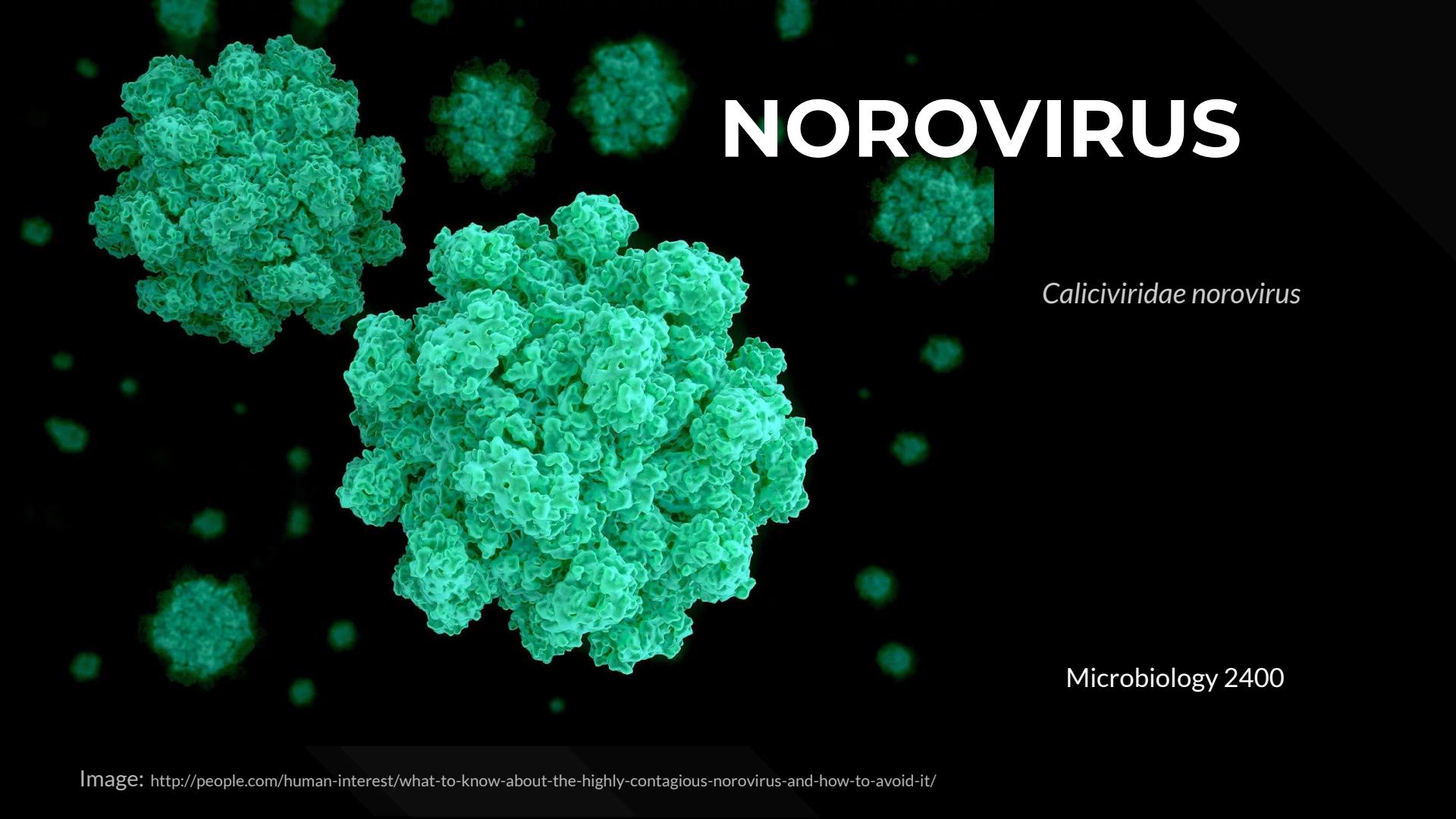


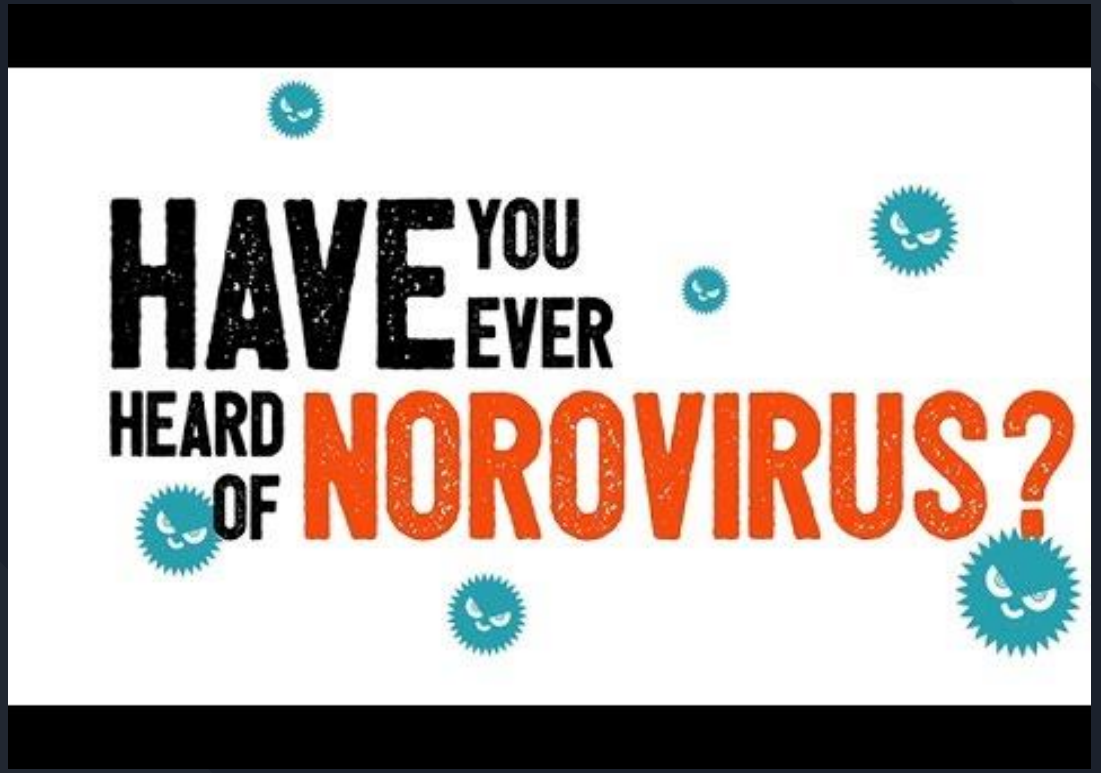
NOROVIRUS

Caliciviridae norovirus

Microbiology 2400

Image: http://people.com/human-interest/what-to-know-about-the-highly-contagious-norovirus-and-how-to-avoid-it/

Video!



https://www.youtube.com/watch?v=Ey_OV_-pBeo

History of Norovirus

- First reported at the causative agent of an outbreak in 1982.
- Affected over 1500 people in a small community in Georgia. Highest rates of infection occurred in geographical areas closest to the points that interconnected the industrial and municipal water systems. The industrial water contained coliform contamination.
- The evidence of norovirus was confirmed by the antibody titers to Norwalk virus in patient serum.
- Outbreaks have been linked to potable water sources at camps, municipal water systems, commercial ice consumptions and recreational water exposure during rafting and swimming.
- Oysters and other shell-fish often represent the link between environmental water contamination and foodborne outbreaks. Mollusks are thought to concentrate the viruses and other microbes.
- Viral concentrations within water systems have been documented to peak during winter months.

COMMON AREAS WHERE NOROVIRUS THRIVES

- Military
- Hospitals
- Cruise ships
- University dorms
- Retirement centres
- daycares

Clinical features of Norovirus

Asymptomatic person excretes the Norovirus through fecal matter. The implications is that transmission of Norovirus can happen without any indication of infection.

Symptomatic incubation period is 1.2 days (median) and 2 days for infection illness.

Signs & symptoms : vomiting, diarrhea, abdominal pain and low-grade fever. Nausea may also occur.

Complications: the illness may be more severe & prolonged in individuals with medical comorbidities. Newborns (risk for necrotizing enterocolitis), children and the elderly are at risk for fatality outcome.

Treatment: no specific medicine is available to treat people with norovirus illness.

Contamination

By eating food or drinking liquids that are contaminated with norovirus, touching surfaces or objects contaminated with norovirus then putting your fingers in your mouth, or having contact with someone who is infected with norovirus (for example, caring for or sharing food or eating utensils with someone with norovirus illness).

Fecal-oral route is most common, also airborne & vehicle transmission

risk of getting sick from oysters from contaminated water

Norovirus is a highly contagious virus.

Different types of noroviruses
The virus can stay in your stool for 2 weeks or more *after* you feel better.

most contagious is when person is sick with norovirus illness, and during the first few *days after* you recover from norovirus illness.

Management of Norovirus

- Treatment for the infected primarily involves the reversal of dehydration and electrolyte imbalance caused by diarrhea.
- Medical aid should be sought by patients with persistent and prolonged symptoms.
- Outbreaks of Norovirus are difficult to control due to contamination of surrounding surfaces from projectile vomit and fecally-contaminated surfaces.
- Prevention and control are especially difficult when individuals aren't socially competent. (I.E. the elderly in a nursing home).
- Proper hygiene and handwashing are the most important way to reduce transmission when managing an outbreak.
- Important for individuals to understand the risk of contaminated food, water and environment when in contact with infected individuals.
- Separation of infected individuals and patients who've come into contact of them is highly recommended due to how highly infectious Norovirus is.

Public health importance of norovirus:

- **Limited awareness** and public profile, despite high incidence rate, suggests that public health professionals should take an active role in health protection and **health education** surrounding norovirus (Bartsch al., 2016).
- Highly dependent on **environmental factors** such as clean water sources
- Children and elderly are most vulnerable to recurrent infections, highlighting the importance of **protecting these vulnerable populations**

Pathogenicity Virulence

- Norovirus is heavily capable of causing disease and has even been described as "the perfect human pathogen" (Hall, 2012).
- Factors that contribute to its virulence include its low infectious dose (only 10-100 particles needed), it's constantly evolving nature, it's large amounts of viral shedding and its environmental stability (able to survive heat and freezing temperatures)

The incredible viral diversity of norovirus:

Norovirus has been called a shape-shifter because its immense genetic diversity

Near-constant evolution in response to the human immune system

Has at least 6 genogroups and well over 40 genotypes

norovirus outbreaks

Cold is #1
Norovirus #2

Happen from November to April and you can get norovirus more than once

Can be both epidemic and sporadic

Canada: 300 - 400 cases per year

Prevention

- proper handwashing
- hand sanitizers
- wash fruits / veg
- when sick do not prepare food, even after 2 days symptoms go
- clean & disinfect surfaces - use bleach
- Use disposable towel wipes
- Remain at home if sick
- Clean surrounding areas of toilet as vomit and feces are contagious

Vaccinations

- No current long-term vaccinations to prevent Norovirus infections. (relates to viral evolution of the norovirus; similar to Influenza virus).
- Possible short-term vaccinations with use of bivalent GI.1/GII.4-derived VLP vaccine (from Intramuscular inoculation from chimpanzees in relation to Norwalk virus), through Oral and Intranasal vaccine methods.
- Bivalent GI.1/GII.4-derived VLP vaccine with MLA and alum are tested to healthy humans. Result shows that there are no decrease to cases of Norovirus, when using the vaccine. While, there are only a few participants who has side effects from using the vaccine.

Surveillance

Many countries have their own monitoring systems which includes collection information on the sequencing of the virus and monitoring outbreaks.

The National Institute for Public Health and the Environment of the Netherlands (RIVM) is in charge of a multinational molecular epidemiological surveillance effort called NoroNet. NoroNet is an informal network of university and public health scientists which maintains a database of outbreaks.

The Center for Disease Control & Prevention has National Outbreak Reporting System (NORS) and CaliciNet, both are used for surveillance within the US.

Public Health Agency of Canada has National Enteric Surveillance Program (NESP), which provides analysis and reporting of laboratory confirmed enteric disease cases in Canada.

Immunology

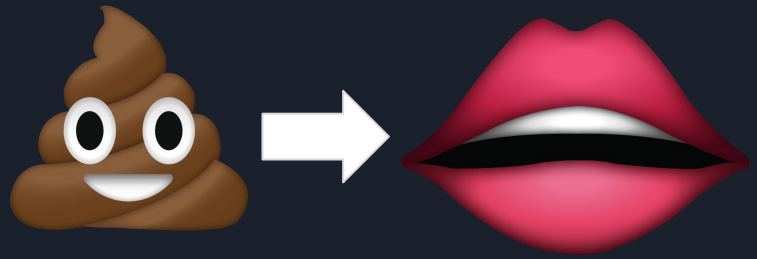
- Over 40 different strains of Norovirus, and are divided into 5 genogroups based on sequence similarity. (GI and GII are important for human infection, with GII-4 accounting for 70-80% of norovirus infections world wide)
- Research has been hindered due to a lack of small-animal models and reliable cell culture systems.
- Conflicting findings regarding immunity (Short term vs long-term immunity)
- Mutation resulting in different receptor binding and antigenic features creates challenges for immunity and vaccine prototypes

Immunology

- Studies examining seroprevalence to GI and GII have reported that at least 50% of of children 5 and under have been exposed to norovirus. 60-90% at the age of 10 years and 100% for adults, indicating that nearly all adults have been exposed to one or more strains of norovirus.
- Differences in susceptibility to norovirus has been linked to differences in genes.

NOROVIRUS SUMMARY

Very contagious



Fecal-oral route is the most common transmission

Symptoms include vomiting, diarrhea, and fever.

Prevention

Bleach surfaces

References

Atherton, S., Tjoelker, R., & Barker, T. (2007). Norovirus outbreak management applied to pandemic influenza planning. *AJIC: American Journal of Infection Control*, *35*(5), E45-E45. doi:10.1016/j.ajic.2007.04.040

Bartsch, S. M., Lopman, B. A., Ozawa, S., Hall, A. J., & Lee, B. Y. (2016). Global economic burden of norovirus gastroenteritis. *PloS One*, *11*(4), e0151219. doi:10.1371/journal.pone.0151219

Centers for Disease Control and Prevention. (2016). Norovirus. Retrieved from: https://www.cdc.gov/norovirus/index.html

Centers for Disease Control and Prevention. (2016). Frequently asked questions about CaliciNet. Retrieved from: https://www.cdc.gov/norovirus/reporting/calicinet/faq.html

Centers for Disease Control and Prevention. (2016). National Outbreak Reporting System (NORS). Retrieved from: https://www.cdc.gov/nors/

European Centre for Disease Prevention and Control. (2017). Norovirus infection. Retrieved from: https://ecdc.europa.eu/en/norovirus-infection

References continued

Hall, A. J. (2012). Noroviruses: The Perfect Human Pathogens? *The Journal of Infectious Diseases*, *205*(11), 1622–1624. http://doi.org/10.1093/infdis/jis251

Korte, S., Pettke, A., Kossow, A., Mellmann, A., Willems, S., & Kipp, F. (2016). Norovirus outbreak management: how much cohorting is necessary?. *Journal of Hospital Infection*, doi: 10.1016/j.jhin.2015.10.014

Public Health Agency of Health. (2014). Norovirus Fact sheet. Retrieved from: http://www.phac-aspc.gc.ca/fs-sa/fs-fi/norovirus-eng.php

Public Health Agency of Canada. (2015). National Enteric Surveillance Program (NESP). Retrieved from: https://www.nml-lnm.gc.ca/NESP-PNSME/index-eng.htm

Robilotti E, Deresinski S, Pinsky BA. 2015. Norovirus. *Clinical Microbiology Review*, *28*. 134 –164. doi:10.1128/CMR.00075-14. Retrieved from: http://cmr.asm.org/content/28/1/134

Gould, D. (2009). Management of norovirus gastroenteritis in the community. *British Journal of Community Nursing*, *14*(3), 117-121. doi:10.12968/bjcn.2009.14.3.40094

The next few slides will present a variety of case scenarios that will test your knowledge of norovirus!

Your loved one is excited to finally be up and moving again after being sickened with norovirus. They have not had any symptoms for around two days now and excitedly make dinner to celebrate. Should you have dinner with them?

A. Yes, norovirus is no longer contagious after 24 hours of symptoms fading
B. No, norovirus could still be infective at this stage

A physician diagnoses a patient with norovirus. The patient says “that can’t be right, I already got norovirus once this year”. Is the patient right?

A. Yes, an individual can only catch norovirus once per season.
B. No, due to it’s genetic diversity, norovirus can occur more than once

A child is taken to a pediatrician with a high-grade fever, vomiting, nausea and diarrhea. *Should they be diagnosed with norovirus?*

Explain.

Questions