Model Aquatic Health Code Network Webinar

Cyanuric Acid and the Fecal, Vomit, and Blood Response

Tuesday, September 19th

Thank you for your interest and attendance!

Please use your computer speakers to listen to today's presentation

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

We will begin at 1:00PM Eastern

NACCHO
National Association of County & City Health Officials

NACCHO Updates

- Next Webinar: November 2017
- Take NEHA's Assessing Recreational Water Health (assessment of aquatic inspection and data use procedures)
  - ✓neha.org/node/59129
  - ✓To better understand the health hazards presented by recreational waters
- Model Aquatic Health Code Network (MAHC) Webpage
  - ✓http://www.naccho.org/programs/environmental-health/hazards/water/model-aquatic-health-code-mahc-network
  - ✓Archived webinars & MAHC resources
  - ✓Join the MAHC Network today!

    MAHCnet@naccho.org

Questions

MAHC NETWORK
September 19, 2017
CMAHC UPDATES

Douglas Sackett
Executive Director
Council for the Model Aquatic Health Code

CMAHC
COUNCIL for the MODEL AQUATIC HEALTH CODE
Driven by your expertise.

MAHC UPDATE PROCESS

- 178 Change Requests (CR'S) for member vote
- Technical Review Committee (TRC) evaluations/reports complete and posted
- CR's and TRC evaluation reports available for review at: https://cmahc.org/view-change-requests.php

MAHC *VOTE ON THE CODE CONFERENCE*

October 17-18, 2017: Omni Interlocken Hotel, Denver, CO

- On-line *Vote on the Code* Conference Registration opened April 3.
- Livestream only now free !
  - must still register
- CMAHC Public Health members can take part in the MAHC update process to have their input heard by CDC
- You are encouraged to be on site at the conference for:
  - networking with your fellow CMAHC Public Health members including caucus discussions
  - discussion of all Change Requests, member comments, and Technical Review Committee recommendations
  - CMAHC annual updates

Contact Information

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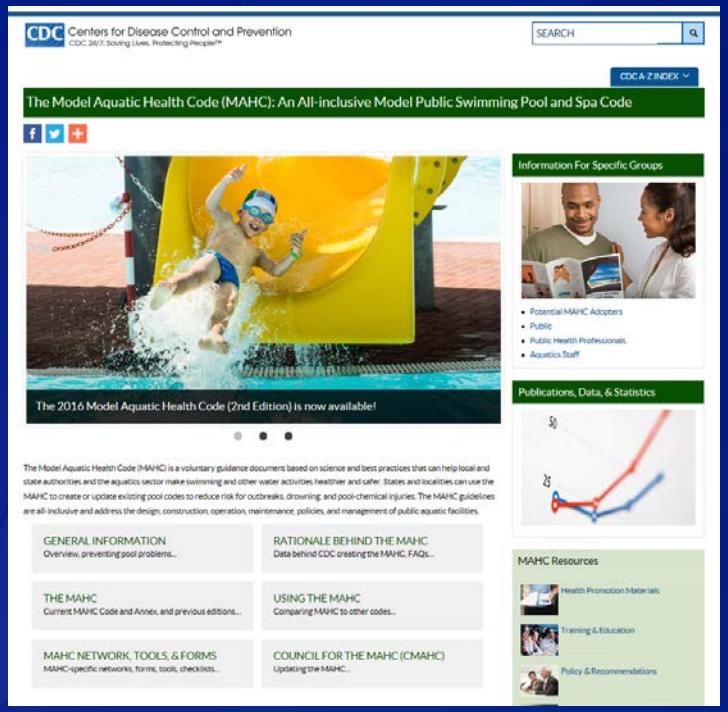
MAHC

More Information: Search on "CDC MAHC" or visit the Healthy Swimming MAHC Website: www.cdc.gov/mahc

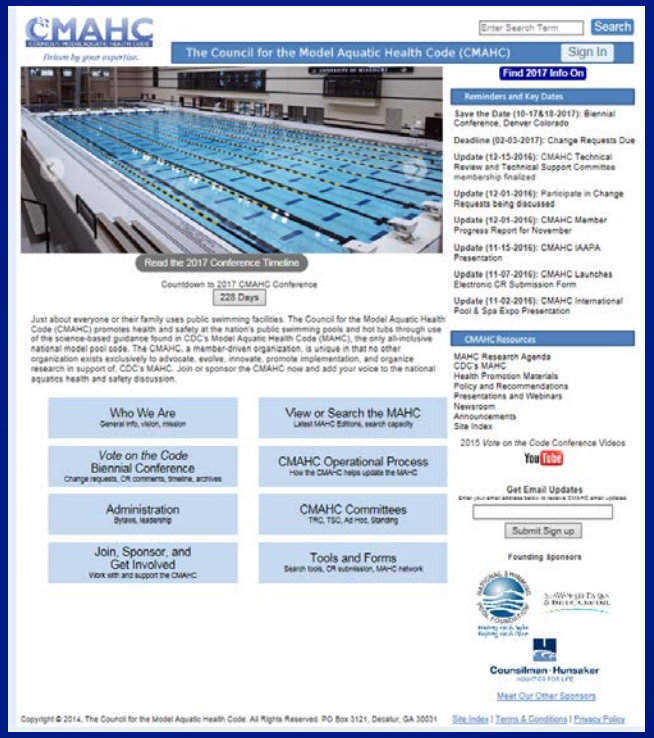
Email: mahc@cdc.gov



CMAHC

More Information: Search on "CMAHC" or visit the CMAHC Website: www.cmahc.org

Email: info@cmahc.org



CMAHC
COUNCIL FOR THE MODEL AQUATIC HEALTH CODE
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Cyanuric Acid and the Fecal, Vomit, and Blood Response

Michele Hlavsa, RN, MPH
Chief, Healthy Swimming
Centers for Disease Control and Prevention

Model Aquatic Health Code Webinar
September 19, 2017

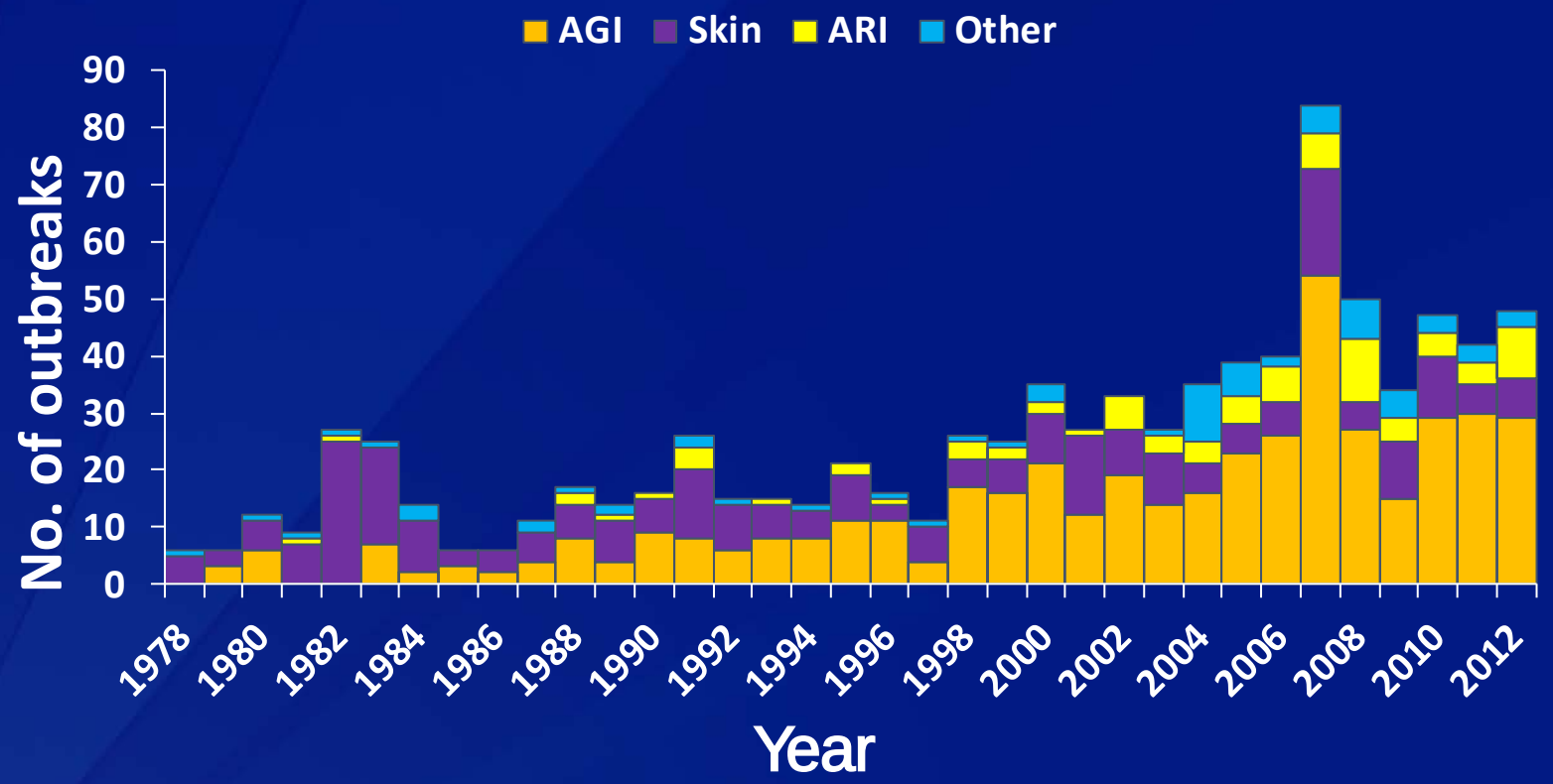
Problem: Swimming is fun and a great form of physical activity, but it can lead to illness and injury

Solution: Work together to minimize risk of illness and injury

Outline

- Disinfection of
  - Chlorine-intolerant infectious pathogens
  - Extremely chlorine-tolerant *Cryptosporidium*
- Pool chemical safety

Outbreaks associated with Recreational Water (n=879), by Predominant Illness and Year — United States, 1978–2012



Abbreviations: The category of illness reported by ≥50% of ill respondents. AGI: acute gastrointestinal illness; Skin: illness, condition, or symptom related to the skin; ARI: acute respiratory illness; Other: includes bronchitis; illness, condition, or symptom related to the ears; illness, condition, or symptom related to the eyes; hepatitis; leptospirosis; meningitis; meningoencephalitis; and multiple predominant illnesses. All outbreaks of legionellosis (i.e., Legionnaires' disease and Pontiac fever) are classified as ARI.

Source: Hlavsa MC *et al*. 2015. MMWR 64(24);668–72.

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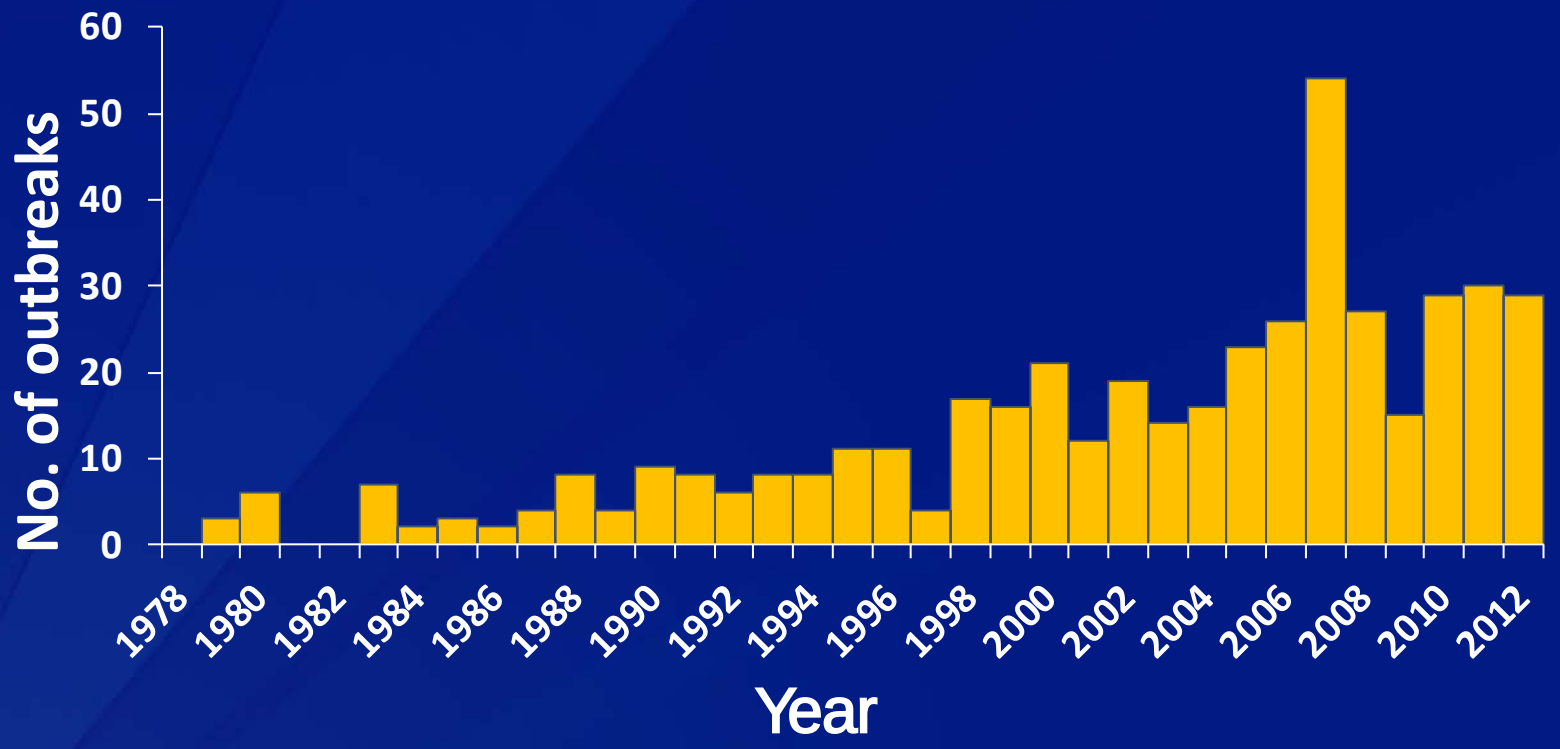
Outbreaks of Acute Gastrointestinal Illness associated with Recreational Water (n=452), by Year United States, 1978–2012



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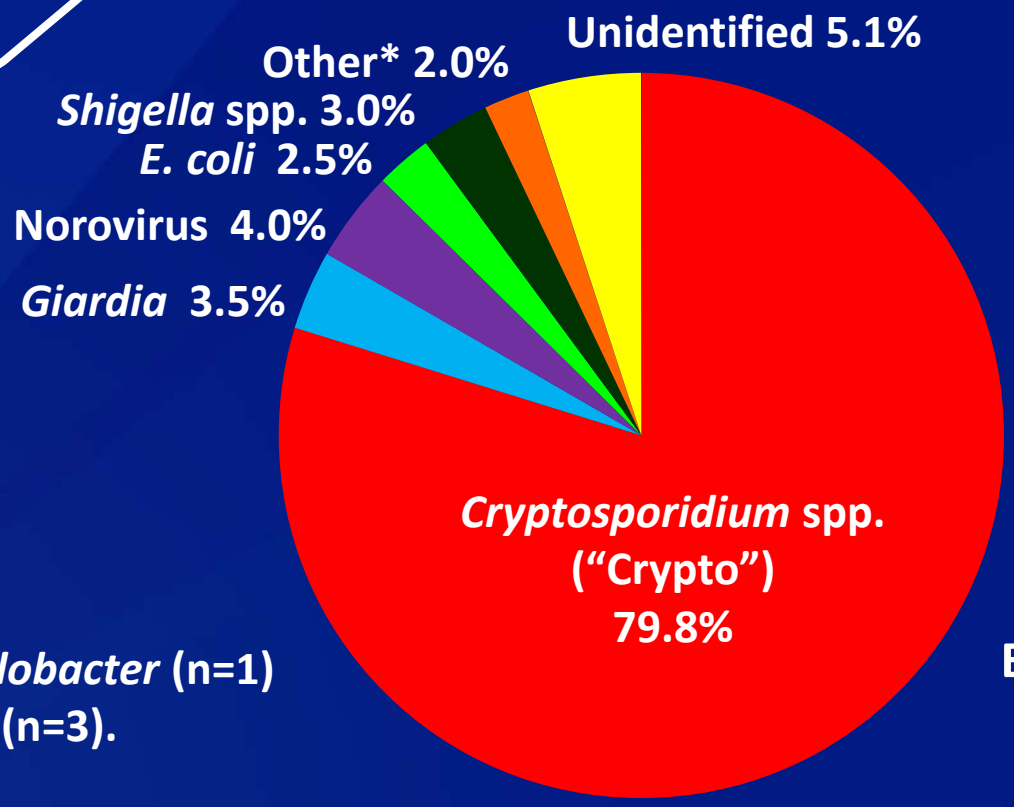
Outbreaks of Acute Gastrointestinal Illness associated with Treated Recreational Water (n=198) United States, 2003–2012

Chlorine intolerant: Poor pool operation & maintenance



Extremely chlorine tolerant

***Other includes *Campylobacter* (n=1) and multiple etiologies (n=3).**

Source: Hlavsa MC *et al*. 2015. MMWR 64(24);668–72.

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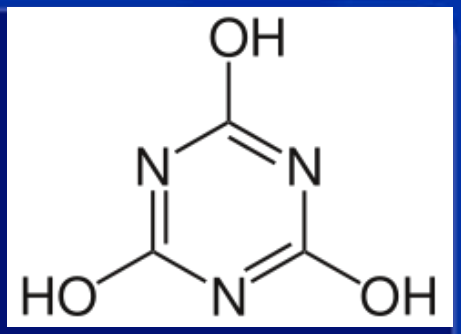
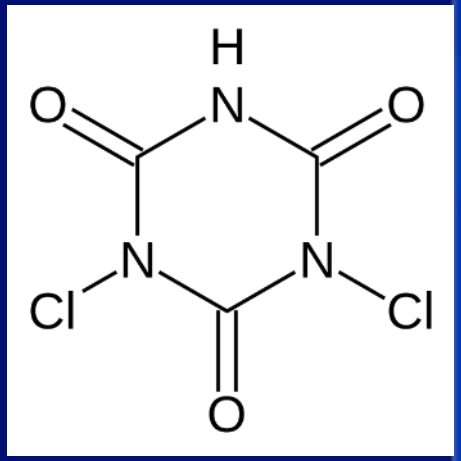
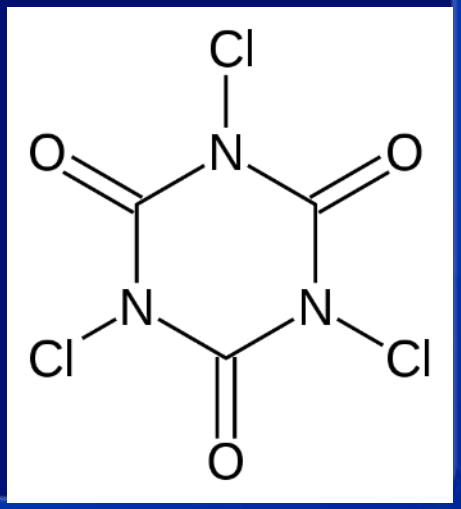
Cyanuric Acid (CYA)

- Products
  - CYA: isocyanuric acid
  - Dichlor: dichloro-s-triazinetrione, sodium dichloroisocyanuric acid
  - Trichlor: trichloro-s-triazinetrione, sodium trichloroisocyanuric acid
- Add to water in aquatic venues to protect chlorine from degradation by sun's ultraviolet light
- Increases contact time (CT) inactivation values or inactivation times of bacteria, parasites, viruses, and algae







Staphylococcus Inactivation*

CYA (mg/L)	CT (mg·min/L)*	Inactivation time (minutes)
0	0.5	1.0
10	2.6	5.2
25	3.8	7.6
50	5.2	10
100	6.3	13

* 3-$\log_{10}$ (99.9%) CT inactivation value at chlorine 0.5 mg/L (water pH 7.5 and temperature 25°C)

- CT inactivation value =
  Concentration of disinfectant (mg/L)
  x
  Inactivation time (minutes)

* Preliminary CDC data. Source: personal communication with Jennifer L. Murphy.

MAHC 5.7.3.1.3.1: Cyanuric Acid

- Maintain CYA at ≤90 ppm
- Do not use in newly constructed or substantial altered
  - Hot tubs/spas
  - Therapy pools

MAHC 5.7.3: Disinfection and pH Control

- Chlorine (hypochlorite)
  - Minimum: 1.0 ppm in aquatic venues not using cyanuric acid and 2.0 ppm in aquatic venues using cyanuric acid
    - Except: 3.0 ppm in hot tubs/spas
  - Maximum: 10.0 ppm at any time aquatic venue open to bathers
- Bromine
  - Minimum: 3.0 ppm in aquatic venues
    - Except: 4.0 ppm in hot tubs/spas
  - Maximum: 8.0 ppm at any time aquatic venue open to bathers
- pH: 7.2–7.8

MAHC: Other Disinfectants

- Compressed chlorine gas
  - Prioritize safety
- Salt electrolytic chlorine generators, brine electrolytic chlorine or bromine generators
- Copper/silver ions
  - Not to exceed 1.3 ppm copper and 0.10 ppm silver
  - Do not modify recommended chlorine and bromine concentrations
- Other disinfectants
- Chlorine dioxide
  - Prioritize safety

Giardia

- Study of formed stools from fecal incidents in water[1]
  - Collect from 47 aquatic venues/facilities across United States during 1999 summer swim season
  - 4.4% (13/293) formed stools tested + for *Giardia*
  - 0.0% (0/293) formed stools tested + for *Cryptosporidium*
- 3-$\log_{10}$ (99.9%) cyst inactivation[2] at water pH $\leq$7.5 and temperature $\geq$25°C
  - 1.0 ppm: 45 minutes
  - 2.0 ppm: 25 minutes
  - 3.0 ppm: 19 minutes

1. CDC. 2001. MMWR 50(20):410–2.
2. U.S. Environmental Protection Agency Disinfection Profiling and Benchmarking Guidance Manual.

MAHC 6.5.2: Response to Formed Fecal, Vomit, or Blood Contamination of Water

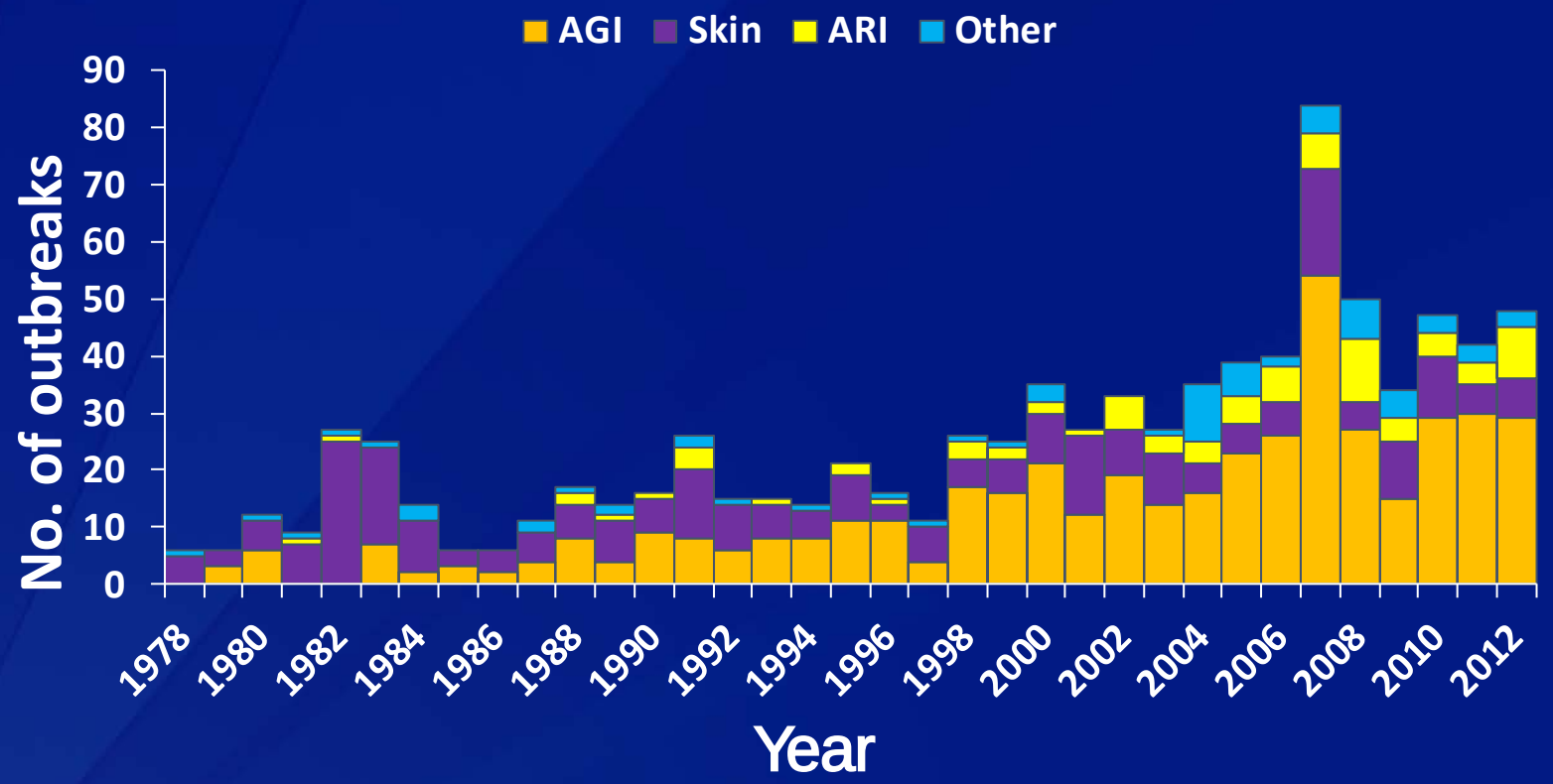
1. Close immediately aquatic venue to bathers
   - MAHC 6.5.3.4.1 (blood contamination): choose if close and treat as a formed stool contamination
   - Including any aquatic venue sharing recirculation system
2. Remove contaminating material and dispose of
   - Do not use vacuum cleaner
   - Clean item used to remove contamination and immerse in aquatic venue during disinfection
3. Raise chlorine to 2.0 ppm (if <2.0 ppm) for ≥25 minutes*
   - Test chlorine and pH at multiple sampling points
   - Add only non-stabilized chlorine
   - Double inactivation time if CYA in aquatic venue water

* Verify and maintain water pH ≤7.5 and temperature ≥25°C.

MAHC 6.5.4: Surface Contamination Cleaning and Disinfection

1. Limit access to area contaminated by bodily fluid, such as feces, vomit, or blood
2. Clean and remove all visible contaminant with disposable cleaning products <u>before</u> disinfection
3. Dispose of contaminant in sanitary manner or as required
4. Disinfect contaminated surfaces using
   - 1:10 dilution fresh household bleach with water or
   - Equivalent U.S. EPA registered disinfectant approve for bodily fluids
5. Soak affected area for minimum 20 minutes or as directed by disinfectant label
6. Remove disinfectant by cleaning and dispose of in sanitary manner or as required

Outbreaks associated with Recreational Water (n=879), by Predominant Illness and Year — United States, 1978–2012



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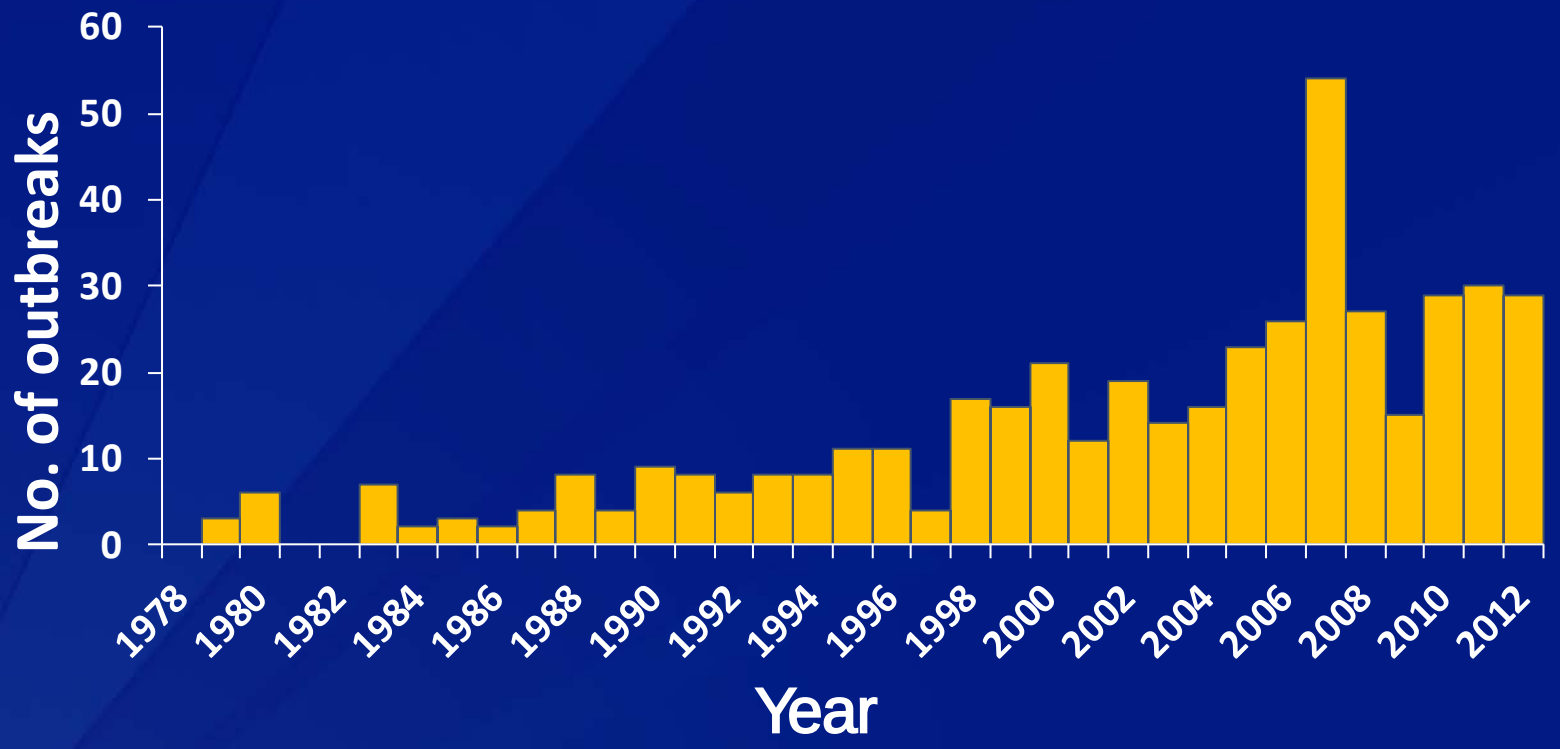

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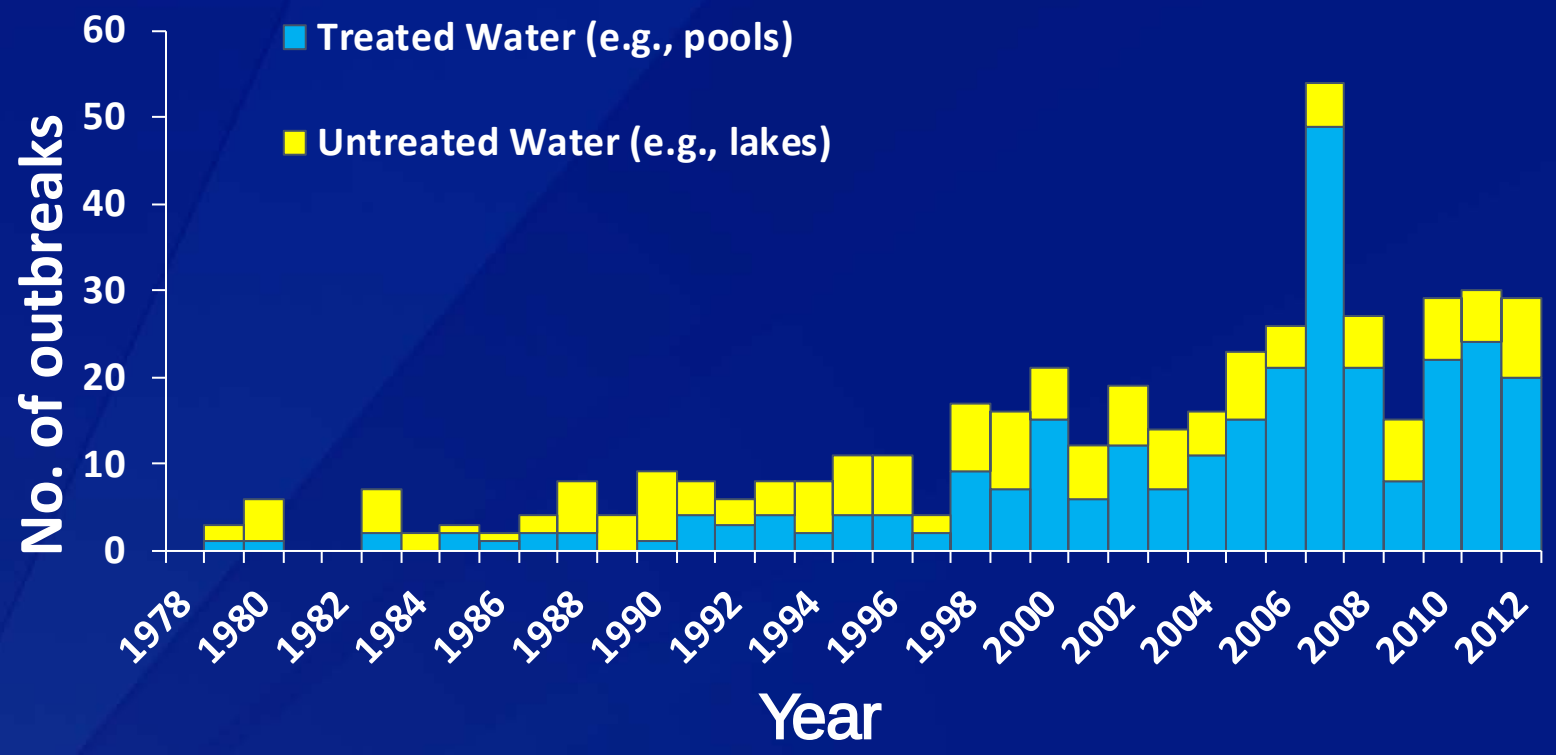
Outbreaks of Acute Gastrointestinal Illness associated with Recreational Water (n=452), by Type of Exposure and Year United States, 1978–2012



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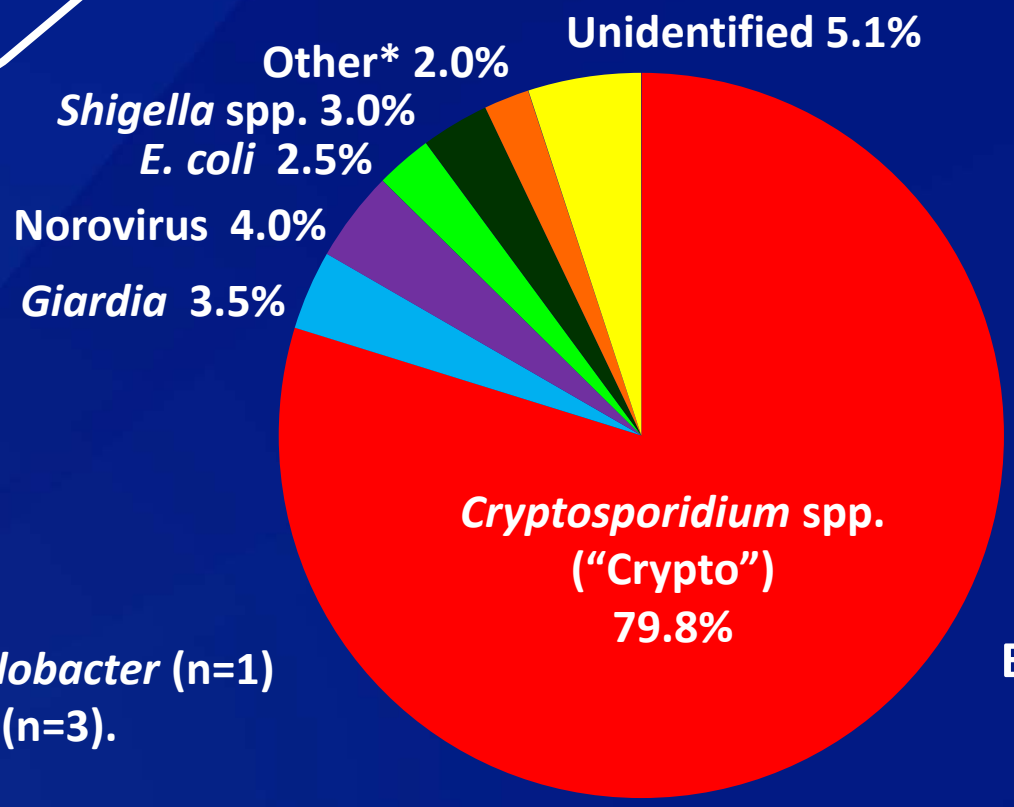

Extremely chlorine tolerant

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MAHC 4.7.3.3, 4.7.3.4, & 5.7.3.2: Secondary or Supplemental Disinfection Systems

- New construction or substantially altered increased-risk aquatic venues
  - Increased risk of microbial contamination (e.g., designed for children ages <5 years)
  - Used by people more susceptible to infection
- Secondary versus supplemental disinfection systems
  - 3-$\log_{10}$ (99.9%) inactivation of *Cryptosporidium* oocysts
- Ultraviolet light and ozone
  - Use of does <u>not</u> modify any other water quality recommendations

MAHC 6.5.2: Response to Diarrheal Contamination of Water Without CYA

1. Close immediately aquatic venue to bathers
   - Including any aquatic venue sharing recirculation system
2. Remove contaminating material and dispose of
   - Do not use vacuum cleaner
   - Clean item used to remove contamination and immerse in aquatic venue during disinfection
3. Raise chlorine to 20.0 ppm for ≥12.75 hours or equivalent*
   - Test chlorine and pH at multiple sampling points
   - Add only non-stabilized chlorine

   OR

   Circulate water through secondary disinfection system to reduce number of infectious *Cryptosporidium* oocysts to 1 oocysts/100 mL

* Verify and maintain water pH ≤7.5 and temperature ≥25°C.

Cryptosporidium Inactivation with CYA ≤16 ppm

Average chlorine concentration (mg/L)	Average CYA concentration (mg/L)	Average estimated CT* (mg·min/L)	Average inactivation time (hours)
21.6	0	10,500	8.2
21.1	8	17,800	14.1
19.1	16	31,500	27.5
40.6	0	12,400	5.1
40.9	9	15,300	6.2
38.3	15	19,400	8.4

* 3-$\log_{10}$ (99.9%) CT inactivation value at water pH 7.6 and temperature 25°C

Source: Murphy JL *et al*. 2015. Environ. Sci & Technol 49(12):7348–55.

Cryptosporidium Inactivation with CYA ≤48 ppm

Average chlorine concentration (mg/L)	Average CYA concentration (mg/L)	Average estimated CT* (mg·min/L)	Average inactivation time (hours)
21.6	0	3,500	2.7
21.2	48	76,500	61.9
40.6	0	4,100	1.7
38.5	46	40,000	17.2

* 1-$\log_{10}$ (90%) CT inactivation value at water pH 7.6 and temperature 25°C

Source: Murphy JL *et al*. 2015. Environ. Sci & Technol 49(12):7348–55.

Cryptosporidium Inactivation with CYA ≤48 ppm

Average chlorine concentration (mg/L)	Average CYA concentration (mg/L)	Average estimated CT* (mg·min/L)	Average inactivation time (hours)
21.6	0	3,500	2.7
21.2	48	76,500	61.9
40.6	0	4,100	1.7
38.5	46	40,000	17.2

* 1-$\log_{10}$ (90%) CT inactivation value at water pH 7.6 and temperature 25°C

Could not achieve 3-$\log_{10}$ (99.9%) inactivation in reasonable time frame (<24 hours) with 46-48 mg/L CYA

Source: Murphy JL *et al*. 2015. Environ. Sci & Technol 49(12):7348–55.

Cryptosporidium Inactivation with CYA 100 ppm

- 0.8-$\log_{10}$ (84%) reduction with chlorine 20 mg/L for 144 hours (6 days)
- 0.8-$\log_{10}$ reduction with chlorine 40 mg/L for 24 hours
- 1.4 $\log_{10}$ (96%) reduction with chlorine 40 mg/L for 72 hours
- 1-$\log_{10}$ (90%) CT inactivation values could not be calculated

MAHC 6.5.2: Response to Diarrheal Contamination of Water With CYA

1. Close immediately aquatic venue to bathers
   - Including any aquatic venue sharing recirculation system
2. Remove contaminating material and dispose of
   - Do not use vacuum cleaner
   - Clean item used to remove contamination and immerse in aquatic venue during disinfection
3. Lower CYA to ≤15 ppm (drain and refill), raise chlorine to 20.0 ppm for ≥28 hours, 30 ppm for ≥18 hours, 40 ppm for ≥8.5 hours, or equivalent*
   - Test chlorine and pH at multiple sampling points
   - Add only non-stabilized chlorine

   OR

   Circulate water through secondary disinfection system to reduce number of infectious *Cryptosporidium* oocysts to 1 oocysts/100 mL

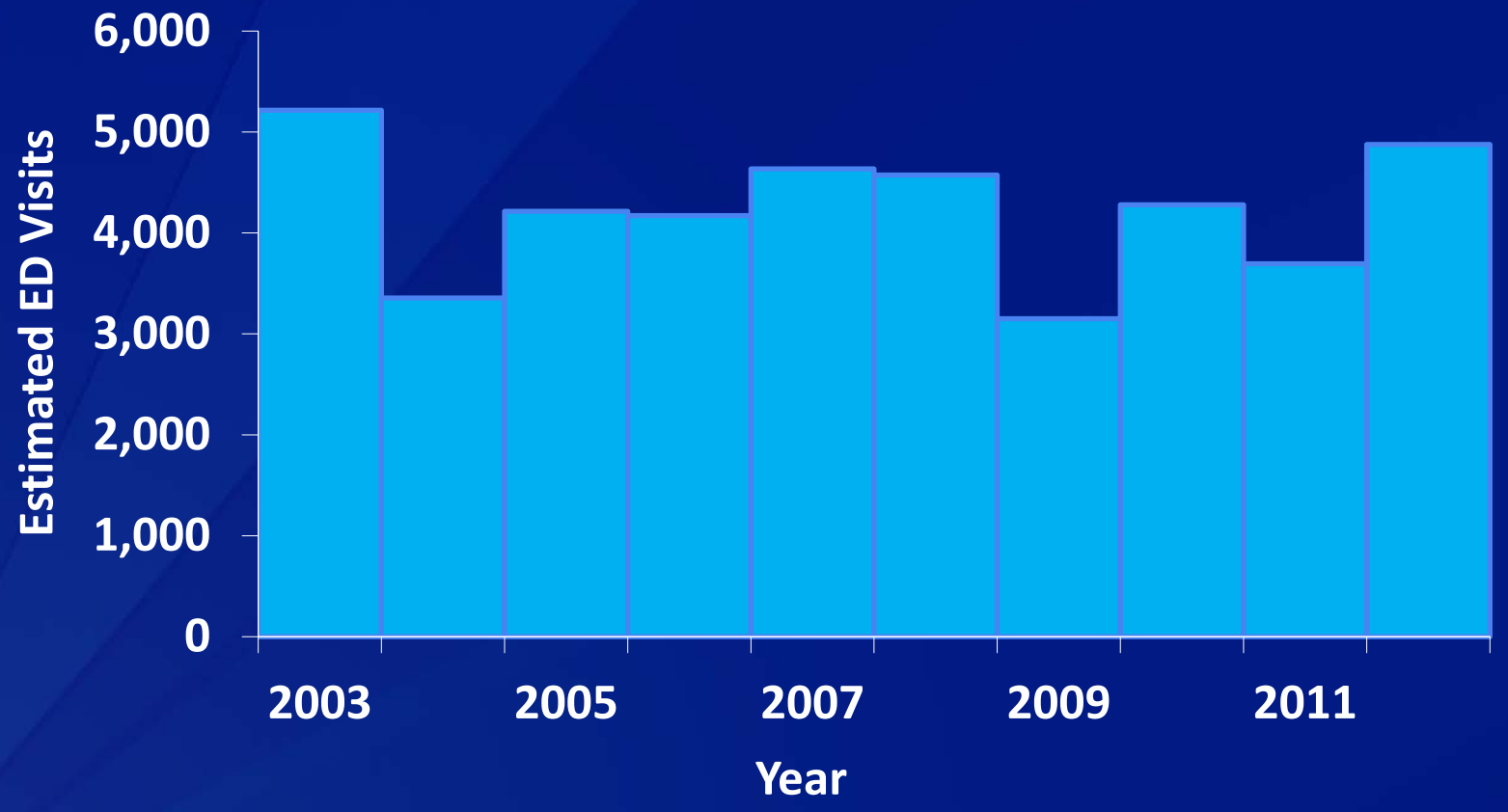
   OR

   Drain aquatic venue completely and refill

* Verify and maintain water pH ≤7.5 and temperature ≥25°C.

Pool Chemical Safety

Estimated Annual Emergency Department Visits for Pool Chemical–associated Injuries, by Year United States, 2003–2012



Source: Hlavsa MC *et al*. MMWR 2014;63(19);427–30.

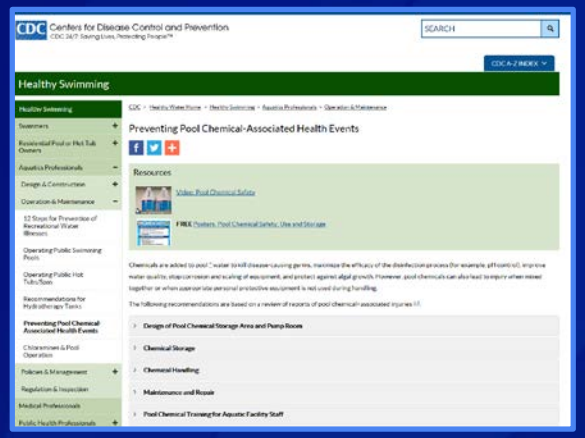
Common Themes

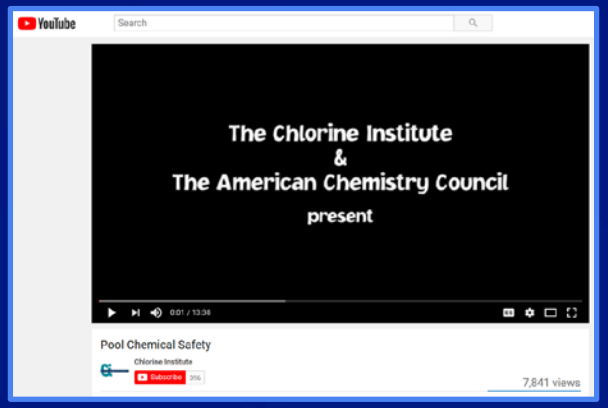
- Injuries frequently occurred in 2012 when
  - Handle chemicals without using personal protective equipment (e.g., goggles)
  - Add chemicals directly to water just before patient enters
    - Frequently in hotel/motel or residential pools
  - Fail to secure chemicals away from children
- Contributing factors: human error and equipment failure
  - Pool operators and residential pool owners lack knowledge of basic pool chemical safety
  - Standard pool equipment allows for situations where concentrated chlorine and acid mix

MAHC on the 3 E's of Pool Chemical Safety

- Engineering
  - 4.7.3.2.1.3 and 5.7.3.5.1.2: Electrical interlock between chemical feed and recirculation systems
  - 4.9.2: Chemical storage space design and construction
- Education
  - 6.0.1: Training staff storing and handling chemicals
  - 6.1.2.1.4.6: Operator training on chemical safety
- Enforcement
  - 4.1.2.2.6: Design report includes chemical storage space schematic layout
  - On-site inspections: model MAHC inspection form https://www.cdc.gov/mahc/pdf/mahc-aquatic-facility-inspection-report.pdf

Resources





FREE video available in English and translated into Spanish

2 posters in English and Spanish FREE from CDC thanks to the American Chemistry Council

https://www.cdc.gov/healthywater/swimming/aquatics-professionals/preventing-pool-chemical-events.html

Contact Information

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Required Disclaimer

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.