

Outbreak of Norovirus and *Clostridium perfringens* Associated with New Theatre Restaurant — Johnson County, January 2016



Background

On January 19, 2016, a citizen notified the Kansas Department of Health and Environment's Infectious Disease Epidemiology and Response section (KDHE) of a large group of persons that experienced gastrointestinal illness after attending New Theatre Restaurant (9229 Foster St, Overland Park, KS, 66212). Initial investigation revealed that there were other parties in attendance that also became ill with gastrointestinal symptoms. KDHE notified the Johnson County Department of Health and Environment (JCDHE) and in conjunction with the Kansas Department of Agriculture (KDA), an outbreak investigation was initiated to determine the cause of illness, scope of illness, and to implement prevention and control measures.

Methods

Epidemiologic Investigation

An in-depth, food specific, online questionnaire was developed and KDHE conducted telephone interviews with the large group of attendees that initially reported illness. New Theatre Restaurant provided KDHE with a list of reservation names from the day that gastrointestinal illness exposure had been reported. KDHE conducted additional interviews from this list through a random selection method to try to identify individuals that became ill as well as those that did not become ill. During these interviews, persons were reporting illness on other dates and times than what was initially reported. KDHE issued a press release with a web link to the online questionnaire.

For the norovirus outbreak, a retrospective cohort study was conducted through use of convenience sampling to determine potential associations between illness and exposures (i.e., food items, buffet side use, restroom use) at New Theatre Restaurant.

A case for the norovirus outbreak was defined as diarrhea (more than 3 loose stools in 24-hour period) or vomiting within 12 to 72 hours in a person that had attended New Theatre Restaurant between January 14 and January 31, 2016.

A retrospective case control study was conducted for the *Clostridium perfringens* outbreak to determine potential associations between food items served at New Theatre Restaurant and subsequent gastrointestinal illness.

A case for the *Clostridium perfringens* outbreak was defined as diarrhea (more than 3 loose stools in 24-hour period) within 6 to 24 hours in a person that had eaten at New Theatre Restaurant between January 14 and January 31, 2016. A control was defined as an individual who ate at New Theatre Restaurant between January 14 and January 31, 2016 and did not become ill. A ratio of one case to four controls was obtained. Controls were randomly selected and were matched to cases by date of attendance.

Analysis for both outbreaks was conducted using SAS® 9.3. Relative risk (RR) and odds ratio (OR) were calculated and associations between exposures at New Theatre Restaurant with subsequent gastrointestinal illness were assessed using 95% confidence intervals (95% CI) and p-values. Exposures were considered statistically associated with illness if p-value was less than 0.05.

Employees of New Theatre Restaurant were requested to complete an online questionnaire to assess for illness and duties performed.

Laboratory Analysis

Seven stool specimens from seven individuals were collected and submitted to the Kansas Health and Environmental Laboratories (KHEL) for testing. Five specimens were forwarded to the Wisconsin State Laboratory of Hygiene for sequencing. Two of these specimens were submitted to the Minnesota Department of Health Public Health Laboratory for testing. No food samples were available for testing.

Environmental Assessment

KDA conducted an inspection of the New Theatre Restaurant on January 20, 2016. New Theatre Restaurant performed a norovirus specific clean-up of their facility on January 22. On January 29, 2016, KDA returned with KDHE, JCDHE, and City of Overland Park to conduct a second inspection and to supervise a second norovirus specific clean-up of the facility that was completed by a professional cleaning company. A third inspection was conducted on April 5, to monitor staff hygiene practices particularly for employees preparing and handling ready-to-eat salad and bread. A Hazard Analysis Critical Control Point (HACCP) inspection was conducted on New Theatre Restaurant by KDA to monitor temperatures and procedures for preparing and cooling poppy seed salad dressing. A HACCP is planned to occur on burnt ends, but will not be conducted until it is offered as a menu item again.

Norovirus Outbreak

Results

Epidemiologic Investigation

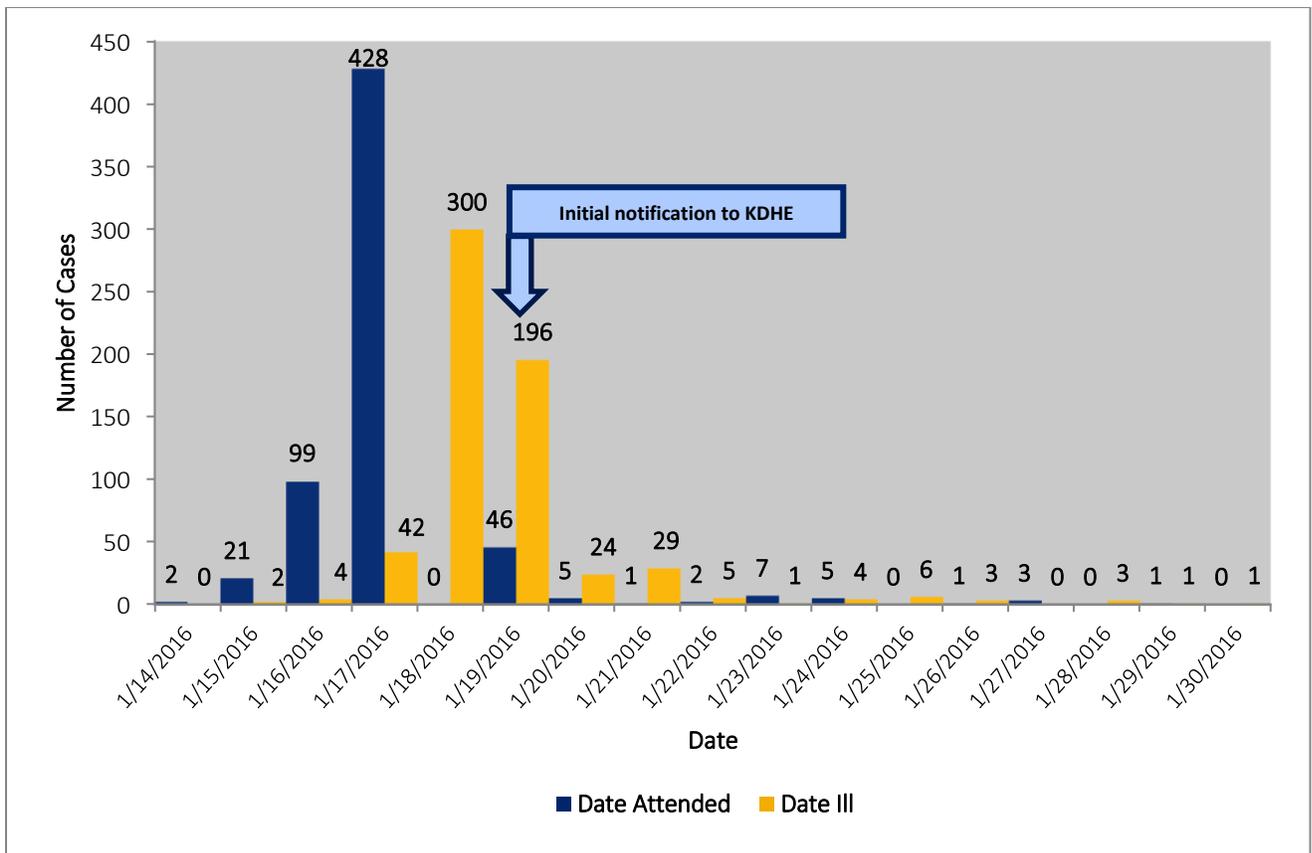
Overall, 2,117 completed the online questionnaire and of those, 1,743 (82%) attended New Theatre Restaurant from January 14 – 31, 2016. One-hundred seventy-six persons were excluded because they reported illness but did not meet the norovirus outbreak case definition; 1,567 individuals were included in this analysis. Of those, 621 (40%) met the norovirus case definition. The predominant symptoms included nausea, diarrhea, and stomach cramps (Table 1). Forty-four ill persons reported visiting a health care provider, 19 reported visiting an emergency room, and 3 reported being hospitalized for their gastrointestinal illness. Three-hundred eighty-one (62%) ill persons were female and 233 (38%) were male.

Table 1: Symptoms reported among ill persons (n=621)

Symptom	# of Ill Persons/ # Reporting	% of Ill Persons
Nausea	574/611	94%
Diarrhea	545/609	89%
Stomach cramps	514/590	87%
Vomiting	495/609	81%
Chills	422/587	72%

Onset dates ranged from January 15 to January 30, 2016 (Figure 1). The incubation period ranged from 12 to 72 hours (median, 32 hours). Five-hundred forty-nine (88%) ill persons had recovered by time of survey completion and duration of illness ranged from 4 hours to 12 days (median, 59 hours).

Figure 1: Attendance Date and Onset Date of Illness Among Persons – Outbreak of Norovirus Associated with New Theatre Restaurant, Johnson County, January 2016 (n=621)



Food items served and other exposures at New Theatre Restaurant were analyzed for association with gastrointestinal illness consistent with norovirus. Facing the stage, persons using the buffet on the right side of the stage were significantly more likely to become ill than

those using the left buffet line (Table 2). Consumption of bread and salad, specifically jicama and ranch dressing on the salad, were also significantly associated with illness.

Table 2: Norovirus exposure information

Exposure/Food Item	Relative Risk	95% CI	P-value
<i>Right buffet side</i>	<i>1.2</i>	<i>1.1 – 1.4</i>	<i>.0008</i>
Restroom use	1.0	0.9 – 1.2	0.91
<i>Salad</i>	<i>2.5</i>	<i>1.6 – 4.0</i>	<i><0.0001</i>
Carrots	1.3	0.9 – 1.7	0.14
<i>Jicama</i>	<i>1.9</i>	<i>1.5 – 2.4</i>	<i><0.0001</i>
Tomatoes	1.1	0.9 – 1.3	0.35
<i>Ranch dressing</i>	<i>1.2</i>	<i>1.0 – 1.3</i>	<i>0.03</i>
Poppy seed dressing	1.0	0.8 – 1.1	0.59
Vinaigrette dressing	0.9	0.7 – 1.0	0.06
Green beans	1.0	0.9 – 1.2	0.79
Glazed carrots	1.0	0.9 – 1.2	0.84
Sicilian vegetable medley	1.0	0.8 – 1.1	0.51
Penne	1.0	0.9 – 1.2	0.73
Garlic mashers	1.1	0.9 – 1.2	0.51
Polenta	0.9	0.8 – 1.1	0.42
Basa	1.1	1.0 – 1.3	0.14
Flat iron beef	1.0	0.8 – 1.1	0.79
Fried chicken	1.0	0.9 – 1.2	0.99
BBQ salmon	1.0	0.9 – 1.2	0.62
Burnt ends	1.1	0.9 – 1.2	0.52
<i>Bread</i>	<i>1.2</i>	<i>1.1 – 1.5</i>	<i>0.01</i>

An online questionnaire was distributed to 126 New Theatre Restaurant employees. Forty-five (36%) employees completed the questionnaire and of those, 5 (11%) reported gastrointestinal illness which included vomiting or diarrhea. One employee reported that onset of illness occurred while at work on January 16, 2016. The other four employees reported onset of illness between January 17 and January 18. It was reported by one interviewed employee that many employees were working while ill.

Laboratory Analysis

Five of seven stool specimens submitted to KHEL for norovirus testing were positive for norovirus genogroup II. These specimens were submitted to the Wisconsin State Laboratory of Hygiene for sequencing and all five were confirmed to be the norovirus strain, Kawasaki 2014 G11.17.

Environmental Assessment

KDA conducted an inspection of the New Theatre Restaurant on January 20, 2016. The inspector observed four priority violations and three priority foundation violations. The priority

violations included an ungloved employee touching ready-to-eat bread rolls, a gloved employee handling a pan of raw chicken then immediately handling pans of ready-to-eat fried chicken, storage of an aerosol dusting spray on food contact surfaces of a meat slicer, and storage of hand sanitizer above utensils at a wait staff area and above a food contact bowl. The priority foundation violations included dried food debris on food contact surfaces of a knife that was stored as clean, a bartender using a handwashing sink to rinse out a silver mixing cup, and a chip in food contact surfaces of a spatula. All priority and priority foundation violations were corrected while the inspector was on-site.

KDA provided New Theatre Restaurant with a norovirus clean-up protocol on the day of the first inspection. Employees of New Theatre Restaurant cleaned the facility on January 22. Due to continued reports of gastrointestinal illness after January 22, the dinner theater hired a professional cleaning company to disinfect the facility on January 29 during the second inspection. In addition, all employees scheduled to work January 29 were assessed for gastrointestinal symptoms before starting work. On April 5, employees were observed for appropriate hand hygiene and preparation of salad and bread. This third inspection revealed full compliance; no violations were found. KDA suggested continuing to monitor and educate employees on proper hand washing procedures, glove usage, and on no bare-hand contact with ready-to-eat foods to enhance food safety.

Clostridium perfringens Outbreak

Results

Epidemiologic Investigation

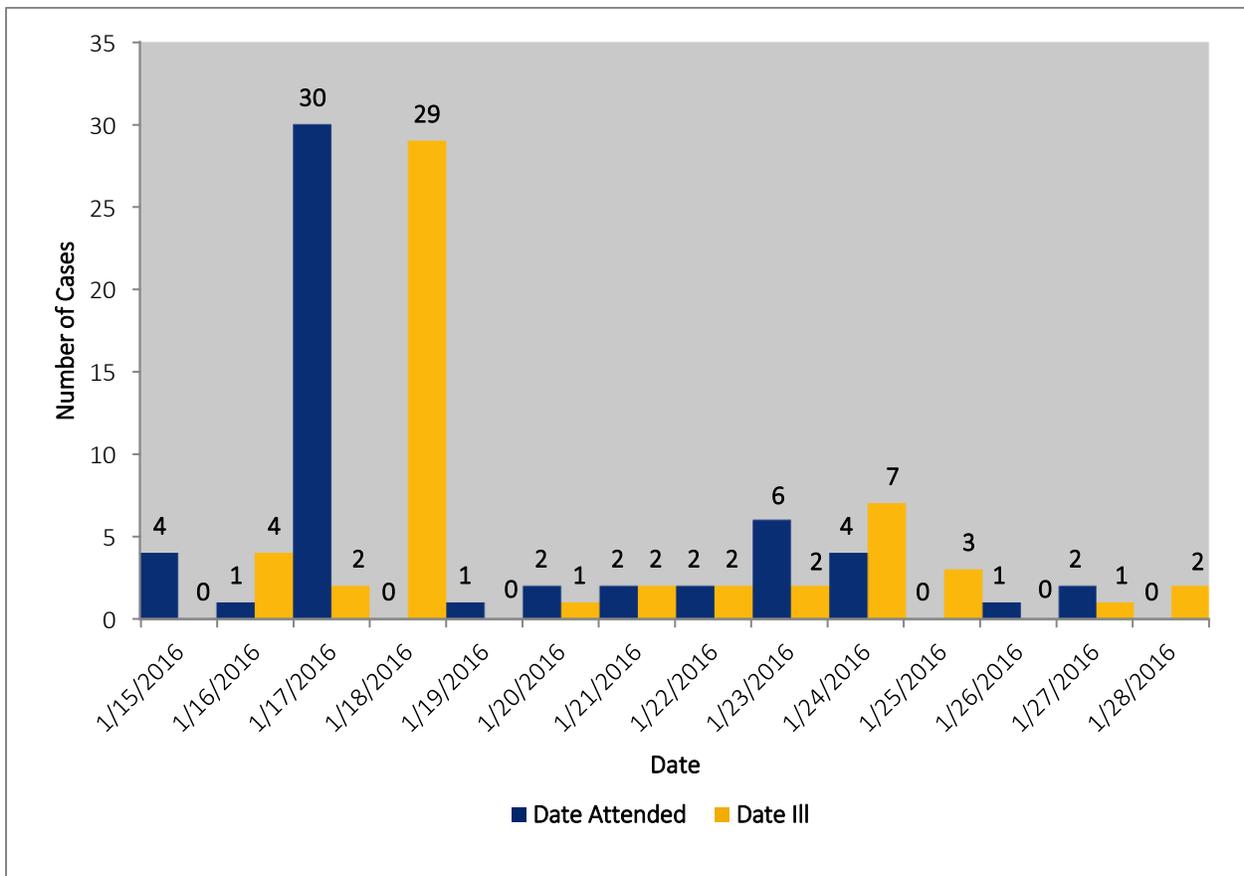
Overall, 2,117 completed the online questionnaire and of those, 1,743 (82%) attended New Theatre Restaurant from January 14 – 31, 2016. Seven-hundred fifty-five persons were excluded because they did not meet the *C. perfringens* outbreak case definition; 988 were included in this analysis. Of those, 55 (6%) met the case definition. The predominant symptoms included diarrhea and stomach cramps (Table 3). One ill person reported visiting a health care provider, and one ill person reported visiting an emergency room and was subsequently hospitalized for their gastrointestinal illness. Twenty-eight (52%) ill persons were female.

Table 3: Symptoms reported among ill persons (n=55)

Symptom	# of Ill Persons/ # Reporting	% of Ill Persons
Diarrhea	55/55	100%
Stomach cramps	43/52	82%
Nausea	34/51	67%
Headache	32/52	62%
Muscle aches	25/49	51%

Onset dates ranged from January 16 to January 28, 2016 (Figure 2). The incubation period ranged from 6 to 24 hours (median, 15.5 hours). Forty-four (80%) ill persons had recovered by time of survey completion and duration of illness ranged from 13 hours to 8 days (median, 54 hours).

Figure 2: Attendance Date and Onset Date of Illness Among Persons – Outbreak of *Clostridium perfringens* Associated with New Theatre Restaurant, Johnson County, January 2016 (n=55)



Food items served at New Theatre Restaurant were analyzed for association with gastrointestinal illness consistent with *C. perfringens*. Consumption of burnt ends and poppy seed salad dressing were significantly associated with illness (Table 4).

Table 4: *C. perfringens* exposure information

Exposure/Food Item	Odds Ratio	95% CI	P-value
Salad	0.8	0.3 – 2.3	0.65
Carrots	2.1	0.5 – 9.3	0.32
Jicama	3.2	0.9 – 10.8	0.06
Tomatoes	1.0	0.4 – 2.3	0.10
Ranch dressing	1.2	0.6 – 2.4	0.64
<i>Poppy seed dressing</i>	<i>2.7</i>	<i>1.2 – 6.2</i>	<i>0.02</i>
Vinaigrette dressing	1.4	0.7 – 3.1	0.38
Green beans	1.2	0.5 – 2.7	0.68
Glazed carrots	1.1	0.6 – 2.4	0.71
Sicilian vegetable medley	1.0	0.5 – 2.0	0.91
Penne	0.8	0.4 – 1.5	0.48
Garlic mashers	1.0	0.4 – 2.2	0.94
Polenta	1.3	0.7 – 2.4	0.44
Basa	1.3	0.6 – 2.8	0.43
Flat iron beef	1.5	0.8 – 3.0	0.22
Fried chicken	1.6	0.6 – 4.1	0.37
BBQ salmon	1.8	0.8 – 3.3	0.13
<i>Burnt ends</i>	<i>2.6</i>	<i>1.0 – 6.8</i>	<i>0.04</i>
Bread	1.7	0.8 – 3.6	0.17

Laboratory Analysis

The two specimens that tested negative for norovirus also tested negative for *Salmonella*, *Shigella*, *Campylobacter*, and Shiga toxin-producing *Escherichia coli* at KHEL. These specimens were submitted to the Minnesota Department of Health Public Health Laboratory for *Clostridium perfringens* testing and one was positive for *Clostridium perfringens* enterotoxin type A and *Clostridium perfringens* was isolated from the specimen.

Environmental Assessment

KDA conducted an inspection of the New Theatre Restaurant on January 20, 2016. No violations regarding temperature holding were found; however, many processes such as receiving food at proper temperature, proper reheating procedures for hot holding, and proper cooling time and temperatures were not observed at the time of the inspection. On April 5, the HACCP inspection for the poppy seed dressing was performed. The inspector observed employees from preparation to boiling to cooling of the dressing and found all procedures to be in compliance. To enhance food safety, KDA suggested utilization of a cooling temperature log for the poppy seed dressing to ensure proper cooling temperatures.

Discussion

This was a large outbreak of gastrointestinal illness associated with New Theatre Restaurant in Johnson County between January 14 and January 31, 2016. Two etiologic agents were identified as causes of illness. Initially, norovirus was confirmed, but during the investigation, it was discovered that an outbreak of *Clostridium perfringens* was ongoing as well.

Six-hundred twenty-one persons became ill with norovirus. Ten persons reported gastrointestinal symptoms consistent with norovirus before attending the dinner theater and one employee reported onset of symptoms while at work. Five stool specimens tested positive for the Kawasaki strain of norovirus genogroup II. Fifty-five persons reported gastrointestinal symptoms consistent with *Clostridium perfringens* infection after attending New Theatre Restaurant. One stool specimen tested positive for *Clostridium perfringens* enterotoxin type A and *Clostridium perfringens* was isolated.

Norovirus is the most common cause of acute gastroenteritis and foodborne disease outbreaks in the United States, causing an estimated 19-21 million illnesses and 56,000 to 71,000 hospitalizations each year. Typical symptoms of norovirus include diarrhea, vomiting, and nausea¹. Transmission can occur via person-to-person routes including fecal-oral and ingestion of aerosolized vomitus; it can also be transmitted indirectly via contaminated surfaces or fomites, or by contaminated food or water². Infected food workers are frequently identified as source of outbreaks, where contamination likely occurs via bare-handed contact with ready-to-eat foods¹. Norovirus has been detected in fecal specimens 3 to 14 hours before the onset of clinical symptoms and can be detected for 13 to 56 days after exposure to the virus³. Approximately 20% of norovirus infected individuals do not have clinical symptoms⁴. However, these persons can still shed norovirus and can be potential sources of contamination. Prevention includes excluding ill food workers and ensuring proper hand hygiene and proper food handling practices to reduce contamination¹.

Kawasaki is a newly identified strain of norovirus globally and this is the first identification of Kawasaki norovirus in Kansas. This particular strain caused many norovirus outbreaks in Asia during the winter season of 2014-2015 and it slowly began showing up in the United States during the same time period. It is not known if the Kawasaki norovirus strain causes more severe symptoms, but its emergence has been associated with increased norovirus activity⁵.

Clostridium perfringens is a type of bacteria that is found in the intestines of humans and animals as well as in many environmental sources and some strains of these bacteria can produce a toxin that causes gastrointestinal illness when consumed. Common sources of C.

perfringens infections include beef, poultry, gravies, and dried or pre-cooked foods, and *C. perfringens* is estimated to cause nearly a million cases of illness each year, making it a common cause of foodborne illness in the United States. Typical symptoms of *C. perfringens* include diarrhea and abdominal cramps, which often develop within six to 24 hours of consuming contaminated food and usually last fewer than 24 hours⁶. Complications and severe illness are rare, and the disease is not spread person-to-person⁷.

Outbreaks of *C. perfringens* more commonly occur when foods are prepared in large quantities and then kept warm for long periods of time before serving and consumption. Since the *C. perfringens* spores that produce the bacteria can withstand cooking temperatures, food must be held at appropriate temperatures between preparation and consumption to prevent bacterial growth. When food is held between 40°F and 140°F, *C. perfringens* spores germinate and the bacteria multiplies⁸. If food continues to be held at improper temperatures, particularly between 109°F and 117°F, the bacteria concentration will rise rapidly. After consumption, the bacteria inside the intestine can produce a toxin that causes gastrointestinal illness⁶.

With the norovirus outbreak, using the right buffet side was statistically associated with illness and it is likely a combination of sources contaminated the right buffet side. Also, consumption of bread and salad, specifically jicama and ranch dressing on the salad were statistically associated with norovirus illness. There were attendees who reported illness prior to and during the theater performance and this could have led to environmental contamination or could have caused the bread that was served at the start of the buffet line to become contaminated with norovirus. The salads, including the jicama and ranch dressing, are ready-to-eat food items, but are served directly to the dining tables by wait staff. Five employees reported gastrointestinal illness; one reported onset of illness while at work. These employees may have contaminated environmental surfaces or foods items depending on their job duties. Employees that prepared these items may have contaminated them if they were shedding norovirus at the time.

For the *C. perfringens* outbreak, consumption of burnt ends and poppy seed salad dressing were statistically associated with illness. *C. perfringens* is commonly found on raw meat so it is likely spores were present on the burnt ends prior to preparation, and temperature abuse may have occurred between preparation and consumption, which would allowed for growth of the bacteria. An environmental source likely contaminated the poppy seed salad dressing with *C. perfringens* and the dressing may not have been properly cooled and stored before serving, which would also allow for growth of the bacteria.

There were several limitations during these outbreak investigations. For attendees who completed the survey, inaccuracies may exist in food and symptom histories due to recall bias for both the norovirus outbreak and *C. perfringens* outbreak. Other limitations are listed below for each outbreak:

Norovirus Outbreak

- A convenience sampling method was used; therefore, not all persons who attended New Theatre Restaurant between January 14 and January 31, 2016 were assessed for illness. There is potential for under- or over-representation of particular groups that completed the survey.
- Only 36% of employees completed an online questionnaire. A higher response could have allowed for a better understanding of ways norovirus was transmitted during this particular outbreak and how it continued to be transmitted across several days.

C. perfringens Outbreak

- This was a case control study and four controls were randomly assigned to one case by date of attendance. Since controls were matched to cases by date of attendance, some ill persons were excluded if there were not enough controls to match to number of cases on any given day between January 14 and January 31. This could have affected the results of this investigation.
- Only one specimen tested positive for *C. perfringens*. This is insufficient to confirm *C. perfringens* as the etiologic cause of this outbreak; however, the clinical information provided by the other ill individuals and the food items statistically associated with illness are consistent with *C. perfringens* infection.
- Food items were not available for testing of *C. perfringens* as all hot buffet food items from New Theatre Restaurant are packaged and donated to a food charity daily. Testing the food items could have definitely identified specific food items as a source of illness.

Both of these investigations were aided by the quick response and collaboration between JCDHE, KDHE, and KDA, which allowed for timely initiation of the outbreak investigation. In addition, the use of an online questionnaire allowed for a good response rate among New Theatre Restaurant attendees while minimizing the staff time required for the investigation. Immediate cooperation of New Theatre Restaurant allowed for rapid identification of norovirus and timely interventions to prevent further transmission. Although the first implementation by New Theatre Restaurant of a norovirus-specific cleaning protocol provided by KDA seemed to have significantly decreased further spread of norovirus, there were continued reports of illness so New Theatre Restaurant hired a professional cleaning company to disinfect the entire facility. This seemed to be successful in preventing any further transmission as no further cases have been reported.

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¹Centers for Disease Control and Prevention. *Norovirus*. Accessed March 2016 at <http://www.cdc.gov/norovirus/about/overview.html>

²Hall, A.J., Vinje, J., Lopman, B., et al. (2011). Updated Norovirus Outbreak Management and Disease Prevention Guidelines. *MMWR* 60(RR03), 1-15.

³Atmar, R. L., Opekun, A. R., Gilger, M. A., et al. (2008). Norwalk Virus Shedding after Experimental Human Infection. *Emerging Infectious Diseases*, 14(10), 1553-1557.

⁴Moe, C. L. (2008). Preventing Norovirus Transmission: How Should We Handle Food Handlers. *Clinical Infectious Diseases*, 48(1), 38-40.

⁵Medici, M. C., Tummolo, F., Calderaro, A., et al. (2015). Identification of the Novel Kawasaki 2014 GII.17 Human Norovirus Strain in Italy, 2015. *Eurosurveillance*, 20(35).

⁶Centers for Disease Control and Prevention. *Clostridium perfringens*. Accessed March 2016 at <http://www.cdc.gov/foodsafety/diseases/clostridium-perfringens.html>.

⁷Federal Department of Agriculture. *Bad Bug Book: Clostridium perfringens*. Accessed March 2016 at <http://www.fda.gov/food/foodborneillnesscontaminants/causesofillnessbadbugbook/ucm070483.htm>.

⁸FoodSafety.gov. *Clostridium perfringens*. Accessed March 2016 at <http://www.foodsafety.gov/poisoning/causes/bacteriaviruses/cperfringens>.