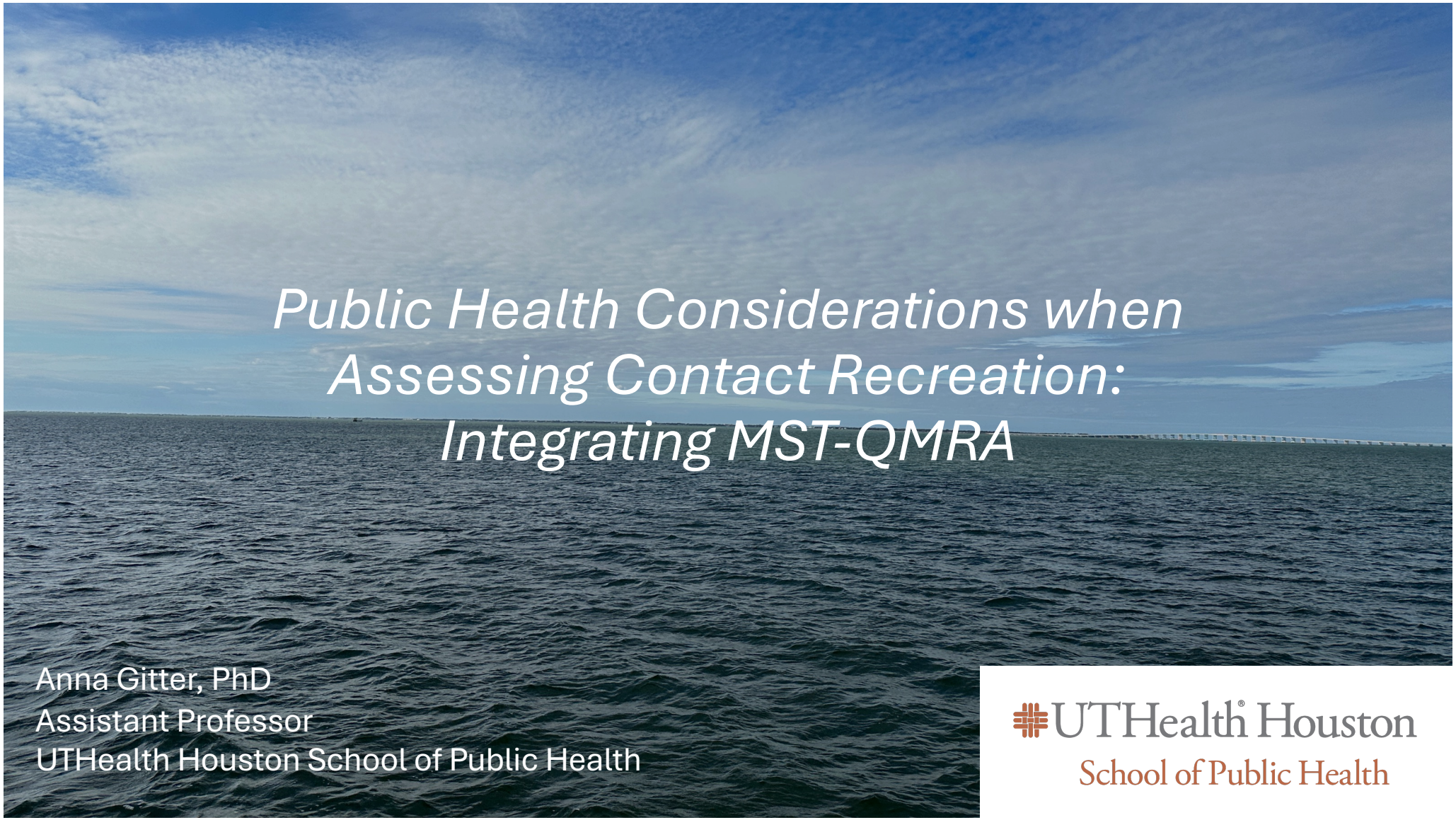
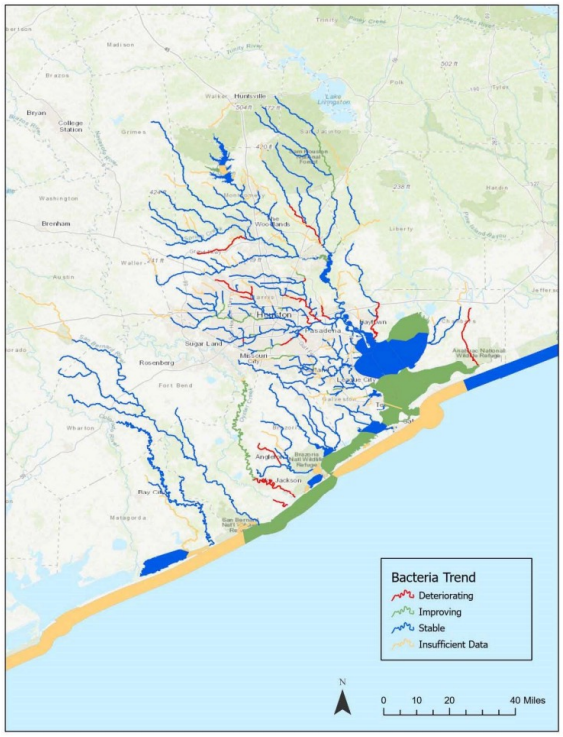


Public Health Considerations when Assessing Contact Recreation: Integrating MST-QMRA

Anna Gitter, PhD
Assistant Professor
UTHealth Houston School of Public Health

UTHealth® Houston
School of Public Health

Beyond Trends and WQ Standards…



Source: HGAC 2024
Basin Highlights Report

Summary 2024 Texas Integrated Report for Clean Water Act, §305(b) and §303(d)

Parameters by Type	Media	Use	2022 Cat 5	2024 Cat 5	2024 Impairments (Categories 4 and 5)					Restored/ Protected[4]
					All	WQS Review[1] (5b)	WBP[2] in Progress	Action TBD (5c)	WBP in Place[3]	
Bacteria	In water	Recreation	342	350	567	83	25 (5a) 17 (5r)	153	214 (4a) 3 (4b) 72 (5r)	289
		General Use	2	1	1	-	-	1	-	-
	In shellfish	Oyster Waters	10	20	32	-	-	20	12 (4a)	-
	Beaches	Beach Use	4	4	6	-	2 (5a)	2	2 (4a)	-

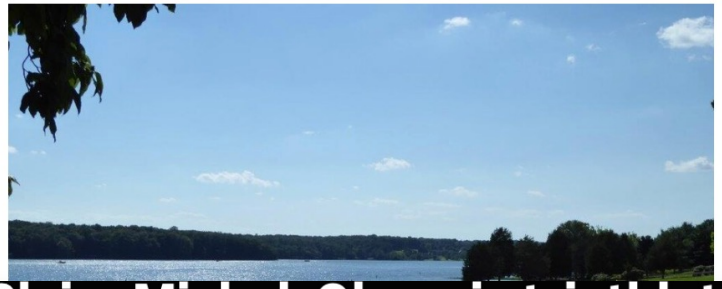
Source: TCEQ 2024 (https://www.tceq.texas.gov/downloads/water-quality/assessment/integrated-report-2024/2024-exec-summ.pdf)

D.C., Md. & Va. The District Maryland Virginia Crime & Public Safety Local Education Obituaries Transportation Capital Weather Gang

Lake Anna bacteria levels safe, Va. says; E.coli outbreak cause unclear

Tests show Lake Anna water meets benchmarks for safe swimming, Virginia health officials said, after at least 25 recent visitors were diagnosed with E. coli infections.

4 min 49



Advert

Claire Michel, Olympic triathlete who fell ill after swim in Seine River, says a virus made her sick

The New York Times

Keep Your Mouth Closed: Aquatic Olympians Face a Toxic Stew in Rio

Share full article 530

TRAVEL & OUTDOORS

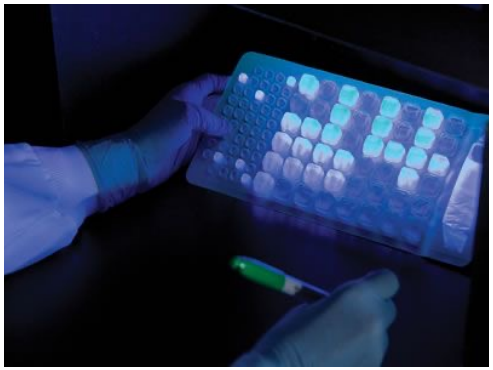
Are Texas Waters Clean Enough for Swimming? (Short Answer: Yes)

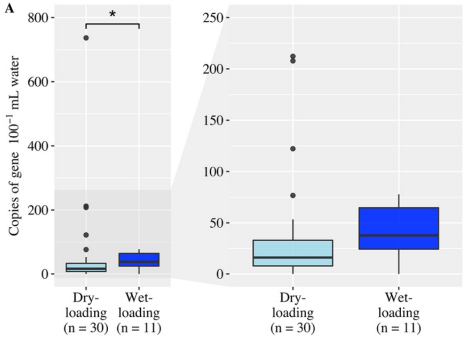
The bad news: Texas beaches really do have a fecal pollution problem. The good news: it's complicated.

By Peter Holley June 2024 1

Measuring water quality

Water sampling → Measure FIB → Quantify fecal markers → Data analysis





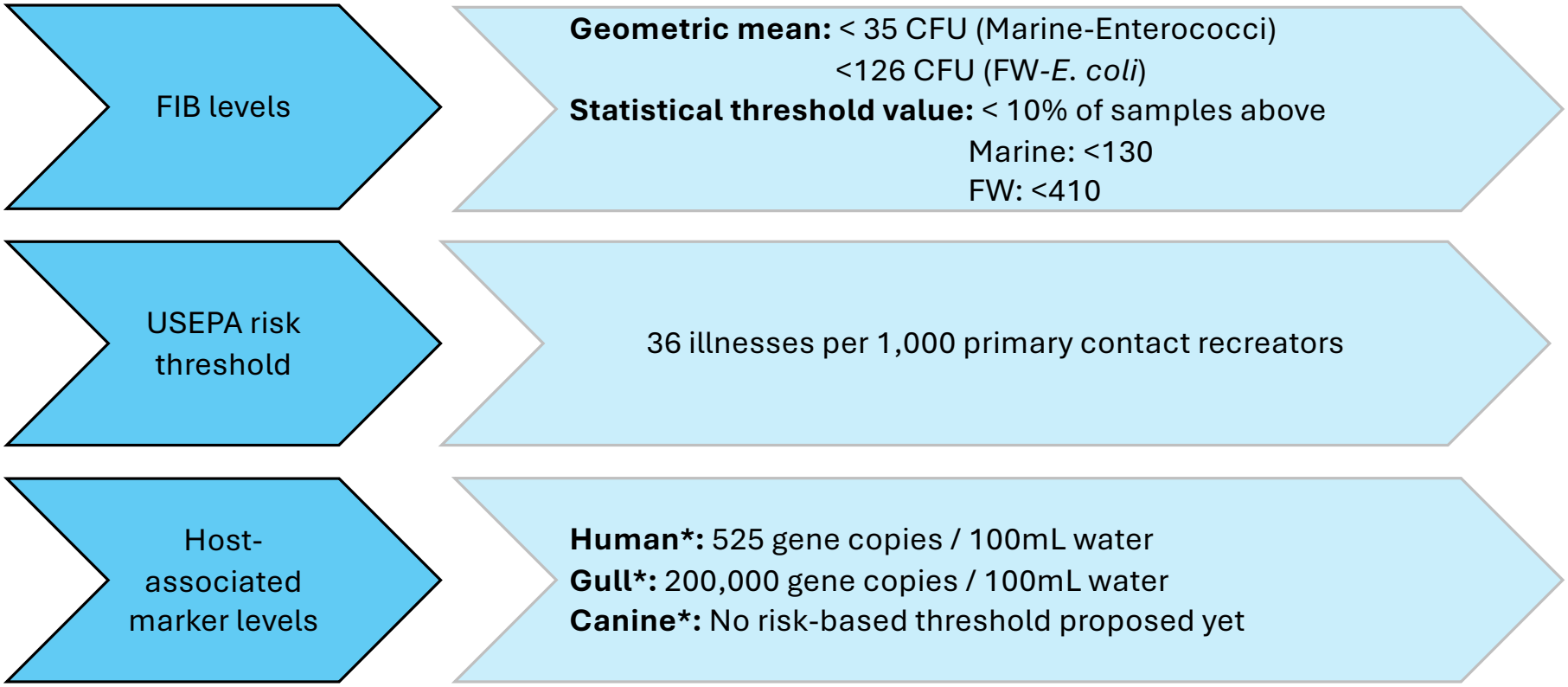
Slide Credit: Nicole Powers, PhD

Are all fecal sources equal?

(Source Molecular, 2012)

Slide Credit: Nicole Powers, PhD

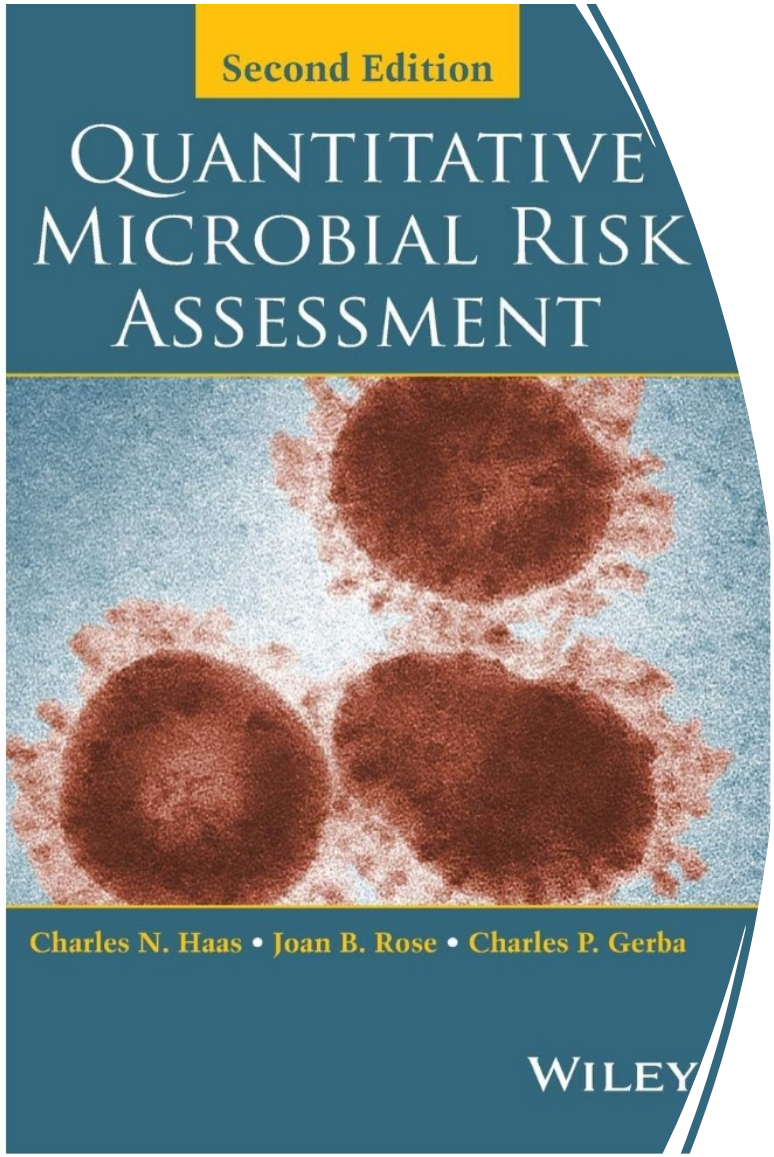
Water Quality Standards



*Each proposed risk-based threshold is based on the assumption that no other sources of fecal pollution are present (Boehm and Soller, 2020)

Slide Credit: Nicole Powers, PhD

Human Health Risk Assessment

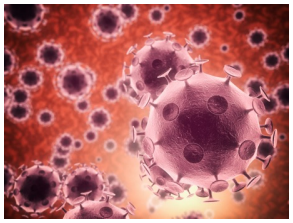


Quantitative Microbial Risk Assessment

- Follows the chemical risk assessment framework
- Accounts for nature of biological contaminants and host-pathogen relationship
- Typically acute exposure
  - Infection/illness
- Validated by WHO, U.S. EPA, NHMRC (Australia)
- Can evaluate health risks from pathogens and FIB
- Uses secondary data (literature, field data, etc.)

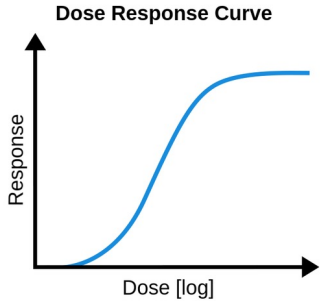
QMRA

Hazard Identification → Exposure Assessment → Dose-Response → Risk Characterization



Identify pathogens of greatest concern

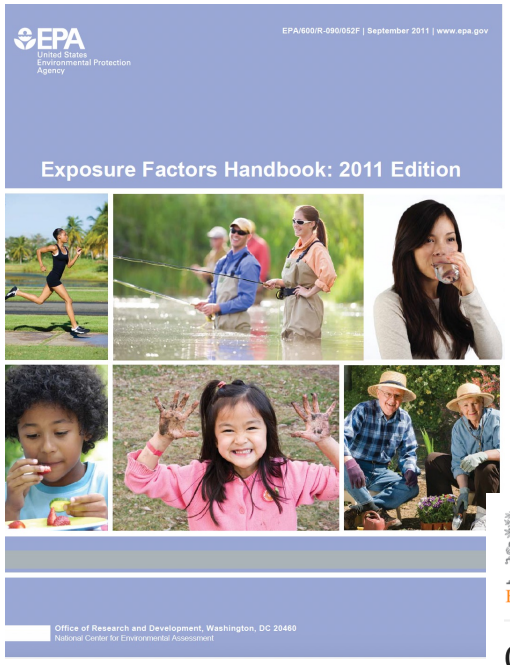
Exposure pathway: ingestion of water



Probability of risk of infection
Probability of risk of illness

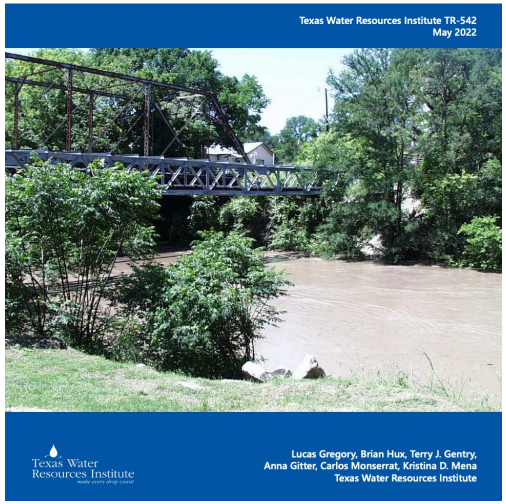
Estimate risks based on all markers, compare to EPA risk threshold (32 or 36 illnesses per 1,000 recreation events)

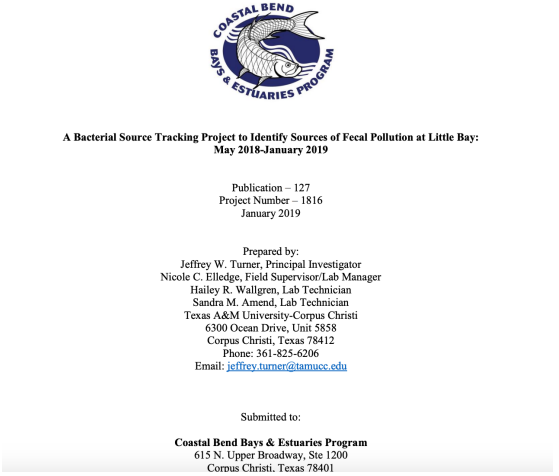
Data we use...



Published Handbooks/Reports

Texas Bacterial Source Tracking Program (FY20-FY21)





Field Data

Peer-reviewed literature

ELSEVIER
Water Research
Volume 111, 15 March 2017, Pages 366-374

Occurrence of norovirus in raw sewage – systematic literature review and meta-analysis

Sorina E. Eftim [a], Tao Hong [a], Jeffrey Soller [b], Alexandria Boehm [c], Isaac Warren [a], Audrey Ichida [a], Sharon P. Nappier [d]

Original Article | Published: 08 November 2017

Child environmental exposures to water and sand at the beach: Findings from studies of over 68,000 subjects at 12 beaches

Stephanie DeFlorio-Barker, Benjamin F Arnold, Elizabeth A Sams, Alfred P Dufour, John M Colford Jr, Steven B Weisberg, Kenneth C Schiff & Timothy J Wade

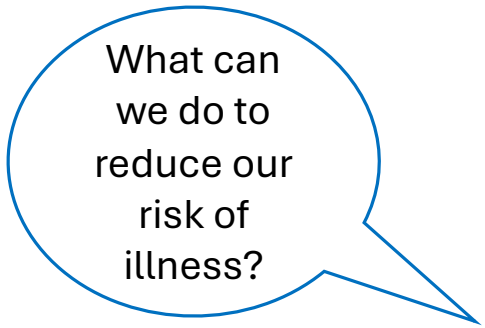
Journal of Exposure Science & Environmental Epidemiology **28**, 93–100 (2018) | Cite this article

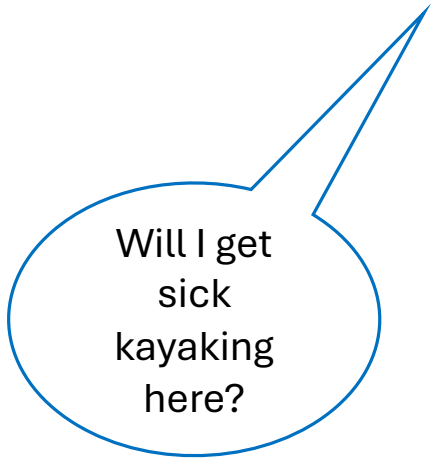
Exposure Scenarios

- Primary Contact Recreation
  - Swimming, wading by children, water skiing (any activity with risk of head submersion)
- Secondary Contact Recreation
  - Kayaking, canoeing, fishing, boating

Human Health Risk Assessment

Can be used to help answer questions regarding safety and exposure risks.





U.S. EPA Risk Threshold for Contact Recreation:
32 or 36 illnesses per 1,000 individuals (0.032 or 0.036)

ACS ES&T Water > Vol 4/Issue 7 > Article

Open Access

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ARTICLE | June 27, 2024

Quantitative Microbial Risk Assessment with Microbial Source Tracking for Mixed Fecal Sources Contaminating Recreational River Waters, Iowa, USA

Tucker R. Burch*, Joel P. Stokdyk, Aaron D. Firnstahl, Sarah A. Opelt, Rachel M. Cook, Joseph A. Heffron, Amanda Brown, Claire Hruby, and Mark A. Borchardt

Water Research 121 (2017) 280–289

Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres

Integrating microbial source tracking with quantitative microbial risk assessment to evaluate site specific risk based thresholds at two South Florida beaches

Anna Gitter*, Maribeth Gidley[2,3], Kristina D. Mena[1], Alesia Ferguson[4], Christopher Sinigalliano[3], Anthony Bonacolta[5,6] and Helena Solo-Gabriele[7]

Check for updates

OPEN ACCESS

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Anna Gitter
anna.gitter@uth.tmc.edu

RECEIVED 21 April 2023
ACCEPTED 20 September 2023

Water Research
Volume 259, 1 August 2024, 121852

Incidence of gastrointestinal illness following wet weather recreational exposures: Harmonization of quantitative microbial risk assessment with an epidemiologic investigation of surfers

Jeffrey A. Soller [a, *], Mary Schoen [a], Joshua A. Steele [b], John F. Griffith [b], Kenneth C. Schiff [b]

[a] Soller Environmental, LLC, 3022 King St, Berkeley, CA 94703, USA

Marine Pollution Bulletin
Volume 144, July 2019, Pages 334-350

Review

The application of quantitative microbial risk assessment to natural recreational waters: A review

Two risk assessments: Evaluating the use of indicator HF183 *Bacteroides* versus pathogen measurements for modelling recreational illness risks in an urban watershed

K. Skiendzielewski [a], T. Burch [b], J. Stokdyk [c], S. McGinnis [a], S. McLoughlin [a], A. Firnstahl [c], S. Spencer [b], M. Borchardt [b], H.M. Murphy [a d]

Show more

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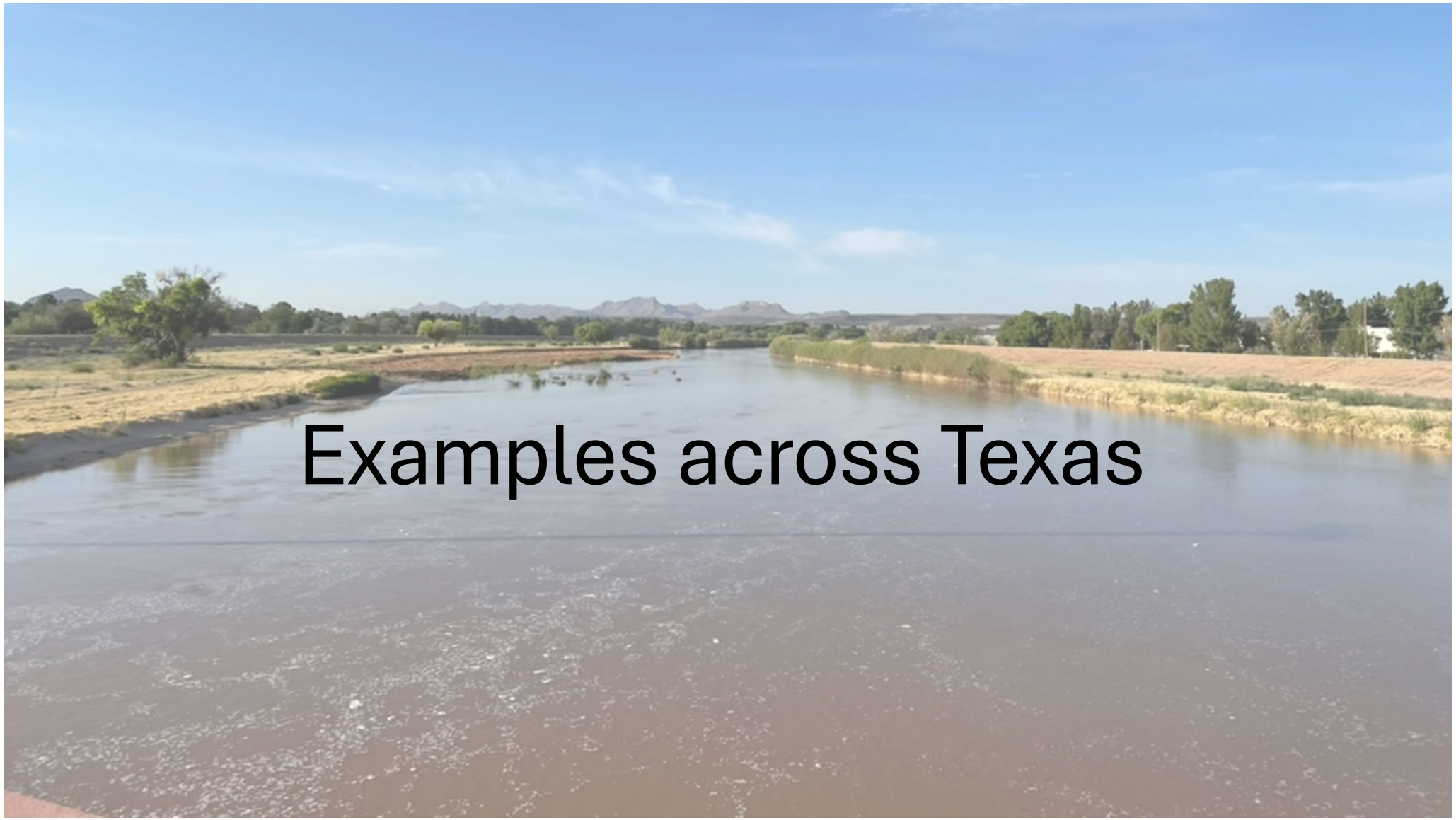
Quantitative Microbial Risk Assessment to Estimate Illness in Freshwater Impacted by Agricultural Animal Sources of Fecal Contamination

U.S. Environmental Protection Agency

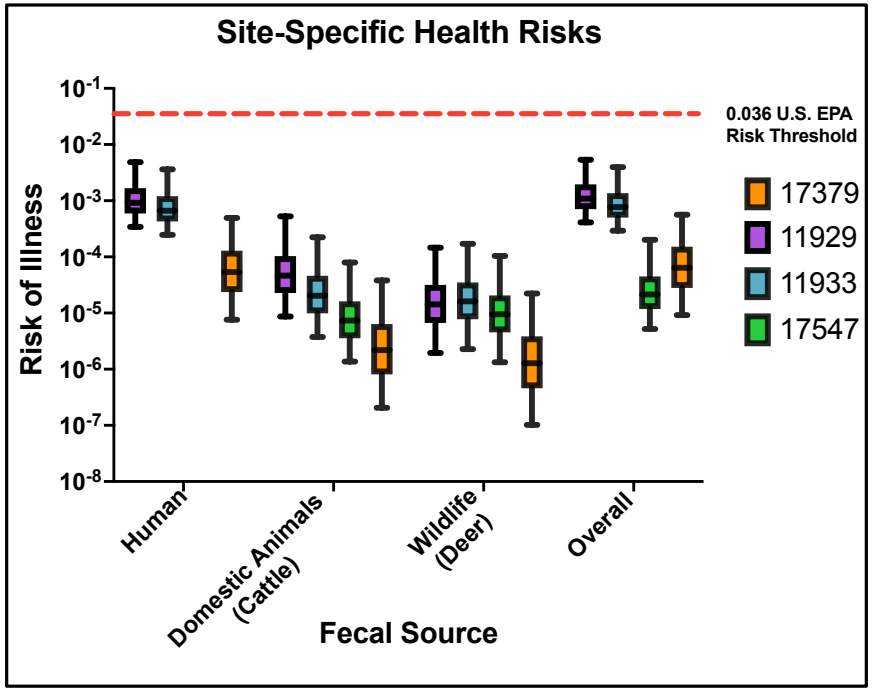
Microbial Risk Analysis
Volume 16, December 2020, 100139

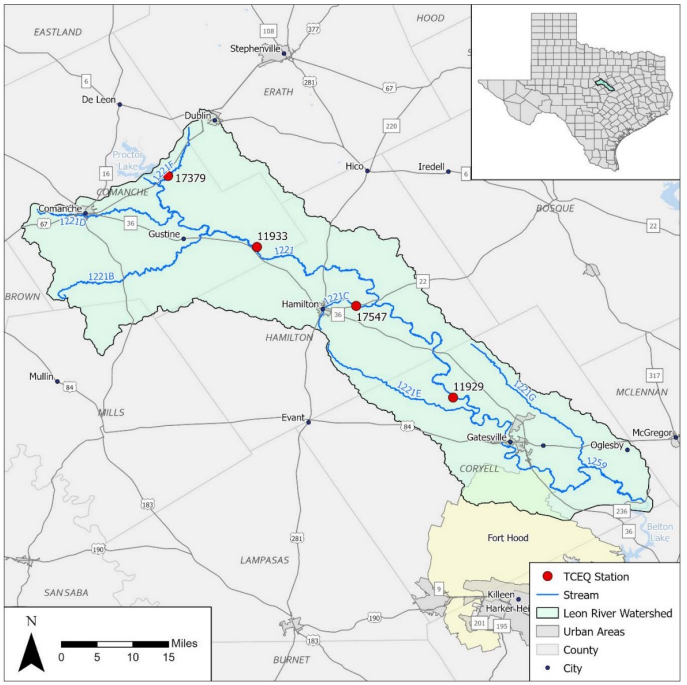
Refined ambient water quality thresholds for human-associated fecal indicator HF183 for recreational waters with and without co-occurring gull fecal contamination

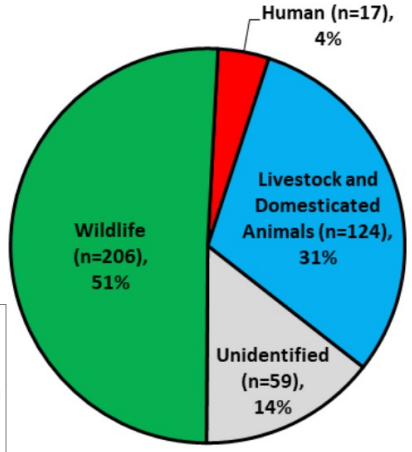
A.B. Boehm [a], J.A. Soller [b]


Examples across Texas

Leon River (Central Texas)







State of Texas BST Grant FY20-22

TEXAS STATE Soil & Water CONSERVATION BOARD

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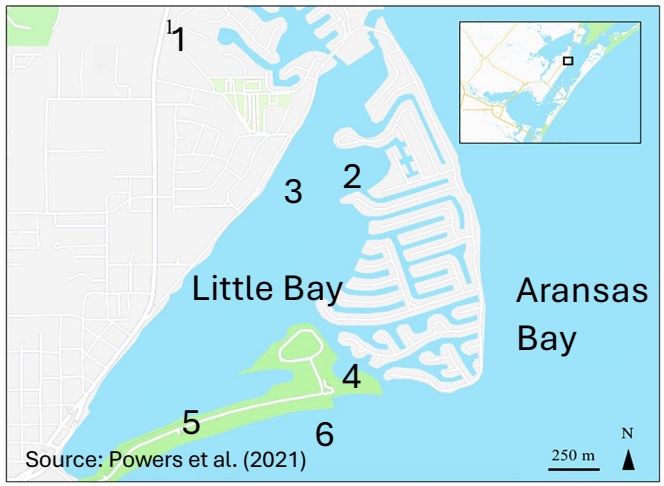
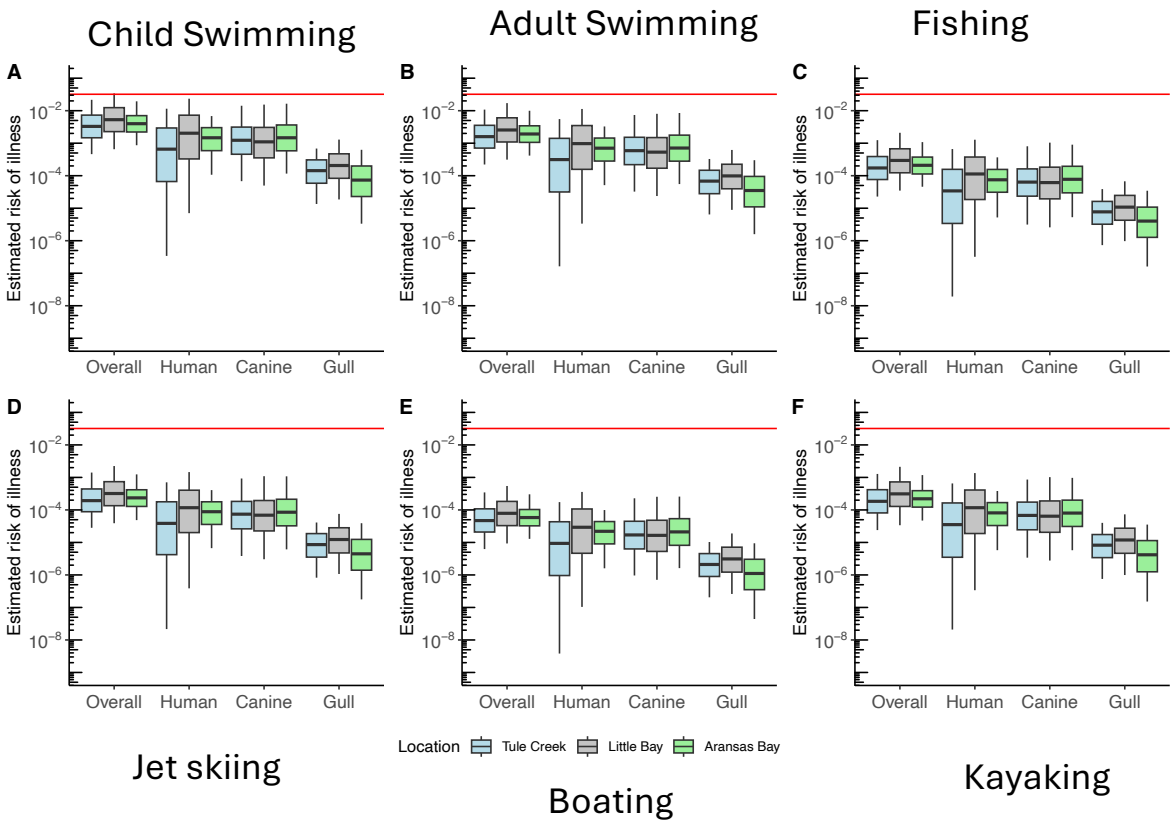
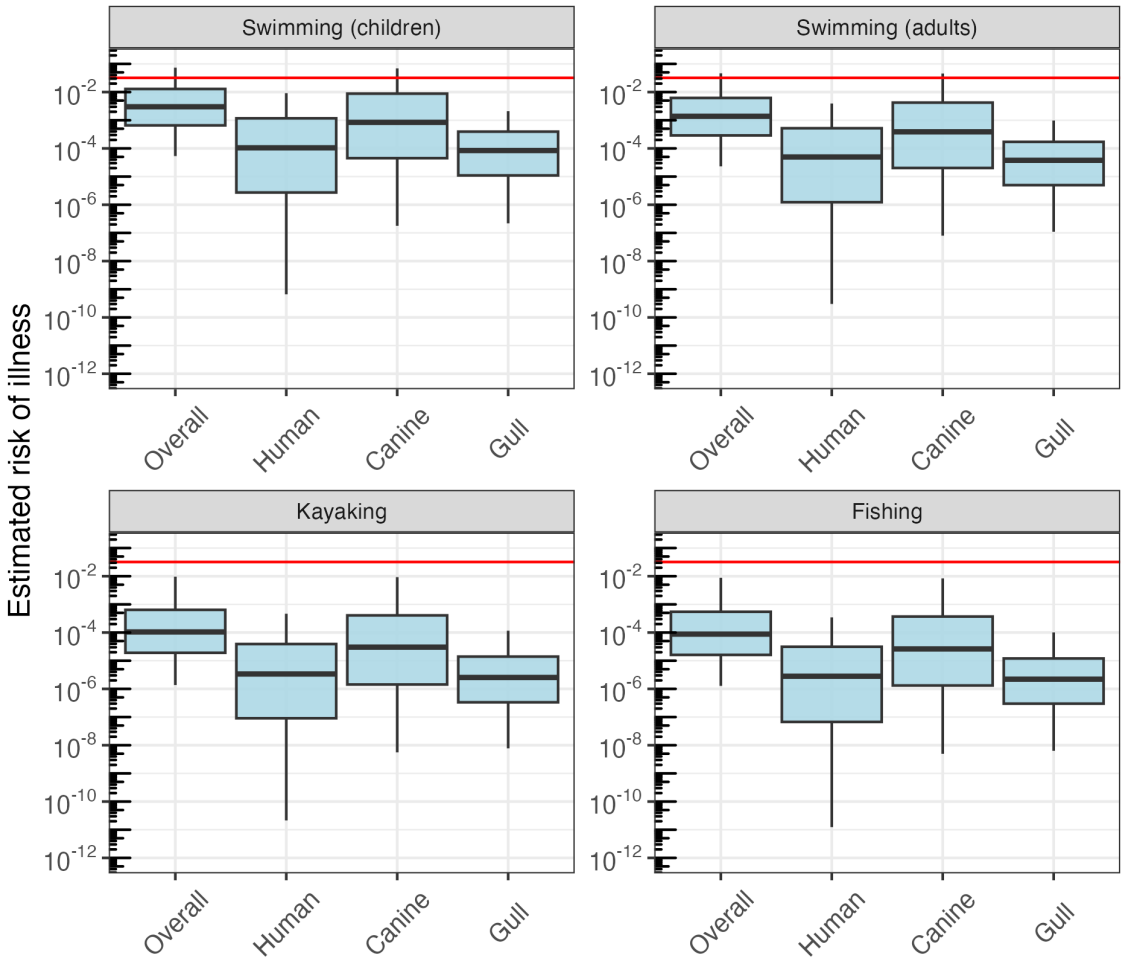
Little Bay (Rockport, Texas)





Red line = 32 illnesses per 1,000 people

City-by-the-Sea (Canal Community on TX Coast)



(Powers et al., under review)

Slide Credit:
Nicole Powers, PhD

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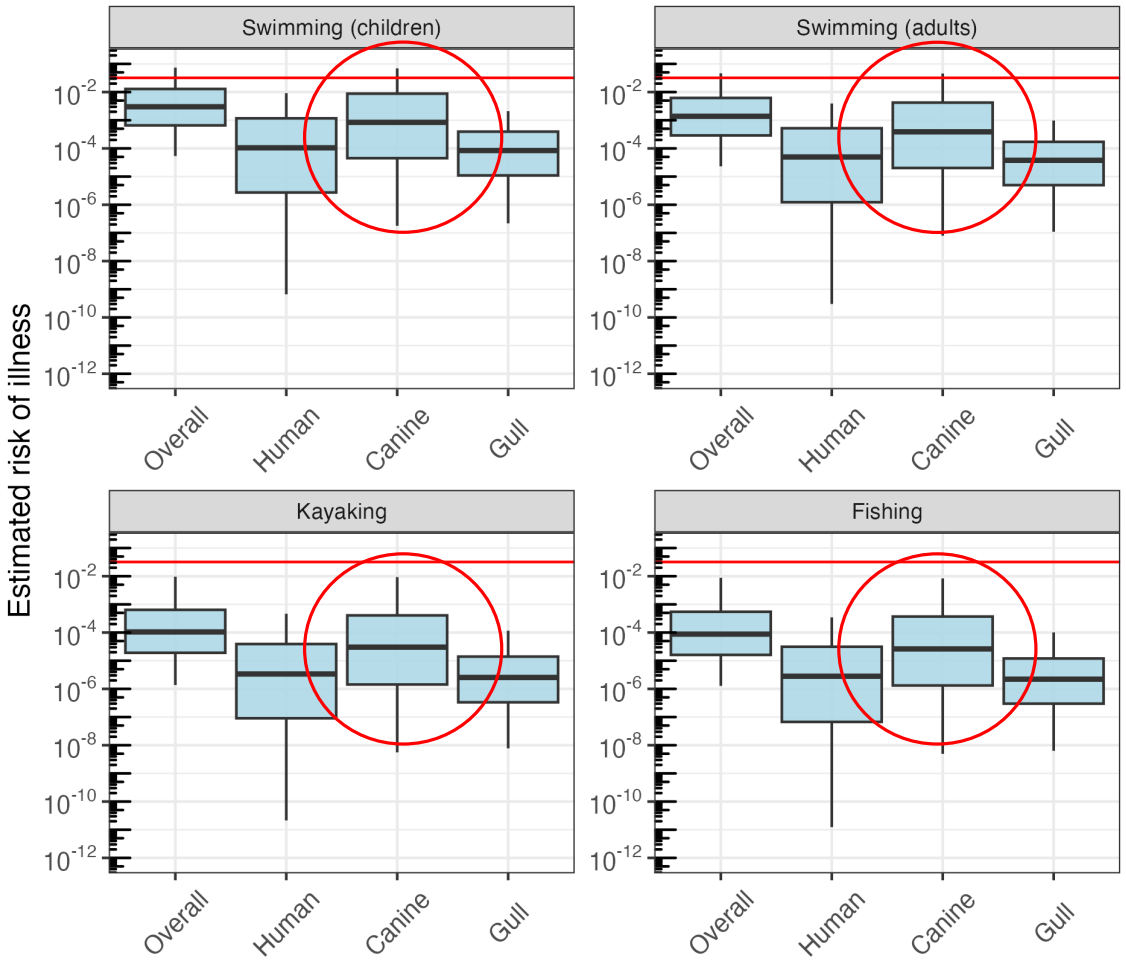
City-by-the-Sea (Canal Community on TX Coast)



(Powers et al., under review)

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Slide Credit: Nicole Powers, PhD

Gitter et al. (2023)

Haulover Beach (Florida)

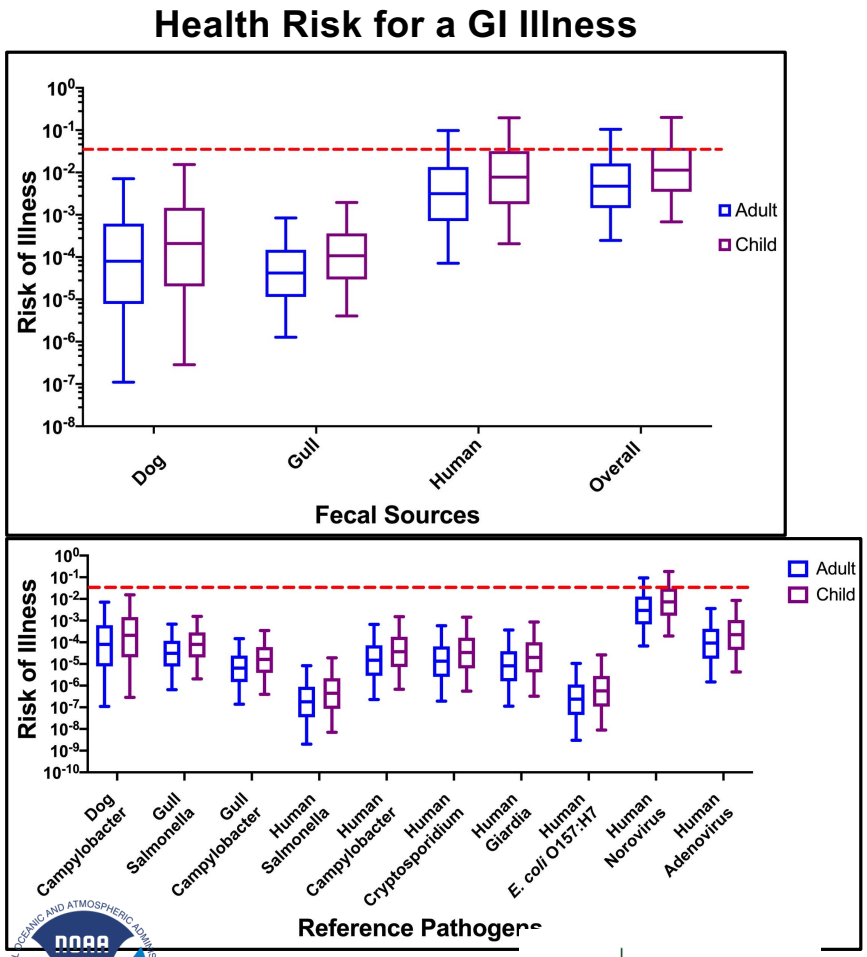

FIGURE 1
Location and photographs of study beaches in Miami Dade County, Florida, for the beach exposure and child health study.

U.S. EPA risk threshold: 36 illnesses per 1,000 individuals (0.036)

Key findings so far…

- Not all fecal sources created equal…
  - Human fecal source often drives risk (but not always the case)
  - Cattle fecal source can contribute a significant health risk (as supported by U.S. EPA guidance)
  - What about dogs?
  - Evidence suggests that greatest risk stems from multiple fecal sources contributing
- Current approaches addressing water quality through bacteria loading may not capture the health risks associated with pathogens

UNIVERSITIES COUNCIL ON WATER RESOURCES
JOURNAL OF CONTEMPORARY WATER RESEARCH & EDUCATION
ISSUE 176, PAGES 36-49, AUGUST 2022

Total Maximum Daily Loads and *Escherichia coli* Trends in Texas Freshwater Streams

*Michael Schramm[1], Anna Gitter[2], and Lucas Gregory[1]

[1]*Texas Water Resources Institute, Texas A&M AgriLife Research, College Station, Texas*
[2]*University of Texas Health Science Center at Houston, School of Public Health, El Paso, Texas*
**Corresponding author*

- TMDLs not statistically associated with decreasing *E. coli* concentrations in water bodies
- Time to identify innovative approaches to address water quality?
  - MST
  - QMRA
  - Site-specific considerations (site specific alternative water quality criteria)

Who is interested (aka who will fund it)?

TEXAS STATE Soil & Water CONSERVATION BOARD

QMRA has been added to the last 3 rounds of BST Infrastructure grant funding

U.S. EPA Gulf of Mexico Division currently funding a project in Baffin Bay assessing water quality through MST & QMRA

MST-QMRA study for Little Bay funded by Texas GLO and the Coastal Management Program

Currently working with the Coastal Bends and Bay Estuaries Program for potential funding for a Little Bay continuation project.

It takes a village (of water quality experts)

Anna Gitter, PhD

Nicole Powers, PhD

Valeria Ruvalcaba, MPH

Texas Water Resources Institute
make every drop count

TEXAS A&M AGRILIFE RESEARCH

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