

Practical Environmental Health Strategies for Controlling Norovirus Infections

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Today's Topics

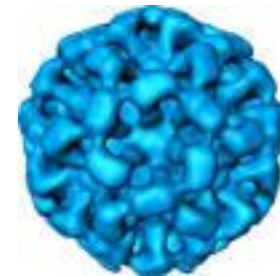
- A Sanitarian's overview of the Norovirus
- Norovirus Infection
- Decontamination
- Disinfection Procedures
- Disinfectants
- Hand Hygiene

Norovirus - Critical Characteristics

- Highly contagious – leading cause of foodborne disease
- Multiple modes of transmission
- Stable in the environment
- Resistant to routine disinfection methods
- Asymptomatic infections
- Limited immunity

Norovirus (HuNoV)

- Non-enveloped single-stranded RNA virus
- 27-35 nm in size [small round structured virus (SRSV)]
- Infectious dose of 10-100 virus particles (16)
- Viral shedding of 3 weeks or more
- Survives 0°C, 60°C, chlorine 10 ppm
- Limited (few months) immunity



Norovirus
3-D



"Diarrhea Hotline... your call is important to us... please hold..."

Norovirus - Disease Characteristics

- HuNoV causes one of the most common form of gastroenteritis.
- Occurs throughout the year, but in winter close indoor contact makes spread more likely (“winter vomiting disease”).
- Up to 5% of the population will develop it each year.
 - 570 – 800 deaths
 - 56,000 – 71,000 hospitalizations
 - 400,000 Emergency department visits
 - 1.7 million – 1.9 million outpatient visits.
 - 19 million – 21 million total norovirus illnesses
- Outbreaks in hospitals, nursing and residential homes, nurseries, schools, correctional facilities, hospitality venues (aka “nursing home virus”).

Norovirus - Disease by Setting

| <u>Setting</u> | <u>Percentage</u> | <u>Number of Outbreaks</u> |
|--------------------------------|-------------------|----------------------------|
| Health Care facilities | 62.7% | 2189 |
| Restaurant or banquet facility | 22.1% | 771 |
| School or daycare facility | 6.1% | 214 |
| Private residence | 1.9% | 69 |
| Other/multiple settings | 7.2% | 251 |

Data collected over 27 years (2012)

Norovirus Transmission

Generally oral-fecal route

| <u>Vehicle</u> | <u>Percentage</u> | <u>Number of outbreaks</u> |
|------------------|-------------------|----------------------------|
| Foodborne | 54% | 362 |
| Person to person | 26% | 174 |
| Waterborne | 11% | 70 |
| Fomites | 9% | 60 |
| Air* | | |

27 years of compiled data (2012)

* Proven in 2012

Widespread environmental contamination with NLV detected in a prolonged hotel outbreak of gastroenteritis; JS Cheeseborough; Epidemiol Infect 2000, 125: 93-98

• RT-PCR (messenger RNA) environmental surface testing

| | | |
|-----------------------------------|--------|-------|
| • Carpets (known vomiting) | 5/8 | (62%) |
| • Carpets (no vomiting) | 9/12 | (75%) |
| • Toilet rims/seats | 8/11 | (73%) |
| • Toilet handles, taps, basins | 13/39 | (39%) |
| • Horizontal surfaces below 1.5 m | 11/29 | (37%) |
| • Horizontal surfaces above 1.5 m | 6/12 | (50%) |
| • Phones, door handles, etc. | 7/29 | (24%) |
| • Soft furnishings | 2/10 | (20%) |
| • Total | 61/144 | (42%) |

Norovirus - Food Contamination

Shellfish (oysters, clams, mussels)

Ready to eat foods



that require handling but no subsequent cooking

- Salads
- Peeled fruits
- Deli-sandwiches
- Finger foods
- Hors d'oeuvres
- Dips
- Communal foods



Norovirus - Water Contamination

- Improper sewerage treatment or overflow
- Surface water
- Swimming pool water
- Ice
- Well water



Norovirus Infection Symptoms of Concern

Vomiting and Diarrhea



The day when Bobby's goldfish had diarrhea

“Vomiting Larry”

Developed by Catherine Makison Booth at the Health and Safety Laboratory in Harper Hill, UK

Mimics projectile vomiting using a pneumatic ram and fluorescent water to measure distance of splash.

Area covered = 84 ft²

USDA-funded NoroCORE proved that someone can become infected by aerosol during vomiting incident.



Norovirus Response Plan

- Isolation
- Containment and Contaminant removal
- Disinfection
- Investigation
- Information/Education

Principles of Contamination Control

Keep contaminants out.

Get rid of the ones that get in.

Prevent damage from those that have gotten in.

Minimize their movement.



Containment and Contaminant Removal

- Restrict access to soiled and contaminated areas until cleaned and disinfected.
- Use specifically trained and equipped janitorial teams for vomitus and diarrhea contamination incidents
- Use a cleaning strategy that will significantly reduce the bioburden prior to terminal decontamination.
 - Realistically, we can reduce bioburden by > 5-logs. (10^5) with mechanical cleaning and dilution.
 - Realistically, in vivo disinfection may reduce the bioburden by approximately 2- to 3-logs (10^{2-3}), but only if done correctly.

Basic Decontamination Equipment

RED 7-10-gallon plastic biohazard bags

- For use in 6-gallon Biohazard Waste can (self-closing lid)



PPE:

- Gloves (double gloved),
- Mask (N95),
- Gown (disposable polypropylene),
- Eye protection (face shield or safety glasses)
- Shoe covers (water resistant)



Disinfectant (use dilution) in 2-liter or ½-gallon, hand-held pump pressure sprayer

Absorbent powder (Amorphous Alumina Silicate)

Paper towels and disposable rags

Squeegee and dustpan



Norovirus Decontamination Process

1. Cordon off the contaminated area.
2. Spray disinfectant directly onto gross contaminants (vomitus or stool); dwell time = 5-10 minutes.
3. Apply absorbent powder and cover the area with paper towels or rags.
4. Clean surface of gross contaminants.
5. Reapply disinfectant.
6. Remove PPE and dispose as Biohazard.
7. Dispose of waste.
8. Clean hands with soap and water.

Norovirus Post-Decontamination Process

- Open the room to outside air or increase air exchanges.
- Soiled carpets and upholstery can be steam cleaned after chemical disinfection.
- Air dry rugs and furniture (preferably in sunlight).
- Promptly bag and clean soiled linens or dispose of them as hazardous waste.
- Advise against the use of public restrooms.
- In food service, remove any potentially contaminated food, beverages, ice and serving utensils from service

Disinfection Targets

Consider all frequent hand contact surfaces to be contaminated
In less than two to three hours, most common- (high) touch surfaces are contaminated, and within five to six hours nearly all touchable surfaces are contaminated.

- Door handles, push plates
- Faucet and flush handles
- Railings, elevator buttons
- Telephones, keyboards
- Pens, pencils
- Tables, counters
- Sports equipment

Disinfectants for Norovirus

- The Norovirus cannot be grown in culture
- Efficacy testing of disinfectants for Norovirus is done using a surrogate virus, typically the **feline calicivirus (FCV)**, a similar non-enveloped ssRNA virus



Inactivation of Feline Calicivirus, a Norwalk Virus Surrogate; JC Doultree; J Hosp Infect 1999, 41:51-57

- Effective disinfection agents
 - Glutaraldehyde 0.5%
 - Iodine 0.8%
 - Hypochlorite 1000 ppm (freshly reconstituted)
Household bleach required 5000 ppm
- Ineffective disinfection agents
 - QUAT 1:10
 - Ethanol 75%
 - Anionic detergent 1%

Inactivation of Feline Calicivirus, a Norwalk Virus Surrogate; JC Doultree; J Hosp Infect 1999, 41:51-57

Heat inactivation of FCV

- 56°C for 60 minutes = complete inactivation
- 70°C for 3 minutes = 6.5 log₁₀ reduction
- 70°C for 5 minutes = complete inactivation
- 100°C for 1 minute = complete inactivation

Efficacy of Commonly Used Disinfectants for the Inactivation of Calicivirus on Strawberry, Lettuce and Food Contact Surfaces; BR Gulati; J of Food Protection 2001, 64(9):1430-1434

- Phenolic compounds at 2-4 times the recommended concentration completely inactivated FCV on contact surfaces.
- Hypochlorite (liquid bleach) 5000 ppm was needed to inactivate FCV.
- QUATS are ineffective!
 - Effective when 2% sodium bicarbonate is added to the solution, or,
 - When combined with other disinfecting compounds (ClO_2).

Efficacy of Commonly Used Disinfectants for the Inactivation of Calicivirus on Strawberry, Lettuce and Food Contact Surfaces; BR Gulati; J of Food Protection 2001, 64(9):1430-1434

Effective sanitizers on FCV contaminated strawberries and lettuce

- 15% peroxyacetic acid + 11% hydrogen peroxide at 4X normal concentration
- Hypochlorite (liquid bleach) at 5000 ppm
- Water alone produced a 2 log₁₀ reduction (dilution)

Disinfectants for Norovirus

List G: EPA's Registered Antimicrobial Products Effective Against Norovirus 4/3/18

The disinfectants are listed by Registration Number and Primary Product Name.

150 compounds are on the registry.



Disinfectants for Norovirus

- Accelerated Hydrogen PeroxideTM (AHPTM)
- Chlorine dioxide + QUAT (Cryocide 20TM)
- Hypochlorite (bleach) / Hypochlorous Acid[®]
- Parachlorometaxylenol (EcoTru[®])
- Peroxomonosulphate (Virkon[®])
- Phenols (Mikro-Bac II[®], Mikro-Bac 3[®])

Disinfectants for Norovirus

To make an informed choice of disinfectants:

- Request independent testing data from the manufacturer or distributor that supports their efficacy claims against FCV/Norovirus.
- Not all viricidal disinfectants must meet EPA FIFRA testing requirements.
- Read the label for use conditions and safety precautions.
- Test the disinfectant for adverse effects on environmental surfaces.

Fogging

- Applies small droplets of disinfectants to environmental surfaces.
 - Unsubstantiated claims for air decontamination.
- Should be used only as an adjunct to thorough surface cleaning and disinfection.
- Provides rapid exposed environmental surface coverage.
- Effective for soft-surfaces: furniture, carpets, wall coverings, drapes.

Disinfection

Steam cleaning

- Dry or wet steam
- Soiled carpets and furniture
- Use of special tools to direct biocidal treatment

One steam cleaner is listed under NSF P448:
Sanitization Performance of Commercial Steam
Generators





For removing **viruses** from the **hands**, physical removal with soap and water was most effective since some **viruses** are hardy and relatively resistant to disinfection.

- After washing and drying hands with the warm-air dryer, the total number of bacteria was found to increase on average on the finger pads by 194% and on the palms by 254%.
- Drying with the jet-air dryer resulted in an increase on average of the total number of bacteria on the finger pads by 42% and on the palms by 15%.
- After washing and drying hands with a paper towel, the total number of bacteria was reduced on average on the finger pads by up to 76% and on the palms by up to 77%.

2008 research UK



Hand Hygiene

- The jet-air dryer, which blows air out of the unit at claimed speeds of 400 mph (640 km/h), could blow micro-organisms from the hands and the unit and potentially contaminating other washroom users and the washroom environment up to 2 meters away.
- Use of a warm-air hand dryer spread micro-organisms up to 0.25 meters from the dryer.
- Paper towels showed no significant spread of micro-organisms.

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That's all Folks!

*Questions,
Comments,
Brickbats?*