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Gastroenteritis Outbreak at YMCA Youth & Government Conference, February 2010—Investigation Summary, April 7, 2010 (*replaces interim version dated March 23, 2010)*

Background

On Saturday, February 13, 2010, the North Carolina Division of Public Health was notified of an outbreak of acute gastroenteritis among attendees at the YMCA-sponsored Youth and Government Conference being held at the Sheraton Hotel in downtown Raleigh. The conference had 1020 attendees including participants aged 14–18 years as well as adult staff and counselors, and involved events at the nearby Raleigh Convention Center and other venues. An initial on-site investigation by the Wake County Health Department identified approximately 150 individuals with gastrointestinal illness. Approximately 25 of these individuals received on-site intravenous hydration; 5 of these required subsequent hospital transfer. All of the ill recovered; there were no deaths. Nine stool samples were sent to the state lab; four were positive for norovirus by initial PCR testing, three were negative for norovirus, and two results could not be reported due to incomplete labeling.

The initial investigation by the Wake County Health Department included collection of clinical information and food histories from conference attendees identified as ill; inspection of the facilities that catered meals for the conference; and interviews with staff at those facilities. These facilities included Hungry Howie's Pizza, the Sheraton, two Chick-Fil-A restaurants, and the Raleigh Convention Center's catering company, Centerplate.

Because the conference attendees were from areas across the state of North Carolina, additional epidemiologic investigations were conducted by the North Carolina Division of Public Health.

Methods

A retrospective cohort study was conducted using an on-line survey to identify risk factors for illness and a possible source of the outbreak. The survey was piloted on public health officials and on a small set of individuals aged 15–19 who did not attend the conference. Emails containing a link to the on-line survey were sent using the YMCA listserv in an effort to target the entire cohort of conference attendees. Links to the survey were also posted on the YMCA Youth and Government website and on the Youth and Government Facebook Page.

Cases were defined as vomiting and/or diarrhea (at least two episodes of loose stools in a 24-hour period) among individuals who attended the conference and reported onset during February 11–14, 2010, while attending the conference. Information on exposures was also gathered from individuals who attended the conference and reported becoming ill outside of the designated time period and from those who denied developing illness.

Relative risk estimates were calculated. Pearson's Chi square and Fisher's exact test were used to evaluate statistical significance. Analyses were performed using SAS 9.1 (Cary, NC).

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Wake County Environmental Health inspected Hungry Howie's pizza, Sheraton Food Services, and Centerplate Catering for the convention center on the day of the outbreak. Environmental health specialists reviewed the menu of food items served to conference participants and interviewed employees regarding food preparation, storage methods, and illness among employees. The Chick-Fil-A restaurants were contacted and interviewed on Monday, February 15.

Stool specimens were tested for norovirus at the North Carolina State Laboratory of Public Health using reverse-transcription PCR (RT-PCR). Stool specimens were also tested for norovirus at CDC using RT-PCR and were tested for *Clostridium perfringens* enterotoxin using the Oxoid toxin detection kit and for the *C. perfringens* toxin gene using PCR.

Results

Descriptive Epidemiology

The YMCA provided demographic information on conference registrants (Table I). The majority were ages 14–18 years with some adult chaperones. Fifty-four percent of conference registrants were female.

Analytic Epidemiology—Survey Results

Six hundred two individuals attempted to answer the survey for a response rate of 59% (Table II).

The demographic characteristics of conference registrants and survey respondents are presented in Table I. Of note, much of the demographic information on the conference registrants was missing.

The following respondents were excluded from analysis: Eight individuals who did not attend the conference; one who answered questions inappropriately; fifty-nine who did not complete the entire questionnaire; one who reported onset of symptoms prior to arriving at the conference; nine who reported onset of illness after the conference had ended; and thirty-three individuals who were ill during the conference with symptoms which did not meet the case definition. Our final analysis included 310 persons who reported onset of illness during the conference and met case definition and 181 persons who reported no illness.

The earliest reported symptom onset among ill survey respondents occurred at 10:00 am on Thursday, February 11(Figure 1). That individual reported experiencing nausea, vomiting, diarrhea, and abdominal cramps. Some survey respondents reported hearing that individuals with vomiting were present on a bus bringing students to the conference; however, no one who answered the survey reported witnessing vomiting on a bus.

The risk of illness among those exposed to the Friday night banquet (February 12) was 2.58 times (CI 1.58–4.21) that of those who were not exposed to the dinner (Table III). The relative risks for the other meals were not statistically significant.

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Eighty-five percent (262/310) of those who met our case definition reported experiencing diarrhea without vomiting (Table IV). Vomiting without diarrhea was reported by 10/310 (3%) of cases and vomiting with diarrhea was reported by 38/310 (12%).

We further evaluated the risk of consuming individual food items at the dinner among all respondents (Table V). Those who ate the chicken were 2.62 times more likely to become ill (95% CI: 1.88–3.66). The pasta, over which the chicken was served, was also significantly associated with illness. Of note, several other food items served at the Friday banquet were associated with a significantly increased risk of illness, though not as strongly as the chicken (Table V).

Environmental Investigation

Four group meals were served during the conference prior to the outbreak. These included pizza at the hotel on Thursday evening and breakfast, lunch, and dinner on Friday. On Thursday, groups of attendees ordered individual pizzas from Hungry Howie's for their rooms. The Friday morning breakfast was served buffet-style and was catered by Sheraton food services. The lunch was catered at two different sites by two different Chick-Fil-A restaurants. There were six different lunch periods, each catered by both restaurants. The dinner on Friday night was plated and served at the convention center and catered by Centerplate.

Environmental health specialists found no violations during inspection of the Sheraton and Hungry Howie's pizza. Centerplate was noted to have cooked chicken to inadequate temperatures, 160°F as opposed to the recommended temperature of 165°F. The chicken served at the dinner on the night of February 12 was seared on February 11, chilled to 38–39°F, and then cooked on the day of the event. No employee absences due to illness were reported around the dates of the conference.

Laboratory Results

The four identifiable stool specimens which initially tested positive for norovirus by PCR at the state lab were sent to CDC for confirmation and sequencing. Norovirus could not be detected by testing at the CDC, and repeat testing subsequently performed on the same specimens at the state lab was also negative for norovirus. Symptom profiles were available for only two of those whose tests were positive for norovirus: one reported diarrhea only and the other reported nausea, vomiting, and diarrhea. Both of these individuals reported symptom onset on February 13, 2010; the onset dates for the other two with positive norovirus tests were not available.

Stool specimens collected in sterile urine containers and held at 4°C for approximately four weeks were tested by CDC for *Clostridium perfringens* enterotoxin and for the enterotoxin gene. Enterotoxin was detected in eight of nine specimens tested. The gene for the toxin was detected in five of six specimens tested.

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Conclusions

The tight clustering of illness onsets in time is consistent with a point-source outbreak (Figure I). The peak of illness onset occurred at 6 am on the morning of Saturday, February 13. Illness was strongly associated with the dinner (and particularly with the chicken) which was served approximately 10 hours earlier on Friday, February 12. This timing is suggestive of a foodborne outbreak caused by ingestion of a bacterial toxin. Of note, during interviews performed on Saturday, February 13, several ill attendees reported concerns that the chicken might have been undercooked. The possibility of illness due to ingestion of a bacterial toxin is also supported by the fact that vomiting was reported by only 15% of cases, a lower proportion than would be expected if the majority of cases were due to norovirus. Detection of *Clostridium perfringens* toxin in eight of the nine specimens tested also supports the conclusion that the outbreak was due to bacterial intoxication due to *Clostridium perfringens*.

Of note, laboratory specimens were initially positive for norovirus, but these results could not be replicated. The outbreak might have been mixed in origin with norovirus causing illness in some attendees. This is supported by the fact that norovirus was known to be widely circulating at the time of the outbreak and that a few individuals did report illness prior to the dinner on Friday night. However, the short incubation period and relative paucity of vomiting among cases make it unlikely that norovirus was the primary cause of the outbreak.

Recommendations

Inspection of all food handling facilities involved in this outbreak was conducted by Wake County Environmental Services and recommendations were made based on their findings. These recommendations included the following:

- For the Sheraton and Hungry Howie's Pizza:
  - Switch to chlorine-based sanitizer.
  - Empty and sanitize ice machines.
  - Avoid all bare hand contact with ready-to-eat food.
- For Centerplate Catering:
  - Switch to chlorine-based sanitizer.
  - Empty and sanitize ice machines.
  - Continue use of gloves to avoid bare hand contact with ready-to-eat food.
  - Cook chicken to internal temperature of 165°F.

Gastroenteritis Outbreak at YMCA Youth & Government Conference, February 2010—Interim Investigation Summary, March 23, 1010
(Tables and Figure)

Table I. Demographic Characteristics of Conference Registrants (n=1112)*

	n	%
Age		
<13	1	<1
13	0	0
14	7	1
15	115	12
16	239	25
17	316	34
18	226	24
>18	36	4
Sex		
Female	603	62
Male	368	38

* Age unknown for 172 registrants; sex unknown for 141 registrants

Table II. Demographic Characteristics of Survey Respondents (n=602)

	n	%
Age		
<13	0	0
13	1	<1
14	31	5
15	106	18
16	168	28
17	150	25
18	73	12
>18	73	12
Sex		
Female	383	64
Male	219	36

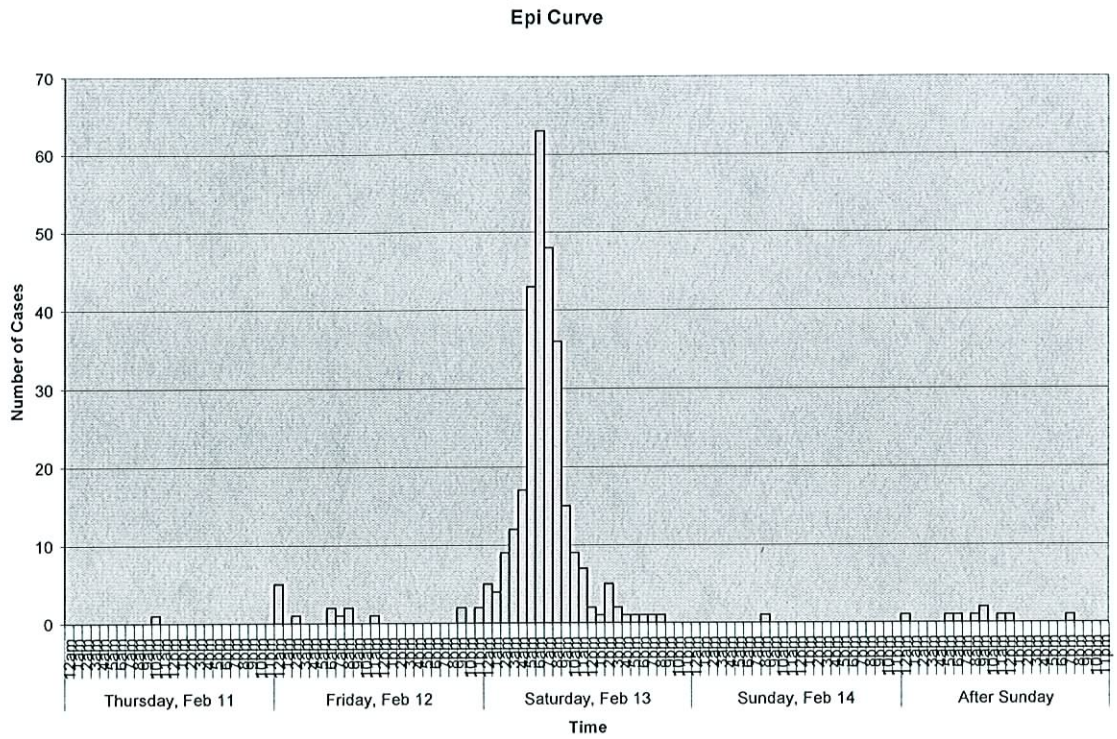

Figure 1. Time of Symptom Onset among Survey Respondents Reporting Illness

Table III. Relative risks for Conference Exposures among All Survey Respondents (n=491)

	Exposed				Not Exposed					
Exposure	**Ill**	**Not Ill**	**Total**	**Attack Rate**	**Ill**	**Not Ill**	**Total**	**Attack Rate**	**Relative risk**	**95 % CI**
Meeting room water	112	72	184	60.9%	198	109	307	64.5%	0.94	(0.82 , 1.09)
Thursday night pizza	126	73	199	63.3%	184	108	292	63.0%	1.00	(0.87 , 1.15)
Friday morning breakfast buffet	245	137	382	64.1%	65	44	109	59.6%	1.08	(0.91 , 1.28)
Friday lunch	279	158	437	63.8%	30	21	51	58.8%	1.09	(0.85 , 1.38)
Friday banquet dinner	297	145	442	67.2%	12	34	46	26.1%	**2.58**	**(1.58 , 4.21)**

Table IV. Symptoms Reported by Symptom Group

			Symptoms				
Group	**n**	**%**	**Vomiting**	**Diarrhea**	**Nausea**	**Abdominal Cramps**	**Other Symptom**
Vomiting (without diarrhea)	10	3	10	0	9	7	2
Diarrhea (without vomiting)	262	85	0	262	164	182	26
Vomiting and diarrhea	38	12	38	38	37	36	9
Total	310	100					

Table V. Table of Relative Risks for Exposure to Items at the Friday Night Banquet (n=491)

	Exposed				Not Exposed					
Exposure	Ill	Not Ill	Total	Attack Rate	Ill	Not Ill	Total	Attack Rate	Relative risk	95% CI
Apple Crisp	146	74	220	66.4%	164	107	271	60.5%	1.10	(0.96 , 1.25)
Asparagus	190	93	283	67.1%	120	88	208	57.7%	1.16	(1.01 , 1.34)
Butter	6	1	7	85.7%	304	180	484	62.8%	1.36	(1.00, 1.86)
Cheesecake	167	87	254	65.7%	143	94	237	60.3%	1.09	(0.95 , 1.25)
Chicken	284	112	396	71.7%	26	69	95	27.4%	**2.62**	(1.88 , 3.66)
Coffee	79	39	118	66.9%	231	142	373	61.9%	1.08	(0.93 , 1.26)
Hot Tea	2	3	5	40.0%	308	178	486	63.4%	0.63	(0.22 , 1.85)
Iced Tea	213	104	317	67.2%	97	77	174	55.7%	1.21	(1.03 , 1.40)
Mushroom Sauce	203	89	292	69.5%	107	92	199	53.8%	1.29	(1.11 , 1.50)
Pasta	282	131	413	68.3%	28	50	78	35.9%	**1.90**	(1.40 , 2.58)
Peas	200	85	285	70.2%	110	96	206	53.4%	1.31	(1.13 , 1.52)
Portobello Mushrooms	1	3	4	25.0%	309	178	487	63.4%	0.39	(0.07, 2.15)
Ranch Dressing	146	75	221	66.1%	164	106	270	60.7%	1.09	(0.95 , 1.24)
Rolls	249	118	367	67.8%	61	63	124	49.2%	1.38	(1.14 , 1.67)
Salad	258	125	383	67.4%	52	56	108	48.1%	**1.40**	(1.14 , 1.72)
Vinaigrette Dressing	118	52	170	69.4%	192	129	321	59.8%	1.16	(1.01 , 1.33)
Water	267	129	396	67.4%	43	52	95	45.3%	**1.49**	(1.18 , 1.88)
Other	11	5	16	68.8%	299	176	475	62.9%	1.09	(0.78 , 1.53)

Table VI. Comparison of Demographic Features of Ill and not Ill Attendees

	Ill (Met Case Definition) (n=310)		Without Illness (n=181)		
	n	%	n	%	*p*-value
Age					
<13	0	0	0	0	
13	0	0.0	1	0.6	
14	12	3.9	10	5.5	
15	51	16.5	36	19.9	
16	100	32.3	36	19.9	
17	74	23.9	40	22.1	
18	35	11.3	27	14.9	
>18	38	12.3	31	17.1	0.3746
Gender					
Female	206	66.45	105	58.01	
Male	104	33.55	76	41.99	0.06
Conference Role					
Advisor	26	8.39	22	12.15	
Director	5	1.61	7	3.87	
Chaperone	3	0.97	0	0	
Participant	271	87.42	150	82.87	
College Staff	0	0	1	0.55	
Other	5	1.61	1	0.55	0.1162
Date of Arrival					
February 10	9	2.9	11	6.08	
February 11	296	95.48	166	91.71	
February 12	5	1.61	4	2.21	0.1997
Hotel					
Sheraton	309	99.68	180	99.45	
Other	1	0.32	1	0.55	0.6996