

Diagnosis of norovirus infection: every minute counts

Noroviruses are recognised as the most common cause of outbreaks of acute gastroenteritis. In addition to morbidity and mortality in patients, the financial impact on healthcare settings is heavy; for example, the costs associated with a recent outbreak in a tertiary care hospital were estimated to be nearly €550 000. Rapid diagnosis can reduce the socio-economic burden on healthcare systems.

by Dr F. Apostel

In 2001, it was estimated that infectious diseases accounted for an estimated 26% of total deaths worldwide [1]. Approximately 1400 species of infectious organisms are known to be pathogenic to humans, and 12% of these are associated with diseases that are considered to be emerging [2]. Emerging pathogens are not a new phenomenon — they have always played an important role in human history. Nowadays, such diseases are associated not only with increased mortality, but also with increased lengths of hospital stay and the inevitable corresponding increase in healthcare costs. As for symptoms, many of the emerging infection diseases give rise to gastroenteritis in one form or another. Acute gastroenteritis is a common cause of morbidity and mortality worldwide. Conservative estimates put diarrhoea among the top five causes of mortality worldwide, with most cases occurring in young children in non-industrialised countries. It should, however be noted that in these countries, diarrhoeal diseases do not just affect the young; they are also a significant cause of morbidity across all age groups. Aetiological agents include bacteria, viruses, parasites, toxins and drugs [3].

Epidemic and sporadic gastroenteritis is an important public health problem in both high income and low income countries. In the last 30 years, several viruses have been identified as aetiological agents of gastroenteritis in humans. Outbreaks of gastroenteritis may be

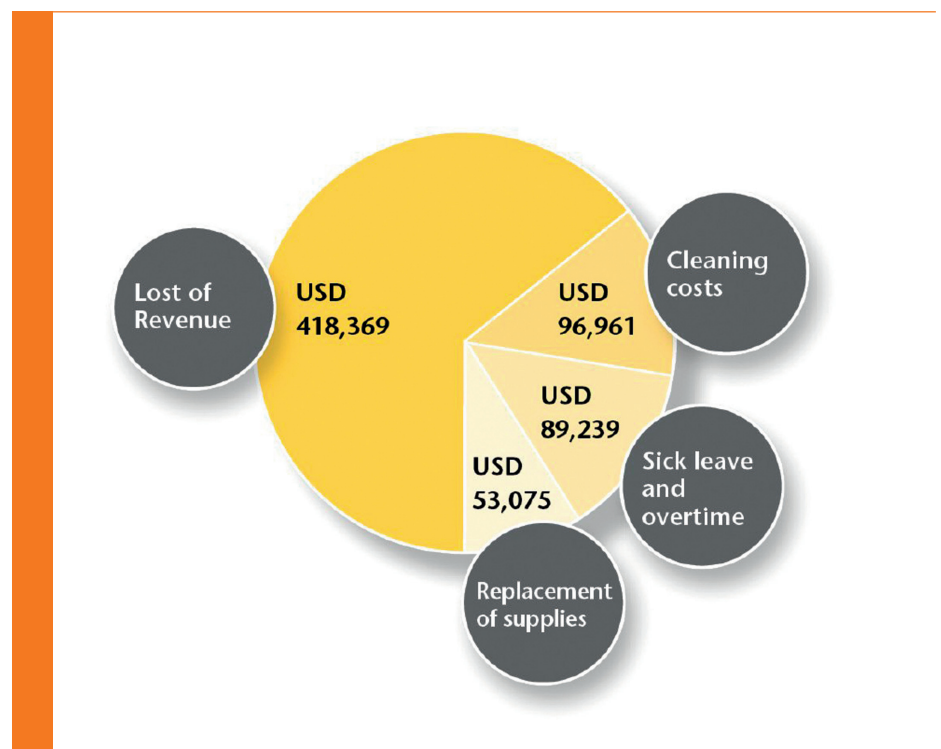


Figure 1. Cost analysis of a typical norovirus outbreak in a 1,000-bed U.S. hospital.

caused by rotaviruses, astroviruses, adenoviruses and also noroviruses (NoVs) and sapoviruses. These two latter are genetically and antigenically diverse single-stranded RNA viruses belonging to the family Caliciviridae and are collectively referred to as human caliciviruses. Norovirus causes illness in people of all age groups, whereas Sapovirus predominantly causes illness in children. Epidemic viral gastroenteritis or “winter vomiting disease” was described as early as 1929, but it took over 40 years until the discovery, using immune electron microscopy, of the Norwalk virus in faecal samples. Norwalk virus was so-called simply

because the specimens tested were collected during an outbreak of acute gastroenteritis that occurred in 1968 in an elementary school in Norwalk, Ohio, USA.

Noroviruses are enterically transmitted and are a frequent cause of acute gastroenteritis. The detection of Norovirus is of particular concern due to a rapid increase in its prevalence in both Europe and the United States. A rapid diagnostic strategy combined with appropriate infection control measures can help to significantly reduce the costs, outbreak duration and number of infected people.

Europe: an increase in reported number of Norovirus outbreaks

Since the summer of 2006, several EU countries have reported an increase in the reported number of outbreaks or confirmed cases of Norovirus. In many countries, the outbreaks have occurred in hospitals and other public settings. Two novel strains of the GII-4 Norovirus cluster appear to be disseminating across Europe, according to the European Centre for Disease Prevention and Control. The Robert Koch Institut in Berlin, Germany reported 48 deaths caused by infections with Norovirus in 2007.

Outbreak cost analysis

Recent studies on the socio-economic burden of outbreaks have analysed the costs in the healthcare system. For example, a recent study described a Norovirus outbreak and its control in a tertiary care hospital in the U.S.

[4]. This study determined the cost of the outbreak, including the estimated lost revenue associated with unit closures, sick leave and cleaning expenses. Based on these criteria, the total estimate of the economic impact of this outbreak for the hospital was estimated to be the equivalent to €550 000 [4], [Figure 1].

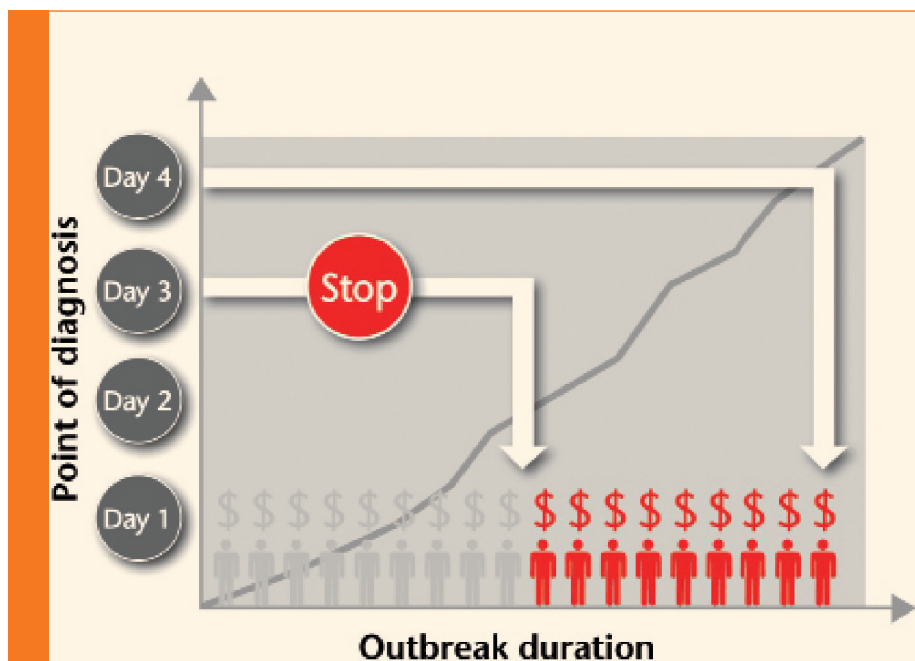


Figure 2. Impact of point of diagnosis and duration of outbreak. If the diagnosis can be made at day 3 rather than day 4, the overall length of the outbreak can be reduced by as much as 9 days.

United States: more than 1,000 acute gastroenteritis outbreaks

Norovirus affects 23 million people annually in the United States. The Centers for Disease Control and Prevention (CDC), which obtain information from health departments from all over the United States, reported a total of 1,316 acute gastroenteritis outbreaks with onsets during the period October-December 2006; 50% of these occurred in long-term-care facilities. Each simple outbreak can of course involve tens or hundreds of individual patient.

Timely clinical testing

The most useful measures to reduce both mortality/morbidity and costs are early diagnosis followed by appropriate hygiene-related interventions. For example, it was demonstrated that diagnosis within three days instead of four days of the first case reduces the duration of the outbreak by seven days [5], [Figure 2].

Rapid diagnostics

One increasingly useful method for the determination of the causative agent of the outbreak is the use of rapid assays, which are quick and easy to perform [Figure 3].

Sensitive and specific results can be read visually in less than 20 minutes. The results facilitate timely diagnosis and control of acute gastroenteritis outbreaks. These near-patient tests, which do not require special laboratory equipment, are designed for microbiology laboratories, nursing homes and even for cruise ship operators [6].

Summary

A fundamental question remains to be addressed: are Noroviruses “emerging” pathogens? To answer this question, one must apply the definition of an “emerging disease”, which, according to the World Health Organisation, is “one that has appeared in a population for the first time, or that may have existed previously but is rapidly increasing in incidence or geographic range.” Both the reported incidence and geographic range of Norovirus infection has increased in the last two years, but better detection with the use of improved diagnostics has led to a higher number of reported Norovirus cases. However new Norovirus strains *are* emerging worldwide. The question can thus be answered in the affirmative: Noroviruses are “emerging” pathogens. Timely clinical testing as close as possible to the patient, however, is a great help in reducing the number of infected people as well as the overall costs to healthcare systems.

References

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