July 2007 volume 03
Infectious Disease Outbreak Newsletter

Waterborne Disease Outbreaks

Waterborne Disease Surveillance

Waterborne disease outbreaks (WBDO) are defined as outbreaks of disease associated with either drinking water or contact with water not intended for drinking, such as recreational water or inhalation of droplets from water systems (e.g. water features, misting systems). WBDO surveillance has been conducted in the U.S. since 1971 by a system maintained through the collaborative efforts of the Council of State and Territorial Epidemiologists (CSTE), the U.S. Environmental Protection Agency (EPA), and the Centers for Disease Control and Prevention (CDC). Data collected by the Waterborne Disease Outbreak Surveillance System are used at the local, state, and federal level to guide policy, develop regulatory rules, and educate the public health community about water safety issues in the United States.[1] Findings are published every other year in the CDC-Morbidity and Mortality Weekly Report (MMWR) Surveillance Summaries. A survey of WBDO surveillance stakeholders in 1995 suggested that 67–90% of WBDOs go undetected or unreported.[2] WBDO detection, investigation, and reporting are usually handled by local and state/territorial public and environmental health professionals. There are no national guidelines that outline investigation methodology and surveillance requirements.[1] However, at a recent meeting of WBDO surveillance stakeholders organized by CDC and EPA a request was made to develop standardized investigation and testing guidelines for states and territories. In addition, it was announced that WBDOs will soon be reported electronically to CDC through eFORS (electronic Foodborne Outbreak Reporting System).

Recreational Water-Related Illnesses

Recreational water-related illnesses (RWI) are illnesses contracted by swallowing, breathing, or having contact with contaminated water from swimming pools, spas, lakes, rivers or the ocean. Exposure to contaminated water can lead to a variety of symptoms involving the gastrointestinal, respiratory, and/or the neurologic systems as well as skin, eyes, or ears. Persons with compromised immune systems (children, pregnant women, elderly, and HIV-infected) are at higher risk for severe complications related to RWI.

In the United States, swimming is one of the most popular summertime activities—especially for children—with an estimated 360 million visits to recreational water. Diarrheal illnesses associated with recreational water use are the most commonly reported RWI, with approximately 19,000 cases reported in the U.S between 1984 and 2002.[3] Parasites such as *Cryptosporidium* (text box) and *Giardia* (text box), bacteria such as *Shigella* and *E. coli 0157:H7*, and viruses such as norovirus and Hepatitis A are pathogens associated with recreational water that cause diarrheal illness. With the exception of norovirus infections, illness related to any one of these organisms is reportable in Georgia. Any cluster of illnesses, regardless of etiology, is also reportable and will be investigated by Public Health.

During 2003–2004, 62 WBDO associated with recreational water were reported from 27 states to the Waterborne Disease and Outbreak Surveillance System. [4] Treated water venues (swimming pools, etc) were associated with the majority of the outbreaks (43; 69.4%) and 90.7% of the ill persons. Untreated water venues (such as lakes and rivers) accounted for 30.6% of the outbreaks but only 9.3% of the total illness cases. Of the 62 reported outbreaks, 30 (48.4%) were characterized by gastroenteritis, 13 (21.0%) dermatitis, and seven (11.3%) acute respiratory illness. WBDO occur most frequently during summer months (June through August) among exposed individuals.

Cryptospordium (text box) is most often implicated as the source of infectious gastroenteritis related to treated water venues. Oocysts can survive for many days in the chlorine levels recommended for swimming pools (1–3 ppm free chlorine).[5] Consequently, other measures besides chlorination must be in place to prevent outbreaks of cryptosporidiosis, such as operator training and community education about healthy swimming practices. CDC has provided extensive information for both aquatics staff and the general public at their website http://www.cdc.gov/healthyswimming/.

Drinking Water-Related Outbreaks

A drinking water-related outbreak is defined as two or more ill persons linked by location, time, and exposure to a water supply (i.e. contaminated drinking water, contaminated commercially bottled water, ice or beverages made with contaminated water, and deficiencies in equipment/devices for which drinking water was used or distributed). Drinking water can be classified or described in multiple ways, including the water system type and the water source. Water

systems are characterized as community (municipal), noncommunity, or individual (wells). Deficiencies in the source of water that are relevant to WBDO include surface water contamination, ground water contamination, and problems with water treatment or distribution. The Safe Drinking Water Act (SDWA) of 1974 gives the United States Environmental Protection Agency (EPA) authority to set standards for public water systems.[6] The Food and Drug Administration (FDA) regulates commercially bottled water. The standards protect drinking water from naturally occurring or man-made contaminants. [6]

During 2003–2004, 30 WBDO associated with drinking water were reported to the Waterborne Disease and Outbreak Surveillance System from 18 states. [6] Approximately 2,760 persons were affected by these outbreaks and four deaths were reported. Twenty-nine (96.7%) of the 30 outbreaks were characterized by acute respiratory illness or acute gastrointestinal illness. Seventeen of the 25 outbreaks with known etiology were associated with an infectious agent and eight (32.0%) were linked to a chemical or toxin. Eight (61.5%) of the 13 bacterial WBDOs were caused by *Legionella* spp. (text box) Of the known chemical/toxin outbreaks, three were associated with high levels of copper, three were found to be associated with bromate and other by-products of disinfection, and two were caused by large amounts of sodium hydroxide in a community water supply. [6]

Cryptosporidiosis

- Causative agent
  - Microscopic parasite: *Cryptosporidium parvum*
- Incubation period
  - 2 to 10 days
- Duration of illness
  - 2 weeks but can be cyclical
- Clinical symptoms
  - Loose or watery stools
  - Non-bloody diarrhea
  - Stomach cramps
  - Possible asymptomatic infection
- Population patterns
  - Immunocompromised persons—HIV/AIDS
- Associated vehicles
  - Swallowing contaminated recreational water
  - Petting zoos-calves, lambs, or other young animals
- Spread
  - Person to water
  - Person-to-person
- Filters designed to remove *Cryptosporidum parvum**
  - Reverse-osmosis
  - Absolute pore size of 1 micron or smaller
  - Certified by NSF Standard 53 for cyst removal
  - Certified by NSF Standard 53 for cyst reduction
- Chlorine disinfection*
  - 1 mg/L (1ppm) free chlorine at pH 7.5 and 25° C
  - Approximately 9600 minutes or 6.7 days

*Content source: Division of Parasitic Diseases, National Center for Zoonotic Vector-borne, and Enteric Diseases.

http://www.cdc.gov/healthyswimming/chlorine_timetable.htm

Giardiasis

- Causative agent
  - Microscopic parasite: *Giardia intestinalis or lamblia*
- Incubation period
  - 1 to 2 weeks (usually 7 days)
- Duration of illness
  - 2 to 6 weeks but can last longer
- Clinical symptoms
  - Non-bloody diarrhea
  - Stomach cramps
  - Gas or flatulence
  - Greasy stools that tend to float
  - May lead to weight loss
  - Possible asymptomatic infection
- Population patterns
  - Daycare children and workers
  - International travelers
  - Backpackers, hikers, and campers drinking untreated water
  - Swimmers: lakes, rivers, ponds, and streams
  - People who drink from shallow wells
- Associated vehicles
  - Swallowing contaminated recreational water
  - Petting zoos-calves, lambs, or other young animals
- Spread
  - Person to water or food
  - Person-to-person
- Filters designed to remove *Giardia intestinalis or lamblia* *
  - See Cryptosporidiosis text box
  - Absolute pore size of 1 micron or smaller
  - Certified by NSF Standard 53 for cyst removal
- Chlorine disinfection*
  - 1 mg/L (1ppm) free chlorine at pH 7.5 and 25° C
  - Approximately 45 minutes

*Content source: Division of Parasitic Diseases, National Center for Zoonotic Vector-borne, and Enteric Diseases, CDC | http://www.cdc.gov/healthyswimming/chlorine_

Legionellosis
Legionnaires' Disease/Pontiac Fever

- Causative agent
  - *Legionella* spp.
- Incubation period
  - 2 to 14 days
- Duration of illness
  - Varies with antibiotic treatment: 5–30% mortality
- Clinical symptoms
  - High fever
  - Chills
  - Cough
  - Muscle aches and headaches
- Population patterns
  - Older persons (usually 65 years of age or older)
  - Smokers
  - Persons with chronic lung disease
  - Immunocompromised
- Associated vehicles
  - Hot tubs
  - Cooling towers
  - Hot water tanks
  - Large plumbing systems
  - Fountains
- Spread
  - Contaminated aerosolized warm water
  - Not person-to-person

*Content source: Division of Bacterial and Mycotic Diseases, National Center for Zoonotic Vector-borne, and Enteric Diseases, CDC

http://www.cdc.gov/ncidod/dbmd/diseaseinfo/

References:

1. Vugia D, Arguello D, Beach M, et al. Improving detection, investigation, and reporting of waterborne disease outbreaks. *Council of State and Territorial Epidemiologists Infectious Disease Committee* 2006; 12:1–6.
2. Frost J, Calderon R. Waterborne disease surveillance: findings of a survey of state and territorial epidemiology programs. *Journal of Environmental Health* 1995:58 (5):6–9.
3. Centers for Disease Control and Prevention. Division of Parasitic Diseases, National Center for Zoonotic, Vector-borne, and Enteric Diseases. Recreational Water Illnesses. http://www.cdc.gov/healthyswimming/. Accessed on June 15, 2007.
4. Centers for Disease Control and Prevention. Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water—United States, 2003–2004. *MMWR Morb Mortal Wkly Rep.* 2006;55(SS12):1–24.
5. Korich D, Mead J, Madore M, et al. Effects of ozone, chlorine dioxide, chlorine, and monochloramine on Cryptosporidum parum oocyst viability. *Appl Environ Microbiol* 1990;56:1423–1428.
6. Centers for Disease Control and Prevention. Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Water and Water Not Intended for Drinking—United States, 2003–2004. *MMWR Morb Mortal Wkly Rep.* 2006;55(SS12):31–58.

Georgia Waterborne Disease Outbreaks, 2003–2006

During 2003–2006, 11 WBDO were investigated in Georgia. Ten were associated with recreational water. Six (54.5%) WBDO involved chlorine treated swimming pools or hot tubs. Four (36.4%) outbreaks were associated with untreated recreational water (lake or river). Eight (72.7%) of the reported WBDO had an identified etiology, including four (50%) C*ryptosporidium* outbreaks, one *Campylobacter* outbreak, one chemical/toxin outbreak, one *Shigella soneii* outbreak, and one *Mycobacterium* outbreak. Individual cases of water-related illness were also reported in Georgia during this time including wound infections with *Vibrio* species following marine water contact, primary amoebic meningoencephalitis after recreational use of a pond, and Legionnaire's disease (see Outbreak Spotlight).

Georgia Infectious Disease Outbreaks Totals, 2nd Quarter: April–June, 2007

The Notifiable Diseases Epidemiology Section (NDES) received 62 reports of outbreaks or clusters occurring during the second quarter of 2007. Forty-six were later confirmed as Georgia outbreaks (Table 1). *Shigella* was the most commonly identified etiology (25/46; 54%) and 96% (24/25) of these were laboratory-confirmed. All reported *Shigella* outbreaks took place in the Northwest Health District. A *Shigella* outbreak was defined as at least two cultured-confirmed *Shigella* patients with a known epidemiologic link, i.e school, daycare center, etc. Of the total confirmed Georgia outbreaks during the second quarter of 2007, District Epidemiologists reported 39 (85%) and 34 (74%) were laboratory-confirmed. Only six (13%) of the outbreaks were foodborne, during the second quarter of 2007, with the etiology being laboratory-confirmed in five (83%). *Salmonella* was the most common etiology among foodborne outbreaks [3/5 (60%)].

The total number of outbreaks reported to NDES in the second quarter of 2007 represented a 77% increase compared to the second quarter of 2006. A large proportion of the increase was related to the *Shigella* outbreaks in the Northwest Health District. Any suspect outbreak or cluster of illness investigated in Georgia should be reported to Cindy Burnett, Outbreak Coordinator, NDES, or Carrie Shuler, Medical Epidemiologist, NDES.

INFECTIOUS DISEASE OUTBREAK SPOTLIGHTS

Legionnaires' Disease Outbreaks: Issues and Challenges

Legionnaires' disease is caused by several species of *Legionella* bacteria, which grow in many types of water systems including potable and recreational water. Legionnaires' disease outbreaks have been associated with hot tubs, decorative fountains, cooling towers, grocery store produce misters, and other similar sources of "misty water". Infection is by aspiration or inhalation of aerosolized water; *Legionella* bacteria are not transmitted directly from person to person.

Important aspects of a Legionnaires' disease outbreak investigation include laboratory confirmation, patient interviews including travel histories and daily schedules, as well as environmental assessments of epidemiologically-linked sources. Tools may include mapping software, visual surveys of the area, and environmental assessment surveys including measuring pool and hot tub chemistries and taking temperatures of potable water systems.

Outbreaks are unique in that they can be difficult to detect due to travel-related cases and low attack rates. There are several obstacles to investigating suspected Legionellosis clusters or outbreaks in Georgia. The limited amount of information collected about each case is often not enough to link cases to a common source, and a supplemental questionnaire is required once a cluster is suspected. Laboratory testing is commonly by urine antigen test, which is unable to identify the serogroup of the infecting organism, and therefore limits environmental investigations by an inability to positively link patient and environmental specimens. Also, sporadic community-acquired cases of Legionnaires' disease are common. Since outbreaks of Legionnaires' disease are difficult to detect and are relatively rare, few public health professionals are experienced in these investigations. Additional training on case investigation, particularly environmental aspects, is needed to address knowledge gaps.

An example of these challenges occurred in Fulton County at the end of 2005. GDPH received laboratory reports of 10 cases of Legionella infection clustered together by onset date into two groups, 3 months apart. Four cases resided in two zip codes, and two were residents of different cities with different zip codes, less than 1 mile apart. Due to the timing of the cases, two outbreaks or a continuous source like a cooling tower was suspected to have infected people over several months. Cases or surrogates were interviewed with a 7-page, 30-minute questionnaire to compile exposure information and a complete list of all places the case had traveled during their incubation period, including mode of transportation. However, only 5 of the 10 cases could be contacted for interview. Mapping of residences, workplaces, and recreational areas was conducted using online mapping resources and ArcView GIS 3.2. SaTScan, a program for space-time analysis, was also used. Despite the appearance of a cluster, there were no obvious links to any one place for all of the cases. A source was never implicated.

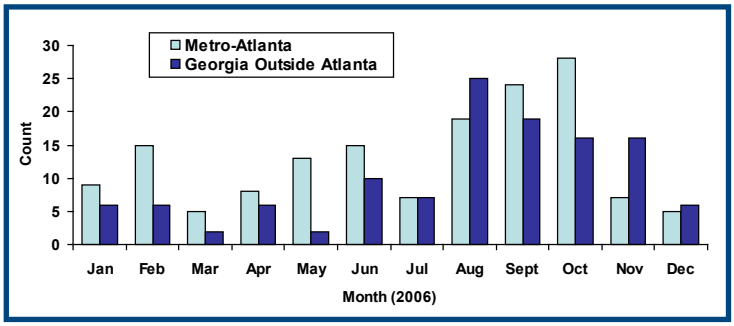
Spotlight contributed by Laurel Garrison, MPH; Notifiable Diseases Epidemiology Section

Georgia Cryptosporidosis Outbreaks

A recent national case-control study identified a number of significant risk factors for infection with *Cryptosporidium,* including international travel, contact with cattle, and recreational water exposure.[1] This last finding is important during summer months when recreational water activities are at their peak. *Cryptosporidium* is frequently resistant to chlorine, so infection may occur even after swimming in chlorinated water. In 2006, there were three confirmed outbreaks of cryptosporidiosis in Georgia, two of which were associated with swimming pools. It is likely that a greater number of cases and outbreaks are actually occurring, but are not being identified or reported. During August through October 2007, the Notifiable Disease Epidemiology Section will be interviewing a subset of cases of cryptosporidiosis, determined by caseload and District interest. The goal of these interviews will be to determine how much of the burden of cryptosporidiosis is associated with recreational water exposure.

Roy, Sharon L., DeLong, Stephanie M., Stenzel, Sara A., et al. Risk Factors for Sporadic Cryptosporidiosis among Immunocompetent Persons in the United States from 1999 to 2001. J. Clin. Microbiol. 2004 42: 2944-2951.

Cryptosporidium Cases Reported to Public Health — Metropolitan Atlanta and Georgia Outside Atlanta, 2006



Outbreak spotlight contributed by Stacy Crim, MPH; Notifiable Diseases Epidemiology Section.

Outbreak of *Cryptosporidium parvum* Among Visitors to Swimming Pools in Two Neighborhoods in July and August 2004

On August 20, 2004, the Notifiable Diseases Epidemiology Section (NDES) was notified by the North Georgia Health District Epidemiologist of a cluster of *Cryptosporidium* cases in Cherokee County. Between July 1 and August 31, 2004, 14 cases of cryptosporidiosis were identified in Cherokee County, Georgia (nine confirmed and five probable). During those same months in 2003, only one case of *Cryptosporidium* was reported in the county. Thirteen of the fourteen case-patients lived in the same neighborhood and frequented the community swimming pools. An investigation was initiated by Georgia Division of Public Health (GDPH) and the epidemiologists and environmentalists in District 1-2.

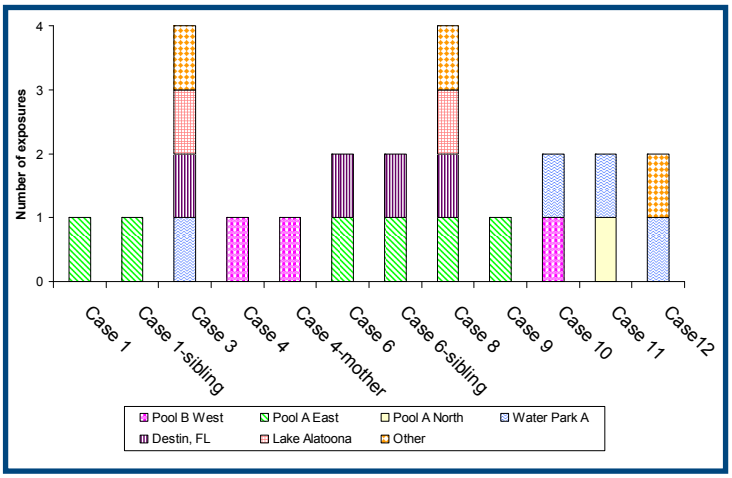
Twelve out of the fourteen case-patients were children, ranging in age from 2 to 10 years. Their parents were interviewed with an extended recreational water questionnaire. Many of the children had long durations of illness due to the waxing and waning of symptoms seen with *Cryptosporidium* infection; many were not immediately seen by a physician for diagnoses. Four of the children had chronic medical conditions involving their gastrointestinal systems. Ill children had visited their neighborhood pools many times throughout the summer, leading to an incubation range between 0 and 14 days with a mean of 6 days between probable pool exposure and illness onset. One child reported mild illness with only one day of diarrhea while the longest duration was reported as 35 days. One child was hospitalized; this child had a history of gastrointestinal problems and was also co-infected with *Shigella*.

Recreational and swimming pool exposures were found among all 12 of the interviewed case-patients (see figure). None of the 12 case-patients visited more than one pool in the community swimming complexes. Four of the children had been to Destin, Florida during the summer, and two had swum at Lake Allatoona.

Cherokee County Environmentalist Curtis Barnhart investigated the neighborhood pools on August 20, 2004. The pool logbooks were inspected, and personnel were notified of the correct procedures to treat the pools for *Cryptosporidium*. The decision was made, due to the number of cases and timing with the Labor Day Weekend, to close the three main and wading pools overnight and to treat with 25 ppm chlorine, according to the CDC protocol for *Cryptosporidium* disinfection.[2] Filtration and chlorination systems were adequate for the pool complexes, and no definitive source of the infections was identified during the investigation.

The etiologic organism in the outbreak was identified, but the point source of exposure for the case-patients was undetermined. Cryptosporidiosis is often asymptomatic or self-limiting in persons with intact immune systems. There may have been more people affected in these neighborhoods that never visited their physician or had fecal analyses done. It is hypothesized that the pools were contaminated with the oocysts, but which pool was affected first and by whom is unknown. The children made frequent trips during the summer break to the community swimming pools, making an exposure date difficult. The swimming pool complexes had detailed logbooks and had been treating and filtering their pools according to regulations. This outbreak happened due to the hardiness of the organism and the immuno-compromised status of the affected population.

Cryptosporidium Outbreak Recreational Water Exposures—Cherokee County, GA, August 2004



Outbreak investigation team: Jamie Cope, North Georgia Health District 1.2; Curtis Barnhart, Cherokee County Environmental Health Services; Carrie Shuler, NDES

Please visit our website for more information on Georgia outbreaks.

http://health.state.ga.us/epi/outbreak/index.asp.

Table 1. Reported Infectious Disease Outbreaks* by Health District— Georgia, 2nd Quarter 2006 and 2007**

Health District	Number of Outbreaks		Number of Laboratory-Confirmed Outbreaks		Number of Foodborne Outbreaks		Number of Shigella Outbreaks	
	2006	2007	2006	2007	2006	2007	2006	2007
1.1: Rome	1	27	1	25	0	0	0	25
1.2: Dalton	1	0	1	0	0	0	0	0
2.0: Gainsville	0	0	0	0	0	0	0	0
3.1:Cobb-Douglas	1	0	1	0	0	0	0	0
3.2: Fulton	0	1	0	1	0	0	0	0
3.3: Clayton	1	0	0	0	1	0	0	0
3.4: Gwinnett	5	1	1	1	3	0	0	0
3.5: DeKalb	4	4	1	1	1	2	0	0
4.0: LeGrange	3	2	1	1	2	1	0	0
5.1: Dublin	1	0	1	0	0	0	0	0
5.2: Macon	0	2	0	0	0	0	0	0
6.0: Augusta	0	0	0	0	0	0	0	0
7.0: Columbus	1	3	1	1	0	0	0	0
8.1: Valdosta	1	0	0	0	0	0	0	0
8.2: Albany	1	2	1	2	0	0	0	0
9.1: Coastal	1	0	1	0	0	0	1	0
9.2: Waycross	3	2	3	0	1	1	0	0
10.0:Athens	2	2	1	2	0	2	0	0
Total	**26**	**46**	**14**	**34**	**8**	**6**	**1**	**25**

***Does not include vaccine preventable diseases, environmental or injury outbreaks**
****April–June 2006 and April–June 2007**

Outbreak Newsletter | Edited by Carrie Shuler, DVM, MPH & Cindy Burnett, MPH
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