Well water vulnerable to rain-related disease

Waterborne disease risks expected for non-disinfected drinking water systems serving Wisconsin's northwest

Key Message

Approximately 4,000 young children, mostly in the northwest part of the state, live with an increased risk for contracting waterborne disease because 39 communities in this region do not disinfect their water supply and 2011 Wisconsin Act 19 no longer requires disinfection.

More than 65,000 Wisconsinites are served municipal water that is not disinfected for pathogens that cause acute diarrhea.This water comes from 60 small public water systems throughout the state, about two-thirds of which cluster northwest of Eau Claire, whose motto is "Here [is] clear water!"

2011 Wisconsin Act 19 removed the state's authority to require continuous disinfection of municipal water unless required by federal law or unless "Water quality data, well construction, or water system construction indicate a potential health hazard."

In its fiscal estimate, the Department of Administration stated it was "uncertain of the cost to communities should waterborne illnesses occur."

We have data that shed light on those societal costs.

Viruses in Well Water & Non-Disinfected Tap Water

Viruses that cause diarrhea have been found in well water around the state.

In 2012, researchers found viruses in the *tap* water of all 14 of 14 Wisconsin communities they considered that did not disinfect their well water. They also found an association between the concentration of viruses in tap water and acute diarrhea. Leaky sewer pipes were implicated as the source of the viruses.

The evidence is clear. No disinfection means more viruses in water. More viruses mean more acute diarrhea. This places our children at risk.

14 of 14

Researchers tested the tap water of 14 Wisconsin communities that do not disinfect their well water. They found ***viruses in the tap water*** of all 14.

Policy Recommendation

Public municipal well water should be disinfected to reduce disease risk.

Of those 1% of the population who are routinely served non-disinfected municipal drinking water, roughly 4,000 are children under age 5, the group most vulnerable to acute gastrointestinal illness complications like fever, vomiting, and severe dehydration. The population served by untreated non-municipal public systems and private wells is roughly 1.65 million, or 29% of the population.

Our current policy leads to a greater risk of disease for those who drink from non-disinfected water. This constitutes a potential health hazard.

Current Policy Shifts Costs from Prevention to Cure

The fiscal note for 2011 Wisconsin Act 19 estimated an annual cost savings to local governments of $130,200, with a one-time savings of $634,800.

Approximately 5% of Wisconsin children in the counties most affected do not have health insurance.

Groundwater is not intrinsically safer than surface water—stormwater runoff contaminates both. We expect the stormwater threat to be exacerbated by climate change, with increasingly intense precipitation transporting more fecal pathogens to groundwater and public water systems via runoff and infiltration.

There are several methods to disinfect water systems. Disinfection with chlorine is one well-proven ounce of prevention that bolsters public health. Chlorine provides residual disinfection, which means it not only kills pathogens from source water but helps protect against pathogens that infiltrate pipe systems.

Center for Water Policy • School of Freshwater Sciences • University of Wisconsin-Milwaukee

Well water vulnerable to rain-related disease

Based on the work of Jonathan Patz, UW-Madison; Henry Anderson, DPH; Kristen Malecki, UW-Madison; Mark Werner, DHS; Sandra McLellan, UW-Milwaukee; Megan Christenson, DHS; Mark Borchardt, USDA; Steve Vavrus, UW-Madison; Steven R. Corsi, USGS; Marc Gorelick, MCW; Ron Gangnon, UW-Madison; Jiale Xu, UW-Madison.

This work was partially funded by the Centers for Disease Control and Prevention (CDC) Cooperative Agreement Numbers 1U17EH001043-02, 5U01EH000428-03, and 5U38EH000951-02.

Authored by Michael Timm
Supervised by Jenny Kehl

Supporting literature

Borchardt, Mark A.; Phil D. Bertz; Susan K. Spencer; and David A. Battigelli. 2003. Incidence of enteric viruses in groundwater from household wells in Wisconsin. Applied and Environmental Microbiology 69: 1172-1180.

Borchardt, Mark A.; Po-Huang Chyou; Edna O. DeVries; and Edward A. Belongia. 2003. Septic system density and infectious diarrhea in a defined population of children. Environmental Health Perspectives 111: 742-748.

Borchardt, Mark A.; Nathaniel L. Haas; and Randall J. Hunt. 2004. Vulnerability of drinking-water wells in La Crosse, Wisconsin, to enteric-virus contamination from surface water contributions. Applied and Environmental Microbiology 70: 5937-5946.

Borchardt, Mark A.; Kenneth R. Bradbury; Madeline B. Gotkowitz; John A. Cherry; and Beth L. Parker. 2007. Human enteric viruses in groundwater from a confined bedrock aquifer. Environmental Science & Technology 41: 6606-6612.

Borchardt, Mark A.; Susan K. Spencer, Burney A. Kieke Jr.; Elisabetta Lambertini; and Frank J. Loge. 2012. Viruses in nondisinfected drinking water from municipal wells and community incidence of acute gastrointestinal illness. Environmental Health Perspectives 120: 1272-1279.

Bradbury, Kenneth R.; Mark A. Borchardt; Madeline Gotkowitz; Susan K. Spencer; Jun Zhu; and Randall J. Hunt. 2013. Source and transport of human enteric viruses in deep municipal water supply wells. Environmental Science & Technology. DOI: 10.1021/es400509b.

Elliott, Elizabeth Jane. 2007. Acute gastroenteritis in children. BMJ 334: 35-40.

Gorelick, Marc A.; Sandra L. McLellan; D. Wagner; and J. Klein. 2011. Water use and acute diarrhoeal illness in children in a United States metropolitan area. Epidemiol. Infect. 139: 295-301.

Helmuth, Jeff. 2013. Email correspondence.

Lambertini, Elisabetta; Susan K. Spencer; Burney A. Kieke, Jr.; Frank J. Loge; and Mark A. Borchardt. 2011. Virus contamination from operation and maintenance events in small drinking water distribution systems. Journal of Water and Health 9: 799-812.

Lambertini, Elisabetta; Mark A. Borchardt; Burney A. Kieke, Jr.; Susan K. Spencer; and Frank J. Loge. 2012. Risk of viral acute gastrointestinal illness from nondisinfected drinking water distribution systems. Environmental Science & Technology 46: 9299-9307.

Patz, Jonathan A.; Stephen J. Vavrus; Christopher K. Uejio; and Sandra L. McLellan. 2008. Climate change and waterborne disease risk in the Great Lakes region of the U.S. Am J Prev Med 35: 451-458.

Richardson, Hopi Yip; Gordon Nichols; Chris Lane; Iain R. Lake; and Paul R. Hunter. 2009. Microbiological surveillance of private water supplies in England—The impact of environmental and climate factors on water quality. Water Research 43: 2159-2168.

Seely, Ron. 26 February 2012. At least 60 communities in state don't treat water despite research on danger. Wisconsin State Journal. Available at: http://host.madison.com/wsj/news/local/health_med_fit/at-least-communities-in-state-don-t-treat-water-despite/article_7bb7a04c-6083-11e1-9020-001871e3ce6c.html. Accessed 22 March 2013.

U.S. Census Bureau. 2010. Decennial Census. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml. Updated 2012. Accessed 11 March 2013.

Vavrus, Steve and Jeff Van Dorn. 2009. Projected future temperature and precipitation extremes in Chicago. Journal of Great Lakes Research 36: 22-32.

Wisconsin Department of Natural Resources. 2012. Learn If Your Municipal Water System Disinfects Its Water (updated 21 December 2011): http://dnr.wi.gov/topic/DrinkingWater/documents/MunicipalDisinfectList.pdf. Accessed 11 March 2013.

Wisconsin Legislature. 2011. Wisconsin Act 19. Madison, Wisconsin.

Contact: Center for Water Policy, thiela@uwm.edu

Quick Stats: Borchardt et al. 2012; Lambertini et al. 2011; Lambertini et al. 2012.