

# Norovirus – A Very Successful Pathogen

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## Grand Canyon Outbreak of 2002

During the summer of 2002, over 130 people became ill after rafting in the Colorado River as it flows through Grand Canyon National Park. An Intensive investigation was conducted by an inter-disciplinary team including the NPS Public Health Program, the Arizona and Coconino Health Departments, and the Centers for Disease Control and Prevention. Despite this effort, the exact cycle of this illness remains in doubt, but from the data collected the most likely explanation is:

- Norovirus was identified from individual stool samples, trip toilet cans, and from limited environmental sampling.
- Guides and some rafters were exposed to Norovirus through contact with water from the Colorado River, probably from drinking water that was either not treated or only partially treated.
- Once one or two people became ill, the virus rapidly spread through much of the group, perhaps by many routes including water, food and person-to-person (through the contamination of equipment and by personal contact).
- A **possible** source of the virus was the sewage treatment plant at the Glen Canyon Dam.
- It is also possible that guides or passengers came onto some trips either incubating the virus or still shedding the virus after an earlier illness.

Because the study conducted during 2002 was not conclusive, the NPS in collaboration with the Centers for Disease Control and Prevention are planning follow-up research in hopes of better understanding this cycle.

## About the Culprit

Viruses are small packages of genetic material that cannot replicate on their own, but instead must commandeer the machinery of a plant or animal cell. These protein-coated genetic Trojan horses attach to the cell and inject their genetic material, causing their new host to produce all of the parts for hundreds or thousands of new viruses. Once these are produced the cell breaks open releasing these stealth warriors, now greatly increased in numbers, to attack another cell.

Norovirus (before August, 2002, it was known as Norwalk), a small, 27 nanometers in width (0.0000011 inches), round virus, is the most common cause of acute gastroenteritis in the United States. It is estimated by the Centers for Disease Control and Prevention that this virus causes around 23 million cases of illness in the U.S. each year. This virus is actually many slightly different viruses all grouped under one heading but causing virtually identical illness. This agent belongs to a family of viruses called *Caliciviridae*, a family which is thought, perhaps, to have originated in ocean environments and contains members that are pathogens for other animals as

well as people. Norovirus, however, is only a pathogen of people, and as far as we know has no other known animal hosts.

Norovirus is transmitted by a fecal-oral route and after about a day or two of incubation, begins to cause nausea, vomiting and diarrhea. Illness usually only lasts one to two days. For most healthy adults this is a relatively self-limiting illness, resolving without medical intervention. As with most diseases, Norovirus can be more severe for the very young, elderly, or those who have compromised immune systems. Because of the vomiting and diarrhea, dehydration, especially in extreme conditions such as are encountered in places like the Grand Canyon, can be a threat.

Because transmission is achieved by the ingestion of less than 100 virus particles, Norovirus is very infectious. Transmission can be by person-to-person spread, food, water, and from contact with vomitus or from being in close proximity to the aerosol from vomitus. Persons who are ill shed large numbers of virus particles in their stool and can continue shedding for some time after their symptoms end.

As viruses go, Norovirus is fairly hardy in the environment, remaining infectious for several days, depending on conditions, on objects from cups to rocks. Temperatures used in everyday cooking methods destroy the virus as do most chemical disinfectants. There is some evidence, however, that on hard surfaces, this virus may be somewhat resistant to disinfection and higher concentrations of sanitizers are recommended. CDC recommends that 1,000 milligrams per liter of chlorine be used to disinfect surfaces. In drinking water treatment, standard chlorine residuals should be effective (0.2-0.5 milligrams per liter) as long as this is **free (not bound up in organic or inorganic compounds) chlorine** and the chemistry of the water is near neutral pH.

Prevention is primarily good sanitation and personal hygiene.

- Obtain water from municipal sources or properly filter and disinfect
- When working with foods, practice good personal hygiene
- Good, frequent hand washing, using treated water (**not raw river water**) and soap is extremely important in preventing this type of transmission (the virus does not grow in food, in water, or on objects, but merely has to be present and only in small numbers)
- Anyone who is ill or has been ill within the last three days should never be allowed to prepare food or filter water. If possible, those who have been ill within the last three days should avoid extensive handling of equipment and if they must handle equipment, careful hand washing is critical.

Over the last year or so, there has been what appears to be a nation-wide increase in illnesses caused by Norovirus. Particularly hard hit are people in “closed” settings such as nursing homes, hospitals, day care centers, cruise ships, and our “mini cruise ships,” rafting trips. No one is certain if this increase is just part of a natural cycle (there was also an increase in 1995-96) or if something in the virus or environment has changed. Either way, with over 23 million cases a year, just in the United States; this little critter is obviously a very successful pathogen.