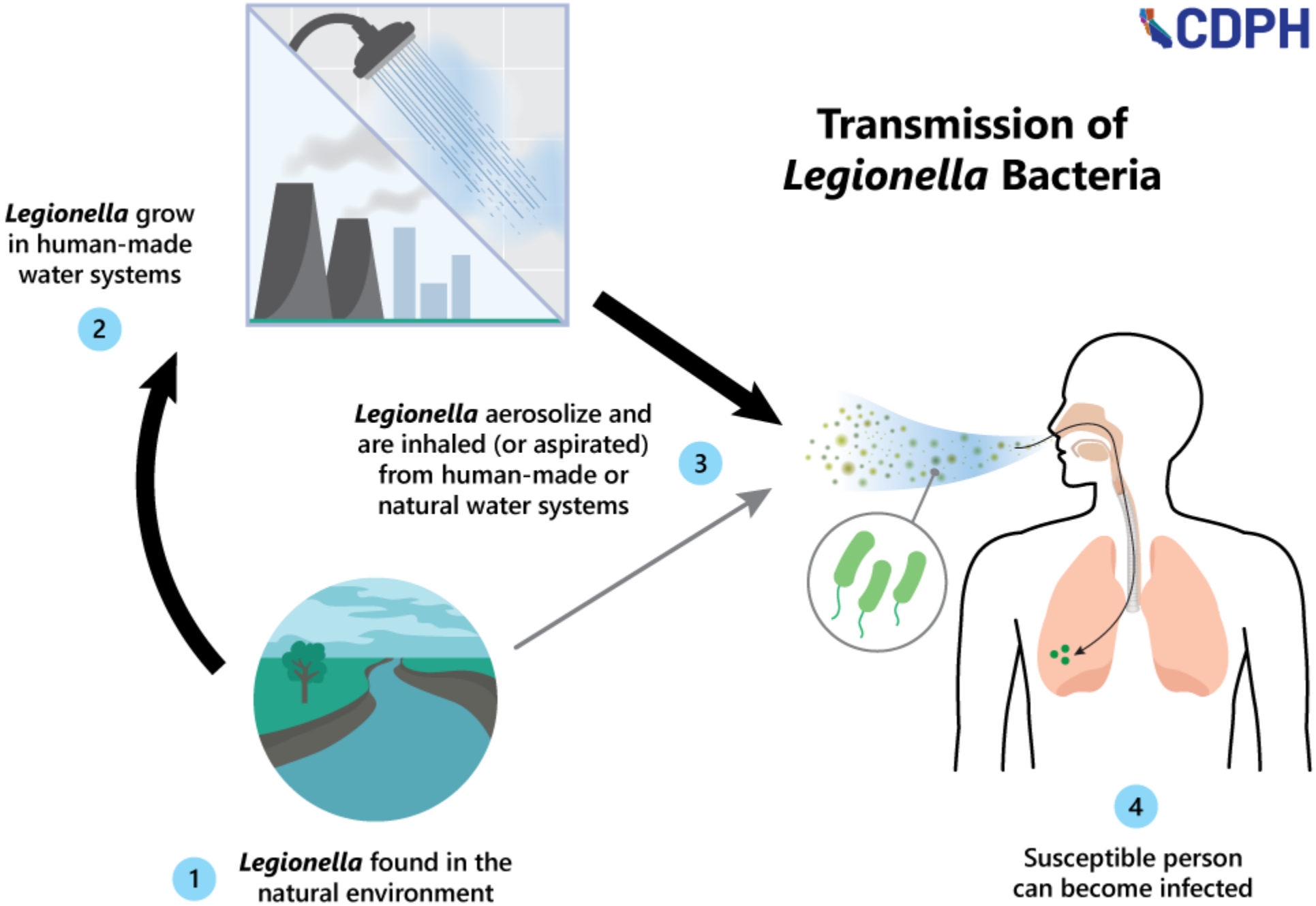
Project Background

- **Overall Goal**: Better understand and predict occurrence of disinfectant byproducts, opportunistic pathogens, and the associated health tradeoffs posed by them in drinking water distribution systems across the continental US
- **Specific Aim**: Characterize risks and system risk factors associated with legionellosis for multiple communities and populations

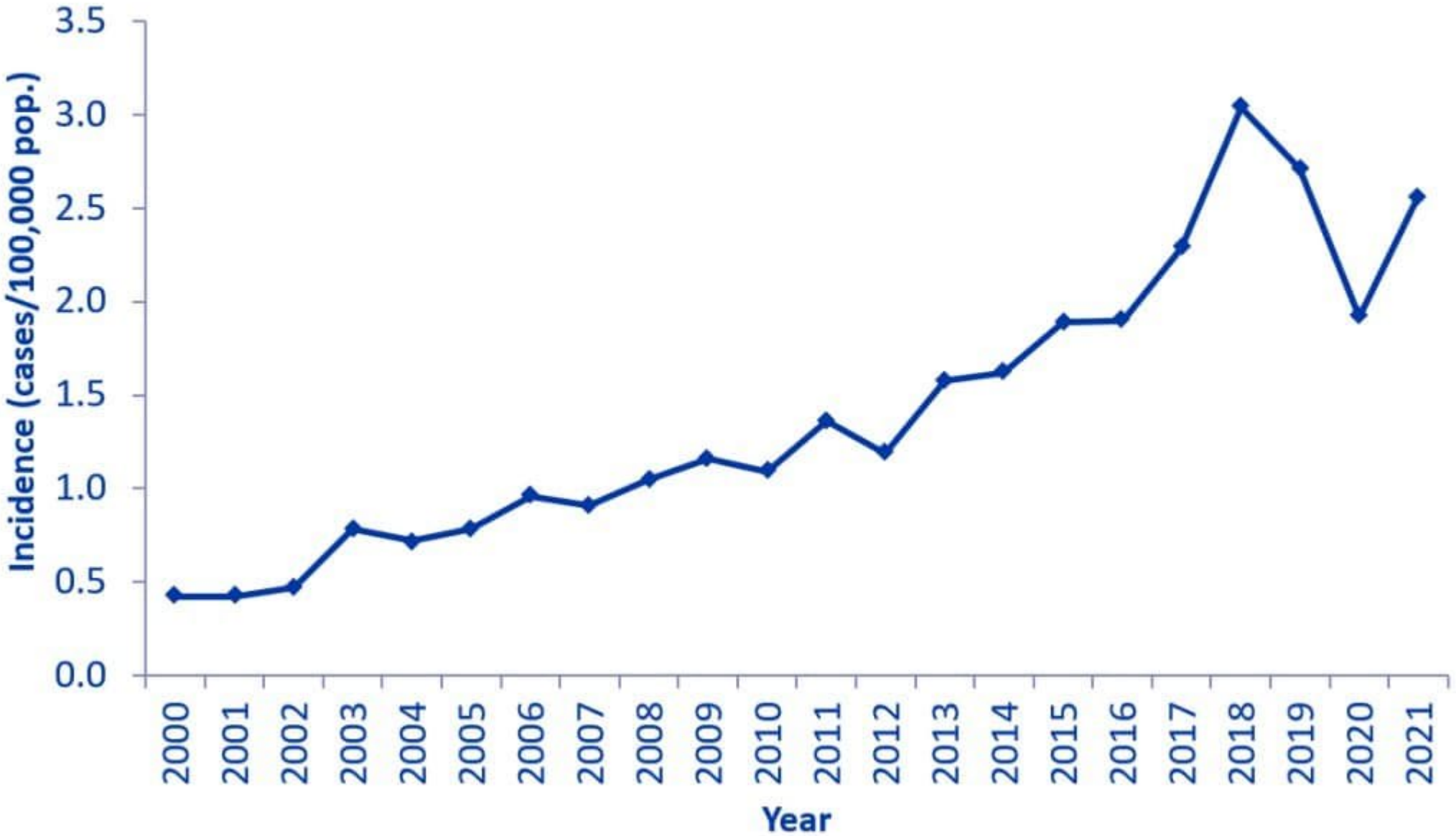


Furst et al. 2018

Consortium for Drinking Water Risk Trade-Offs, MSU

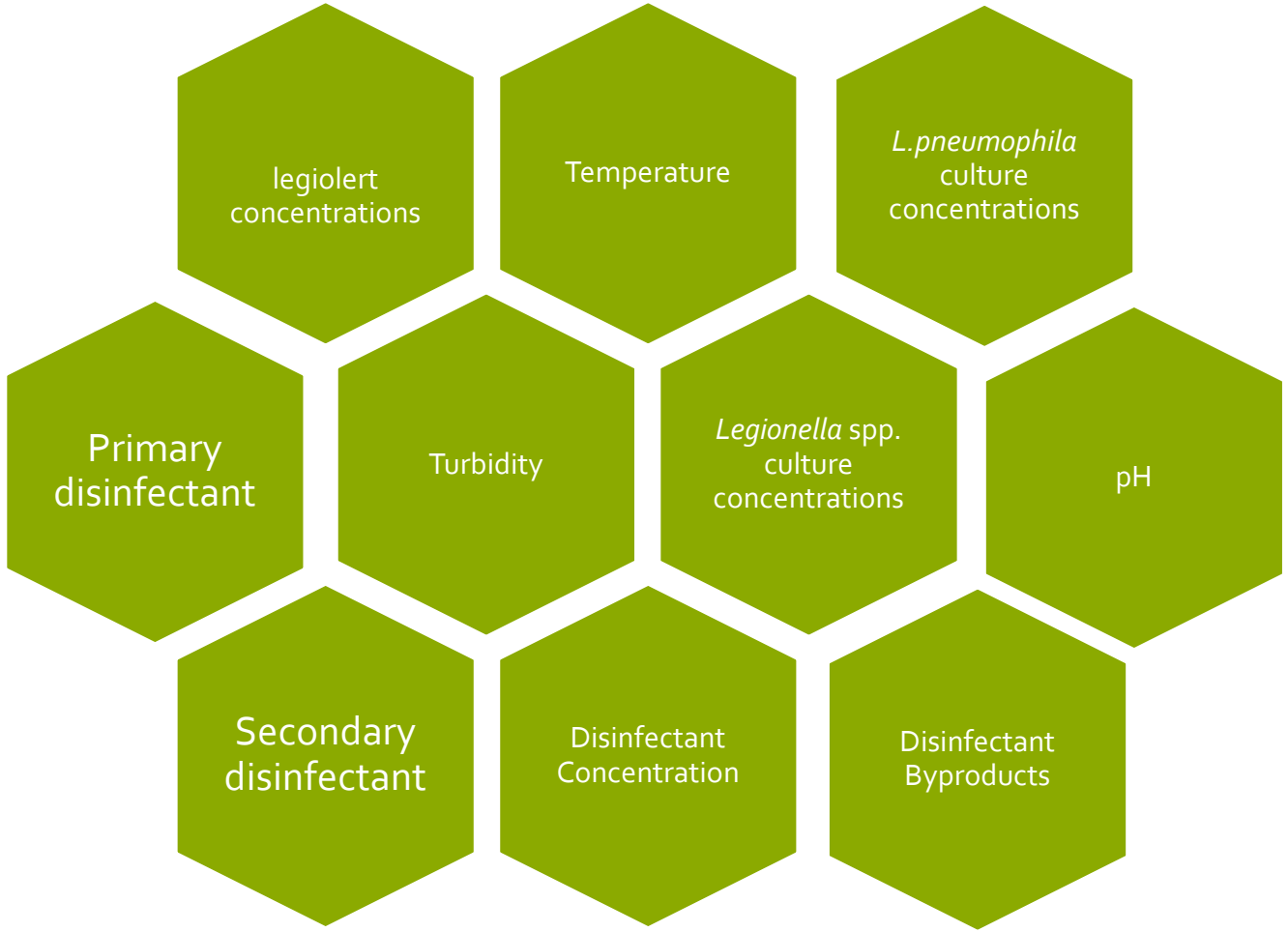

CDPH
Transmission of
Legionella Bacteria
Legionella grow in human-made water systems
2
Legionella aerosolize and are inhaled (or aspirated) from human-made or natural water systems
3
1
Legionella found in the natural environment
4
Susceptible person can become infected

Legionnaires' disease in the United States, 2000-2021

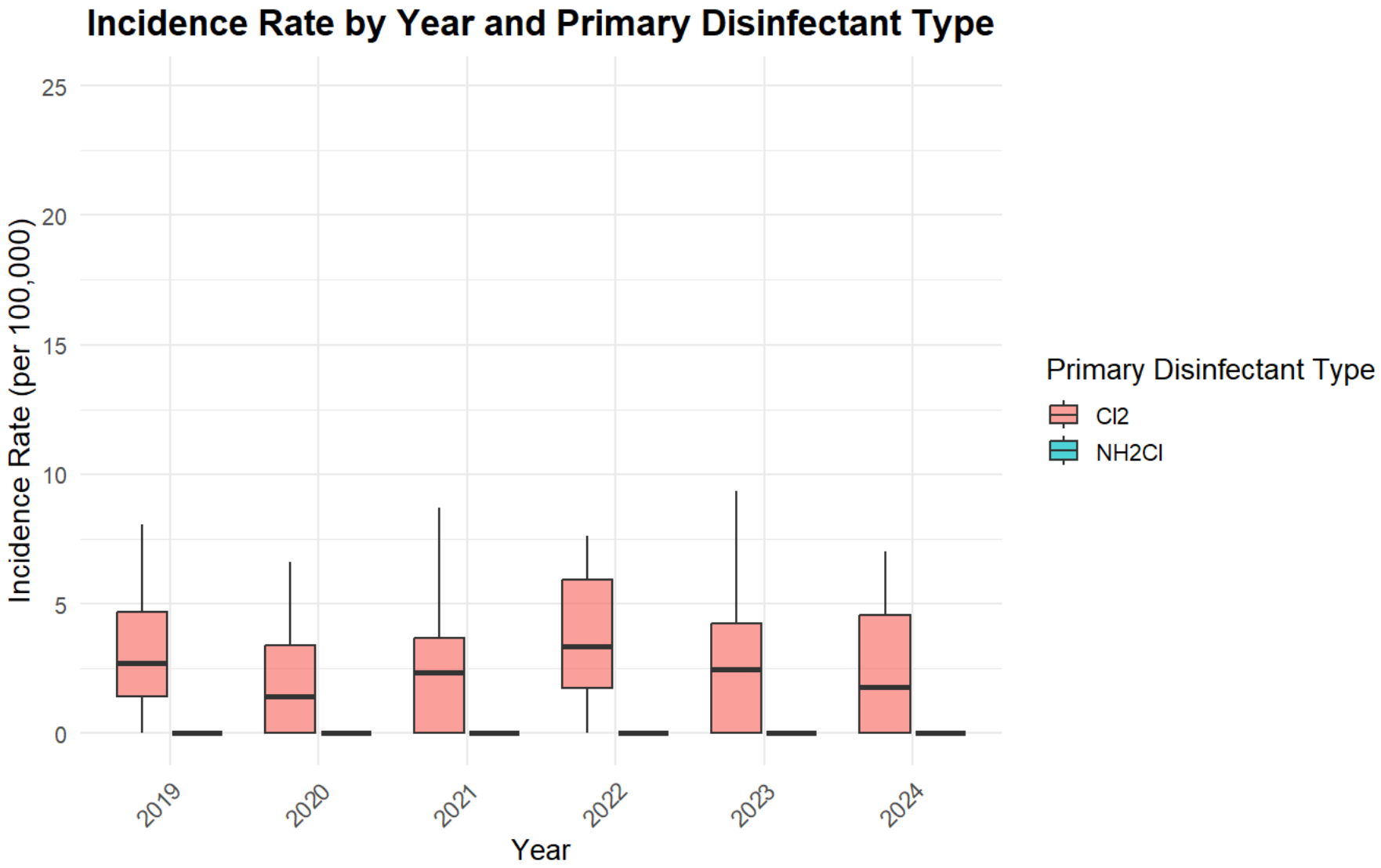


Methods

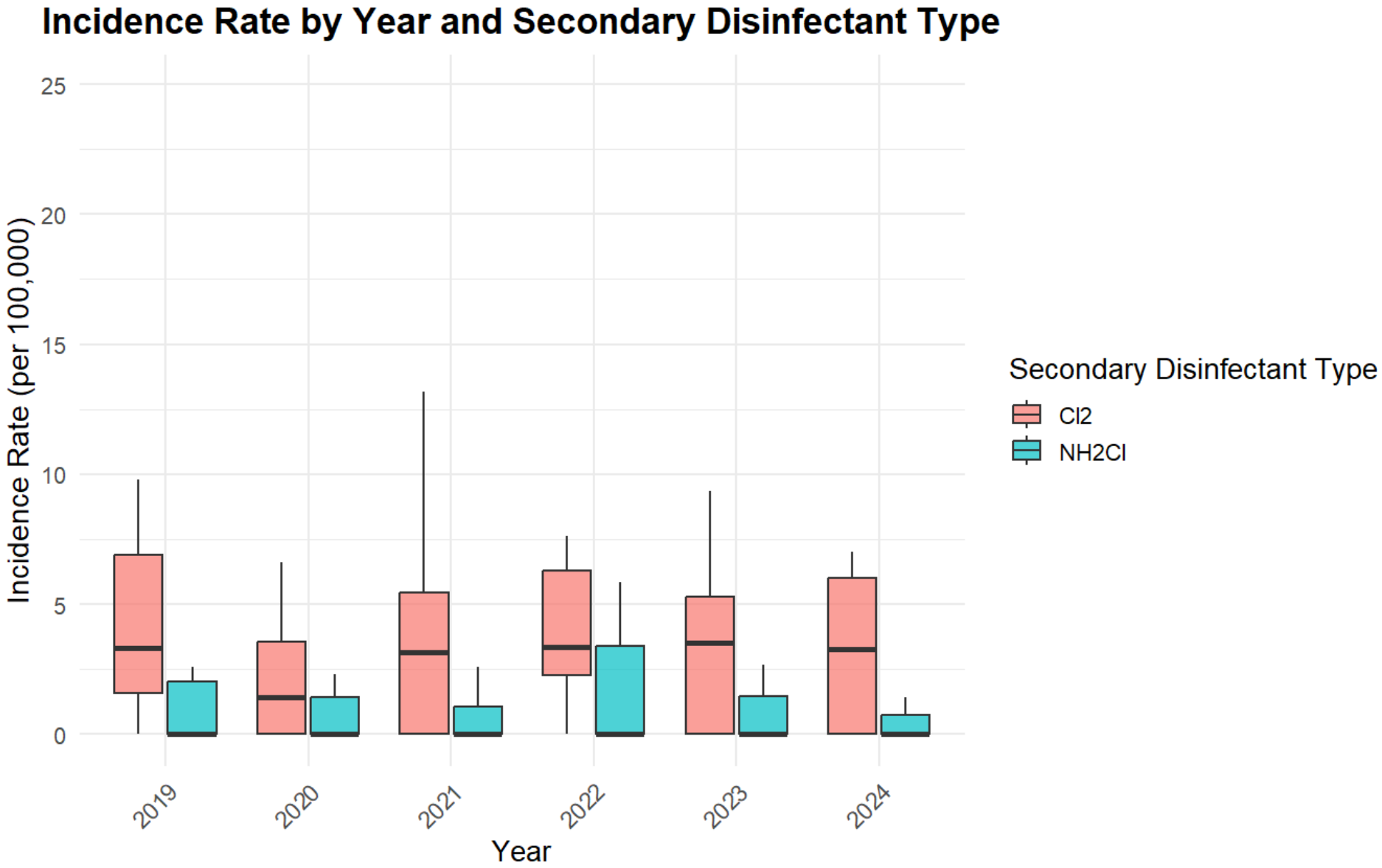
- **Curb Sampling**
  - 392 data points
  - 24 Utilities
- **Legionellosis**
  - Zip Code Level
  - 2019 - 2024



Legionellosis Incidence Rates by Primary Disinfectant Type



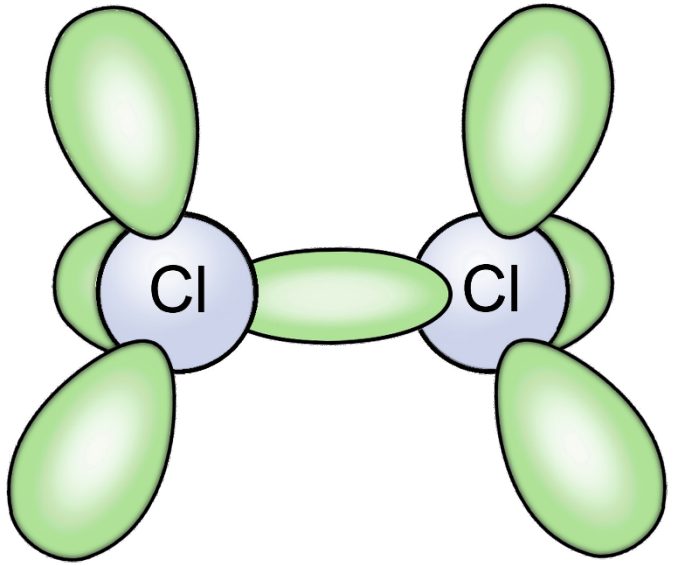
Legionellosis Incidence Rates by Secondary Disinfectant Type



Chlorine vs. Monochloramine

- Chlorine
  - More potent
  - Quickly disinfects
- Monochloramine
  - Slower
  - Does not dissipate as quickly

- **Odds Ratio:** 5.59 (95% CI: 4.58 – 6.82)
  - Chlorine as the secondary disinfectant



Correlations

- (medians by utility)
  - Correlation Value (p-value)

-	Legionellosis Incidence	Temperature	Turbidity	Disinfectant Conc.	pH	*L.pneumophila mpn*	*L.pneumophila* culture	*Legionella* spp. culture
Legionellosis Incidence	-	-0.58 (0.009)	-0.16 (0.51)	-0.33 (0.17)	0.03 (0.90)	-0.23 (0.35)	-0.26 (0.28)	-0.36 (0.13)
Temp	-0.58 (0.009)	-	-0.13 (0.59)	0.23 (0.33)	-0.19 (0.44)	0.27 (0.26)	0.50 (0.03)	0.64 (0.003)
Turbidity	0.16 (0.51)	-0.13 (0.59)	-	0.08 (0.74)	0.31 (0.19)	-0,14 (0.57)	0.12 (0.63)	0.12 (0.61)
Dis. Conc.	-0.33 (0.17)	0.23 (0.33)	0.08 (0.74)	-	0.67 (0.002)	0.40 (0.09)	-0.09 (0.71)	0.30 (0.21)
pH	0.03 (0.90)	-0.19 (0.44)	0.31 (0.19)	0.67 (0.002)	-	0.21 (0.38)	-0.20 (0.41)	-0.17 (0.48)
***Lp* mpn**	-0.23 (0.35)	0.27 (0.26)	-0,14 (0.57)	0.40 (0.09)	0.21 (0.38)	-	0.14 (0.57)	0.16 (0.52)
Lp. culture	-0.26 (0.28)	0.50 (0.03)	0.12 (0.63)	-0.09 (0.71)	-0.20 (0.41)	0.14 (0.57)	-	0.57 (0.01)

Key Takeaways

- We *need* more **data!**
- Monochloramine is likely the preferred secondary disinfectant
- Cancer epidemiology
- Collaborations with utilities

Limitations

- Data/funding
- Temporal Analysis
- Spatial Analysis
- Current epidemiological data

Thank you! Questions?

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