

INFECTION

Childhood gastroenteritis—the rise of norovirus

Norovirus has become the leading cause of acute gastroenteritis in children who need medical attention in the USA, accounting for nearly 1 million medical visits per year and ~US\$273 million in health-care costs. “Norovirus is now the most frequent and costly cause of acute gastroenteritis among US children <5 years of age who require medical care,” says Daniel Payne from the Centers for Disease Control and Prevention, USA.

Historically, the majority of cases of acute gastroenteritis in young children worldwide were caused by infection with rotavirus; norovirus was typically viewed as the second aetiological agent and a major cause of gastroenteritis in adults. In 2009, the WHO recommended that routine rotavirus vaccination be included in all national immunization programmes (*WHO*, 5 June 2009). By the end of 2011, 31 countries had introduced rotavirus vaccination (*WHO*, Global Immunization data, October 2012), one of which was the USA, and it seems that the consequent reduction in rotavirus infection has revealed the substantial burden of norovirus-associated gastroenteritis.

In their new study, Payne *et al.* provide epidemiological evidence to support their previous suspicion that successful rotavirus vaccination programmes would dramatically highlight the incidence of norovirus infection. Taking advantage of the New Vaccine Surveillance Network, the researchers conducted active surveillance of laboratory-confirmed cases of norovirus in children <5 years of age with acute gastroenteritis in hospitals, emergency departments and outpatient clinics in 2009 and 2010. Faecal samples were collected and tested for both norovirus and rotavirus. Medical and hospital-billing records were also assessed. As a comparison, the same parameters were monitored in healthy children during well-child visits.

Norovirus was detected in 21% of young children receiving medical attention for acute gastroenteritis in 2009 and 2010;

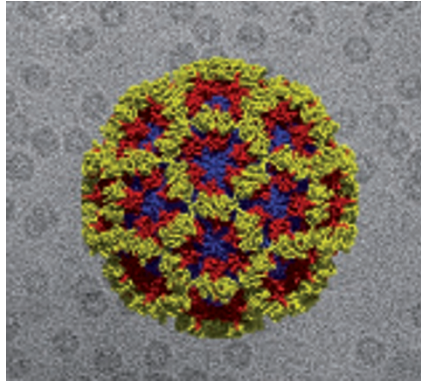


Image of norovirus structure courtesy of B. V. V. Prasad, M. K. Estes and R. L. Atmar.

rotavirus was detected in only 12% of children with acute gastroenteritis. Nearly half (47%) of all medical visits owing to norovirus were among young infants aged 6–18 months. Taking into account the average number of hospitalizations, emergency department visits and outpatient visits because of norovirus infection (exceeding 14,000, 281,000 and 627,000, respectively), the researchers estimated that treatments costs for norovirus-associated gastroenteritis in children alone in the USA amounted to >\$273 million each year.

Norovirus infection—also known as winter vomiting disease—was observed during every month of the 2-year study, although peak incidence did occur in the winter months. Interestingly, the disease burden of norovirus was consistent across 2009 and 2010 despite changes in the predominant strain from GII.4 Minerva in 2009 to GII.4 New Orleans in 2010.

“Our study estimates that by a child’s fifth birthday, 1 in 278 US children will be hospitalized for norovirus illness, 1 in 14 will visit an emergency room and 1 in 6 will receive outpatient care,” notes Payne. Another facet of these new findings is that they highlight the success of rotavirus vaccination in decreasing the burden of rotavirus-associated disease. Clearly, norovirus infection has now become the primary cause of acute gastroenteritis in children as a result. The question now is

how can norovirus infection be brought under control?

Clinical trials of norovirus vaccines in adults are already underway, remarks Robert Atmar from Baylor College of Medicine, USA, who was not involved in the study. “As vaccine candidates are shown to be safe and effective in adults, evaluation should proceed into paediatric populations,” he says. “Another research approach to control norovirus disease burden is the development of antivirals for treatment or prevention,” Atmar adds, “but a significant barrier in norovirus antiviral drug development has been our inability to propagate human noroviruses *in vitro*”.

Payne notes another approach to infection control whilst results from current clinical trials of norovirus vaccines are awaited. “Specific interventions are needed to protect against norovirus illness, especially among young children and the elderly,” he says, “but currently, the best ways to reduce the risk of norovirus infection are proper handwashing and good hygiene”.

Outbreaks of norovirus have been in the news worldwide in recent months; more than 1 million people in the UK alone were estimated to be infected with norovirus this past winter. Of note, the UK Department of Health (*BBC News*, 10 November 2012) is to implement a widespread vaccination programme against rotavirus, which is planned to begin in September 2013, and it will be interesting to see whether the US trends in norovirus infection will be repeated in the UK and other countries that implement routine rotavirus vaccination.

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Original article Payne, D. C. *et al.* Norovirus and medically attended gastroenteritis in U.S. children. *N. Engl. J. Med.* 368, 1121–1130 (2013)

Further reading David, R. Norovirus strikes back. *Nat. Rev. Microbiol.* 11, 70 (2013) | Donaldson, E. F. *et al.* Viral shape-shifting: norovirus evasion of the human immune system. *Nat. Rev. Microbiol.* 8, 231–241 (2010)