

## The inexorable progress of norovirus

Perhaps because of its proclivity to cause outbreaks of explosive vomiting and diarrhoea that can sweep through closed and semiclosed communities (eg, hospital wards, schools, and cruise ships), norovirus is an infectious disease that attracts popular attention. Norovirus outbreaks can occur worldwide and all year round, although cases usually peak during the winter months, hence the name winter vomiting disease given to the illness caused by the virus. At the beginning of January, van Beek and colleagues warned of a worldwide increase in norovirus cases compared with previous seasons. In the UK, the Health Protection Agency reported more than 4000 laboratory-confirmed cases in the second half of 2012, a 63% increase over 2011, which, given that most cases are not reported, indicates about 1.2 million total cases. What makes this virus such a successful human pathogen, and what can be done to limit its spread?

Discovered in 1972, the name norovirus is derived from the town of Norwalk, OH, USA, from where the virus was first isolated after a 1968 school outbreak of gastroenteritis. Noroviruses are positive-sense, single-strand RNA viruses of the Caliciviridae family. The genus norovirus contains one species, called Norwalk virus. The viral genome has a high mutation rate, which means that—in a similar way to the influenza virus—noroviruses frequently evolve into new forms that may not be recognised by the human immune system. Indeed, van Beek and colleagues suggest that the current upsurge in norovirus cases is associated with emergence of a new variant of viral genogroup II, genotype 4 (GII.4). This strain, named Sydney 2012, was first reported from Australia in March 2012. New strains of GI.4 have emerged every 2–3 years since the mid 1990s and been linked to increased norovirus activity.

The mutability of the norovirus genome is one factor that helps make it the most common cause of viral gastroenteritis. The virus is also highly contagious, with fewer than 20 viral particles sufficient to cause infection. Transmission is via ingestion of contaminated food or water, contact with an infected person, or via aerosolisation and subsequent contact with contaminated surfaces. The virus is robust enough to survive for days on surfaces and for months in water.

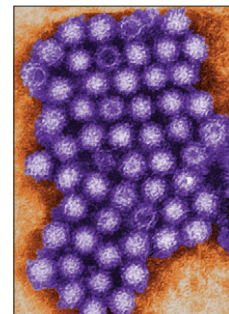
In addition to vomiting and diarrhoea, which cause the shedding of prodigious quantities of virus, symptoms

include abdominal pain, headache, fever, chills, and myalgia. Fortunately, illness seldom lasts for more than a day or two, and fatalities are rare and only likely if dehydration is not managed properly. For example, among more than 20 million norovirus cases estimated per year in the USA, there are about 56 000 hospital admissions and 571 deaths. Thus, moderate virulence, ensuring a large pool of hosts, is another factor aiding the success of norovirus. However, fatal outcomes can occur among young children, elderly individuals, and immunocompromised people. In developing countries, where access to rehydration may be difficult, norovirus is estimated to kill 200 000 children less than 5 years old every year.

There is no specific treatment for norovirus gastroenteritis. Research on possible treatments is not helped by the fact that the virus cannot yet be grown in cell culture. Management should focus on maintaining fluid and electrolyte balance. Results of a volunteer challenge trial of a vaccine against norovirus, developed by Ligocyte Pharmaceuticals, were reported in 2011. Vaccination significantly reduced the frequency of norovirus gastroenteritis from 69% in placebo recipients to 37% in vaccine recipients. Because human immunity against norovirus seems not to be longlasting, and because of antigenic drift, it is likely that in routine practice frequent revaccination with formulations reflecting the prevalent viral strains would be necessary.

Sound sanitary practices are the only protection against norovirus. UK and US guidelines recommend rapid cleaning up of vomit and surrounding areas, cleaning of hard surfaces with detergent followed by a bleach solution, and washing of soft furnishings and fabrics as recommended by the manufacturer. Infected people should be isolated and avoid visiting health-care facilities if at all possible. Hand hygiene is key. Hands should be washed with soap and running water for at least 20 s. The efficacy of alcohol-based hand sanitisers is controversial, but they may be useful between handwashing.

Arguably among the best adapted of human pathogens, although vaccination may one day have a role in slowing the march of norovirus, there is as yet no substitute for the basics of forewarning from epidemiological surveillance and diligent infection control. ■ *The Lancet Infectious Diseases*



CDC/Charles D. Humphrey

For van Beek and colleagues' paper see *Euro Surveill* 2013; **18**: pii20345

For estimate of norovirus cases in the USA see [http://wwwnc.cdc.gov/eid/article/17/1/P1-1101\\_article.htm](http://wwwnc.cdc.gov/eid/article/17/1/P1-1101_article.htm)

For norovirus vaccine trial see *N Engl J Med* 2011; **365**: 2178–87

For HPA guidelines see [http://www.hpa.org.uk/webc/HPAwebFile/HPAweb\\_C/1317131639453](http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317131639453)

For CDC guidelines see <http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6003a1.htm?z>