

AN OUTBREAK OF NORWALK-LIKE VIRUS GASTROENTERITIS IN AN AGED-CARE RESIDENTIAL HOSTEL

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Norwalk-like viruses are members of the calicivirus family, first discovered in 1972 following an outbreak of gastroenteritis in Norwalk, Ohio,¹ and more recently renamed Norovirus.² They are a common cause of outbreaks of gastroenteritis in institutions throughout the winter months. The faecal-oral route is the primary method of transmission; however, airborne spread from vomitus and fomites (objects or places where infection survives apart from the host's body) has also been reported.^{3,4} The infection typically presents with acute projectile vomiting, watery diarrhoea, and nausea. These symptoms usually resolve within 72 hours.⁵ High concentrations of Norwalk-like virus (NLV) are found in infected faeces and vomitus, and as only small amounts of virus are required to cause infection, this contributes to the ease of transmission.⁶

In September 2002, the Central Sydney Public Health Unit (CSPHU) investigated an outbreak of gastroenteritis caused by NLV in an aged-care residential hostel. A possible index (or source) case was identified and over a two-week period a total of 28 residents and five staff became ill. A case-control study was conducted, which demonstrated a significant relationship between experiencing gastroenteritis and exposure to the two floors of the facility where the index case had been ill (OR=3.6; P=0.01). This article describes the investigation and the epidemiological characteristics of the outbreak, its management, and the potential role of fomites in the transmission of NLV.

BACKGROUND

The CSPHU was notified of 16 residents from an aged-care hostel who all commenced diarrhoea and vomiting within a period of 11 hours. The hostel has 66-rooms spread over four levels. A separate nursing home is located in an adjacent building. There was no recent history of a special event or excursion outside of the hostel to explain the illness; however,

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there was a possible index case, a resident had become unwell with projectile vomiting and diarrhoea three days previously. Given the acute nature of the events, and the number of residents involved, the CSPHU conducted an investigation to: determine a potential source of the outbreak; identify a causative organism; and identify factors increasing the risk of transmission.

METHODS

The CSPHU conducted a case-control study to ascertain if there was an association between the illness and any particular food or environmental factor. Cases were defined as individuals who developed vomiting or diarrhoea and one other symptom (such as nausea, abdominal cramps, or fever) within 10 days of the index case. The control population were the remaining residents and staff of the hostel who had no symptoms. Using a questionnaire based on the daily menus, the CSPHU was able to determine the history of the illness and the food eaten by residents. Questions covered demographic information, onset and duration of illness, and symptoms, as well as food eaten over the four days preceding the outbreak. An attempt was made to interview all cases in the hostel and all other residents and staff in the control population; however, this objective was limited by the cognitive capabilities of some residents.

For all hostel residents, the location of their bedrooms was noted on a floor plan and their seating position in the

dining room was recorded. A diagram of the dining room was constructed and the site where the index case had vomited, and the seating positions of other cases, was mapped.

Analysis was performed using Epi-Info version 6.04.7. Attack (or infection) rates were calculated for menu items eaten and for those residents seated adjacent to the vomiting site. Crude odds ratios were used to estimate risk of illness for individual menu items, dining room seating position in relation to the site where the index case had vomited, and the floor plan of the residence. Statistical significance was calculated using two-tailed chi-squared tests.

Food and environment

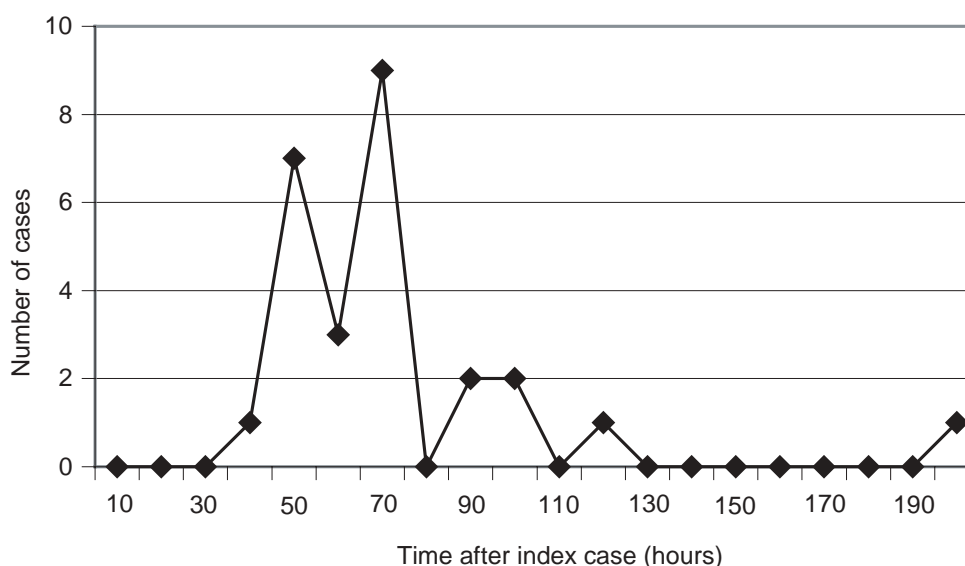
CSPHU staff visited the hostel on the day of notification and the common areas, room layout, and kitchen were inspected. The kitchen was examined for cleanliness and food handling procedures. There were no leftover food items that could be analysed. The dining room seating and bedroom of the index case were examined for their proximity to other residents. The availability of soap in common wash areas was assessed and common rooms were examined for cleanliness.

Laboratory investigations

Hostel staff were asked to submit stool specimens for all residents who were ill. These samples were examined by faecal microscopy, bacterial culture, and viral studies,

FIGURE 1

EPIDEMIC CURVE FOR AN OUTBREAK OF NORWALK-LIKE VIRUS GASTROENTERITIS IN A RESIDENTIAL HOSTEL, CENTRAL SYDNEY AREA HEALTH SERVICE, NSW, SEPTEMBER 2002



Source: Central Sydney Public Health Unit.

including testing for rotavirus and reverse transcriptase polymerase chain reaction (RT-PCR) testing for NLV.⁶

RESULTS

Identification of history relevant to transmission

The index case had had an episode of projectile vomiting in the common dining room of the hostel, located on the ground floor, during the evening meal, three days before the outbreak was notified. The next day, he had an episode of diarrhoea on the carpet of his bedroom floor, located on the second floor of the hostel. This resident is not independently mobile, nor does he socialise with other residents. Besides attending the dining room for meals, he remains in his bedroom and this pattern was followed in the period preceding and during his illness. Following the episode of diarrhoea, his bedroom was steam cleaned by contract professional cleaners who used their own equipment and were not involved in cleaning other areas of the hostel. The index case was transferred to hospital 30 hours after onset of vomiting for further management. He was discharged six days later with a diagnosis of viral gastroenteritis.

Over the following six days after the initial notification of the 16 cases, a further 12 cases among residents and five among staff were notified. Two of the cases notified among staff were food handlers. Two of the further cases notified among residents were admitted to hospital for one and five days respectively and both were diagnosed with viral gastroenteritis. The final case occurred nine days after the index case. Throughout this period, no cases were reported in the adjacent nursing home. An epidemic curve for the onset of illness is not consistent with a classic point source of infection but may represent a point source with secondary transmission (Figure 1).

Questionnaires were completed by 23 of the 28 residents who became ill and three of the five staff cases who became ill. A further 26 questionnaires were completed by the control group (23 residents and three staff). This represented a 70 per cent completion rate from the hostel residents in the control population, and a 79 per cent completion rate from notified cases. Non-completion of questionnaires in residents was due to a lack of cognitive capability and late onset of illness (one resident was reported as ill after the collection of the questionnaires). Failure to return questionnaires accounted for the non-completion by staff.

Among residents, there was no significant difference in age or sex distribution between cases and controls. The mean age of cases was 82.9 years compared with 82.5 years for controls. Twenty-four per cent of cases and 26 per cent of controls were males.

The attack rate for illness was 42 per cent. The most common symptom was diarrhoea followed by vomiting,

TABLE 1

SUMMARY OF CHARACTERISTICS OF ILLNESS AMONG 26 CASES OF GASTROENTERITIS IN A RESIDENTIAL HOSTEL, CENTRAL SYDNEY AREA HEALTH SERVICE, NSW, SEPTEMBER 2002

Symptom	Number of cases	Total cases (%)
Diarrhoea	23	89
Vomiting	22	82
Abdominal cramping	16	62
Fever	16	62
Nausea	8	31

Source: Central Sydney Public Health Unit.

TABLE 2

ATTACK RATES AND ODD RATIOS FOR A SAMPLE OF MENU ITEMS IN AN OUTBREAK OF GASTROENTERITIS IN A RESIDENTIAL HOSTEL, CENTRAL SYDNEY AREA HEALTH SERVICE, NSW, SEPTEMBER 2002

Food	Attack Rate (%)	Odds Ratio	P-value
Salad	71	2.89	0.22
Chicken	51	1.27	0.73
Egg and bacon pie	47	0.82	0.76
Sausages	52	1.21	0.76
Pudding	52	2.14	0.23

Source: Central Sydney Public Health Unit.

fever, abdominal cramping and nausea (Table 1). The majority of resident cases (73 per cent) became ill within 72 hours of the index case vomiting in the dining room. The median time for the onset of illness was 64.5 hours and the mean time 69.9 hours; however, the range of time between the possible index case and illness presenting in other cases was wide—from 36 hours to 200 hours. Duration of illness had a median range of 36 hours (minimum 24 hours, maximum 72 hours).

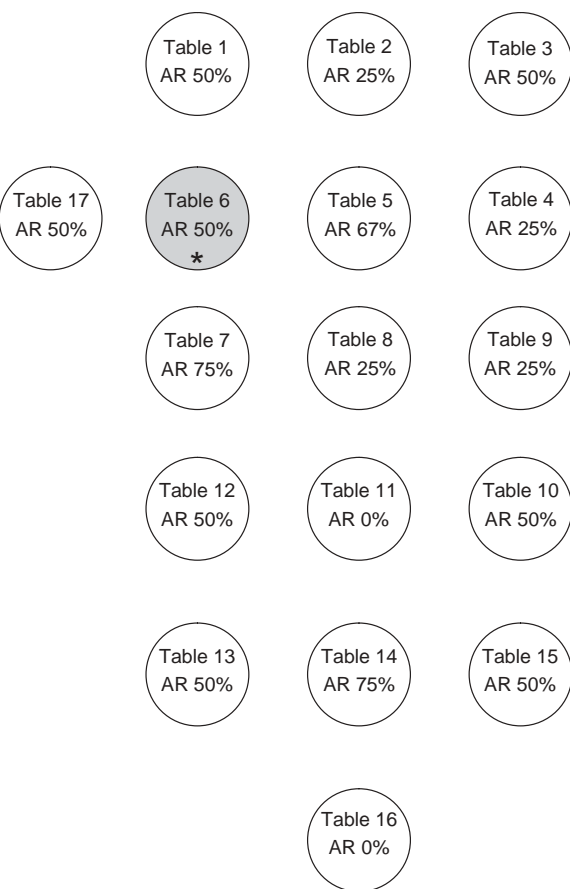
Food and environment

Attack rates and odds ratios for 46 menu items over five days were examined. No food was significantly associated with illness. Table 2 illustrates attack rates and odds ratios for a sample of menu items.

The dining room contained 17 dining tables with approximately four residents seated at each table. Mapping the seating of the residents with illness showed no obvious pattern (Figure 2). There was no significant association between illness and being seated directly adjacent to the vomiting point (OR 1.3, 95 per cent; CI 0.5–3.6). Attack rates for those residents seated on dining tables on or immediately adjacent to the vomiting point

FIGURE 2

PLAN OF DINING ROOM SEATING IN A RESIDENTIAL HOSTEL, CENTRAL SYDNEY AREA HEALTH SERVICE, NSW, SEPTEMBER 2002



* Position where index case vomited;
AR = Attack rate for table.
Source: Central Sydney Public Health Unit.

(dining tables 1,2,5,6,7,8,17) was 44 per cent, while for other dining tables it was 39 per cent.

There was no significant association found between any floor of residence and illness; however, there was a significant association found when the analysis for ground and second floor residents was combined (Table 3).

Laboratory investigations

Five stool samples were sent and analysed for enteric bacterial pathogens, rotavirus and NLV. Presence of NLV was confirmed in all five samples by RT-PCR. There was no growth on bacterial culture. One vomitus sample was sent and returned with a positive reading for NLV. Unfortunately, no stool sample was available for testing from the index case.

TABLE 3

RISK ASSOCIATED WITH FLOOR OF RESIDENCE IN AN OUTBREAK OF GASTROENTERITIS IN A RESIDENTIAL HOSTEL, CENTRAL SYDNEY AREA HEALTH SERVICE, NSW, SEPTEMBER 2002

Floor	Odds Ratio	P-Value	95% CI
0 (dining room)	2.3	0.15	0.6–8.3
1	0.4	0.14	0.1–1.7
2	2.6	0.09	0.8–9.1
3	0.3	0.07	0.1–1.3
Combined 0 + 2	3.6	0.01	1.2–11.1

Source: Central Sydney Public Health Unit.

DISCUSSION

Outbreaks of NLV gastroenteritis in residential aged-care institutions are commonly reported.^{8,9,10} Prompt infection control measures, along with epidemiological investigation, can prevent further transmission of the virus. On notification of this outbreak, staff at the CSPHU immediately advised of measures to reduce the potential for transmission. The hostel staff were advised to minimise contact between residents, particularly those who were unwell. The need for careful hand-washing by staff was reinforced and all sick employees were excluded from work for 48 hours after the resolution of their symptoms of gastroenteritis. During the outbreak, the movement of staff between the hostel and the adjacent nursing home was minimised. Fostering a working partnership between the management of the hostel and the public health unit, assisted in the strict implementation of these recommendations.

Given the initial reporting of this outbreak, suspicion of food-borne illness was high, however the identification of an index case with vomiting in the common dining room 36 hours before other cases alerted the CSPHU to the possibility that this individual was a potential point source. Odds ratios assessing risk of food and illness showed no significant association. Similarly, no association was found between seating proximity to the vomiting point of the index case in the dining room with illness. Therefore, alternate routes of transmission were considered. Presumably, residents residing on the ground floor, where the dining room is located, and the second floor, where the index case resides, would have more potential for contact with the index case. In addition, the carpets on these two floors had been soiled. The increased risk of illness among residents found on both these floors supports the likelihood of transmission related to direct contact with the index case and fomites.

The incubation period for NLV gastroenteritis is in the vicinity of 24–48 hours.^{5,11} The bimodal distribution of the epidemic curve with an early initial peak occurring at 50 hours, and a second peak at 70 hours, may represent direct transmission of NLV from the index case and then subsequent secondary transmission. While well recognised routes such as faecal–oral and airborne spread are likely to be the route of direct and secondary transmission in this outbreak,⁵ high proportions of NLV have been found in areas directly and indirectly exposed to vomitus such as carpets and furniture.³ This hostel is extensively carpeted, including the dining room and the residents' bedrooms. Although the bedroom of the index case was professionally steam cleaned after his episode of diarrhoea on the carpet, there are no clear recommendations on the efficacy of carpet cleaning methods, and NLV has been shown to be resistant to chlorination (10ppm chlorine) and stable in the environment up to 60°C.¹² There are suggestions that steam cleaners may fail to achieve these temperatures within carpets;¹³ and, in this case, there exists a possibility that organisms remained viable in the immediate environment following cleaning.

Environmental swabs for NLV in this situation may have contributed to more conclusive evidence to support this hypothesis; however, timeliness, cost, and issues such as 'infective dose' of the virus are factors that need to be considered before obtaining environmental swabs. In this case, the prevention of the spread of NLV gastroenteritis to the adjacent nursing home supports the value of early strict infection control practices in containing an outbreak.

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