



## **Outbreak of Norovirus at Augusta Middle School**

**Butler County, Kansas  
April 2007**

### **Report Date**

May 31, 2007

### **Outbreak Investigators**

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### **Reported By**

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### **Background**

On Friday, April 13, 2007, the Butler County Health Department (BCHD) notified the Kansas Department of Health and Environment (KDHE) of widespread illness among students at Augusta Middle School. Approximately 150 students—about 30% of the total student body—were absent Thursday, April 12. Vomiting, diarrhea, and abdominal cramps were reported among the absent students; some of the school staff were also reported to be ill. Over 100 students were out of school again on Friday, April 13. The illness seemed to be limited to one school; no other district school had reported extensive illnesses, and BCHD was unaware of similar outbreaks in the community.

Staff at KDHE and BCHD initiated an outbreak investigation to determine the source of illness and implement appropriate control and prevention measures.

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## **Methods**

### **Laboratory and Clinical Investigation**

BCHD delivered stool specimen collection kits to seven symptomatic individuals. Four stool samples were returned to BCHD and submitted to KDHE Laboratories. All four samples of these were from individuals in different households.

### **Epidemiologic Investigation**

Attendance records were obtained to determine the school's background level of absenteeism. The records suggested a point-source outbreak—attendance was high until Thursday, April 12, when 136 students were reported absent.

A retrospective cohort study was conducted to determine if the illness was linked to food served at the school cafeteria. A questionnaire was developed by KDHE Office of Surveillance and Epidemiology (OSE) staff to collect student demographic information, clinical information, and food histories. The questionnaire was delivered to the school by BCHD staff, self-administered, and returned to OSE for analysis.

Cases were defined as students who became ill with vomiting and/or diarrhea within ten to 50 hours after eating a school cafeteria meal. Teachers were excluded from the analysis, as only six of the 32 teachers surveyed reported eating from the school cafeteria on April 9, April 10, or April 11.

A questionnaire regarding work history, food history, and clinical information was distributed to all of the school district's foodworkers.

### **Environmental Investigation**

Staff from KDHE's Bureau of Consumer Health inspected both the district's central kitchen, where food is prepared for distribution to all area schools, and the school cafeteria, which is primarily used to reheat food.

### **Public Health Measures**

In addition to interviews with the local media, BCHD issued news releases to educate the community about disease control and prevention.

## **Results**

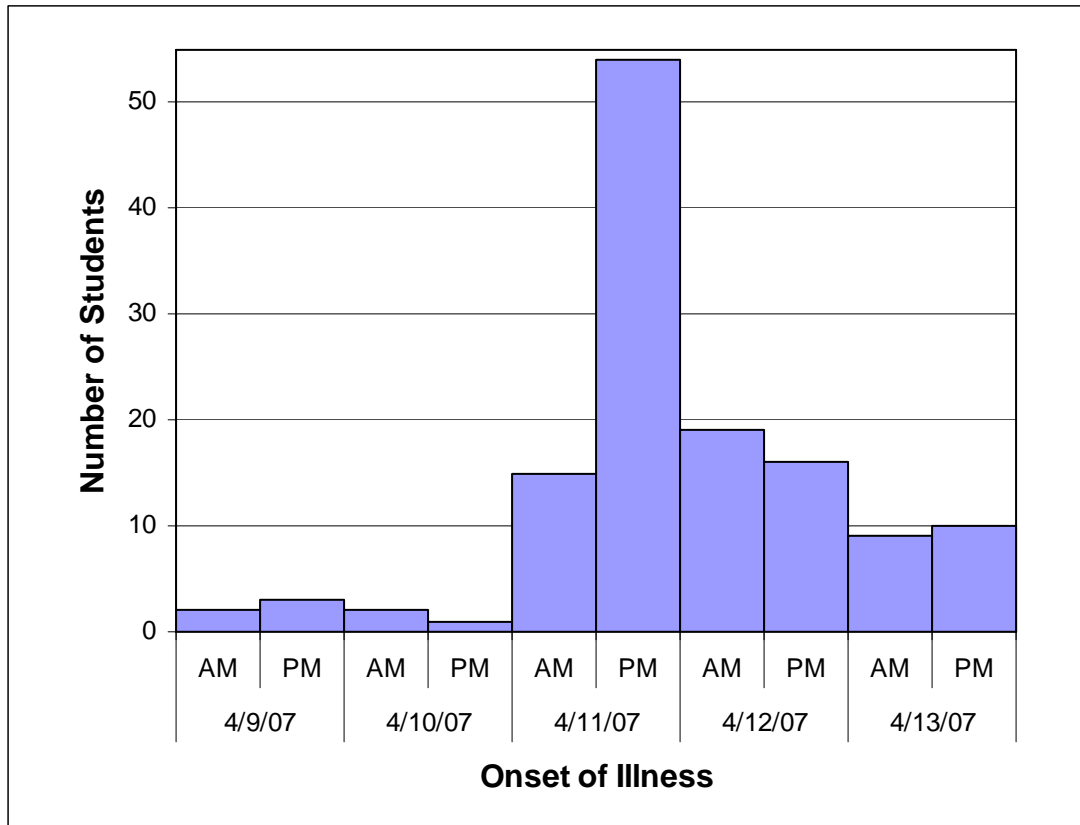
### **Laboratory and Clinical Investigation**

All four stool samples tested positive for norovirus—no bacterial pathogens were isolated. The positive samples were forwarded to the Minnesota Department of Health for further characterization. Genetic sequencing indicated that each stool sample contained the same strain of norovirus. All isolates were identified as genogroup I.

### Epidemiologic Investigation

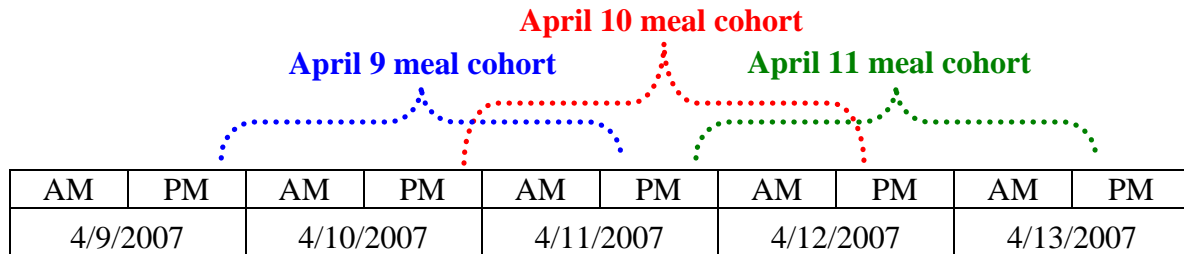
Questionnaires were completed by 80% of the 490 students (n=391). Although 35 (9%) respondents reported an onset of illness prior to April 9, and 23 (6%) reported an onset after April 13, the investigation focused on the week when absenteeism spiked: Monday, April 9, through Friday, April 13. A total of 134 students (34%) reported illness onset with vomiting and/or diarrhea during that week (Figure 1).

**Figure 1: Students reporting vomiting and/or diarrhea, April 9, 2007 - April 13, 2007 (n=134)**



To determine if any meal or food item from the school cafeteria was associated with illness, questionnaire respondents were grouped for analysis. To be included in the analysis for a given date's meal, each student must have either not become ill, or reported an onset of vomiting and/or diarrhea between ten hours after the beginning of that date's lunch period (11:00 a.m.) and 50 hours after the end of that date's lunch period (1:30 p.m.). For example, when examining the meal on April 9, a student must have become ill between April 9 at 9 p.m. and April 11 at 3:30 p.m. to be defined as a case (Figure 2).

**Figure 2: Illness onset ranges grouped for analysis for cafeteria meal dates.**



Two meal dates, April 9 and April 10, were significantly associated with illness (Table 1). However, because many students ate on both dates (n=257, 66%), and because the case ranges for April 9 and April 10 overlap by 18.5 hours, a false association between illness and the April 9 meal was created. This confounded result is apparent when examining the dates more closely. Of the 203 students that ate at the cafeteria on April 9, 34 (17%) became ill. Of the 187 students that ate at the cafeteria on April 10, 78 (42%) became ill. Given that a higher percentage of students became ill after eating April 10, and given the wide confidence interval calculated for the April 9 meal, it is likely that the meal on April 10 was the only meal truly associated with student illness. Students who ate lunch served at the school cafeteria on April 10 were 3.05 times more likely to become cases compared to those that did not eat that meal. Of the 97 students who became ill within 50 hours of the April 10 meal, 78 (80%) reported eating the April 10 meal.

**Table 1: Relative risk of illness associated with school cafeteria meals, April 9 - April 11**

Meal Date	Total Students	Ill Students (%)	Relative Risk	95% Confidence Interval
April 9	203	34 (17)	<b>8.65</b>	<b>2.03 - 36.86</b>
April 10	187	78 (42)	<b>3.05</b>	<b>1.71 - 5.44</b>
April 11	114	35 (31)	1.33	0.74 - 2.40

Bivariate analyses of foods served on April 10 demonstrated a significant association between taco salad consumption and illness (relative risk, 3.42; 95% confidence interval, 1.91-6.12). (Questionnaire respondents were asked to indicate if they ate "taco salad", as well as its ingredients, "lettuce", "cheese", and "salsa". Due to the high correlation among these choices, analysis was limited to the most frequently checked item, "taco salad".) Of the 63 students that reported eating taco salad, 35 (56%) became ill—these 35 students represent 46% of all those that became ill after eating on April 10. No other food item was statistically linked to illness.

Among those students that reported an onset of vomiting and/or diarrhea between 9 p.m. on April 10 and 3:30 p.m. on April 12 (n=97), 94 (97%) reported vomiting, 67 (69%) reported stomach cramps, 43 (44%) reported diarrhea, and 37 (38%) reported fever. Among those cases that indicated a specific date and time of recovery (n=73), the median duration of illness was 43 hours. The median age of these cases was 13 years (range, 11-14 years), and 48% were male. A similar percentage of students were affected in each grade. Some student teams reported more illness than others; Team T, part of the 7<sup>th</sup> grade, reported the highest number and percentage of ill students (Table 2).

**Table 2: Cases by grade and team (n=92\*)**

	<b>Students Surveyed</b>	<b>Cases (%)</b>
6 <sup>th</sup> Grade	134	30 (22)
Team M	67	9 (13)
Team E	67	21 (31)
7 <sup>th</sup> Grade	134	38 (28)
Team T	69	25 (36)
Team G	65	13 (20)
8 <sup>th</sup> Grade	102	24 (24)
Team R	64	18 (28)
Team S	38	6 (16)

*\*Five cases that did not indicate grade or team were excluded. Case Definition: vomiting and/or diarrhea between 9 p.m. on April 10 and 3:30 p.m. on April 12.*

Questionnaires were completed by all 24 district foodworkers. Five (21%) reported vomiting and/or diarrhea between April 9 and April 14. One ill foodworker worked at the central kitchen, and two of these ill foodworkers worked at the affected middle school; only one reported an onset prior to the spike in student illness. This individual became ill at 10:30 p.m. on April 9, and did not work on April 10. Although they did not meet the case definition for this outbreak, three additional foodworkers, including one at the central kitchen and two at the affected middle school, reported being ill with nausea between April 9 and April 12.

### **Environmental Investigation**

No critical violations were observed during the facility inspections. Inspectors reviewed the kitchen's Hazard Analysis and Critical Control Point (HACCP) plan, and verified that it was being correctly followed.

## **Conclusion**

Clinical information collected from the outbreak questionnaire indicated that gastrointestinal illness, consistent with the symptoms of norovirus infection, was present in the student body prior to April 11. An average of five students became ill on each day from April 2 through April 10. This low level of disease transmission is likely explained by transmission from one student to another. However, on April 11, 69 students became ill; this spike in illness is likely too great to have been caused only by person-to-person transmission.

The epidemiologic, clinical, and laboratory data collected regarding the peak period of student illness are consistent with a point-source outbreak of norovirus. The meal served at the school cafeteria on April 10 was statistically implicated as a cause of illness—persons who ate that meal were approximately three times more likely to become ill compared to those that did not the meal. The taco salad served at the April 10 meal was the only specific food item to be statistically associated with illness. Because only 35 of the 97 students that became ill after eating on April 10 reported eating taco salad, it is unlikely that this single food item was responsible for all illness. It is more likely that norovirus was spread through several food items served on April 10. Person-to-person transmission of disease may also account for a small percentage of those 97 illnesses.

No food samples were tested to confirm viral contamination; historically, isolation of norovirus from food has been difficult.\* The foodworkers who prepared and served the April 10 meal denied vomiting or diarrhea prior to the time of its preparation; however, asymptomatic carriers have been previously noted. Asymptomatic shedding of norovirus may last for up to two weeks after initial infection.\*

Norovirus is the leading cause of foodborne illness in the United States; an estimated 23 million people are infected with norovirus every year—40% of these infections may be foodborne.# Onset of diarrhea and vomiting are common 12-48 hours after infection, and may last from 12 to 60 hours. Vomiting is more prevalent in children than adults. The disease is transmitted through fecal-oral routes; historically, norovirus outbreaks have been associated with fecally contaminated foods, especially ready-to-eat foods such as salads, sandwiches, ice, cookies, and fruit.¶ Humans are the only known reservoir of norovirus.

Special care should be taken to avoid norovirus contamination of ready-to-eat foods. Foodhandlers should be educated on proper handwashing and discouraged from bare hand contact with such foods. Ill foodhandlers should be excluded from work while experiencing gastrointestinal illness.

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\* Centers for Disease Control and Prevention. "Norwalk-Like Viruses: Public Health Consequences and Outbreak Management." MMWR 2001;50(No. RR-09);1-18

# Mead PS. Food related illness and death in the United States. Emerging Infectious Diseases, 1999. 5(6):607-625.

¶ Centers for Disease Control and Prevention. "Diagnosis and Management of Foodborne Illnesses: A Primer for Physicians and other Health Care Professionals." MMWR 2004;53(No. RR-4).

## **Limitations**

This retrospective cohort study was limited by several factors:

- Selection of participants
  - The outbreak questionnaire was self-administered on April 19, 2007. Students absent from school on that date did not participate. Eighty percent of the total student body completed the questionnaire; the response rate of each student team ranged from 56%-100% (median, 82.5%).
- Recall bias
  - Over a week had passed from the cafeteria meal dates to the time the questionnaires were completed. Food histories and clinical information reported by the students may not be accurate.
- Scope of investigation
  - No other exposures—such as breakfast served at the school cafeteria, which is eaten by a relatively low number of students—were examined as a source of illness.

## **Acknowledgements**

The investigators of this outbreak thank the school staff, the Butler County Health Department, and KDHE for the assistance provided during this investigation. KDHE is grateful for the assistance provided by the students and their parents in completing outbreak questionnaires and obtaining stool specimens for testing.