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Elizabeth Scott, PhD. Co-director Simmons Center for Hygiene and Health in Home and Community. Simmons

College, Boston, USA

Norovirus Infections in Home and Community Settings

Summary

Noroviruses are the most common cause of gastroenteritis in the industrialized world and it is estimated that they are responsible for some 23 million infections each year in the United States. First recognized in 1972, the virus has undergone several name changes since it was first identified as the cause of an elementary school “stomach flu” outbreak in Norwalk, OH. Symptoms include severe vomiting, diarrhea, nausea, fever, aching and tiredness. Most people recover without complication but as with other gastrointestinal infections, the young, the elderly and the immunocompromised are at higher risk from complications of dehydration. Home and community settings, including hospitals, are the common location for norovirus outbreaks although outbreaks in the home are underreported and under recognized. Person-to-person spread, either directly or via contaminated surfaces and contaminated food are the main routes of transmission of norovirus and therefore, prevention is based on effective hygiene practices, including hand hygiene, surface sanitation and food safety.

Introduction

Noroviruses are the most common cause of gastroenteritis in industrialized countries. In the United States, the Center for Disease Control (CDC) reports that noroviruses are not only responsible for 23 million cases annually of viral gastroenteritis (1) but also the cause of 50% of all foodborne gastroenteritis outbreaks. During major outbreaks, emergency rooms may become crowded with infected individuals, and hospitals often have to close down wards to new patients and visitors for periods of days in order to halt the spread of this virus. There is no treatment, and while most individuals recover in a matter of days, the cumulative effect of a major outbreak may impact the entire economy as a result of lost productivity. For instance, the recent norovirus outbreak in the UK, which forced several hundred thousand Britons to stay home and miss work (, was estimated to cause an economic burden of \$80 million (£40 million) per day due to lost productivity (2).

Wherever people gather closely together in indoor settings such as homes, workplaces, schools, colleges, hotels, vacation settings, etc., there is a risk of an outbreak. The best line of defense against noroviruses is the practice of vigorous personal hygiene and effective environmental decontamination.

This paper addresses the misconceptions about noroviruses, describes the epidemiology of the virus in a range of settings and makes recommendations for appropriate hygiene practices that can help to break the chain of infection.

Noroviruses

The noroviruses are a group of related, single-stranded RNA, non-enveloped viruses that cause acute gastroenteritis in humans.

Several different names have been previously used to describe this family of viruses including “Norwalk-like viruses”, calciviruses and small round structured viruses or SRSV’s. They are named after Norwalk, Ohio where an outbreak of acute gastroenteritis occurred among children at an elementary school in 1968.

Symptoms

The gastroenteric illness caused by norovirus is sometimes referred to as ‘stomach ‘flu’, because of the flu-like symptoms that can be experienced, but there is no relation to the influenza that attacks the respiratory system. It has also been called ‘winter vomiting disease’ because of the wintertime seasonality of earlier outbreaks, but surveillance data have shown that summertime peaks in infection can also occur (3). The incubation period is usually between 24 and 48 hours but illness can occur as quickly as within 12 hours of exposure. The main symptom of infection is uncontrollable projectile vomiting. Other symptoms include nausea, non-bloody diarrhea, fever, aching limbs and general tiredness. Low-grade fever also occasionally occurs while vomiting is more common in children. Most people recover without complication but as with other gastrointestinal diseases, the very young, the elderly and those who are immunocompromised by other illness or treatments are at risk from the life threatening complications of dehydration. Symptoms usually last 24 to 60 hours. Recovery is usually complete and there is no evidence of any serious long-term effects. Infection without symptoms may occur in as many as 30% of infections, although the role of asymptomatic infection in norovirus transmission is not well understood (1). Recovering patients can continue to carry and transmit the virus to others for up to three weeks after the symptoms have disappeared although the heaviest shedding occurs in the first few days.

Treatment

There is no treatment for the disease and the best course of action is to rest, stay warm, remain hydrated and allow the virus to run its course. As far as possible, infected individuals should try to keep themselves isolated during the vomiting phase of illness and remain away from work and school for at least 3 days after symptoms have subsided, in order to avoid infecting others. Oral re-hydration fluids, juice and water can be taken to prevent dehydration. Medical attention may be required for the very young, the elderly and immunocompromised individuals in order to prevent dehydration, and its potentially serious consequences. At this time there is no vaccination available against noroviruses and no antiviral medication that is completely effective against noroviruses. Because the agent is a virus, it cannot be treated with antibiotics.

Immunity

Immunity to the virus appears to be strain specific and lasts only a few months. Because there are many genetically different strains of the virus individuals can be repeatedly infected throughout their lifetime and do not build up any long-term immunity. This may explain why people of all ages are seen to be infected during an outbreak. Recent evidence also suggests that susceptibility to infection may be genetically determined, with people of blood group O being at greatest risk for severe infection and that more than one strain may be present during an outbreak (1).

The sources and spread of noroviruses in the home and community

Today, noroviruses are recognized as the most common cause of infectious gastroenteritis among persons of all ages. Infections occur around the globe and throughout the year. Although noroviruses have achieved a certain public notoriety because of press reports of outbreaks occurring in hospitals, hotels and cruise ships, indications are that norovirus infections are now commonly circulating in the home and in the community resulting in many sporadic infections. Surveillance data from the US, Japan and the Netherlands suggest that person-to-person spread and food-borne spread are the most common transmission routes (4, 5,6,7)

These studies suggest that contact with an infected person is the greatest source of risk for infection by norovirus (7,8,9). This is because of the very large potential for person-to person transmission of this virus, either directly through person-to-person contact, via airborne particles that land on environmental surfaces as a result of vomiting or even swallowing of the aerosolized particles after they enter the nasal passages (10). It is known that the projectile vomiting can generate up to 30 million virus particles (11,12) and it has been shown that proximity to vomit at the time of vomiting may be a significant risk factor. The virus is highly infectious and ingestion of fewer than 10 virus particles may be all that is needed to cause illness. In addition, the virus can survive on dry surfaces for periods up to 7 days (13).

Alternatively aerosolized virus may settle on uncovered food and cause infection following food consumption.

Once a virus is present on environmental surfaces, it can be both hard to eliminate and remain infective for long periods of time, and these factors may play a role in extending the length of outbreaks as has been shown in a prolonged hotel outbreak (15).

Foodborne spread of noroviruses

According to the CDC (1) most foodborne outbreaks of norovirus illness are likely to arise through direct contamination of food by a food handler immediately before its consumption. Outbreaks have frequently been associated with consumption of cold foods, including various salads, sandwiches, and bakery products. Liquid items (e.g., salad dressing or cake icing) that allow virus to mix evenly are often implicated as a cause of outbreaks.

Raw foods can also be contaminated at its source, and oysters from sewage polluted waters have been associated with widespread outbreaks of gastroenteritis. Other foods, including raspberries and salads, have been contaminated, often as result of irrigation or washing in sewage polluted water, before widespread distribution and subsequently have caused extensive outbreaks.

Place of infection

The CDC does not currently conduct active surveillance to monitor all outbreaks of norovirus infection. Data collection relies on reporting by states when specimens are sent to CDC for testing. As a result, and is the case with much gastrointestinal infection, the data is often both hugely underestimated and skewed as sporadic infections tend not to get overlooked.

In a CDC study of the 232 outbreaks of norovirus illness reported from July 1997 to June 2000, 57% were foodborne, 16% were due to person-to-person spread, and 3% were waterborne; in 23% of outbreaks, the cause of transmission was not determined. In this study, common settings for outbreaks include restaurants and catered meals (36%), nursing homes (23%), schools (13%), and vacation settings or cruise ships (10%) (1). However, as mentioned above, it should be noted that this data is unreliable as a result of a number of reporting factors including lack of reporting of family outbreaks in the home and over representation of the very few facilities that are required to report outbreaks of noroviruses. A recent report from Germany (15) indicated that 66% of reported norovirus outbreaks occurred in hospitals and 13% in homes, and this home data is still considered as under-reported.

Prevention

In the absence of a vaccination or a cure, prevention of norovirus infections is largely dependent on good hygiene practices wherever people gather together - at home, work, school, college, hotels etc. In this context, effective hygiene practice incorporates personal

hygiene, safe food practices and environmental sanitation. A degree of individual personal responsibility is required to break the chain of infection, in the sense that infected individuals should isolate themselves as far possible and avoid preparing food for others and also everyone in the community in potential contact with infected individuals needs to adopt a rigorous approach to hand hygiene at all times.

Personal hygiene

Good handwashing practice is the single most important infection control measure. Hands should be thoroughly washed with soap and running water many times a day, both at home and away from home. If access to soap and running water is a problem, use an alcohol hand rub or hand sanitizer. Hand washing is preferred wherever possible because some strains of norovirus may be relatively less susceptible to alcohol. In “high risk” situations, for example, where there is an outbreak of norovirus in the home, it is suggested that handwashing followed by use of an alcohol rub/sanitizer should be encouraged. It is useful to carry a small container of alcohol hand sanitizer at all times so that hands can be sanitized after touching shared hand contact surfaces, such as keyboards, mouse, and phones, in the office, exercise equipment in the gym, hand rails on public transport, etc. More information on hand washing for better health is available at the Center for Hygiene and Health website at the following link:

<http://www.simmons.edu/hygieneandhealth/Handwashing%20Tips.pdf>. (16)

Environmental sanitation in the home (adapted from the IFH Advice Sheet (17))

- Hygienically clean surfaces in the bathroom, with particular attention to surfaces that come into hand contact such as washbasins, tubs, toilet seats, toilet handles and showers. This can be achieved by cleaning with a detergent cleaner followed by thorough rinsing under running water, or when this is impractical, e.g. for toilet seats, flush handles etc., using a disinfectant cleaner effective against norovirus**. During outbreaks these surfaces should be disinfected after each use to prevent recontamination.
- Other important surfaces are those that come into contact with the hands, e.g. door handles, telephones, bedside tables, bed frames, computer keyboards, TV remote controls. To make these surfaces hygienically clean use a disinfectant cleaner effective against norovirus**. For items like computer keyboards which might be damaged by direct application, apply the cleaner to a disposable wipe, then clean the surface. In addition make sure that family members (and others) always wash or sanitize their hands before using shared family computers.

- Rags and sponges can easily spread norovirus around the home and the use of paper towels or disposable rags is recommended during outbreaks (or as a preventive measure all year).
- If floors or other surfaces become contaminated with feces or vomit, they should be hygienically cleaned at once. Protect yourself first by donning a dust mask to inhibit inhalation of airborne particulates. Using gloves, remove as much as possible of the infected material from the surface using paper towels/disposable wipes.
 - Apply disinfectant cleaner effective against norovirus** to the surface using a paper towel/wipe.
 - Apply disinfectant cleaner** to the surface a second time using a fresh wipe or paper towel to destroy any residual contamination.
 - Dispose of the contaminated materials into a plastic bag, tie the top shut, and place into the bulk garbage (typically this is the same large family trash can set outside on garbage day) not into a trash can inside the home.
- After cleaning up vomit, if possible, vacate the room and ventilate the room by opening windows for a short time to change out the air which will also remove airborne particulates.
- Do not share towels, facecloths, toothbrushes and other personal hygiene items with the infected person.
- Clothing, sheets and pillows and towels from the infected person should be kept separate from the rest of the family laundry and should be laundered in a manner that kills norovirus.
 - If you prefer not to wash with chlorine bleach, wash water must be at 140° F (60° C) or above as this is the wash temperature required to destroy norovirus.
 - Use of a bleach-containing laundry (powder or tablet) product is necessary to destroy norovirus when washing at temperatures below 140° F (60° C).

Safe food practices

Rigorous food hygiene is important in preventing the spread of norovirus in the home. Where there is an infected person in the home, food hygiene practices should focus on preventing contamination of food by the infected person. Only non-infected persons should prepare sandwiches, salads, and other ready-to-eat foods. Infected individuals should stay away from the kitchen and should not prepare food for others. Noroviruses can survive refrigerator temperatures and, as mentioned above, requires heating to temperatures above 140° F or 60° C to destroy the virus.

- Wash and sanitize hands after handling raw foods.
- Wash and sanitize hands before handling ready-to-eat foods and foods that will not be cooked.

- Hygienically clean all food contact surfaces, utensils, rags and sponges before and after handling and preparing raw or ready-to-eat foods using a disinfectant cleaner which is effective against noroviruses**.
- Cook foods thoroughly.
- Wash any foods such as fruits and vegetables to be eaten raw thoroughly under clean running water.
- Store foods carefully in both the refrigerator and freezer. Separate cooked food from raw.

****Disinfectants and disinfectant cleaners**

Use a disinfectant or disinfectant/cleaner such as a bleach-based product, which is active against norovirus. Consult the manufacturers' instructions for information on the "spectrum of action", and method of use (dilution, contact time etc). For bleach (hypochlorite) products, use a solution diluted to 0.5% or 5000 parts per million (ppm) available chlorine. Household bleach (both thick and thin bleach) for domestic use typically contains 4.5 to 5.0% (45,000-50,000 ppm) available chlorine. In situations where "concentrated bleach" is recommended, a solution containing not less than 4.5% available chlorine should be used. Bleach/cleaner formulations (e.g. sprays) are formulated to be used "neat" (i.e. without dilution). It is always advisable however to check the label as concentrations and directions for use can vary from one formulation to another. It should be noted that products labelled as 'antibacterial' are not active against norovirus. Frequent use of disinfectants will likely place these containers in proximity to children and others who may not understand the hazards, so please keep containers up high or use cabinet locks to prevent unwarranted access and accidental contact/poisoning.

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