

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

MWRDGC Research Seminar

October 29, 2010

Samuel Dorevitch, MD, MPH



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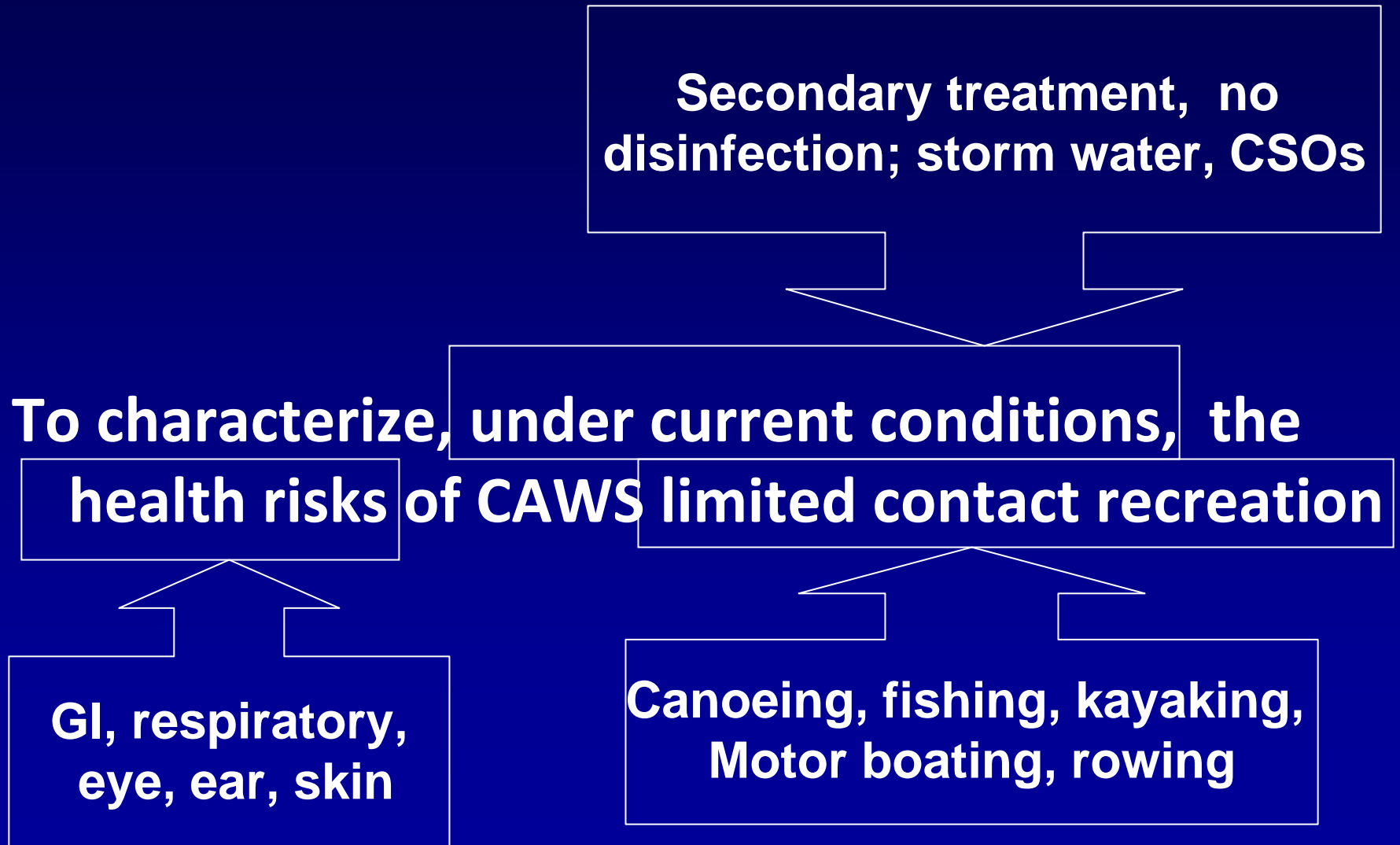
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To characterize, under current conditions, the health risks of CAWS limited contact recreation

GI, respiratory,
eye, ear, skin

Canoeing, fishing, kayaking,
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Overall purpose of the study



Overall purpose of the study

Through direct observation

Secondary treatment, no disinfection; storm water, CSOs

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

GI, respiratory, eye, ear, skin

Canoeing, fishing, kayaking, Motor boating, rowing

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

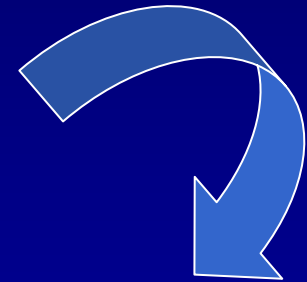
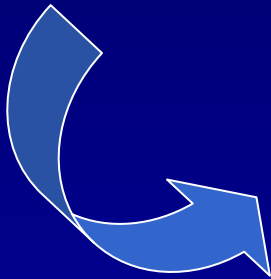


General Use



CAWS

Data collection



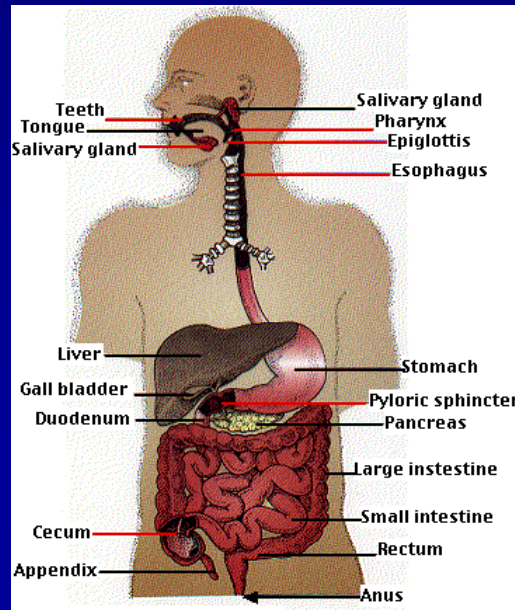
Water sampling

- 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**

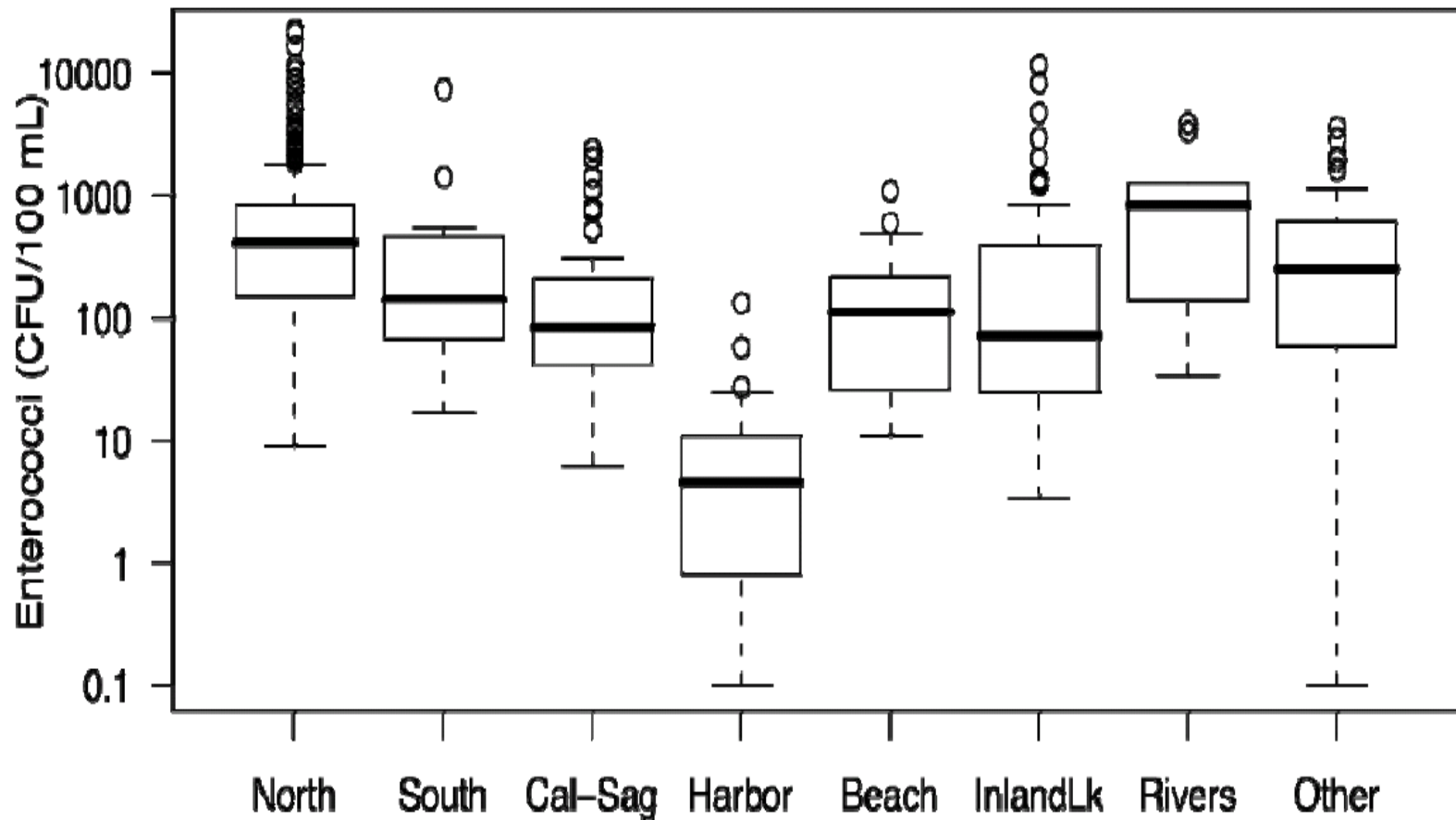
Data analysis approach: For each health endpoint...

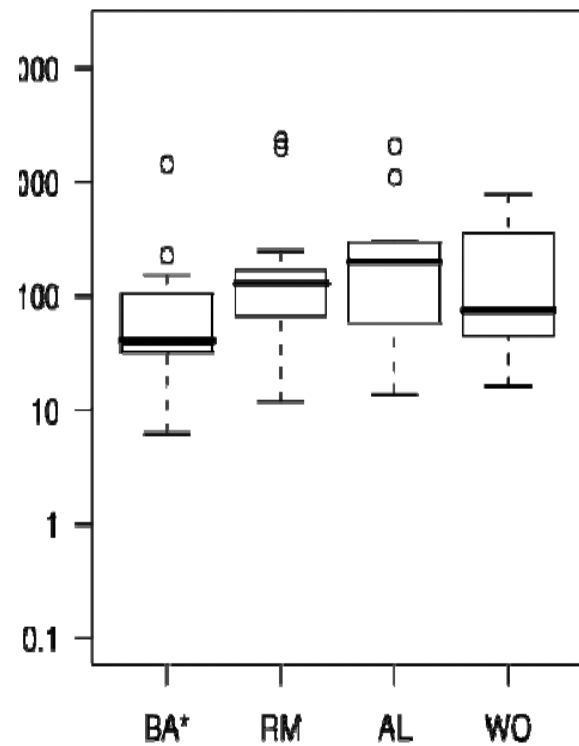
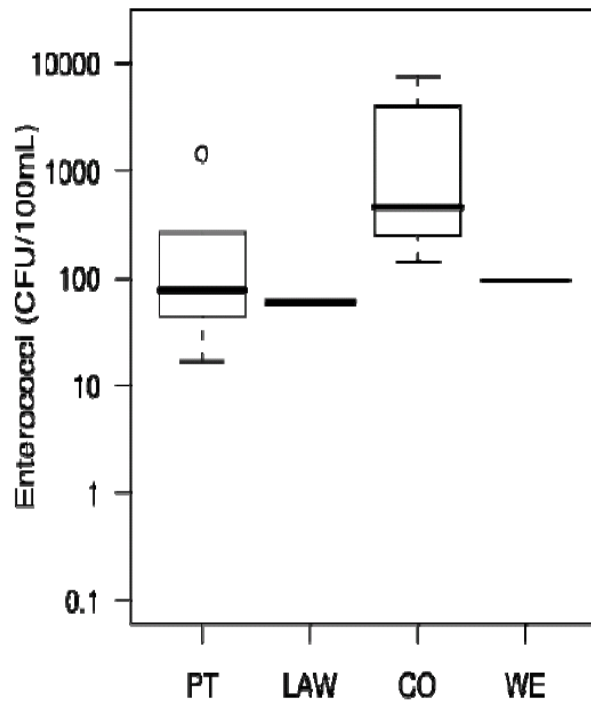
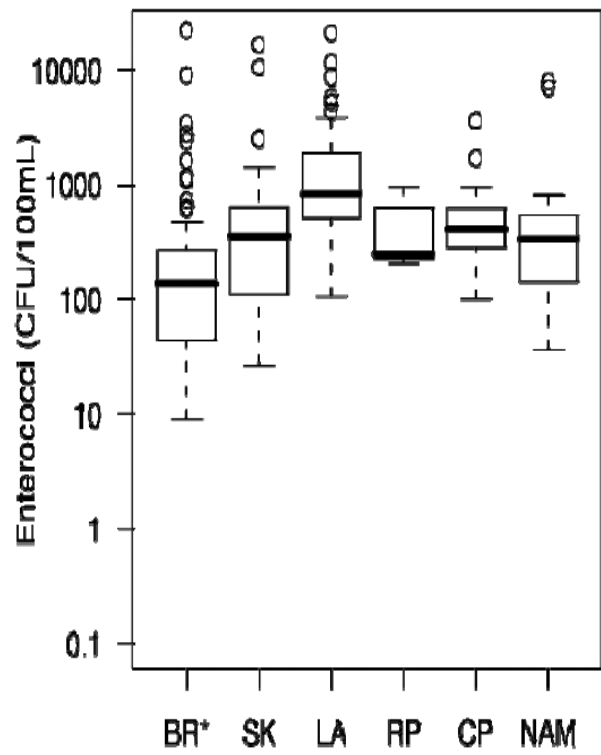
- 1. Develop conceptual model**
- 2. Define time windows of interest**
- 3. Bivariate analysis**
- 4. Multivariate logistic regression**
- 5. Attributable risk calculation**
- 6. Evaluate model assumptions and alternative approaches**

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





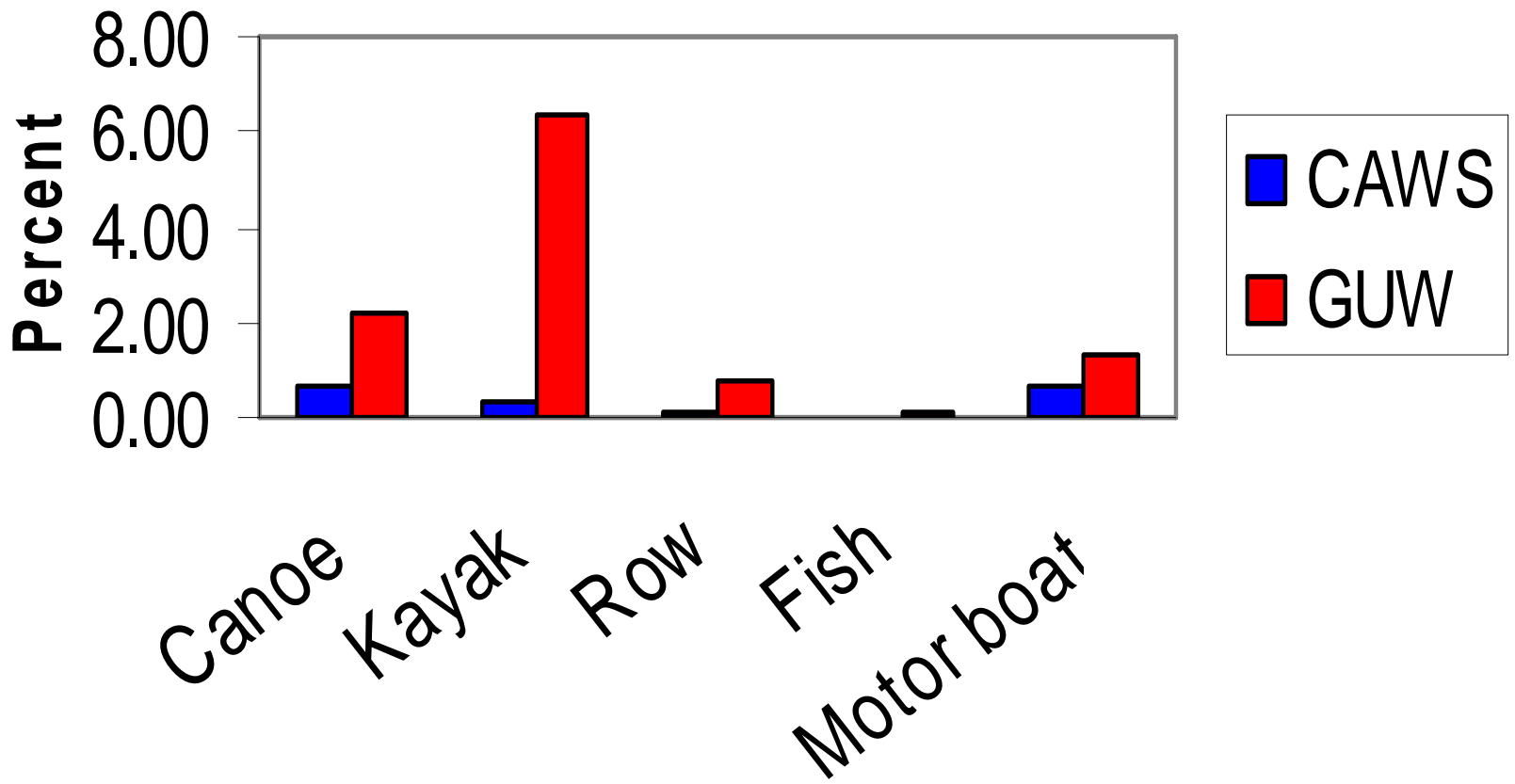
Study participants

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

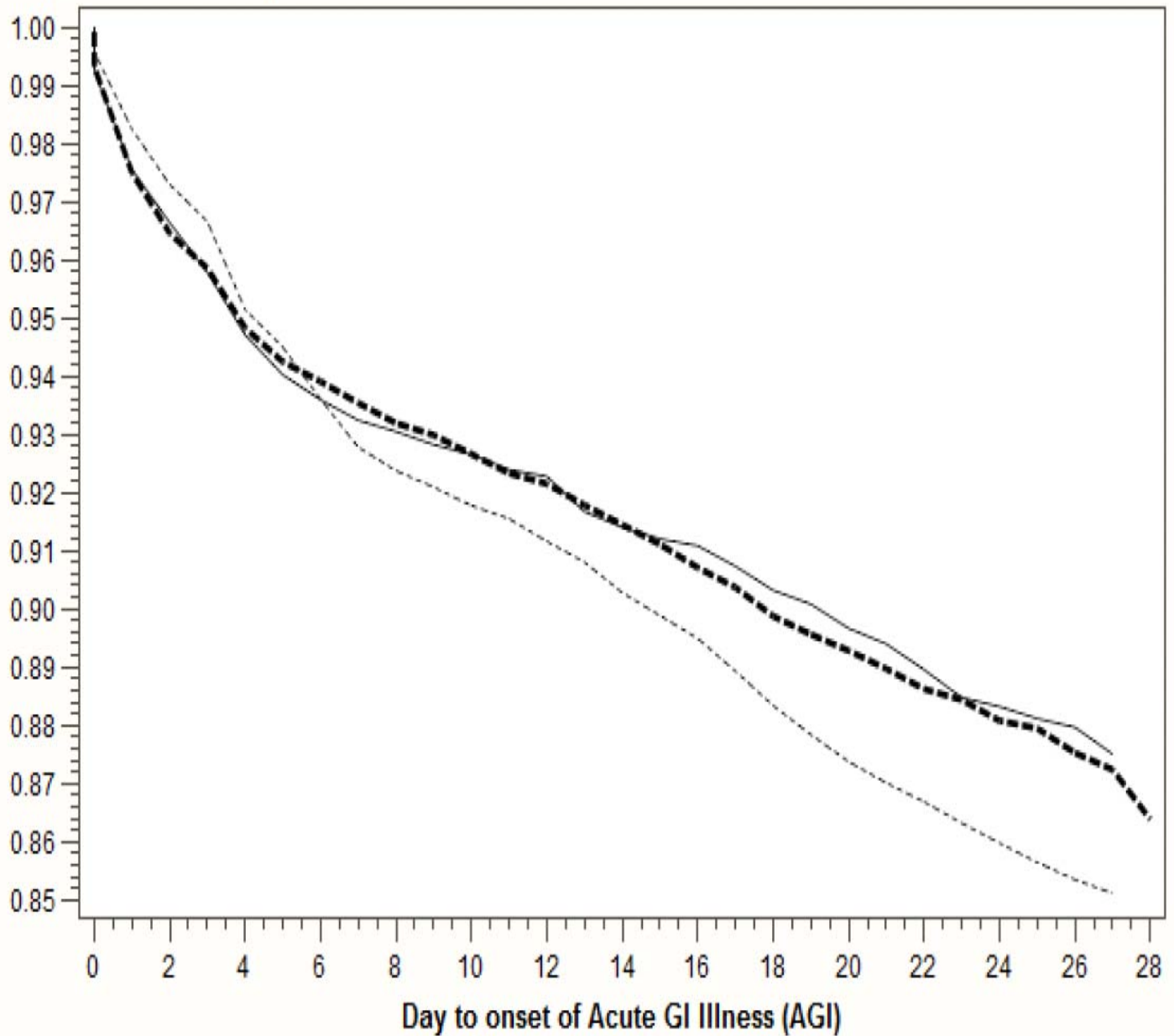
Water recreation activities

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

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

CAWS	45.4
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UNX	32.9
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Difference	12.5
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Cases of gastrointestinal Illness attributable to water recreation, per 1,000 uses

GUW	46.3
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UNX	32.9
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Difference	13.4
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Cases of gastrointestinal illness attributable to water recreation, per 1,000 uses*

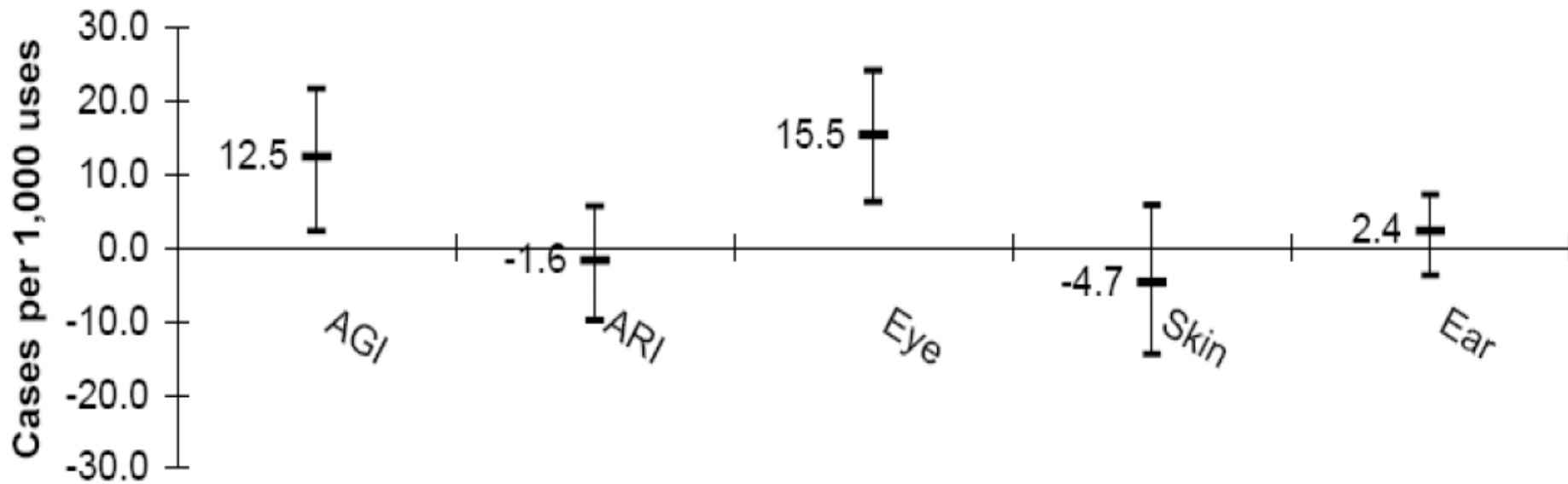
CAWS	43.6
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GUW	-43.0
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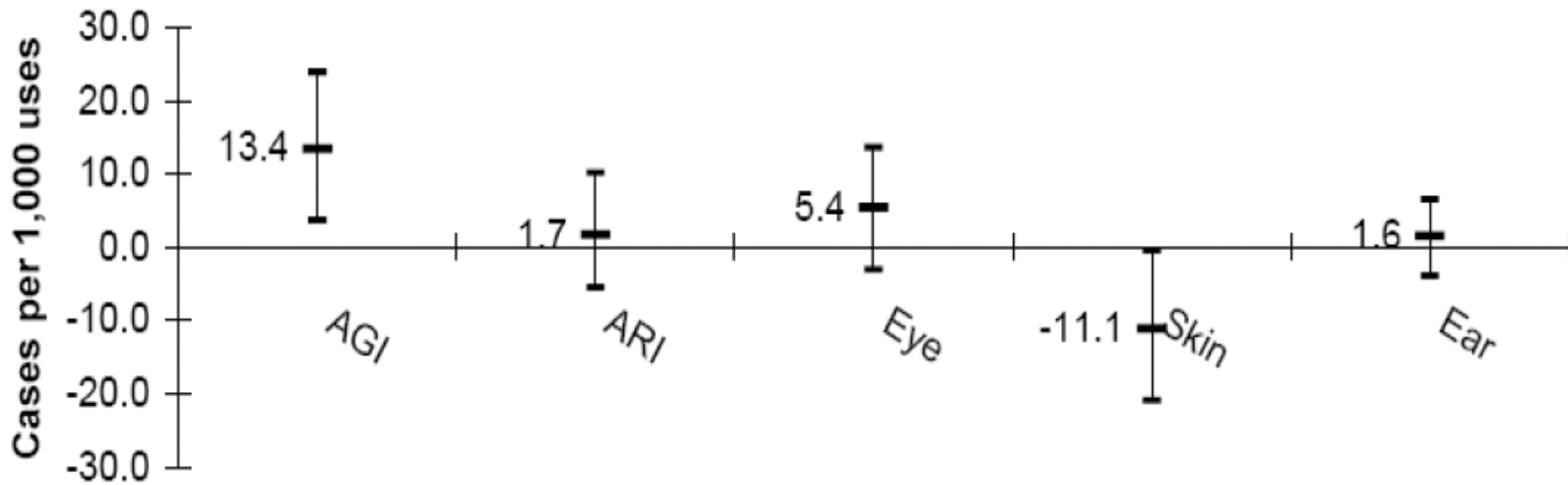
Difference	0.6
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*Takes into account differences in recreational activities and water exposure

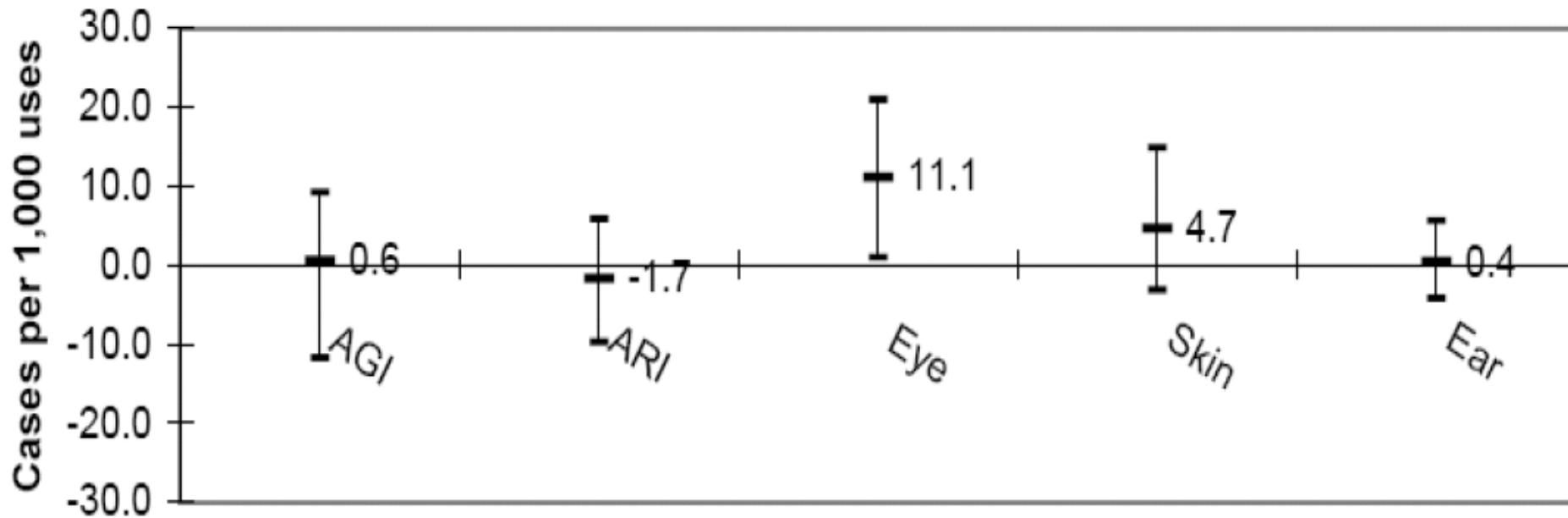
CAWS – Unexposed Differences



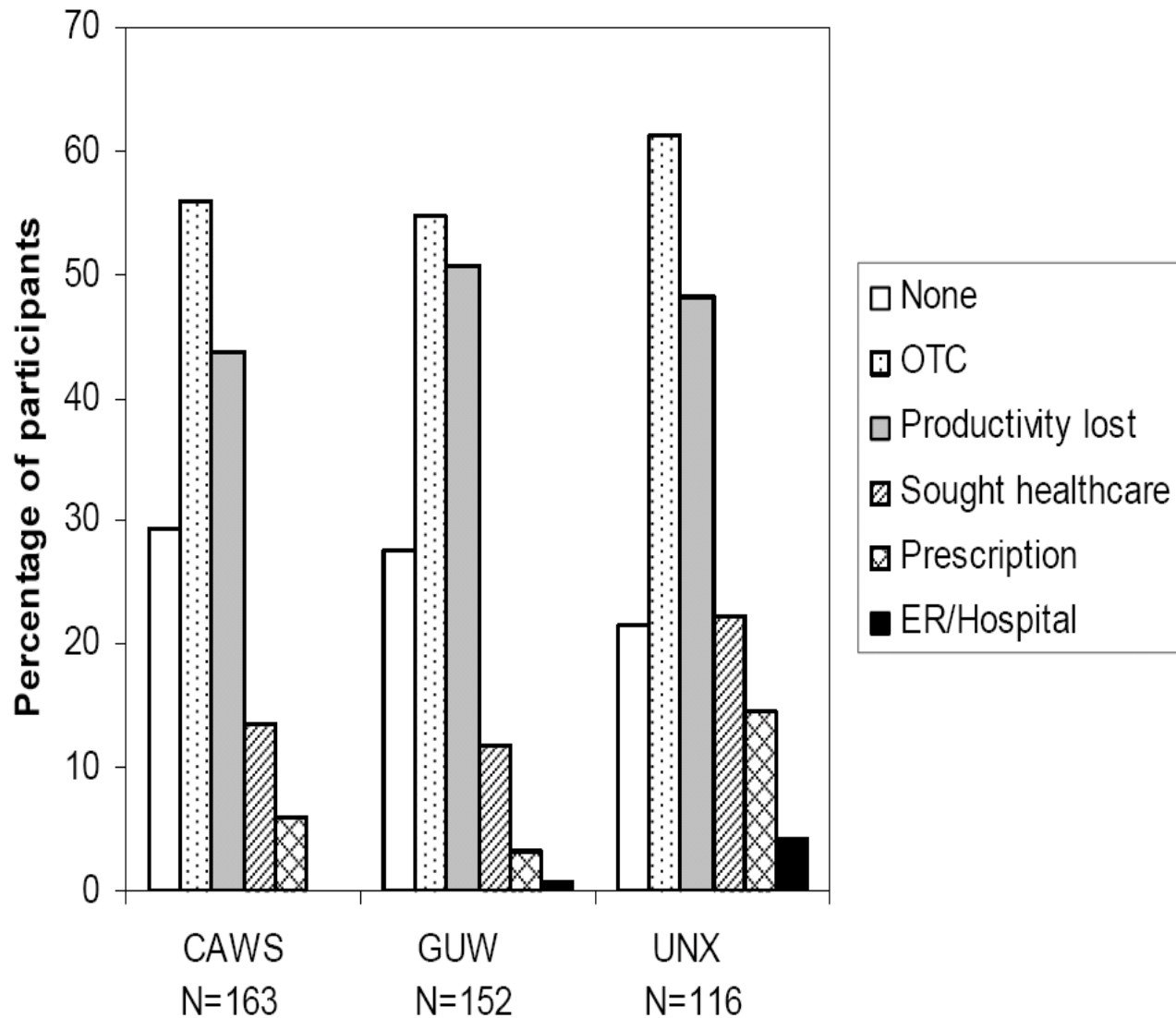
G UW – Unexposed Differences



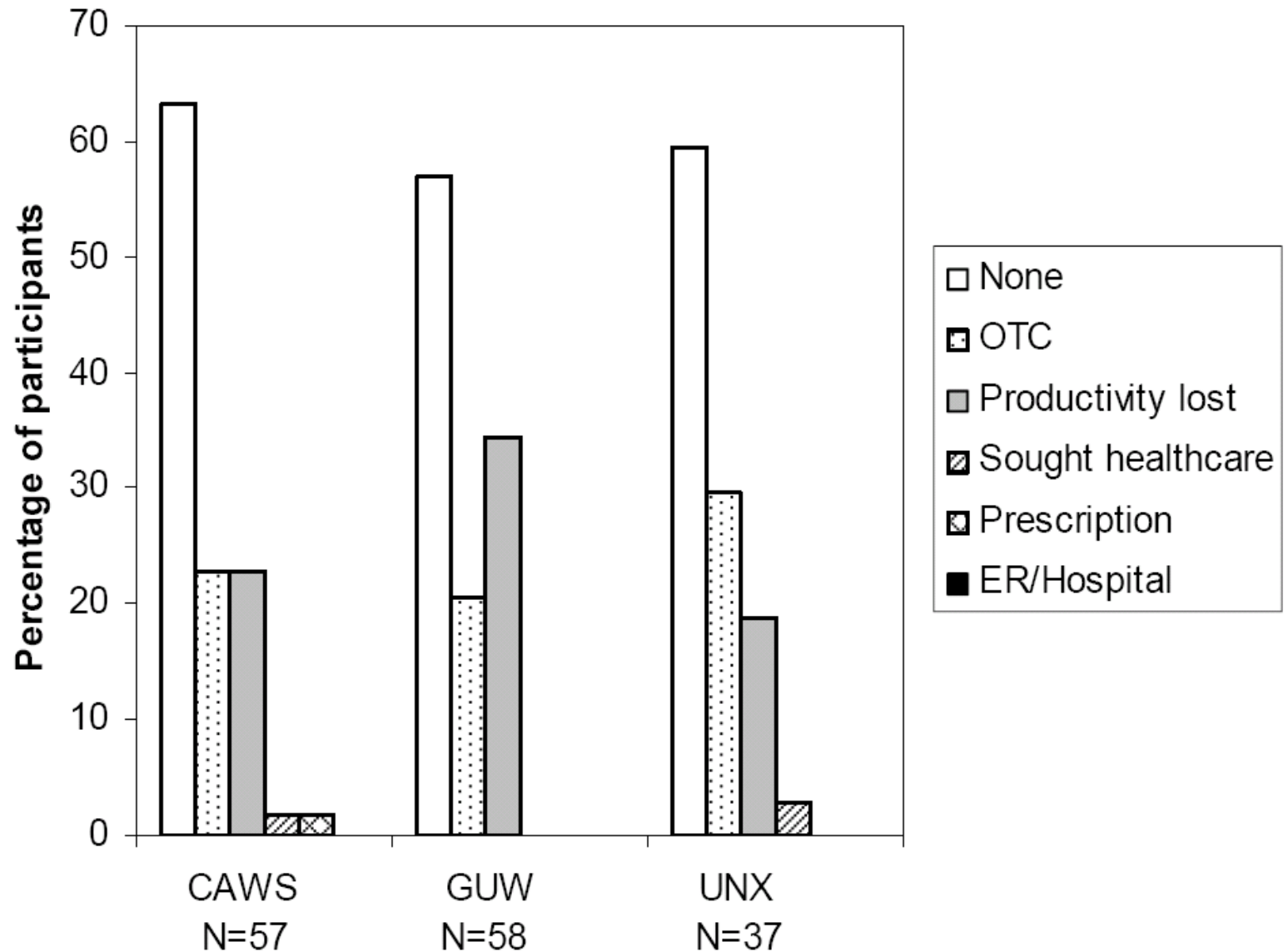
CAW – G UW Differences



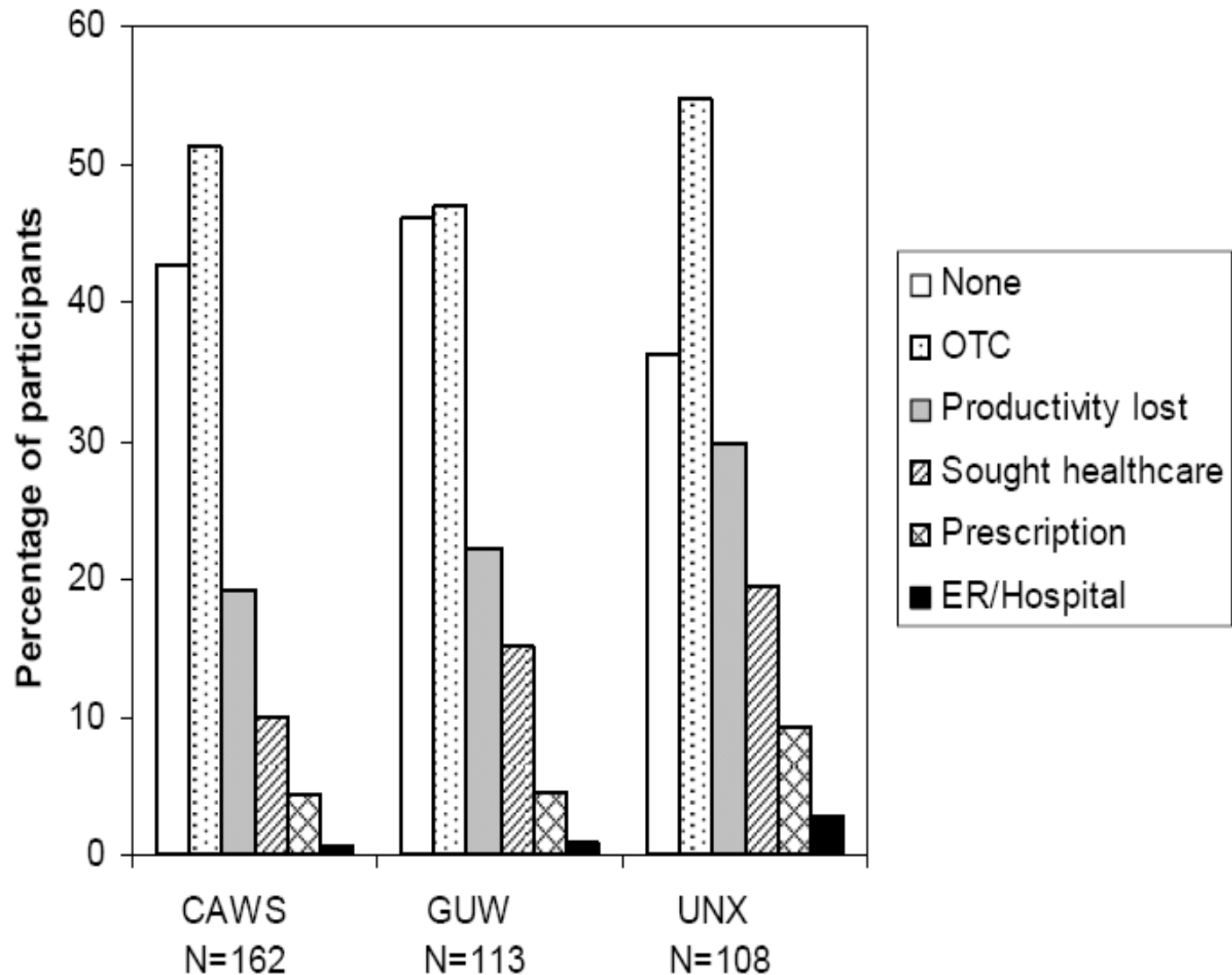
Severity – Any AGI



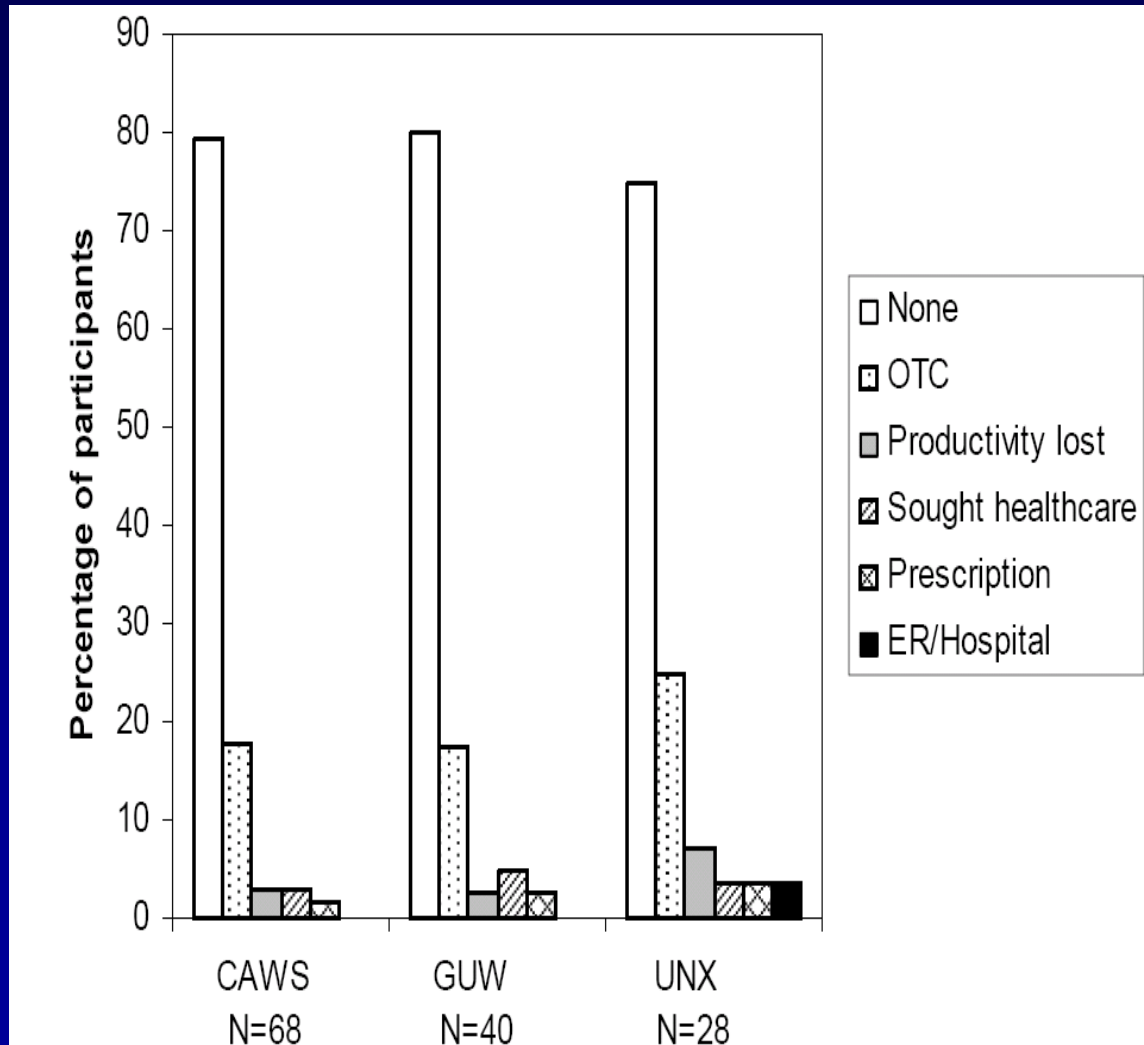
Illness Severity: AGI only



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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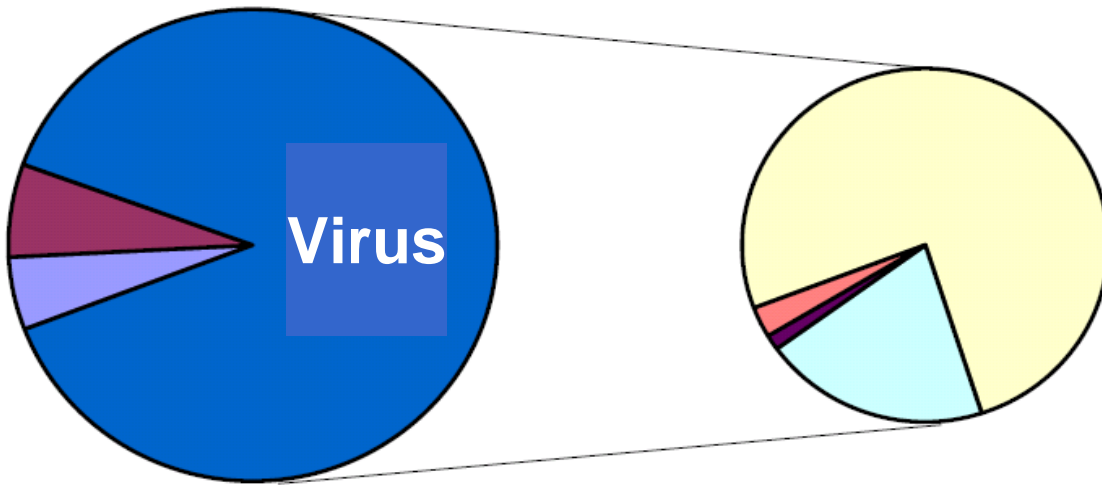
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2,467 (22.4%) developed GI symptoms*

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

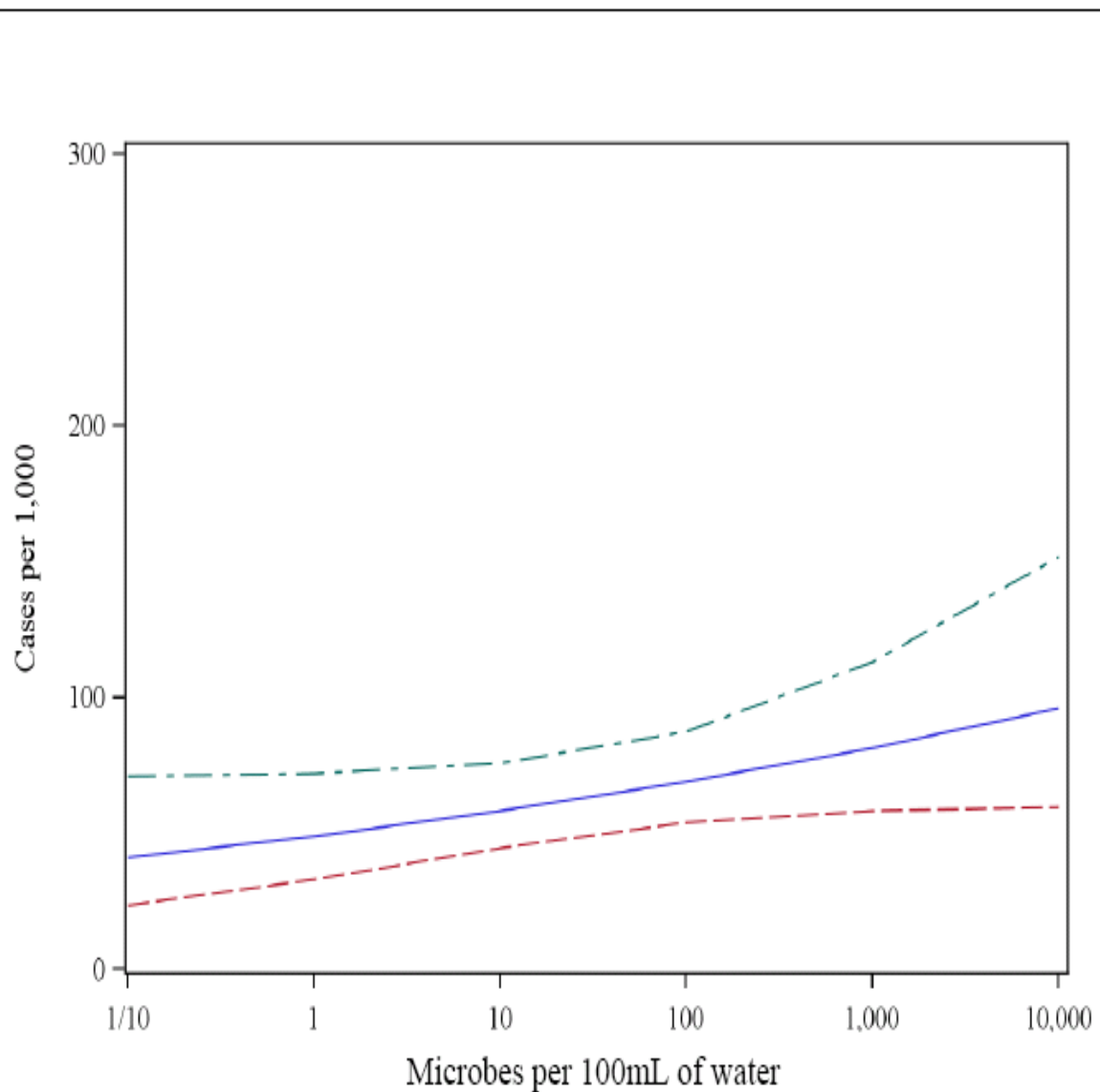
<u>Group</u>	<u>% positive</u>
CAWS	8.6
GUW	10.5
<u>UNX</u>	<u>11.3</u>
Total	10.2

What we didn't find

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



Ongoing analysis: Study objective #2



Ongoing analysis (example)

Excess Cases per 1,000	Microbe concentration per 100mL
5	1
10	10
15	100
20	1,000

Many thanks

- **UIC Survey Research Lab**
- **Peter Scheff**
- **Preethi Pratap**
- **Margit Javor**
- **Buck Hanson**
- **Meredith Wroblewski**
- **Chiping Nieh**
- **Ross Gladding**
- **Suraj Panthi**
- **Leslie Prince**
- **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**

**This research was funded by the
Metropolitan Water Reclamation
District of Greater Chicago**

**Many thanks to:
Toni Glymph
Dr. Tom Granato
Dr. Catherine O'Connor
Dr. Geeta Rijal**

Questions?

