

Outbreak of Norovirus Following a Catered Event Manchester, New Hampshire – November 2019

Background

On Wednesday, November 27, 2019, the New Hampshire (NH) Department of Health and Human Services (DHHS), Division of Public Health Services, Bureau of Infectious Disease Control (BIDC) received a report from the Office of the Chief Medical Examiner (OCME) of a person who died after becoming ill with an unspecified gastrointestinal illness following a group meal at the Puritan Backroom Conference Center in Manchester, NH on November 24, 2019. The OCME reported that other people who attended the group meal were ill with symptoms of an unspecified gastrointestinal illness. On the day of notification, BIDC contacted the Manchester Health Department (MHD) to request an immediate environmental assessment at the Puritan Backroom and launched an investigation into the possible outbreak of gastrointestinal illness among meal attendees.

Methods

Case-finding and Hypothesis Generation

During its environmental assessment at the Puritan Backroom, MHD obtained a list of food items served at the November 24th event and obtained contact information for the organizer of the event. As the health agency of a self-inspecting jurisdiction, MHD has environmental health oversight for food service establishments in the city. In that oversight role, MHD served as the primary contact for the Puritan Backroom for any questions during the investigation. MHD provided the contact information for the event organizer to BIDC. BIDC staff contacted the host to confirm the food items were served at the event, obtain a list of attendees with contact information, and define an initial list of symptoms attendees reported experiencing. The hypothesis generation focused on this one event at the Puritan Backroom because the host identified no other common gatherings or potential sources of infection that would have been common to all of the individuals reporting illness and there were no other reports of illness from other groups who patronized the conference center or restaurant. BIDC staff developed a standardized questionnaire from the menu of all foods served at the meal. This form asked about foods eaten and symptoms of gastrointestinal illness before and after the event. Individuals who attended the group meal were called by MHD staff and administered the survey. Stool samples were requested from ill attendees for pathogen testing and sample collection was coordinated through MHD.

Cohort study and statistical analysis

BIDC conducted a cohort study to identify risk factors for infection. A cohort study is an epidemiologic method for identifying risk factors (i.e. exposures or food items that increase a person's risk for developing an illness) within a clearly defined group of people who were potentially exposed. Group meal attendees were included in the cohort. For case ascertainment purposes, the following case definitions were used:

Confirmed: Any person who (1) attended the meal, and (2) experienced diarrhea (defined as three or more loose stools within a 24 hour period) or vomiting between November 24, 2019 and November 28, 2019, and (3) tested positive for norovirus.

Probable: Any person who (1) attended the group meal, and (2) experienced diarrhea (defined as three or more loose stools within a 24 hour period) or vomiting between November 24, 2019 and November 28, 2019, and (3) either did not test positive for a gastrointestinal pathogen or did not submit a stool specimen.

Questionnaires were administered via telephone by MHD on November 29th with responses recorded on paper and entered into an electronic software system (Epi Info version 7.0 web survey) on December 2, 2019. Upon completion of all interviews, data were analyzed to identify foods potentially related to the illness using a statistical software system (SAS version 9.4). Frequency of foods eaten and attack rates were calculated and compared (using risk ratios) between people who became ill and those who did not. The risk ratio is calculated for each food item and assess whether people who ate a particular food were more likely to become ill. It compares the proportion of people who became ill among those who consumed the item to the proportion ill among those who did not consume the item.

Trace-back and environmental investigation

MHD conducted an on-site environmental assessment of the Puritan Backroom on November 27, 2019. Additionally, information on meal preparation and food holding methods were obtained from the manager. Additional follow-up inquiries were also made to the manager at the Puritan Backroom via email in the days following the initial assessment.

Laboratory investigation

Stool specimens were sent to the New Hampshire Public Health Laboratories (NH PHL) for pathogen testing. No leftover food specimens were available for testing.

Results

Case-finding and Hypothesis Generation

Overall, 20 people reported gastrointestinal illness following the event, including 18 attendees (attack rate = 40%) and two staff members of the Puritan Backroom. Onset of illness for all case-patients occurred on or after November 25th (Figure 1), with a median illness onset time of 35 hours following the event (range: 19 - 46.5 hours). Case-patients ranged in age from 2 to 62 years, with a median age of 25; 12 (67%) were male. The most prevalent symptoms reported were vomiting (94%), nausea (82%), diarrhea (79%), and fatigue (75%). See Table 1 for details of all reported symptoms. The median duration of illness was 30 hours (range: 6-72 hours). Two case-patients sought healthcare and none were hospitalized. The OCME reported that acute norovirus gastroenteritis was a contributing cause of death for one person.

Cohort study and statistical analysis

Forty-one out of 45 total meal attendees completed the standardized questionnaire (response rate = 91%); however, one person who completed the questionnaire was excluded from the exposure analysis because the timing of their illness onset made it unlikely they became ill from the event itself. The group of 40 attendees included in the exposure analysis consisted of 6 confirmed cases, 11 probable cases, and 23 persons who denied experiencing any gastrointestinal illness following the meal. Four group meal attendees were not interviewed, including the person who died; BIDC staff reviewed all interviews prior to analysis.

A comparison of the food items that what people who became ill ate compared to those who did not become ill was performed using exposure frequencies and univariate risk ratios for all foods served at the meal. No statistically significant associations between illness and individual food items consumed were identified. A listing of all food items served at the group meal and the percent of meal attendees who consumed each food is available in Tables 2 and 3.

Trace-back and environmental investigation

During the inspection at the Puritan Backroom, meal preparation and serving practices related to foods served at the meal were reviewed by MHD. Most items, including the Greek salad, pasta salad, chicken tenders, macaroni and cheese, mashed potatoes, and green beans were prepared by staff the day-of the event in large batches that were served to restaurant patrons as well as other event groups. Ice cream cakes were made in several stages over approximately 3 days and between days the cakes were stored in a deep freezer. Two days before the event, toppings and decorations were added, and the day before the event, the cake was placed in a temperate freezer to allow for consumption the following day. Rolls and pita were warmed, and a coffee and tea service was provided. All foods were made in the restaurant kitchen, then served in the adjoining conference center. There were no critical item violations identified (i.e. violations which are known to increase the risk of foodborne illness) during the environmental assessment conducted by MHD. There were no foodservice workers identified as being ill at the time of the group meal. Two staff who worked the event reported becoming ill with a gastrointestinal illness after the event on November 26th. There were no reports of illness made to the Puritan Backroom, MHD, or DHHS from other groups using the conference center or restaurant on the day of the event. Additionally, there were no indications of other unreported common source gastrointestinal illness outbreaks in the community based on routine review of existing public health surveillance systems (e.g. notifiable infectious diseases, emergency department visit monitoring, etc.).

Laboratory investigation

Seven of 11 stool specimens submitted from meal attendees tested positive for norovirus G2 by real-time polymerase chain reaction testing at the New Hampshire Public Health Laboratories. DNA sequencing was attempted on all seven specimens and three resulted in high enough quality sequencing information for analysis. All three were determined to be the GII.P16_GII.2 subtype. Sequence analysis also showed that the three specimens shared identical sequences in the B-C region of the norovirus genome.

Discussion

Investigation activities related to this outbreak identified the causative agent as norovirus that was transmitted through an unknown method with indeterminate origin. Norovirus was identified in stool specimens from seven attendees and three of them shared identical sequences, indicating norovirus as the pathogen causing the illnesses. Additionally, symptoms of illness were consistent with a typical norovirus outbreak. Norovirus infection (gastroenteritis) is typically characterized by a 1-2 day incubation period (i.e. time from exposure to illness onset), symptoms that last between 12 and 60 hours, and having over 50% of individuals in an outbreak report vomiting.^{1,2} During this outbreak, the median incubation period was approximately 1.5 days, the median duration of symptoms was 30 hours, and well over 50% of cases reported vomiting, all of which are consistent with typical observations made in norovirus outbreaks.

Norovirus is a very contagious virus that causes vomiting and diarrhea. The virus is shed in the vomitus and stool of people who are sick and is spread by having direct contact with an infected person, from eating or drinking contaminated food or water, or touching contaminated surfaces and then putting

unwashed hands in the mouth.³ The most common symptoms of norovirus are diarrhea, vomiting, nausea, and stomach pain. There is no specific treatment for norovirus and most people with norovirus illness get better within 1 to 3 days. However, the virus can make a person feel extremely ill and cause frequent vomiting or diarrhea that can lead to dehydration, especially in young children, older adults, and people with other illnesses.

Norovirus is very common in the winter months and it is the leading cause of acute infectious gastroenteritis. Each year, on average, norovirus causes 19 to 21 million infections in the United States and it contributes to about 570 to 800 deaths, mostly among young children and the elderly.⁴ Norovirus is not a reportable disease in New Hampshire, meaning individual cases of illness are not required to be reported to DHHS. As a result, it is not known exactly how many people become ill with norovirus in New Hampshire. However, outbreaks are required to be reported in New Hampshire and typically there are an average of 50 to 75 outbreaks each year of acute gastroenteritis, most due to norovirus (DHHS, unpublished data).

When determining the cause of a gastrointestinal outbreak, there are five primary modes of transmission that investigators consider as potential sources of the outbreak⁵:

- Foodborne: Transmission occurred through consumption of contaminated food or non-water beverages;
- Waterborne: Transmission occurred through exposure via ingestion, inhalation, contact or other route (e.g. injection) to water;
- Person-to-Person: Transmission occurred through direct contact with an infected person, their bodily fluids, or by contact with the local environment that the infected person had contact with
- Environmental Contamination: Transmission occurred through exposure to a contaminated environment; and
- Animal contact: Transmission occurred through contact with an animal, its bodily fluids, fur, feathers, scales, hair, skin, its food or the environment where it resides.

When it is not possible to determine which of the five primary modes listed resulted in transmission of the pathogen causing the outbreak, the outbreak is considered to be of indeterminate or unknown origin. Identifying the pathogen causing the outbreak does not always result in the identification of the source. According to national data, approximately 15% of all acute gastroenteritis outbreaks are of an indeterminate or unknown origin.⁶ Among those with an indeterminate or unknown origin, 30% were caused by norovirus, as was observed in this outbreak.⁴

During outbreaks, norovirus is typically spread from person-to-person, through consumption of contaminated food or water, or by touching contaminated surfaces. In regards to potential foodborne transmission in this outbreak, no food exposures were statistically associated with illness (i.e. no food items were identified that increased the risk of developing illness). However, the fact that a statistically significant food item was not identified in the analysis of interview data does not exclude the possibility that food was the source of the outbreak. It is possible that multiple food items were contaminated or that a particular food item had lower levels of contamination, which could limit the ability of the investigation to identify a single common implicated food item. Low statistical power (i.e. small numbers due to the group's size) may also impact the ability of an investigation to identify a statistically significant food item. There were also no food service workers who reported illness at the time of the event. In regards to potential person-to-person transmission, no attendees reported illness in the seven days prior to or at the time of the meal. However, the investigation relied on the information that people are able to recall and willing to share and the possibility that an ill attendee or ill food service worker introduced norovirus to the event cannot be excluded. DHHS was unable to determine the

source of this norovirus outbreak that caused 20 people to become ill because none of the evidence collected during the course of the investigation pointed to any of the aforementioned transmission mechanisms or identified a common source. As a result, this norovirus outbreak is classified as being of indeterminate origin.

Recommendations^{2,7}

While not specifically identified as factors in this outbreak, the following recommendations are made to prevent future outbreaks of norovirus from occurring, in general:

1. All people should wash their hands thoroughly with soap and water especially after using the toilet or changing diapers, before eating, preparing, or handling food, and before giving themselves or someone else medicine.
2. Individuals experiencing gastrointestinal symptoms such as vomiting and diarrhea should remain at home and refrain from attending communal events, school, work, or camps until 48 hours after resolution of symptoms.
3. Food service establishments should ensure ready access to hand sinks for employees, and that those hand sinks are fully stocked with hot water, soap, and paper towels. Food service managers should review food preparation practices and remind all food service workers that ready-to-eat food must not be contacted with bare hands. Suitable utensils, including deli tissue, spatulas, tongs, and single-use gloves or dispensing equipment, should be considered. Gloves should be used and changed frequently when handling food items.
4. People preparing foods must wash their hands frequently especially:
 - a. After touching bare human body parts;
 - b. After using the toilet;
 - c. After coughing, sneezing, using a handkerchief tissue, using tobacco, eating or drinking;
 - d. After handling soiled equipment or utensils;
 - e. During food preparation, as often as necessary to remove soil and contamination and to prevent cross contamination when changing tasks;
 - f. When switching between working with raw food and working with ready-to-eat food; and
 - g. Before donning gloves for working with food; and after engaging in other activities that contaminate the hands.
5. Food service workers should be informed of their responsibility to report information about their health as it relates to diseases transmissible through food to the person in charge of the food establishment. Any food service workers reporting illness must be excluded from work until 48 hours after resolution of symptoms.
6. Consumer self service operations (e.g. buffets) shall be monitored by food employees trained in safe operating procedures as stated in the FDA Food Code 3-306.13 and New Hampshire Administrative Rules He-P 2304.32 .
7. When an outbreak of disease is suspected (e.g. multiple people become ill following attendance at the same event), it should be reported to public health authorities within 24 hours of suspicion. Prompt reporting can lead to quicker identification of the infectious agent, fewer challenges related to recalling food and environmental exposures, and can lead to more timely disease control interventions to prevent the spread of illness.

Investigated By

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This report was prepared by the Bureau of Infectious Disease Control, New Hampshire Department of Health and Human Services, 29 Hazen Drive, Concord, NH 03301, Telephone: 603-271-4496.

This outbreak was reported to the Centers for Disease Control and Prevention via the National Outbreak Reporting System (NORS). To view NORS data, please visit the NORS Dashboard: <https://wwwn.cdc.gov/norsdashboard/>.

References

1. Hedberg CW, Palazzi-Churas KL, Radke VJ, Selman CA, Tauxe RV. The use of clinical profiles in the investigation of foodborne outbreaks in restaurants: United States, 1982-1997. *Epidemiol Infect.* 2008; 136: 65-72.
2. Heymann DL, ed. *Control of Communicable Diseases Manual*, 19th ed., Washington, DC: American Public Health Association; 2008.
3. Centers for Disease Control and Prevention. Norovirus. <https://www.cdc.gov/norovirus/about/index.html>. June 1, 2018. Accessed January 7, 2020.
4. Centers for Disease Control and Prevention. Burden of Norovirus Illness in the U.S. <https://www.cdc.gov/norovirus/trends-outbreaks/burden-US.html>. June 1, 2018. Accessed January 7, 2020.
5. National Outbreak Reporting System. Guidance document for reporting all enteric foodborne, person-to-person, environmental, animal contact, and unknown/indeterminate mode of transmission outbreaks and for the general sections for reporting waterborne outbreaks. <https://www.cdc.gov/nors/downloads/guidance.pdf>. Published September 28, 2017. Updated November 2017. Accessed January 6, 2020.
6. Wikswo ME, Kambhampati A, Shioda K, Wasdh KA, Bowen A, Hall AJ. Outbreaks of acute gastroenteritis transmitted by person-to-person contact, environmental contamination, and unknown modes of transmission – United States, 2009-2013. *Morbidity and Mortality Weekly Reports.* 2015; 64(12): 1-16.
7. U.S. Public Health Service. *FDA Food Code 2009*. U.S. Department of Health and Human Services; 2009.

Figure 1: Epidemic Curve of Case Illness Onset Dates, n=20

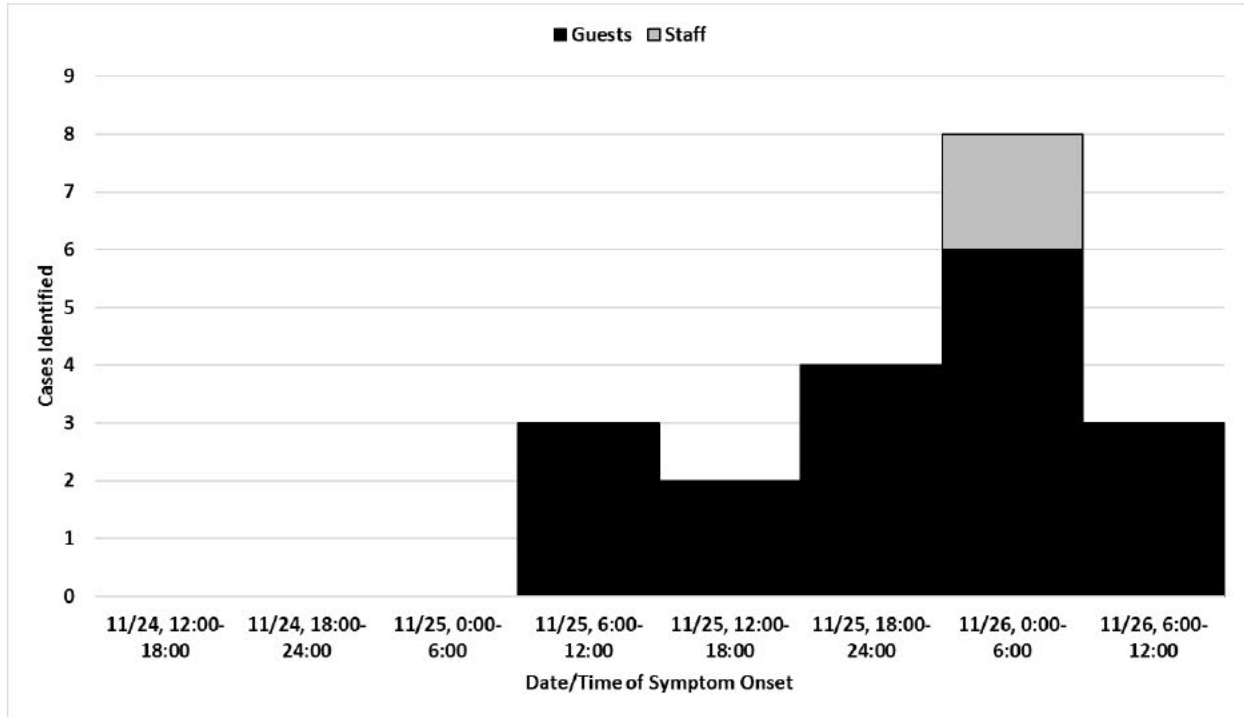


Table 1: Frequency of Symptoms among Case-Patients, n=20

Symptom	# of Case-Patients with symptoms	# of Case-Patients for which information was available	% of Case-Patients with symptoms
Vomiting	17	18	94.4%
Nausea	14	17	82.4%
Diarrhea	15	19	78.9%
Bloody Diarrhea	0	16	0.0%
Fatigue	12	16	75.0%
Headache	11	16	68.8%
Abdominal Cramps	10	16	62.5%
Chills	8	16	50.0%
Body Aches	6	15	40.0%
Fever	4	10	25.0%
Constipation	0	15	0.0%
Asymptomatic	0	19	0.0%

Table 2 : Food Exposures Among Meal Attendees, November 24, 2019; n=40 (17 cases and 23 controls)*

Item	# Cases Exposed (%)	Ate			Did not eat			Risk Ratio ‡	p-value †
		Ill	Total	Attack Rate	Ill	Total	Attack Rate		
Sliced Fruits	10 (58.8%)	10	23	43.5%	7	17	41.2%	1.06	1.00
Mashed Potatoes	10 (58.8%)	10	28	35.7%	7	12	58.3%	0.61	0.30
Greek Salad	6 (35.3%)	6	16	37.5%	11	24	45.8%	0.82	0.75
Pasta Salad	4 (23.5%)	4	13	30.8%	13	27	48.1%	0.64	0.33
Chicken Tenders	16 (94.1%)	16	39	41.0%	1	1	100%	0.55	0.91
Macaroni and Cheese	17 (100%)	17	38	44.7%	0	2	0.0%	2.69	0.44
Green Beans	8 (47.1%)	8	25	32.0%	9	15	60.0%	0.53	0.11
Dinner Roll	7 (41.2%)	7	20	35.0%	10	20	50.0%	0.70	0.52
Pita Bread	1 (5.9%)	1	4	25.0%	16	36	44.4%	0.56	0.62
Duck Sauce	9 (52.9%)	9	21	42.9%	8	19	42.1%	1.02	1.00
Butter	5 (29.4%)	5	17	29.4%	12	23	52.2%	0.56	0.20
Ice Cream Cake	15 (88.2%)	15	31	48.4%	2	9	22.2%	2.18	0.26
Coffee	5 (29.4%)	5	13	38.5%	12	27	44.4%	0.57	1.00
Tea	0 (0.0%)	0	3	0.0%	17	37	45.9%	0.27	0.96
Milk	4 (23.5%)	4	7	57.1%	13	33	39.4%	1.45	0.43

*Only cases (n=17) and controls (n=23) with a complete interview are included in the analysis. All exposures served at the group meal are included. Controls are people who did not develop illness following the event.

† Chi-square p-values. Where expected values are <5, Fisher Exact p-values are used.

†† Notes: The attack rate (AR) is the proportion of individuals who became ill within the defined population. The table above displays the AR among people who ate each food and among those who did not eat those foods. The Risk Ratio (RR) compares these two numbers to assess whether those who ate a particular food were more likely to become ill (a RR greater than 1). The P-value expresses whether the difference in these attack rates (represented by the RR) is statistically significant. Generally a P-value of less than 0.05 is considered statistically significant and indicates the difference in attack rates was most likely not due to chance. While the p-value and RR are important indicators of a potential exposure/food item of interest, other factors such as biologic and epidemiologic plausibility are essential to interpreting statistical results and the potential source of illness.

Table 3 : Food Component Exposures Among Meal Attendees, November 24, 2019; n=40 (17 cases and 23 controls)*

Item	# Cases Exposed (%)	Ate			Did not eat			Risk Ratio ‡	p-value †
		Ill	Total	Attack Rate	Ill	Total	Attack Rate		
Sliced Fruits									
Cantaloupe	4 (23.5%)	4	9	44.4%	13	31	41.9%	1.06	1.00
Watermelon	3 (17.6%)	3	5	60.0%	14	35	40.0%	1.50	0.63
Grapes	3 (17.6%)	3	3	100%	14	37	37.8%	2.29	0.51
Strawberries	4 (23.5%)	4	4	100%	13	36	36.1%	2.46	0.48
Pineapple	5 (29.4%)	5	6	83.3%	12	34	35.3%	2.36	0.07
Blueberries	1 (5.9%)	1	1	100%	16	39	41.0%	1.82	0.61
Honeydew	1 (5.9%)	1	3	33.3%	16	37	43.2%	0.77	1.00
Other drinks									
Water	11 (64.7%)	11	27	40.7%	6	13	46.2%	0.88	1.00
Cream	2 (11.8%)	2	5	40.0%	15	35	42.9%	0.93	1.00
Hot cocoa	1 (5.9%)	1	4	25.0%	16	36	44.4%	0.56	0.62

*Only cases (n=17) and controls (n=23) with a complete interview are included in the analysis. An ingredient-level breakdown for sliced fruit and other drinks are included. Controls are people who did not develop illness following the event.

† Chi-square p-values. Where expected values are <5, Fisher Exact p-values are used.

†† Notes: The attack rate (AR) is the proportion of individuals who became ill within the defined population. The table above displays the AR among people who ate each food and among those who did not eat those foods. The Risk Ratio (RR) compares these two numbers to assess whether those who ate a particular food were more likely to become ill (a RR greater than 1). The P-value expresses whether the difference in these attack rates (represented by the RR) is statistically significant. Generally a P-value of less than 0.05 is considered statistically significant and indicates the difference in attack rates was most likely not due to chance. While the p-value and RR are important indicators of a potential exposure/food item of interest, other factors such as biologic and epidemiologic plausibility are essential to interpreting statistical results and the potential source of illness.