Waterborne Disease Outbreak

Waterborne diseases have been a major cause of human morbidity and mortality, and remains so even in the 21st century. Recent large outbreaks due to contaminated drinking water or recreational water illustrate the ongoing risks. In 1993 Milwaukee, Wisconsin, experienced a city-wide outbreak of cryptosporidiosis due to inadequately treated municipal water with an estimated 403,000 illnesses and over 50 deaths. Walkerton, Ontario, had an outbreak of shiga toxin-producing E. coli (STEC) in 2000 due to manure washing into a shallow supply well which caused an estimated 2500 illnesses and at least 7 deaths, mainly children. A 1998 STEC outbreak connected to a Georgia water park resulted in 26 cases and one death. During 2007 Utah experienced an extensive cryptosporidiosis outbreak associated with treated recreational water involving over 1900 cases and almost 100 hospitalizations.

Agents and Outbreaks

Untreated contaminated water can cause outbreaks of cholera, typhoid, polio, and hepatitis A and many less severe conditions. However, waterborne disease outbreaks due to Cryptosporidium, Legionella, and norovirus occur even in regions with modern water treatment. The Centers for Disease Control and Prevention (CDC) consider about 50 communicable conditions to be potentially waterborne. Only a few agents such as Legionella and certain amoeba are exclusively or almost entirely waterborne; other agents are often transmitted from food, animals, fomites, or other people in addition to water. Waterborne disease outbreaks are particularly challenging due to this multiplicity of potential exposures.

Information about symptoms, incubation period, and duration of illness can suggest an agent (Table). Norovirus-like agents cause relatively minor illnesses of short duration; bloody diarrhea suggests an enteric bacterial infection; and diarrhea extending over weeks with weight loss is consistent with parasitic infections like giardiasis or cryptosporidiosis. Less common waterborne diseases include leptospirosis, tularemia, and Naegleria (amebic meningitis). Legionella pneumonia has special outbreak
investigation protocols. Swimmer’s itch, a common allergic reaction to certain aquatic parasites, is not included in waterborne disease outbreak surveillance.

Table: Common Waterborne Disease Agents

<table>
<thead>
<tr>
<th>Agent</th>
<th>Reservoir</th>
<th>Symptoms</th>
<th>Incubation</th>
<th>Duration</th>
<th>PHL* testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norovirus-like agents</td>
<td>humans (frequent secondary cases)</td>
<td>vomiting, diarrhea, fever</td>
<td>0.5-2 days</td>
<td>1-2 days</td>
<td>human</td>
</tr>
<tr>
<td>STEC (shiga toxin-producing E.coli, Shigella, other enteric bacteria)</td>
<td>animals, humans (Shigella); may be secondary cases</td>
<td>vomiting, diarrhea (may be bloody)</td>
<td>1-8 days</td>
<td>5-10 days</td>
<td>human, animal, water</td>
</tr>
<tr>
<td>Cryptosporidium, Giardia</td>
<td>animals, humans; (frequent secondary cases)</td>
<td>prolonged diarrhea</td>
<td>few days to &gt; 1 week</td>
<td>weeks</td>
<td>human</td>
</tr>
<tr>
<td>Pseudomonas</td>
<td>humans</td>
<td>rash (folliculitis)</td>
<td>0.5-5 days</td>
<td>days</td>
<td>water</td>
</tr>
<tr>
<td>Legionella (uses separate CDC form)</td>
<td>water systems</td>
<td>pneumonia</td>
<td>2-10 days</td>
<td>days</td>
<td>human</td>
</tr>
</tbody>
</table>

*Washington State Public Health Laboratories (testing only for outbreaks)

With water as a vehicle there is considerable dilution of an agent. Most waterborne agents have a small infective dose (sometimes < 10 organisms) and are also environmentally stable. As a result, these agents often have high secondary attack rates among close contacts, such as in homes or childcare centers, so investigations are further complicated.

Waterborne disease outbreaks are likely under-detected, with fewer than 100 outbreaks reported in this country most years (in Washington usually no more than one a year). A recent article (Collier) assumed certain conditions primarily associated with waterborne agents (giardiasis, cryptosporidiosis, legionellosis, non-tuberculous mycobacteria, otitis externa) caused around 40,000 hospitalizations annually in this country. Additional conditions partly associated with water (campylobacteriosis, salmonellosis, shigellosis, hemolytic uremic syndrome, toxoplasmosis) resulted in about 50,000 additional hospitalizations each year.
Outbreak Investigations

CDC categorizes water source of outbreaks into four types:

1. Water intended for recreation, treated: includes pools, interactive fountains, water slides, spas, whirlpools, and hot tubs
2. Water intended for recreation, untreated: includes lakes, rivers, streams, hot springs, and ocean sites
3. Water intended for drinking: includes water used for drinking, bathing, showering, ice, or reconstituting beverages, and bottled water
4. Water not intended for drinking and water of unknown intent: includes waste water, agricultural or industrial water, and ornamental fountains

There are specific CDC forms for reporting each of these outbreak types in addition to general outbreak forms, or the Department of Health (DOH) form can be used in the place of the CDC forms (see Resources). An optional DOH case investigation worksheet is also available.

From the initial report of a possible waterborne disease outbreak, the local health jurisdiction (LHJ) can determine the number ill, their onset dates and symptoms, any laboratory results, and shared exposures including water and food. The incubation period and the typical reservoirs of the likely agents will suggest whether the implicated water source is epidemiologically consistent and may suggest the source of exposure. For example, norovirus-like agents and Shigella have only humans as reservoirs so an outbreak suggests exposure to human excretions. Plausible reasons for the implicated water to be contaminated, such as recent rainfall or known system maintenance problems, would be supportive information.

LHJ communicable disease and environmental health staff may work collaboratively on an initial evaluation and investigation. Based on an assessment of the likely agent and implicated water source, the LHJ will decide the appropriate degree of further investigation. Reports of a small number of ill persons, particularly if they share multiple exposures, may not warrant additional investigation, or there may be a more plausible source of exposure.

Environmental investigations to determine possible points of contamination of an implicated water source can be complex. Drinking water outbreaks can result from contamination at the source (e.g., shallow well), insufficient treatment, contamination from the distribution system, or poor maintenance at a point not under the jurisdiction of the water system (e.g., within a building). Recreational water outbreaks can result from upstream contamination of untreated water, insufficient treatment, onsite sewage problems, or contamination from the swimmers.
Reporting Requirements

Washington State mandates reporting of suspected or confirmed waterborne disease outbreaks to the LHJ even in the absence of a confirmed agent. DOH reports all confirmed waterborne disease outbreaks to CDC regardless of laboratory confirmation. Note that confirmed individual cases of notifiable conditions should be reported separately.

DOH epidemiologists are responsible for coordinating the investigation of multi-county or multi-state outbreaks involving Washington residents. Since waterborne disease outbreaks have low detection and reporting rates, LHJs in Washington may have minimal experience with the investigations. DOH can provide assistance and consultation with both epidemiologic and environmental components of investigations to improve investigation and reporting of waterborne outbreaks in Washington, and thereby protect the health of Washington State residents.

Resources


DO NOT DRINK - Contaminated Water-

•Do not use for drinking.
•Do not use to mix/dilute baby formula.

For more information, ______________________

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No beba el agua.

No use el agua para preparar la fórmula para bebés (biberón).