Recognizing Waterborne Disease, Water Pollution, and Water Terrorism: Understanding the Role of the Medical Community in Protecting the Public's Health

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Contamination of drinking water by microbial pathogens, chemical compounds or radiologic agents has the potential to affect the health of millions of Americans and may lead to severe morbidity and mortality in vulnerable populations most at risk for water-related disease. Prevention of waterborne disease and the health effects of water contamination is vital to our nation’s health due to the fact that access to safe drinking water is a cornerstone of public health. It is important to note that the advent of childhood vaccinations, modern sanitation methods, and access to potable water have increased the lifespan and improved the general health of US citizens more than any other advancement in the field of medicine to date (1).

The medical community will continue to play a critical role in protecting the public’s health through the recognition, management, and prevention of water-related disease in their patients and in their local communities (2). The events of September 11th have added a new dimension to this public health challenge and have emphasized the need for medical practitioners to recognize unusual waterborne disease trends that may result from intentional contamination of water with biological, chemical or radiologic agents (3). Medical practitioners throughout the United States must understand that they are likely to be the first to observe the early warning signs and changes in illness patterns that may result from intentional contamination of water and that they may be the “front-line responders” in detecting acts of water terrorism (2, 3).

Timely detection and treatment of waterborne disease is essential since the medical, public health, and economic consequences of a water contamination may be grave. The massive outbreak of waterborne cryptosporidiosis in Milwaukee, Wisconsin in 1993 is an example of how contaminated water distributed through a municipal water system can lead to a major public health crisis (4). As a result of the Cryptosporidium contamination, an estimated 403,000 Milwaukee residents developed diarrhea reflecting an attack rate of 52% of the population with more than 4,000 requiring hospitalization (5). Cryptosporidiosis was listed as the underlying or contributory cause of death in 54 residents following the outbreak, severely impacting susceptible populations most at risk (6). An estimated 725,000 productive days were lost as a result of the water contamination event and more than $54 million in lost work time and additional expenses to residents and local government resulted from the waterborne disease outbreak (7, 8). In 2000, the town water supply of a small rural community in Walkerton, Ontario was contaminated with E. coli O157:H7 resulting in 2,300 symptomatic residents and seven deaths attributed to the waterborne disease outbreak (2). More than $11 million was required to reconstruct the community’s potable water supply and install temporary filtration after the water treatment and distribution systems were contaminated. The estimated total cost of the Walkerton, Ontario waterborne disease outbreak and municipal water contamination event had already reached $155 million by 2001 (2).

Recognizing waterborne disease resulting from natural, accidental or intentional contamination of water supplies is a diagnostic challenge for the majority of practicing physicians in the United States and includes but is not limited to the following issues:
• Patients may not be aware of their previous waterborne exposure to biological, chemical or radiologic agents and obtaining an accurate exposure history is often very difficult (2).
• Many of the signs and symptoms of waterborne disease and the health effects of water contamination are non-specific and often mimic more common medical disorders (2).
• Co-infections with multiple waterborne pathogens or exposure to a mixture of chemical agents are common scenarios in many presenting patients exposed to waterborne contaminants complicating an accurate diagnosis (2, 8).
• Waterborne exposure events in a healthy patient population may present as benign symptoms or self-limited illness while the same waterborne exposure events in a vulnerable patient population may result in significant morbidity including chronic and life-threatening disease and, in some cases, mortality (8).
• Public drinking water may represent only one source of waterborne contaminant exposure and other scenarios must also be investigated including exposure to contaminated recreational waters, swimming pools and water parks, medical or dental devices, and commercial bottled water (2).
• Many of the infectious pathogens and chemical contaminants found in the water environment are not unique to water and other sources of contamination in the patient’s environment such as food, soil, and air must also be ruled out during clinical evaluation (8, 9).

Accurate and timely diagnosis of water-related disease by the medical community is a critical element to any successful strategy to protect water quality and security and ultimately the public’s health. As is apparent from this short review, there are numerous barriers to detecting and accurately diagnosing waterborne disease and the health effects of water contamination. Understanding the following subject areas will provide the key elements necessary for healthcare providers to improve their clinical knowledge of water-related disease and to enhance their awareness of water quality issues in their community.

1. **Basic Understanding of Waterborne Disease Trends and Exposure Pathways:** In order for healthcare providers to accurately diagnose water-related disease, they must acquire a basic understanding of waterborne disease trends, major causes of water pollution, and subsequent routes of transmission and sources of exposure to water contaminants that their patients may experience in order to take an effective exposure history and not miss the diagnosis of water-related disease (2, 3).

2. **Evaluation and Management of Water-related Disease Resulting from Biological, Chemical, and Radiologic Contaminants:** A working knowledge of the symptomatology of water-related disease, appropriate diagnostic laboratory testing, disease-specific clinical management guidelines, and public health reporting requirements for the most common infectious waterborne pathogens, chemical compounds, and radiologic agents encountered in the US is also an important element to effective patient care (2, 3).

3. **Evaluation and Management of Water-related Disease in Susceptible Populations Communication:** All healthcare providers must recognize the special health needs of sensitive populations at greatest risk for morbidity and mortality from exposure to waterborne contaminants including pregnant women and developing fetuses; neonates, infants and children; geriatric patients including nursing home residents; immunosuppressed individuals including HIV and AIDS patients; patients undergoing immunosuppressive therapy including organ transplantation and chemotherapy; and patients with pre-existing clinical disorders or chronic diseases resulting in impairment of the renal, hepatic or immunologic system (2, 3).
Two free web-based clinical resource guides and disaster response tools have been developed for the medical community that address all aspects of the evaluation and management of water-related disease resulting from both accidental and intentional water contamination and are posted at www.WaterHealthConnection.org. The primary purpose and educational intent of these web-based clinical guides is to provide the medical and public health community with streamlined access to resources that will help guide them through the recognition, management, and prevention of water-related disease resulting from all types of water contamination.

REFERENCES