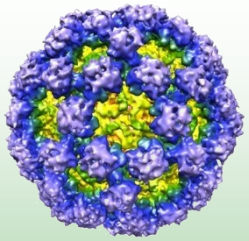
CREM Co Labs
For a Safer Tomorrow

CREM CO'S PRIMERS ON PATHOGENS

Issue #1, Jan 2018

Noroviruses – tiny yet powerful and unique pathogens!

In relation to other viruses, human noroviruses (HNV) are small (~27 nm), but they pack a powerful pathogenic punch! Globally, they sicken nearly 300 million people every year with acute gastroenteritis (diarrhea and vomiting), and kill approximately 200,000, mainly from severe dehydration. Each episode of watery diarrhea, among the hallmarks of norovirus infection, contains an estimated 5 billion infectious units per gram of feces with the potential to cause widespread environmental contamination. Projectile vomiting, with its own virus load, makes matters even worse. HNV are environmentally-stable and relatively resistant to disinfection, making them a formidable challenge for infection prevention and control. In fact, with the successful vaccination of children against rotaviruses (another common cause of acute diarrhea), the relative importance of HNV is increasing. Taken together, the following attributes make HNV stand out among human pathogens:



Computer graphic of a norovirus particle (NIH)

1. HNV are the most common cause of acute non-bacterial gastroenteritis.
2. HNV are able to spread via contaminated water, food, hands, fomites and air.
3. The incubation period of HNV is just 12-15 hours, the shortest known for an infectious agent.
4. A minimal infective dose of just 15-18 infective units is required.
5. HNV can cause sporadic cases as well as localized outbreaks, epidemics, and even pandemics.
6. Outbreaks of HNV in hospitals and nursing homes can lead to closure of entire institutions.
7. Closed communities such as cruise ships often fall victim to devastating and costly HNV outbreaks.
8. HNV have worldwide distribution with no specific target age.
9 HNV have no well-defined seasonality.
10 HNV are highly contagious, with a secondary attack rate greater than 55%.
11. No long-term immunity is conferred after HNV infection, and the risk of reinfection is high.
12. No vaccination is available to prevent HNV.
13. No specific chemotherapy is available for HNV, but timely rehydration can be life-saving.
14. Periodic genetic changes evolve new HNV strains (reminiscent of influenza viruses!).

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Even though HNV are among the most common pathogens, they remain difficult to culture in the laboratory, seriously impeding the development of vaccines and chemotherapy. The mouse norovirus, which can be successfully cultured in the laboratory, is often used as a surrogate for HNV in assessing disinfectants and hand hygiene agents.

Although the vast majority of the infections caused by HNV are self-limiting and devoid of any long-term sequelae, the sheer numbers of cases they cause represent a huge burden on our healthcare system. Globally, HNV are estimated to cost $4.2 billion USD in direct health system costs each year, and an additional $60.3 billion in societal costs. These sobering numbers point to the need for better infection prevention and control in the absence of safe and effective vaccines.

HNV exert an oversized influence on humanity. It is important to note that these relatively small and structurally-simple pathogens are comparably more impactful on our health than the combined influence of many higher-profile microbes.

Electron micrograph of norovirus particles (NIH)

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Further reading

Bartsch SM et al. (2016). Global economic burden of norovirus gastroenteritis. PLoS ONE 11(4): e0151219. https://doi.org/10.1371/journal.pone.0151219.

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Leone CM et al. (2016). Presence of human noroviruses on bathroom surfaces: a review of the literature. Int J Environ Health Res. Aug;26(4):420-32. doi: 10.1080/09603123.2015.1135312.

Lopman BA et al. (2016). The vast and varied global burden of norovirus: Prospects for prevention and control. PLoS Med. 2016 Apr 26;13(4):e1001999. doi: 10.1371/journal.pmed.1001999.

Robilotti E et al. (2015). Norovirus. Clin Microbiol Rev. Jan;28(1):134-64. doi: 10.1128/CMR.00075-14.

Sattar SA et al. (2011). *In vivo* comparison of two human norovirus surrogates for testing ethanol-based handrubs: The mouse chasing the cat! PLoS One Feb 24;6(2):e17340. doi: 10.1371/journal.pone.0017340.

CREM Co Labs is a contract and R&D laboratory uniquely positioned to provide value to the infection prevention and control (IPAC) industry as well as those working in health-related environmental microbiology and molecular biology. For further information please visit us on the web at www.cremco.ca