OUTBREAK #2266-2023-00023

Summary of Investigation

Date of Report: March 24, 2023

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Overview of Outbreak

Late in the afternoon of March 8th, 2023, Wellington-Dufferin-Guelph Public Health (Public Health, WDGPH) received reports of illness involving gastrointestinal symptoms in several persons who had attended a luncheon event earlier the same afternoon at the Best Western Plus Orangeville Inn & Suites, Orangeville Ontario. Initial reports indicated some people had experienced symptoms before leaving the venue and others experienced symptoms shortly after. Through these early conversations Public Health had reason to believe that a point source outbreak might be occurring, with a seemingly short incubation period and sudden onset of symptoms. An outbreak investigation that included public health staff from several program areas was immediately launched.

The luncheon event had been held on Wednesday March 8th, 2023, with lunch served from about 12.10 to 12.45 p.m. followed by speeches until approximately 1.30 p.m. From information received, approximately 244 guests had attended the event, along with additional staff taking part in the meal. The main dishes were variations of a 'power bowl' with chicken, or with tofu as the vegetarian option, accompanied by non-alcoholic drinks and desserts. Each bowl was provided individually plated and served by the catering staff, with assistance by Best Western staff. Preceding the meal, a number of local vendors were set up in the hotel lobby featuring local products. One vendor offered food samples of tomato soup and squash soup while another vendor offered samples of granola mix.

The first and foremost priority for Public Health was to secure any remaining food from the suspect meal and to ensure there would be no further distribution of suspect food items. Following that action, the outbreak investigation by Public Health included interviews with event organizers, event attendees and food handlers, inspection of the facilities used for food preparation, the online administration of an outbreak questionnaire to all guests and staff, collection and submission of food and clinical samples for laboratory testing, and epidemiological analysis of data collected via the outbreak questionnaire. All information gathered by the various aspects of the investigation was discussed at daily outbreak investigation meetings and used to develop a hypothesis on the probable source and cause of the illness reported. This report describes the investigation done by Public Health to identify the cause and scope of the outbreak.

The Investigation

Components of the Investigation (not necessarily in chronological order) were as follows:

A. Collection of food and clinical samples and preventing further use or distribution of remaining ingredients used in the meal
B. Formation of rapid response public health outbreak team, and creation of a communication strategy and investigative framework
C. Preliminary and follow-up caterer and food handler interviews: Review of food ingredients and food handling practices
D. Preliminary and follow-up facility inspections (of the Best Western catering kitchen (by Wellington Dufferin Guelph Public Health) and of the caterer's Caledon East location (by Peel Public Health),
E. Referral to other health unit jurisdictions for food source follow up and inspections (e.g., as mentioned above)

F. Information gathering on symptoms of illness, onset dates and times and food exposures: administration of food questionnaires to guests and staff
G. Analysis of outbreak questionnaires, including food exposures

A: Collection of Food and Clinical Samples

Samples of all foods remaining from the meals served at the event, totalling 24 individual samples, were collected and submitted by private courier to the Public Health Laboratory (PHL) in Toronto on March 9th. Testing was requested for all bacterial pathogens commonly associated with foodborne illness including *Salmonella, E. coli. Campylobacter and Staphylococcus aureus*. Additional testing was requested for enterotoxin-producing bacteria that commonly cause sudden onset gastrointestinal illness.

Stool sample kits were made available to any attendee who had experienced symptoms and who wanted to submit a stool specimen sample. Public Health staff arranged delivery and pickup of several specimen kits from individual homes to ensure expedited delivery to PHL in Toronto. All clinical (stool) samples were tested by the laboratory for viruses and bacteria associated with food borne gastrointestinal illness: norovirus, rotavirus, adenovirus, *Salmonella, Shigella, Campylobacter, Yersinia, E.coli 0157, Staphylococcus aureus and Clostridium perfringens.*

The staff at PHL were given prior notification of the outbreak and of incoming specimens, in order to ensure the prioritization of testing for samples submitted from the outbreak and to highlight the depth of the investigation being undertaken.

B: Formation of rapid response public health outbreak team, and creation of a communication strategy and investigative framework

A rapid response public health outbreak team was formed within 24 hours of the initial report of illness being received by Public Health. The team consisted of public health inspection staff as well as representatives from the Communications, Infectious Disease and Health Analytics teams. For the first several days of the investigation, the team met at least once daily. In addition to the core outbreak investigation being conducted, discussions of the team encompassed the creation of a communication strategy and of an investigative framework.

C: Preliminary and follow-up caterer and food handler interviews: Review of food ingredients and food handling practices

A preliminary food processing/preparation review was conducted with the caterer and food handlers on March 9th, 2023. This included gathering preliminary information by Public Health on how each menu item had been prepared, how and where ingredients had been purchased, transported, stored and served, and how each dish had been prepared, plated and served. At certain stages of the investigation, additional follow-up discussions with the caterers in order to gather additional information or clarify information that had previously been received.

D: Preliminary and follow-up inspections of food preparation facilities

The caterer's food preparation facilities at the Best Western, Orangeville were inspected on March 9, 2023. Available menus, fridge temperatures, cleaning records, supply records and staff absenteeism records were reviewed. Staff involved in the food preparation, transportation, serving and storage were interviewed. This was a preliminary inspection designed to identify

and eliminate any visible hazards and to ensure suspect foods were adequately secured from future distribution or sale.

In addition to this preliminary inspection of the caterer's kitchen, a follow-up visit was made to the caterer's facility at the Orangeville Best Western on Thursday March 16th, after some laboratory testing results received by Public Health implicated two menu items served at the event as the likely cause of the reported cases of illness. To further investigate this possibility, a very detailed analysis of the food handling and preparation steps (from purchase to service) was conducted by Public Health. Using a HACCP (Hazard Analysis Critical Control Points) investigative method, all food handling and preparation steps were assessed in order to identify time/temperature or contamination-related hazards.

E: Referral of aspects of the investigation to other public health units

The caterer maintains his primary operating site in Peel Region. The majority of the food handling occurred in Orangeville but some food handling and storage occurred at the Peel Region operating site. A Peel Region Public Health inspector inspected the site on March 9th and found it to be in compliance.

F: Information gathering on symptoms of illness, onset dates and times and food exposures: administration of food questionnaires to guests and staff

The list of menu items served at the luncheon was obtained from the caterer who had prepared the meal and was used to develop an outbreak questionnaire for all attending guests who had attended the event, as well as for staff who has eaten food served at the event. The questionnaire included questions designed to gather information on symptoms experienced by attendees and staff, if any, as well as menu items and drinks consumed at the event, use of medical facilities and willingness to submit clinical samples for testing. The questionnaire was created in REDCap, an electronic data capture tool hosted at WDGPH. REDCap (Research Electronic Data Capture) is a secure, web-based software platform designed to support data capture for research studies. The survey was distributed to guests and staff associated with the event via a link sent out by Public Health. The quick and efficient distribution of the survey was made possible because tickets had been pre-purchased for the event and the organizer was willing to assist with the investigation by using the contact information that guests had provided for that purpose.

The analysis of the guest food exposure information collected via this questionnaire, and results obtained, are described further in this report.

G: Epidemiological analysis of outbreak questionnaire data, including food exposures

Data gathered using the outbreak questionnaire were summarized to provide information on the range, prevalence and severity of symptoms experienced by those who had become ill. Demographic information was also summarized.

The overall attack rate (percentage ill) that occurred among those who had consumed the meal was calculated, based on the responses received. Individual attack rates were also calculated for the various menu items (dishes) served at the event, and statistical analysis was performed to identify which of the dishes appeared to be most associated with illness.

Results of Investigation

The following epidemiological analysis is based on information received up to and including March 14th, 2023 at 2.41 pm (14.41h), from responses to the on-line outbreak questionnaire submitted by 213 of an estimated 264 individuals (244 guests and 20 food handlers/serving staff) associated with the outbreak.

Case definition
For the purposes of this investigation, the following case definition was used:

Case (probable):
Acute-onset enteric symptoms in an individual who had consumed food served at the event associated with the outbreak, with or without diarrhea or vomiting, with onset within 3 days following Wednesday March 8th, 2023 at 12.00 noon (the time of food service and day of the event).

Epidemiological summary

i. Demographics and Description of Respondents to Survey
Of the 213 persons who responded to the outbreak questionnaire, only 197 respondents provided all or most of the information needed for epidemiological analysis. Of those, information on age was provided by 193 and information on gender for 197. Over 95% of respondents were female, which was expected, given the nature of the event. Only one respondent reported their age as 19 years and under; all others were above this age group, with the 50 to 59-year age group having the highest proportion of respondents (37.8%).

Information on the type of respondent, in terms of role in the event, was provided by 194 respondents. Of these, 87.6% were guests, with remainder being food handlers (2.6%) and staff (9.8%).

The tables below summarize the sex and age distributions of the respondents to the questionnaire:

Sex	Number of Respondents	Percent
Male	8	4.1
Female	188	95.4
Prefer not to Answer	1	0.5
Total	**197**	**100.0**

Age Group	Number of Respondents	Percent
19 years or under	1	0.5
20-29 years	14	7.2
30-39 years	26	13.5
40-49 years	26	13.5
50-59 years	73	37.8
60 years or older	53	27.5
Total	**193**	**100.0**

ii. Illness and Symptoms

One hundred and ninety-three (193) respondents provided information on whether or not they had experienced gastrointestinal symptoms after consuming the meal. Of those respondents, 88 (45.6%) indicated that they had definitely experienced symptoms, giving an attack rate of 45%. Since not everyone who attended the event (number estimated at 244 guests and 20 food handlers or staff) responded to the questionnaire, this is probably an over-estimation of the actual overall attack rate (percentage of people consuming the meal who were ill in the outbreak); however, the minimum attack rate that occurred, based on this estimated total number of guests and staff, was 33.3%. Six respondents were unsure whether they had experienced symptoms, indicating that the overall attack rate may have been slightly higher than 33.3% if those respondents had in fact become ill.

Symptoms at/after event?	Freq.	Percent
Unsure	6	3.1
No	99	51.3
Yes	88	45.6
Total	193	100.0

Nausea was the most common symptom, with 84.5% of ill respondents reporting this. Approximately 63% of ill respondents experienced vomiting, which in some cases was reported as very severe and protracted, and approximately 54% experienced diarrhea, with one respondent describing it as bloody. Headache was also quite common among symptoms reported, with 44.0% indicating that they had experienced this symptoms and some describing the headache as severe and persistent.

Most (70.7% of) respondents reporting illness had recovered by the time they responded to the survey one to three days after the event. However, 29.3% reported that they were still experiencing symptoms at that time. Based on the responses to the survey, two individuals indicated that they had visited the emergency room at a hospital for medical assistance and/or had been admitted for care.

The table below summarizes the symptoms reported by respondents to the outbreak questionnaire:

Symptom	Number	Percent of Ill Cases
Nausea	71	84.5
Cramps	55	65.5
Vomiting	53	63.1
Diarrhea	45	53.6
Fatigue	40	47.6
Headache	37	44.0
Weakness	36	42.9
Bloating	33	39.3
Chills	30	35.7

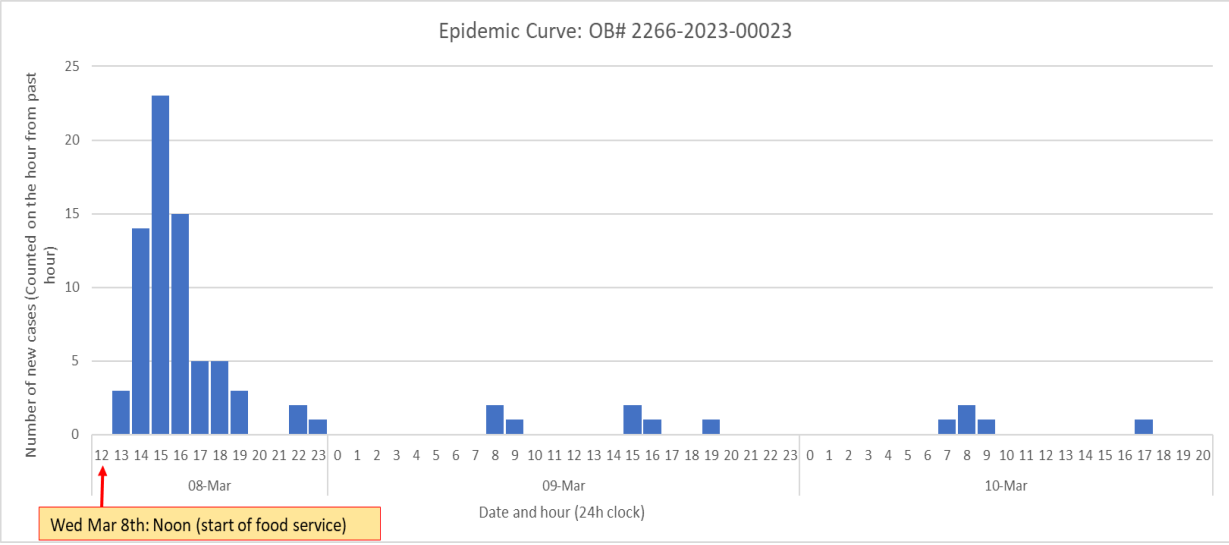
Muscle aches	17	20.2
Fever	11	13.1
Joint pain	3	3.6
Other*	4	4.8

**'Other' symptoms were described as bloody diarrhea, dizziness, clamminess, and chest, back and shoulder pain.*

iii. Epidemic Curve

Onset dates of respondents reporting illness ranged from March 8th at 12.30 pm (12.30h; approximately 30 mins from the estimated start of lunch service) to March 10th at 4.29 pm (16.29h) – approx. 52.5 hours after the estimated start time of the food service. In the analysis, the hour with the highest number of new cases was between 2.01 and 3.00 pm (14.01h and 15.00h) on Wednesday March 8th. One response is excluded from this analysis: one indicating an onset time that fell over 24 hours after the upper limit defined in the case definition above.

The epidemic curve below illustrates the trend in new cases arising within each hour following the start of lunch service at the event, based on responses to the outbreak questionnaire. For each bar shown on the chart, new cases are counted on the hour for the previous hour (e.g. the bar for 13.00h [shown as 13h on the chart] shows cases with onset between 12.01 noon and 13.00h (1.00 pm).



iv: Food Exposures and Attack Rates

In the analysis of the exposure data for each menu item served at the event, one menu item showed a statistically significant association with illness: the chicken bowl, which was served to the vast majority of attendees and contained a variety of different ingredients, including chicken, a 'grain' (quinoa) and several vegetables. The table below summarizes the results of the exposure analyses: the two highest attack rate differences and risk ratios (positively or negatively associated with illness) that were significant at the 10% level (p≤0.10) are highlighted, with those for items positively associated with illness in **bold red** font and those for those negatively associated in **bold green** font.

Food or Beverage	Group A: Persons who ate specified foods				Group B: Persons who did not eat specified foods				(Attack rate) Difference*	Risk Ratio	p value
	Ill	Not ill	Total	Attack Rate (% ill)	Ill	Not ill	Total	Attack Rate (% ill)			
Chicken bowl	78	84	**162**	48.1	4	14	**18**	22.2	**25.9**	**2.2**	0.04
Tofu bowl	4	11	**15**	26.7	78	82	**160**	48.8	**-22.1**	**0.5**	**0.1**
Chicken bowl (gluten free)	1	5	**6**	16.7	80	86	**166**	48.2	-31.5	0.3	0.13
Tofu bowl (gluten free)	1	3	**4**	25.0	81	90	**171**	47.4	-22.4	0.5	0.38
Focaccia bread	53	74	**127**	41.7	29	24	**53**	54.7	-13.0	0.8	0.11
Crackers (gluten-free)	36	46	**82**	43.9	46	49	**95**	48.4	-4.5	0.9	0.55
Hummus	59	82	**141**	41.8	23	16	**39**	59.0	-17.1	0.7	0.06
Dessert squares	57	72	**129**	44.2	25	25	**50**	50.0	-5.8	0.9	0.48
Dessert cookies	41	41	**82**	50.0	41	54	**95**	43.2	6.8	1.2	0.36
Squash soup	22	19	**41**	53.7	60	76	**136**	44.1	9.5	1.2	0.28
Tomato soup	7	8	**15**	46.7	75	85	**160**	46.9	-0.2	1.0	0.99
Granola bar	2	2	**4**	50.0	80	91	**171**	46.8	3.2	1.1	0.9
Coffee	45	51	**96**	46.9	37	44	**81**	45.7	1.2	1.0	0.87
Tea	1	6	**7**	14.3	81	88	**169**	47.9	-33.6	0.3	0.08
Water	74	88	**162**	45.7	8	10	**18**	44.4	1.2	1.0	0.92
Punch	4	7	**11**	36.4	78	87	**165**	47.3	-10.9	0.8	0.48

The food exposures analysis showed that, based on data gathered from respondents to the outbreak questionnaire, the menu item most positively associated with illness, while also being statistically significant at the 10% level, was the chicken bowl, while the item most negatively associated with illness was the same bowl served with tofu instead of chicken. This meant that guests and others who ate the chicken bowl were statistically more likely to become ill, whereas those who ate the same bowl with tofu instead of chicken were statistically less likely to become ill. However, as the table shows, some individuals who ate the chicken bowl did not become ill, while some who ate the tofu bowl did become ill.

The following limitations apply to the food exposures analysis and must be considered when interpreting the results:

- Some attendees at the event did not complete the questionnaire, and also, responses to some data fields used in these analyses were missing for some respondents. Therefore, the dataset might over-represent or under-represent the proportion of all attendees that became ill, not only with regard to the overall attack rate but also for individual food item attack rates calculated here.
- Some menu items were consumed by a very small number of people. Therefore, estimates for those items may be statistically unreliable.
- Some menu items were consumed by almost all attendees (chicken bowl), allowing for only a very small number of controls.
- Quinoa, sweet potato and other vegetables, and most of the other ingredients in the bowls served at the event, were consumed by almost all attendees, including most of those who were served the gluten-free options. In addition, these items were all present

together in the bowls. This made it difficult to distinguish between the ingredients in the bowls when trying to determine the food items most associated with illness. Very few attendees were served bowls without quinoa, with the number of people in this category not being high enough to allow for a statistical comparison to be made between bowls with and without quinoa.

Because of the above limitations, the results of these epidemiological analyses should be interpreted with caution, and in conjunction with other findings from the outbreak investigation.

Laboratory Findings

None of the clinical specimens (stool samples) submitted during this outbreak investigation yielded positive results for any of the laboratory tests performed for enteric gastrointestinal pathogens, including norovirus. In other words. results of tests for all enteric bacteria tested were reported as 'not isolated' or 'not detected', including those for two enterotoxin producing bacteria - *Clostridium perfringens* and *Staphylococcus aureus*. The results were helpful to rule out the enteric pathogens commonly associated with food borne illness. Note that, due to limitations in scientifically validated testing methods, some enterotoxin producing bacteria CANNOT be isolated from the stool of an infected person.

Results of tests conducted on the food samples submitted did prove to be conclusive, revealing that both the quinoa and sweet potato samples submitted for laboratory analysis produced high levels (greater than 200,000 colony-forming units [CFU] per gram of food) of the bacterium *Bacillus cereus,* this amount being several times higher than the maximum acceptable limit **(10^4 CFU/gram)**. [Reference - (https://www.publichealthontario.ca/en/laboratory-services/test-information-index/bacillus-cereus-food)]

Lower levels of *B. cereus* were detected on other food samples, but at a much lower level. The presence of low levels of the organism on those samples appeared to be consistent with cross contamination during the latter stages of food handling.

Inspection Findings

The HACCP-based assessment of the food handling and preparation steps of the two food items implicated by the laboratory results, conducted at the follow-up inspection on March 16th, revealed that the food preparation processes related to cooling, plating and serving the quinoa resulted in the quinoa spending extended periods of time in what is referred to as the 'temperature danger zone' (4 - 60°C). Extended time in this temperature range is associated with the growth and development of hazardous concentrations of bacterial cells or toxins. [Ref: PHAC Food Safety Info page]

Similarly, the food preparation processes related to cooling, plating and serving the sweet potato also resulted in the sweet potato spending extended periods of time in this high-risk temperature range. Further, the sweet potato was not washed prior to slicing or cutting. If this reflected what was usually done by the caterer, the use of unwashed sweet potatoes in the preparation of the meal served at the event on March 9th would probably have resulted in surface contamination, such as bacteria, being introduced into the flesh of the sweet potato, increasing the likelihood of bacterial growth later in the food preparation process.

Discussion and Conclusions

The symptoms reported by cases in this outbreak were suggestive of an acute-onset gastrointestinal illness with a very short incubation period and relatively short duration. In addition, the laboratory findings of this investigation showed that the quinoa and sweet potato used in the preparation of the bowls served at the event contained very high levels of the bacterium *Bacillus cereus*, an organism commonly found in the soil as spores and often also found on raw produce and grains after harvest. The spores of this bacterium can be resistant to some cooking temperatures. [Ref PHAC] Under certain conditions, the bacteria can become activated and capable of multiplying in foods and producing toxins, some also resistant to cooking temperatures, that are capable of causing illness in people who have consumed the contaminated food(s).The bacteria generally grow at temperatures between 10 and 45°C, with the optimal temperature for growth being about 37°C [Ref PHAC]. The holding of food at room temperatures for prolonged periods after cooking therefore permits the growth of *B. cereus* bacteria and the production of toxin. Many outbreaks that have been reported, particularly those of the emetic (vomiting) syndrome, are associated with cooked starchy foods such as rice (Raevuori et. al. 1976; Rodrigo et al., 2021), usually where such foods have been exposed to prolonged 'danger zone' temperatures during the preparation period.

Symptoms of illness caused by these toxins often start 0.5 to 16 hours after ingestion of contaminated food, depending on the type of toxin [Ref BCCDC, PHAC], and disappear in 6 to 24 hours. The diarrheal syndrome, caused by one type of *B. cereus* toxin, usually appears 8 to 16 hours after ingestion of the toxin, with the most common symptoms being diarrhea, nausea and abdominal pain, whereas the emetic (vomiting) syndrome occurs very shortly (0.5 to 5 hours) after ingestion of the toxin that causes it, with nausea, vomiting and abdominal pain and sometimes diarrhea. [Ref: BCCDC] Most cases of *B. cereus* toxicity resolve within 24 hours without any treatment; however, in some cases, such as those where a person is older or has a lower level of stomach acid, illness can be more severe. [Ref BCCDC]. In this outbreak, the range of the incubation period for the bulk of cases (0.5 to 6 or 7 hours) fitted within the published range for *B. cereus*, and relatively few cases reported incubation periods of longer than 16 hours.

While the results of laboratory analysis of food samples detected high levels of *B. cereus* in the quinoa and sweet potato, these two food items did not stand out in the results of epidemiological analysis of food exposures. The main reason for this was probably the fact that nearly all of the attendees were served both quinoa and sweet potato, both together with the protein and several other food items in the bowls. Therefore, the risk of illness following the consumption of quinoa or sweet potato could not be compared with the risk of illness in those who had not consumed those items; as mentioned, very few people had meals that did not contain quinoa, and everyone was served the sweet potato.

The food exposure analysis did imply an increased risk of illness after consumption of the bowls that contained chicken, in comparison with consumption of bowls without chicken; there was a statistically significant lower risk of illness in those who had the bowls containing tofu. The reason for the apparent implication of the chicken is unclear; the samples of chicken submitted for laboratory testing appeared to be free of any pathogens associated with gastrointestinal illness. However, the quinoa and sweet potato were cooked in large batches and were also stored in large containers between cooking and plating. This may have resulted in some portions of these batches (for example, the quinoa in the more slowly cooling centre of the mass within the container) becoming more contaminated than other portions that may have been cooled more quickly. If this was the case, there may have been a difference between the

proportions of bowls with chicken and bowls with tofu containing quinoa or sweet potato from highly contaminated sections of the containers. Temperature cooling logs were not available by the caterer, therefore it was not possible to accurately confirm the cooling rates that occurred during preparation of the meal for the event. However, the methods used for cooling were not in-line with well-recognized and acceptable 'quick cooling' methods and thus would have presented suitable conditions for bacterial growth and toxin production. [Ref: MOHLTC Food Handler's Training Guide]

In conclusion, the findings of this outbreak investigation implicate toxins produced by *B. cereus* bacteria in some of the food items served at the event as the cause of this outbreak. Assessment of the food handling practices of the caterer suggested that those foods may have been cooled too slowly after cooking and allowed to remain at room temperature for too long during service, allowing proliferation of the bacteria and production of the bacterial toxins that caused the illness.

Public Health Actions and Recommendations:

As described earlier, a primary focus early on in the outbreak was to secure suspect food supplies in order to prevent the spread of further illness. Having accomplished this task, the public health efforts shifted toward identifying the implicated food and causative agent. The on-site HACCP-based assessment identified time-temperature concerns with specific food handling steps and practices.

Public Health will develop and communicate specific recommendations designed to prevent similar outbreaks from recurring. Recommendations will focus on the elevated risks associated with mass catering (preparing and serving food for large groups at the same time). Mass catering requires specific skill sets, knowledge, processes and equipment in order to adequately manage the risks and challenges associated with preparing and serving food to large groups of people.

These recommendations will be operator practice-based (for example, practices related to chilling or portioning / serving at mass catering events) but will also be system-based (for example, public health communication and training strategies with respect to food safety at mass catering events).

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