

Identifying Populations at Greatest Risk of Waterborne Disease

By Kelly A. Reynolds, Ph.D.

The risk of waterborne disease is clearly recognized by the general public, but perhaps not as earnestly by immunocompromised individuals as it should be. This group consists primarily of the very young, the elderly, pregnant women and persons with diminished immunity, either due to medical intervention (organ transplants, invasive surgery), previous illness (diabetes, cancer) or infection (AIDS, etc.). For these populations, the risk of serious illness due to contaminated water consumption is greater than the general population.

Guidelines issued by the U.S. Environmental Protection Agency (USEPA) and the Centers for Disease Control & Prevention (CDC) recommend that immunocompromised individuals drink only treated water and, whenever possible, boil their water prior to consumption. Because microbial infections are more likely to have fatal outcomes with persons of decreased immunity, the water purification industry has an immense responsibility to those most at risk.

State of sensitive populations

According to 1991 estimates from the Department of Commerce, sensitive populations constitute nearly 20 percent of the population. Future projections indicate that a continued increase in population growth and advances in medicine will lead to a greater number of individuals at risk.

The number of individuals over the age of 65 is expected to be up to 69.4 million by 2030.¹ During 1995, the proportion of adults aged greater than or equal to 65 years was 12.8 percent, compared with an anticipated 20 per-

cent during 2030. Adults aged greater than or equal to 85 years are the fastest growing segment of the population; during 1995-2030, their numbers are projected to increase from 3.6-to-8.5 million. Conversely, approximately 21.5 million children greater than or equal to four years of age will be living in the United States by 2025.²

In 1999 alone, 1,221,800 new cancer cases are estimated to have occurred.³ Calculations using projected populations and assuming constant prevalence rates yield an estimated 6.2 million people with a history of cancer in the United States by the year 2000 and 9.6 million by 2030.⁴

Due to highly active antiviral therapy repelling the onset of AIDS with HIV positive individuals, there's been a decrease over previous years, with 44,296 new cases reported in the United States in 1998.⁵ The number of people living with AIDS, however, is increasing as new treatments prolong the lives of infected persons. In 1997, approximately 270,000 people were living with AIDS.⁶ And more than 21,197 transplants were performed in 1998.⁷

Fatal outcomes

Although the causative agent is not identified in half of all documented U.S. waterborne outbreaks, a number of microbial agents have been found to cause waterborne outbreaks. Protozoa and viruses are most commonly associated with waterborne illness.⁸ The severity of the outcome following exposure to human pathogens is affected by a number of factors including general health and immune response, nutrition, age, and

other nonspecific host factors.

In addition, specific characteristics of the infecting organism play a major role. For example, some viruses primarily produce disease in children, but only affect a small percentage of adults. Most enteric pathogens will produce clinically observable illness in 50 percent or more of infected individuals.^{9,10} This means the other 50 percent of the infected population will not show visible signs of illness. For immunocompromised individuals, the infectivity rate may be much higher. In addition, the number of clinical illnesses leading to death is higher for sensitive populations.

Recent outbreaks of waterborne disease have certainly had the most deleterious effects on immunocompromised individuals. For instance, on Aug. 28, 1999, a massive *E. coli* outbreak occurred in Albany, N.Y. Labeled the worst outbreak in the state's history, the number of people reporting symptoms was 921, with 65 hospitalized. The waterborne organism also claimed the life of a three-year-old girl and a 79-year-old man.⁹ The well publicized Milwaukee, Wis., outbreak linked to *Cryptosporidium* was reported to have affected 403,000 individuals. More than 100 deaths among immunocompromised individuals were associated with that incident.¹⁰

Assessing risk by group

Pregnancy—During pregnancy, women appear to be at greater risk of enteric virus infection and subsequent infection to the unborn fetus. Available information on Hepatitis E infections—no U.S. outbreaks have been reported—in immunocompetent and

pregnant women show that the case fatality ratio is 1-to-2 percent vs. 10-to-20 percent, respectively. A viral infection during pregnancy may result in transfer to the child either in utero, during birth or shortly after birth. Enterovirus infections may be particularly dangerous in the first two weeks of an infant's life, where infection is most likely to result in a fatal outcome. Coxsackie B viruses have been associated with stillbirths, spontaneous abortions and birth defects.¹¹

Nursing home residents—Microbial outbreaks in nursing homes have been documented as having a significantly higher mortality than the general population.¹¹ Case fatality rates may be 10-to-100 times greater than the general population, depending on the agent. One documented outbreak of rotavirus in a nursing home resulted in nearly 66 percent infection with symptomatic illness, an extremely high attack rate.¹¹

Cancer and transplant patients—Cancer patients and transplant recipients are subjected to intensive thera-

pies known to reduce the ability of the immune system to ward off disease. The mortality rate among bone marrow transplant patients with enteric viral infections was an alarmingly high 59 percent according to one study.¹¹

AIDS patients—Enteric diseases are among the most common and devastating problems affecting AIDS patients. Estimates of 50-to-90 percent of AIDS victims suffer from chronic diarrheal illnesses. Adenovirus and rotavirus are the most common enteric viruses afflicting persons with AIDS. Twelve percent of the AIDS patients with clinical symptoms are infected with adenovirus, and 45 percent of these cases will result in death within two months.¹¹

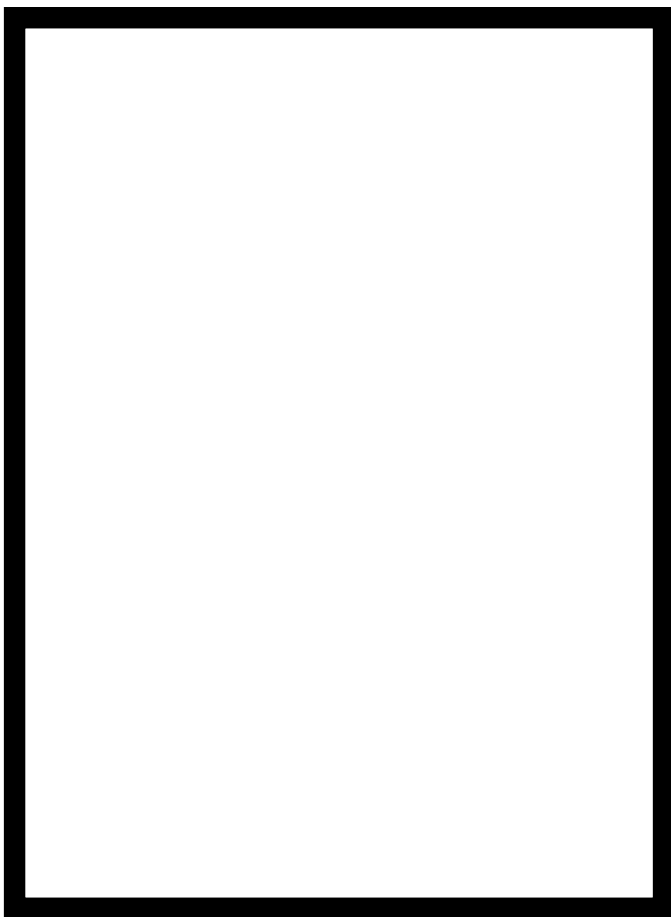
Cryptosporidium is perhaps the most serious microbe affecting AIDS patients, usually resulting in a prolonged diarrhea with fluid losses of several liters a day. Mortality rates are as high as 50 percent.¹¹ The CDC and USEPA have issued guidance state-

ments informing immunocompromised individuals on how to minimize or avoid *Cryptosporidium* infection (see *Chart 1*), in light of the fact the protozoan pathogen is difficult to remove from water and that public water supplies do not provide adequate measures of protection for sensitive populations.

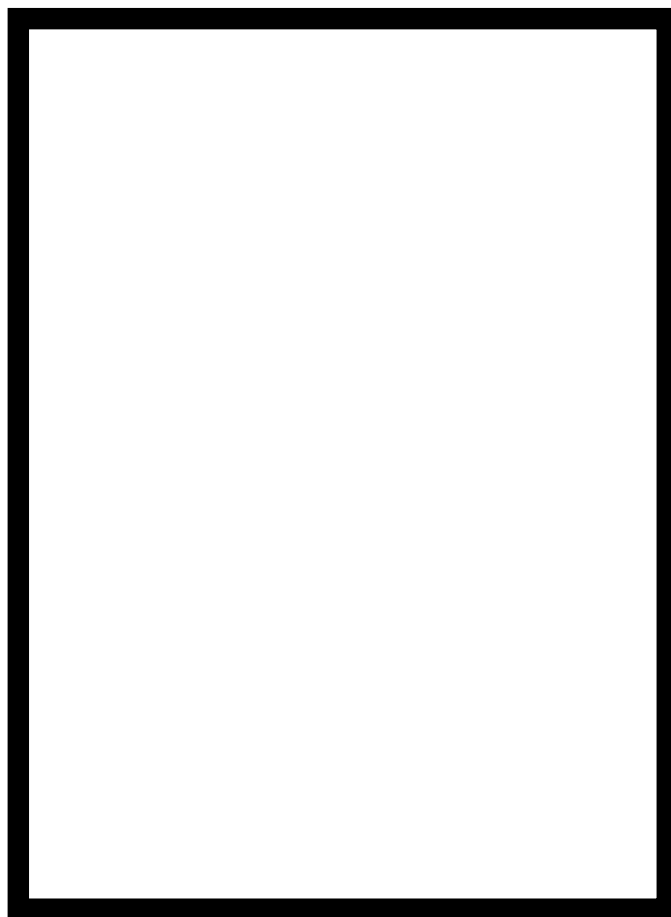
Some water treatment systems, particularly reverse osmosis (RO) units, have been associated with regrowth of heterotrophic plate count bacteria (HPC). Although the majority of heterotrophic bacteria are not pathogenic to humans, some strains are opportunistic pathogens, meaning they can cause disease in immunocompromised populations. Thus, the CDC recommends boiling as the most effective treatment for the reduction of microbes in water.

Conclusion

As a health conscious industry, we must continue to educate sensitive populations to the fact that public



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drinking water supplies, even when they meet or exceed all state and federal standards, are not sterile; nor is bottled water or water treated by a home water treatment device. According to a CDC draft report, "Immuno-compromised persons who wish to take independent action to reduce the risk of waterborne cryptosporidiosis may choose to take precautions similar to those recommended during outbreaks (such as boiling tap water for one minute). Such decisions should be made in conjunction with their health care provider." □

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About the author

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Chart 1. Language and Water Barriers: Official advice from the CDC

Boiling—for at least a minute—is the best extra measure to ensure that water is free of the waterborne pathogen *Cryptosporidium* and other organisms. Filtered water or bottled water may also be effective, provided a specific treatment protocol has been followed. Look for the following information on the label of filters or bottled water:

Filters* Filters designed to remove <i>Crypto</i> should have any of the four messages below on a package label:	Filters labeled only with these words may not be designed to remove <i>Crypto</i> :
Reverse osmosis (with or without NSF testing)	Nominal pore size of 1 micron or smaller
Absolute pore size of 1 micron or smaller (with or without NSF testing)	One micron filter
Tested and certified by NSF Standard 53 for cyst removal	Effective against <i>Giardia</i>
Tested and certified by NSF Standard 53 for cyst removal	Effective against parasites
	Carbon filter
	Water purified
	EPA approved (USEPA does not approve or test filters)
	EPA registered (USEPA does not register filters for <i>Crypto</i> removal)
	Activated carbon
	Removes chlorine
	Ultraviolet light
	Pentiodide resins
	Water softener

* Filters collect germs from the water, thus someone who is immunocompromised should not change filter cartridges

Bottled Water Water labeled as follows was processed by methods effective against <i>Crypto</i> :	Water labeled solely as follows may not have been processed by methods effective against <i>Crypto</i> :
Reverse osmosis treated	Filtered
Distilled	Micro-filtered
Filtered through an absolute 1 micron or smaller filter	Carbon-filtered
"1 micron absolute"	Multimedia-filtered
	Ozonated
	Ozone-treated
	Ultraviolet light-treated
	Activated carbon-treated
	Carbon dioxide-treated
	Ion exchange-treated
	Deionized
	Purified
	Chlorinated

Other notes:
 • Home distillers are also effective at removing *Crypto* and other germs from water.
 • *Crypto* is also killed or removed in canned or bottled soda, seltzer and fruit drinks; coffee or tea at 175°C or hotter; and pasteurized drinks.
 • Fountain drinks: fruit drinks made with tap water; iced tea or coffee; and unpasteurized juices or fresh juices may be contaminated with *Crypto*.
 Excerpted from a handbook provided by the Centers for Disease Control and Prevention entitled *Cryptosporidium and Water: A Public Health Handbook*. From the Working Group on Waterborne Cryptosporidiosis, Atlanta, Ga.

If you have questions concerning this column, or if there's a topic you would like addressed, please let us know. Contact "On Tap," at: WC&P Magazine, 2800 E. Fort Lowell Rd., Tucson, AZ 85716 USA; (520) 323-6144, (520) 323-7412 (fax); email: publicom@azstarnet.com