Always Drink Upstream of the Herd: Moving the Dial on Waterborne Disease Prevention with Limited Resources

CSTE

Nashville, TN June 6, 2014

National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne, Waterborne, and Environmental Diseases

"Always drink upstream from the herd."

WILL ROGERS
1879-1935

Waterborne Disease Prevention Objectives: Learn from Each Other to Maximize Progress with Limited Resources

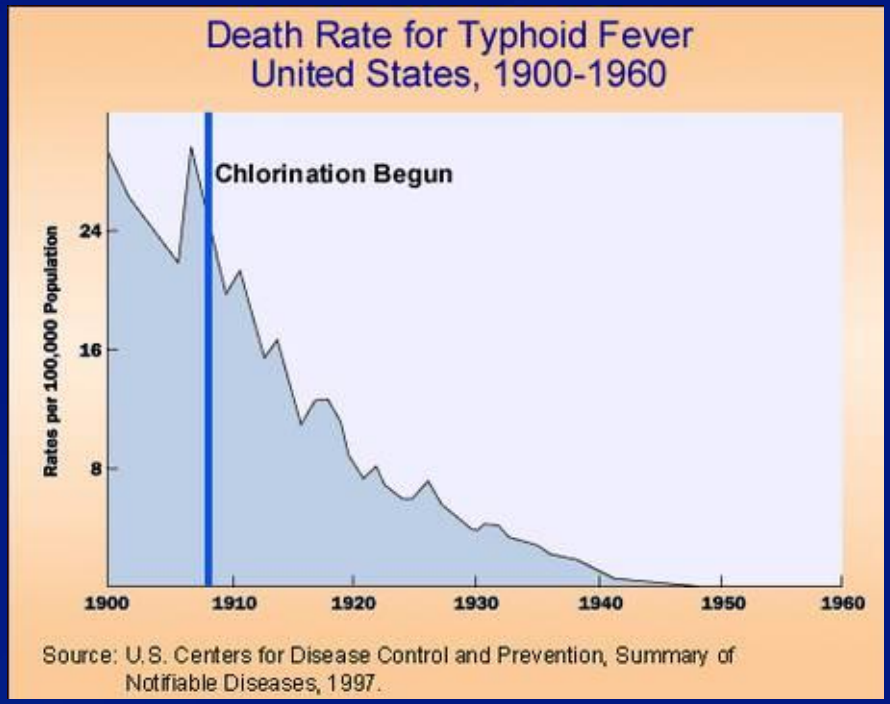
- Challenges and opportunities
- Available resources
- Impact of partnerships in reaching long-term goals
- Inform about waterborne disease prevention initiatives
- How and why to report unreported outbreaks
- Identify state/local needs for guidance documents/tools

- Drive fed/state/local interaction and sharing to avoid "reinventing the wheel"
- Inform future CDC work to optimize assistance level

WATERBORNE DISEASE AND OUTBREAK SURVEILLANCE: BACKGROUND AND FRAMING THE ISSUES

U.S. Drinking Water History

- **1900**
  - Approximately 100 cases typhoid for every 100,000 Americans
- **1908**
  - First filtration and disinfection of U.S. public water supply in NJ
- **1910-1920**
  - Thousands of U.S. cities begin disinfecting drinking water
- **2006**
  - Approximately 0.1 cases of typhoid for every 100,000 Americans (mostly travel-related)
- **One of the greatest public health achievements of the 20th Century**



EPA. The History of Drinking Water Treatment: 2000.; CDC. Achievements in Public Health, 1900-1999: Safer and Healthier Foods. MMWR 1999; 48(40): 905.; CDC. Summary of Notifiable Diseases—United States, 2006. MMWR 2008; 55(53): 17

No More Waterborne Disease Issues in the U.S., Right?

Moving from an Under-Developed to a Developed World Paradigm of Waterborne Disease

Tainted Well: Illinois demands answers Water

47 Contract *Salmonella* From Drinking

Legionnaires' bug found in hospital cooling tower

Dallas Spends Summer Fighting Crypto and Crypto is Winning

Boil Water Advisory Issued for Nearly 2 million in Massachusetts

Pharmaceuticals Found in Source Water

Routes of Transmission

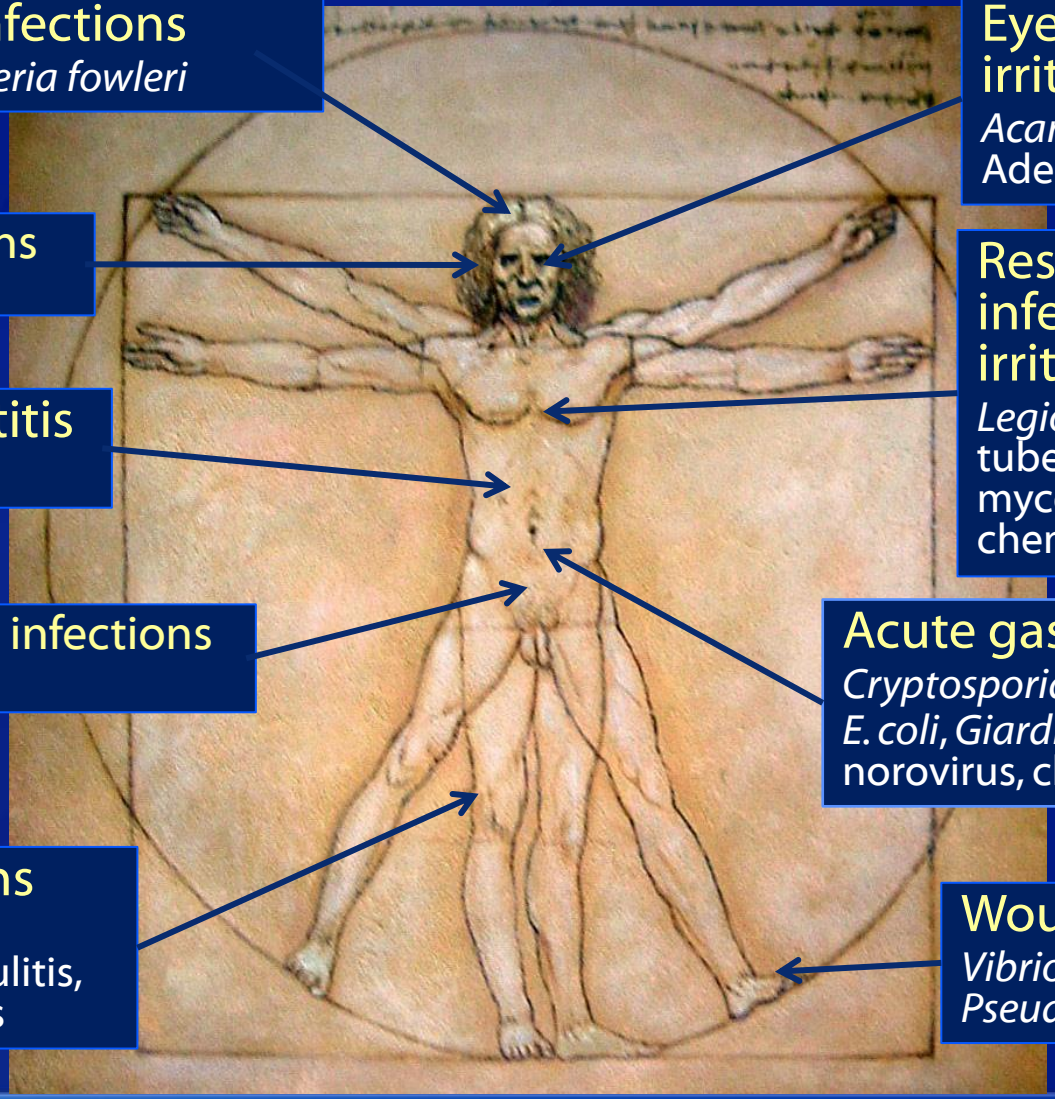
Ingestion

Inhalation

Contact (dermal, ear, eye, wound, urinary tract)

Nasal

Waterborne Pathogens and Chemicals Affect Many Systems



Neurologic infections
Echovirus, *Naegleria fowleri*

Eye infections & irritation
Acanthamoeba keratitis, Adenoviruses

Ear infections
Pseudomonas

Respiratory infections & irritation
Legionella, non-tuberculus mycobacteria, chemicals

Hepatitis
HAV

Urinary tract infections
Pseudomonas

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

Skin infections
Pseudomonas dermatitis/folliculitis, fungal infections

Wound infections
Vibrio, Aeromonas, Pseudomonas

Developed World Waterborne Disease Stressors

- Industrialization and urbanization
- Increased wastewater treatment needs
- Impact of deregulation, under-regulation
- Infrastructure maintenance
- Millions of miles of pipes for biofilm growth
- Expanded water uses; medical, industrial
- Increased leisure time, recreational use
- Increased consumption/importation of fruit, vegetables using water
- Intensive farming and animal husbandry
- Loss of historical "disease memory"
- Climate change

The Developed World Paradigm for Waterborne Disease

- Increased human/animal waste and chemical contamination of water supplies
- Regulatory needs increase, support decreases
- Crumbling infrastructure, water main breaks
- Premise plumbing colonization, microbiome
- Increased swimming, pathogen transmission
- Increased water-related food contamination
- Rising temperatures expand ranges and growth of pathogens
- Severe weather events increase water supply contamination
- Reduction in use of basic hygiene practices

Surveillance Issues

- Limited support for waterborne disease prevention
  - It no longer exists, not an issue
  - Perception that is not a large burden or severe disease
- Lack of public health burden data
  - If you don't document, no one thinks it is a problem
  - Limited to drinking water
- Fragmentation of waterborne disease into groups
  - Drinking, recreational, premise plumbing, etc.
- Many WB pathogens have multiple routes of transmission making association with water difficult
  - Food, Person–to-Person, Animal-to-Person

Surveillance Issues

- Water is not a groups first thought for many of the pathogens (i.e., most think food)
- Epi can be complex (city-wide, multiple routes of transmission)
- Environmental health and water sampling not always included in investigation
  - Water testing can require large volumes, complex protocols, and is costly
- Water may be route cause but may be part of larger process and difficult to document
  - E.g., agricultural water and food process water quality issues
- Why is counting /documentation so important?

Surveillance Issues

- Data gaps or needs?
- Unreported outbreaks?
- Adding healthcare-related outbreaks to waterborne surveillance
- Data collection and reporting needs?
- What needs to be created, developed?

COMMUNICATION, HEALTH PROMOTION, PARTNERSHIP BUILDING

Communication and Health Promotion

- Outbreak investigation, surveillance, data collection are foundational steps in public health
  - But not sufficient without translation into prevention activities and communication
- Identify and quantify problem
- Translate science and develop messages
- Identify audiences
- Optimize messages for specific audiences
- Combine with other groups to reduce resource use
  - Can customize for local situation

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

* n=393; Hlavsa MC *et al.* 2014. MMWR 63(1):6–10.

Increased Leisure Time and Recreational Water Use

- Swimming, water parks, hot tubs/spas
- Communal bathing
- Chlorine-tolerant pathogens
- Poor hygiene

No. 1 swimming pool problem? It's number two!

Maggie Fox, Senior Writer, NBC News

May 16, 2013 at 12:07 PM ET

Mario Tama / Getty Images /

Healthy Swimming Materials

Posters

Social media library

Apps

Infographics

Videos

Brochures

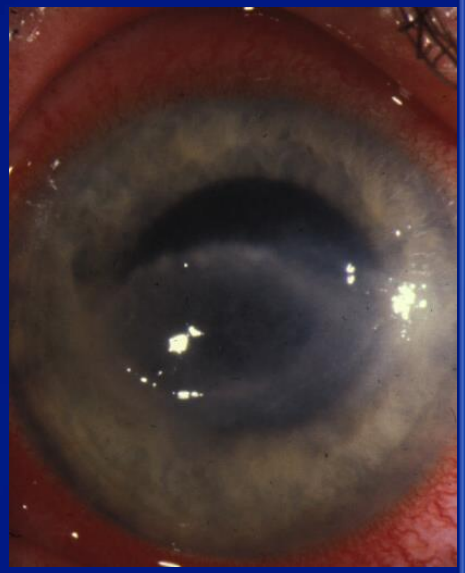
Stories

Recreational Water Illness and Injury Prevention Week 2014

- **2000, official observance in 2005**
- **Focused on the power of free media to disseminate messages**
  - MMWR, homepage feature, promotional materials, video contests
- **2005: state/local toolkit, partnership effort**
  - **Community outreach ideas, resource list, sample press release, op-ed, proclamation**
- **What is needed over next 10 years?**
- **What direction should this effort go?**

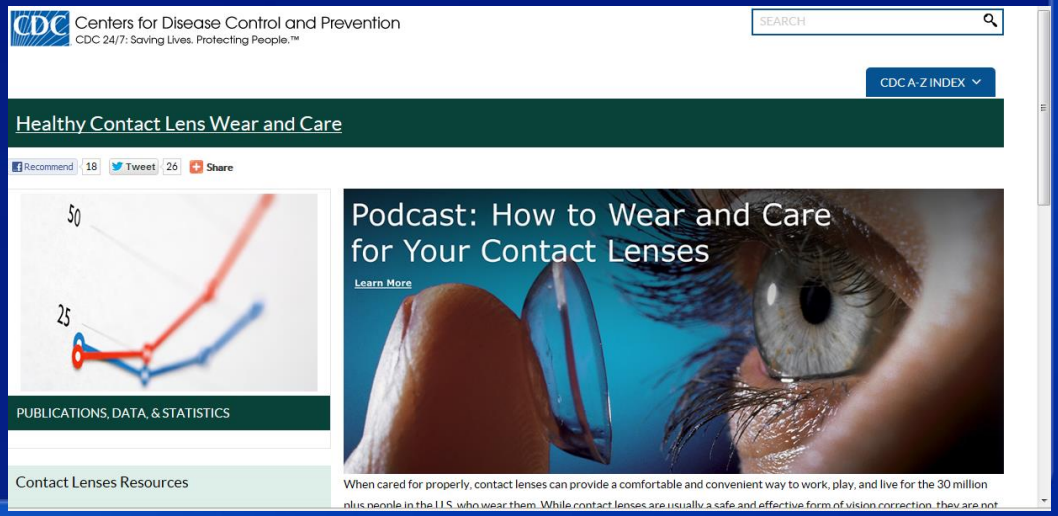
Contact Lens Hygiene

- *Acanthamoeba* keratitis
  - Multiple national outbreaks over past 10 years that are contact lens-related
  - 33 million users
  - Solution and hygiene-related, not pathogen specific
- Transition to messages about lens hygiene and microbial keratitis vs. pathogens



Healthy Contact Lens Effort

- Tap Water is NOT Sterile
- Observance in November
- Collecting first burden data for microbial keratitis
- Developing health promotion materials

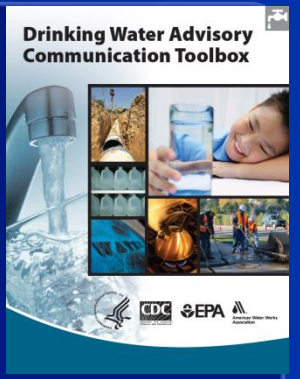


What Can We Learn?

- Are these efforts useful for partners?
- Are materials or toolkits useful?
- How do we evaluate them?
- What are critical needs for development?
  - Role of syndication
- How can we share learning lessons, materials?
  - Role of webinars, conference calls, meetings
- How can we best tie state materials together so all can learn and share?
  - Clearinghouse(s)

IMPACTING PUBLIC HEALTH THROUGH POLICY AND PREVENTION, AND INTERVENTION TOOLS

Providing Emergency Water System Guidance to Protect Public Health

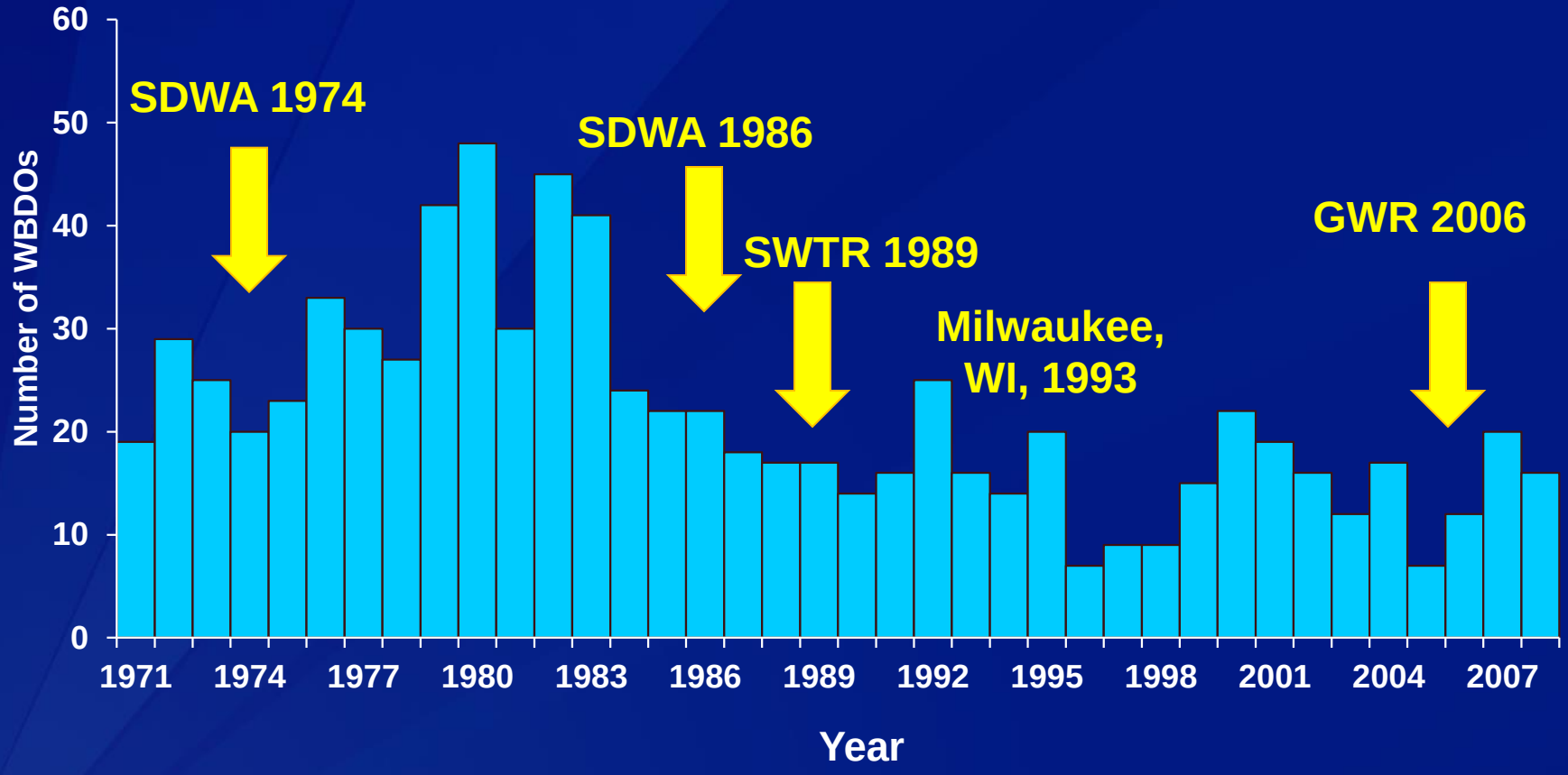


- Clear EPA guidance on initiating a water advisory
  - No guidance on how to communicate with partners and the public about advisories
  - Local utilities re-inventing the process each time
- Worked with AWWA, EPA, and partners on:
  - Drinking Water Advisory Communication Toolbox
    - 156 pages, guidance, templates, fact sheets, resources
  - Emergency Water Supply Planning Guide for Hospitals and Health Care Facilities

www.cdc.gov/healthywater/emergency/drinkingwateradvisory.html

Watson, Miller , AWWA et al.

Number of Waterborne-Disease Outbreaks Associated with Drinking Water, United States, 1971–2008



Brunkard *et al.*, MMWR (2011) 60(SS-12):38-68.; N=818

Healthy and Safe Swimming for Everyone

- One of top sports in the US – >300 million visits a year
- Demonstrated health impact
- Documented increases in disease transmission
- Continuing issues with drowning and injuries

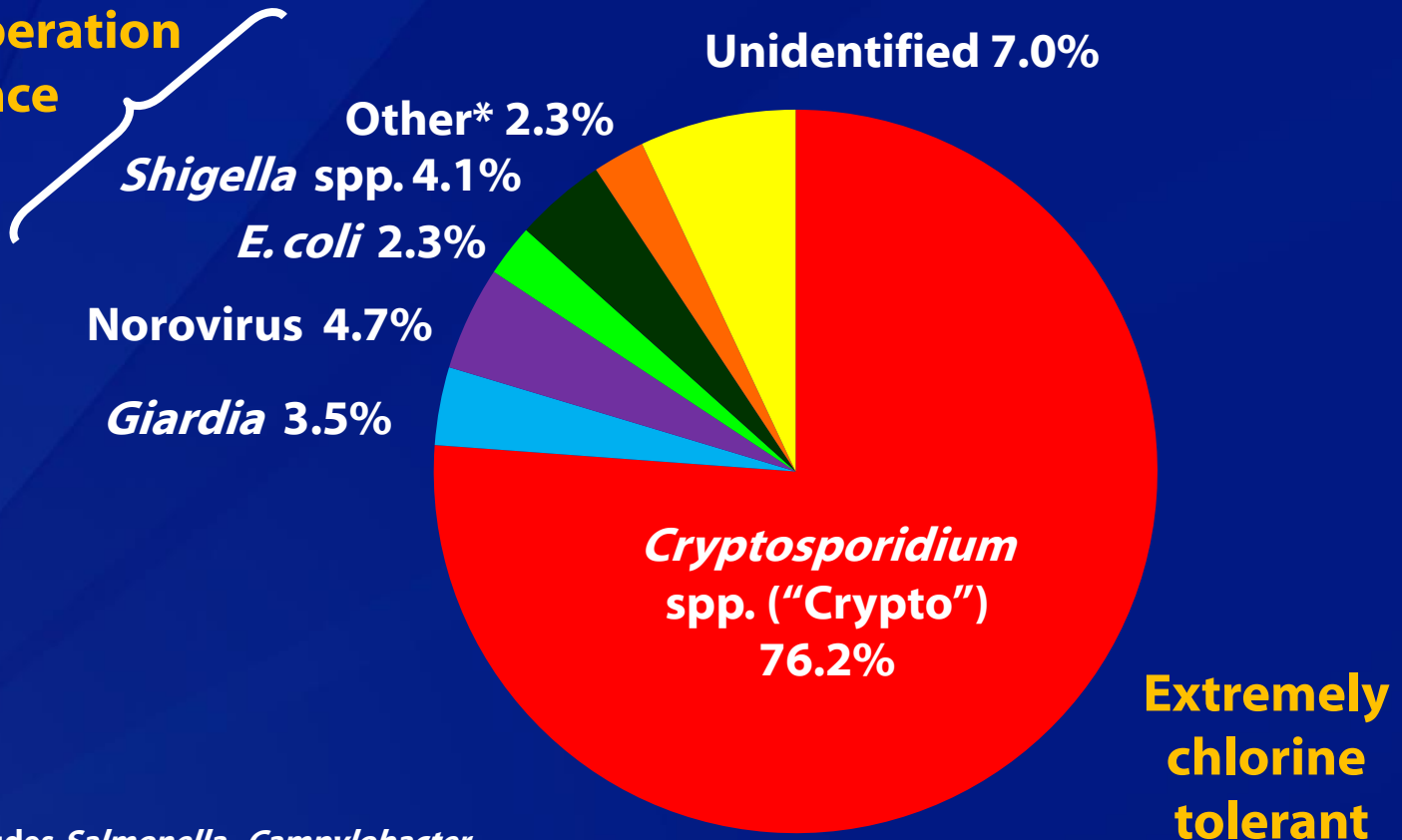
For more information, see http://www.cdc.gov/healthywater/swimming/health_benefits_water_exercise.html:

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

* n=393; Hlavsa MC *et al.* 2014. MMWR 63(1):6–10.

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

Chlorine sensitive: Poor pool operation & maintenance



Extremely chlorine tolerant

* n=172; Other includes *Salmonella*, *Campylobacter*, *Plesiomonas*, and multiple pathogens; Hlavsa MC *et al.* 2014. MMWR 63(1):6–10.

Inadequate Pool Operation and Maintenance is NOT Uncommon

- Pool inspection data from 4 state and 11 local pool inspection programs
- Inspected >120,000 pools
- Conducted January 1–December 31, 2008
- 12.1% of routine inspections resulted in immediate closure of the pool pending correction of violation

CDC. MMWR 2010;59(19):582–7.

Healthy and Safe Swimming for Everyone

- Education ongoing
- How can we have impact on engineering and enforcement issues?
- CSTE position statement led to national workshop
  - #1 recommendation to create a national model code to assist states/locals, avoid reinventing the wheel

For more information, see http://www.cdc.gov/healthywater/swimming/health_benefits_water_exercise.html:

Model Aquatic Health Code (MAHC): Vision and Mission

- Healthy and safe aquatic experiences for everyone
- Provide user-friendly guidance to state and local officials to assist in transforming health department pool programs into data-driven, knowledge-based, risk reduction efforts to prevent disease and injuries and promote healthy recreational water experiences

MAHC Genesis

- May 2007: Organize Steering Committee
  - Develop organizational plan and structure
  - Program outline/guidance, Strawman blueprint
  - Develop 2 modules as guidance examples
- Fall 2008: Organize Technical Committees
  - Appoint Chairs, recruit membership
- Spring 2009: Initial Technical Committees start work using modular approach

MAHC Development: Process and Timeline

1. Recirculation Systems and Filtration
2. Monitoring and Testing
3. Contamination Burden
4. Hygiene Facilities
5. Fecal/Vomit/Blood Contamination Response
6. Operator Training
7. Public Health Guidelines
8. Facility Design and Construction
9. Lifeguarding and Bather Supervision
10. Disinfection and Water Quality
11. Regulatory Program Administration
12. Facility Maintenance and Operation
13. Risk Management/Safety
14. Ventilation and Air Quality

14 Modules

Develop modules; Post for 1st round of public comment

Completed

1. Recirculation Systems and Filtration
2. Monitoring and Testing
3. Contamination Burden
4. Hygiene Facilities
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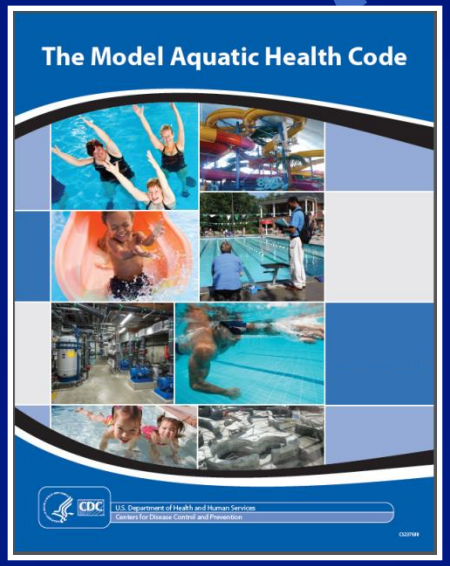
14 Modules

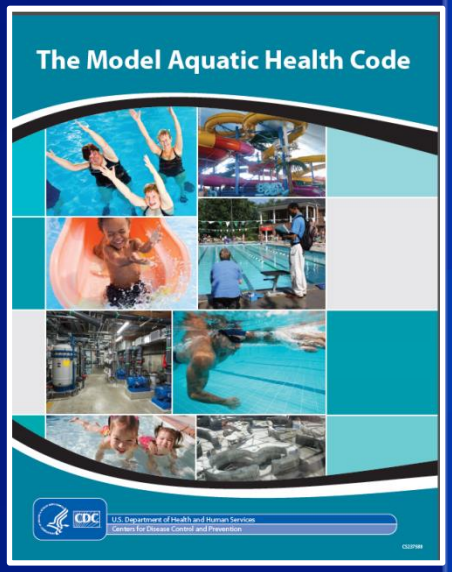
Revise-repost all modules. 2979 comments: 64% accepted, 20% denied, 16% neutral/clarification

Completed



Merge all modules; Post "Knitted" Version for 2nd (final) round of public comment

Completed



Revise and post MAHC 1st Edition

Summer 2014

Short Term Outcomes: Guidelines Adopted (continued)

- Secondary disinfection for increased risk aquatic venues
- Improved filtration systems for increased risk venues (for example, kiddie pools)
- Improved ventilation (indoor pools)
- Improved chemical storage/handling
- Pool fencing
- Lifeguard staffing & equipment
- Comprehensive water quality & testing parameters

Intermediate Outcomes: System Improvements

- Fewer pool/facility closures
- Better inspection and surveillance data
- Development of a research agenda to fill gaps
- Enhanced collaboration among stakeholders

Long-Term Public Health Outcomes

- Fewer outbreaks of recreational water illnesses resulting from exposure to contaminated swimming water
- Fewer drowning incidents in aquatic venues
- Fewer injuries from pool chemicals/disinfection by-products
- Fewer emergency room visits due to swimming-related issues

Issues

- Are these efforts worth the resources?
- Do partners use the materials?
- How do we keep it all up to date with latest science and technology?
- How do we spread the word so it can help reduce workloads and "reinventing the wheel"?
- What other projects are needed?
- How do we form partnerships to develop them?

Questions?
More Information: Healthy Water Website
www.cdc.gov/healthywater;
healthywater@cdc.gov

"The findings and conclusions in this presentation have not been formally disseminated by CDC and should not be construed to represent any agency determination or policy."