Waterborne outbreak of acute gastroenteritis in a costal area in Slovenia in June and July 2008

B Kopilović[1], V Ucakar[2], N Koren[2], M Krek[1], Alenka Kraigher (alenka.kraigher@ivz-rs.si)[2]
1. Institute of Public Health Koper, Slovenia
2. Institute of Public Health of the Republic of Slovenia, Communicable Disease Centre

In June and July 2008, an outbreak of acute gastroenteritis with a total of at least 408 cases occurred in the municipality of Piran, Slovenia. The town has 17,400 inhabitants and is located in touristic area on the Slovenian Adriatic coast.

The first 20 cases were reported on 26 June to regional Institute of Public Health Koper (IPH Koper). Preliminary interviews indicated that the only common source of exposure was the local water distribution system in Piran which supplies all inhabitants of the town. IPH Koper informed the local water distribution company on the same day, and control measures for containing the outbreak were implemented immediately.

In June 2007, only 87 cases of acute gastroenteritis of infectious aetiology were notified to IPH Koper from the costal region of Koper with 142,000 inhabitants (including the municipality of Piran). In the whole year 2007, 1,321 cases were reported in this region (between 75 and 167 cases per month).

Methods

The following steps were taken in the course of the outbreak investigation:

Case finding and laboratory analysis of stool samples

According to the law on communicable diseases, all cases of acute gastroenteritis and outbreaks of communicable diseases in Slovenia need to be reported indicating the causative agent. All general practitioners and the regional hospital in the area were informed of the outbreak and encouraged to report all cases of acute gastroenteritis and to collect stool samples of cases. The samples were tested for gastrointestinal bacteria (*Salmonella, Shigella, Campylobacter, Escherichia coli, Yersinia*), viruses (rotavirus, adenovirus, norovirus) and parasites.

Risk assessment and analysis of drinking water

A risk assessment of the drinking water distribution system and laboratory testing of the water were systematically undertaken in affected area (Piran). Water samples were tested for *E. coli*, coliform bacteria, enterococci, *Clostridium perfringens*, and the total number of colonies at 22°C and 37°C.

Retrospective cohort study

A retrospective cohort study was conducted. Our aim was to estimate the magnitude of the event and to test the hypothesis that the drinking water from the distribution system was the source of infection.

The information was collected by questionnaires. Because the exact number of exposed people in Piran was impossible to determine with many visitors staying only for the day, the investigation targeted the 1,470 households in the area of Piran. Four questionnaires were posted to each household – 5,880 questionnaires altogether.

The questions covered demographic data, disease symptoms, and epidemiological data with an emphasis on exposure to drinking water from the water distribution system. A case was defined as any person that stayed in Piran on and after 19 June and developed one of the following symptoms: diarrhoea, vomiting, or abdominal pain. The collected data were analysed using EpiInfo 3.3.5 and SPSS 13.0 software.

Results

Case finding and laboratory analysis of stool samples

By 1 August 2008, 170 cases of acute gastroenteritis that could be connected with the outbreak had been reported by health services. All had developed symptoms between 25 June and 11 July 2008. Laboratory analysis of stool samples was conducted for 43 reported cases (25.3%). Twenty-six samples were negative and 17 were positive. The microbiological agents identified in the positive samples are shown in Table 1.

Table 1

Isolated microorganisms in stool samples of reported cases. Outbreak of acute gastroenteritis, Piran, Slovenia, June-July 2008 (n=43)

Isolated microorganisms	Number of stool samples tested positive	%
Adenovirus	1	2,3
Arcobacter cryaerophilus	1	2,3
Bacillus cereus, toxin+	1	2,3
Campylobacter fetus	1	2,3
Giardia lamblia	1	2,3
Rotavirus	1	2,3
Rotavirus, adenovirus, norovirus	1	2,3
Staphylococcus aureus, enterotoxin D+	1	2,3
Norovirus	2	4,7
Campylobacter jejuni	2	4,7
Staphylococcus aureus	2	4,7
Staphylococcus aureus, enterotoxin C+	3	7,0
Negative	26	60,5
Total	**43**	100,0

Risk assessment and analysis of drinking water

All water samples taken from the local distribution system in the area of Piran taken on 26 June showed faecal contamination. The values for all tested bacteria were above the recommended limits. It was assumed that the water had been contaminated in the night between 23 and 24 June when the water supply system in this area was connected to a newly built part of the system.

Measures were taken to clean up the water distribution system in the area: The degree of contamination was followed up daily, starting on 26 June. On 15 July, the two consecutive water samples were negative and the water was again suitable for drinking.

Retrospective cohort study

Until 1 August 2008 we received 624 completed questionnaires, of which 408 (65.4%) met the case definition. Characteristics of the cohort and the cases are shown in Table 2.

The epidemic curve (Figure 1) showed a clear peak in the number of cases with the onset of illness on 26 June 2008 and suggests a common source exposure. Onset of symptoms for 90% of cases was between 24 June and 3 July 2008. Their geographical distribution is shown in Figure 2.

Table 3 lists the symptoms reported by the cases. The mean duration of illness was 2.7 days (range 0–5 days). 130 cases

TABLE 2

Demographic characteristics of cohort and cases with attack rates (AR) and risk ratio (RR). Outbreak of acute gastroenteritis, Piran, Slovenia, June-July 2008

	All	Cases	AR (%)
All	624	408	65,4
Sex			
female	358	233	65,1
Male	266	175	65,8
Age group			
0-10	40	30	75,0
11-20	56	39	69,6
21-30	92	65	70,6
31-40	58	42	72,4
41-50	109	73	66,9
51-60	94	54	57,4
61-70	57	35	61,4
71-80	55	28	50,9
81-90	11	6	54,5
>90	3	2	66,6
Unknown	49	34	69,4

TABLE 3

Reported symptoms, outbreak of acute gastroenteritis, Piran, Slovenia, June-July 2008 (n=408)*

Symptoms	Number	%
Diarrhoea	380	93,1
Vomiting	205	50,2
Fever	188	46,1
Abdominal pain	347	85,0
Headache	168	41,2
Feeling ill	332	81,3
Nausea	262	64,2

* More than one answer possible

FIGURE 1

Date of onset of illness among cases. Outbreak of acute gastroenteritis, Piran, Slovenia, June-July 2008 (n=408)

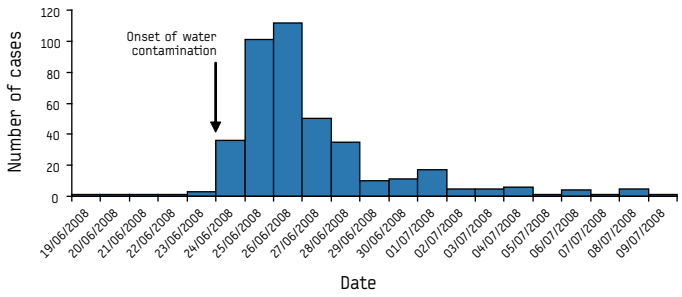

FIGURE 2

Map of affected area, outbreak of acute gastroenteritis, Piran, Slovenia, June-July 2008 (n=408)

(31.9%) sought medical advice, 16 cases (3.9%) were hospitalised, none died.

The data analysis showed that people who drank only water from the water distribution system after 23 June had a higher attack rate (76.4%) for developing disease in contrast to those who also drank water from other sources (attack rate 52.5%). Drinking bottled water was a protective factor.

Public health measures for containing the outbreak

From 26 June to 15 July, the following public health measures were in place in the affected areas of Piran:

- Inhabitants were advised not to drink water from local distribution system;
- Inhabitants were advised to use only boiled water for cooking and washing fruits and vegetables;
- Instructions for boiling of the water were distributed to each household;
- Uncontaminated drinking water (bottled water and water from water tanks) was distributed in the affected area with the help of the civil protection and the fire department. The water tanks were organised in the main square. Senior inhabitants had bottled water delivered to their homes.

Discussion and conclusions

The described outbreak of acute gastroenteritis in Piran started on 24 June and ended on 11 July 2008.

2% of cases from the retrospective cohort study reported onset of illness before 24 June. It is possible that part of these cases can be attributed to recall bias, as the study started only on 10 July 2008. Another part may be attributable to infection from a different source and to other medical conditions, as the case definition was quite broad.

The peak in the onset of illness on 26 June 2008 suggests a common source of exposure. The somewhat tailed distribution of the cases in the epidemic curve can be due to the following probable causes:

- Some of the isolated causative agents can be transmitted also through human to human contact (calicivirus, rotavirus, adenovirus);
- As seen also by other authors, there was a problem with informing the consumers about the contamination of the drinking water, and the information about how to boil the drinking water was not sufficiently adopted [1];
- Some of the isolated agents have a longer incubation period (Giardia lamblia) [2];
- Some of the cases could have been infected by a different source.

The number of cases identified in the retrospective cohort study was 2.4-fold higher than the number reported cases by physicians. We assume that many cases did not seek medical attention. In addition, there is a continuous problem of underreporting of communicable diseases by physicians in Slovenia in general. The response rate in the retrospective cohort study was very low. One reason could be that the questionnaires were sent to households, not to individuals, and the exact number of inhabitants of each household was not known. Another possible reason is that ill people are more likely to have responded than people that were not ill.

All known cases were local inhabitants. Because Piran is a well known summer holiday destination for foreign and Slovenian tourists, it is possible that the number of cases reported by the physicians and the number of cases identified through the retrospective cohort study (only inhabitants were included) underestimate the real extent of the outbreak.

According to the results of outbreak investigation, retrospective cohort study, and microbiological analysis of drinking water and stool samples, we conclude that the source of this outbreak was most probably contaminated drinking water from the local water distribution system. We assume that the water was contaminated in the night between 23 and 24 June when the water supply system in this area was disturbed due to the establishment of a new connection. Unauthorised interventions to the water supply system have been done by some inhabitants in the past, and it is likely that differences in pressures in the system appeared when the new system was connected, which resulted in a connection with the sewage system.

In the outbreak, different pathogens were isolated from stool samples of patients. This is common in outbreaks caused by contamination of drinking water by sewage water. Several similar outbreaks in the United States in 2003/2004 were caused by different pathogens [3].

Between 1997 and 2007, 20 waterborne outbreaks were notified in Slovenia, with between five and 181 cases reported in each outbreak. More than half of those outbreaks were caused by contamination of drinking water from water supply systems. In twelve outbreaks where the causative agent was identified, the following agents were isolated: astrovirus, calicivirus, *Cryptosporidium parvum*, *E. coli*, hepatitis A virus, rotavirus and *Shigella sonnei* [4].

References

1. Carrique-Mas JJ, Andersson Y, Hedlund KO, Petersén B. A waterborne outbreak of Norwalk-like virus in a winter holiday resort in Sweden. Euro Surveill. 2002;6(16):pii=2120. Available from: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=2120
2. Montesor A. Giardiasis. In: Heymann DL, editor. Control of Communicable Diseases Manual. 18th ed. Washington: American Public Health Association, 2004: 229-31.
3. Centers for Disease Control and Prevention. Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water — United States, 2003–2004 and Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Waterand Water not Intended for Drinking — United States, 2003–2004. Surveillance Summaries, December 22. MMWR 2006;55(No. SS-12).
4. Kraigher A, Grilc E, Blaško M, Klavs I, Kustec T, Kastelic Z, et al. Epidemiološko spremljanje nalezljivih bolezni v Sloveniji v letu 2006. Ljubljana: Inštitut za varovanje zdravja RS; 2007.

This article was published on 21 August 2008.

Citation style for this article: Kopilović B, Ucakar V, Koren N, Krek M, Kraigher A. Waterborne outbreak of acute gastroenteritis in a costal area in Slovenia in June and July 2008. Euro Surveill. 2008;13(34):pii=18957. Available online: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=18957