Surveillance for Outbreaks Associated with Untreated Recreational Water—United States

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Waterborne Disease and Outbreak Surveillance System (WBDOSS)

- Primary source of national data about the scope and effects of waterborne disease outbreaks among persons in the United States
- Initiated in 1971 for drinking water outbreaks by:
  - The Centers for Disease Control and Prevention (CDC)
  - The Environmental Protection Agency (EPA)
  - The Council of State and Territorial Epidemiologists (CSTE)
- Recreational water-associated outbreaks reported since 1978
>2 persons epidemiologically linked by time, exposure to water, and characteristics of illness

And for recreational water, caused by

- Infectious pathogens transmitted by ingesting, inhaling aerosols of, or having contact with contaminated water
- Chemicals/Toxins in the water or chemicals/toxins that volatilize from water
Outbreak Reporting

Surveillance System Attributes

- Voluntary reporting by health departments
- Outbreaks are nationally notifiable (since 2010)
- Passive surveillance (no active search for outbreaks)
- Paper-based from 1971-2008
- Electronic reporting since 2009 via the web-based National Outbreak Reporting System (NORS)

NORS: [http://www.cdc.gov/nors](http://www.cdc.gov/nors)
Outbreak Reporting Process

1. People exposed to a pathogen
2. People get sick and seek treatment
3. Health department notified of possible outbreaks
4. CDC checks data for accuracy and analyzes
5. Health department enters outbreak info into NORS
6. Health department conducts outbreak investigation
7. Data summarized and published
Exposure Classification for Outbreaks

- Drinking Water
- Recreational Water
- “Other,” built environment
Waterborne Pathogens and Chemicals Affect Many Systems

- **Acute gastroenteritis**: Cryptosporidium, toxigenic E. coli, Giardia, Shigella, norovirus, chemicals
- **Skin infections**: Pseudomonas, dermatitis/folliculitis, fungal infections
- **Ear infections**: Pseudomonas
- **Hepatitis**: HAV
- **Urinary tract infections**: Pseudomonas
- **Neurologic infections**: Echovirus, Naegleria fowleri
- **Eye infections & irritation**: Acanthamoeba keratitis, Adenoviruses
- **Respiratory infections & irritation**: Legionella, non-tuberculous mycobacteria, chemicals
- **Acute gastroenteritis**: Cryptosporidium, toxigenic E. coli, Gardia, Shigella, norovirus, chemicals
- **Wound infections**: Vibrio, Aeromonas, Pseudomonas
Outbreak Data Uses

- Surveillance summary reports (http://www.cdc.gov/healthywater/surveillance/rec-water-surveillance-reports.html)

- Other publications, data, and statistics

- Development and support of programs, health promotion, policies. e.g., Healthy Swimming Program, Model Aquatic Health Code, trends in outbreaks involving public water systems provided support for the EPA Ground Water Rule (2006)
Outbreaks Associated with Recreational Water (n=789), by Type of Exposure and Year — United States, 1978–2010

Outbreaks of Acute Gastrointestinal Illness Associated with Recreational Water (n=393), by Type of Exposure and Year
United States, 1978–2010

Outbreaks of Acute Gastrointestinal Illness associated with Treated Recreational Water (n=172) United States, 2001–2010

- Chlorine sensitive: Poor pool operation & maintenance
  - Other* 2.3%
  - *Other includes Salmonella, Campylobacter, Plesiomonas, and multiple pathogens
  - Shigella spp. 4.1%
  - E. coli 2.3%
  - Norovirus 4.7%
  - Giardia 3.5%

- Extremely chlorine tolerant
  - Cryptosporidium spp. (“Crypto”) 76.2%
  - Unidentified 7.0%

*Other includes Salmonella, Campylobacter, Plesiomonas, and multiple pathogens

Outbreaks of Acute Gastrointestinal Illness Associated with Untreated Recreational Water Use, United States, 2001–2010

- Norovirus 19.0%
- Unidentified 19.0%
- Shigella spp. 14.3%
- E. coli 15.9%
- Cryptosporidium spp. (“Crypto”) 15.9%
- Other* 12.7%
- Giardia 3.2%
- * Other includes Campylobacter, Salmonella, Plesiomonas, and multiple pathogens

N=63; Hlavsa MC et al. 2014. MMWR 63(1):6-10
Outbreaks Associated with Untreated Recreational Water (n=209), by Location and Year
United States, 1978–2010

Algal Bloom-Associated Outbreaks Reported to WBD OSS Prior to 2009 (n=5)*

- **Hawaii, August 1981**
  - *Microcoleus lyngbyaceus*, skin symptoms in 14 persons, ocean setting

- **New Hampshire, August 2001**
  - *Oscillatoria* suspected, gastrointestinal symptoms in 42 persons, lake in a state park

- **Nebraska, August 2004**
  - Microcystin, respiratory and skin symptoms in 20 persons, lake setting
  - Microcystin, respiratory and skin symptoms in 20 persons, lake setting

- **Florida, July 2007**
  - *Karenia brevis*, respiratory symptoms in 15 persons, ocean setting


Algal Bloom-associated Outbreaks Reported to CDC, 2009-2010

- 11 outbreaks
- Person
  - 61 cases, 2 hospitalizations, 0 reported deaths
  - 38 (66%) < 19 years of age
- Place
  - Fresh water
  - New York, Ohio, Washington
- Time
  - June–August, 2009-2010

Algal Bloom-associated Outbreaks reported to CDC, 2009-2010 cont.

- 8 outbreak investigations included detection of toxins
  - Microcystins, anatoxin-a, saxitoxin, cylindrospermopsin
- 2 outbreak investigations revealed potential association with fish or dog deaths or bird illness
- Health effects
  - Dermatologic, gastrointestinal, respiratory, and neurologic

Cases of endemic waterborne disease not included

Swimming-related illnesses underreported

National Epidemiologic and Environmental Assessment of Recreational Water (NEEARWater) study \(\rightarrow\) 54,250 beachgoers

Swimmers had higher incidence (unadjusted \(\chi^2\)) of illness (gastrointestinal, respiratory, ear, rash)

No associated outbreaks reported

Historic data reviews have identified previously unreported outbreaks

Source: Collier SA et al. Oct. 2014. JWH
Challenges to Detecting, Investigating and Reporting Recreational Water Outbreaks

- Changes in surveillance
- Wide geographic dispersion of ill swimmers
- Lack of communication
- Small outbreak size
- Transient nature of contamination
- Limited illness severity
- Long incubation period of illness
Building Capacity for Surveillance

- CDC funded in 2013-2014 by the Great Lakes Restoration Initiative to expand surveillance capacity for waterborne disease in Great Lakes (8 states)
- Harmful algal blooms (HABs) and ambient waters

Great Lakes Activities
- Build Great Lakes state surveillance capacity and communication network
- Build regional capacity through state and federal partnerships, data and information sharing
- Build harmful algal bloom reporting module within the National Outbreak Reporting System (NORS)
Harmful Algal Bloom Surveillance Collaboration

- Current working group includes:
  - Former enhanced HAB surveillance states, Great Lakes states
    - FL, IL, IN, IA, KS, MD, MA, MI, MN, NY, OH, OR, SC, VA, WA, WI
  - Federal and other interested organizations
    - CDC, EPA, NPS, NOAA, EPA, USGS
    - IJC
  - IT developers and NORS program staff
Harmful Algal Bloom Surveillance Materials

- Reporting forms
  - HAB environmental data report
  - HAB animal illness case report
  - HAB human illness case report

- Definitions/Reporting criteria
  - HAB events
  - HAB illnesses
Progress Toward Developing a HAB Reporting Module

- GLRI funding
- Fall, 2013
- CDC coordinator
- State-Federal working group
- NOAA-sponsored workshop
- Draft materials revised
- Draft materials revised
- Working group expansion
- IT development activities
- Sep – Nov, 2014
- Apr – Aug, 2014
- Nov 2013 – Mar, 2014
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- HAB Working Group
  - FL, IL, IN, IA, KS, MD, MA, MI, MN, NY, OH, OR, SC, VA, WA, WI
  - CDC, EPA, USGS, NPS, NOAA, IJC
Thank you!

For more information please contact Centers for Disease Control and Prevention

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Questions?