

AN OUTBREAK OF VIRAL GASTROENTERITIS LINKED TO MUNICIPAL WATER SUPPLY, LOMBARDY, ITALY, JUNE 2009

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We report an outbreak of viral gastroenteritis linked to municipal drinking water in a town in northern Italy in June 2009. Over one month we identified 299 probable cases of whom 30 were confirmed for at least one of the following viruses: norovirus, rotavirus, enterovirus or astrovirus. Water samples and filters from the water system also tested positive for norovirus and enterovirus. Control measures included treating the water system with chlorine dioxide and filters with peracetic acid, while providing temporary alternative sources of drinking water to the population.

Introduction

On 9 June 2009, a general practitioner from the municipality of San Felice del Benaco notified to the local health authority of Brescia (Lombardy region, north Italy) 21 cases of gastroenteritis among guests of a hotel. Patients presented with vomiting, diarrhoea and fever. In the following days, there were also reports of cases among local residents. Located near the lake of Garda, San Felice del Benaco has 3,360 residents but is very touristic during the summer months. We investigated the outbreak in order to identify the source of infection and implement appropriate control measures.

Methods

We defined a probable outbreak case as a person who fell sick with vomiting or diarrhoea after 7 June 2009 and who stayed prior to disease onset in San Felice del Benaco. A confirmed outbreak case was defined as a person who fulfilled the criteria of a probable case and whose stool sample was laboratory-confirmed for at least one of the following viruses: norovirus, rotavirus, enterovirus or astrovirus. Probable cases who tested negative for the presence of virus in the stools were still considered as probable cases.

Active case finding was performed as follows: a public hotline was set up where people could call the health authority for information regarding the disease and report symptoms, date of onset and basic demographic data. In parallel, the outbreak investigation team collected daily information on case-patients presenting at the emergency unit of the local hospital and collected stool samples when possible.

The local and regional health authorities initiated an environmental investigation at the hotel on 9 June 2009, taking food samples from the kitchen, interviewing and collecting stool samples for microbiological testing from 20 probable cases (both guests and hotel staff). When it was clear that the outbreak was spreading to the larger community (apart from three campsites with their own private water supply, where no cases were reported), the environmental investigation was extended and included collection of water samples from the municipal water supply. Municipal water comes from the nearby lake. Before being distributed to the town as drinking water, it is treated with chlorine dioxide and hypochlorite and passes through sand filters. The investigators collected a total of 94 water samples from the lake at the location where the water is pumped, from filters and from public fountains. Samples were sent to the Lombardy and Emilia Romagna Experimental Zooprophyllactic Institute (IZSLER) to test for the presence of bacterial pathogens (*Salmonella* sp., *Shigella* sp., *Campylobacter* sp., *E. coli* O157, *Yersinia enterocolitica*, *Aeromonas* sp., *Clostridium perfringens* toxins), parasites (*Cryptosporidium* sp.) and viral pathogens (norovirus, rotavirus, enterovirus, astrovirus). Virological methods included negative staining electron microscopy, type A rotavirus ELISA and PCR methods for norovirus, rotavirus, enterovirus and astrovirus.

Results

A total of 299 persons fulfilled the outbreak case definition, including 269 probable and 30 confirmed cases. The epidemic curve in Figure 1 shows the probable and confirmed outbreak cases by date of onset. The outbreak occurred between 8 June and 4 July 2009 and peaked on the 15 and 16 June with 47 outbreak cases per day.

The attack rate for the town of San Felice del Benaco was 8.9% (299/3,360). Age group-specific attack rates ranged from 7% (50/713) in persons aged 65 years and older to 14% (34/242) in the age group 15-24 years (Figure 2). Four cases were hospitalised, all of them children.

There was no fatality. Stool samples obtained from 36 probable cases were examined at the laboratory. Of these, 17 (47.2%) tested

positive for norovirus, 19 (52.8%) for rotavirus, 12 (33.3%) for enterovirus and 4 (11.1%) for astrovirus. Eight cases had both norovirus and rotavirus in the stools and two cases tested positive for norovirus, rotavirus and enterovirus. The laboratory did not find any virus in six cases (but we still included them among probable outbreak cases because of compatible symptoms). *Salmonella* sp., *Clostridium perfringens* and *Campylobacter* sp. were found in samples from two, one and one cases, respectively.

The mean age of confirmed cases of rotavirus was 29 years (range: 0-71) compared to the mean age of 39 years (range: 0-88) for cases of norovirus and 39 years (9-88) for cases of enterovirus. The age distribution of confirmed cases is shown in Figure 3.

Food samples from the hotel tested negative for the presence of pathogens. On 16 June 2009, preliminary environmental investigation results showed abnormally high levels of *Clostridium perfringens* (4 UFC/100 ml) and *Aeromonas hydrophyla* (16 UFC/100 ml) in water samples from two public fountains. Tests on 44 water samples from from the municipal water system (water from fountains and filters) showed the presence of norovirus and enterovirus. Examination of the municipal water network revealed that: 1) the water company had undertaken work on the collection reservoir which might have limited the effect of chlorination; 2)

two filters were 10 years old (cleaned weekly but not disinfected); 3) the chlorine concentration in the water before it passed through the filters was 0.4 mg/l; in filtered water it was only 0.08 mg/l.

Control measures

On 17 June 2009, a special ordinance from the municipality restricted the use of municipal water (inhabitants were told not to use municipal water for drinking and cooking purposes) and provided alternative water supplies to the population via water tankers. Local authorities organised a door-to-door information campaign and distributed leaflets in order to reach as many people as possible. On 19 June 2009, the municipality started disinfecting the water system with chlorine dioxide (0.2 mg/l) and sand filters with peracetic acid. When the presence of norovirus in water and stools of cases was confirmed, the residual concentration of chlorine dioxide in terminal points of the network was increased to 3.4 mg/l for three consecutive days from 23 June 2009. Regular water sampling and testing was performed to monitor the efficiency of control measures. The ordinance on drinking water was maintained until all water quality tests complied with safety norms. Water samples collected after the first treatment with chlorine dioxide and peracetic acid all tested negative for the presence of norovirus.

FIGURE 1

Probable (n=269) and confirmed (n=30) cases of viral gastroenteritis, by date of onset of symptoms, San Felice del Benaco, Italy, 8 June 2009 - 4 July 2009

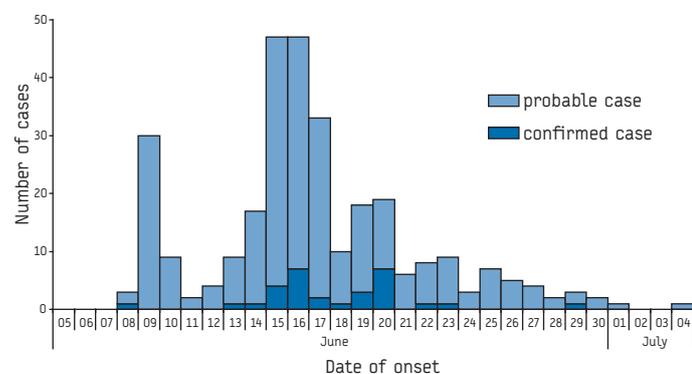
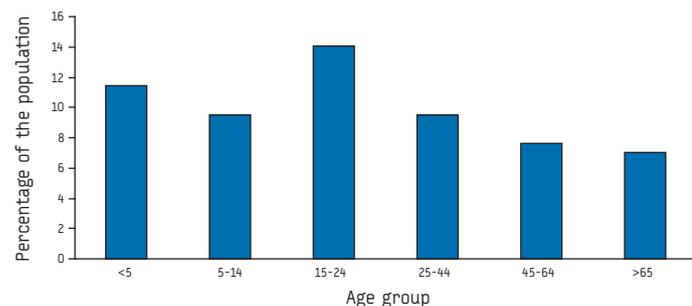


FIGURE 2

Attack rate of gastroenteritis per age group, outbreak in San Felice del Benaco, Italy, 8 June 2009 - 4 July 2009 (n=299 cases)



Source: Azienda Sanitaria Locale (ASL) Brescia, Italy

TABLE

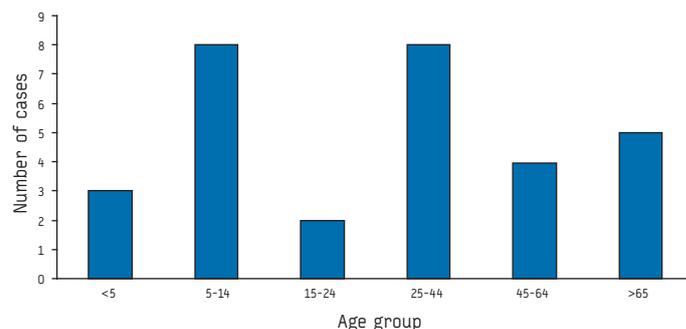
Pathogens found in stools samples of 36 cases of gastroenteritis, San Felice del Benaco, Italy, 8 June 2009 - 4 July 2009

| Pathogen | Number of patients with positive results (multiple infection possible) | Percentage (%) |
|--------------------------------|--|----------------|
| Rotavirus | 19 | 52.8 |
| Norovirus | 17 | 47.2 |
| Enterovirus | 12 | 33.3 |
| Astrovirus | 4 | 11.1 |
| <i>Salmonella</i> sp. | 2 | 5.6 |
| <i>Clostridium perfringens</i> | 1 | 2.8 |
| <i>Campylobacter</i> sp. | 1 | 2.8 |

Source: Lombardy and Emilia Romagna Experimental Zooprophyllactic Institute (IZSLER), Brescia, Italy

FIGURE 3

Age distribution of confirmed cases of viral gastroenteritis, San Felice del Benaco, Italy, 8 June 2009 - 4 July 2009 (n=30)



Source: Azienda Sanitaria Locale (ASL) Brescia, Italy

Conclusion and discussion

An outbreak of viral gastroenteritis has been microbiologically linked to a contaminated municipal water supply in a small town of Lombardy. Timely control measures and good compliance of the population following the information campaign prevented a much higher attack rate.

The alert came from a cluster of gastroenteritis in a hotel. The direction of the hotel promptly informed a general practitioner who notified the cluster to the public health authorities. An increase of gastroenteritis in the general population was noticed one day after the initial alert. The hotel is located along the lake, near the water reservoir, which could explain why the guests and its staff were among the first to be affected (see the first peak on the epidemic curve on 9 July 2009).

Although the number of residents in San Felice Del Benaco is 3,360, it is important to note that in the summer season many tourists stay in the town and the total population is multiplied by three. Therefore, the attack rates reported above (based on the resident population) are probably overestimates even though the surveillance system did not capture all cases. All age groups were affected. This is consistent with an exposure that is equally distributed across all ages. The relatively high mean age of confirmed rotavirus cases (29 years) is also consistent with an exposure that is not limited to young children.

The municipal water is taken from the lake at a place where the water is stagnant. So far, water samples from the lake tested negative for the presence of norovirus, rotavirus, enterovirus or astrovirus. However, we cannot exclude contamination of the lake due to over-capacity of the sewage system and/or illegal wastage.* In Italy, municipal water systems have been identified as the source of water-borne infections in several norovirus outbreaks (1, 2). It reminds us of the public health importance of well-maintained and monitored water supplies in our towns and cities (3).

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* Authors' correction

Upon the request of authors, one sentence was deleted from the discussion after the publication of the article. The correction was made on 3 August 2009.

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