

# Health Risks of Recreation on the Chicago Area Waterways System: Results of CHEERS

MWRDGC Research Seminar

October 29, 2010

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# Overview

- **Why the study was done**
- **How the study was done**
- **Findings: Water quality**
- **Findings: Health risks of CAWS recreation**
- **Findings: Clinical microbiology**
- **Next steps**



# **Overall purpose of the study**

**To characterize, under current conditions, the health risks of CAWS limited contact recreation**

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graph TD; A[To characterize, under current conditions, the health risks of CAWS limited contact recreation] --- B[Canoeing, fishing, kayaking, Motor boating, rowing];
```

Canoeing, fishing, kayaking,  
Motor boating, rowing

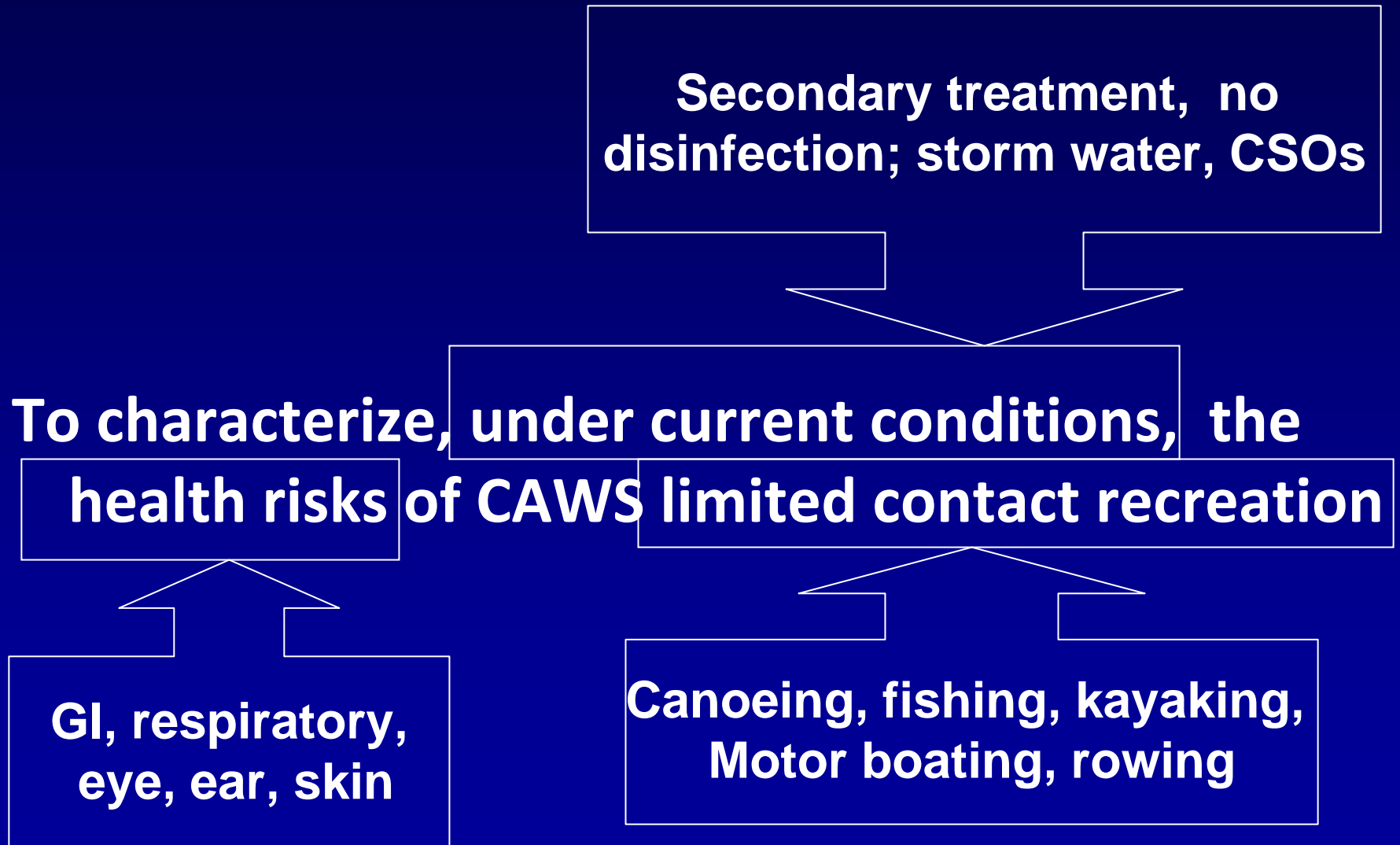
# Overall purpose of the study

To characterize, under current conditions, the health risks of CAWS limited contact recreation

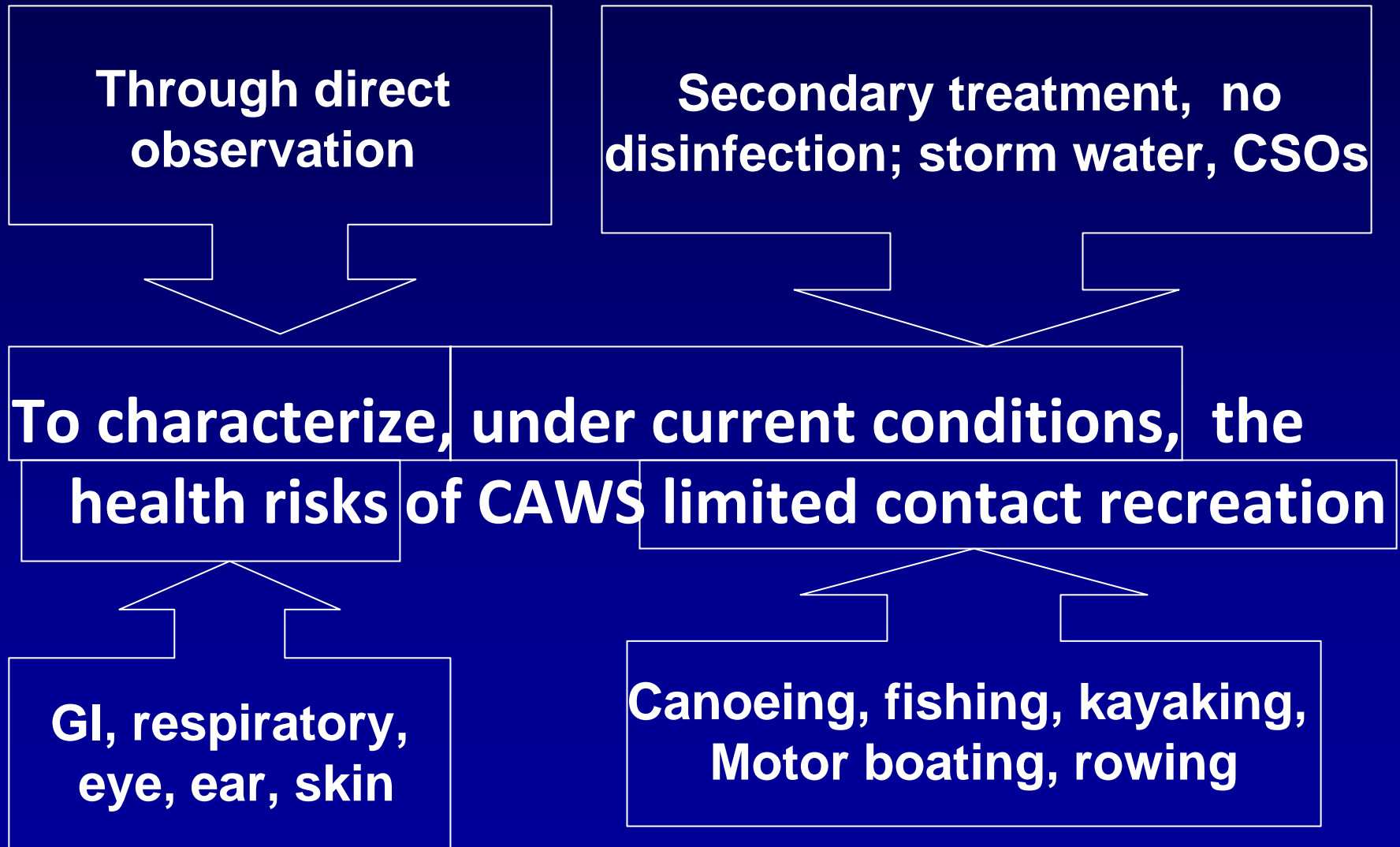
GI, respiratory,  
eye, ear, skin

Canoeing, fishing, kayaking,  
Motor boating, rowing

# Overall purpose of the study



# Overall purpose of the study



# Why characterize the health risks?

- Clean Water Act goal: Recreation in and on the water (“swimmable and fishable” where attainable)
- Use Attainability Analysis
- Proposed effluent standards



# **Is an epidemiologic study the only approach?**

- **Existing literature focuses on studies of swimming at beaches**
- **Microbial risk assessment has been done**
- **US EPA has established ambient water quality criteria using epidemiologic data**

# **Specific study objectives**

- 1. To estimate health risks attributable to CAWS recreation**
- 2. To evaluate the relationship between microbial measures of water quality and health risk**
- 3. To identify pathogens responsible for illness**

# Study design

- **“Prospective cohort”**
  - **Enroll people free of disease**
  - **People have varying exposure**
  - **Evaluate development of disease in relation to exposure**

# What is CHEERS?

Chicago  
Health,  
Environmental  
Exposure, and  
Recreation  
Study



# Enroll groups with and without the factor of interest, in this case, exposure to CAWS water



Unexposed  
recreators



General use  
recreators



CAWS  
recreators

# Sources of risk, by group



Unexposed

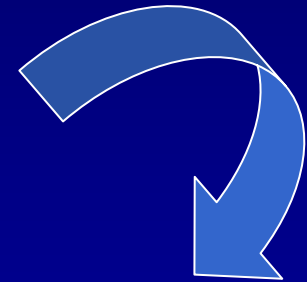
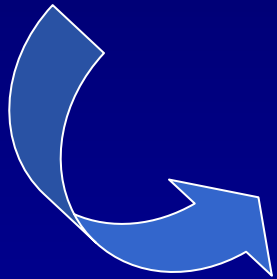


General Use



CAWS

# Data collection





# Water sampling

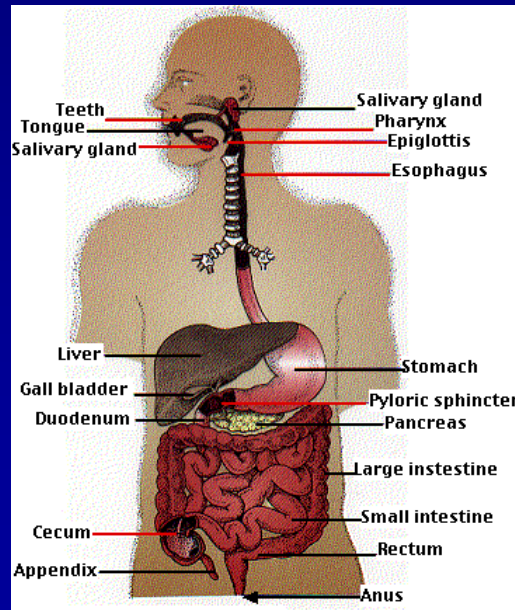
- Indicators by culture (q 2 hours)
  - *E. coli*
  - *Enterococci*
  - *Somatic coliphages*
  - F+ coliphages
- Pathogens (q 6 hrs)
  - *Giardia*
  - *Cryptosporidium*





# Evaluate by phone on days 2, 5 and 21

- Acute GI illness
- Acute respiratory illness
- Dermatitis
- Eye infection
- Ear infection
- Culture of clinical specimens



# Data analysis

- **Multivariate logistic regression: odds of illness occurring**
- **Takes into account potentially important differences between groups**
- **Calculation of attributable risk differences**

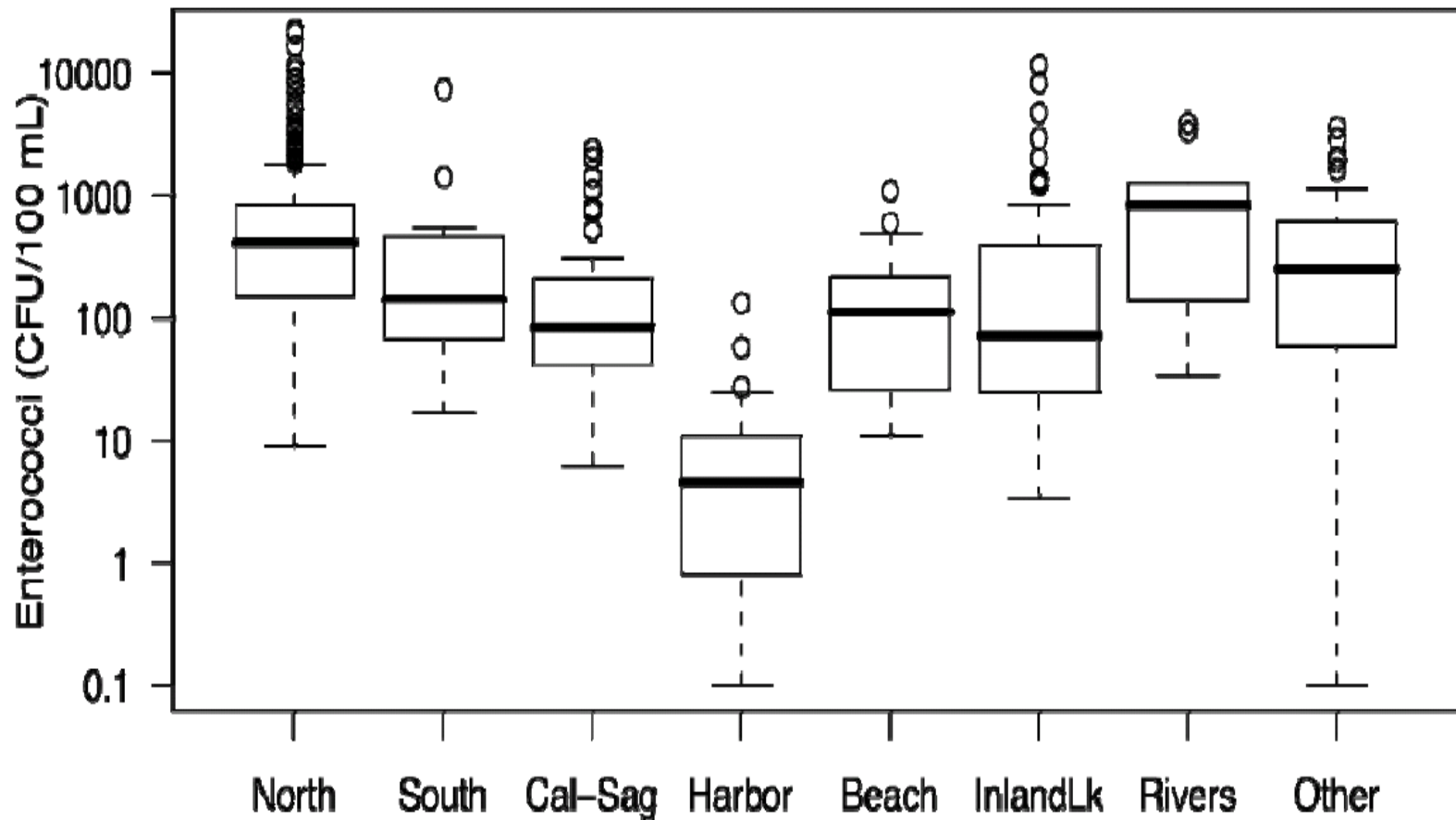
# **Data analysis approach: For each health endpoint...**

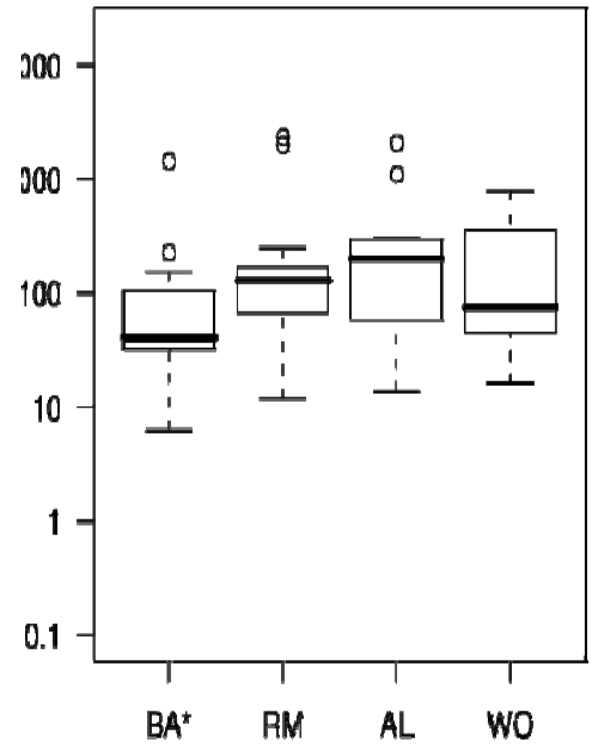
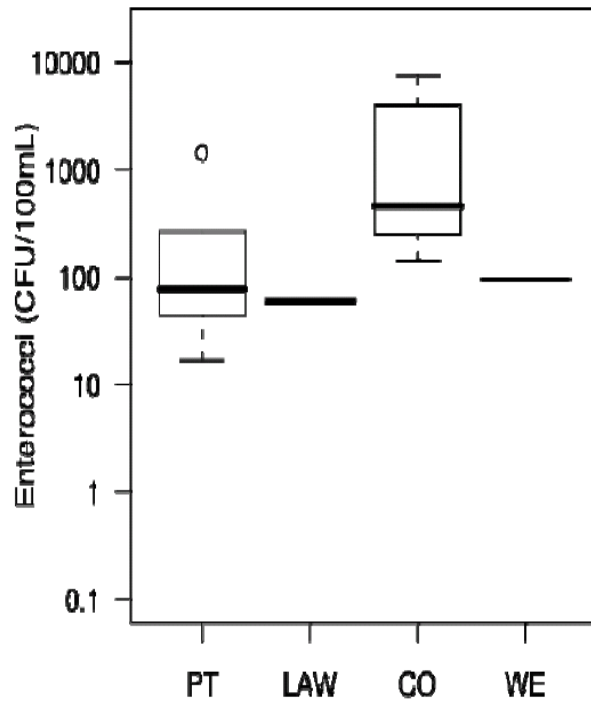
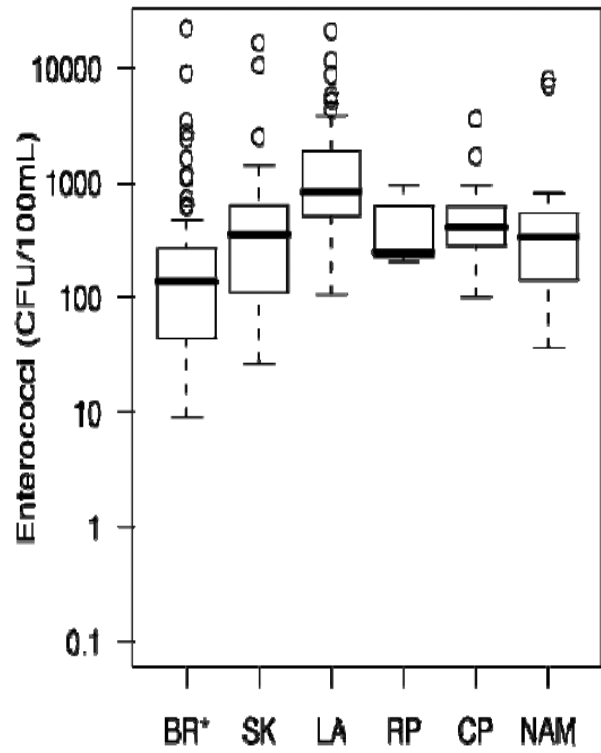
- 1. Develop conceptual model**
- 2. Define time windows of interest**
- 3. Bivariate analysis**
- 4. Multivariate logistic regression**
- 5. Attributable risk calculation**
- 6. Evaluate model assumptions and alternative approaches**

# Peer Review

- **Water Environment Research Foundation (WERF)**
- **National and international authorities**
- **EPA, CDC, utility, academia, consulting**
- **Protocol review**
- **Data quality review**
- **Data analysis methods**
- **Report**

# Results: Microbes





# Study participants

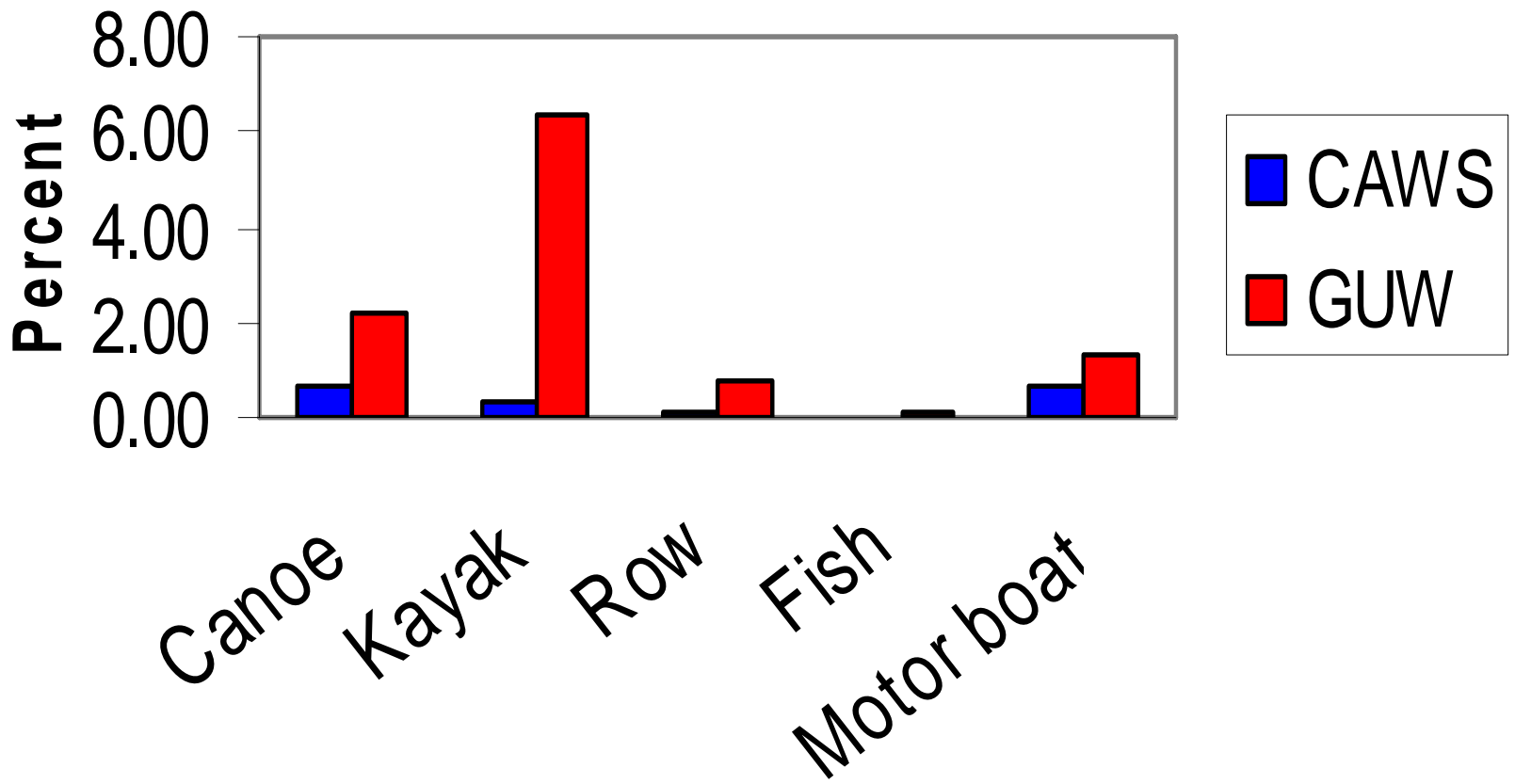
Year	CAWS		GUW		UNX		Total
	n	(%)	n	(%)	n	(%)	n
2007	342	(8.6)	127	(3.4)	323	(9.0)	792
2008	2,426	(61.2)	2,110	(56.4)	2,080	(58.0)	6,616
2009	1,198	(30.2)	1,507	(40.2)	1,184	(33.0)	3,889
Total	3,966	(100.0)	3,744	(100.0)	3,587	(100.0)	11,297

# Water recreation activities

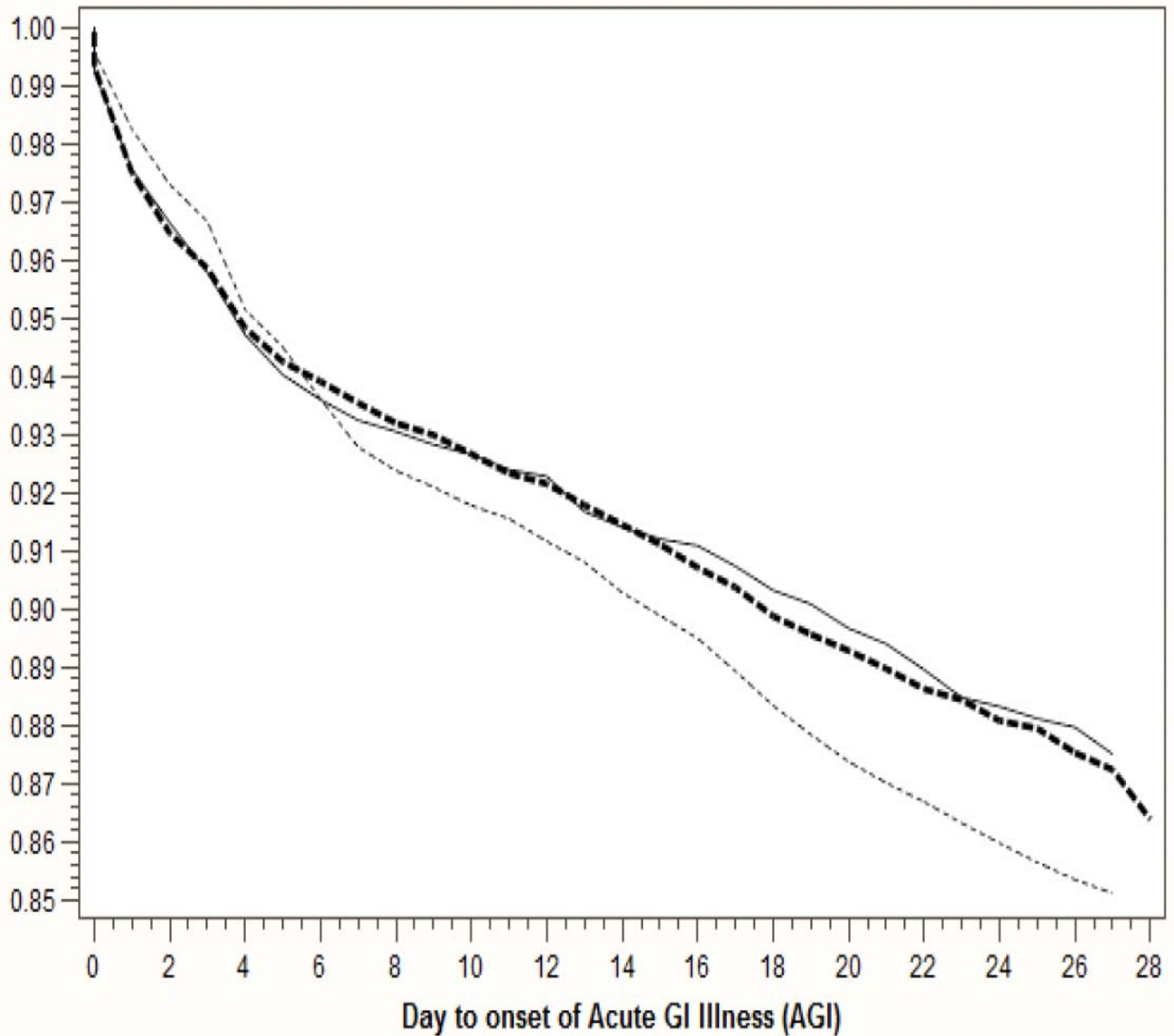
<b>Activity</b>	<b>CAWS</b>	<b>GUW</b>
<b>Motor boating</b>	<b>16.7%</b>	<b>6.2%</b>
<b>Canoeing</b>	<b>22.3%</b>	<b>32.1%</b>
<b>Fishing</b>	<b>10.7%</b>	<b>23.0%</b>
<b>Kayaking</b>	<b>34.2%</b>	<b>32.0%</b>
<b>Rowing</b>	<b>16.1%</b>	<b>6.7%</b>
<b>Total</b>	<b>100.0%</b>	<b>100.0%</b>



# Self-reported head/face immersion, by water recreation activity and study group



Proportion Remaining AGI-free



Study Group — CAWS — G UW -- UNX

# Cases of gastrointestinal Illness attributable to water recreation, per 1,000 uses

<b>CAWS</b>	<b>45.4</b>
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<b>UNX</b>	<b>32.9</b>
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<b>Difference</b>	<b>12.5</b>
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# Cases of gastrointestinal Illness attributable to water recreation, per 1,000 uses

<b>GUW</b>	<b>46.3</b>
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<b>UNX</b>	<b>32.9</b>
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<b>Difference</b>	<b>13.4</b>
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# Cases of gastrointestinal illness attributable to water recreation, per 1,000 uses\*

<b>CAWS</b>	<b>43.6</b>
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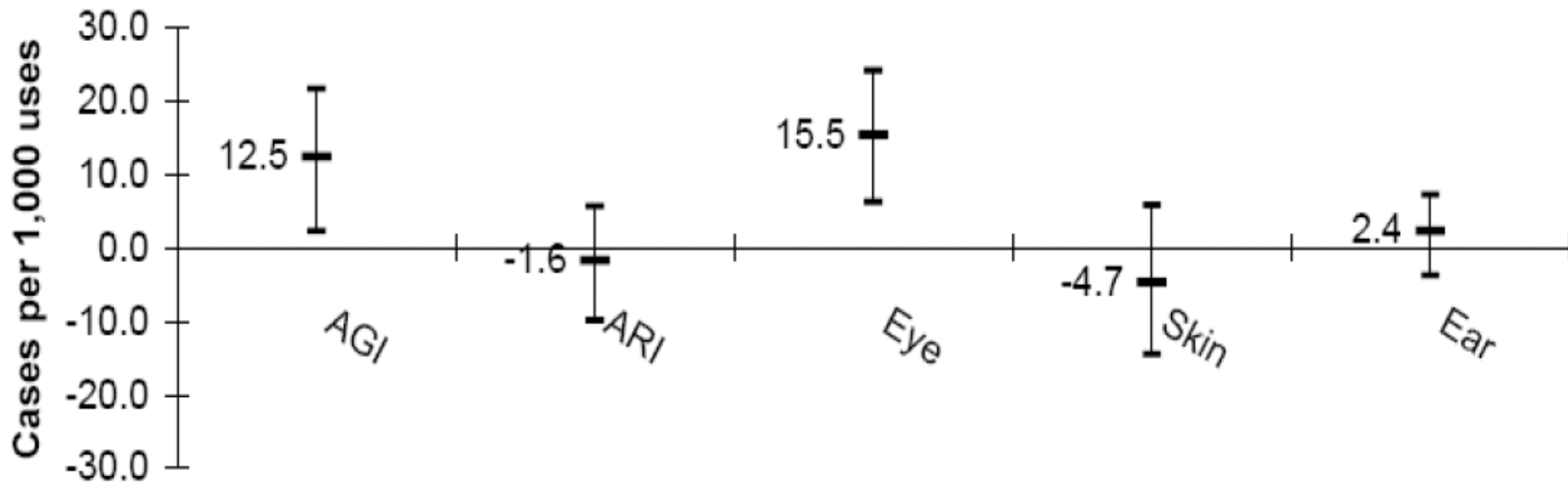
<b>GUW</b>	<b>-43.0</b>
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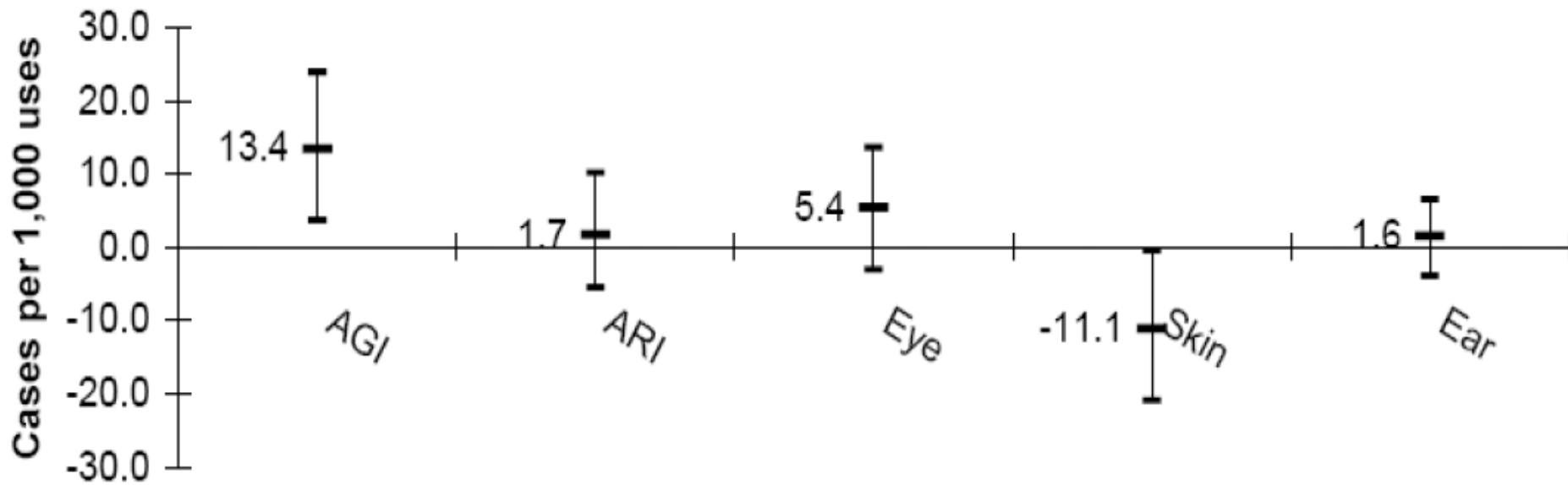
<b>Difference</b>	<b>0.6</b>
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\*Takes into account differences in recreational activities and water exposure

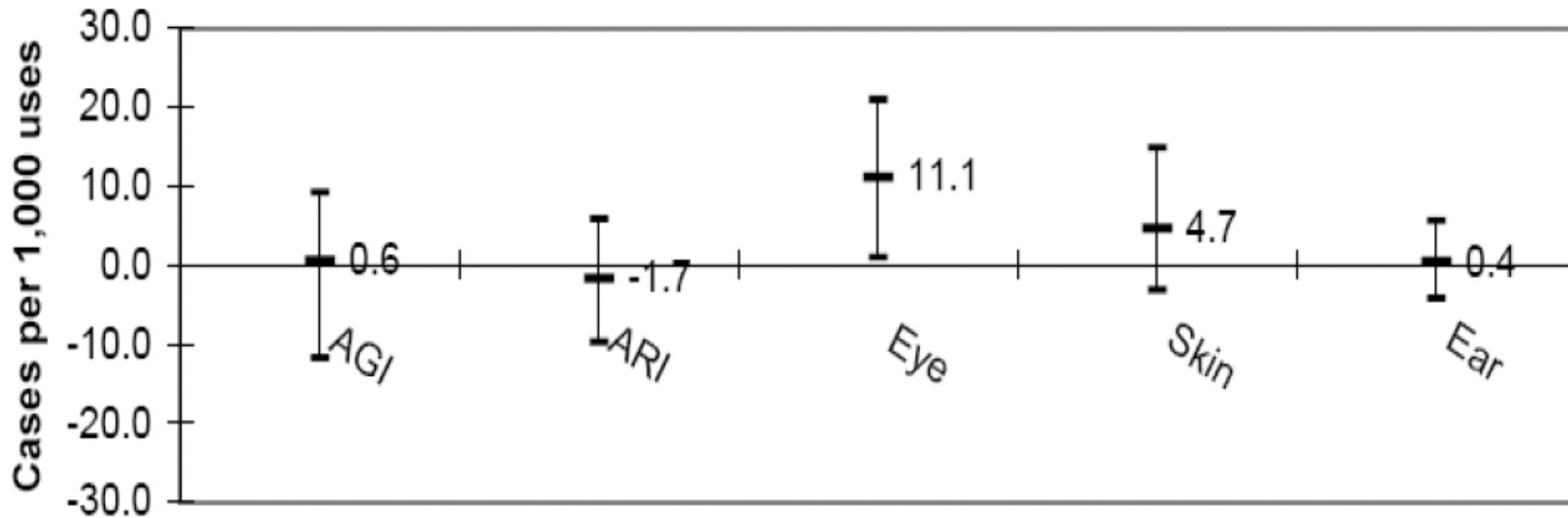
# CAWS – Unexposed Differences



# G UW – Unexposed Differences

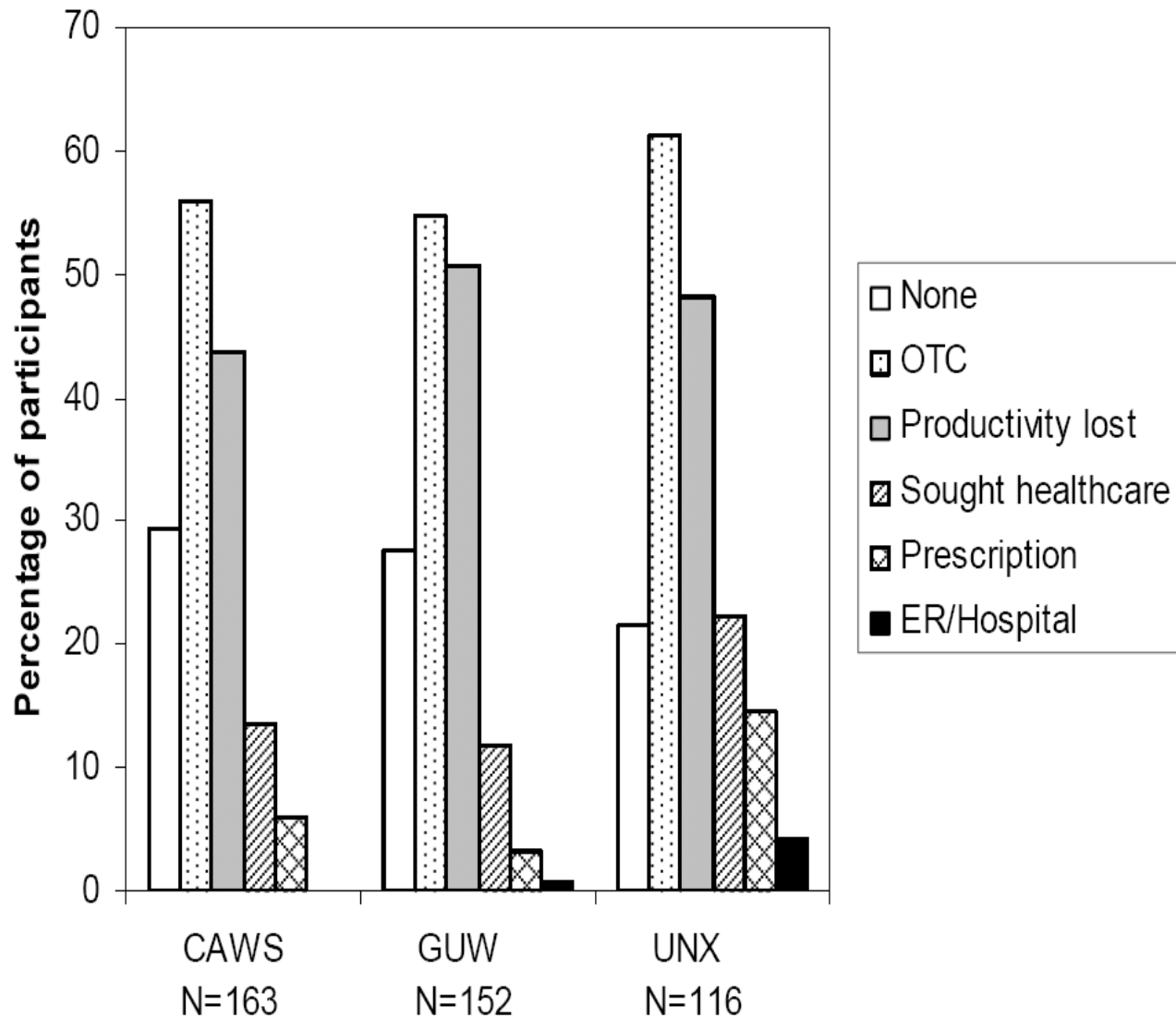


# CAW – G UW Differences

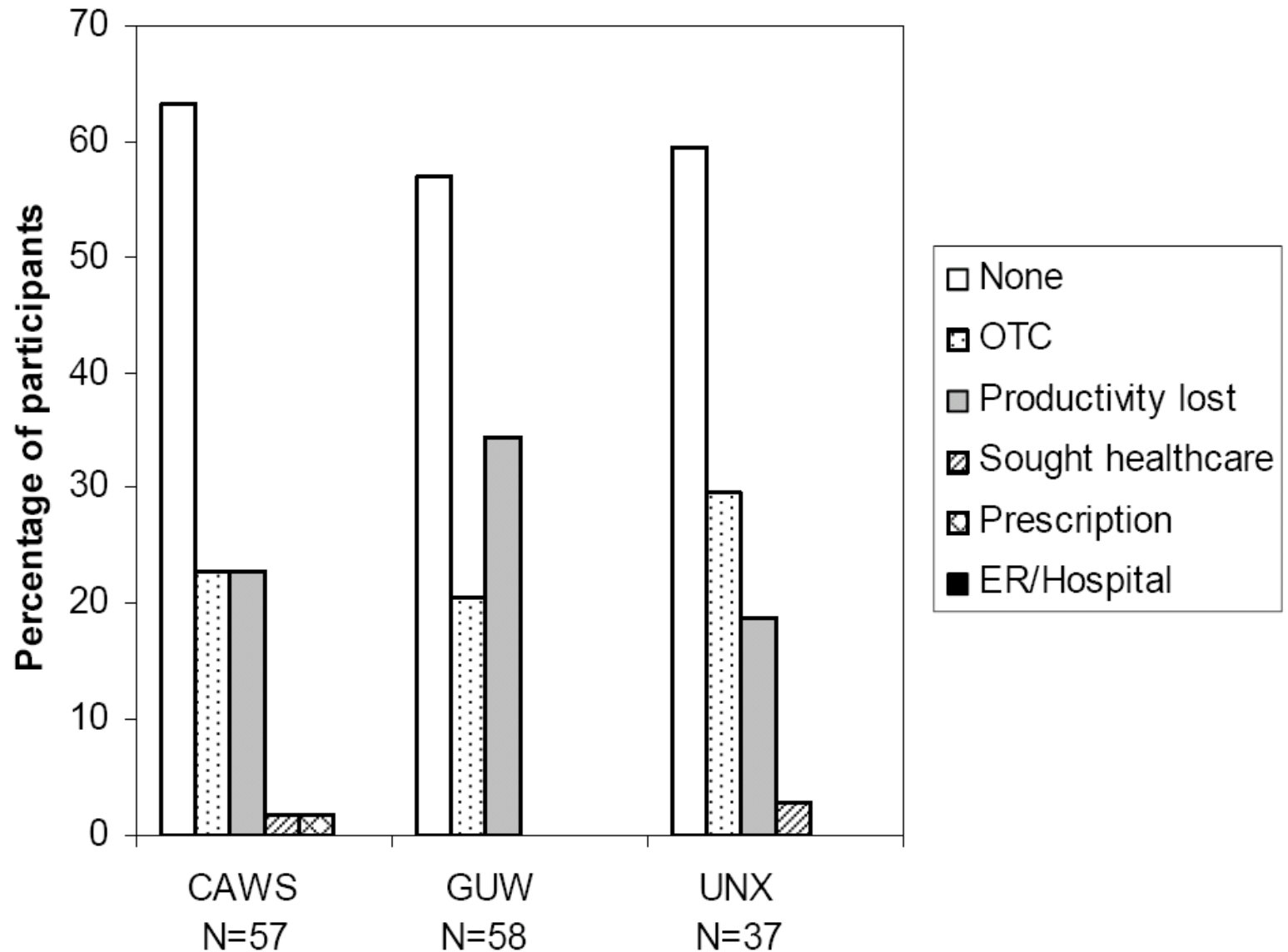




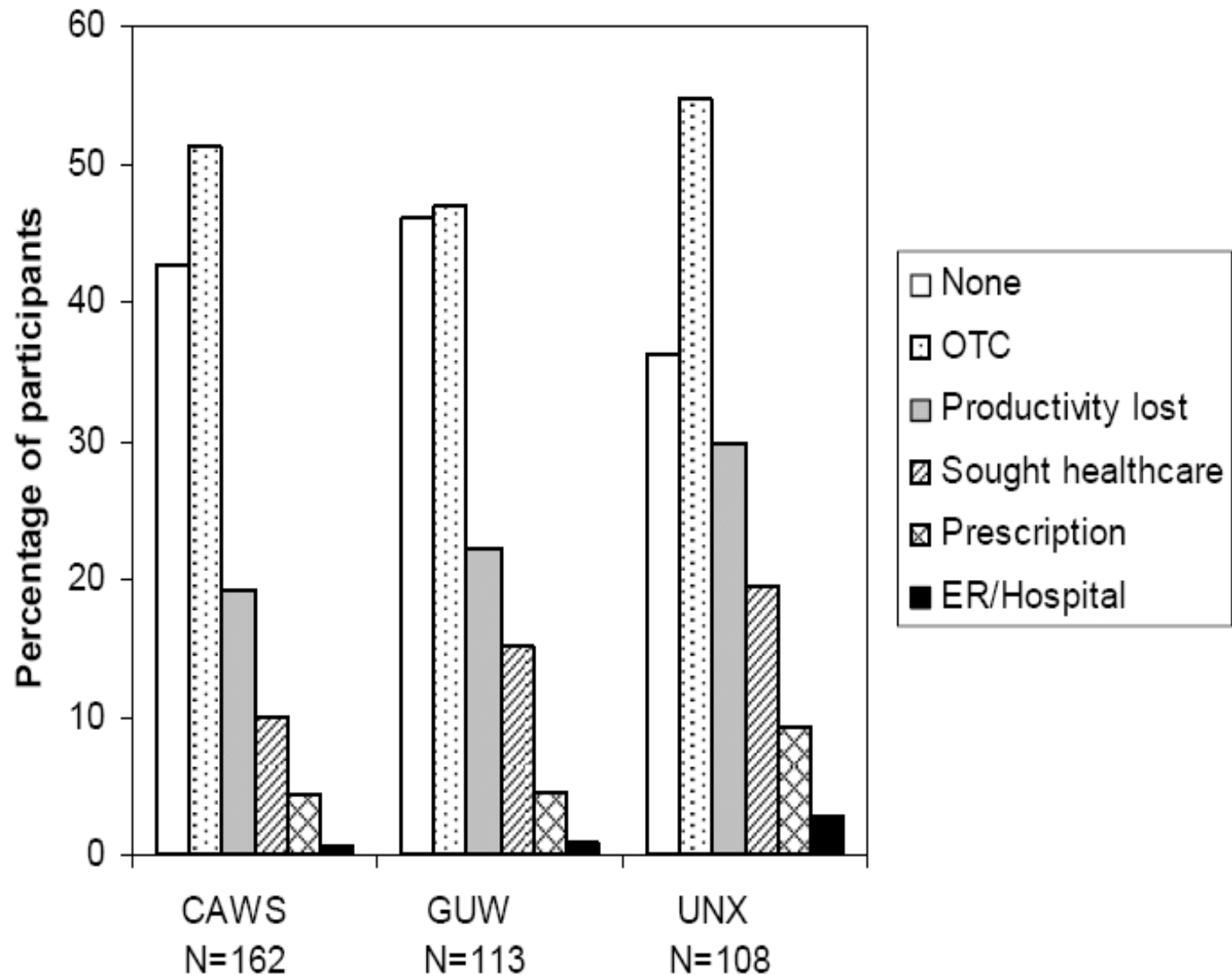
# Severity – Any AGI



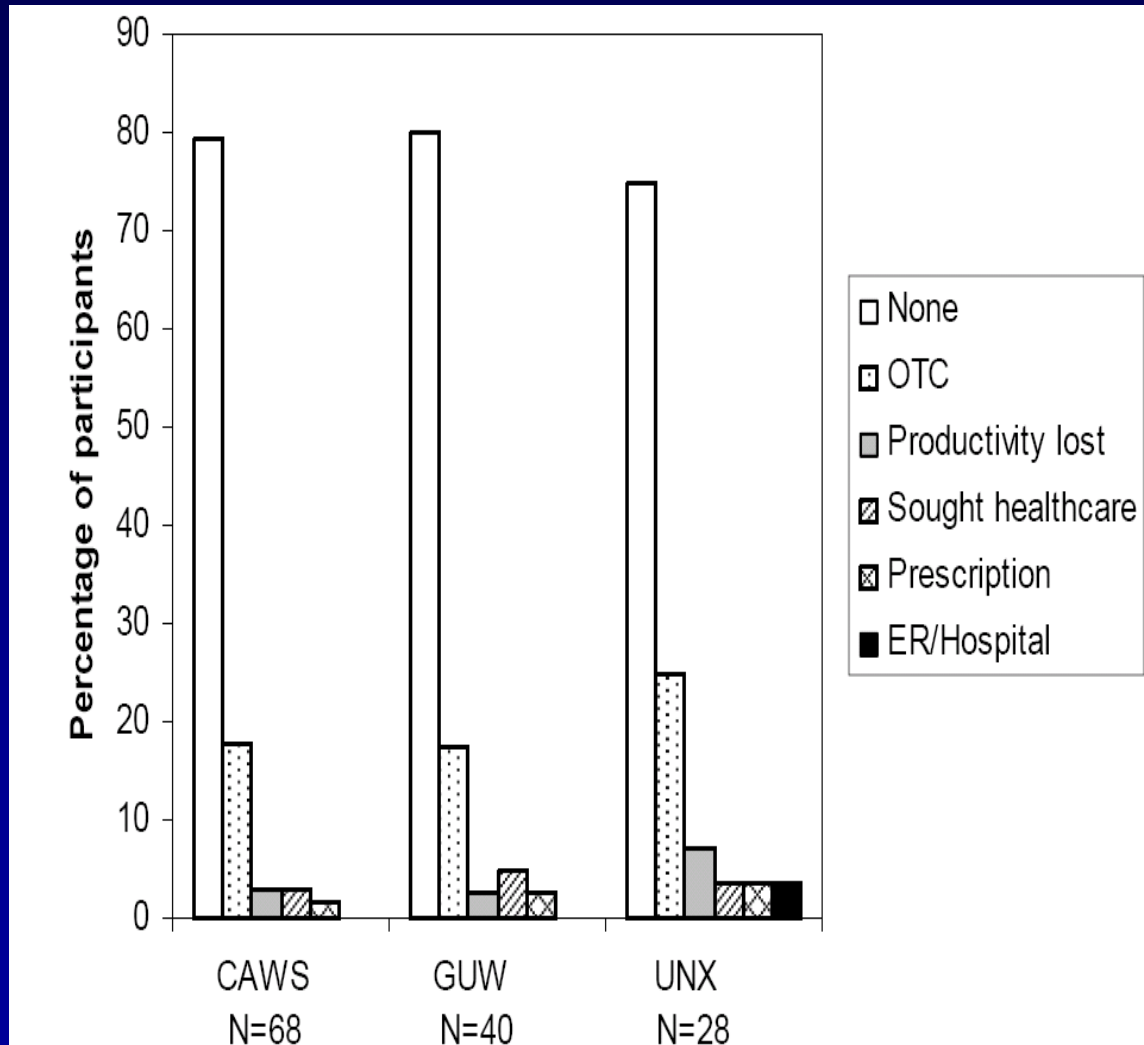
# Illness Severity: AGI only



# Illness severity: eye symptoms, all



# Illness severity: eye symptoms only



# Study Objective #3: Pathogens

**11,297 participants**

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graph TD; A[11,297 participants] --> B[10,998 (97.4%) had no baseline GI symptoms];
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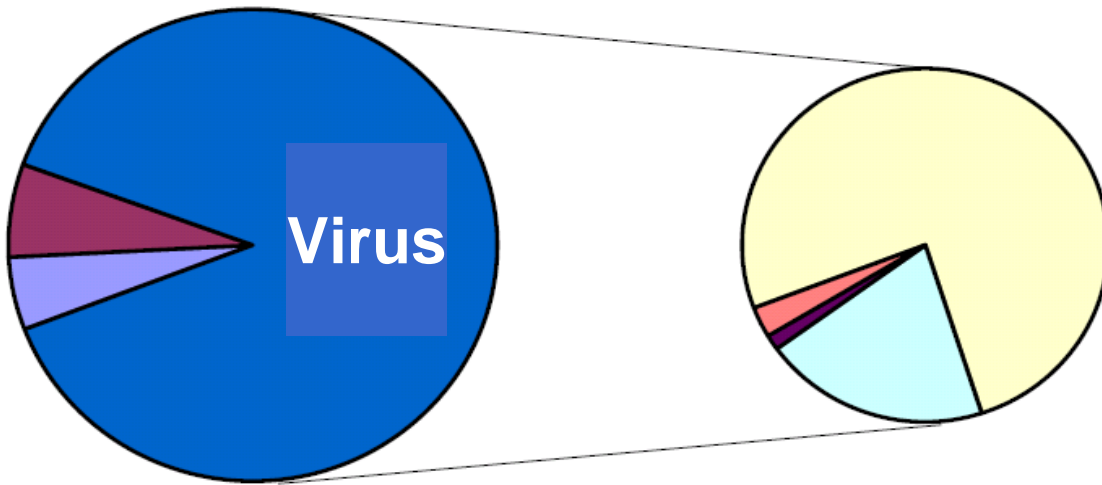
10,998 (97.4%) had no baseline GI symptoms

2,467 (22.4%) developed GI symptoms\*

745 (30.2%) provided stool sample

76 (10.2%) tested positive for a pathogen

# Breakdown of pathogens: all participants



- Bacteria
- Protozoa
- Rotavirus
- Norovirus
- Echovirus type 11
- Adenovirus

# Pathogen positive stool samples, by study group

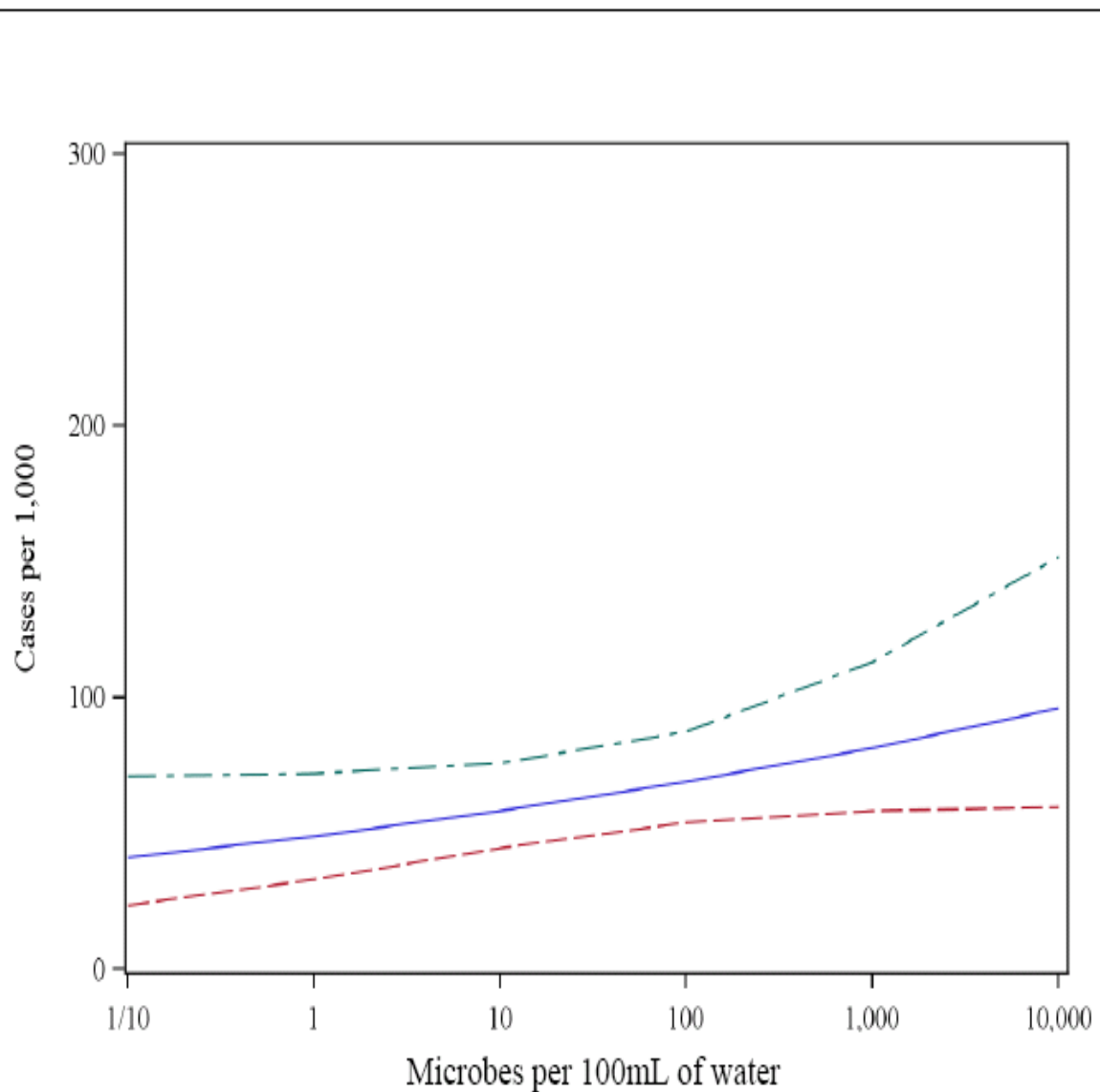
<u>Group</u>	<u>% positive</u>
<b>CAWS</b>	<b>8.6</b>
<b>GUW</b>	<b>10.5</b>
<u><b>UNX</b></u>	<u><b>11.3</b></u>
<b>Total</b>	<b>10.2</b>

# What we didn't find

- *Salmonella*
- *Shigella*
- *E. coli* O157:H7
- *Cryptosporidium*



# Ongoing analysis: Study objective #2



# Ongoing analysis (example)

<b>Excess Cases per 1,000</b>	<b>Microbe concentration per 100mL</b>
<b>5</b>	<b>1</b>
<b>10</b>	<b>10</b>
<b>15</b>	<b>100</b>
<b>20</b>	<b>1,000</b>

# Many thanks

- **UIC Survey Research Lab**
- **Peter Scheff**
- **Preethi Pratap**
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- **Stephanie Deflorio**
- **An Li**
- **Rachael Jones**
- **Angela Michalek**
- **Ember Vannoy**
- **Jennifer McGowan**
- **Sal Cali**
- **Jackee Wuellner**
- **Li Liu**
- **Dan Hryhorczuk**
- **Ron Hershow**
- **Mark Dworkin**
- **Hong Li**
- **Mary Doi**

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# Questions?

