Controlling the Annual Threat of Norovirus Gastroenteritis Outbreaks

ABSTRACT

The principal cause of acute gastroenteritis (AGE) epidemics is the highly contagious norovirus. The Centers for Disease Control and Prevention attributes a 254% increase in AGE outbreaks nationwide from 2005 to 2006 to the emergence of two new norovirus strains. Norovirus-like illness is a common cause of healthcare facility outbreaks and emergency department visits. It can be fatal among vulnerable populations (e.g., very young, elderly, immunocompromised). The reports of non-Clostridium difficile (non-C. diff) AGE cases in Pennsylvania nursing homes increased from 633 cases in the third quarter of 2009 to 812 cases in the fourth quarter of 2009 and then surged to 4,040 cases in the first quarter of 2010. Pennsylvania hospitals also reported an increase in non-C. diff AGE in the first quarter of 2010. Recurring, annual attacks of norovirus affect resident/patient and staff safety, disrupt healthcare facility operations, and may result in financial and operational burden to facilities. Published health department guidelines suggest that the best method to reduce the risk or mitigate the impact of a norovirus outbreak is to develop pre-season preparation measures and to have a rapid response plan in place. Interviews with Pennsylvania healthcare facilities revealed successful strategies for controlling noroviral outbreaks. Key components of an outbreak prevention/containment program include addressing risk factors that increase the potential for norovirus infection and applying best practices to identify and control an AGE outbreak. (Pa Patient Saf Advis 2010 Dec;7[4]:141-8.)

Introduction

Norovirus is a highly contagious virus recognized as the principal cause of worldwide acute gastroenteritis (AGE) epidemics in all age groups. The illness can be introduced into a healthcare facility environment by patients/residents, visitors, or staff. It is a common cause of hospitalization. It can be severe and sometimes fatal, especially among vulnerable populations such as the elderly, the immunocompromised, and the very young. The Centers for Disease Control and Prevention (CDC) estimates that norovirus may be the causative agent in more than 23 million AGE cases every year in the United States, composing 60% of all AGE cases and 50% of AGE outbreaks reported by institutional settings. Pennsylvania hospitals and nursing homes reported marked increases in non-Clostridium difficile (non-C. diff) AGE during the first quarter of 2010.

In a nationwide comparison of AGE outbreaks in 2006 to those in 2005, U.S. AGE outbreaks increased 254%, which is attributed to the emergence of two new norovirus strains. The incidence increase was likely associated with potential increases in pathogenicity and transmissibility of new strains and decreased population immunity to the strains. Recurring, annual attacks of norovirus disrupt healthcare facilities operations nationwide, affecting patient/resident and staff safety. Noroviruses spread rapidly in healthcare facilities and are difficult to control due to the low infectious dose, ease of transmission, short incubation period, environmental persistence, and lack of long-lasting immunity following infection. In 1998, norovirus was responsible for an outbreak of necrotizing enterocolitis and two deaths in a neonatal intensive care unit of a large Pennsylvania urban teaching hospital. A staff member recalled having gastroenteritis symptoms and giving care before the outbreak.

Outbreaks happen quickly in communal living settings with shared toileting facilities, social dining, and incontinence hygiene issues. The incidence of norovirus outbreaks tends to peak in cold weather when people are more likely to congregate indoors. For example, high wintertime occupancy of healthcare facilities as well as environmental factors (e.g., lower temperatures, diminished ultraviolet light) may increase the virus’ transmission potential. This in turn may trigger a seasonal epidemic, resulting in high levels of population immunity. By spring and the end of the virus season, population immunity is at its highest. Outbreaks often result in significant financial and operational burden to facilities for the following reasons:

- Inability to manage infected patients/residents
- Staff sick leave and overtime
- Need for additional healthcare supplies
- Additional cleaning expenses
- Lost revenue due to temporary closures of affected facilities

Guidelines from the Philadelphia Department of Public Health suggest that the best method to reduce the risk or mitigate the impact of a norovirus outbreak is for healthcare facilities to develop pre-season preparation measures and to have a standardized rapid response plan in place. Considerations in developing a facility-specific norovirus outbreak control plan include risk factors that increase the potential for a norovirus outbreak, best methods to identify an outbreak, and interventions that best prevent or contain gastroenteritis outbreaks.
**AGE Reports from Pennsylvania Nursing Homes and Hospitals**

According to CDC, reported outbreaks of AGE in Pennsylvania increased 443% from 2005 to 2006. Thirty-two percent of the outbreaks occurred in long-term care facilities. Norovirus was confirmed in 66% of the 2006 Pennsylvania outbreaks.4 (See Table 1.)

Pennsylvania Patient Safety Authority analysts reviewed reports in the Authority’s reporting system and the National Healthcare Safety Network databases from a 12-month period from July 2009 through June 2010 and found that reports of non-C. diff AGE infections are consistent with the outbreaks of norovirus AGE during winter months. (See Figure 1 and Table 2.)

The reports of non-C. diff AGE cases in Pennsylvania nursing homes increased from 633 cases in the third quarter of 2009 to 812 cases in the fourth quarter of 2009 and then surged to 4,040 cases in the first quarter of 2010. Pennsylvania hospitals also reported an increase in non-C. diff AGE in the first quarter of 2010. An average of 25 cases occurred per nursing home outbreak, and an average of 6 cases occurred per hospital outbreak. Forty-two of the 67 counties in Pennsylvania reported nursing home AGE; the most outbreaks occurred in Philadelphia and Montgomery counties. Thirty-seven percent (25) of counties reported no nursing home outbreaks, 25% (17) of counties reported less than average outbreaks, and 37% (25) of counties reported greater than average outbreaks. Figure 2 illustrates the percentage of nursing home outbreaks by county.

**Features of Norovirus That Promote Epidemics**

**Host Factors**

Elderly or very young individuals, disabled individuals, and individuals with impaired immune systems are at increased risk for prolonged duration and recovery from diarrhea and vomiting.7 The chronically ill and the elderly are particularly vulnerable to complications resulting from AGE such as dehydration, electrolyte disturbances, aspiration of vomitus, and rarely, death from profound volume depletion.8,9 Norovirus infection is characterized by acute onset of vomiting, watery nonbloody diarrhea with abdominal cramps, nausea, and typically a low-grade fever. Children experience diarrhea more often than vomiting.10 Norovirus transmission occurs by the fecal-oral route from contaminated food, water, environmental surfaces, and droplets, including the following:

- Consumption of food prepared by the contaminated hands of food handlers who are ill, followed by secondary person-to-person transmission
- Consumption of shellfish or water contaminated with raw sewage
- Oral contact after exposure to contaminated body fluids or skin surfaces
- Oral contact after exposure to environmental surfaces contaminated with fecal material
- Exposure to aerosolized vomitus resulting in droplets that can enter the oral mucosa and be swallowed

**Viral Factors**

Preventing norovirus transmission is a challenge because it spreads easily and rapidly leads to disease in 50% of inoculated individuals.9 Ease of transmission is related to a low infectious dose, environmental persistence, and lack of sustainable immunity following infection.7

As little as 10 viral particles can cause noroviral infection, contributing to sustained transmission of norovirus and the potential for outbreaks in institutional settings.11 Vomiting patients/residents or staff members can disseminate the virus through airborne transmission. Generally, symptoms begin 12 hours to 2 days following exposure. Episodes typically resolve spontaneously within 24 to 72 hours.10 Viral particles are excreted in high numbers in feces and vomitus during the first 48 hours of illness; convalescing

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**Table 1. Number and Percentage of Reported Acute Gastroenteritis Outbreaks, by State, Number in Long-Term Care Facilities, and Number with Norovirus Confirmed—Multiple States, 2005 and 2006**

<table>
<thead>
<tr>
<th>STATE*</th>
<th>NO. OF OUTBREAKS DURING OCTOBER–DECEMBER 2005†</th>
<th>NO. OF OUTBREAKS DURING OCTOBER–DECEMBER 2006†</th>
<th>% CHANGE FROM 2005 TO 2006</th>
<th>OUTBREAKS IN LONG-TERM CARE FACILITIES, OCTOBER–DECEMBER 2006§</th>
<th>OUTBREAKS WITH NOROVIRUS CONFIRMED, OCTOBER DECEMBER 2006§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pennsylvania</td>
<td>7</td>
<td>38</td>
<td>443</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Other States Total*</td>
<td>365</td>
<td>1,278</td>
<td>250</td>
<td>750</td>
<td>357</td>
</tr>
</tbody>
</table>

* Only states that reported at least five outbreaks during October through December 2005 and October through December 2006 were included.
† Date of outbreak onset.
§ Confirmed by reverse transcriptase–polymerase chain reaction.

individuals can continue to shed virus for two or more weeks after symptoms subside. No vaccine is available for norovirus, and generally no medical treatment exists other than symptomatic treatment and replacement of fluids and electrolytes.

Diarrhea is caused by damage to the small intestine causing malabsorption. Vomiting is related to a change in gastric motility and delayed gastric emptying. Prior exposure to norovirus appears to provide strain-specific immunity for only a few months, which explains the high rate of repeated infection in individuals of all ages. Reinfection and outbreak recurrence may be due to repeated introduction of 1 of 25 different strains of norovirus.

Environmental Factors

Norovirus is easily transmitted and difficult to remove from the environment. Some outbreaks have been traced to contaminated computer keyboards and to sinks in which foodservice workers first washed their hands and then rinsed fresh vegetables. Surfaces soiled with aerosolized vomitus droplets or contaminated hands can sustain an uncontrolled epidemic. Barker et al. found in a human challenge study that contaminated fingers could transfer norovirus to up to seven consecutive clean surfaces. Environmental contamination is frequently found in rooms of infected patients/residents.

Environmental transmission of norovirus is facilitated by the following virus characteristics:

- Able to survive temperatures ranging from freezing to 60°C (140°F)
- Able to survive and continue to cause infection after prolonged periods of time on surfaces
- Able to transiently colonize healthcare workers’ hands, which then can transfer the pathogen
- Resistance to many disinfectants used on environmental surfaces

Methods to Detect an Outbreak of Norovirus

Early recognition of cases is a vital first step of outbreak control. CDC defines a case of norovirus as an acute onset of vomiting or diarrhea, with 3 or more loose stools within any 24-hour period. An outbreak of norovirus is likely when at least 3 patients/residents or staff members in a facility are experiencing symptoms of the virus during a 48-hour period. Continuous surveillance for symptoms of AGE will alert staff to respond to a surge or cluster of cases or a number of cases that is above average for the facility. Surveillance includes investigation for other causes of AGE such as C. diff or bacterial infections such as salmonella. As not all laboratories possess the ability to rapidly diagnose norovirus, the CDC IA recommendation is to use Kaplan’s clinical and epidemiologic criteria to aid in early detection of norovirus cases, as follows:

- Vomiting in more than half of symptomatic cases
- The mean or median duration of illness ranges between 12 to 60 hours
- The mean or median incubation period ranges between 24 to 48 hours
- No bacterial pathogen found in stool cultures

The current standard for identification of norovirus in stool and vomitus uses a reverse transcriptase polymerase chain reaction test, available from the Pennsylvania Department of Health Bureau of Laboratories. Stool specimens should be submitted as early as possible during a suspected outbreak and ideally obtained from infected individuals during the acute phase of the illness (two to three days after onset). Liquid stool or vomitus specimens from at least five individuals should be collected and put into dry, sterile, leak-proof containers and refrigerated until ready for transport.

Key Components of an Outbreak Prevention/Containment Program

Healthcare facilities and their staff are better equipped to respond to norovirus when protocols for...
Preventive measures are in place before the norovirus season arrives. Elements of an effective protocol (detailed below) include tasks needed to prepare for, manage, and report norovirus outbreaks. Outbreak control is greatly enhanced by the rapid action of a multidisciplinary team to advise and coordinate timely implementation of control measures. CDC has released evidence-based recommendations in its draft “Guideline for the Prevention and Control of Norovirus Gastroenteritis Outbreaks in Healthcare Settings” to identify gaps in current facility protocols and develop detailed implementation guidance for prevention and control of norovirus AGE outbreaks.

Preparing for the Norovirus Season

Education
- Provide education on norovirus transmission, symptoms, and prevention. Reinforce hand hygiene and control measures with staff, patients/residents, and visitors by using in-services, notices, handouts, and posters as part of annual staff fall training, when cases are detected, and throughout the duration of an outbreak.
- Review, monitor, and reinforce adherence to facility protocols based on current CDC, health department, and evidence-based guidelines to promote correct and consistent implementation of control measures.

Surveillance System
- Develop and institute facility policies to enable rapid clinical confirmation of potential cases. The policies should include the following:
  - A clear case definition
  - Unit-based systems to find, monitor, and record case information
  - Use of line listing logs to record daily symptoms and case information for patients/residents and staff
  - Facility-specific AGE baseline
  - Facility-specific AGE attack rate by unit


Resources
- Ensure sufficient quantities, personal protection equipment (PPE) for isolation, single-use dedicated patient care equipment (e.g., commode, rectal thermometers), and toileting supplies, as well as sufficient quantities of precaution signs and education materials.

Communication Plan
- Designate which individuals are responsible for managing communication to patient/resident care areas, patients/residents, families, other...
providers, the medical director, facility leadership, corporate bodies, and the local health department as required.  

- Include a plan for rapid dissemination of information, the location and extent of the infection, control measures, requirements for documentation, and notification of ongoing cases.

### Staffing and Employee Health

- Exclude ill staff members from work for a minimum of 48 hours after the resolution of symptoms. Exclude nonessential staff, students, and volunteers from working in areas experiencing outbreaks of norovirus gastroenteritis.
- Establish protocols for staff cohorting in which staff provide care for only one patient group on their ward (i.e., symptomatic, exposed but asymptomatic, or unexposed), and do not move between patient cohorts.  

To aid in preparation for the norovirus season, the Authority has developed a “Norovirus Preparedness Checklist” that itemizes multidisciplinary tasks for implementing an outbreak prevention program (available at http://patientsafetyauthority.org/EducationalTools/PatientSafetyTools/Pages/home.aspx).

### Basic Outbreak Control Measures

#### Contact Precautions

The rapid, simultaneous implementation of multiple control measures, as follow, is key to controlling disease transmission and reducing the magnitude of outbreaks:

- During an outbreak, place patients in private rooms or separate patients into separate cohorts. Cohorts include those who are symptomatic, exposed but asymptomatic, and unexposed. Precautions should continue for a minimum of 48 hours after the resolution of symptoms.  

- Segregate patients and staff on affected wards from unaffected wards as possible.
- When necessary, facilities can discharge patients/residents on contact precautions for norovirus if receiving facilities are able to provide adequate cohorting or isolation.
- Require separate toilets or commodes for symptomatic patients.
- Isolate infants up to five days, as there is the potential for asymptomatic viral shedding and environmental contamination.
- Ensure availability of PPE, including gloves and a gown.

A mask and eye protection may be necessary if there is a risk of splashes to the face during the care of patients/residents who are vomiting and for individuals who clean areas heavily contaminated with feces or vomitus. Visitors having close contact with symptomatic patients/residents should be instructed in proper use of PPE and hand hygiene.

### Hand Hygiene

Traditionally, CDC recommends hand washing with soap and water for at least 15 seconds or use of hand sanitizers until hands are dry. Barker et al. demonstrated in a human challenge study that hand washing with an antibacterial soap for at least 1 minute followed by rinsing for 20 seconds and drying with a disposable paper towel may be more effective in removing norovirus. An effective hand-hygiene program requires hand washing with soap and water in any of the following circumstances:

- When hands are visibly soiled and have been in contact with diarrheal patients/residents
- When in contact with contaminated surfaces or body secretions
- After removing gloves
- Before any contact with food or beverages (e.g., preparing, serving)

### Environmental Cleaning

Environmental contamination has been documented as a contributing factor in ongoing transmission of outbreaks. Environmental reservoirs of pathogens during outbreaks are often related to a failure to adhere to the following recommended procedures for cleaning and disinfection:

- Clean and disinfect patient care areas at least twice daily; clean and disinfect frequently touched surfaces at least three times daily. Clean shared patient equipment between patient uses. Clean with an appropriate Environmental Protection Agency (EPA)-registered product approved for use in healthcare settings, and follow manufacturer’s recommendations for optimal disinfectant dilution, application, and surface contact time. A freshly made chlorine-based agent like sodium hypochlorite or 5 to 25 tablespoons of household bleach per gallon of water is recommended. EPA lists registered products with activity against norovirus on its website at http://www.epa.gov/oppad001/list_g_norovirus.pdf.

- Clean surfaces and patient equipment before applying a disinfectant. Presence of residual organic and protein loads on surfaces reduces the overall effectiveness of disinfectants. Clean and disinfect surfaces starting from the areas with a lower likelihood of norovirus contamination (e.g., tray tables, countertops) and progressing 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. Discard disposable patient care items from isolation rooms upon discharge.

- Immediately clean emesis or fecal material from upholstered furniture using a manufacturer-approved cleaning agent or detergent. Steam clean furniture upon patient discharge, or discard the furniture if cleaning is not possible.
Leadership

Leaders of healthcare facilities play a vital role in successful prevention of healthcare-associated infections (HAIs). As described by Saint et al., a 2005 survey of 516 hospitals revealed several key behaviors exhibited by hospital leaders who successfully implemented HAI prevention practices, including the following:\(^\text{17}\)

- Plan ahead to ensure that roles and tasks are clearly specified.
- Inspire staff at all levels to focus on a facility vision of clinical excellence and patient safety.
- Maintain high expectations.
- Focus on overcoming barriers.
- Deal directly with resistant staff.
Facility leaders can partner with frontline providers by meeting on the unit, discussing safety issues, and helping to remove barriers to implementation of outbreak improvement efforts.\(^\text{18}\)

Postoutbreak Activities

Monitoring compliance is fundamental to determine the effectiveness of norovirus improvement strategies and the existence and extent of barriers to safe care. Norovirus control measures can be assessed using an adaptation of the Society for Healthcare Epidemiology of America's outcome and process measures for C. diff, including the following:\(^\text{19}\)

- Report process and outcome measures to leadership, staff, and clinicians.
- Express the norovirus outcome measure as the rate of infection for a unit or facility (divide the number of norovirus cases by the number of patient days in thousands).
- Measure performance, including observation of compliance with hand hygiene, contact precautions, and environmental cleaning. Monitor these processes through actual or simulated observation and employee interview. To calculate these measures, divide the number of observations that were compliant by the total number of observation performed.


Pennsylvania Success Stories

The Authority interviewed representatives from five Pennsylvania nursing homes—Vincentian Regency, Allison Park; Nottingham Village, Northumberland; Somerton Center, Philadelphia; Twin Oaks, Campbellsport; and Golden LivingCenter-East Mountain, Wilkes-Barre—to identify methods of influencing an effective and sustainable gastrointestinal illness prevention and control program. Analysts selected the facilities based on facility reports to the Authority that indicated an outbreak of norovirus AGE in the facility during one month for the first quarter of 2010 and on the facility’s successful and timely resolution of the outbreak. Standardized interview questions addressed preoutbreak plans, management of cases and outbreaks, postoutbreak activities, and which intervention was thought to be the most effective in AGE outbreak control. These facilities reported that the most effective practices contributing to a rapid, successful resolution of gastrointestinal outbreak included:

- praising staff for rapid, effective handling of outbreak activities and ill patients/residents;

- Restrict access to community ice machines to staff wearing a clean pair of disposable gloves. Clean and sanitize ice scoops, buckets, and pitchers at least once every 24 hours.\(^\text{15}\)

- Launder unused linens remaining in patient rooms before use on another patient. Double bagging of linen, incineration, or modifications for laundering are not recommended.\(^\text{2}\)

- Wear appropriate PPE to minimize the likelihood of personal contamination.\(^\text{2}\)

- Change privacy curtains when they are visibly soiled and upon patient discharge.\(^\text{2}\)

- Avoid dispersing the virus by handling soiled linens without agitating them.\(^\text{2}\)

-handle foodservice items using standard precautions and normal processing and cleaning procedures.\(^\text{2}\)

- Restrict nonessential visitors from affected areas.
- Restrict symptomatic and recovering patients from affected clinical areas.
- Launder unused linens remaining in patient rooms before use on another patient. Double bagging of linen, incineration, or modifications for laundering are not recommended.\(^\text{2}\)

Linen Handling

Prompt, careful linen handling, which includes the following, is a key factor in controlling AGE outbreaks:

- Avoid dispersing the virus by handling soiled linens without agitating them.\(^\text{2}\)

- Wear appropriate PPE to minimize the likelihood of personal contamination.\(^\text{2}\)

- Change privacy curtains when they are visibly soiled and upon patient discharge.\(^\text{2}\)

- Launder unused linens remaining in patient rooms before use on another patient. Double bagging of linen, incineration, or modifications for laundering are not recommended.\(^\text{2}\)

Enhanced Precautions

Uncontrolled or widespread outbreaks of norovirus gastroenteritis may prompt more stringent measures, as follow, to reduce the likelihood of environmental contamination and transmission of norovirus in unaffected clinical areas:

- Restrict symptomatic and recovering patients from leaving the patient care area other than for essential care or treatment.\(^\text{2}\)

- Suspend group activities (e.g., dining events), and close wards to new admissions or transfers to attenuate the magnitude of an outbreak of norovirus gastroenteritis. The threshold for ward closure varies and depends on individual state requirements and risk assessments by infection prevention personnel and facility leadership.\(^\text{2}\)

- Restrict nonessential visitors from affected areas during outbreaks of norovirus gastroenteritis. If visitors are permitted, a process for screening visitors for symptoms consistent with norovirus infection is encouraged.\(^\text{2}\)

An example of an environmental cleaning checklist that could be adapted for norovirus outbreak control can be found at http://www.apic.org/Content/NavigationMenu/PracticeGuidance/APICEliminationGuides/C_diff_Elimination_guide.pdf.

Pennsylvania Patient Safety Advisory

Leaders

■ Plan ahead to ensure that roles and tasks are clearly specified.
- Inspire staff at all levels to focus on a facility vision of clinical excellence and patient safety.
- Maintain high expectations.
- Focus on overcoming barriers.
- Deal directly with resistant staff.

Facility leaders can partner with frontline providers by meeting on the unit, discussing safety issues, and helping to remove barriers to implementation of outbreak improvement efforts.

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Monitoring compliance is fundamental to determine the effectiveness of norovirus improvement strategies and the existence and extent of barriers to safe care. Norovirus control measures can be assessed using an adaptation of the Society for Healthcare Epidemiology of America’s outcome and process measures for C. diff, including the following:

- Report process and outcome measures to leadership, staff, and clinicians.
- Express the norovirus outcome measure as the rate of infection for a unit or facility (divide the number of norovirus cases by the number of patient days in thousands).
- Measure performance, including observation of compliance with hand hygiene, contact precautions, and environmental cleaning. Monitor these processes through actual or simulated observation and employee interview. To calculate these measures, divide the number of observations that were compliant by the total number of observation performed.


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- praising staff for rapid, effective handling of outbreak activities and ill patients/residents;
increasing education on the units;
- ensuring nursing leadership off shifts (supervising line listings, linen handling, environmental cleaning, and supplies);
- providing data feedback (graphs) on effectiveness of interventions to staff and physicians;
- monitoring of strict environmental cleaning/linen handling;
- ensuring visitor cooperation;
- providing access to a detailed plan; and
- ensuring administrative support.

Other practices thought by some to be influential in controlling norovirus outbreaks include a multidisciplinary team approach to tasks, direct involvement of the medical director and the director of nursing, use of commodes for symptomatic residents, and closed group activities. These findings validate the necessity for a structured norovirus control plan as described above.

**Conclusion**

Outbreaks of norovirus-associated AGE have increased nationwide in healthcare facilities. The experience of a select group of Pennsylvania healthcare facilities shows that the preseason development and implementation of a rapid response plan helps to reduce or mitigate the impact of a norovirus outbreak. Evidence-based strategies to modify host, viral, and environmental risk factors for outbreaks include preparing for norovirus season, ensuring basic outbreak control measures, using enhanced precautions, and conducting leadership and postoutbreak activities. Postoutbreak measurement of compliance with process measures is fundamental to determine the existence and extent of barriers to safe care and the effectiveness of norovirus improvement strategies.

**Notes**

Self-Assessment Questions

The following questions about this article may be useful for internal education and assessment. You may use the following examples or come up with your own.

Five residents in ward A in a long-term facility are reported to have symptoms of acute gastrointestinal illness with complaints of vomiting, watery diarrhea, and abdominal cramps, as well as some with fever. Stool cultures rule out Clostridium difficile. Two days later, nine staff members, including several dietary staff, call out sick with the same symptom pattern. Within the next 48 hours, 16 new cases of gastrointestinal illness are reported on wards B and C. The director of nursing notifies the facility’s infection control personnel about a potential norovirus outbreak.

1. Which of the statements below is appropriate as the first step to detect a norovirus outbreak at the facility?
   a. Immediately determine the facility-specific acute gastroenteritis (AGE) attack rate by unit.
   b. Conduct early continuous surveillance to rapidly confirm potential cases.
   c. Closely monitor all AGE cases with bloody stool.
   d. Send all diarrheal specimens to the state’s department of health bureau of laboratories.

2. Key components of an outbreak prevention/containment program for the facility include all EXCEPT:
   a. Clean surfaces and resident equipment before applying a disinfectant.
   b. Apply Kaplan’s criteria to clinically identify an outbreak.
   c. Wash hands with an antibacterial soap for 30 seconds followed by rinsing for 20 seconds.
   d. Separate residents into symptomatic, exposed but asymptomatic, and unexposed cohorts.

3. Which of the following criteria is recommended by CDC for rapid clinical diagnosis of norovirus cases such as described in the case study?
   a. Fifty percent of cases involve vomiting; incubation period ranges 24 to 48 hours; duration of illness ranges 12 to 60 hours; no bacterial pathogen in stool
   b. Nausea in 10% of cases; incubation period ranges 12 to 48 hours; bloody diarrhea 3 times in 12 hours; dehydration
   c. Vomiting twice in 24 hours; duration of illness ranges 12 to 60 hours; bacterial pathogen in stool culture; abdominal pain
   d. Fifty percent of cases involve vomiting; duration of illness ranges 12 to 24 hours; no bacterial pathogen in stool; low-grade fever

4. All of the following are risk factors that increase the potential for norovirus transmission EXCEPT:
   a. Patient age (i.e., elderly and very young)
   b. Amount of viral particles excreted by patients/residents in feces and vomitus during the first 48 hours of illness
   c. Lack of sustainable immunity following infection
   d. Viral resistance to sodium hypochlorite

5. Select the method that is least likely to contribute to transmission of norovirus.
   a. Touching mouth with hands exposed to the skin surface of a convalescing patient/resident
   b. Sanitizing environmental surfaces once a day with quaternary ammonium
   c. Cleaning the room of patients who are actively vomiting
   d. Eating fresh vegetables rinsed in the dietary hand washing sink

6. Select the appropriate measures to include in a preseason norovirus prevention plan.
   a. Education, communication protocol, staffing plan, contact precautions, resource evaluation
   b. Education, communication protocol, staffing plan, surveillance system, resource evaluation
   c. Education, communication protocol, staffing plan, surveillance system, hand hygiene
   d. Education, communication protocol, staffing plan, surveillance system, environmental cleaning
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