Human Norovirus in Groundwater Remains Infective After Two Months

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Researchers from Emory University have discovered that norovirus in groundwater can remain infectious for at least 61 days. The research is published in the October issue of Applied and Environmental Microbiology.

Human norovirus is the most common cause of acute gastroenteritis. The disease it causes tends to be one of the more unpleasant of those that leave healthy people unscathed in the long run, with diarrhea and vomiting that typically last for 48 hours. Norovirus sickens 1 in 15 Americans annually, causing 70,000 hospitalizations, and more than 500 deaths annually, according to the Centers for Disease Control and Prevention (CDC).

The results answer a question of great importance to public health, which had driven researcher Christine Moe and her colleagues to conduct this research: If well water becomes contaminated with noroviruses--perhaps from leaking sewer lines or a septic tank—how long do these noroviruses survive in water, and when would it be safe to drink from that well?

To answer that question, they prepared a safety-tested virus stock solution. They then put a known amount of this solution into a container of groundwater from an Atlanta well, which had met Environmental Protection Agency drinking water standards.

The researchers then tested the virus infectivity at days naught, 4, 14, 21, 27, and 61, by having volunteers drink the water on those days. The durability of the virus' infectivity was unexpected, says Moe. Most of the 13 volunteers became infected at various time points, exhibiting among them the complete range of norovirus symptoms, which endured for as long as five days post challenge. "We were surprised to observe that even the volunteers that drank the water 61 days after we had added the virus still got infected with the norovirus," says Moe.

Norovirus may remain infective far longer than 61 days. The researchers stored the groundwater at room temperature in the dark, using reverse transcription polymerase chain reaction to determine how much viral RNA remained after 622 days, and again after 1,266 days. They found no reduction after the first interval, and very little at the end of the second interval. Unfortunately, funding was insufficient to test infectivity in human volunteers beyond day 61.

"This study provides further evidence of the need to treat groundwater used for drinking water," says Moe, adding that the Environmental Protection Agency and other decision-makers who regulate drinking water need to take these findings into account, particularly since roughly half the U.S. population relies upon groundwater for drinking.

To ensure that the volunteers' health would not be compromised, the investigators conducted the study in a special research unit of Emory University Hospital, while taking a variety of other precautionary measures.

Anticipating a question about who would volunteer to participate in a study with such potentially unpleasant consequences, Moe says that some volunteers have said that "they want to see how good their immune system is, and whether they will actually get sick." Three of the 13 volunteers did not become sick. One volunteer was the local librarian "who came to the research unit with a huge bag of books that she wanted to read while she was in the study," says Moe.

Reference: S.R. Seitz, J.S. Leon, K.J. Schwab, G.M. Lyon, M. Dowd, M. McDaniels, G. Abdulhafid, M.L. Fernandez, L.C. Lindesmith, R.S. Baric, and C.L. Moe, 2011. Norovirus infectivity in humans and persistence in water. Appl. Environ. Microbiol. 77:6884-6888.