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The Three Es of Healthy Swimming

Editor's Note: NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature a column from the Environmental Health Services Branch (EHSB) of the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In this column, EHSB and guest authors from across CDC will highlight a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health. EHSB's objective is to strengthen the role of state, local, and national environmental health programs and professionals to anticipate, identify, and respond to adverse environmental exposures and the consequences of these exposures for human health. The services being developed through EHSB include access to topical, relevant, and scientific information; consultation; and assistance to environmental health specialists, sanitarians, and environmental health professionals and practitioners.

The conclusions in this article are those of the author(s) and do not necessarily represent the views of the Centers for Disease Control and Prevention.

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Thankfully, none of us has to know everything or go it alone in public health. We have colleagues with different backgrounds who can share their knowledge and wisdom to help address emerging public health threats. We, as epidemiologists, are fortunate that our Centers for Disease Control and Prevention (CDC) environmental health colleagues, Charles Otto and Pat Bohan, have taught us to view outbreak investigations and other recreational water illness (RWI) issues with an environmental health perspective and use a systems-based approach to problem solving. Recreational water illnesses (RWIs) are

caused by pathogens transmitted by ingesting, inhaling aerosols of, or having contact with contaminated water in pools, hot tubs, interactive fountains, lakes, rivers, oceans, and so forth. RWIs can also be caused by chemicals in the water or those that volatilize from the water and cause indoor air quality problems. At state and local public health agencies, environmental health specialists like New York State's Doug Sackett bring emerging issues to our attention and remind us of the need to balance science with what is practical and feasible. One of the many great insights we have taken from working with Doug is his belief

in the three Es—education, engineering, and enforcement—to combat public health challenges, including RWIs.

Education

Decreasing the number of RWI outbreaks starts with the education of three key stakeholder groups: pool inspectors, pool operators, and swimmers. Pool inspectors enforce pool codes through pool inspections and provide information to pool operators and the swimming public, so they must have efficient and effective opportunities to maintain and enhance current knowledge about pool operation and RWI prevention. Properly trained pool operators do a better job of maintaining required free chlorine and pH levels (Buss et al., 2009; Johnston & Kinziger, 2007) so it makes sense to require operators to be trained to understand the operation of complex systems. Additionally, because swimmer behavior can contribute to RWIs, public health and the aquatics industry must work together to educate the public about the importance of healthy swimming behaviors (see Sidebar). One great opportunity to get healthy swimming messages out to the public is Recreational Water Illness and Injury Prevention Week (RWIIPW), held every year during the week before Memorial Day when the media is looking for swimming-related stories. The focus of RWIIPW 2011 (May 24–30) is preventing swimmer's ear (www.cdc.gov/healthywater/swimming/rwi/rwi-prevention-week/index.html).

Engineering

To date, aquatics has relied on traditional disinfection and filtration to help keep swimming healthy. The emergence of chlorine-tolerant *Cryptosporidium*, the leading cause of RWI

outbreaks, however, has changed the face of aquatics forever (Centers for Disease Control and Prevention [CDC], 2007). It is driving new engineering improvements that inactivate *Cryptosporidium* such as UV or ozone treatment. Because *Cryptosporidium* is too small for removal by most existing pool filters, improved filtration is also needed. Other improvements to help prevent RWIs caused by toxic chlorine gas generated when chemical feed pumps keep running after the main circulation pumps shut down (CDC, 2009) include installation of an electrical interlock and a flow switch sensor. If the circulation pump shuts down but the chlorine and acid feed pumps continue running, concentrated hypochlorous acid and acid can mix within the piping. When the circulation pump is restarted, the toxic chlorine gas that is generated in the static water return lines is vented into the pool.

Enforcement

In 2005, in response to the increasing number of RWI outbreaks, local, state, and federal public health officials and the aquatics industry met to determine how best to reduce the risk of RWIs. Setting uniform national guidelines by developing a nonregulatory, model aquatic health code (MAHC) was determined to be a key prevention measure. The MAHC, supported by CDC, is designed to be a data-driven, best practices-based, open-access national model that will be available to state and local partners for voluntary adoption (Beach, 2009). Volunteers from public health, the aquatics industry, and academia have been drafting MAHC modules on topics ranging from ventilation to water quality. The MAHC effort is actively seeking environmental health input, particularly from the state and local levels, on draft modules being posted for public comment at www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/.

CDC's Healthy Swimming Program is an epidemiologic, health communications, and environmental health collaboration to prevent and control RWIs. The three Es give us a strategic framework to do just that. Given the need to train personnel, disseminate educational messages, promote engineering changes, and develop national model guidelines for pools and hot tubs, Healthy Swimming efforts must continue to expand the repertoire of expertise available. New expertise in health policy, laboratory research, engineering, and behavioral science is needed to advance the health and safety of U.S.

Triple As of Healthy Swimming

1. Awareness

- Visit CDC's Healthy Swimming Web site at www.cdc.gov/healthywater/swimming.
 - Learn how to protect yourself and others from RWIs and follow the Six Steps for Healthy Swimming:
 - Don't swim when you have diarrhea. You can spread germs in the water and make other people sick.
 - Don't swallow the pool water. Avoid getting water in your mouth.
 - Practice good hygiene. Shower with soap before swimming and wash your hands after using the toilet or changing diapers. Germs on your body end up in the water.
- Three Steps for All Swimmers*
- Don't swim when you have diarrhea. You can spread germs in the water and make other people sick.
 - Don't swallow the pool water. Avoid getting water in your mouth.
 - Practice good hygiene. Shower with soap before swimming and wash your hands after using the toilet or changing diapers. Germs on your body end up in the water.
- Three Steps for Parents of Young Kids*
- Take your kids on bathroom breaks or check diapers often. Waiting to hear "I have to go" may mean that it's too late.
 - Change diapers in a bathroom or a diaper-changing area and not at poolside. Germs can spread in and around the pool.
 - Wash your child thoroughly (especially the rear end) with soap and water before swimming. Invisible amounts of fecal matter can end up in the pool.

2. Action

- Check pool water yourself using test strips purchased at your local hardware or pool supply store. CDC recommends the following water quality ranges:
 - Free chlorine level 1–3 parts per million (ppm).
 - pH 7.2–7.8.
- Ask the pool operator the following questions:
 - Are the free chlorine and pH levels checked at least two times per day and more often when the pool is heavily used?
 - What is the latest pool inspection score?
 - Has he/she completed specialized training in pool operation?

3. Advocacy

- Encourage pool operators to take steps known to kill germs.
 - Add ultraviolet or ozone technology to pool water treatment.
 - Hyperchlorinate regularly; not even the toughest germs (like Crypto) can tolerate free chlorine levels at 20 ppm for 12.75 hours.
- Educate other swimmers about RWIs to promote healthy swimming.

swimmers. With constant improvement, local, state, and federal Healthy Swimming resources, expertise, and models will be honed to finally stem the rising tide of RWIs. 🌊

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