Norovirus Outbreak in a Children’s Hospital

Jennifer Adams, MT, MPH, CIC
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Objectives

• Discuss the epidemiology, symptoms, and transmission of norovirus.
• Identify key infection control activities targeting the prevention of norovirus.
• Identify challenges specific to the management of norovirus outbreaks.
• Explore resources for the identification and management of norovirus outbreaks.
• It’s Friday at 4:00 pm...
• A nurse manager notifies you of a few patients with diarrhea and/or vomiting over the past couple of days.
• Tests have come back negative for Rotavirus and C.difficile.
• You find out that a few staff have also called in sick with GI symptoms.
• Physicians are beginning to suspect this is Norovirus.

What is Norovirus???
Norovirus

- Most common cause of cases of acute gastroenteritis and gastroenteritis outbreaks
- Affects everyone – no long term immunity to the virus
- Noroviruses are named after the original Norwalk strain, which caused an outbreak of gastroenteritis in a school in Norwalk, Ohio in 1968
- As the levels of infection increase in the community it becomes more likely that an outbreak will happen in the healthcare setting
- Burden of infection in healthcare settings varies annually with some years being worse than others
- Relatively high burden of norovirus outbreaks during the 2012-2013 winter season
  - Less severe 2013-2014 winter season

Burden of Norovirus Infection

- Occurs year round – peak activity during the winter months
- Occurs in all settings, worldwide
  - Norovirus often gets a lot of attention for outbreaks on cruise ships, but those account for only about 1 percent of all reported norovirus outbreaks.

Norovirus in Healthcare Facilities

• Cause of gastroenteritis outbreaks in institutions

• Outbreaks of gastroenteritis in healthcare settings pose a risk to patients, healthcare personnel, and to the efficient provision of healthcare services

• Healthcare facilities are the most commonly reported settings of norovirus gastroenteritis outbreaks in the US and other industrialized countries

• Incidence of norovirus outbreaks in acute care facilities and community hospitals within the United States remains unclear
**Texas Notifiable Conditions**

24/7 Number for Immediately Reportable – 1-800-705-8868

Report confirmed and suspected cases.

Unless noted by *, report to your local or regional health department using number above or find contact information at [http://www.dshs.state.tx.us/idcu/investigation/conditions/contacts/](http://www.dshs.state.tx.us/idcu/investigation/conditions/contacts/)

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td><em>Acquired immune deficiency syndrome (AIDS)</em></td>
<td>Within 1 week</td>
<td><em>Lead, child blood, any level &amp; adult blood, any level</em></td>
<td>Call/Fax Immediately</td>
</tr>
<tr>
<td>Amebiasis</td>
<td>Within 1 week</td>
<td>Legionellosis</td>
<td>Within 1 week</td>
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<tr>
<td>Amebic meningitis and encephalitis</td>
<td>Within 1 week</td>
<td>Leishmaniasis</td>
<td>Within 1 week</td>
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<tr>
<td>Anaplasmosis</td>
<td>Within 1 week</td>
<td>Listeriosis</td>
<td>Within 1 week</td>
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<tr>
<td><strong>Anthrax</strong></td>
<td>Call Immediately</td>
<td><strong>Lyme disease</strong></td>
<td>Call Immediately</td>
</tr>
<tr>
<td>Arbovirus infection</td>
<td>Within 1 week</td>
<td>Malaria</td>
<td>Within 1 week</td>
</tr>
<tr>
<td><em>Asbestosis</em></td>
<td>Within 1 week</td>
<td>Measles (rubeola)</td>
<td>Call Immediately</td>
</tr>
<tr>
<td>Babesiosis</td>
<td>Within 1 week</td>
<td>Meningococcal infections, invasive</td>
<td>Call Immediately</td>
</tr>
<tr>
<td><strong>Botulism (adult and infant)</strong></td>
<td>Call Immediately</td>
<td><strong>Multidrug-resistant Acinetobacter (MDR-A)</strong></td>
<td>Call Immediately</td>
</tr>
<tr>
<td><strong>Brucellosis</strong></td>
<td>Within 1 work day</td>
<td><strong>Mumps</strong></td>
<td>Within 1 work day</td>
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<tr>
<td>Campylobacteriosis</td>
<td>Within 1 week</td>
<td>Pertussis</td>
<td>Within 1 work day</td>
</tr>
<tr>
<td><strong>Escherichia coli infection, Shiga toxin-producing</strong></td>
<td>Within 1 week</td>
<td>Taenia solium and undifferentiated Taenia infection</td>
<td>Within 1 week</td>
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<tr>
<td><strong>Gonorrhea</strong></td>
<td>Within 1 week</td>
<td>Tetanus</td>
<td>Within 1 week</td>
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<tr>
<td>Haemophilus influenza type b infections, invasive</td>
<td>Within 1 week</td>
<td><em>Traumatic brain injury</em></td>
<td>Within 10 work days</td>
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<tr>
<td>Hansen’s disease (leprosy)</td>
<td>Within 1 week</td>
<td>Trichinosis</td>
<td>Within 1 week</td>
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<tr>
<td>Hantavirus infection</td>
<td>Within 1 week</td>
<td>Tuberculosis disease</td>
<td>Within 1 work day</td>
</tr>
<tr>
<td>Hemolytic Uremic Syndrome (HUS)</td>
<td>Within 1 week</td>
<td>Tuberculosis infection</td>
<td>Within 5 work days</td>
</tr>
<tr>
<td>Hepatitis A (acute)</td>
<td>Within 1 work day</td>
<td><strong>Tularemia</strong></td>
<td>Call Immediately</td>
</tr>
<tr>
<td>Hepatitis B, C, and E (acute)</td>
<td>Within 1 week</td>
<td>Typhus</td>
<td>Within 1 week</td>
</tr>
<tr>
<td>Hepatitis B identified prenatally or at delivery (acute &amp; chronic)</td>
<td>Within 1 week</td>
<td>Vibrio infection, including cholera</td>
<td>Within 1 work day</td>
</tr>
<tr>
<td>Hepatitis B, perinatal (HBsAg+ &lt; 24 months old)</td>
<td>Within 1 work day</td>
<td>Viral hemorrhagic fever, including Ebola</td>
<td>Call Immediately</td>
</tr>
<tr>
<td><em>Human immunodeficiency virus (HIV) infection</em></td>
<td>Within 1 week</td>
<td>Yellow fever</td>
<td>Call Immediately</td>
</tr>
<tr>
<td>Influenza-associated pediatric mortality</td>
<td>Within 1 work day</td>
<td>Yersiniosis</td>
<td>Within 1 week</td>
</tr>
<tr>
<td>Influenza, Novel</td>
<td>Call Immediately</td>
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</tbody>
</table>

In addition to specified reportable conditions, any outbreak, exotic disease, or unusual group expression of disease that may be of public health concern should be reported by the most expeditious means available.
Clinical Disease

- Infectious dose: 18-1000 viral particles
- Incubation period: 12-48 hours
- Most recover after 2-3 days
  - Up to 10% seek medical attention; some require hospitalization and fluid therapy
  - More severe illness and death possible in elderly and those with other illnesses

How contagious is norovirus?

Just a very small amount - as few as 18 viral particles - of norovirus on your food or your hands can make you sick.

That means the amount of virus particles that fit on the head of a pin would be enough to infect more than 1,000 people!

SOURCE: Journal of Medical Virology, August, 2008
Symptoms

- Acute-onset vomiting and/or diarrhea
- Watery, non-bloody stools
- Abdominal cramps, nausea, low-grade fever
- 30% infections asymptomatic
Viral Shedding

- Primarily in stool, but can also be present in vomit

- Shedding peaks 4 days after exposure

- Most contagious when sick with norovirus illness and during the first 2-3 days after recovering from the symptoms

- Infants and immunocompromised persons may shed this organism for up to 5 days after resolution of symptoms

- In some individuals, shedding may occur for at least 2-3 weeks

- ~$10^{12}$ viral copies/gram feces
WASH YOUR HANDS after using the toilet

1,000,000,000,000 germs can live in one gram of poop

(That's the weight of a paper clip!)
Immunity to Norovirus

• Short-term immunity after infection

• There is little cross protective immunity (against different genotypes)

• No long-term immunity
  • Protection believed to last less than one year, and in some studies, protection may only last a few months

• Genetic susceptibility
  • A portion of the population may be genetically resistant to norovirus infection
  • Currently no commercially available test to identify those who might carry genes conferring resistance to norovirus infection
Transmission of Disease

- Person to person
  - Direct fecal-oral
  - Ingestion of aerosolized vomitus
  - Indirect via fomites or contaminated environment

- Food
  - Contamination by infected food handlers
  - Point of service or source (e.g., raspberries, oysters)

- Recreational and Drinking Water
  - Well contamination from septic tank
  - Chlorination system breakdown

- In healthcare, the most likely and common modes of transmission are through direct contact with infected persons or contaminated equipment
Laboratory Confirmation of Norovirus

• Where available, reverse transcription polymerase chain reaction (RT-PCR) confirmation is the preferred diagnostic for norovirus

• Local or state public health laboratories may be able to provide RT-PCR diagnostics to confirm norovirus

• Stool specimens should be collected from individuals during acute phase of illness
  • Virus may be able to be detected in specimens taken later in the course of illness, but sensitivity is reduced

• Submit stool specimens as early as possible during a potential outbreak or cluster

• While not ideal, vomitus may be submitted for testing to some labs

• Both staff and patient cases can be tested
• Do you have an Outbreak Investigation Policy?
• Do you know the steps of an Outbreak Investigation?

Where do you start?
Steps of an Outbreak Investigation

• Confirming the presence of an outbreak
• Alerting key partners about the investigation
• Performing a literature review
• Establishing a preliminary case definition
• Developing a methodology for case finding
• Preparing an initial line list and epidemic curve
• Observing and reviewing potentially implicated patient care activities
• Considering whether environmental sampling should be performed
• Implementing initial control measures
Reporting Outbreaks

**Internal Communication**
- Report gastroenteritis outbreaks (e.g., 2 or more suspected or confirmed cases among staff or patients) to infection control

**Alert Key Partners**
- Infection Prevention and Control
- Unit/area leadership
- Microbiology laboratory
- Environmental Services
- Central supply/Distribution services
- Occupational or Employee Health
- Relevant clinical departments
- Allied health services
- Patient placement/admitting services
- State or local health department
- Public relations/media department
- Quality/risk management
- Healthcare facility management and administration
- Hospital Epidemiology/Infectious Disease
- Pharmacy
- Engineering/maintenance

## Sample Communication Framework: Suspected or Confirmed Norovirus Outbreaks

<table>
<thead>
<tr>
<th>Department Notification</th>
<th>Role</th>
<th>Department Contact Position</th>
<th>Contact Name(s)</th>
<th>Contact email(s)/ phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core groups to be notified: Initial outbreak measures (2 or more cases, epidemiologically linked)</td>
<td>EXAMPLE: Infection prevention and control</td>
<td>e.g., Infection Preventionist</td>
<td>e.g., Malinda Smith</td>
<td>e.g., <a href="mailto:msmith@hospital.edu">msmith@hospital.edu</a>/ 515-555-1212</td>
</tr>
</tbody>
</table>

- **Infection prevention and control**
  - Implementation of control measures and education, primary contact in facility outbreak control
  - Coordination of patient isolation requirements, patient/staff case finding, modifications to staff assignments, staff absenteeism, visitor policy, etc

- **Unit / Ward leadership**
  - Notify and coordinate testing incoming stool specimens for norovirus confirmation, estimate capacity for performing diagnostics, instructions on how to label and order specimens

- **Clinical laboratory**
  - Assess need for enhanced cleaning frequencies, changes to cleaning and disinfection products for outbreaks, coordinate needs for terminal cleaning of rooms/units, ward closure, ensure correct and complete adherence to cleaning protocols

- **Environmental services**
  - Assess need for increased personal protective equipment, etc.

- **Central supply/Distribution services**
  - Anticipate increased need for linens (e.g., privacy curtains)

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U.S. Department of Health and Human Services
Centers for Disease Control and Prevention
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</thead>
<tbody>
<tr>
<td>Occupational or Employee Health Services</td>
<td>Monitor and document staff reports of gastrointestinal illness from affected clinical areas; coordinate stool specimen collection and testing if required; monitor clinically adverse events</td>
<td></td>
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<tr>
<td>Relevant clinical care teams</td>
<td>Modifications to patient care plans if necessary (e.g., discharge planning)</td>
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<tr>
<td>Allied health services</td>
<td>Modifications to patient therapy for isolated patients (e.g., appointments postponed or rescheduled, location of care)</td>
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<tr>
<td>Patient placement/admitting services</td>
<td>Awareness/planning for potential increases in isolation needs, blocked beds, wing or unit closures</td>
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</tr>
<tr>
<td>State or local health department</td>
<td>Preliminary and confirmatory reporting to outbreak coordination units, requests for assistance or follow-up if necessary, coordination with any media inquiries</td>
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</tbody>
</table>

**Core groups to be notified: uncontrolled transmission or requirements for expanded outbreak measures**

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<thead>
<tr>
<th>Department Notification</th>
<th>Role</th>
<th>Department Contact Position</th>
<th>Contact Name(s)</th>
<th>Contact email(s)/phone #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public relations</td>
<td>Preparations for press release, media and public inquiries, internal messaging</td>
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<tr>
<td>Risk management</td>
<td>Assist in response coordination, strategic planning</td>
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</tr>
<tr>
<td>Healthcare facility management and administration</td>
<td>Assess impact of outbreak on operations, need for unit closure, notification, etc.</td>
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</tbody>
</table>
Reporting Outbreaks

Internal Communication continued

• Provide timely communication to personnel and visitors when an outbreak of norovirus gastroenteritis is identified
• Outline policies and provisions need to be followed to prevent further transmission
Key Infection Control Recommendations
for the Control of Norovirus Outbreaks in Healthcare Settings

Patient Cohorting and Isolation Precautions

- Place patients with norovirus gastroenteritis on Contact Precautions for a minimum of 48 hours after the resolution of symptoms (extend up to 5 days after the resolution of symptoms for infants and young children)

- Single occupancy room with a dedicated bathroom

- When symptomatic patients cannot be accommodated in single occupancy rooms, efforts should be made to separate them from asymptomatic patients. These efforts may include placing patients in multi-occupancy rooms, or designating patient care areas or contiguous sections within a facility for patient cohorts.
  - Staff who have recovered from recent suspected norovirus infection associated with an outbreak may be best suited to care for symptomatic patients until the outbreak resolves.

- Consider the following precautions:
  - Minimize patient movements within a ward or unit during norovirus outbreaks
  - Restrict symptomatic and recovering patients from leaving the patient-care area unless it is for essential care or treatment
  - Suspend group activities (e.g., dining events) for the duration of a norovirus outbreak
  - Remove communal or shared food items for staff or patients for the duration of the outbreak
  - Restrict non-essential visitors from affected areas of the facility during outbreaks of norovirus gastroenteritis
Hand Hygiene

• Actively promote adherence to hand hygiene among healthcare personnel, patients, and visitors in patient care areas affected by outbreaks of norovirus gastroenteritis

• During outbreaks, use soap and water for hand hygiene after providing care or having contact with patients suspected or confirmed with norovirus gastroenteritis
  • Alcohol-based hand sanitizer products appear to be relatively ineffective against norovirus

• *For all other hand hygiene indications refer to the 2002 HICPAC Guideline for Hand Hygiene in Health-Care Settings (http://www.cdc.gov/mmwr/PDF/rr/rr5116.pdf).
Personal Protective Equipment (PPE)

• If norovirus infection is suspected, adherence to PPE use according to Contact and Standard Precautions is recommended for individuals entering the patient care area (i.e., gowns and gloves upon entry)

• The use of masks is recommended when staff anticipate exposure to emesis or circumstances where the virus may be aerosolized
Patient Transfer and Ward Closure

- Consider the closure of wards to new admissions or transfers as a measure to attenuate the magnitude of a norovirus outbreak.

- Consider limiting transfers to those for which the receiving facility is able to maintain Contact Precautions; otherwise, it may be prudent to postpone transfers until patients no longer require Contact Precautions.

- During outbreaks, medically suitable individuals recovering from norovirus gastroenteritis can be discharged to their place of residence.
Diagnostics

- In the absence of clinical laboratory diagnostics or in the case of delay in obtaining laboratory results, use Kaplan’s clinical and epidemiologic criteria to identify a norovirus gastroenteritis outbreak.

**Kaplan’s Criteria:**

1. Vomiting in more than half of symptomatic cases, and
2. Mean (or median) incubation period of 24 to 48 hours, and
3. Mean (or median) duration of illness of 12 to 60 hours, and
4. No bacterial pathogen isolated from stool culture
Diagnostics continued

• Consider submitting stool specimens as early as possible during a suspected norovirus gastroenteritis outbreak and ideally from individuals during the acute phase of illness (within 2-3 days of onset).

• Specimens obtained from vomitus may be submitted for laboratory identification of norovirus when fecal specimens are unavailable (consult with your lab). Testing of vomitus as compared to fecal specimens may be less sensitive due to lower detectable viral concentrations.

• Routine collecting and processing of environmental swabs during a norovirus outbreak is not required.
Environmental Cleaning

- Perform routine cleaning and disinfection of frequently touched environmental surfaces and equipment in isolation and cohorted areas, as well as high traffic clinical areas. Frequently touched surfaces include, but are not limited to, commodes, toilets, faucets, hand/bedrailing, telephones, door handles, computer equipment, and kitchen preparation surfaces.

- Increase the frequency of cleaning and disinfection of patient care areas and frequently touched surfaces during outbreaks of norovirus gastroenteritis (e.g., increase ward/unit level cleaning twice daily to maintain cleanliness, with frequently touched surfaces cleaned and disinfected three times daily using EPA-approved products for healthcare settings).

- Use commercial cleaning and disinfection products registered with the U.S. Environmental Protection Agency (e.g., sodium hypochlorite (bleach) solution, hydrogen peroxide products, etc.)
  http://www.epa.gov/pesticides/antimicrobials/list_g_norovirus.pdf

- Follow manufacturer instructions for methods of application, amount, dilution, and contact time
Environmental Cleaning continued

- Clean and disinfect surfaces starting from the areas with a lower likelihood of norovirus contamination (e.g., tray tables, counter tops) to areas with highly contaminated surfaces (e.g., toilets, bathroom fixtures). Change mop heads when new solutions are prepared, or after cleaning large spills of emesis or fecal material.

- No additional provisions for using disposable patient service items such as utensils or dishware are suggested for patients with symptoms of norovirus infection. Silverware and dishware may undergo normal processing and cleaning using standard procedures.

- Use Standard Precautions for handling soiled patient-service items or linens, which includes the appropriate use of PPE.

- Consider changing privacy curtains routinely and upon patient discharge or transfer.
Key Infection Control Recommendations for the Control of Norovirus Outbreaks in Healthcare Settings

Staff Leave and Policy

- Exclude ill personnel from work for a minimum of 48 hours after the resolution of symptoms. Once personnel return to work, the importance of performing frequent hand hygiene should be reinforced.

- To reduce transmission, and depending on the magnitude of the outbreak, cohort staff to care for patients who are
  • asymptomatic, unexposed
  • asymptomatic, potentially exposed
  • symptomatic

- Exclude non-essential staff, students, and volunteers from working in areas experiencing outbreaks of norovirus.
Communication and Notification

• Notify appropriate local and state health departments if an outbreak of norovirus gastroenteritis is suspected.

• In most states, all outbreaks of public health significance are reportable to the state health department.

• Health departments enter norovirus outbreak data (among other pathogens) into National Outbreak Reporting System (NORS) – Centers for Disease Control and Prevention (CDC).
Surveillance for Norovirus Cases

• Use a “line list” to track symptomatic staff and patients

• During an outbreak, collect key information to assist with controlling the outbreak and to inform local/state health departments on outbreak details

• Suggested line list elements
  • Case (staff/patient) identifier
  • Case location
  • Symptoms
  • Outcome / Date of Resolution
  • Diagnostics submitted

### Acute Gastroenteritis / Norovirus Case Report Worksheet

<table>
<thead>
<tr>
<th>Reporting facility:</th>
<th>Contact Name/Phone Number:</th>
<th>Estimated number of exposed patients during outbreak:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street Address:</td>
<td>Outbreak Identification Number (Health Dept. assigned):</td>
<td>Estimated number of exposed staff during outbreak:</td>
</tr>
<tr>
<td>Unit:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patient/Staff Demographics</th>
<th>Case Location</th>
<th>Symptoms</th>
<th>Outcome</th>
<th>Diagnostics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td>Unique ID (optional)</td>
<td>Patient (P) Staff (S)</td>
<td>Age</td>
<td>Sex (M/F)</td>
</tr>
</tbody>
</table>

1.                      |               |          |         |             |
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17.                     |               |          |         |             |
18.                     |               |          |         |             |
19.                     |               |          |         |             |
20.                     |               |          |         |             |

*If required, REDACT Name column prior to faxing; FAX to local/state health department upon completion.*
Now what?
When can things get back to normal?
When is the Outbreak Over?

• Important to follow all health department recommendations

• Our health department recommended waiting 6 days (2-72 hour incubation periods) after the last known new affected person was in the building before discontinuing all the extra precautions

• This date was a moving target and we re-evaluated every day
  • Patients, visitors, and staff could have GI illness for multiple reasons throughout the year
  • May need to test for negative norovirus at the end
  • Tests take 3-5 days for results
  • Health department may be able to help with testing

• Continued control and prevention measures:
  • Restriction of visitors only to immediate care givers
  • Avoiding use of congregate facilities and cancelling group activities
  • Contact isolation, cohorting (as feasible), and confining to rooms of all cases for at least 48-72 hours after symptoms have ceased. (Isolation of any affected infants <12 months may need to be longer, given capacity for infants to shed norovirus for longer periods of time after illness.)
  • Frequent environmental cleaning, particularly of high-touch surfaces, with cleaning agents which have been EPA-approved in their efficacy against norovirus
  • Restricted new admissions to certain areas of the facility, until the outbreak has terminated
Celebration!!!
Summary: Management of Norovirus Outbreaks

- Key Infection Control Activities
  - Rapid identification and isolation of suspected cases of norovirus gastroenteritis
  - Communicating the presence of suspected cases to Infection Preventionists
  - Promoting increased adherence to hand hygiene, particularly the use of soap and water after contact with symptomatic patients
  - Enhanced environmental cleaning and disinfection
  - Develop a communication plan during outbreaks to include key departments and services

- Promptly initiate investigations
  - Collection of clinical and epidemiological information
  - Obtain clinical samples
  - Consult with and report outbreak to local/state health departments
Additional Resources

- **Key Infection Control Recommendations**

- **Norovirus Gastroenteritis: Management of Outbreaks in Healthcare Settings**
  [http://www.cdc.gov/hai/pdfs/norovirus/NoroVirus-Gen508.pdf](http://www.cdc.gov/hai/pdfs/norovirus/NoroVirus-Gen508.pdf)

- **Norovirus in healthcare settings**

- **CDC HICPAC Guideline for the Prevention and Control of Norovirus Gastroenteritis Outbreaks in Healthcare Settings**

- **General information on norovirus**
Questions?