



ELDERLY

What Health Care Providers Should Know

Why are the Elderly More Susceptible to Contaminants in Drinking Water?

Aging is associated with physiological, functional, and behavioral changes that can result in increased vulnerability to biological and chemical contaminants in drinking water. As a group, the elderly are at increased risk of infection and disease from microbial contamination due to many factors, such as reduced immunity, frailty from malnutrition, or existing chronic illness. In addition, decreased liver and kidney function associated with aging affects how the body processes chemicals, and irregularities of the thirst mechanism alter fluid balance (1,2). Exposure patterns for the institutionalized elderly may also differ in important ways from patterns in other populations. As a group, the elderly can suffer more severe consequences from infections such as *Salmonella* and *E. coli* O157:H7, and are at greater risk of dying from waterborne infections (3,4).

The Elderly are Particularly Susceptible to Microbial Contaminants

The functioning of various immune system cells declines with age, and immunity can be compromised by chronic diseases, malnutrition, and treatment with pharmaceuticals—all common in the elderly (5). Aging also leads to hypochlorhydria, thought to result from chronic atrophic gastritis, degenerative systemic illness, or the use of potent medications that inhibit acid secretion. The resulting increased stomach pH inhibits the defense against enteric pathogens like *Salmonella* (6). Decreased intestinal motility associated with medications, other coexistent gastrointestinal diseases, and more frequent use of antibiotics (7) and diuretics, may also put older patients at greater risk.

Diarrhea, often a trivial illness in younger adults, can be catastrophic in the aged population, resulting in hospitalization or death (8). Fluid losses are normally mediated by urinary concentration and an increased thirst response. With age, some of these mechanisms are less effective. The rapid dehydration that can result from diarrhea in the elderly may have severe consequences, including decreased blood flow in vital organs, infarction, and arrhythmias (8).

Common microbial agents responsible for acute diarrhea in the elderly include *Salmonella*, *Shigella*, *Campylobacter*

jejuni, *E. coli* O157:H7, *Giardia*, and Norwalk virus (8), which can all be waterborne. The elderly may also be more susceptible to the effects of cryptosporidiosis (9,10).

Long-term Residential Care as a Risk Factor

A 1991 study reviewed diarrheal causes of death between 1979 and 1987 (11). The majority of these deaths occurred among those older than 74 years whose risk factors were being white, female, and residing in a long-term care facility. Currently some 1.6 million elderly people live in nursing homes; 72% of them are female (12).

For the period between 1987 and 1996, the incidence rate of reported diarrheal outbreaks in Maryland nursing homes ranged from 11 to 34% (7). In the nursing home setting, outbreaks of diarrhea occur commonly during the winter months, and both the Norwalk viruses and rotavirus have been implicated in these episodes (13). Outbreaks of enterohemorrhagic *E. coli* O157:H7 have also occurred in long-term care institutions (14,15). In nursing homes, the case fatality rates for certain waterborne pathogens, such as rotavirus and *E. coli* O157:H7, can be two orders of magnitude greater than that in the general population (3). In one nursing home outbreak of *E. coli* O157:H7, 35% of the infected patients died (14).

Physiological Changes and Chemical Contaminants

Few studies have addressed risks from chemical exposures to the elderly. We do not know whether the elderly are more susceptible to effects of lower doses of environmental chemicals than other populations. The physiologic changes that accompany aging affect the processes of absorption, distribution, metabolism, and excretion, although it is not known how these changes affect sensitivity to chemical exposures. Liver size and liver blood flow decline with age, which may result in decreased metabolic capacity. There is also an age-related decline in renal function. However, older patients seem to be *more* sensitive to the effects of some drugs and *less* sensitive to the effects of others, so drug metabolism, and presumably that of chemical contaminants, is variable compared with younger adults.

Health effects of some chemical contaminants may be a

result of years of cumulative exposure. For example, there is epidemiological evidence that ingestion of lead-contaminated tap water contributes to increased bone lead levels in the elderly (16). Whether this is associated with increased health risks is unknown. Some evidence suggests that many years of ingesting uranium in drinking water affects kidney function (17), and that long-term arsenic consumption in drinking water is associated with vascular diseases, kidney disease, and certain cancers in older populations (18,19).

What Can Health Care Providers Do to Reduce the Threat of Waterborne Contaminants to their Elderly Patients?

- Be alert to the possibility of diarrhea. The elderly may be reluctant to admit to having chronic diarrhea—especially if they are also incontinent—because they find it embarrassing.
- Consider the possibility that acute diarrhea may be a result of a waterborne pathogen, especially in the institution-alized elderly.
- Advise elderly patients who use private wells to have their water tested regularly for microbial and chemical contaminants. Patients whose water may be at risk for microbial contamination should consider home water treatment units or bottled water.
- Become involved in local efforts to prevent contamination of drinking water sources. See PSR’s *Safe Drinking Water Advocacy Kit* for strategies on how to become involved in these advocacy efforts.

Sources of Additional Information and Guidance

- Physicians for Social Responsibility: (202) 667-4260 or www.psr.org.
- PSR/ACPM online CME course, “Drinking Water and Disease”: www.acpm.org/ehealth/sdw_intro.htm.
- Campaign for Safe and Affordable Drinking Water: (202) 895-0420 or www.safe-drinking-water.org.
- U.S. EPA Safe Drinking Water Hotline: (800) 426-4791.
- NSF International (regarding water filtration systems): (800) 673-6275 or www.nsf.com.
- The Administration on Aging, 202-619-0724 or Eldercare locator: (800) 677-1116 or www.aoa.gov.

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This document is one in a series of Drinking Water Fact Sheets developed specifically for health care providers by Physicians for Social Responsibility. These fact sheets provide practical and concise information to assist health care providers in recognition and prevention of disease caused by exposure to drinking water contaminants.



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