

Newly Released Review on Drinking Water Outbreak Causes

By Kelly A. Reynolds, MSPH, PhD

On September 6, the US Centers for Disease Control and Prevention (CDC) published a review of the causes of waterborne disease outbreaks associated with drinking water and other non-recreational water sources. These CDC surveillance summaries are published roughly every two years, covering a two-year surveillance period. The most recent report range is from January 2009 to December 2010. Although released following a two- to three-year lag period, these outbreak summaries provide valuable insights into trends associated with waterborne outbreaks and can help the drinking water treatment and purification industry identify current and future needs.

The drinking water surveillance system

The CDC and US EPA, in cooperation with the Council of State and Territorial Epidemiologists (CSTE), maintain the Waterborne Disease Surveillance System (WBDSS), a database of reported drinking water outbreaks and their causes. Information in the database is collected and voluntarily reported by health departments in US states, territories and localities. Through these surveillance summaries, information is generally available related to the type of source water involved, causative agents, populations effected, health outcomes and treatment deficiencies. The database, however, is only as good as the reporting, which can vary substantially across regions. State and local health departments are typically tasked with reporting and also investigating waterborne outbreaks. Only those outbreaks with a convincing level of population impacts linked to water ever get investigated, as budgetary constraints continue to limit the amount of resources devoted to outbreak investigations. When a waterborne outbreak is suspected—usually after numerous people have come forward to report their adverse symptoms—the next step is often to collect water samples and clinical specimens. Linking hazardous agents at the source to being the causative agent in an outbreak is not easy or inexpensive. Thus presents the problem of data bias where areas that can afford more testing may be inaccurately identified as the areas of highest concern.

Beginning in 2009, the CDC utilized a new electronic reporting system for waterborne outbreaks, known as the National Outbreak Reporting System (NORS). The NORS system is designed to enhance and integrate state reporting systems with the national outbreak surveillance system and targets numerous etiological agents, including: bacteria, viruses, parasites, chemicals, toxins and other unknown agents associated

with outbreaks. Information has been collected electronically for foodborne outbreaks since 1998. Today, NORS not only collects data on food and waterborne outbreaks but also person-to-person, animal contact and contaminated environment scenarios (i.e., disease transmission via dirty linens or soiled surfaces).

Deadliest agents

In order to be considered an outbreak, at least two or more cases must be linked by time, location of water source and illness characteristics and the evidence of illness in the population must be linked to water as the probable source of illness. Data collected in NORS includes: 1) illness, hospitalization and death counts; 2) the confirmed or suspected causative agent; 3) the implicated water system; 4) deficiencies in the water system suspected to cause the outbreak and 5) the place of exposure.

During the two-year survey period, a total of 33 outbreaks associated with drinking water were reported from 17 states, resulting in 1,040 cases of illness, 85 hospitalizations (8.2 percent of cases) and nine deaths. The majority (58 percent) of outbreaks were due to *Legionella* followed by 12 percent from *Campylobacter*—both bacterial pathogens. *Campylobacter* was associated with the highest number of cases, resulting in 78 percent of all illnesses, compared to seven percent from *Legionella*.

Legionella is a bacterium that is commonly associated with distribution/plumbing systems. The organism can grow in the environment, reaching harmful numbers and exposing victims via the respiratory route when aerosolized. *Legionella* infections resemble pneumonia or flu-like symptoms and can be serious or deadly in elderly or immunocompromised populations. In the 2009-2010 survey period, eight of the nine deaths reported were from *Legionella*.

Campylobacter is an enteric bacterium, meaning it causes disease via the gastrointestinal tract, with diarrhea being the primary symptom. While deaths from *Campylobacter* are rare in the US, infections can result in significant and sometimes long-term illness. From 2009-2010, 812 illnesses were from *Campylobacter* but no deaths resulted.

Other etiological agents listed in the most recent outbreak database include, **Bacteria:** *E. coli* O157:H7 (2 outbreaks, 39 cases, 7 hospitalizations, 1 death); **Parasites:** *Giardia* (4 outbreaks, 41 cases, 1 hospitalization, 0 deaths), *Cryptosporidium* (2 outbreaks, 44 cases, 0 hospitalizations, 0 deaths); **Viruses:** hepatitis A virus (1 outbreak, 2 cases, 0 hospitalizations, 0 deaths), norovirus (1 outbreak, 47 cases, 0 hospitalizations, 0 deaths). One outbreak

caused by an unidentified agent resulted in three cases and three hospitalizations.

Water supply deficiencies identified

Water supply deficiencies linked to 2009-2010 outbreaks were primarily identified as *Legionella* in plumbing systems (57.6 percent). Other identified causes were from drinking untreated groundwater (24.4 percent) and distribution system deficiencies (12.1 percent). Together, distribution system deficiencies and untreated groundwater resulted in 965 (92.8 percent) of all outbreak-associated illnesses.

An additional 12 outbreaks associated with non-recreational water exposures were also identified, resulting in 234 cases of illness, 51 hospitalizations and six deaths. Non-recreational exposures include exposures due to the consumption of water not intended for drinking. Most of the outbreaks (58 percent), hospitalizations (96 percent) and all of the deaths from non-recreational exposures were also due to *Legionella*. Implicated water sources included a cooling tower, a mist/steam device in a workplace, an ornamental fountain and other sources of ingested water not intended for drinking.

Prevention at the point of use

Legionella growth in plumbing may occur outside of the regulatory purview and thus presents a challenge for municipal water suppliers. Two of the 19 reported *Legionella* outbreaks occurred at healthcare facilities that had treatment systems installed to prevent growth of the bacteria. Despite these engineered controls, *Legionella* were still able to compromise public health.

Recognizing that a significant portion of historical drinking water outbreaks were from untreated groundwater sources, US

EPA promulgated the *Groundwater Disinfection Rule* in 2006. This regulation is expected to reduce cases of waterborne disease associated groundwater supplies. This category continues to be a leading cause of waterborne illness in part due to private wells that are not addressed under the current regulation.

Given that a majority of the recent drinking water outbreaks were caused by bacteria in untreated water supplies or in the distribution system post-treatment, most or all could have been prevented by the proper use of a POU treatment device designed to remove bacteria. Continued challenges in preserving the quality of the drinking water supply, such as aging infrastructure, further support water treatment at the point of consumption as the final barrier for public health protection.

References

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