Model Aquatic Health Code Network May Webinar

“Cryptosporidium in Public Swimming Venues: Recommendations for Reducing Crypto Risk in Swimming Pools"

Thank you for your interest and attendance!

Please use your computer speakers for the audio portion of this webinar.

Due to the number of attendees, please submit questions and comments via the Chat box

We will begin at 12:00PM Eastern
May 24, 2017
NACCHO Updates

- Next Webinar: July 2017
- Take a Dive into the Model Aquatic Health Code
  ✓ Learning lab at 2017 NEHA annual conference
  ✓ Facilitated discussion on various aspects
- Model Aquatic Health Code Network (MAHC) Webpage
  ✓ Archived webinars & MAHC resources
  ✓ Join the MAHC Network today!
    mahcnet@naccho.org
Questions................
CMAHC UPDATES

- **180 Change Requests (CR’S) submitted**
  - Available for review at: [https://cmahc.org/view-change-requests.php](https://cmahc.org/view-change-requests.php)

- **Technical Review Committee (TRC) CR review process underway**
  - TRC CR Review Meeting Schedule available to members on CMAHC website under the “Find 2017 Info On” burgundy button at the top right
  - CMAHC members can join conference call but as “listen only”.
CMAHC UPDATES

- Member comment period for influencing TRC reviews and recommendations open until May 31, 2017
  - The CMAHC encourages members to submit comments by opening the specific Change Request and selecting to add a comment as rapidly as possible to have the greatest chance of influencing the technical reviews.
  - Members may wish to submit a comment form based on/in response to TRC discussions during a TRC CR Review Meeting conference call

- On-line Vote on the Code Conference Registration opened April 3.
Contact Information

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MAHC
More Information: Search on “CDC MAHC” or visit the Healthy Swimming MAHC Website: www.cdc.gov/mahc
Email: mahc@cdc.gov

CMAHC
More Information: Search on “CMAHC” or visit the CMAHC Website: www.cmahc.org
Email: info@cmahc.org
Healthy and Safe Swimming Week 2017
Communication Tools

Michele Hlavsa, RN, MPH
Epidemiologist/Chief, Healthy Swimming
Waterborne Disease Prevention Branch

MAHC Network Webinar
May 24, 2017
Diarrhea and Swimming Don’t Mix!
May 22–28, 2017

Objective
- Increase awareness of recreational water–associated diarrhea outbreaks and steps to take to prevent them

Call to Action
- Don’t swallow the water you swim in
- Don’t swim or let your kid swim if sick with diarrhea
- Hyperchlorinate public aquatic venues
  [www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html](http://www.cdc.gov/healthywater/swimming/aquatics-professionals/fecalresponse.html)

Target Audiences
- Swimmers, parents of young swimmers, aquatics staff, and public health
Healthy and Safe Swimming Week Communications Toolkit

- Community outreach suggestions
- List of resources/URLs
- Sample press release
- Sample op-ed
- Sample proclamation
- Social media message bank

Outreach: Website, Social Media, Oh My

- MMWR report on recent crypto outbreaks linked to aquatic venues
  www.cdc.gov/mmwr/volumes/66/wr/mm6619a2.htm?s_cid=mm6619a2_w

- Updates to CDC website
  www.cdc.gov/healthyswimming

- Twitter chat – May 22

- MAHC Network webinar – May 24

- Radio Media Tour – May 25
Outreach: Website, Social Media, Oh My

- GovDelivery announcements
- *Did You Know?* and *Have You Heard?* emails
  - HSSW buttons/badges
  - New posters
- Web content syndication [https://tools.cdc.gov/syndication/](https://tools.cdc.gov/syndication/)
Printed Healthy Swimming Promotion Materials

- **Brochure**
  - (English & Spanish)
  - FREE!

- **2 Pool Chemical Safety Posters**
  - Use
    - FREE!
  - Storage
    - (laminated posters in English & Spanish)
Questions

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healthywater@cdc.gov

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.
Recommendations for reducing Cryptosporidium infection risk at swimming pools

Laura Suppes, REHS, PhD
Assistant Professor
University of Wisconsin – Eau Claire
Environmental Public Health Program

Model Aquatic Health Code Network Webinar
May 24, 2017
Objectives

- Understand why there is risk of Cryptosporidium infection at swimming pools
- Explore methods for reducing Cryptosporidium infection risk at swimming pools
- Discuss the most feasible methods for Environmental Health Specialists to reduce Cryptosporidium infection risk at swimming pools
Why is there risk of Cryptosporidium infection at swimming pools?
What do we know about Cryptosporidium?

- Cryptosporidiosis
  - Vomiting, diarrhea, nausea, death
  - Immunocompromised
    - 20% of U.S. population
    - Including children

- Cryptosporidium caused 50% of treated recreational water-associated outbreaks between 2011-2012

- Treated recreational water venues are ideal for Cryptosporidium outbreaks:
  - Oocysts highly resistant to chlorine (inactivation: 20 ppm for 12.75 hr)
  - Swimming = “community bathing”
  - Bathers can excrete up to $10^9$ oocysts/fecal release
  - Cryptosporidium has low infectious dose
  - Oocyst release up to 50 days post-diarrhea cessation
  - Swimmers perceive pool water is sterile
  - Swimming pool water is recirculated

DuPont et al., 1995; Chappell et al. 1996; Hlavsa et al. 2015; Hunter and Nichols, 2002; Okhuysen et al., 1999; Shields et al. 2008; Yoder and Beach, 2010
What do we know about Cryptosporidium?

Hlavsa et al. 2015

Number of outbreaks associated with recreational water, by year - United States, 1978 - 2012
What do we know about Cryptosporidium?

Per-swim and Annual Risk of Cryptosporidium Infection from Swimming in Treated Recreational Water

<table>
<thead>
<tr>
<th></th>
<th>Infection Risk Per-swim Event</th>
<th>Annual Infection Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>All swimmers</td>
<td>$2.6 \times 10^{-4}$</td>
<td>$3.9 \times 10^{-3}$</td>
</tr>
<tr>
<td>Adults</td>
<td>$2.5 \times 10^{-4}$</td>
<td>$6.8 \times 10^{-3}$</td>
</tr>
<tr>
<td>Children</td>
<td>$3.5 \times 10^{-4}$</td>
<td>$5.4 \times 10^{-3}$</td>
</tr>
</tbody>
</table>

a 99th percentile risk value.

- Risk of Cryptosporidium infection in one year of swimming pool visits:
  - 29 infections per 1,000 child swimmers (≤18)
  - 22 infections per 1,000 adult swimmers

Suppes et al. 2016
Methods for reducing Cryptosporidium infection risk
How can we reduce Cryptosporidium infection risk at swimming pools?

- Treated water venues are ideal for Cryptosporidium outbreaks:
  - Oocysts highly resistant to chlorine (inactivation: 20 ppm for 12.75 hr)
  - Swimming = “community bathing”
  - Bathers can excrete up to $10^9$ oocysts/fecal release
  - Cryptosporidium has low infectious dose
  - Oocyst release up to 50 days post-diarrhea cessation
  - Swimmers perceive pool water is sterile
  - Swimming pool water is recirculated

- Use alternative disinfectants
- Stop introduction of oocysts
- Use more effective filtration techniques
Use alternative disinfectants

- Current free chlorine levels recommended in the Model Aquatic Health Code (MAHC) will not inactivate Cryptosporidium in a timeframe that reduces swimmer risk
  - Cryptosporidium Ct = 15,300: It would take 10 days to achieve a 3 log reduction in oocysts at 1 ppm chlorine

- Higher levels of chlorine will inactivate Cryptosporidium faster
  - Hyperchlorination is recommended following a diarrheal fecal incident to inactivate Cryptosporidium
Use alternative disinfectants

- Problems with using hyperchlorination as a method to inactivate Cryptosporidium:
  - Must use a lot of chlorine
    - Added expense
    - Chlorine product
    - Closure time (CDC guidelines: 20 ppm chlorine for 12.75 h)
  - Must maintain 20 ppm the entire 12.75 h
    - Employee overtime
    - Test kit capability and reliability
    - Operator error
  - Must know if and when fecal incident occurred
  - Hyperchlorination does not work well in pools with high cyanuric acid concentrations
Use alternative disinfectants

- Hyperchlorination and cyanuric acid:

[Article]

Effect of Cyanuric Acid on the Inactivation of Cryptosporidium parvum under Hyperchlorination Conditions

Jennifer L. Murphy,*† Michael J. Arrowood,† Xin Lu,† Michele C. Hlavsa,† Michael J. Beach,† and Vincent R. Hill†

†Waterborne Disease Prevention Branch, Division of Foodborne, Waterborne, and Environmental Diseases, Centers for Disease Control and Prevention, Atlanta, Georgia 30333, United States
Use alternative disinfectants

Inactivation of *Cryptosporidium* in chlorinated pool water

<table>
<thead>
<tr>
<th></th>
<th>No cyanuric acid</th>
<th>8 ppm cyanuric acid</th>
<th>50 ppm cyanuric acid</th>
<th>100 ppm cyanuric acid (MAHC limit is 90 ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine (ppm)</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>pH</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Temperature (°F)</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
<tr>
<td><strong>Time (h)</strong></td>
<td><strong>8</strong></td>
<td><strong>14</strong></td>
<td><strong>62 (2.5 days)</strong></td>
<td><strong>72 (3 days)</strong></td>
</tr>
<tr>
<td>Log reduction</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Use alternative disinfectants

2016 CDC fecal incident response guidelines

<table>
<thead>
<tr>
<th></th>
<th>No cyanuric acid</th>
<th>1 - 15 ppm cyanuric acid</th>
<th>15 + ppm cyanuric acid: drain pool to ≤15 ppm CYA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine (ppm)</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>pH</td>
<td>≤7.5</td>
<td>≤7.5</td>
<td>≤7.5</td>
</tr>
<tr>
<td>Temperature (°F)</td>
<td>≥77</td>
<td>≥77</td>
<td>≥77</td>
</tr>
<tr>
<td>Time (h)</td>
<td>12.75</td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>
Use alternative disinfectants

Approved alternative disinfectants to chlorine in MAHC

<table>
<thead>
<tr>
<th></th>
<th>Pro</th>
<th>Con</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bromine</td>
<td>Leaves a residual</td>
<td>No published Ct values for Cryptosporidium inactivation</td>
</tr>
<tr>
<td>UV light</td>
<td>Inactivates Cryptosporidium quickly</td>
<td>No residual</td>
</tr>
<tr>
<td>Ozone</td>
<td>Inactivates Cryptosporidium quickly</td>
<td>No residual</td>
</tr>
<tr>
<td>Copper/silver ions</td>
<td>Leaves a residual</td>
<td>No published Ct values for Cryptosporidium inactivation</td>
</tr>
<tr>
<td>Chlorine dioxide</td>
<td>Inactivates Cryptosporidium quickly</td>
<td>Only for water quality remediation when swimmers are absent, produces carcinogens, dangerous to handle</td>
</tr>
</tbody>
</table>
Stop introduction of oocysts

- Is stopping introduction possible? Probably not, but we can reduce contamination by controlling sources.
  - Some controls are better than others:
    - Environmental Health Hierarchy of Controls:
      - Elimination
      - Substitution
      - Administrative
      - Engineering
      - Personal Protective Equipment
Stop introduction of oocysts

- Swimming = “community bathing”
  - Separate children and adults
  - Expose the truth about swim diapers

- Bathers can excrete up to $10^9$ oocysts/fecal release
  - Do not allow ill swimmers into the pool
  - Make better swim diapers
  - Improve fecal incident observation and reporting by swimmers, parents of swimmers and pool staff
  - Enforce bathroom breaks

- Cryptosporidium has low infectious dose
  - Educate swimmers on the importance of avoiding pool water ingestion
  - Do parents allow kids to drink bathtub water?

- Oocyst release up to 50 days post-diarrhea cessation
  - Do not allow previously-ill swimmers into the pool
  - Enforce pre-swim showering

- Swimmers perceive pool water is sterile
  - Educate swimmers on pool water hazards
  - Educate swimmers on test kit use
Stop introduction of oocysts

- Elimination
- Substitution
- Administrative

- Engineering
- Personal Protective Equipment

- Elimination controls
  - Do not allow ill swimmers into the pool
  - Do not allow previously-ill swimmers into the pool
    - Signage – do not swim if you have diarrhea
    - Group education on recreational water illness – swim teams, water aerobics, swim classes
    - Waivers – open swim, fitness facility users, swim classes, swim teams, water aerobics
Stop introduction of oocysts

- **Administrative controls**
  - Expose the truth about swim diapers
    - Signage – swim diapers are the same as a bathing suit
    - Group education on recreational water illness - swim teams, water aerobics, swim classes
  - Educate swimmers on the importance of avoiding pool water ingestion
  - Educate swimmers on pool water hazards
    - Group education on recreational water illness - swim teams, water aerobics, swim classes
  - Educate swimmers on test kit use
    - Group education on recreational water illness - swim teams, water aerobics, swim classes
  - Require pool facilities to provide test strips and make water chemistry standards available to swimmers

- **Improve fecal incident observation and reporting by swimmers, parents of swimmers and pool staff**
  - Group education on recreational water illness - swim teams, water aerobics, swim classes
  - Train lifeguards on indicators of diarrheal release
    - Indicators should be researched

- **Enforce bathroom breaks**
  - Swim teams, open swim – everyone out of the pool every hour (CDC recommendation)

- **Enforce pre-swim showering**
  - Hire staff to check if swimmers entering pool area have wet hair or clothing
Stop introduction of oocysts

- **Engineering/PPE controls**
  - Separate children and adults
  - Build separate pools for adults and children
    - Perhaps easier to control Cryptosporidium
      - Child pool, routine treatment to remove Cryptosporidium from pool water

- Make better swim diapers
  - Current swim diapers release 50 – 97% of Cryptosporidium oocysts into pool water within 5 min of swimming after diarrhea

Amburgey, Anderson and Brian, 2011
Use more effective filtration techniques

- Swimming pool water is recirculated
  - Use secondary disinfection (UV or ozone)
  - Maximize efficiency of the pool filter
- Sand
  - Polyaluminum chloride coagulants at appropriate flow rates with deep sand
  - Add thin layer of precoat media

Percent particle removal for different sand filtration scenarios

Amburgey, 2011; Amburgey et al., 2012; Lu and Amburgey, 2016; Amburgey (unpublished)
Use more effective filtration techniques

- Swimming pool water is recirculated
  - Use secondary disinfection (UV or ozone)
  - Maximize efficiency of the pool filter
    - Sand
    - Polyaluminum chloride coagulants at appropriate flow rates with deep sand
    - Add thin layer of precoat media
  - Precoat media
    - Perlite media
    - Diatomaceous Earth

Amburgey et al., 2012; Amburgey et al., 2012; Lu and Amburgey, 2016
What are the most feasible methods for Environmental Health Specialists to reduce Cryptosporidium infection risk?
What are the most feasible methods for reducing Cryptosporidium infection risk?

- A combination of controls must be used to reduce risk of Cryptosporidium infection:
  - Group education on recreational water illness
    - Environmental Health Specialists
      - Provide education materials (fact sheets, videos, handouts) to aquatic venues that host groups of swimmers, and encourage or require organized trainings
      - Provide trainings to groups of swimmers
What are the most feasible methods for reducing Cryptosporidium infection risk?

- **Waivers as a form of education**
  - Environmental Health Specialists
    - Provide waiver examples to aquatic facility staff
      - By swimming in this pool, you agree not to:
        - Swim until two weeks after diarrhea has stopped
        - Intentionally swallow pool water
        - Allow children with diarrhea to swim in bathing suits or swim diapres since neither control diarrheal releases
        - Intentionally pee or poop in the pool water
        - Splash other swimmers in the face (associated with pool water ingestion)
        - Enter the pool without showering for at least 60 sec. (recommended minimum pre-swim shower length)
        - Fail to report a diarrheal release into pool water

Keuten et al. 2014; Suppes et al. 2014
What are the most feasible methods for reducing Cryptosporidium infection risk?

- Environmental Health Specialists can also:
  - Require pool facilities provide swimmers with test strips and handouts or signage on pool water quality standards
  - Suggest implementation of mandatory breaks for open swim or swim teams every hour to high-use facilities
  - Explain the purpose and importance of the new CDC Fecal Incident Response Guidelines to pool operators
    - Make sure operators understand how to respond appropriately to a diarrheal release
  - Require pool facilities install secondary disinfection
  - Suggest operators with sand filters routinely apply a coagulant
    - Operators should follow manufacturers instructions when dosing pool water with a coagulant
  - Adopt parts of the Model Aquatic Health Code when updated with recommendations for improving filtration and disinfection techniques to remove Cryptosporidium from pool water


