Indicators as predictors of gastrointestinal illness among limited-contact recreators

Illinois Water 2012

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Adverse health outcomes following water recreation

- Injury
- Gastrointestinal illness
- Respiratory illness
- Skin symptoms
- Eye symptoms
- “Swimmer’s ear”
Gastrointestinal illness

- **Waterborne disease outbreaks**
  - Source of info: CDC/EPA surveillance system
  - Treated water
  - Untreated water

- **Sporadic cases of illness**
  - Source of info: epidemiologic studies, statistical models (Quantitative Microbial Risk Assessment – QMRA)
The Waterborne Disease Outbreak Surveillance System (WBDOSS)

- 2007-2008: 134 outbreaks, 13,966 cases
- 18 outbreaks, cases in untreated waters, 486 cases
- Causative agent in “untreated water” outbreaks:

- **Norovirus** 27.3%
- **Cryptosporidium spp.** 18.2%
- **Shigella** spp. 18.2%
- **E. coli O157:H7** 9.1%
- **P. shigelloides** 9.1%
- **S. sonnei, norovirus GI, Y. enterolytica** 9.1%
- **G. intestis** 9.1%
- Unidentified 9.1%
Etiology: treated water (n = 70)*

- Cryptosporidium spp.: 82.9%
- G. intestinalis: 4.3%
- G. intestinalis: 4.3%
- Norovirus: 2.9%
- Shigella spp.: 2.9%
- Unidentified: 2.9%
- E. coli O157:H7: 2.9%
- Total: 100%
Consequence of diversity of pathogens

- Measure “indicators”
  - Of fecal contamination?
  - Of human sewage presence?
  - Of human health risk?
  - Of need for public health action... 
    ... but in what time frame?

- Generally used:
  - *E. coli* (culture)
  - Enterococci (culture)

- Coming soon: rapid molecular methods
Limited contact recreation

Limited health risk information
CHEERS: The Chicago Health, Environmental Exposure and Recreation Study
Study design: Prospective cohort, three groups, followed for three weeks after recreation

- Unexposed recreators
- GUW recreators
- CAWS recreators
Water sampling

- Indicators
  - *E. coli*
  - Enterococci
  - Coliphages
- Pathogens
  - Giardia
  - Cryptosporidium
- Year 3 (2009)
  - Adenovirus
  - Enterovirus
  - Enterococci qPCR
Results: *E. coli* (CFU/100mL)
Results: Health outcomes

- 11,000 + participants with follow-up data
- Gastrointestinal illness more frequent among water recreators (~45/1,000) than non-water recreators (~30/1,000)
- No difference in proportion of CAWS and GUW recreators that developed gastrointestinal illness but more frequent eye symptoms in CAWS vs. GUW (~10/1,000 difference)
Results: Water quality as a predictor of health outcomes

- Overall, after adjusting for multiple covariates, no association between indicators and GI illness occurrence
  - True for E. coli, enterococci, coliphages
Why no predictive value in CAWS indicator?

- Several large studies of swimming at beaches found no association between indicators and GI illness
- Maybe we’re measuring the wrong indicators? Should be measuring pathogens? Infectious pathogens?
- Maybe ingesting even a small dose of pathogens increases risk but taking in additional pathogens doesn’t further increase risk?
- Maybe limited contact recreators don’t ingest enough water/pathogens to cause symptoms?
- Maybe symptoms are due in part to anxiety/perception of risk rather than/in addition to infection?
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Questions?