

Testing the Waters: The Wisconsin Experience

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Outline

- ❑ Introduction and background
- ❑ Current state capacity for clinical and environmental testing
- ❑ Testing success stories: outbreak detection and investigation
- ❑ Clinical and environmental sampling challenges
- ❑ Testing needs



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WELCOME TO WISCONSIN

Background

- ❑ 5,742,713 people
- ❑ 1,270,000 cows



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Background

- 15,074 lakes
- Wisconsin Dells
 - Highest concentration of water parks worldwide
 - America's largest water park (70 acres)
 - Contains 16 million gallons of water
 - 5 million annual visitors



www.kayakfishingwisconsin.com

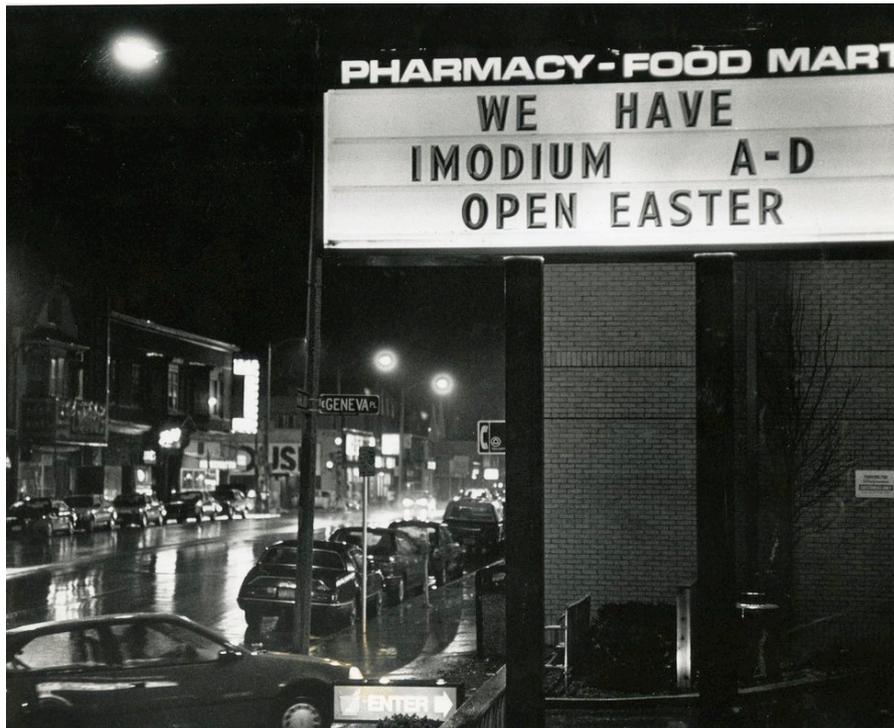


www.kalahariresorts.com

Background

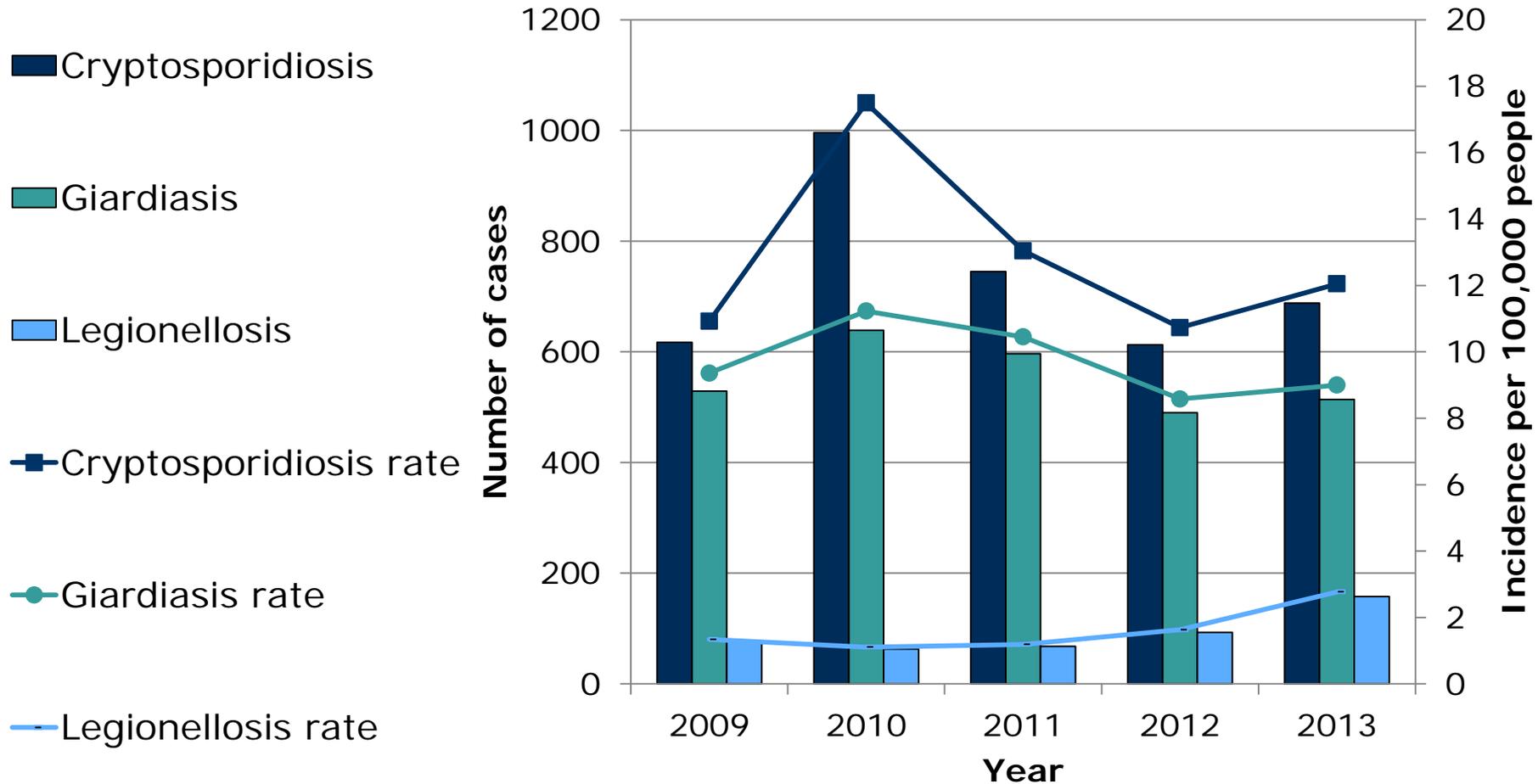
Milwaukee cryptosporidiosis outbreak, 1993

- 403,000 ill, 100 deaths



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Incidence of Select Pathogens, Wisconsin, 2009-2013





CURRENT CAPACITY FOR WATERBORNE OUTBREAK INVESTIGATIONS

Current Capacity: Epidemiology

- ❑ Three full-time enteric disease epidemiologists: foodborne, waterborne, zoonotic and person-to-person outbreaks
- ❑ One CDC/CSTE Waterborne Fellow
- ❑ FoodCORE-funded student interviewing team
- ❑ One epidemiologist funded by state; all other staff and activities are grant funded
- ❑ Home rule state; 99 local health jurisdictions



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Current Capacity: Public Health Laboratory

Wisconsin State Laboratory of Hygiene (WSLH)

▣ Clinical specimens:

- Parasites (*Cryptosporidium*, *Giardia*, other)
- Enteric bacterial culture and Pulse Field Gel Electrophoresis (PFGE)
- Polymerase Chain Reaction (PCR), culture and PFGE for *Legionella*
- Norovirus PCR and sequencing
- PulseNet, CaliciNet, NoroSTAT, DPDx, NARMS



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Current Capacity: Public Health Laboratory (Continued)

Wisconsin State Laboratory of Hygiene (WSLH)

□ Environmental samples

■ Water microbiology:

- Viral and bacterial fecal contamination indicators
- Microbial source tracking
- Parasites and bacterial culture
- *Pseudomonas* in recreational water

■ Cyanobacterial identification and enumeration; cyanotoxin testing



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Current Capacity: Partner Agencies

- U.S. Geological Survey: Wisconsin Water Science Center (WWSC); Environmental samples:
 - Large volume sample collection and concentration
 - Viruses by PCR
 - Fecal contamination indicators (bacterial, viral)
- Centers for Disease Prevention and Control (CDC)
 - *Cryptosporidium* speciation and molecular subtyping



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Current Capacity: Networks

- NoroSTAT site
 - **Norovirus Sentinel Testing And Tracking** network
 - CDC and five state health departments (Minnesota, Ohio, Oregon, Tennessee and Wisconsin)
 - Approximately 150 norovirus outbreaks per year in Wisconsin
 - Ensures norovirus isolates from all outbreaks are sequenced and uploaded to CaliciNet
- NORSDirect pilot site



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LABORATORY TESTING SUCCESS STORIES

Testing Success Stories: Legionella

Environmental testing:

- ❑ Legionnaire's Disease outbreak, 2010
 - High levels of *Legionella* discovered in hospital fountain

Clinical specimens:

- ❑ Legionnaire's Disease outbreak, 2013
 - Revealed 14 unique PFGE patterns from 14 clinical isolates
 - No single environmental source



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Testing Success Stories: STEC

Clinical specimens:

- ❑ STEC outbreaks associated with lake water exposure, 2006-2013
 - Matching PFGE patterns used to identify O145, O111 and O157 STEC clusters.
- ❑ Identification of multi-county and multi-state clusters



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Testing Success Stories: Norovirus

Environmental testing:

- ❑ Norovirus outbreak associated with freshwater lake, 2012
 - WWSC sampled lake water and pit toilets at beach.
 - WWSC performed testing for norovirus, enteric pathogens, and human fecal contamination indicators.
 - Norovirus degraded but human polyomavirus survived in water.
 - Supported beach closure for pathogen degradation by the elements.



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Testing Success Stories: Norovirus

Environmental testing (continued):

- ❑ Norovirus outbreak associated with drinking water at a wedding reception, 2012
 - WWSC sampled multiple taps, private well and septic system.
 - Tested for enteric pathogens by qRT-PCR.
 - Identified and quantified norovirus GI contamination of private well and ground water.
 - Sequenced clinical and water norovirus strains identical.



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Testing Success Stories: Cryptosporidium

Cryptosporidium speciation and molecular subtyping:

- ❑ Multi-jurisdictional recreational water-associated cryptosporidiosis outbreak, 2013
 - CDC identified same rare subtype from 12 clinical isolates (*C. hominis* IfA12G1).
 - Same subtype isolated from patients who swam in epidemiologically linked pools.
- ❑ Water park-associated cryptosporidiosis outbreak, 2013
 - Matching clinical subtypes (*C. hominis* IfA12G1); no epidemiologic links



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Testing Success Stories: Cryptosporidium

Cryptosporidium speciation and molecular subtyping (continued):

- Foodborne cryptosporidiosis outbreak, 2013
 - CDC linked cases by species and subtype (*C. parvum* IIaA17G2R1)
 - Ruled out association with concurrent outbreak in close geographical proximity



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CLINICAL AND ENVIRONMENTAL SAMPLING CHALLENGES

Environmental Sampling Challenges

- ❑ Decision to pursue environmental sampling influenced by:
 - Time elapsed between exposure and outbreak recognition
 - ❑ Late notification, recognized by PFGE, long incubation
 - Pathogen survival
 - ❑ Environmental degradation, chlorine tolerance, water treatment
 - Multiple water exposures or sites of exposure on a single water body, or no strong link to a single location
 - Funding
- ❑ Trend away from culture-based diagnostics for *Legionella* in clinical laboratories
 - Lack of clinical isolates to link to environmental sources.



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TESTING NEEDS

Testing Needs: Legionella

- ❑ Encourage clinicians and clinical laboratories to obtain respiratory specimens for culture and PFGE of *Legionella*
- ❑ Improve knowledge of *Legionella* ecology
- ❑ “LegionellaNet”



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Testing Needs: *Cryptosporidium*

- ❑ Improve outbreak detection and surveillance through routine speciation and molecular subtyping of *Cryptosporidium*.
 - Fund and train WSLH staff to perform subtyping.
 - Participate in CryptoNet.
 - ❑ Provide context for molecular findings.
 - ❑ Establish background prevalence and distribution of *Cryptosporidium* species and subtypes in Wisconsin and nationwide.
 - ❑ Recognize new and emerging species and subtypes.



Testing Needs: Cryptosporidium (Continued)

- Anticipated benefits:
 - Identification of case clusters with common exposure but wide geographical distribution.
 - Ability to distinguish outbreak-related versus sporadic cases in community.
 - Direction of our limited epidemiologic and local health department resources to clusters with matching subtypes.
 - Linkage of clinical and environmental isolates like PFGE.



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THANK YOU

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