

Increased Risks in the Elderly from Tap Water Consumption



By Kelly A. Reynolds, MSPH, Ph.D.

Once again research supports that tap water consumption presents a significantly higher risk of illness compared to purified water. This time the elderly, who drank municipally treated tap water meeting all state and federal water quality standards, were shown to experience a 12-percent increase in stomach illness compared to populations drinking purified tap water from the same source. This additional evidence, showing significant health benefits of point of use devices, is expected to reignite the debate over whether or not tap water is safe enough for health-sensitive populations.

New evidence of tap water risks

In a study by researchers at the University of California Berkeley's School of Public Health, POU drinking water filters were found to reduce stomach illness in the elderly (persons over the age of 55).¹ The incidence of highly credible gastrointestinal disease among those with and without purification systems differed by 12 percent, a statistically significant improvement. It is important to note that the supplied water was from a high quality, treated source in Sonoma County, California that met all state federal water quality standards during the survey period. Thus, the additional rate of illness could be even higher in less quality supplies that are not treated at the POU.

Funded by the National Institute of Health, the study of 714 households (covering 998 individuals) began over five years ago and cost \$2.8 million (USD). Other than age, volunteers were not known to have any other immunocompromising conditions.

Half of the homes were fitted with a POU filter device utilizing ultraviolet light disinfection designed to remove 99.9 percent of all viruses, bacteria and parasites from the municipal water supply. Likewise, half of the homes were fitted with a nonfunctioning system. After six months, households with working systems and fake units were switched. Volunteers recorded their incidence of gastrointestinal illness, including vomiting, diarrhea, nausea and cramps.

Are tap water risks acceptable?

Tap water is not regarded as sterile, and some practical, low level of health risk in the population is considered acceptable. Beginning with the promulgation of the *Safe Drinking Water Act* in 1974, guidelines and regulations aimed at improving treated drinking water supplies have steadily increased. Today, federal regulations require that all source surface waters be treated to reduce the level of pathogens to achieve a single risk of infection per 10,000 persons per year.²

To achieve this acceptable goal, water treatment must—at a minimum—reduce infectious viruses by 99.99 percent and protozoan parasites by 99.9 percent. *The Groundwater Rule*

similarly requires that all municipal groundwater sources be disinfected, unless they meet certain monitoring and sanitary survey requirements by December 1.³

Sensitive populations include the elderly but also the very young, the chronically ill, recipients of immunosuppressive therapies, pregnant women and others. Approximately 25 percent of the US population is immunocompromised and are generally at higher risk of infection due to waterborne agents. While most consider diarrhea to be relatively mild, even mild diseases can be problematic for the elderly in both the short and long term. Total diarrheal deaths in aged populations (> 74 years) are around 50 percent compared to less than five percent in those between the ages of five and 24.⁴

Although diarrhea is the major symptom associated with waterborne pathogens, other chronic sequelae are possible.⁵ Chronic sequelae are diseases that develop in the days, weeks or years after initial infection. Chronic sequelae, such as diabetes, heart disease, autoimmune disease and cancer, can have a significant impact on the individual's quality of life and are also related to infectious disease-causing agents. The incidence of chronic sequelae attributable to tap water in sensitive populations has not been estimated.

Controls needed

Despite the increase in water treatment requirements in the US, an estimated 18.4 million waterborne illnesses (in all age groups) are estimated to occur from consumption of municipal, treated tap water supplies.⁶ Questions remain as to how much illness in sensitive populations is caused by contaminants in drinking water and what additional approaches may be used to further reduce this risk. Should these additional waterborne infections also be considered acceptable or should new, more stringent, federal limits be set to protect our most vulnerable populations?

Water treatment technologies at the point of use can provide an additional barrier of protection from waterborne contaminants. In addition to the study highlighted here, others have reported similar results. A study published in the *American Journal of Public Health* in 1991 was perhaps the first to call attention to the issue that even 'safe' drinking water causes significant levels of disease in certain populations.⁷ In the 1991 study, an estimated 35 percent of gastrointestinal illnesses were attributable to tap water consumption. These illnesses could have been prevented by the use of a POU system.

Studies of persistent *Cryptosporidium* contamination in drinking water prompted the US EPA and CDC to collectively recommend that persons with compromised immune systems consider the use of submicron-filtered, reverse osmosis-treated or boiled tap water. Aragón *et al.*, (2003) found tap water consumption was attributable to *Cryptosporidium* infections in up to 85 percent of immunocompromised AIDS patients.⁸ *Cryptosporidium* is easily removed by advanced POU submicron filtration systems.

Conclusion

The microbes of concern in tap water are not new, but rather the same pathogens we have been concerned about for decades. The increase in the number of sensitive populations, however, has increased the risk of waterborne infections. How to minimize this risk is the subject of an ongoing debate.

Professor Jack Colford, lead researcher in the study of tap-water-transmitted disease in the elderly, is hopeful that the information will become part of an ongoing debate as to whether water quality standards should be more stringent for immunocompromised populations, including children, the elderly and others with chronic health conditions. Others caution that the study is limited to a small area and does not alone warrant a change in the current standard.

POU treatment technologies are available that significantly reduce the risks of waterborne pathogens in both the general and higher-risk populations. Consumers do not have to be complacent while other stakeholders debate the level of disease that is acceptable in our most vulnerable populations.

References

1. Colford, J.M.; Hilton, J.F.; Wright, C.C.; Arnold, B.F. *et al.*, 2009. "The Sonoma Water Evaluation Trial: A Randomized Drinking Water Intervention Trial to Reduce Gastrointestinal Illness in Older Adults". *American Journal of Public Health*. 99(11): 1988-1995.

2. Regli, S.; Rose, J.B.; Haas, C.N. and Gerba, C.P. (1991) *Modeling the risk from Giardia and viruses in drinking water*. Journal, American Water Works Association 19:76-84.

3. US EPA (2006) Prepublication of ground water rule federal register notice. National primary drinking water regulations: Ground Water Rule. 40 CFR Parts, 9, 141 and 142. EPA-HQ-OW-2002-0061; FRL-RIN-2040-AA97.

4. Lew, J.F., Glass, R.I., Gangarosa, R.E., Cohen, I.P., Bern, C. and Moe, C.L. (1991) "Diarrheal deaths in the United States, 1979-1987. A special problem for the elderly." *Journal American Medical Association*. 265:3280-3284.

5. Parkin, R.T. (2000) *Issues in modeling rare health events such as chronic sequelae associated with microbial pathogens*. Annual Meeting of the Society for Risk Analysis. Center for Risk Science and Public Health, Arlington, VA. December 2000.

6. Reynolds, K.A., Mena, K.D. and Gerba, C.P. 2008. "Risk of waterborne illness via drinking water In the United States." *Reviews in Environmental Contamination and Toxicology*. Vol. 192(4):117-158.

7. Payment, P.; Richardson, L.; Siemiatycki, J.; Dewar, R.; Edwardes, M. and Franco, E. (1991) "A randomized trial to evaluate the risk of gastrointestinal disease due to consumption of drinking water meeting current microbiological standards." *American Journal of Public Health*. 81:703-708.

8. Aragón, T.J.; Novotny, S.; Enanoria, W.; Vugia, D.J.; Khalakdina, A. and Katz, M.H. 2003. "Endemic cryptosporidiosis and exposure to municipal tap water in persons with acquired immunodeficiency syndrome (AIDS): a case control study." *BioMed Central Public Health*. Jan 6, 3:2. Epub.

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