

A Collaborative Effort to Identify the Causative Agents of Two Waterborne Outbreaks of Gastroenteritis in Wyoming

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Background

- Caliciviruses are included on EPA's Contaminant Candidate List because they are a major cause of viral gastroenteritis in the U.S. and worldwide (Table 1).
- The caliciviruses most commonly associated with human disease are the noroviruses (Fig 1).
- The potential for widespread outbreaks caused by the large, diverse group of noroviruses in drinking water is a public health concern as shown by numerous outbreaks that have occurred in municipal and private water systems.
- This collaborative study illustrates the usefulness of the methods used to isolate and identify noroviruses from outbreak associated water.

Table 1. Drinking Water Contaminant Candidate List Microbiological Contaminants

Acanthamoeba
Adenoviruses
Aeromonas hydrophila
Caliciviruses
Coxsackieviruses
Cyanobacteria (blue-green algae), other freshwater algae, and their toxins
Echoviruses
Helicobacter pylori
Microsporidia (*Enterocytozoon* and *Encephalitozoon*)
Mycobacterium avium intracellulare (MAC)

Methods

- **Epidemiologic and Environmental Investigation** by CDC, EPA, and the Wyoming Department of Health
 - To determine sources of illness and to examine food processing and groundwater well conditions.
- **Water Sample and Stool Sample Processing**
 - To examine for the presence of coliforms and viruses.
- **Molecular Methods**
 - To use RT-PCR analysis and sequencing for the detection of a norovirus gene.

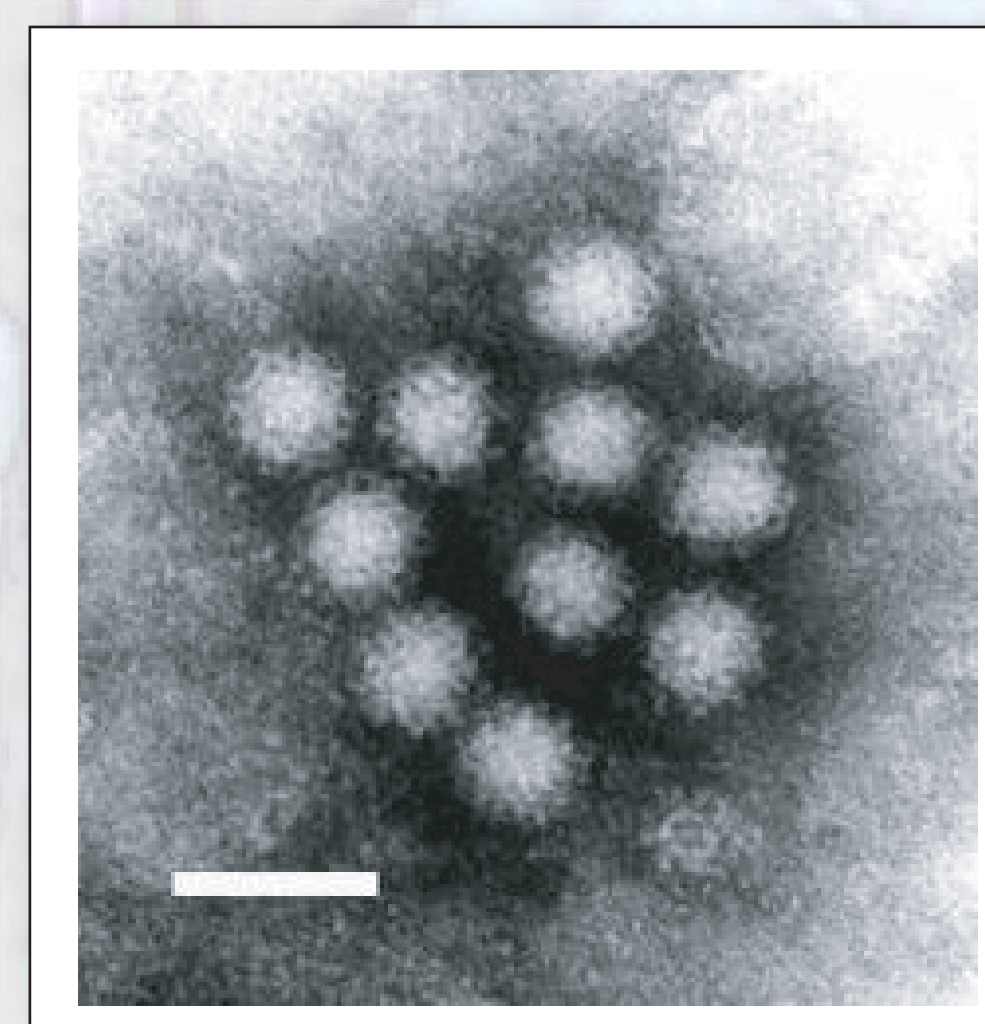


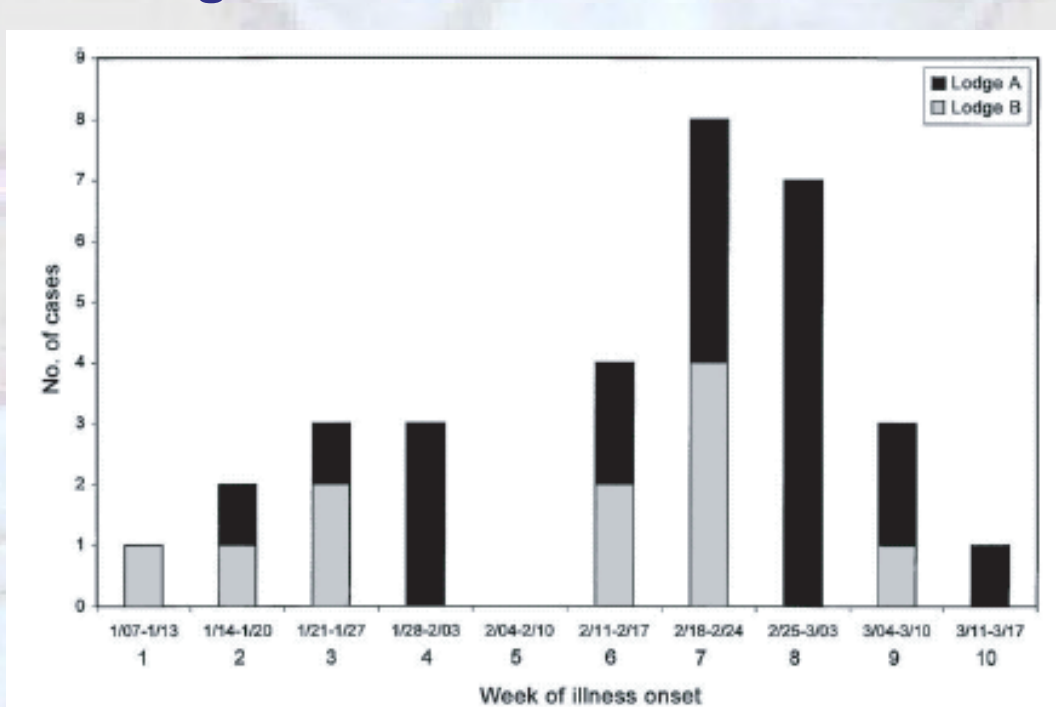
Figure 1: Norwalk Virus

Results

Wyoming Snowmobile Lodges

- 41% (22/54) of persons from Lodge A and 48% (13/27) of persons from Lodge B developed gastroenteritis symptoms between January and March, 2001 (Fig. 2).
- For lodge A, illness was significantly associated with drinking water.
- For lodge B, guests who ate or drank at Lodge A had a greater risk of disease than those who did not.
- Environmental investigation of the groundwater wells at Lodge A revealed three on-site wells that were within 92-115 feet of a septic tank or outhouse.
- Environmental investigation of the septic system revealed that the system was not designed to effectively treat the volume of wastewater that it received.
- 7/8 well water samples collected at Lodge A were positive for fecal coliforms. Well water samples from Lodge B were negative.
- RT-PCR analysis showed the lodge A well water sample (Figure 3) and stool specimens had caliciviruses.
- Gene sequencing analysis revealed that the isolates from the lodge well water sample and stool specimens were a strain that belongs to a common genetic group of noroviruses.

Figure 2: Cases of Gastroenteritis Among Vacationers of Two Snowmobile Lodges



Wyoming Tourist Saloon

- 76% (84/111) of persons from the tourist saloon developed gastroenteritis symptoms during September to October, 2001 (Fig. 4).
- Illness was significantly associated with drinking water and/or consuming ice.
- Environmental investigation of the groundwater well revealed that it was situated 50 feet from the saloon's septic tank, 50 feet from the leach field of a separate septic system, and 100 feet from an effluent disposal of an RV park.
- Environmental investigation of the tourist saloon's septic system revealed perforations in the septic tank.
- 5/6 well water samples were positive for fecal coliforms; all six samples were positive for total coliforms.
- RT-PCR analysis showed that the saloon well water sample (Figure 3) and three stool samples had caliciviruses.
- Gene sequencing analysis revealed that the isolates from the saloon water sample and one of three stool samples were a strain that belonged to a common genetic group of noroviruses. One stool sample differed genetically by three point mutations, and the other belonged to a different genetic group of noroviruses.

Figure 3: Gel Electrophoresis of Well Water Samples

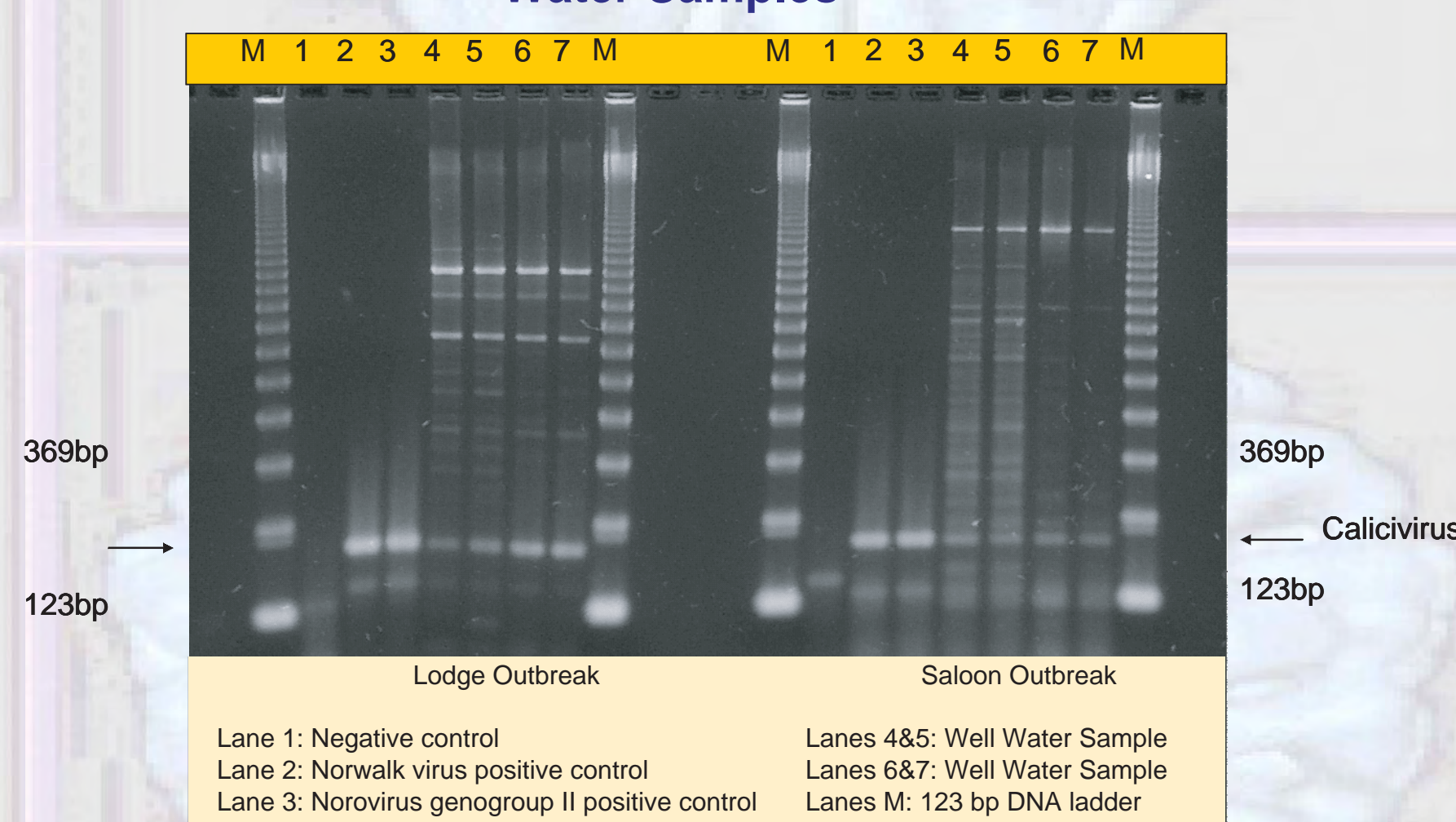
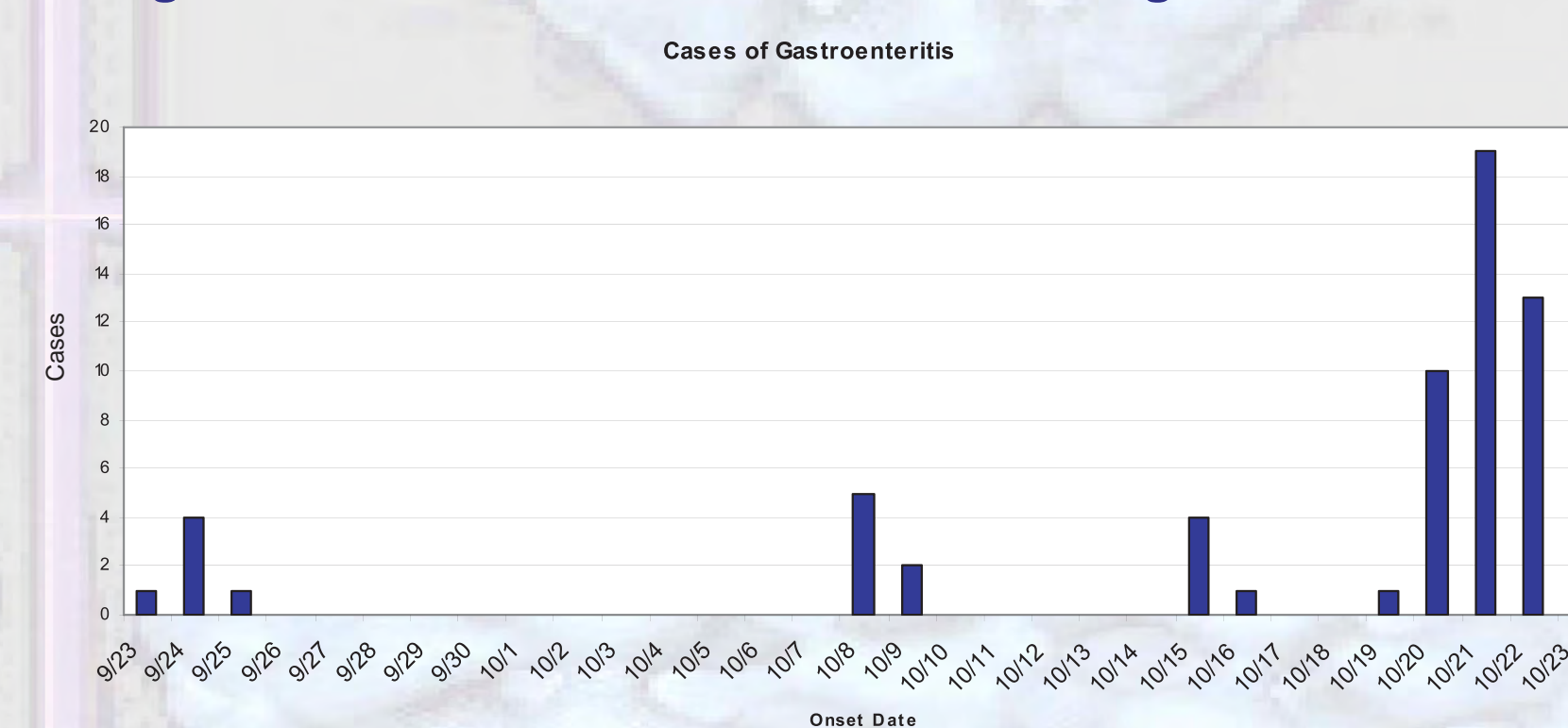


Figure 4: Cases of Gastroenteritis Among Saloon Patrons



References

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2005