viruses, fungi, and parasites have been identified as the source of diarrheal outbreaks. Contaminated foods that have been linked to diarrheal illness include pork, chicken, ground beef, milk, unpasteurized apple cider, spinach, eggs, raspberries, onions, raw nuts, cantaloupe, tomatoes, soft cheeses, and shellfish. Table 1 details the estimated total number of cases, frequency of food-borne transmission, and hospitalizations for the most common causes of infectious organisms that can cause diarrhea in the United States.

**Epidemiology**

Little has been published on the frequency and etiology of diarrheal illness among the incarcerated. Youth often store food in their cells or dorms for later consumption, and do not usually have access to refrigeration or cooking appliances. Perishable food stuf is can be a source of viral and bacterial gastroenteritis. In non-incarcerated institutional settings, toxins and over 200 different bacteria, viruses, fungi, and parasites have been identified as the source of diarrheal outbreaks. Contaminated foods that have been linked to diarrheal illness include pork, chicken, ground beef, milk, unpasteurized apple cider, spinach, eggs, raspberries, onions, raw nuts, cantaloupe, tomatoes, soft cheeses, and shellfish. Noroviruses are a group of related viruses in the Caliciviridae family. Noroviruses have been identified as the most common cause of gastroenteritis in the U.S. Noroviruses cause an estimated 23 million cases of gastroenteritis each year in the U.S., more cases than are caused by all other viral, bacterial, and parasitic agents combined.

**Signs and Symptoms**

The incubation period for norovirus following infection is 12-48 hours. In healthy adults, clinical signs and symptoms are generally mild and of short duration, usually 12-60 hours. The illness can be more severe in the elderly and others who have compromised immunity. Rarely, severe dehydration due to norovirus can be fatal. There are no known long-term sequelae that result from norovirus infection. Most of those who become ill experience the sudden onset of nausea, vomiting, abdominal cramps, and diarrhea. Constitutional symptoms including low-grade fever, headache, chills, and myalgias are common. Patients may experience only vomiting, commonly referred to as winter vomiting disease. Diarrhea due to norovirus is usually watery, and less severe than that caused by bacteria. After recovery from illness due to norovirus, individuals generally experience short-lived immunity from recurrent illness and are therefore susceptible to repeated infection and disease within 6 months.

**Transmission**

Viral gastroenteritis can be introduced into a jail or prison by employees, visitors, volunteers, or youth who are transferred into the facility. Less frequently, the virus can enter a facility in contaminated food or water. Norovirus is excreted in the stool of infected persons, and can be shed from those who do not become clinically ill. Excretion of virus precedes clinical illness and can persist for more than a week after symptoms resolve. Noroviruses are readily spread from person to person, by fomites, and from contaminated environmental surfaces. The major route of transmission is person to person (fecal-oral) via hands contaminated with feces or emesis. Norovirus is characterized by both a low infectious dose (100 viral particles) and a high attack rate among exposed persons. The prolonged shedding of virus in the stool of asymptomatic persons increases the likelihood of transmission by infected food handlers. Noroviruses can survive temperature extremes from freezing to 140 F, and resist killing by numerous disinfectants including relatively high levels of chlorine.

**Diagnosis**

The first and most important step in the diagnosis of gastroenteritis is to remain vigilant, especially when norovirus is known to be circulating in the outside community. Once viral gastroenteritis is suspected, a rapid definitive diagnosis of the causative agent will help guide strategies for infection control and containment. An outbreak should be suspected if >2 youth and/or employees concurrently develop nausea, vomiting, and diarrhea. The coexistence of vomiting and diarrhea is a useful clue to the presence of norovirus.

During a suspected outbreak, fresh stool should be collected from six to twelve persons. In addition to testing specimens for norovirus, stool should be cultured for campylobacter, salmonella, and shigella. If the stool is bloody, it should also be tested for E. coli 0157:H7. Most state public health laboratories can test stool, emesis, rectal swabs, and environmental swabs for noroviruses utilizing RT-PCR. Norovirus can be identified from stool specimens taken between 2 and 7 days after onset of symptoms. Once the presence of norovirus has been confirmed within a facility, additional cases can be diagnosed with sufficient accuracy utilizing clinical criteria. One such definition, the Kaplan criteria, is quite specific for viral gastroenteritis (see Table 2).
There are no specific antiviral therapies for norovirus, and in most cases, oral re-hydration is sufficient. Occasionally, anti-emetics, intravenous fluids, and/or electrolyte replacement therapy is necessary.

In the absence of prompt, thorough infection control measures, norovirus can circulate within an institution for an extended period of time. Managing an institutional outbreak of any contagious illness requires close collaboration between medical and custody staff. During an outbreak of gastroenteritis, movement of youth should be restricted as much as possible. Even those who are not symptomatic may be incubating the virus, and can spread the illness to others. Movement in and out of the impacted housing units should be limited.

Viral gastroenteritis is more likely to be spread in congregate settings. For this reason, strong consideration should be given to temporarily suspending indoor group activities such as visitation, school, and religious services. Youth who are experiencing nausea and/or vomiting should be confined to quarters until they have been asymptomatic for at least 48 hours. Likewise, employees who are ill should be encouraged to stay away from the worksite until they have been without symptoms for at least 48 hours. Sick youth should be fed in their cell, dorm, or housing unit. If possible, well youth should eat in groups by unit. The placement of alcohol-based hand cleansers at the beginning of feeding lines should be considered. Dining areas should be cleaned and then wiped with bleach solution at junctions.

Local operating procedures (LOPs) should facilitate the closing of dormitories, yards, or entire facilities to incoming youth during outbreaks of gastroenteritis and other communicable infectious disease such as varicella, tuberculosis, or scabies. Movement within the institution should also be limited as much as possible. This includes bed moves, visiting, religious meetings, mental health groups, programs, hobby shop, etc. Food handlers should be monitored to ensure that they perform frequent hand hygiene and appropriately use gloves. LOPs should also provide for the rapid screening and clearance of critical youth workers. Plans should be in place to allow for the identification on short notice of alternate workers for food handling, laundry, and essential functions.

During outbreaks of gastroenteritis, employees and youth should be regularly reminded about the importance of frequent hand washing. Routine housecleaning efforts should be intensified, including the cleaning of walls, floors, table tops, handrails, sinks, toilets, and door knobs in day rooms, communal restrooms, dining facilities, and showers. In addition to environmental surfaces, medical and custodial equipment such as blood pressure cuffs, stethoscopes, and restraint gear should be routinely sanitized.

Rapid response teams should be created to remove and disinfect spills of body fluids such as feces or vomit, especially in common areas. The body fluid should be removed, and the area disinfected by the application of a bleach solution for a minimum of ten minutes. After ten minutes, the excess solution should be wiped up. Mop buckets should be disinfected and mop heads cleaned or discarded after each episode of cleaning up a contaminated spill. Mops and other cleaning materials that are used for cleaning up spills should not be reused for routine cleaning in other areas. All mop heads should be changed and either laundered or discarded at least once daily. Housecleaners should utilize personal protective equipment to include masks, disposable gowns, and gloves.

Based upon studies of viral killing with other related calciviruses, chlorine bleach is the only disinfectant that is fully endorsed by the CDC for use against norovirus. Therefore, bleach-containing solutions should be used for surface cleaning and mopping. The solution should be mixed fresh each day utilizing 1 cup of bleach to 3 gallons of water. This disinfectant solution must be changed frequently to prevent dirt and organic materials from inactivating the activate disinfectants. The 101 Section provides directions for mixing bleach solutions. Unfortunately, bleach is caustic and could potentially be used in an assault. Additionally, bleach can be used to change the color of youth clothing and/or alter personal appearance by dying hair. For these reasons, it is important to work in advance with custody to develop procedures that allow for the safe use of bleach when it is legitimately necessary.

Youth and employees should be encouraged to frequently wash their hands with soap and water, or an alcohol-based hand rub. Healthy youth should be allowed access to the showers first, followed by those youth who are ill. Showers should be cleaned and disinfected with bleach solution after being used by sick youth.

Educational efforts should be directed at youth, employees, visitors, volunteers, and the public. The use of multiple teaching methods including handouts, overheads, in-house cable television channels, and posters is encouraged. Youth peer educators can be a valuable resource, as can youth advisory councils, youth family groups, and labor unions. Educational materials should be provided in multiple languages, and be written to accommodate those with low levels of literacy.

Daily briefings should be provided to key medical and custody stakeholders. The public information officer should be prepared to communicate with the media and the surrounding community if called upon to do so.
TRACKING THE OUTBREAK

Tracking of all individuals (youth and employees) is suggested and greatly facilitates the management of outbreaks of viral gastroenteritis and other communicable conditions. Each day, a list should be updated with essential information to include at least the youth name, number, housing, date symptoms began and ended, date of confinement to quarters and release, date specimens collected, and results of specimens. This information should be collated each day into a new updated report that can be shared with key outbreak managers (see Table 3). Each day, a nursing team should conduct face-to-face evaluations of any youth who are experiencing symptoms consistent with gastroenteritis. This is to include new cases and those who are confined to quarters. Nursing staff should carefully monitor these individuals, and rapidly bring them to medical attention if they require additional medical intervention such as intravenous fluid replacement.

CONCLUSIONS

Outbreaks of gastroenteritis commonly occur in congregate living environments such as jails and prisons. Most of these outbreaks are due to viruses, with noroviruses being the most common etiology. Gastroenteritis outbreaks can result in a large number of sick youth and employees, significant morbidity, and major disruption to normal programming. A coordinated response involving on-site medical and custody staff, augmented as needed by local, county, and state public health resources, can be quite effective in mitigating the impacts of gastroenteritis outbreaks. Jail and prison administrators would be prudent to establish policies and procedures in advance of these outbreaks to help facilitate the best possible outcome.

PREPARATION OF BLEACH DISINFECTANT SOLUTIONS

<table>
<thead>
<tr>
<th>Preparation of Bleach Solution</th>
<th>Desired Chlorine Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500 ppm (0.05%)</td>
</tr>
<tr>
<td>Dilutions of standard (5.25%)</td>
<td>1:100 2 1/2 tablespoons (1/6 cup) bleach in a gallon of water</td>
</tr>
<tr>
<td>bleach prepared fresh for use within 24 hours</td>
<td></td>
</tr>
<tr>
<td>Bleach/water Preparation</td>
<td></td>
</tr>
</tbody>
</table>

| Dilutions of standard (5.25%)  | 1:50 5 tablespoons (1/3 cup) bleach in a gallon of water | 1:25 10 tablespoons (2/3 cup) bleach in a gallon of water | 1:5 50 tablespoons (3 1/3 cup) bleach in a gallon of water |
| bleach prepared fresh for use within 24 hours | | | |
| Bleach/water Preparation       | | | |

"Ultra" concentrations of bleach contain 6-7.35% hypochlorite and are not recommended to avoid producing higher than intended concentrations of chlorine.

SOURCES

Control of Viral Gastroenteritis within Jails and Prisons, Joseph Bick, MD [http://www.idcronline.org/archives/june08/article.html]

CDC’s Norovirus (Viral Gastroenteritis) Website [http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus.htm]

CDC’s Norovirus in Healthcare Facilities Fact Sheet [http://www.cdc.gov/ncidod/dhqp/id_norovirusFS.html]


International AIDS Society-USA Panel 2006 Recommendations Treatment for Adult HIV [http://jama.ama-assn.org/cgi/content/full/296/7/827]


American Correctional Health Services Organization [http://www.achsa.org/index.cfm]

American Academy of HIV Medicine [http://www.aahivm.org/]

OHS/DJJ Health Initiative: Gastroenteritis Control 3 of 4 July 2008
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ADDITIONAL RESOURCES

3. CDC: Viral Gastroenteritis (Fact sheet in English and Spanish) http://www.cdc.gov/nicidod/dvd/revb/gastro/faq.html
6. Diagnosis and Management of Food-borne Illnesses: A Primer for Physicians and Other Health Care Professionals. MMWR 2004; 53 (No. RR-4).