Waterborne Illnesses and Outbreak Investigation

Spring Seminars June 10-12, 2014

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Division of Public Health, Bureau of Communicable Diseases &
Emergency Response, Communicable Disease Epidemiology Section

Outline

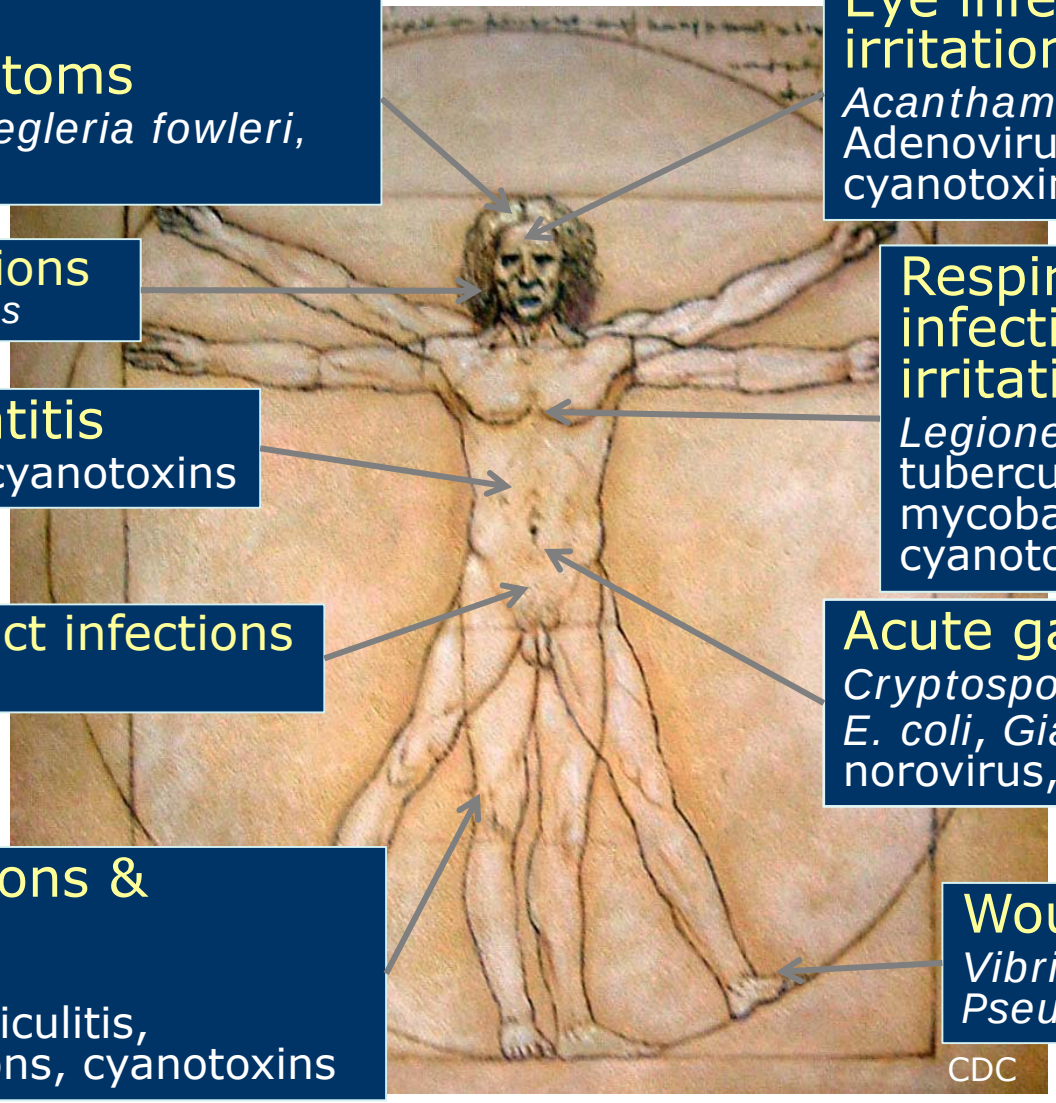
- Overview
- Select waterborne illness review.
- Introduction to Harmful Algal Blooms.
- Waterborne outbreaks in the United States and Wisconsin.
- Challenges of waterborne outbreak investigations.
- Waterborne outbreak case studies.
- On the horizon: updates and new resources.

How many people here have been involved in a waterborne outbreak investigation?

What is a waterborne illness?

- Waterborne illnesses are more than just *cryptosporidiosis* and *giardiasis.*
  - Not just infectious agents (chemicals, toxins).
  - Several routes of exposure (contact, inhalation).
  - Affect many body systems.

Waterborne pathogens and chemicals affect many systems



Neurologic signs/symptoms
Echovirus, *Naegleria fowleri*, cyanotoxins

Eye infections & irritation
Acanthamoeba keratitis, Adenoviruses, cyanotoxins

Ear infections
Pseudomonas

Respiratory infections & irritation
Legionella, non-tuberculous mycobacteria, chemicals, cyanotoxins

Hepatitis
HAV, cyanotoxins

Urinary tract infections
Pseudomonas

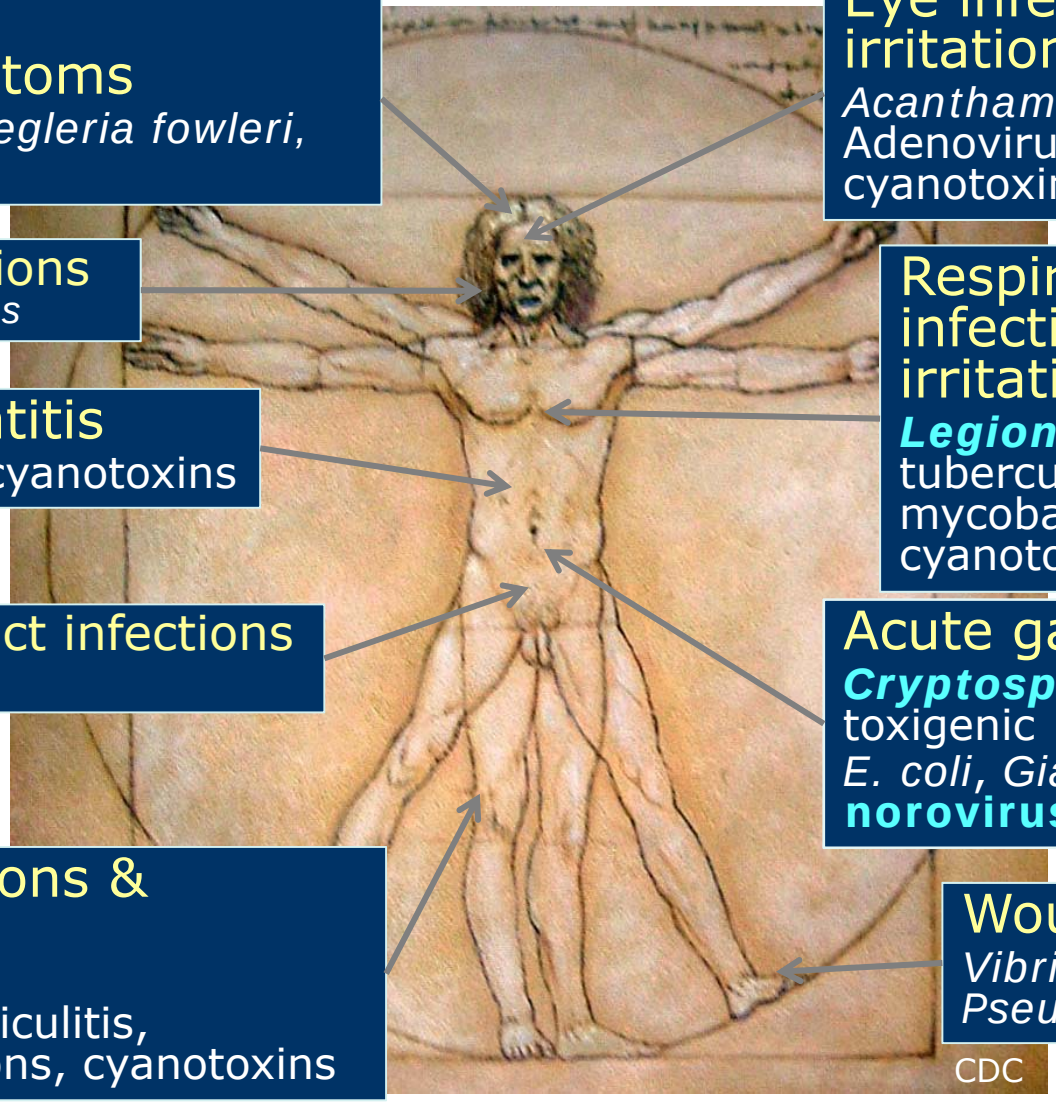
Acute gastroenteritis
Cryptosporidium, toxigenic *E. coli*, *Giardia*, *Shigella*, norovirus, chemicals

Skin infections & irritation
Pseudomonas dermatitis/folliculitis, fungal infections, cyanotoxins

Wound infections
Vibrio, *Aeromonas*, *Pseudomonas*

CDC

Waterborne pathogens and chemicals affect many systems



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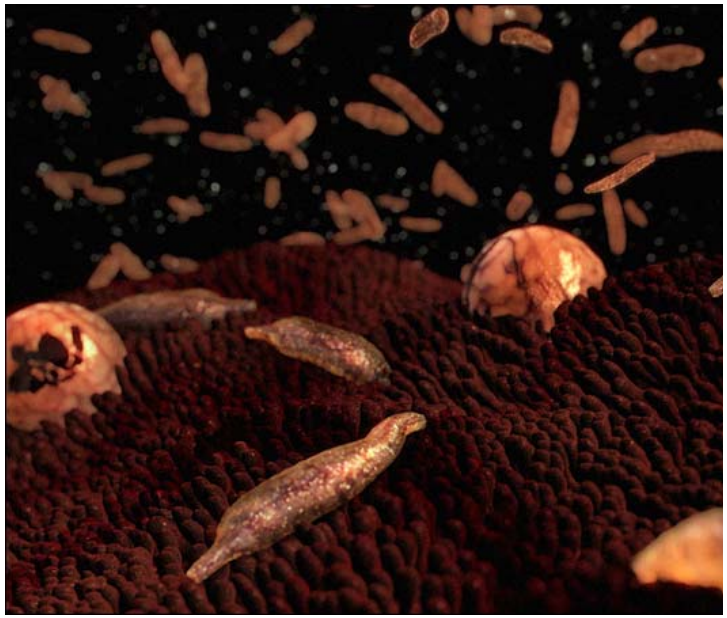
Wound infections
Vibrio, *Aeromonas*, *Pseudomonas*

CDC

CRYPTOSPORIDIUM

Cryptosporidium

- Protozoal organism with a human and domestic/wild animal reservoir.
- Spread: contaminated food/water or contact with infected animals/people.
- Symptoms: abdominal cramps, watery diarrhea, fatigue, weight loss, and vomiting.
- Diagnosis: Stool Ova & Parasite exam or Enzyme Immunoassay (EIA: microplate or rapid card).
- Prevention: Emphasis on hand-hygiene and restriction of patients from recreational waters.
- Chlorine-tolerant



http://freshscience.org.au

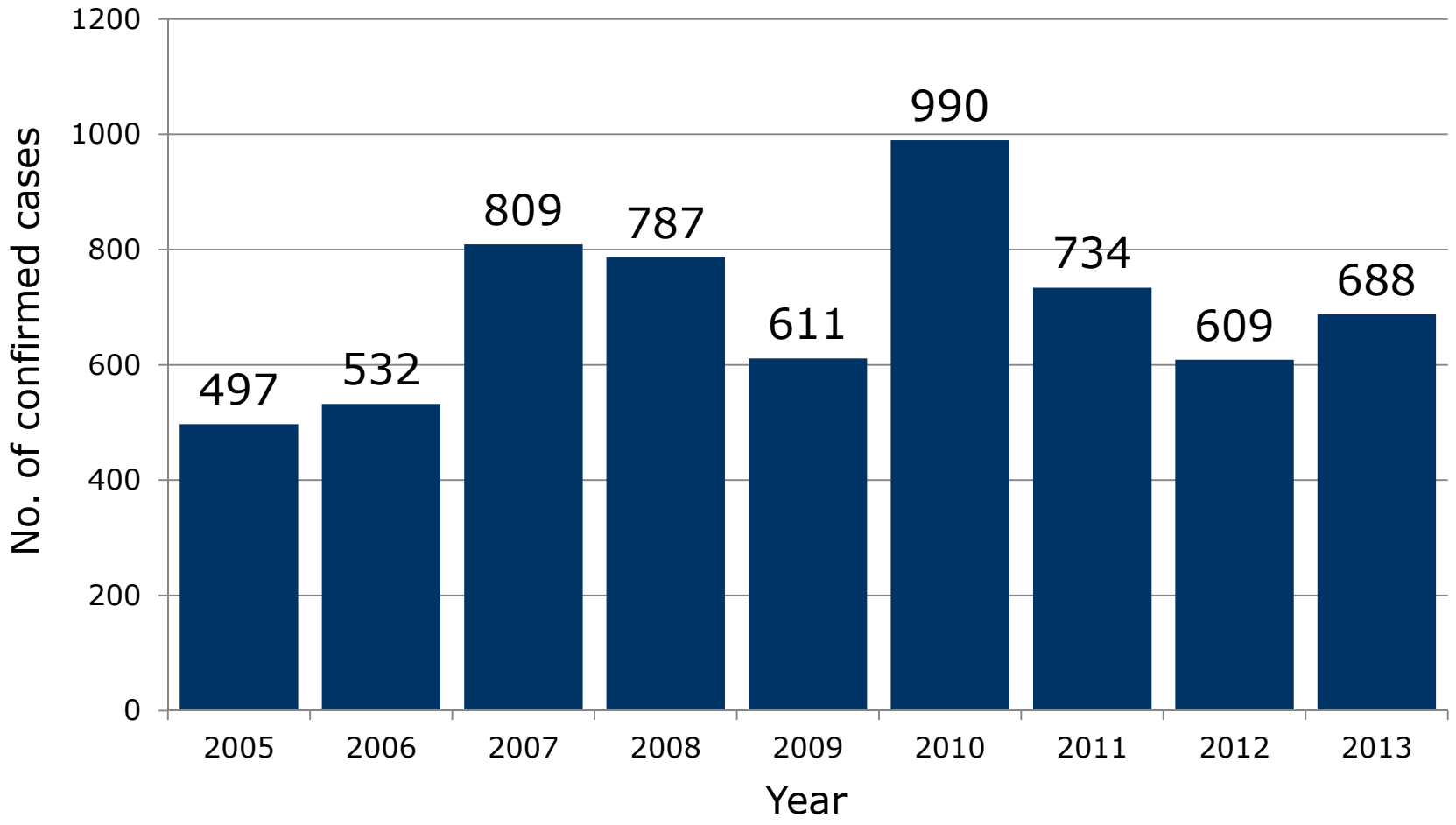
Infectious pathogens versus chlorine

Infectious Pathogen	Disinfection Time in Chlorinated Water
E. coli O157:H7	<1 minute
Hepatitis A virus	16 minutes
Giardia	45 minutes
Cryptosporidium*	**15,300 minutes or >10.6 days**

* 1 mg/L (1 part per million) free chlorine at pH 7.5 and 25°C (77°F) in the absence of chlorine stabilizers (e.g., cyanuric acid).

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

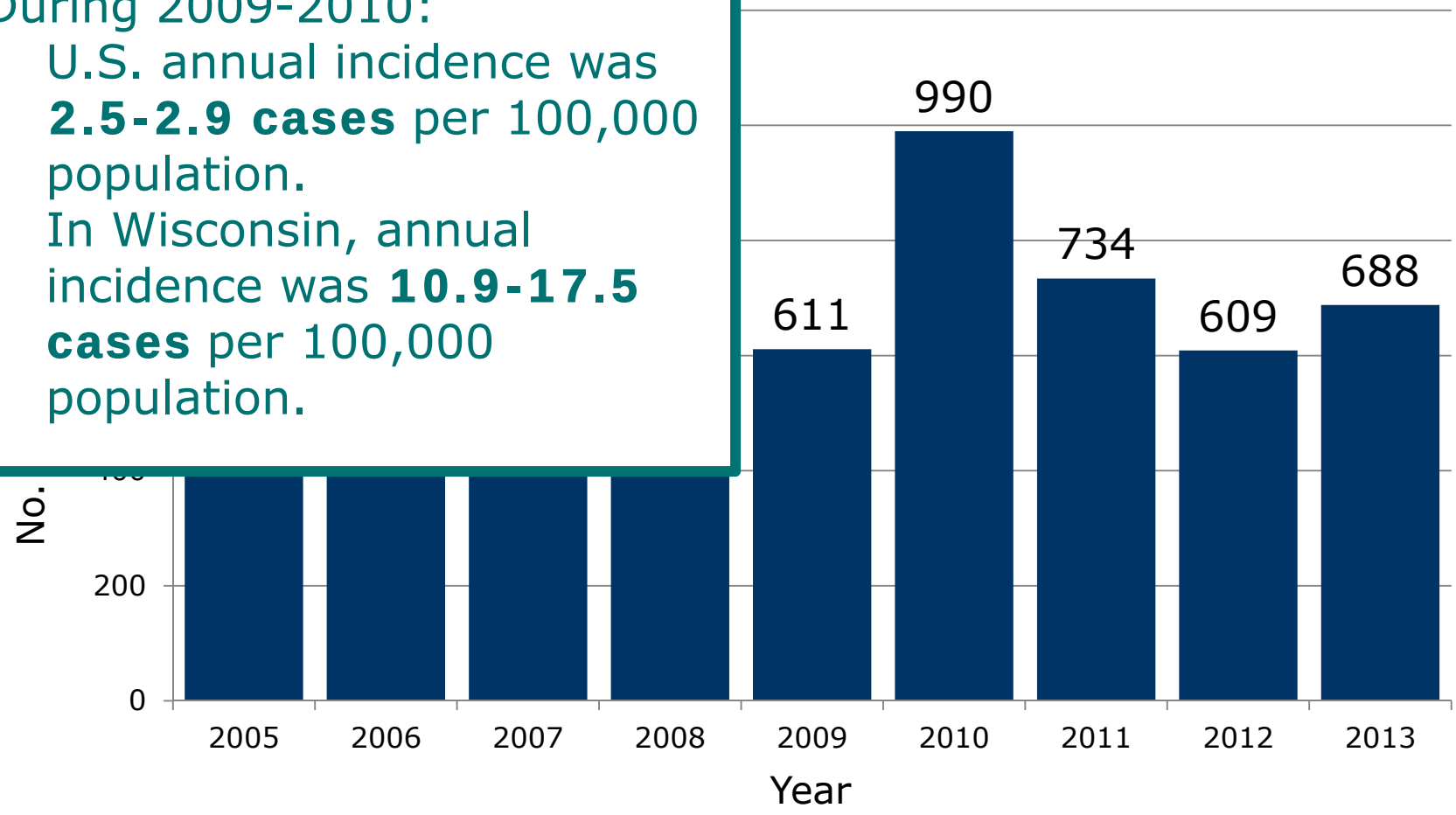
Reported Cryptosporidiosis Cases, Wisconsin, 2005-2013



Reported Cryptosporidiosis Cases, Wisconsin, 2005-2013

During 2009-2010:

- U.S. annual incidence was **2.5-2.9 cases** per 100,000 population.
- In Wisconsin, annual incidence was **10.9-17.5 cases** per 100,000 population.



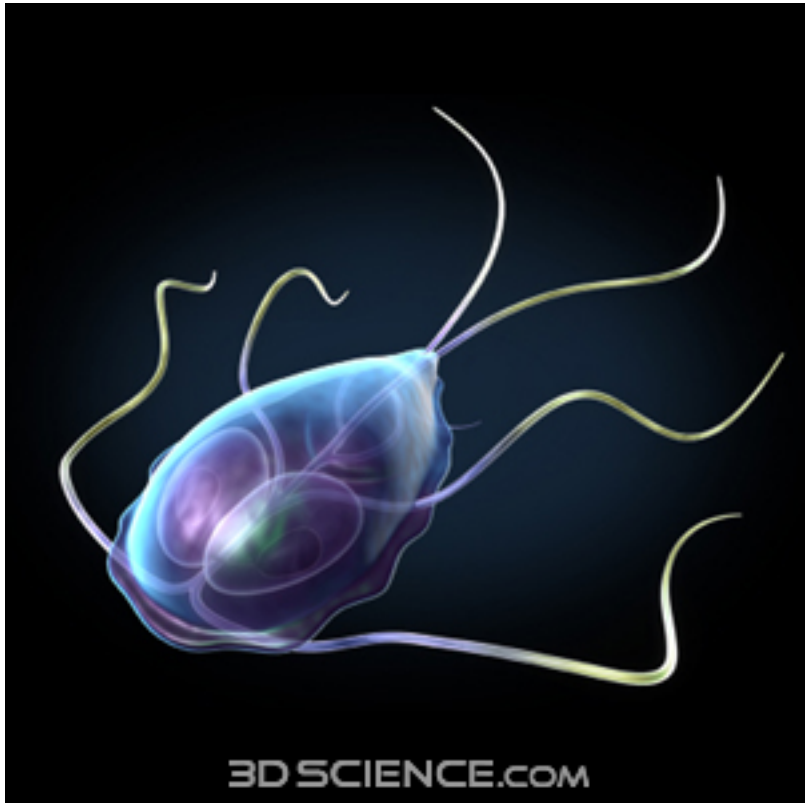
Centers for Disease Control and Prevention. Cryptosporidiosis Surveillance–United States, 2009-2010. MMWR. 2012;61(No. SS-5):1-8.

GIARDIA

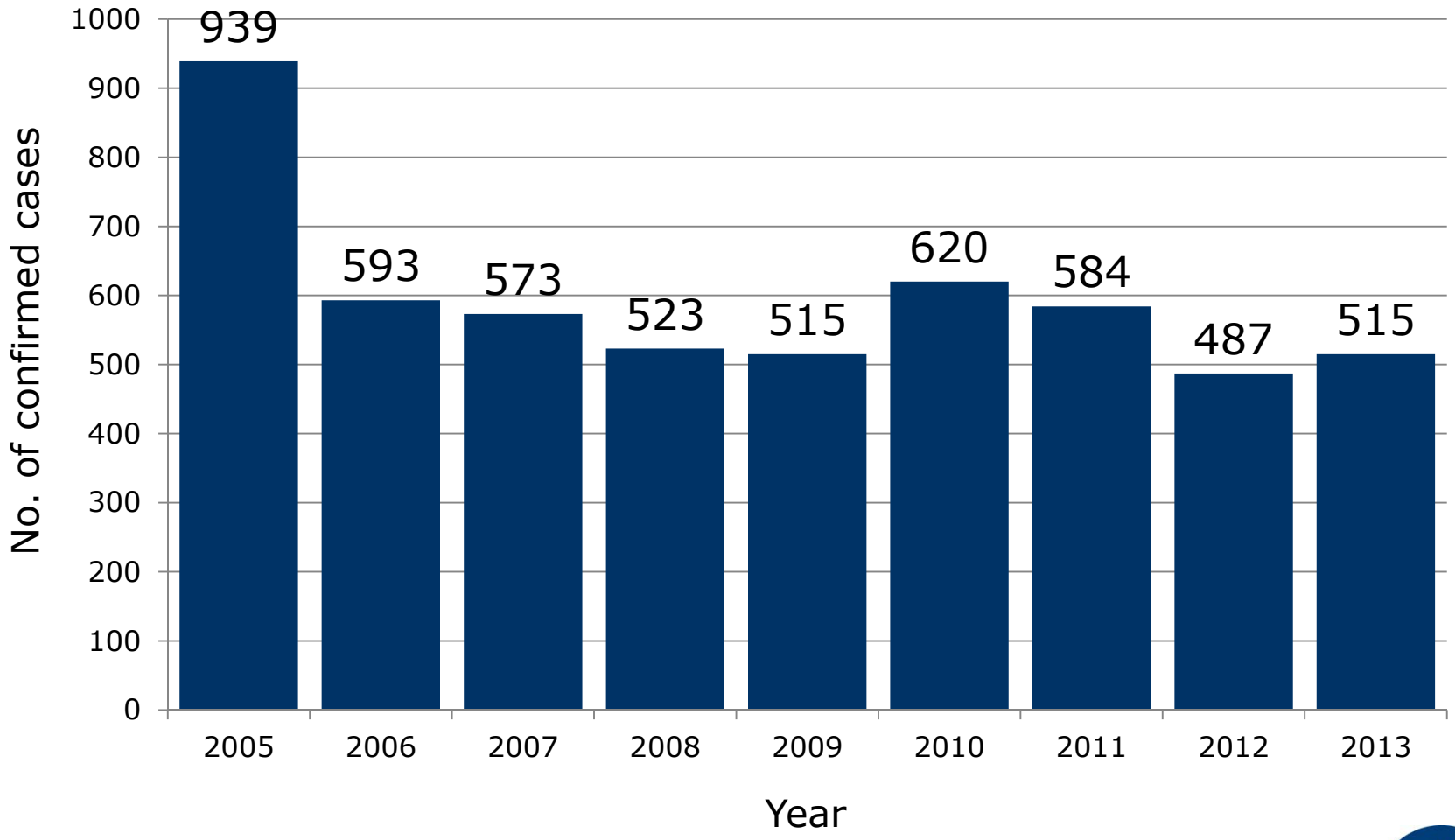
http://2.bp.blogspot.com

Giardia

- Protozoal organism with human and wild/domestic animal reservoirs.
- Spread: contaminated food/water or contact with infected animals/people.
- Symptoms: abdominal pain, watery diarrhea, and weight loss.
- Diagnosis: stool Ova and Parasite Exam or EIA (microplate or rapid card).
- Prevention: Emphasis on hand-hygiene and water sanitation.



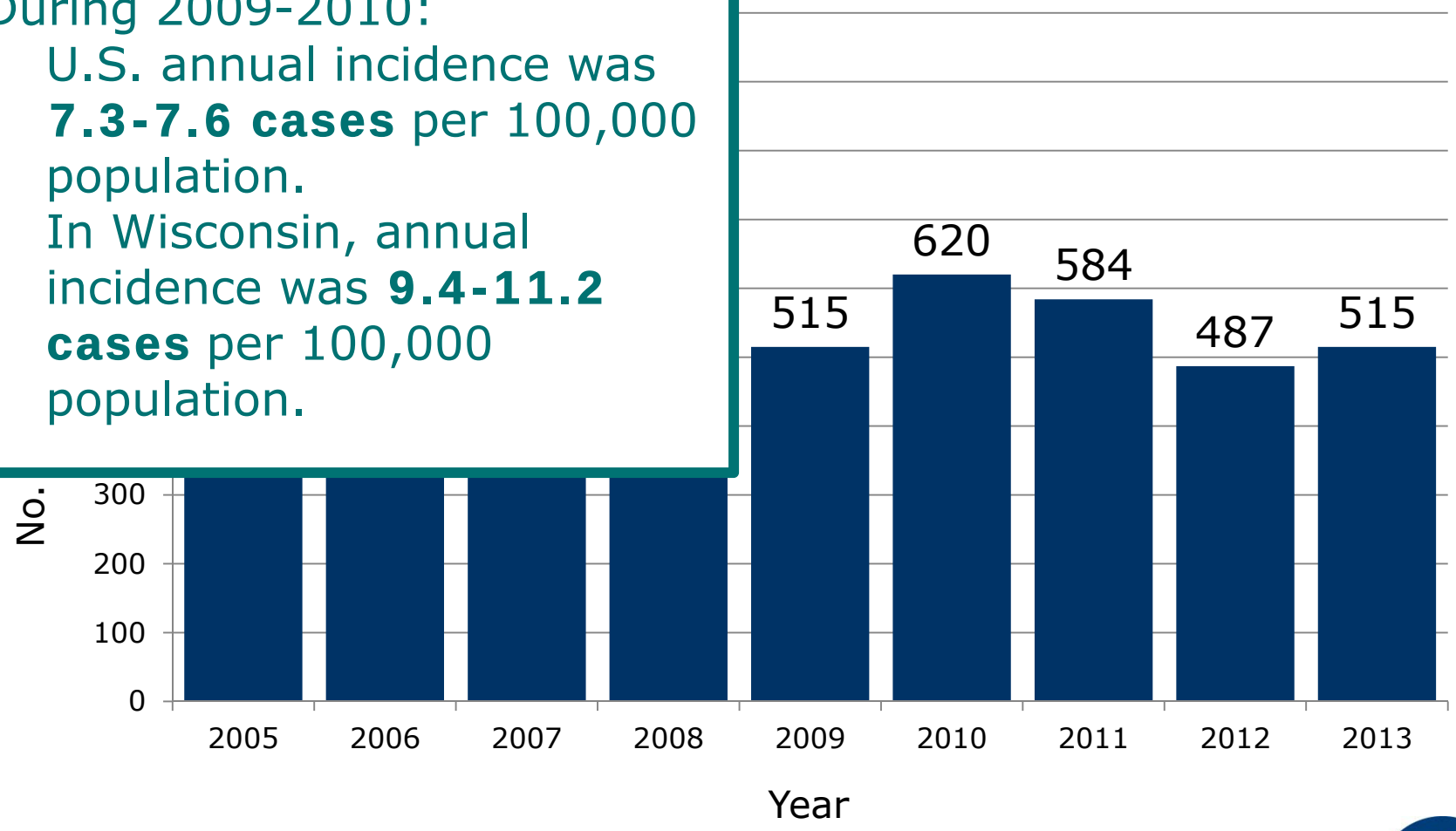
Reported Giardiasis Cases, Wisconsin, 2005-2013



Reported Giardiasis Cases, Wisconsin, 2005-2013

During 2009-2010:

- U.S. annual incidence was **7.3-7.6 cases** per 100,000 population.
- In Wisconsin, annual incidence was **9.4-11.2 cases** per 100,000 population.

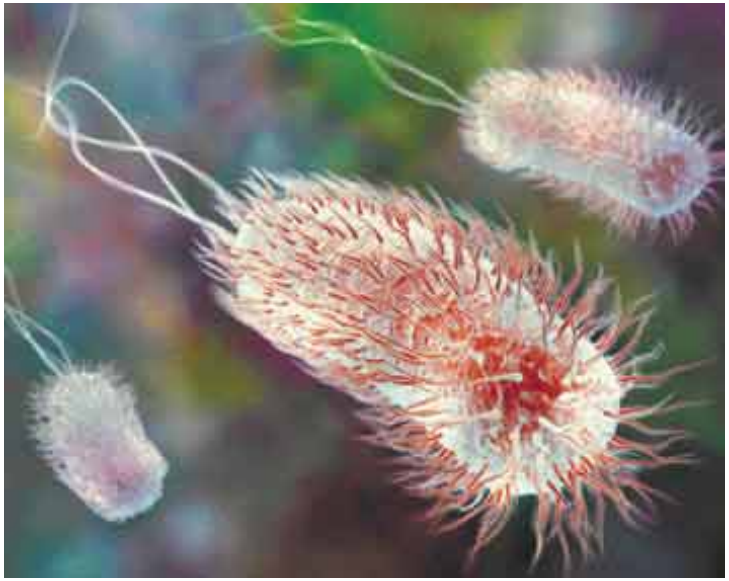


Centers for Disease control and Prevention. Giardiasis Surveillance– United States, 2009-2010. MMWR. 2012;61(No. SS-5):13-19.

SHIGA TOXIN-PRODUCING *E. COLI* (STEC)

Shiga Toxin-Producing *Escherichia coli* (STEC)

- Bacterial organism with a cattle reservoir.
- Spread: contaminated food, water and contact with infected people/animals.
- Symptoms: abdominal pain, diarrhea (often bloody), vomiting, hemorrhagic colitis, and fever.
- May cause Hemolytic Uremic Syndrome (HUS) and Thrombotic Thrombocytopenic Purpura (TTP) as severe secondary complications.
- Diagnosis: stool culture and EIA.
- Prevention: hand-hygiene as well as appropriate food preparation and handling.



www.pitch.com

NOROVIRUS

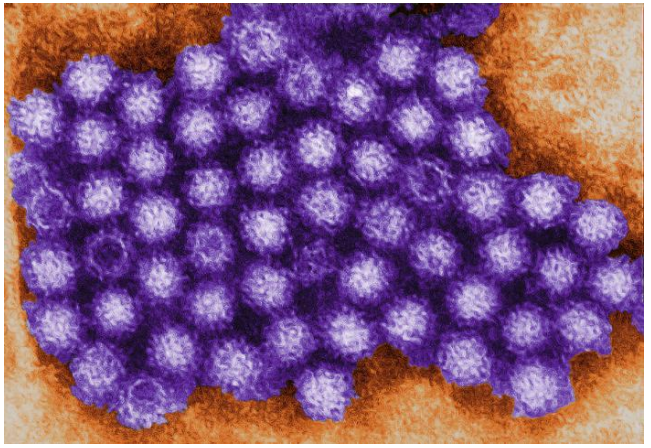
Norovirus

- Cause of acute gastroenteritis in humans.
- Symptoms: sudden onset vomiting; watery, non-bloody diarrhea; abdominal cramps; nausea; headache.
- Vomiting more common in children.
- Incubation: 24-48 hours (range 12-60)
- Duration: 12-60 hours.
- Highly infectious (stool and emesis).

www.tntmagazine.com

Transmission of norovirus

- Transmission:
  - Direct person-to-person.
  - Contact with contaminated environment.
  - Consumption of contaminated food or water.
- Infectious dose ≤10 viral particles.
- Shed in feces at levels up to 10,000,000 viral particles per gram.
- Shedding 2-3 weeks minimum.
- Contaminated fingers to 7 clean environmental surfaces.
- Emphasis on hand washing, exclusion of ill individuals for 48 hours after symptom resolution, cleaning with 10% bleach solution.



www.cruiselawnews.com

LEGIONELLA

Legionella

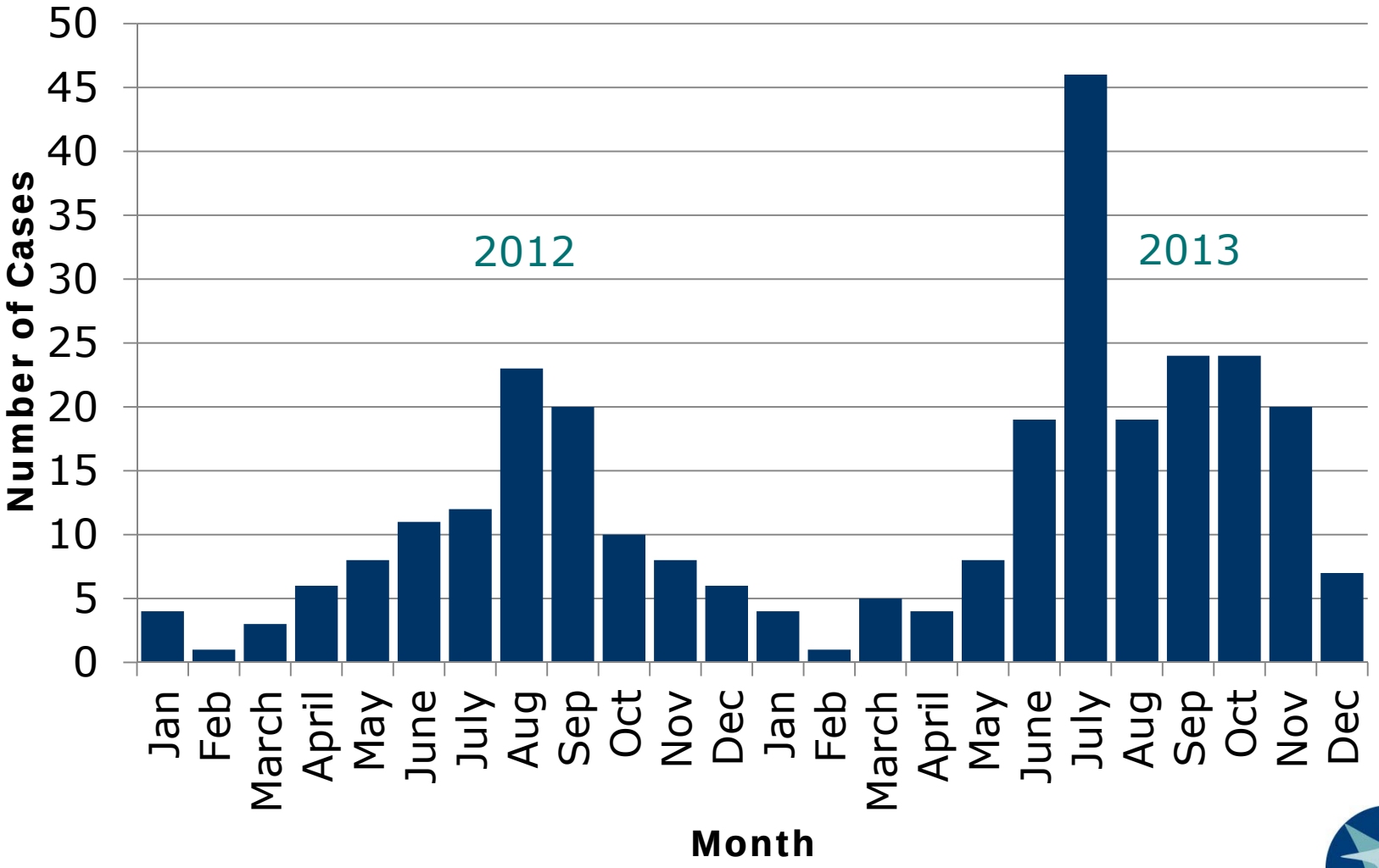
- Environmental bacterium.
- Can be found in any type of water system.
- Prevalent in warm stagnant water (most plumbing systems, hot water tanks, water in cooling towers, evaporative condensers of large air conditioning systems, hot tubs).
- Infection acquired by inhaling mists from a water source that contains *Legionella* bacteria.
  - Cannot be spread from person to person.
- Most cases occur as single isolated events; however, outbreaks have been noted.

Legionellosis

- Two distinct forms of the disease:
  - Legionnaires' disease (pneumonia).
  - Pontiac fever (mild respiratory illness).
- Symptoms include muscle aches, headache, tiredness, loss of appetite, and coughing followed by high fever (102-105º), chills and occasionally diarrhea.
- Chest radiographs often show pneumonia in Legionnaires' disease (LD).
- Fatality rates as high as 30% with LD.
- LD most frequently seen in:
  - Middle-aged adults.
  - Heavy smokers.
  - Patients with chronic lung disease.
  - Patients with underlying medical conditions.
  - Patients with immunosuppression.

www.med-ed.virginia.edu

Cases of Legionnaire's Disease by Month, Wisconsin, 2012-2013



Legionellosis

www.emlab.com

- Diagnosis
  - Urine antigen test
  - Bacterial culture
    - Special medium required (BCYE agar).
    - Ideally before or within 3 days of starting antibiotics.
  - Polymerase Chain Reaction (PCR)
- Enhanced testing for cluster identification.
  - Culture + Pulsed-Field Gel Electrophoresis (PFGE)
  - PCR if no culture.

If a positive urine antigen test result is reported, the physician should be contacted and urged to collect and/or submit a tracheal wash or bronchoalveolar lavage specimen to be submitted for culture and PFGE at WSLH.

HARMFUL ALGAL BLOOMS

When in doubt, stay out!

Harmful Algal Blooms (HABs)

- Cyanobacteria ("blue-green algae")
  - Nitrogen fixers in the environment.
  - Many species can produce toxins (cyanotoxins).
- Harmful Algal Blooms
  - Blooms result when conditions are favorable for growth.
    - Warm temperatures
    - Sunlight
    - Nitrogen input
    - Eutrophic water
  - Recreational and drinking water.
  - Transient
  - Blooms are not always toxic.
  - Affect health, ecosystems, economies.

www.whoi.edu

Harmful Algal Blooms (HABs)

- How are people exposed?
  - Swimming
  - Water skiing
  - Boating
  - Wading
  - Using lake water for drinking or irrigation

www2.epa.gov

- Routes of exposure determine clinical signs/symptoms
  - Ingestion of water or algal scum material
  - Skin contact with bloom material
  - Inhalation of toxins or gases from decaying bloom mats
  - Fish consumption may be a valid exposure pathway

Harmful Algal Blooms (HABs)

- How are animals exposed?
  - Dogs are common victims.
  - Eating scum material, drinking lake water, licking algae from coat.

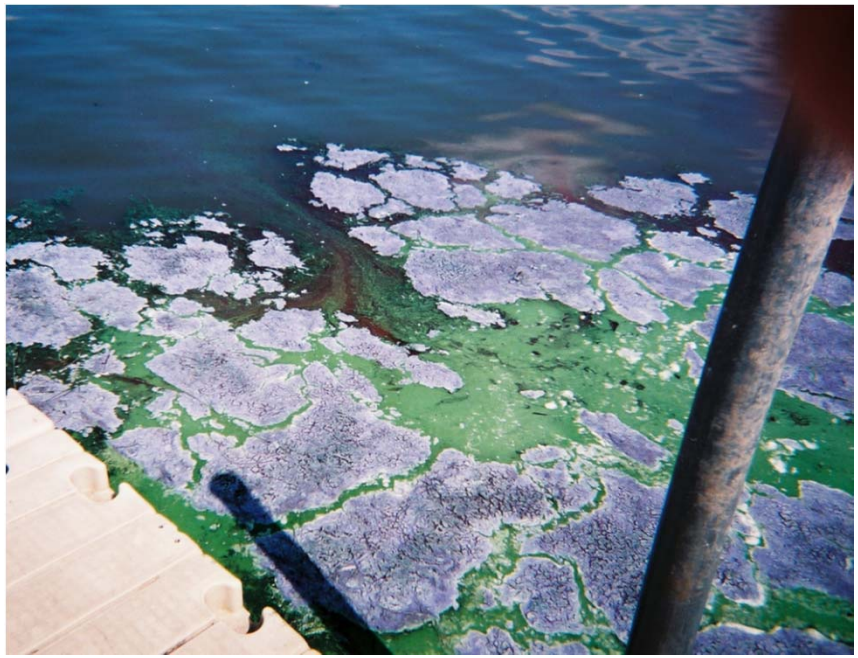
CDC

www.organic-center.org

Algal toxins and health

- Symptoms in Humans
  - Respiratory:
    - Cough, congestion, wheezing, sore throat, eye irritation, difficulty breathing.
  - Dermatologic:
    - Pruritus, redness, blisters, hives, allergic reactions.
  - Other symptoms:
    - Earache, agitation, headache, abdominal pain, diarrhea, vomiting.
- Symptoms in Animals
  - Lethargy
  - Vomiting, drooling
  - Diarrhea
  - Difficulty breathing
  - Weakness
  - Seizures

Wisconsin Division of Public Health, Wisconsin Harmful Algal Blooms Program



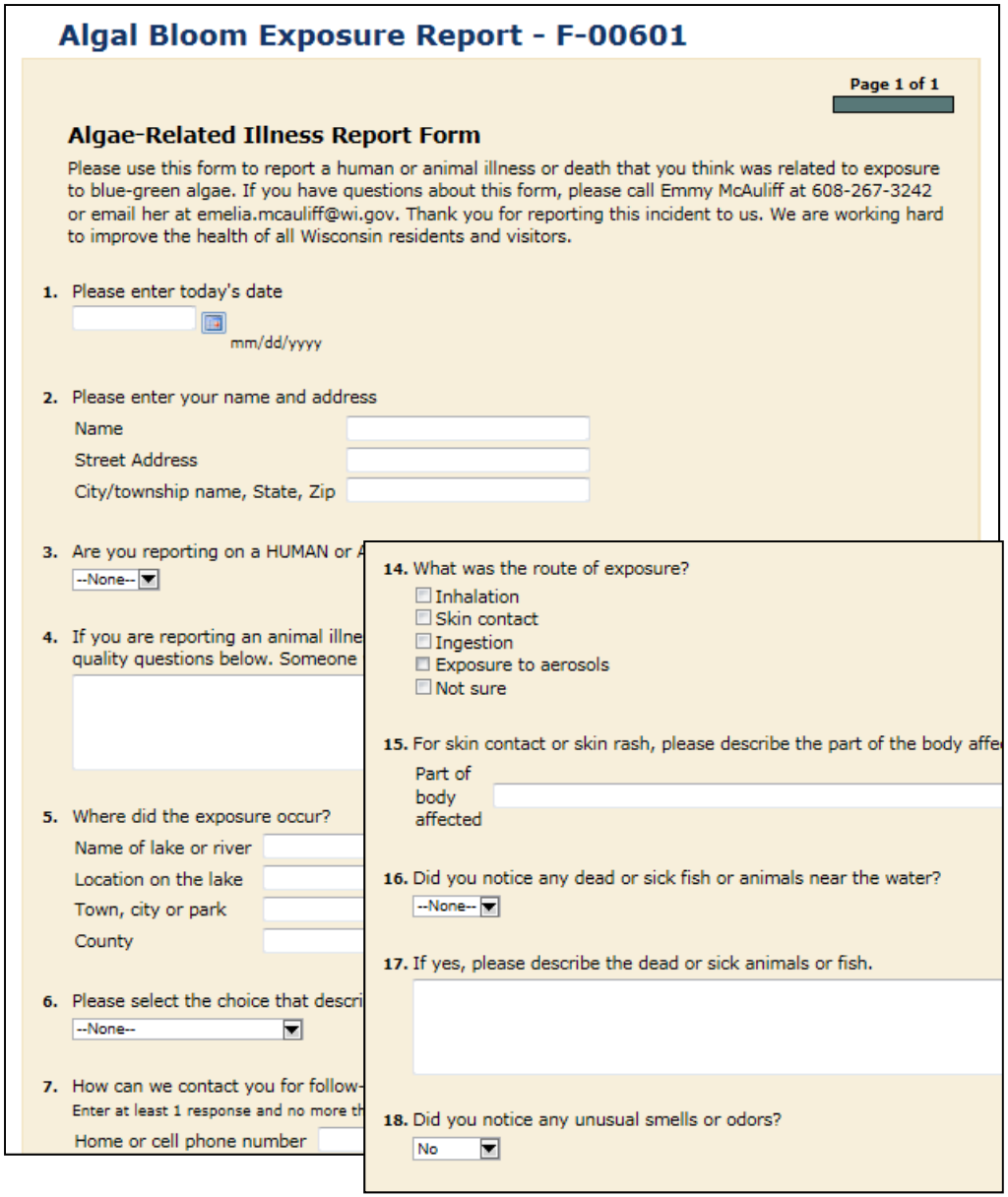
Lake Kegonsa, Dane County, June 2009

- Established in 2008.
- Surveillance of health effects related to HAB exposure.
- Investigates reports of human and animal illnesses.
- Coordinates water sampling and analysis.
- Coordinates health advisories with local public health.
- Education and outreach.

DHS/DNR Live Chat with the Experts on Harmful Algal Blooms - July 1, 2014 at 12pm
http://dnr.wi.gov/chat/expert.html

HAB associated illness reporting

- Reporting pathways:
  - Online case reporting tool on DPH HAB website.
  - Direct contact with staff (email, phone).
  - Dept. of Natural Resources (DNR), local health depts., lake association referrals.
  - WI Poison Center.



Algal Bloom Exposure Report - F-00601

Page 1 of 1

Algae-Related Illness Report Form

Please use this form to report a human or animal illness or death that you think was related to exposure to blue-green algae. If you have questions about this form, please call Emmy McAuliff at 608-267-3242 or email her at emelia.mcauliff@wi.gov. Thank you for reporting this incident to us. We are working hard to improve the health of all Wisconsin residents and visitors.

1. Please enter today's date

mm/dd/yyyy

2. Please enter your name and address

Name

Street Address

City/township name, State, Zip

3. Are you reporting on a HUMAN or A

--None--

4. If you are reporting an animal illne
quality questions below. Someone

5. Where did the exposure occur?

Name of lake or river

Location on the lake

Town, city or park

County

6. Please select the choice that descri

--None--

7. How can we contact you for follow-

Enter at least 1 response and no more th

Home or cell phone number

14. What was the route of exposure?

- Inhalation
- Skin contact
- Ingestion
- Exposure to aerosols
- Not sure

15. For skin contact or skin rash, please describe the part of the body affe

Part of body affected

16. Did you notice any dead or sick fish or animals near the water?

--None--

17. If yes, please describe the dead or sick animals or fish.

18. Did you notice any unusual smells or odors?

No

HAB Associated Illness Reports, Wisconsin, 2009-2013

Year	No. reports
2009	37
2010	27
2011	36
2012	33
2013	13

Symptoms across all years**	No. reports
Dermal rash	31
Respiratory irritation	24
Gastrointestinal distress	56
Cold/flu-like illness	37

**Many cases included multiple symptoms, so the total number of symptoms exceeds the total number of reports.

HAB case study:
Lake Kegonsa, Dane County, 2009

- On July 15, a 31 year old male awoke at 2AM with symptoms of nausea, diarrhea and vomiting.
- Later that day, the patient developed burn-like lesions on his lower left arm.
- The previous evening, he had caught and eaten fish from Lake Kegonsa.

www.floridawatercoalition.org

HAB case study:
Lake Kegonsa, Dane County, 2009

- Patient reported:
  - Lake water was green and cloudy with a strong manure-like odor.
  - Heavy algal mat present.
  - Left arm was exposed to algal material up to his elbow when he reached into the lake.
  - While cleaning the fish, he accidentally severed the liver, possibly contaminating the fillet with algal toxins that can be concentrated in the bile.
- Water sample collected July 17:
  - 2 cyanobacterial species
  - Cyanotoxin present

HAB case study 2:
Lake Tomahawk, Oneida County, 2009

- August 14
- A 15 lb. rat terrier collapsed 30 minutes after swimming and playing fetch near a beach on Lake Tomahawk.
- The dog's owner immediately took it to a local veterinarian.
- On admission, the dog was comatose, with dilated pupils, blue-gray mucous membranes and a heart rate of 180-200 beats per minute.

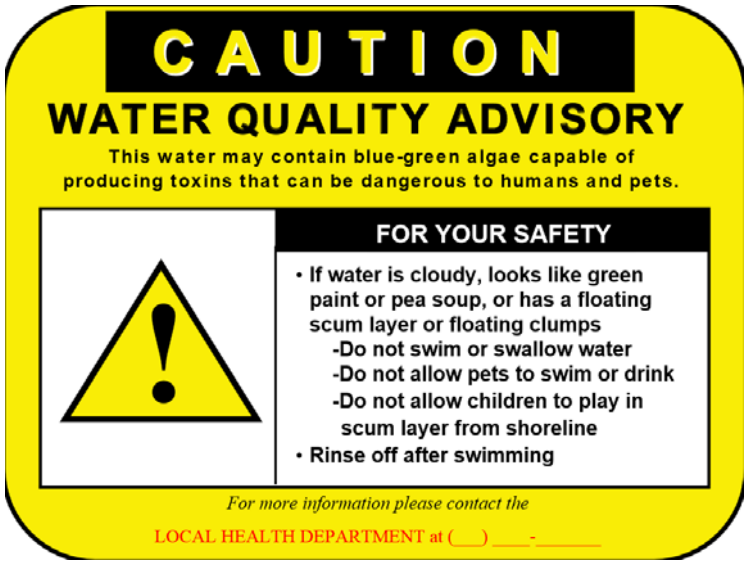
http://msh.mashoid.netdna-cdn.com

HAB case study 2:
Lake Tomahawk, Oneida County, 2009

- Dog died within 90 minutes of onset.
- Inspection of the water at this beach conducted August 17 (three days later) found no visible evidence of an algal bloom.
- Water samples contained two cyanobacterial species at concentrations considered low risk for adult humans.
- Toxin analysis was not conducted.
- The presumptive cause of death was exposure to blue-green algae.

HAB associated illness reporting

- How can I report a suspected HAB associated illness to the WI Harmful Algal Blooms Program?
  - Use the online form (preferred):
    - http://www.dhs.wisconsin.gov/eh/bluegreenalgae/index.htm
  - Call the Bureau of Environmental Health:
    - (608) 266-1120



www.docstoc.com

WATERBORNE OUTBREAKS

Definition of a waterborne disease outbreak

- ≥ 2 epidemiologically-linked cases associated with:
  - Drinking water.
  - Recreational water (treated or untreated).
  - Other non-recreational water use.
- Epidemiologically linked by:
  - Location of exposure to water.
  - Time.
  - Illness.
- Epidemiologic evidence must implicate water as the probable source of illness.

Waterborne outbreak exposures

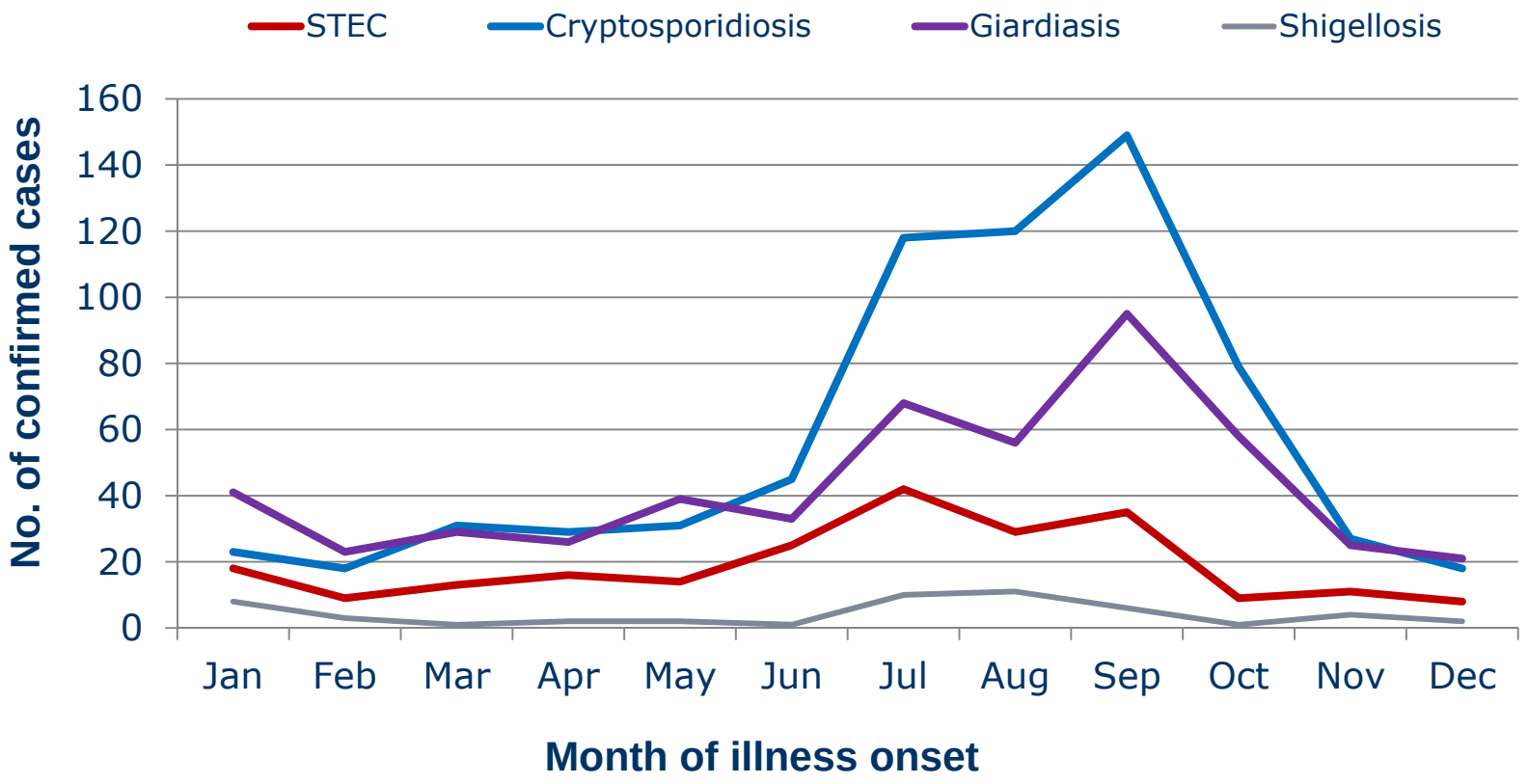
Drinking water

Recreational water

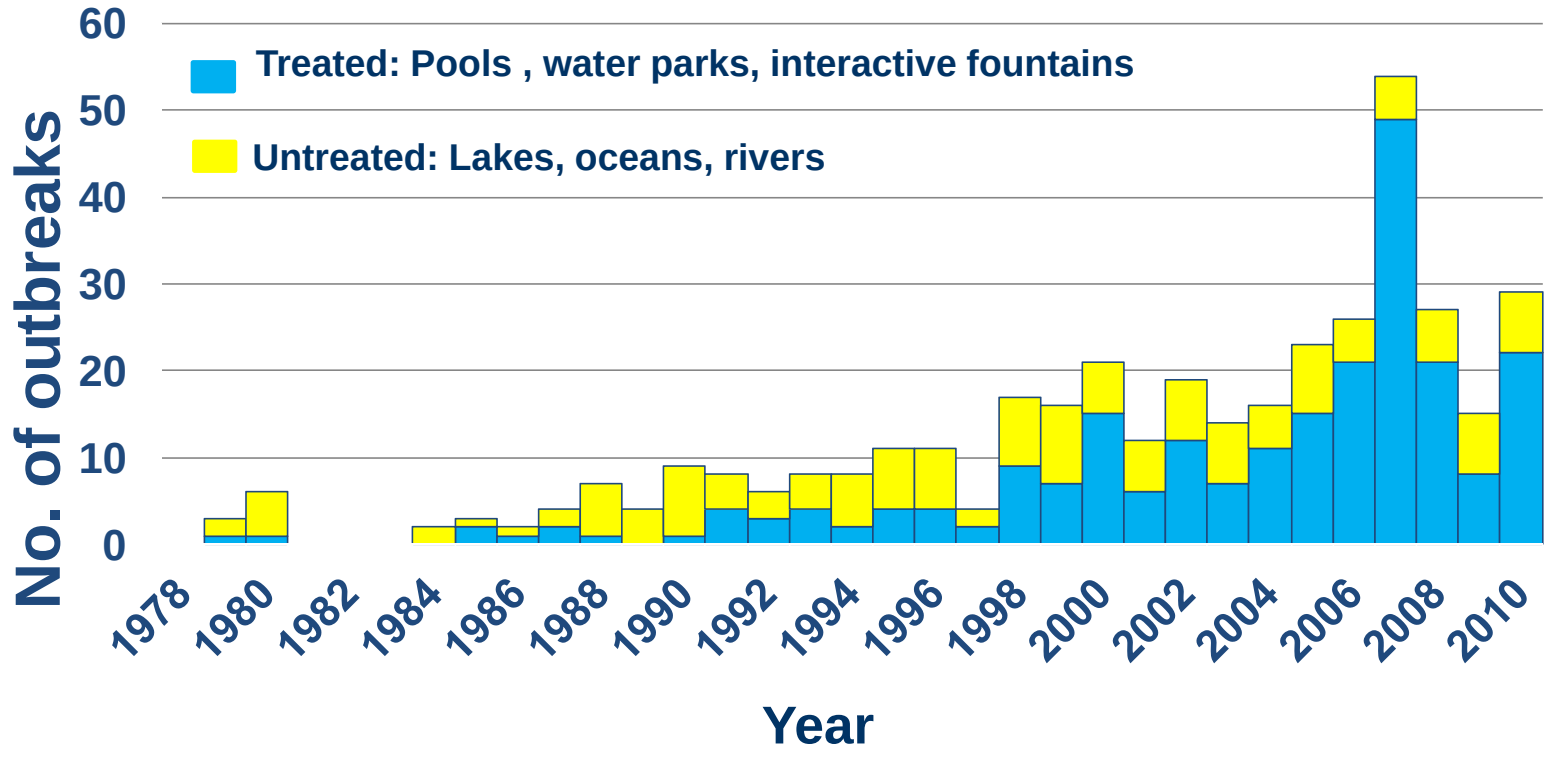
"Other," built environment

WATERBORNE OUTBREAKS: A NATIONAL PERSPECTIVE

Reported Enteric Cases by Month, Wisconsin, 2013

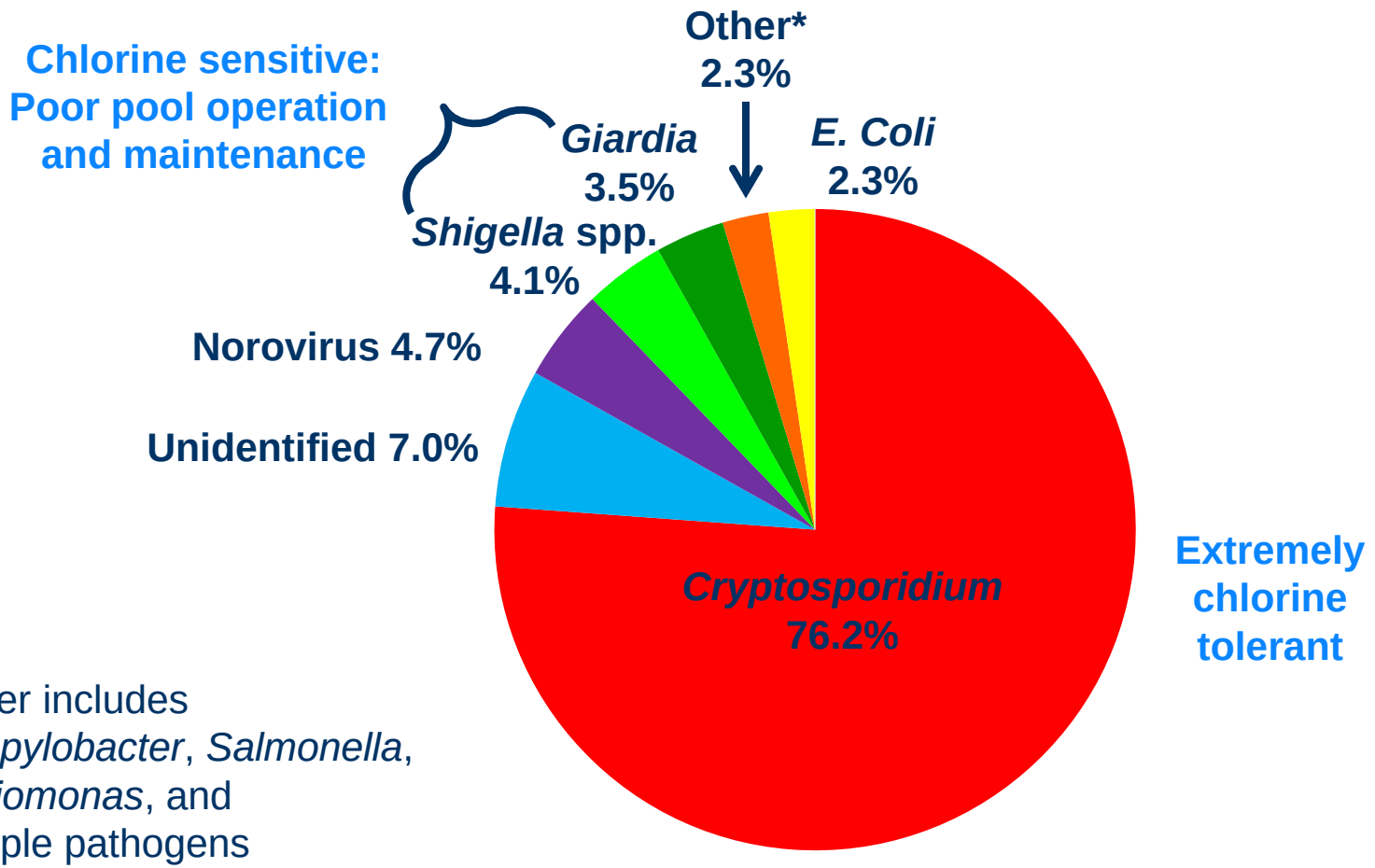


Outbreaks of Acute Gastrointestinal Illness Associated with Recreational Water Use, United States, 1978–2010



N=385: Hlavsa MC *et al*. 2011. MMWR 60(SS-12):1–39; preliminary 2009-2010 data updated 12 September, 2013.

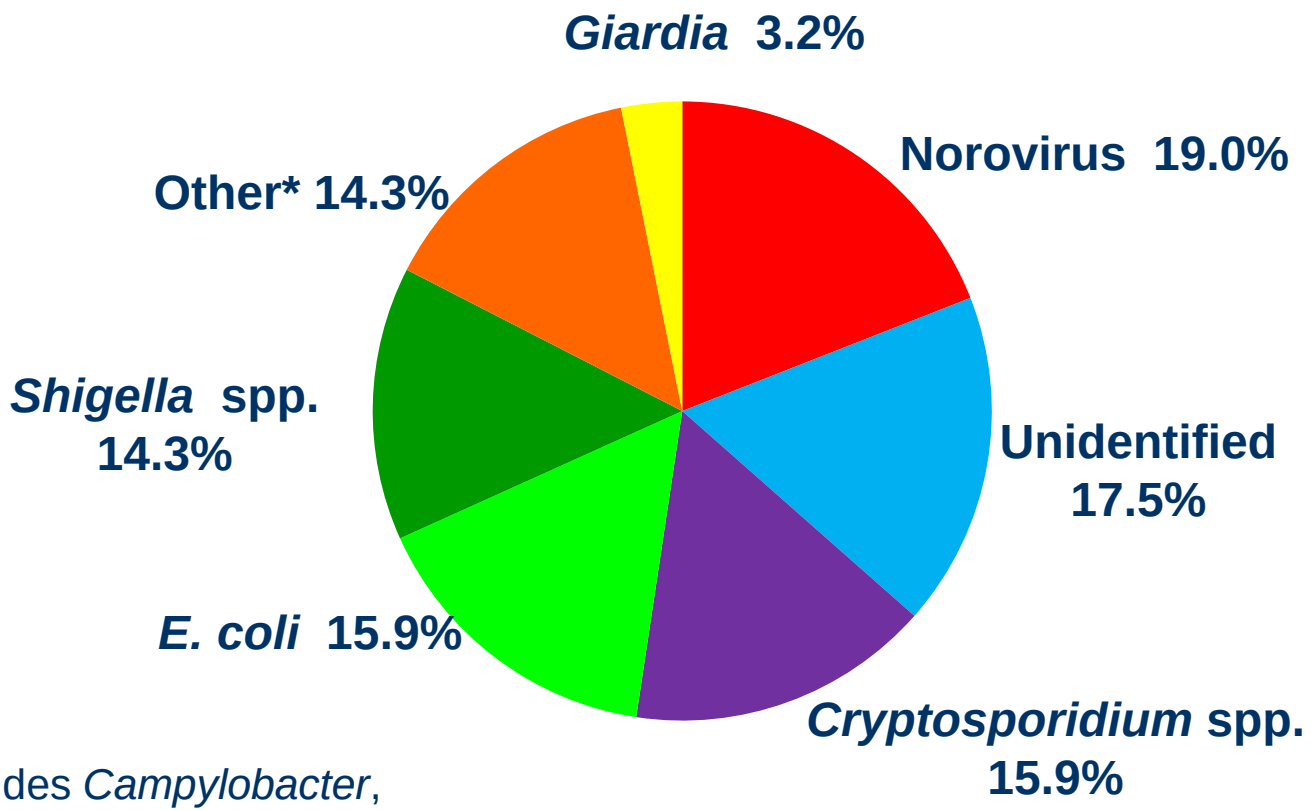
Outbreaks of Acute Gastrointestinal Illness Associated with Treated Recreational Water Use, United States, 2001–2010



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

N=172; Hlavsa MC *et al*. 2011. MMWR 60(SS-12):1–39; preliminary 2009-2010 data updated 12 September, 2013.

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



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

N=63; Hlavsa MC *et al*. 2011. MMWR 60(SS-12):1–39; preliminary 2009-2010 data updated 12 September, 2013.

WATERBORNE OUTBREAKS: DETECTION AND INVESTIGATION CHALLENGES

Hotelwaterparkworkshop.com

Waterborne outbreak detection challenges

- Difficult to detect waterborne outbreaks.
  - Common source, but residents of multiple counties or states.
  - Ongoing low-level transmission or long incubation period.
  - Multiple water exposures.
  - Interview forms not designed to capture detail.
  - Competing disease surveillance priorities.

Waterborne outbreak sampling challenges

- Difficult to link cases and environmental sources.
  - Time lag from exposure to reporting.
  - Capacity to sample and analyze water.
  - Variable pathogen survival/toxin presence.
    - Setting-specific challenges.
    - Treated versus untreated water.
    - Weather.

Waterborne outbreak investigation challenges

- Environmental setting.
  - Multiple possible exposures.
    - Water only?
    - Food service available?
    - Hotel?
- Investigation questionnaire design.
  - Pool recontamination (swimming while ill).
  - Swimming behaviors.

www.sports.yahoo.com

Contributing factors

- Water quality.
- Insufficient water treatment.
- Water re-contamination.
- Swim diapers & kiddie pools.
- Fecal accidents.
- Chlorine tolerance of pathogens.
- Multi-day organism survival in fresh water.
- Environmental contamination.
- Other environmental source contamination (septic, manure runoff).
- Effect of weather on pathogen survival.

www.momsagainstcooties.com

OUTBREAK:
WATER PARK WOES

Background

- County A Environmental Health Department received complaints from three different groups of people who became ill after staying at a Resort/Water Park.

Background

- Reported symptoms included acute onset vomiting and diarrhea; norovirus was suspected.
- Activities among the groups included:
  - A youth sports tournament.
  - A family reunion.
  - Family meals.
  - Visiting the water park.
  - Visiting the arcade.
  - Take-out meals.

Environmental assessment

- Inspection two days later by regional FSRL sanitarians:
  - No overt problems with pool operation.
  - Water chemistry values were normal.
- Sanitarians:
  - Recommended extra hand sanitizer be made available in public areas.
  - Distributed posters to the resort warning against swimming with diarrhea.
  - Alerted housekeeping and maintenance staff to report any vomit/evidence of ongoing sickness at the resort.
  - Distributed norovirus cleaning guidelines for surfaces.
  - Recommended cleaning pool deck, affected guest rooms, and public bathrooms in swimming area with 10% bleach solution.

Epidemiologic investigation

- Investigation questionnaire developed by CDES staff.
  - Ill and well individuals from all four groups.
- Investigation questionnaire design:
  - Symptoms
  - Others ill
  - Stay dates, room number
  - Meals and food
  - Swimming
    - Locations
    - Dates
    - Swimming behaviors at each location
    - Fecal accidents

While you were at the WATER PARK/RESORT did you (your child) swim? Y N

*If yes, please complete the table below for **each day/date and water park location** the respondent/child swam at the RESORT. For example, if they swam at 2 locations on xx/xx/xx and one location on xx/xx/xx, fill out a total of 3 columns. Be sure to answer all questions for each swimming exposure.*

	EXAMPLE				
Question	**Date: Xx/xx/xx**	**Date: _____**	**Date: _____**	**Date: _____**	**Date: _____**
Water Park Location Specify one of the following: **PARK AREA A, WATERSLIDES, LAZY RIVER, KIDDIE POOL** or **WATER BASKETBALL**	LAZY RIVER				
How much time did you spend in this pool area? < 30 min 30-60 min 1-2 hours 2-4 hours > 4 hours	1-2 hours				
Did you submerge your body? (Y/N)	Y				
Did you put your head under water? (Y/N)	Y				
Did you swallow any water? (Y/N)	Y				
Did you spout water from your mouth? (Y/N)	N				
Which of the following activities did you do in the pool?					
Swimming with your face in the water? (Y/N)	Y				
Using a floatation device? (Y/N)	N				
Treading water/floating without a floatation device? (Y/N)	Y				
Standing in water not above your head? (Y/N)	Y				
Going under the waterfall? (Y/N)	Y				
Other activities (describe)? (Y/N)	Arcade games				
Did you witness a fecal accident? (Y/N)	N				
Did you use a hot tub/Jacuzzi? (Y/N)	N				

Epidemiologic investigation

- During patient interviews:
  - Two fecal accidents observed on 3/22 (unknown to management).
  - One child vomiting accident observed 3/22 (unknown to management).
  - "Pool cloudy," "water very warm."

Results

- Stool specimens positive for norovirus GII.5.
- No common meals or meal sources between groups.
- Case-control studies performed among all and individual groups:
  - No meals, restaurant exposures, or arcade visits significantly associated with illness.

Case-control study significant results

- Swimming with face in water (OR 13.7)
- Swallowing water (OR 10.1)
- Head under water (OR 6.5)
- Waterslides
- Going under the waterfall
- Spouting water from the mouth
- Any swimming
- Jacuzzi

N=43, 22 cases, 21 controls. Primary cases, all groups.
Significant at $p \leq 0.05$.

Interesting contributing factors

- Complex venue with multiple exposures.
- Swimming behavior and high risk exposures.
- Unreported fecal and vomiting accidents with no response.
- Environmental contamination.

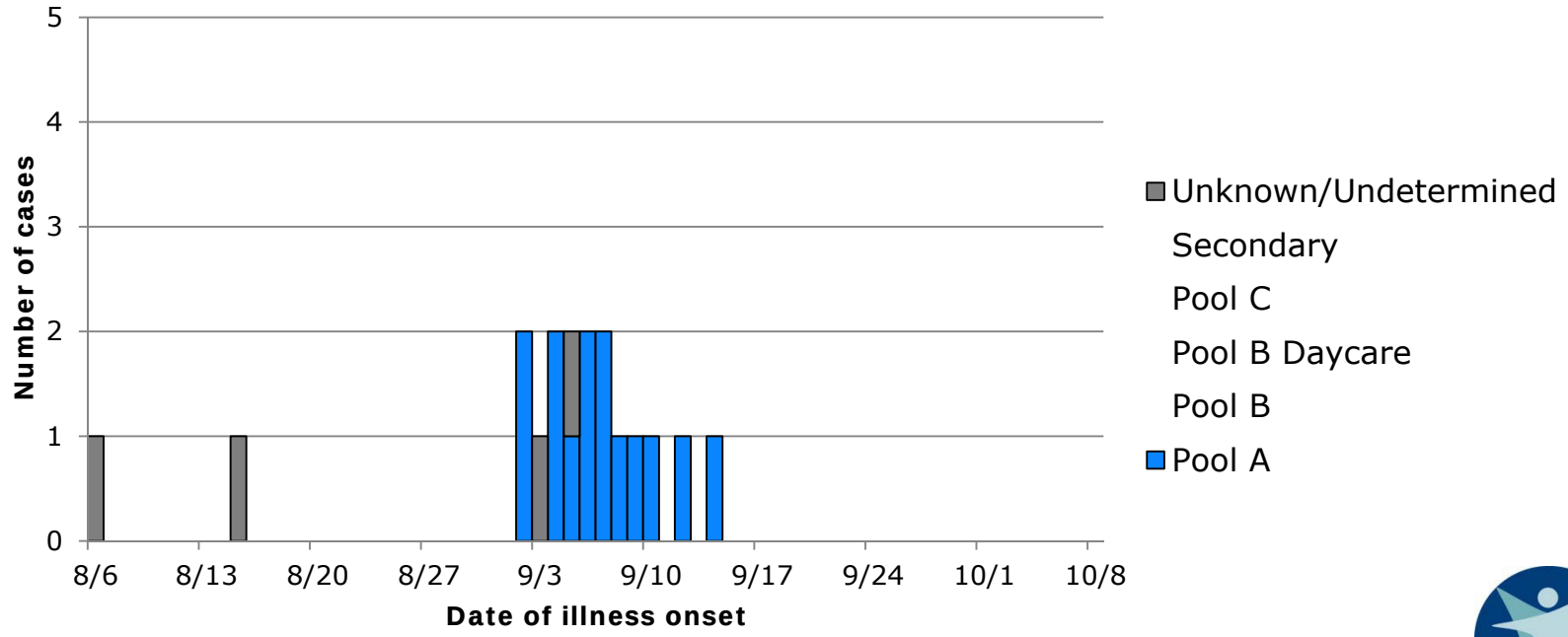
www.momsagainstcooties.com

OUTBREAK:
ATTACK OF THE POOL HOPPERS

Background

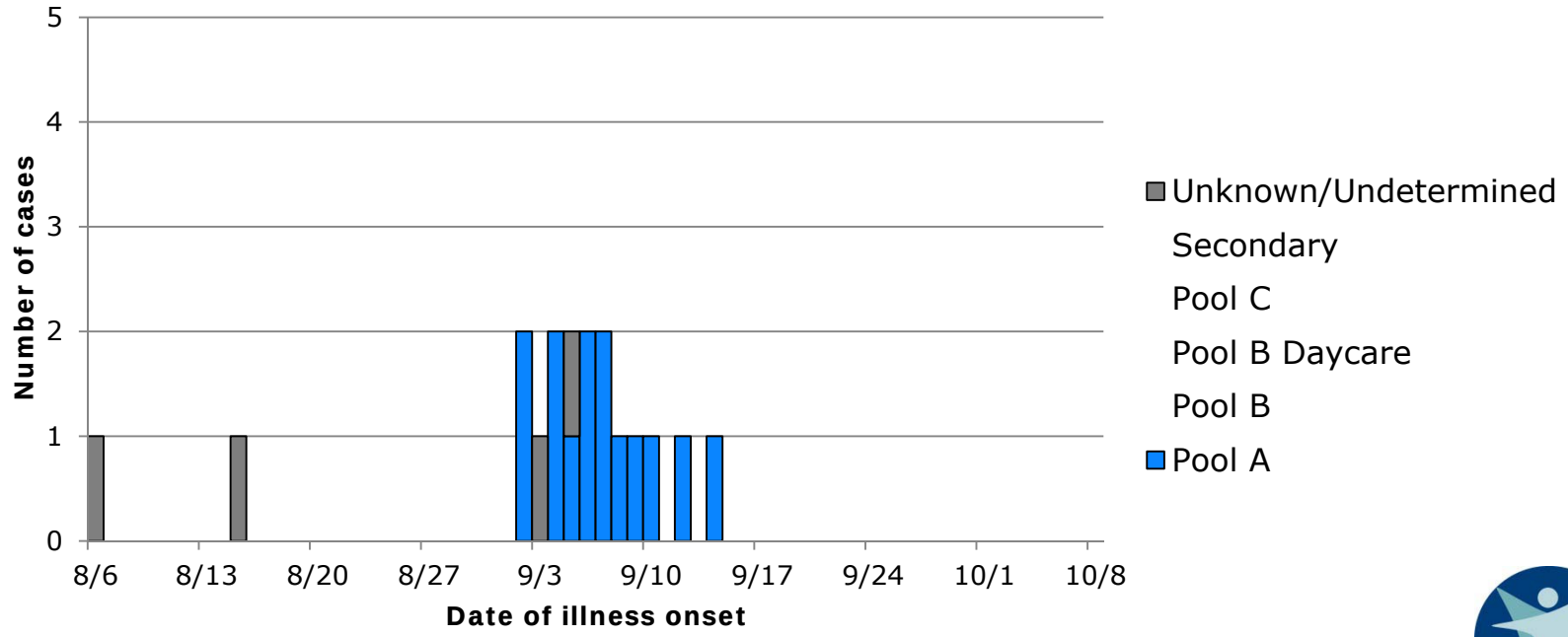
- On September 24, 2013 Health Department B reported to CDES that four patients with recent cases of *Cryptosporidium* infection had reported swimming at Pool A prior to their illness.
- Pool A:
  - Outdoor water park facility for members and their guests.
  - Closed and drained after September 2.
- Several swimmers also reported swimming at nearby indoor Pool B.
  - One person admitted to swimming while ill.
  - Other illnesses were suspected.

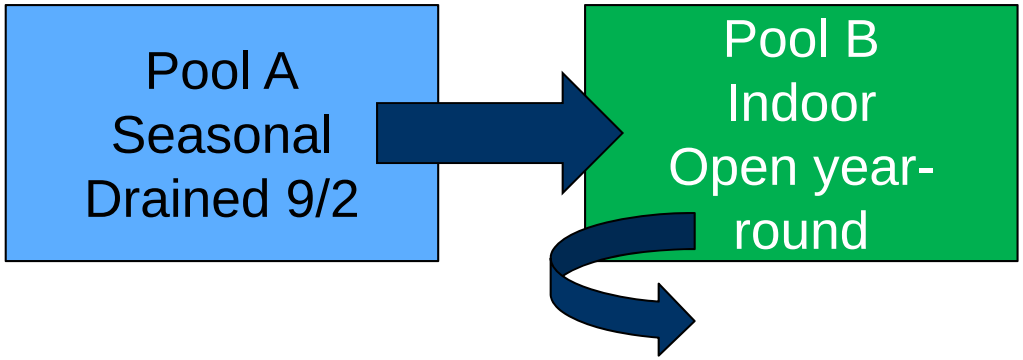
Pool A Seasonal Drained 9/2



Pool A
Seasonal
Drained 9/2

Pool B
Indoor
Open year-round

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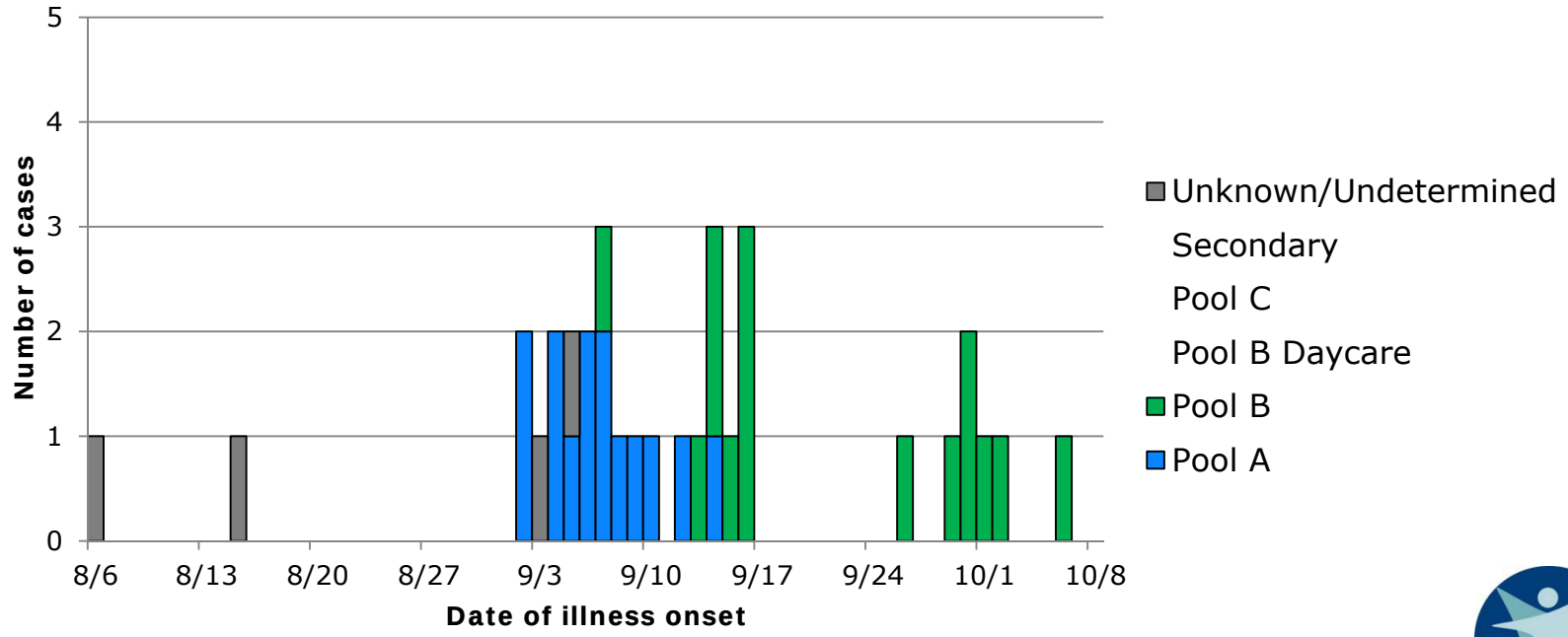
Seasonal
Drained 9/2
Pool B
Indoor
Open year-
round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Number of cases
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9/3
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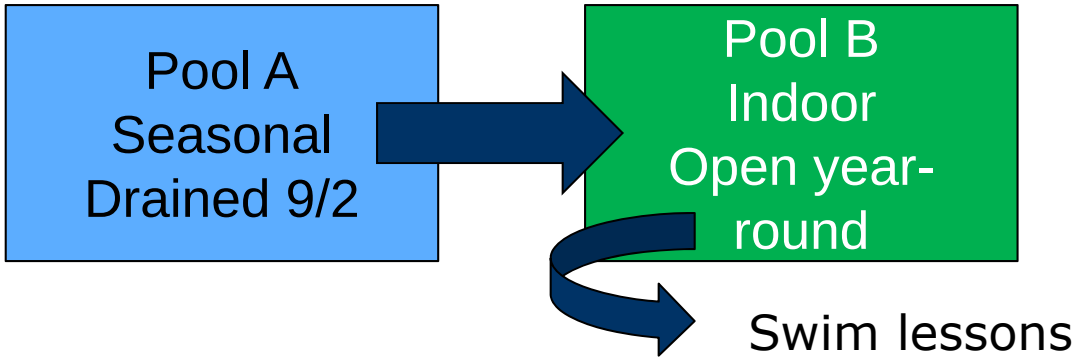
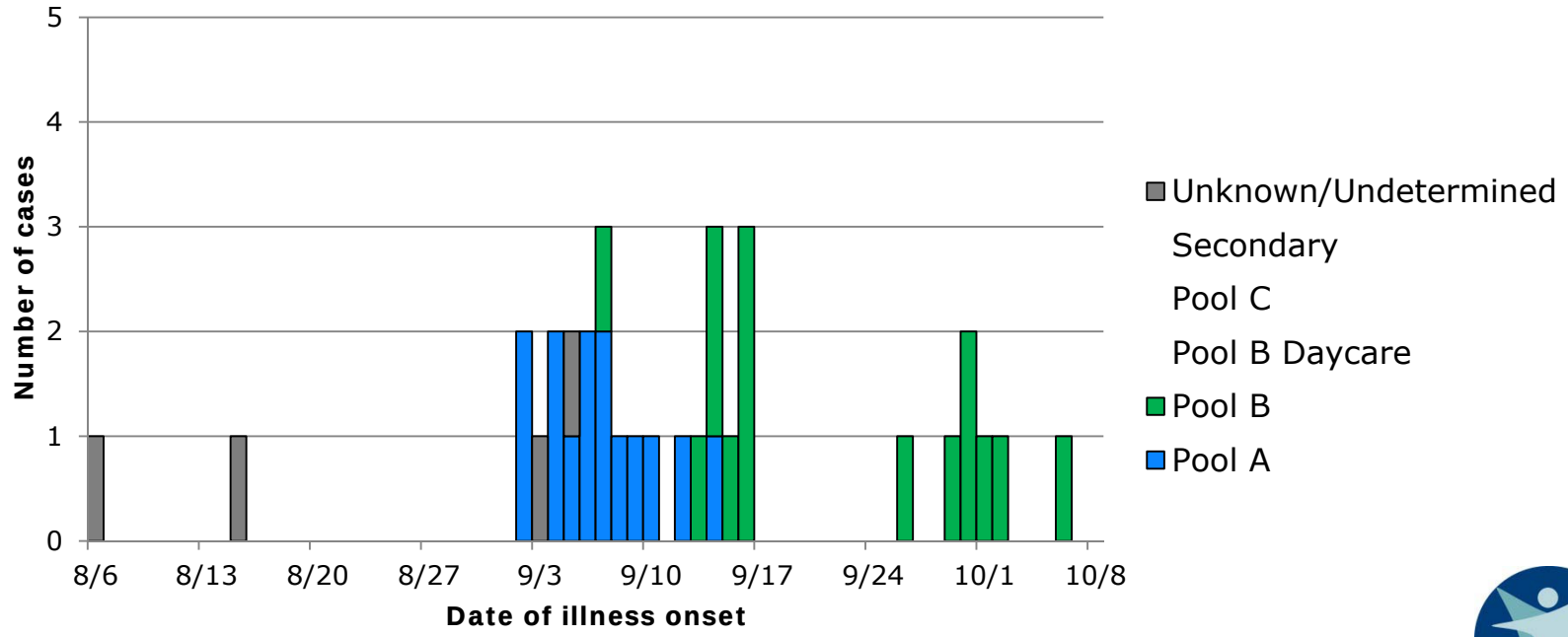
10/1
10/8
Date of illness onset
Unknown/Undetermined
Secondary
Pool C
Pool B Daycare
Pool B
Pool A


Pool A
Seasonal
Drained 9/2
Pool B
Indoor
Open year-
round
Swim lessons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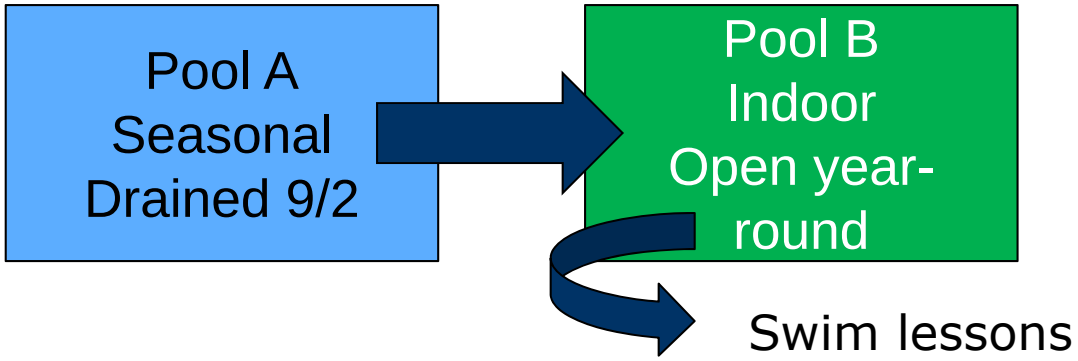
Secondary
Pool C
Pool B Daycare
Pool B
Pool A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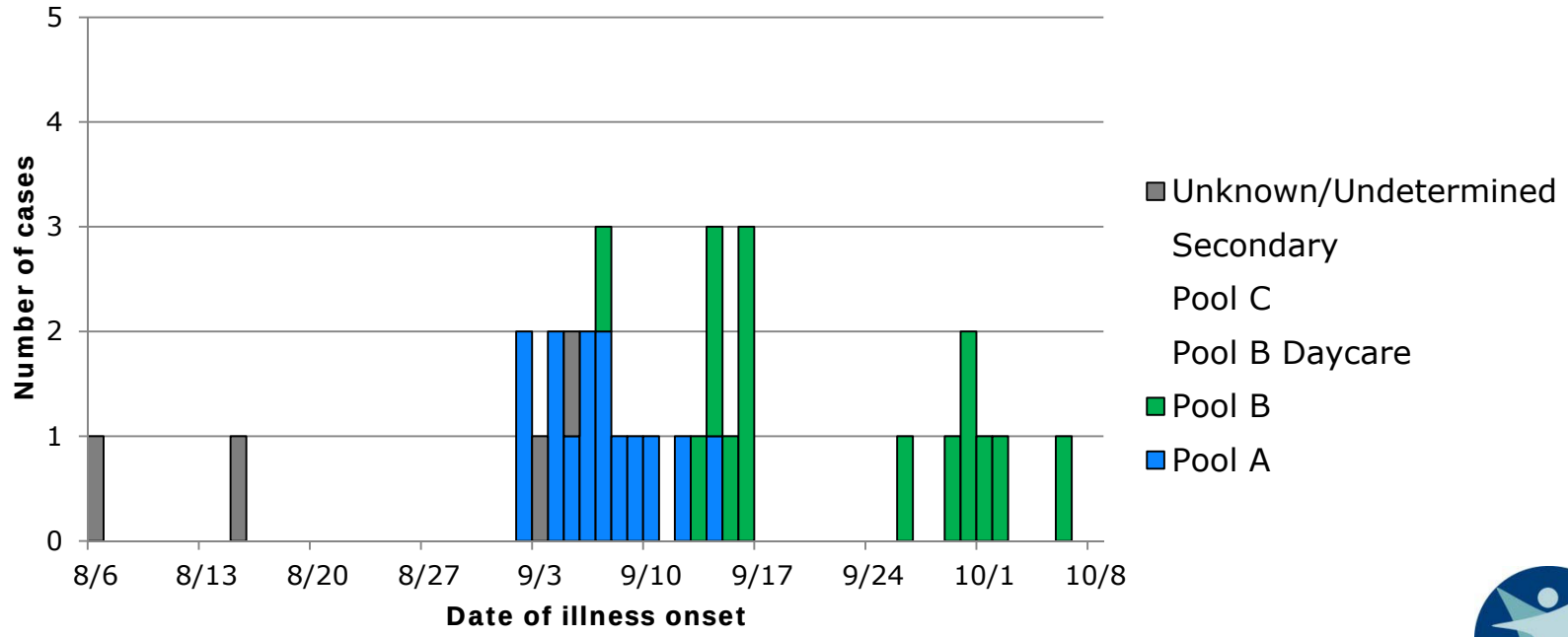
Pool B
Indoor
Open year-
round
Swim lessons
Lifeguards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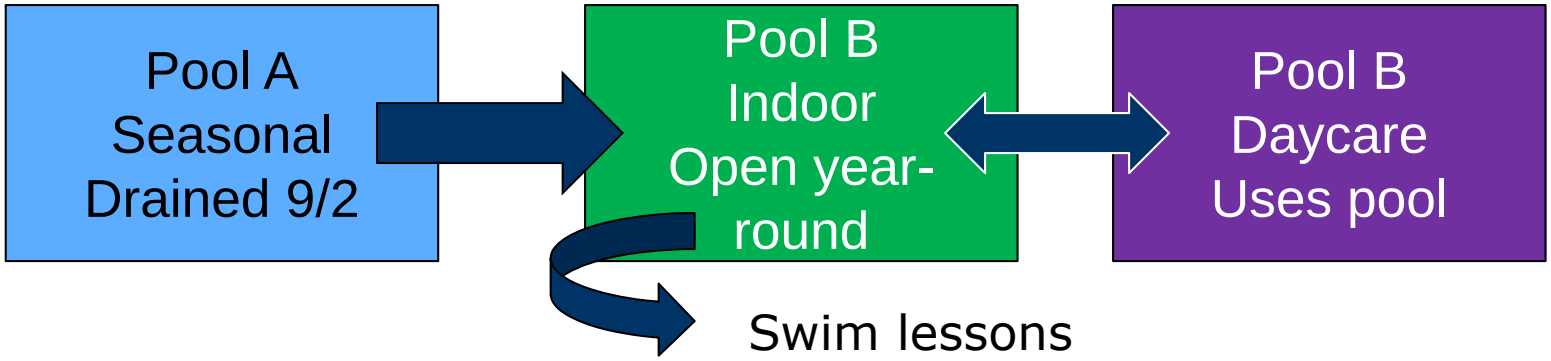
Pool A
Seasonal
Drained 9/2
Pool B
Indoor
Open year-
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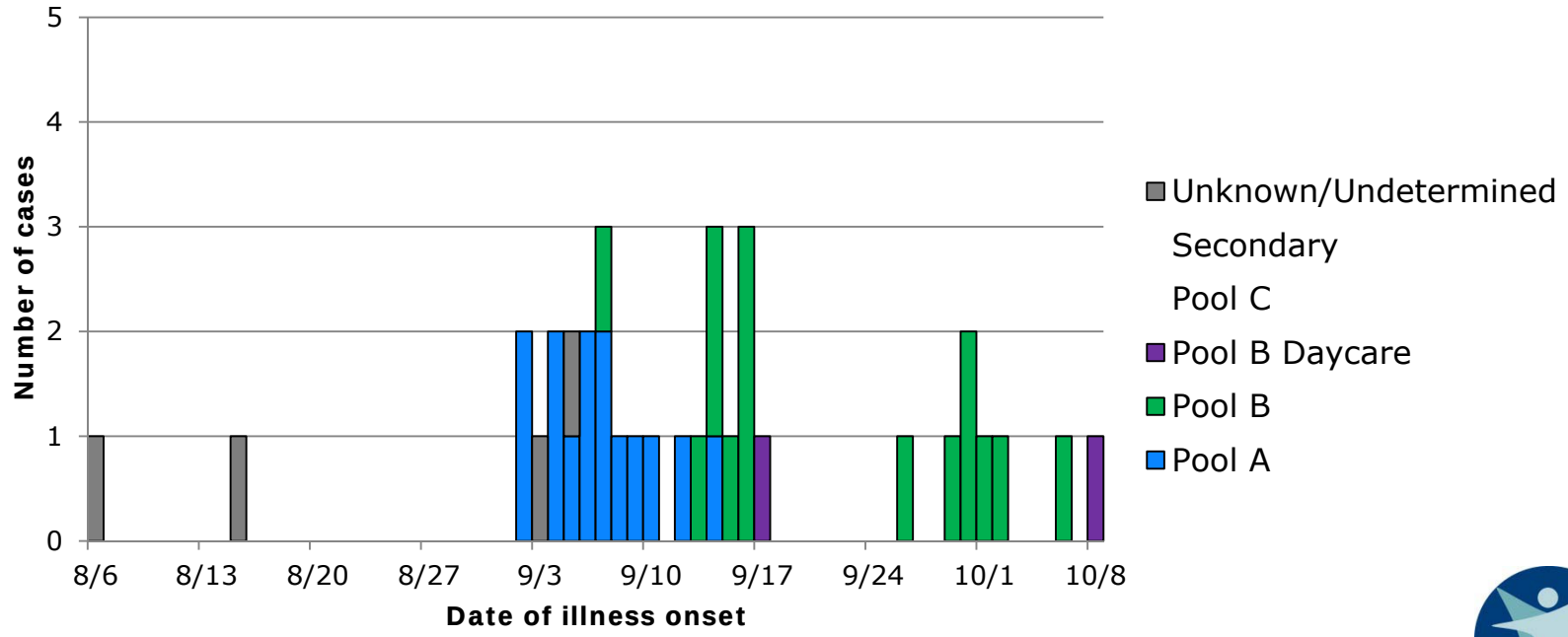
Pool B
Daycare
Uses pool
Swim lessons
Lifeguards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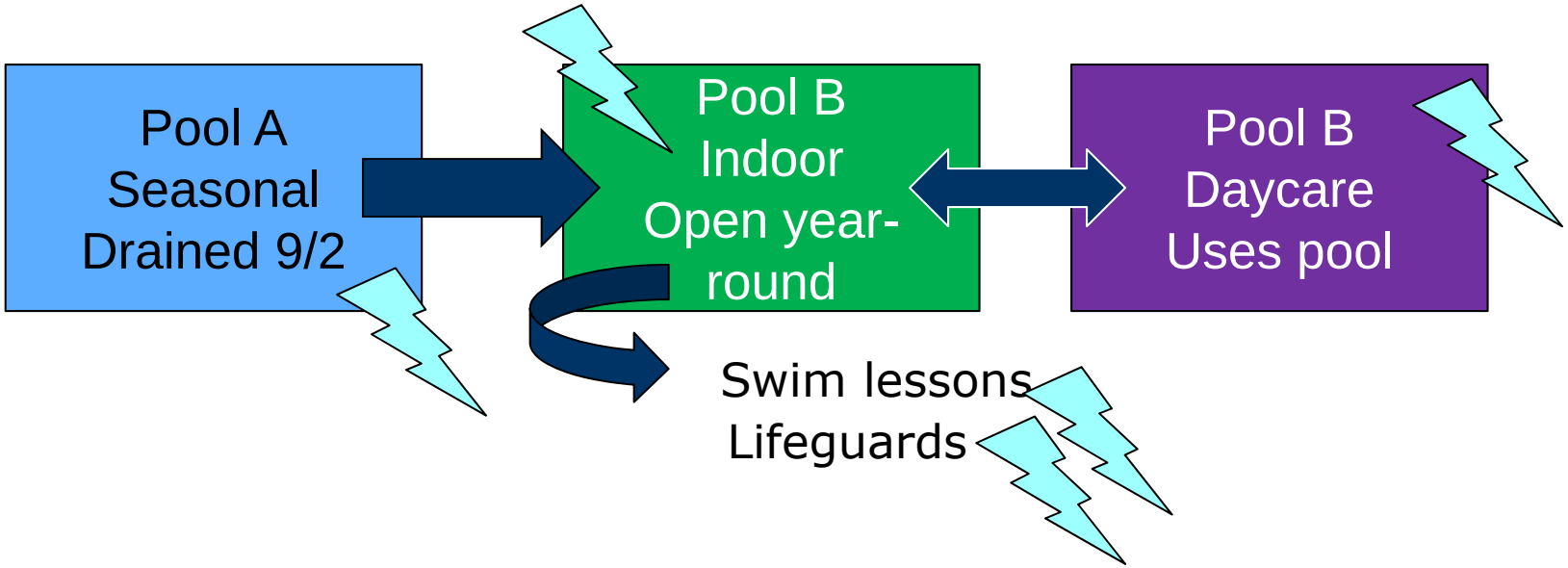
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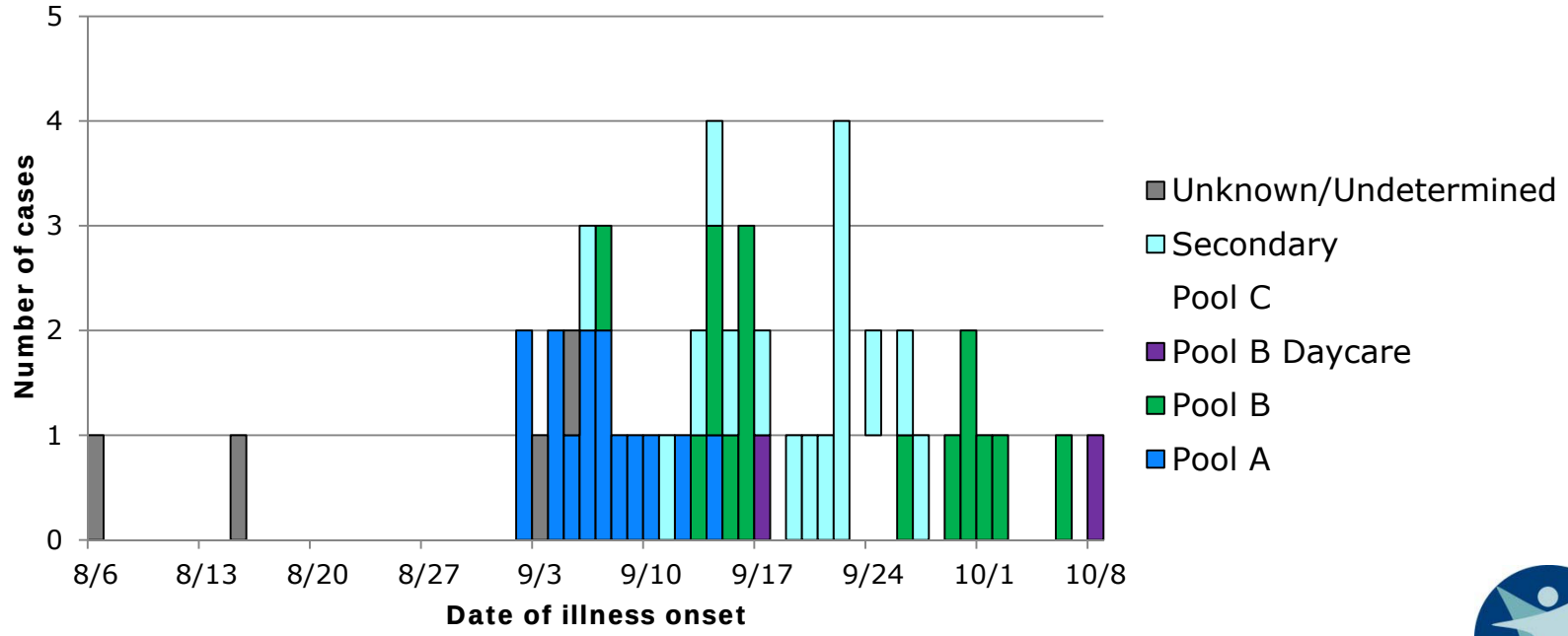
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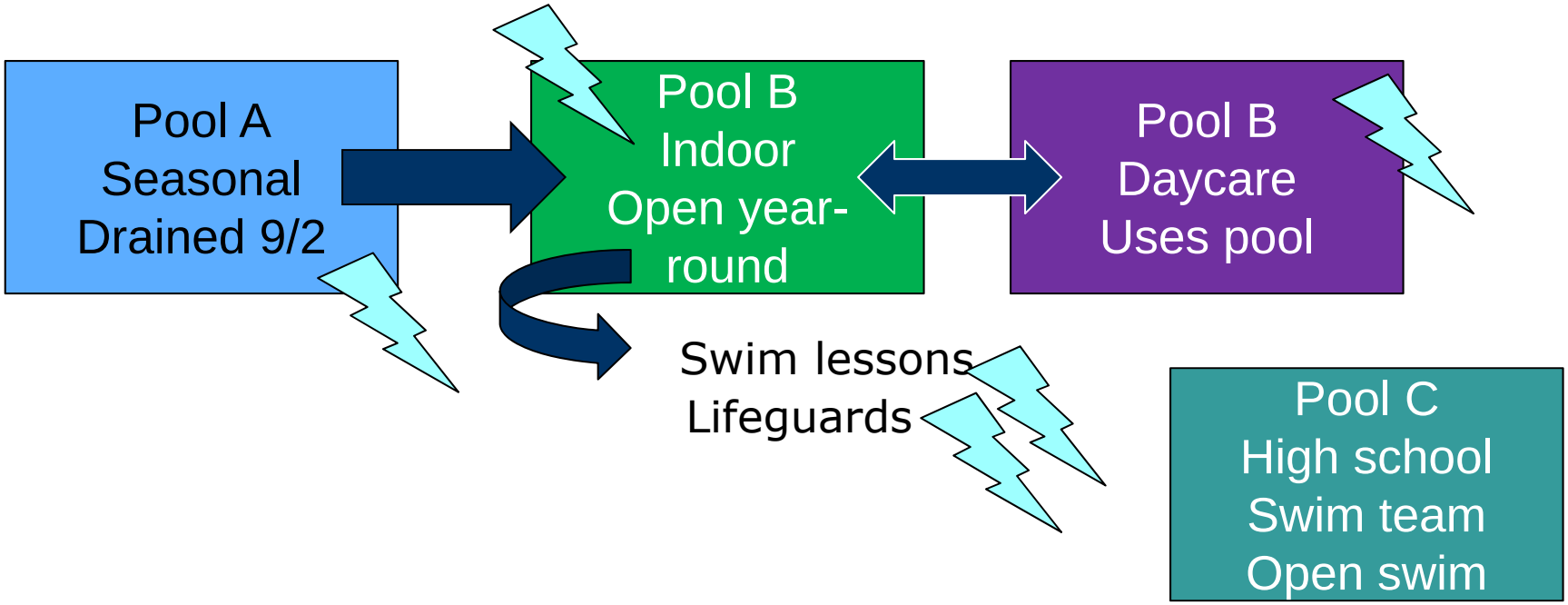
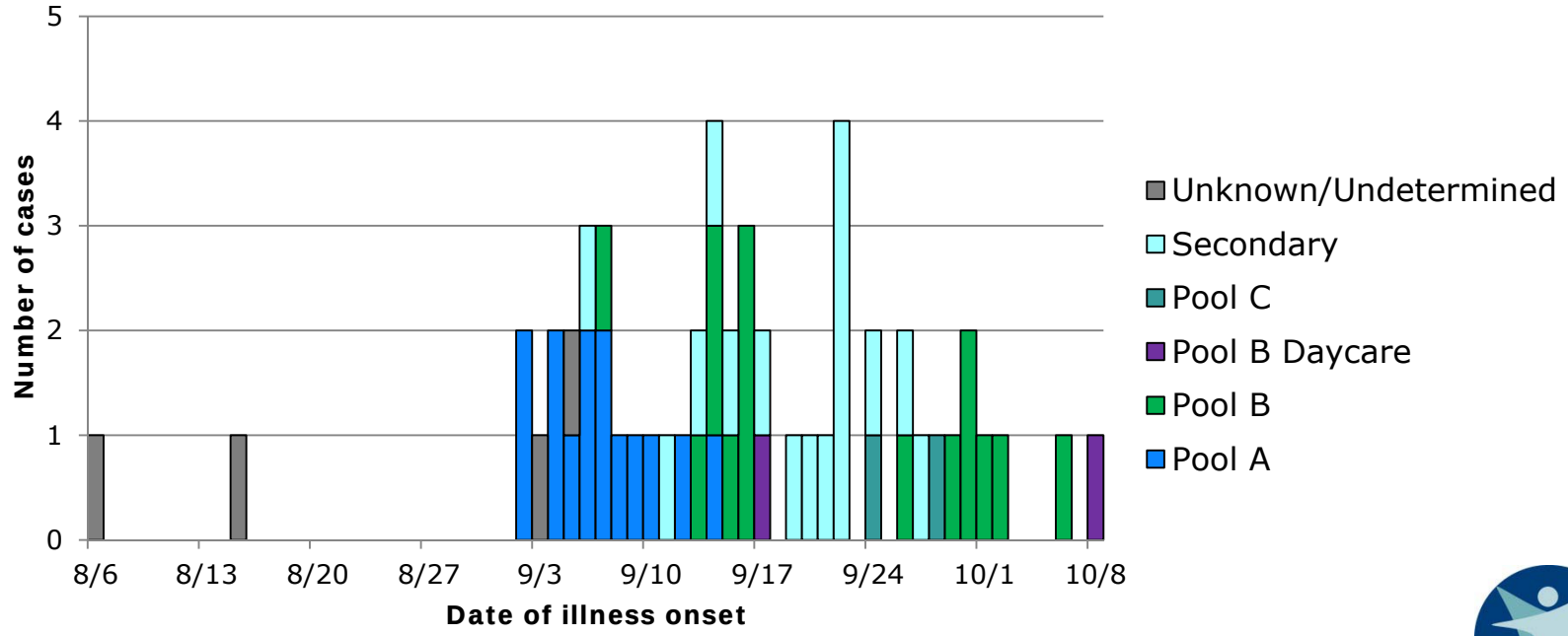

Pool A
Seasonal
Drained 9/2
Pool B
Indoor
Open year-
round
Pool B
Daycare
Uses pool
Swim lessons
Lifeguards
Pool C
High school
Swim team
Open swim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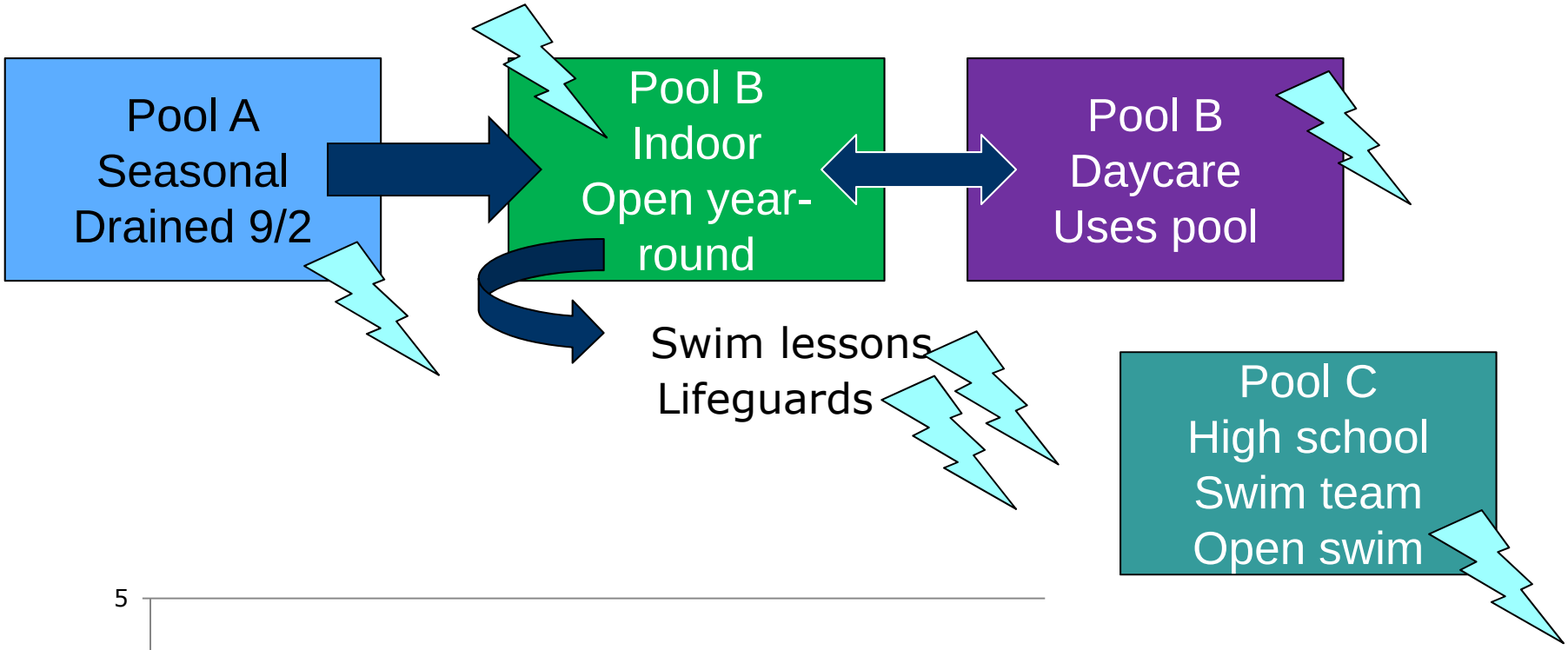
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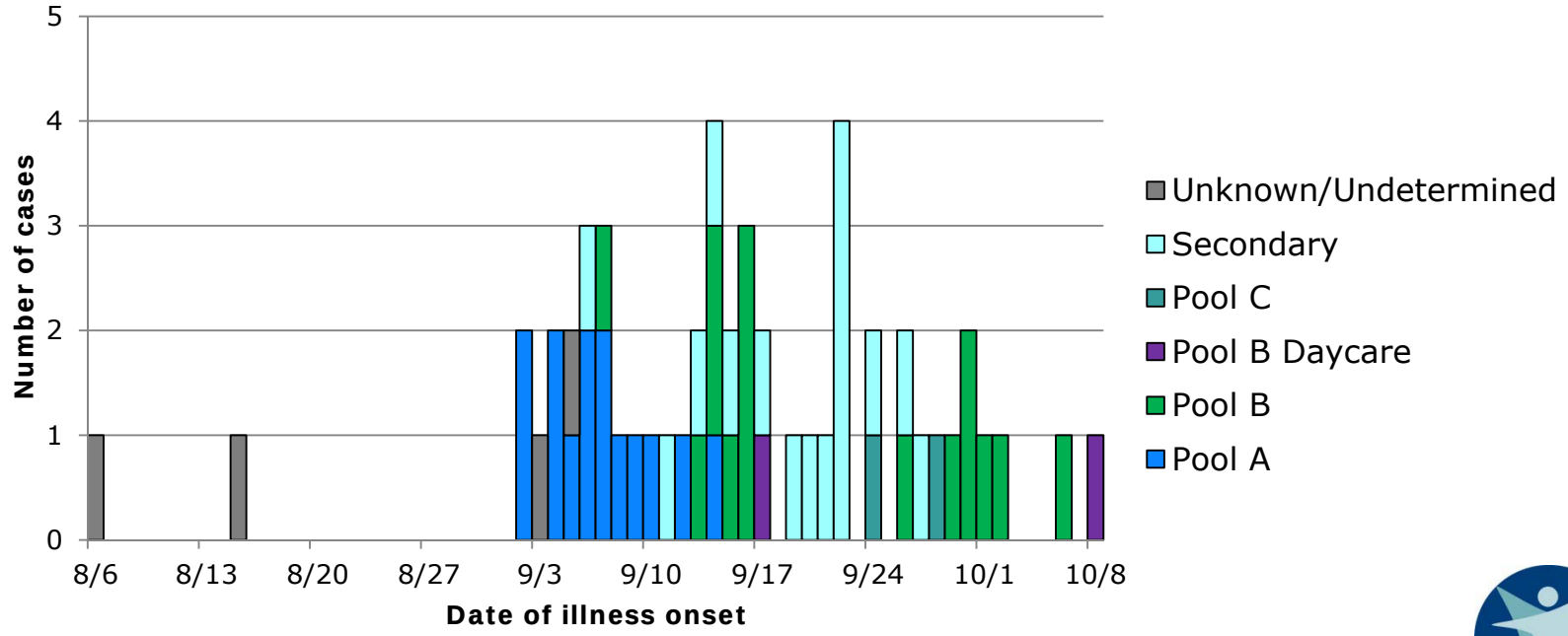
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Epidemiologic investigation

- CDES developed investigation questionnaire.
  - Symptoms/clinical signs.
  - Contact with ill individuals.
  - Swimming lessons (with locations and dates).
  - Chlorinated recreational water exposures.
  - Ambient recreational water exposure.
  - Swimming while ill or in the two weeks after symptoms resolution (with locations and dates).
  - Fecal accident exposure.
  - Daycare exposure, diaper exposure.
  - Summer camp exposure, farm/animal exposure.
  - Travel, and attendance at large gatherings.

Epidemiologic investigation

- 30% (11/37) of those with primary cases swam while symptomatic.
  - 5 of these individuals (46%) attended swim lessons while symptomatic.
  - Median age of patients who swam while ill was 6 years.

Footage.shutterstock.com

Is a fecal accident necessary to introduce *Cryptosporidium* into the water?

a. Yes
b. No

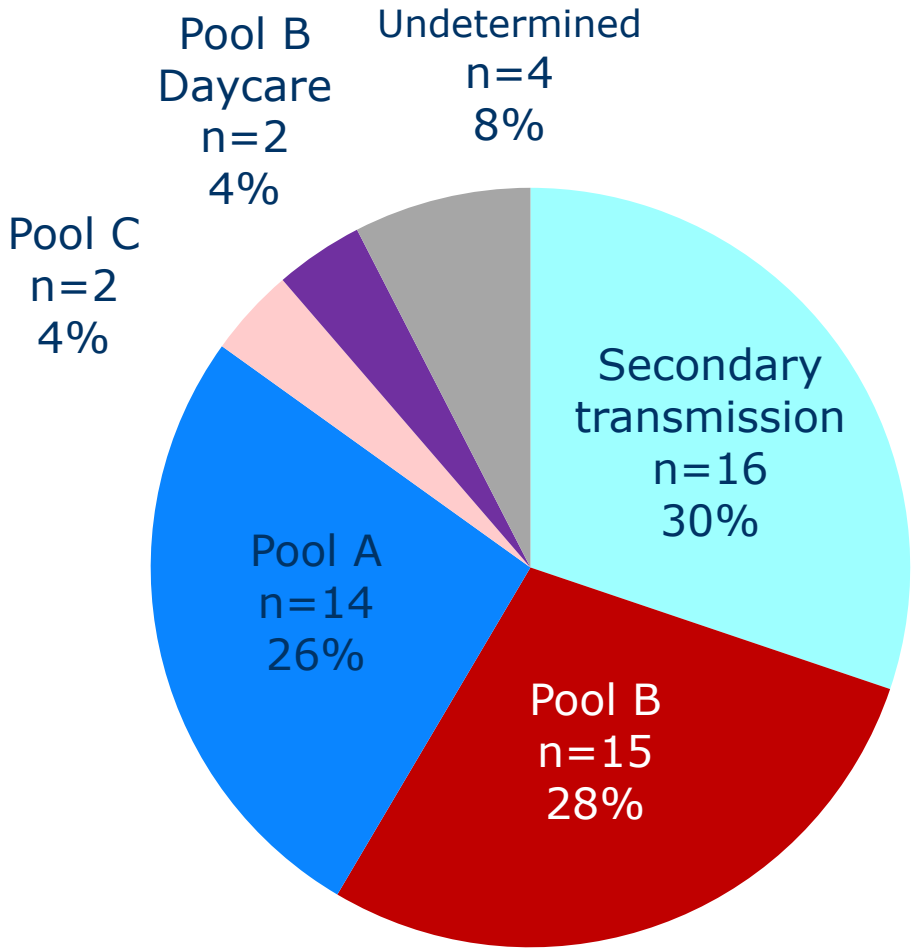
✓ **No**

Each person has an average 0.14 grams of fecal material on their perianal surface if they do not take a pre-swim shower with soap.

A single diarrheal accident can introduce 10^7-10^8 Cryptosporidium oocysts into the water- enough to cause infection with a single mouthful of pool water.

Centers for Disease Control and Prevention. Microbes in pool filter backwash as evidence of the need for improved swimmer hygiene –Metro Atlanta, Georgia, 2012. MMWR 2013;62;19:385-388.

Cases by Most Likely Source of Infection (n=53)



Interesting contributing factors

- “Pool hopping”
- Swimming while ill and at swimming lessons led to ongoing contamination.
- Daycare use of pool.
- High rate of secondary transmission.

Public health successes

- Chlorine shock treatments successful.
- Outbreak contained to three pools.
- Pool B closed voluntarily for 10 days on 10/1.
- Importance of public messaging during pool closure situations to prevent spread.
  - Exclusion for two weeks after symptom resolution.
  - Swim hygiene.
- Extremely aggressive and successful outreach and education by Health Department B.
  - Education during case finding: hand washing, exclusion from swimming for 14 days post symptom resolution.
  - Media releases and Pool B campus visits.

OUTBREAK:
4TH OF JULY FIREWORKS

Background

- On Friday afternoon, July 6, 2012, County C Forestry and Parks contacted County C Health Department (HD) regarding two individuals who report becoming ill after being at Lake Z on July 4th.
- Due to the timing of the call, testing of the lake for *E. coli* could not be performed until Monday.
- County C HD suspected hot weather during the 4th may have caused food contamination within a specific family as no vendor sales are allowed on the beach.

Background

- Over the weekend, six more illnesses were reported after visiting Lake Z.
- Symptoms included nausea and vomiting.
- Health Officer suspected norovirus.

Background

Monday, July 9

- New Sanitarian's first day.
- 20+ phone calls from individuals becoming ill after being at Lake Z.
- Incubation period, exposures, and symptoms suggest exposure at Lake Z beach.
- Forestry and Parks tested Lake Z for *E. coli*.
- Approximately 47 persons had self reported illness.

Environmental sampling

- Water samples were collected by the U.S. Geological Survey Wisconsin Water Science Center (WWSC) Water Microbiology Laboratory in Marshfield, WI.
- Water tested for norovirus, *Giardia*, *Cryptosporidium*, and fecal contamination indicators.

Environmental investigation

- Beach closed to the public.
- 1800-2000 persons estimated to have visited Lake Z beach on July 4.
- 25 large bags of garbage were removed from the beach on July 5.
- Vomit found on the floor of restrooms.

Environmental testing results

- No norovirus detected in water samples from Lake Z.
  - Heat and sunlight degrade viral RNA.
- However, human fecal markers (polyomavirus) were identified in the water samples.
- Beach closed to allow several days of continued heat and sunlight to destroy contaminants.

Results

- Laboratory investigation:
  - Eight stool specimens tested for norovirus, enteric bacteria, and enteric parasites at WSLH:
    - 7 of 8 positive for norovirus GI.3C Beijing.
- Epidemiologic investigation:
  - Interviewed different groups of park visitors using park sign-in registry.
  - Campers who swam in the deep side of the lake were not ill.
  - Swimmers who swam in the shallow side of the lake were ill.
  - No common source food; no vendors on site.

Results

- No norovirus detected in water samples from Lake Z.
  - Heat and sunlight degrade viral RNA.
- Case control study of visit dates, activities, and exposures suggested water was the source.
  - Swimming with face in water (OR 3.3).
  - Putting head under water (OR 2.7).
  - Using floatation device (OR 2.4).
  - Swallowing water (OR 2.1).

Important contributing factors

- Capacity:
  - Beach was over capacity with approximately 2,000 persons present.
  - Instant hand sanitizer gel in restrooms depleted early in the day.
  - Accumulation of garbage on beach.
- Staffing:
  - Only one seasonal employee at pay window.
- Geographical setting:
  - Beach on only inlet leading to large lake.
  - Minimal circulation of water.

OUTBREAK: HORRIBLE HONEYMOON

Background

- In August 2012, County D Health Department contacted CDES regarding an outbreak of gastrointestinal illness following a wedding reception that took place at a sportsman's club.
- Approximately 200 people attended the wedding reception where a buffet style dinner was served.
- Symptoms included acute onset vomiting, diarrhea, and headache.

Results

Food/drinks	Persons who ate foods				Persons who did not eat foods				Statistical analysis		
	Ill	Well	Total	% Ill	Ill	Well	Total	% Ill	Odds Ratio (OR)	95% CI	p-Value*
Roast Beef	10	10	20	50%	8	11	19	42%	1.375	0.39, 4.87	0.4316
Chicken	10	12	22	45%	8	9	17	47%	0.9375	0.26, 3.34	0.5881
Potatoes	15	11	26	58%	3	10	13	23%	4.545455	1.01, 20.51	0.0428
Green Salad	13	11	24	54%	5	10	15	33%	2.363636	0.62, 9.03	0.1740
Carrots	12	9	21	57%	6	12	18	33%	2.666667	0.72, 9.85	0.1219
Dinner Rolls	9	9	18	50%	9	12	21	43%	1.333333	0.38, 4.72	0.4506
Cupcake	8	12	20	40%	10	9	19	53%	0.6	0.17, 2.14	0.3196
Assorted Candies	10	6	16	63%	8	15	23	35%	3.125	0.83, 11.78	0.0834
Water	**14**	**6**	**20**	**70%**	**4**	**15**	**19**	**21%**	**8.75**	**2.03, 37.67**	**0.0027**
Soda	9	7	16	56%	9	14	23	39%	2	0.55, 7.30	0.2333
Beer	5	5	10	50%	13	16	29	45%	1.230769	0.29, 5.19	0.5317
Wine	1	0	1	100%	17	21	38	45%	2.471	0.06, Undef	0.4615
Milk	1	2	3	33%	17	19	36	47%	0.558824	0.05, 6.73	0.5591
Coffee	1	2	3	33%	17	19	36	47%	0.558824	0.05, 6.73	0.5591
Assorted Alcohol	2	3	5	40%	16	18	34	47%	0.75	0.11, 5.07	0.5759

*Calculated using Fisher Exact Test

Water sampling

- WWSC sampled water from taps and private well, as well as septic system.
- Tested for bacterial, viral, and parasitic pathogens.

www.absoluteresourceassociates.com

Water sampling results

- Tap water positive for total coliforms and *Escherichia coli*.
- Concentrated tap water and septic system grab samples positive for norovirus GI and several human fecal contamination indicators.
- Concentration of norovirus in well water 1/40th of raw sewage
- Sequenced norovirus strains in clinical stool specimens and tap water were identical (WSLH).

Results

- Inspection of the private septic system and well determined that water from the septic system was leaching into the well water.
- Facility was unaware they were not on public sewer and had not performed any system maintenance since purchase 10+ years ago.
- New well drilled on premises.
- New septic system installed.
- New well water tested 8/30.
  - Total coliform and *E. coli* negative.

Interesting contributing factors

- Septic system maintenance is the responsibility of the property owner.
  - Leakage and well contamination.
- Importance of considering water and environmental exposures in suspect foodborne outbreaks.

ON THE HORIZON

Cryptosporidiosis case definition changes- 2014

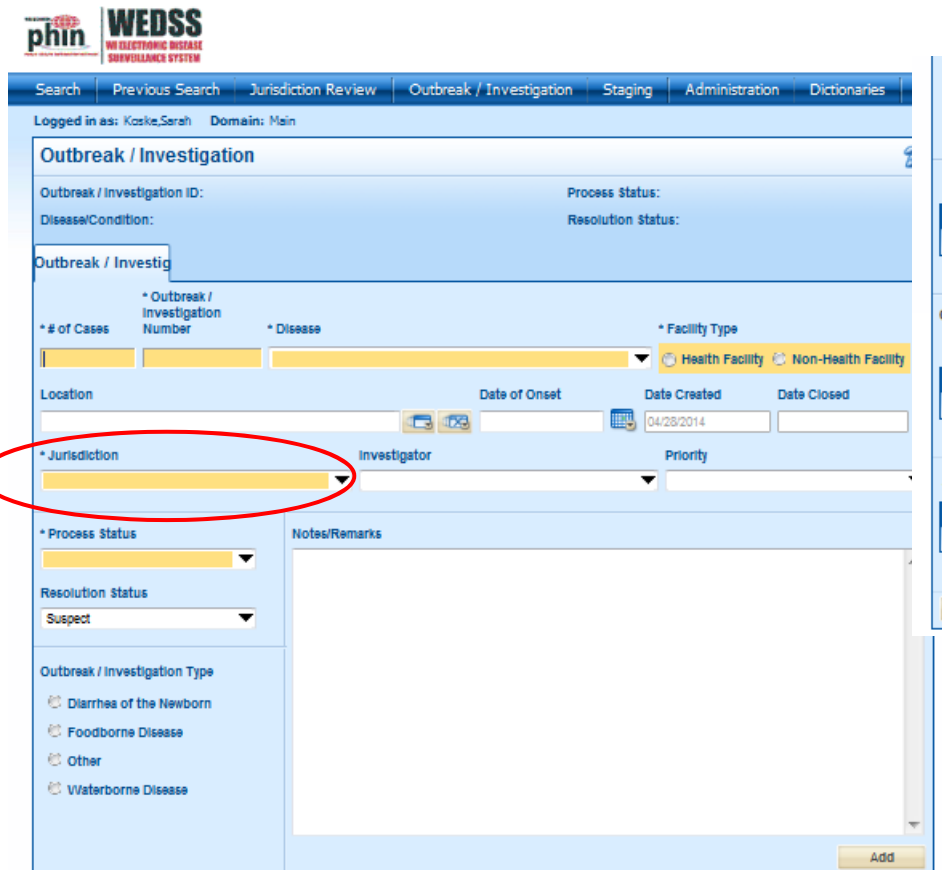
- Updated CSTE case definition relies on laboratory diagnostic test used to diagnose infection.
- Confirmed case= detection of **organisms or DNA** by:
  - Direct fluorescent antibody (DFA).
  - Polymerase Chain Reaction (PCR).
  - Enzyme Immunoassay (EIA- **microplate only**).
  - Light microscopy.
- Probable case= **detection of antigen** by:
  - Enzyme ImmunoAssay (EIA for antigen, microplate not specified).
  - Immunochromatographic card test (i.e. ImmunoCard STAT!, some labs call these as EIAs).
  - Rapid card test (some labs also call these EIAs).
  - Unknown method.

Cryptosporidiosis case definition changes- 2014

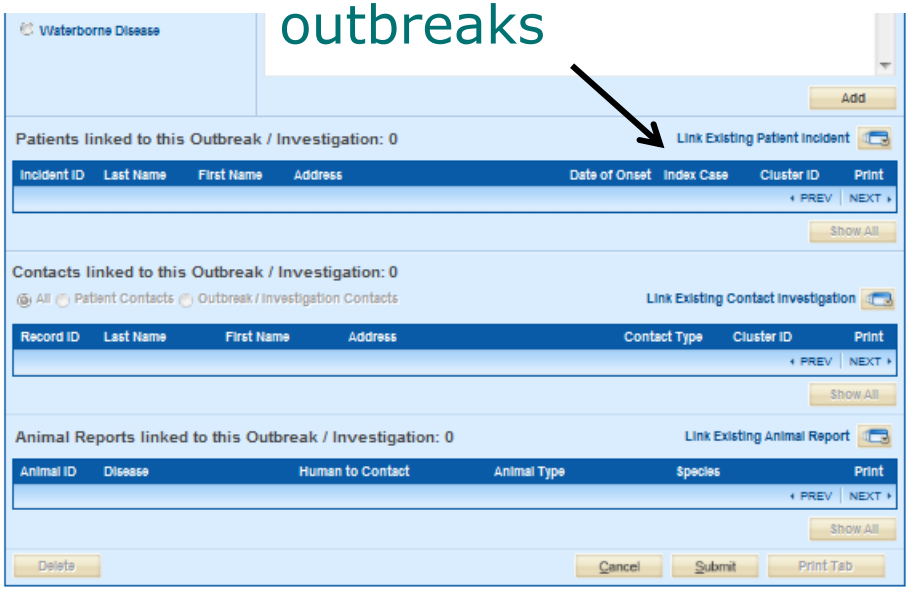
- Development of classification algorithm to help with classification.
- Revision of WEDSS forms for selection of:
  - Laboratory that performed testing.
  - Tests available at that laboratory.
- WEDSS webinar to explain changes.
- Benefits:
  - Improved knowledge of how many labs are using rapid card tests.
    - Rapid card tests have a low positive predictive value and give many false positives.
  - More accurate confirmed vs. probable case numbers.

WEDSS outbreak module

- Facilitates information sharing during multi-jurisdictional outbreaks.

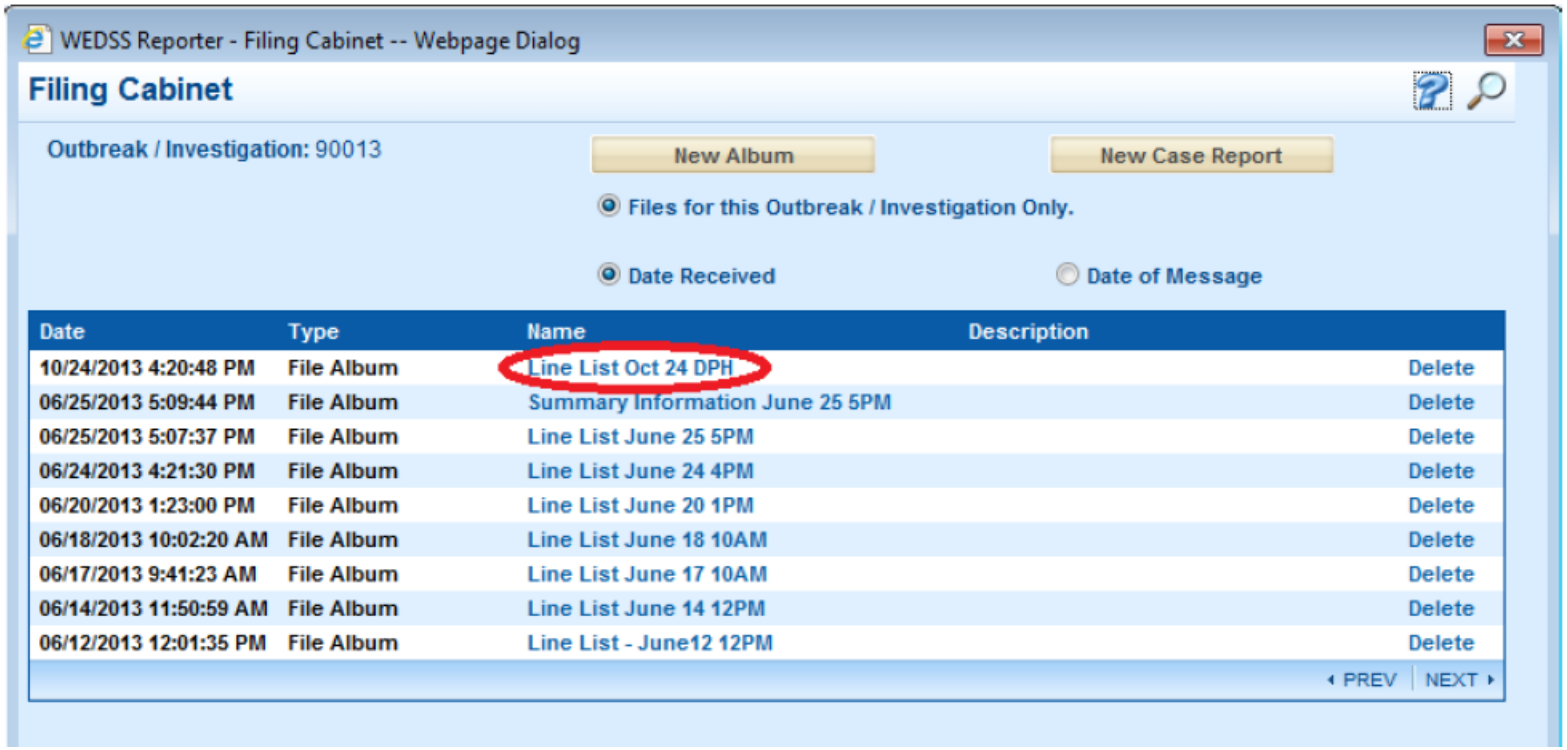


✓ Link case incidents to outbreaks



WEDSS outbreak module

- Upload updated line lists and summaries to share using the file cabinet.
- Instructions with screenshots are available.



Sample collection and submission

Kit 3 – Ova & Parasite Testing

- *Giardia*
- *Cryptosporidium*

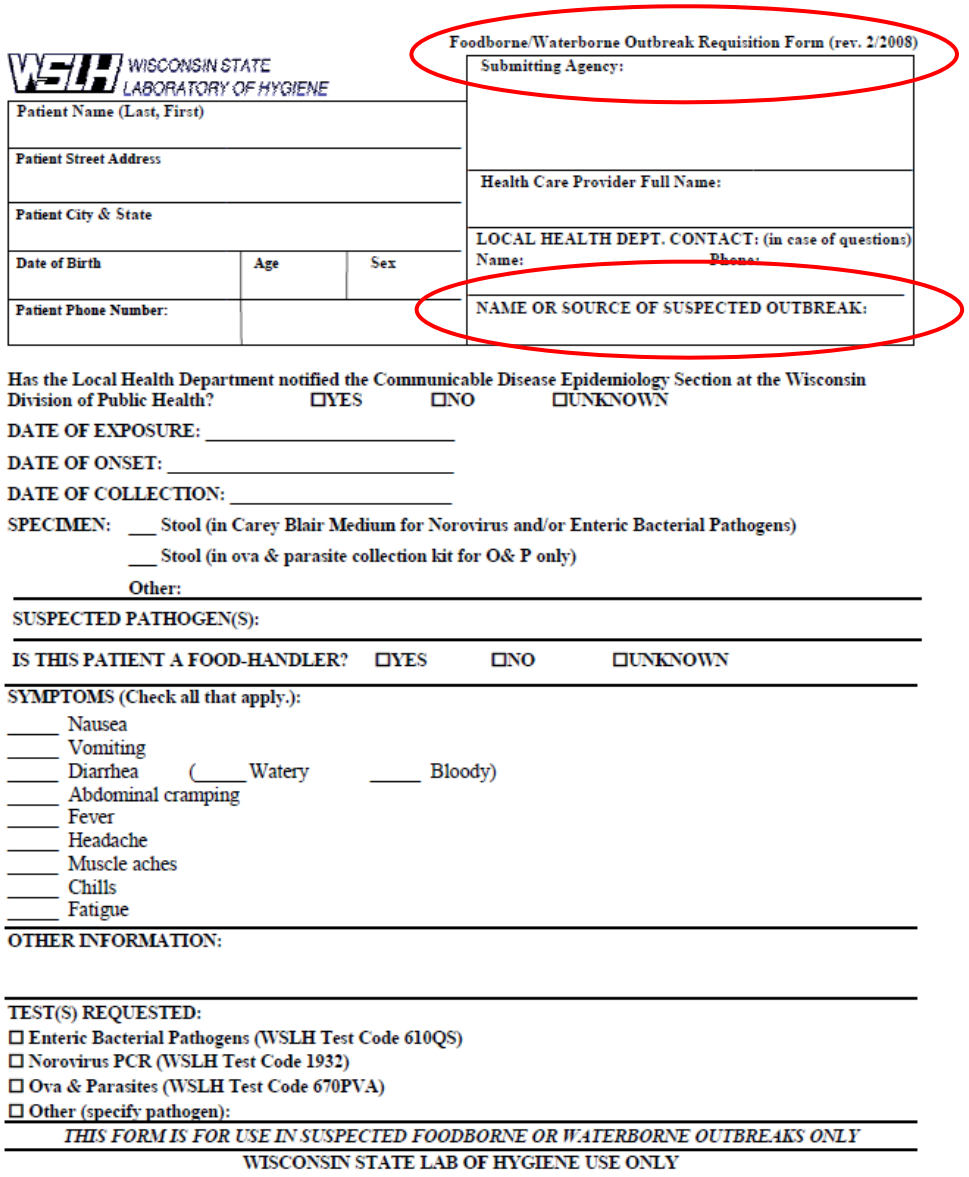
Kit 10 – Enteric Pathogen Culture

- *Salmonella*
- *Shigella*
- *Campylobacter*
- *E. coli* O157
- Norovirus

To order, contact WSLH Customer Service at 1-800-862-1088.
Orders will be received within 3 business days.

Requisition form

- Please fill out the requisition form completely.
- Include:
  - Patient information
  - Submitting agency.
  - LHD contact information.
  - Date of collection.
  - Specimen type.
  - Any available clinical data (organism suspected).
  - Test requested.
  - Outbreak name (provided by CDES).



WSLH WISCONSIN STATE LABORATORY OF HYGIENE

Foodborne/Waterborne Outbreak Requisition Form (rev. 2/2008)

Submitting Agency:

Patient Name (Last, First)

Patient Street Address

Patient City & State

Date of Birth | Age | Sex

Patient Phone Number:

Health Care Provider Full Name:

LOCAL HEALTH DEPT. CONTACT: (in case of questions)
Name: Phone:

NAME OR SOURCE OF SUSPECTED OUTBREAK:

Has the Local Health Department notified the Communicable Disease Epidemiology Section at the Wisconsin Division of Public Health? ☐YES ☐NO ☐UNKNOWN

DATE OF EXPOSURE: _____

DATE OF ONSET: _____

DATE OF COLLECTION: _____

SPECIMEN: ___ Stool (in Carey Blair Medium for Norovirus and/or Enteric Bacterial Pathogens)
___ Stool (in ova & parasite collection kit for O& P only)
Other:

SUSPECTED PATHOGEN(S):

IS THIS PATIENT A FOOD-HANDLER? ☐YES ☐NO ☐UNKNOWN

SYMPTOMS (Check all that apply.):

_____ Nausea
_____ Vomiting
_____ Diarrhea (_____ Watery _____ Bloody)
_____ Abdominal cramping
_____ Fever
_____ Headache
_____ Muscle aches
_____ Chills
_____ Fatigue

OTHER INFORMATION:

TEST(S) REQUESTED:
☐ Enteric Bacterial Pathogens (WSLH Test Code 610QS)
☐ Norovirus PCR (WSLH Test Code 1932)
☐ Ova & Parasites (WSLH Test Code 670PVA)
☐ Other (specify pathogen):

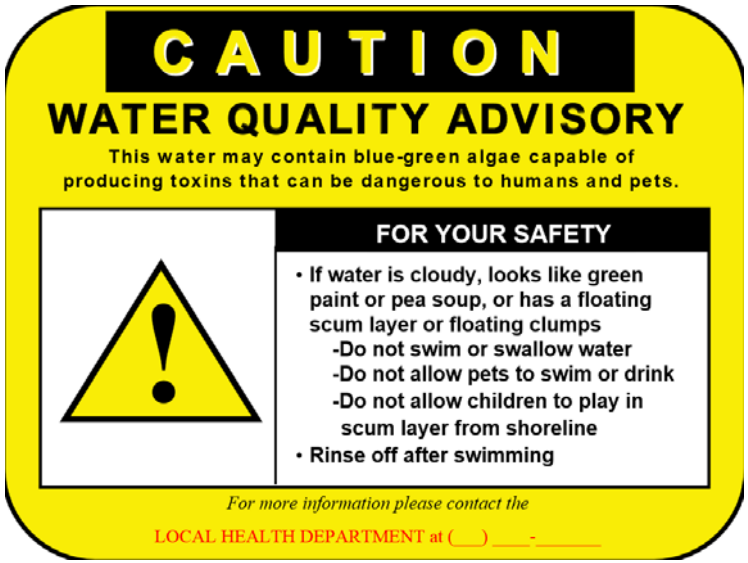
THIS FORM IS FOR USE IN SUSPECTED FOODBORNE OR WATERBORNE OUTBREAKS ONLY

WISCONSIN STATE LAB OF HYGIENE USE ONLY

Sample collection and packaging online reference tutorials coming soon!

HAB associated illness reporting

- How can I report a suspected HAB associated illness to the WI Harmful Algal Blooms Program?
  - Use the online form (preferred):
    - http://www.dhs.wisconsin.gov/eh/bluegreenalgae/index.htm
  - Call the Bureau of Environmental Health:
    - (608) 266-1120



Acknowledgements

- Lorrie Backer
- Virginia Roberts
- Jonathan Yoder
- Michele Hlavsa
- Michael Beach
- Rachel Klos
- Traci DeSalvo
- Emmy Wollenburg
- Mark Werner

Resources

- CDC Healthy Water website:
  http://www.cdc.gov/healthywater/
- CDC recreational water toolkit:
  http://www.cdc.gov/healthyswimming/rwi_outbreak.htm
- CDC drinking water toolkit:
  http://www.cdc.gov/healthywater/emergency/toolkit/drinking-water-outbreak-toolkit.html
- DPH Communicable Diseases A-Z (and fact sheets):
  http://www.dhs.wisconsin.gov/communicable/index.htm
- WI Harmful Algal Blooms Program:
  http://www.dhs.wisconsin.gov/eh/bluegreenalgae/index.htm
- CDC's pool chemical safe storage posters, HAB physician's reference cards, HAB animal safety alert posters available at table

Contact information

Sarah Koske
CDC/CSTE Waterborne Fellow
Phone: (608) 267-7321
Fax: (608) 261-4976
Sarah.Koske@dhs.wi.gov