

**Outbreak of Norovirus Gastroenteritis Associated with a
School -- Seward County, Kansas, April, 2008**



Investigation by:

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BACKGROUND

On Wednesday, April 2, 2008 the Seward County Health Department (SWCHD) notified the Office of Surveillance and Epidemiology (OSE) at the Kansas Department of Health and Environment (KDHE) that an unusually higher number of students were absent from Cottonwood Intermediate School on Tuesday, April 1st. The predominant symptoms reported by absent students and some of the school staff included vomiting, diarrhea, abdominal cramps, and fever. Illness appeared to be limited to only the intermediate school; none of the other schools in the district reported an increase in absenteeism on either Tuesday or Wednesday. Staff at SWCHD and KDHE initiated an outbreak investigation to determine the source of illness and to implement appropriate control and prevention measures.

METHODS

Epidemiologic Investigation

Beginning on April 2, demographic and symptom information were collected from students and staff who were absent from the school because of illness.

A retrospective cohort study was then conducted among all students and staff to determine if illness was associated with any specific food items served in the school cafeteria during breakfast or lunch on March 31 or April 1. A questionnaire was developed in English and Spanish and distributed to students and staff on Friday, April 4. Completed surveys were returned on Monday, April 7.

To determine if any food item from the school cafeteria was associated with illness, students and staff were asked if they had consumed individual food and drink items that were served on Monday, March 31 and Tuesday, April 1. For meals served on Monday, March 31, only those students with onset of illness from Monday night until Thursday afternoon were included in the analysis. For meals served on Tuesday, April 1, only those students that reported onset of illness from Tuesday night until Friday afternoon were included. Odds ratios with 95% confidence intervals were calculated for each food or drink served at breakfast and lunch on Monday, March 31 and Tuesday, April 1.

A case was defined as illness in a student or teacher who had vomiting or diarrhea (3 or more loose stools within a 24-hour period) on or after the evening of Monday, March 31.

Environmental Investigation

Staff from KDHE, Bureau of Consumer Health inspected the cafeteria at the intermediate school and the central kitchen, located at the high school, where food is prepared for all district schools. A food worker survey was distributed to all food handlers at both schools to collect information regarding work history, food history, and illness information.

Laboratory Analysis

Three stool specimens and one vomitus specimen was collected from four ill individuals. The Kansas Health and Environmental Laboratories (KHEL) tested all specimens for norovirus and all stool specimens for enteric bacteria.

RESULTS

Epidemiologic Investigation

Case Finding

Ninety-two individuals met the case definition. The median age of the cases was 11 years, 53 (58%) were female. No difference in illness among grade levels was observed.

Vomiting was the most frequently reported symptom followed by nausea, abdominal cramps, diarrhea, and fever. Four students reported bloody diarrhea. Ten reported seeing a physician, and two sought care from a hospital (Table 1).

Table 1: Clinical Information

Symptoms	Number (%) *
Vomiting	74 (81%)
Nausea	68 (76%)
Abdominal Cramps	66 (75%)
Diarrhea	53 (58%)
Fever	32 (36%)
Bloody Diarrhea	4 (4.4%)
Medical Care	Number (%)
Physician	10 (11%)
Hospital	2 (2.2%)

*For some cases symptom information was incomplete.

The incubation period ranged from less than one day to 4 days with a median of 2 days (Figure 1). Illness increased markedly on April 1 and April 2, with 61 students and 3 teachers reporting illness. Duration of illness was 1 to 4 days with a median of 1 day.

Cohort Study

Of the 498 students who were given the cohort study survey, 214 (43%) responded. Of the 47 professional staff members, one teacher responded (2.1%).

The only food item that was associated with illness was served at lunch on Monday, March 31. Of the 134 students that reported eating pancake-on-a-stick, 40 (30%) became ill. Statistical analysis demonstrated that eating the pancake-on-a-stick was significantly associated with illness (odds ratio [OR] = 3.69; 95% confidence interval [C.I.] = 1.06-12.89). No other food item was statistically linked to illness, as noted in Table 2.

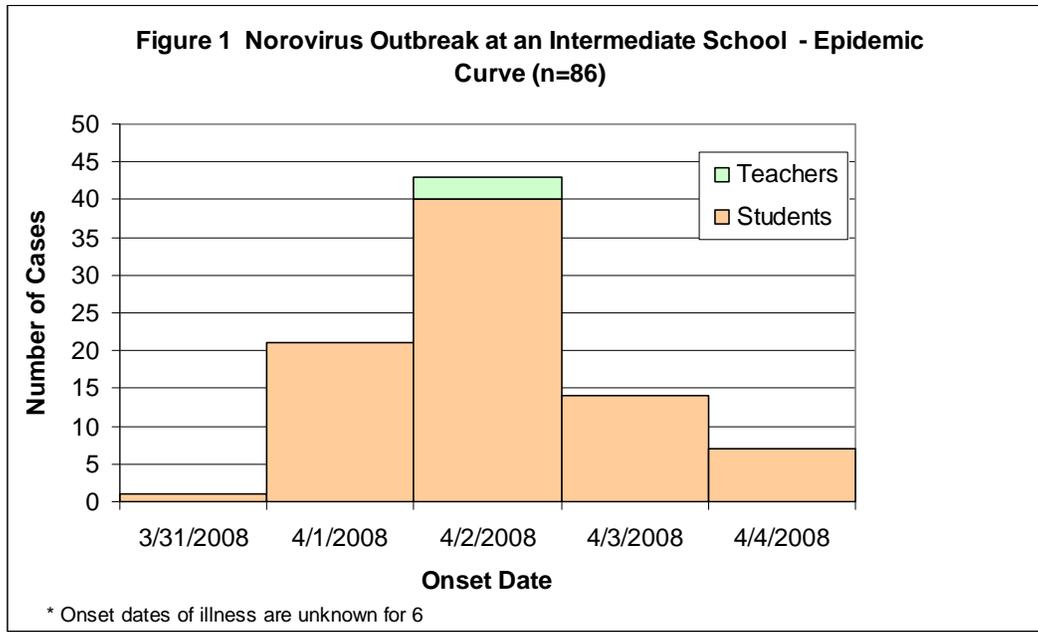


Table 2: Exposure Information

	Ate Meal/Item		Did Not Eat Meal/Item		% Ill	OR*	95% CI [§]
	Ill	Not Ill	Ill	Not Ill			
Monday							
Breakfast							
Cereal	19	37	34	2	7	22	1.80 0.34-9.51
Elfin Loaf	9	21	30	11	19	37	0.74 0.25-2.17
Milk	18	39	32	3	6	33	0.92 0.21-4.11
Juice	14	28	33	6	15	29	1.25 0.40-3.92
Lunch							
Pancake on a Stick	40	94	30	3	26	10	3.69 1.06-12.89
Apple	32	69	32	11	45	20	1.90 0.87-4.14
Milk	38	97	28	6	27	18	1.76 0.67-4.61
Tuesday							
Breakfast							
Burrito	12	28	30	4	12	25	1.29 0.34-4.80
Apple	10	19	34	6	17	26	1.49 0.45-4.98
Milk	14	37	27	2	4	33	0.76 0.12-4.60
Lunch							
Ravioli	26	83	24	12	23	34	0.60 0.26-1.37
Rolls	34	90	27	4	14	22	1.32 0.41-4.30
Green Beans	12	21	36	24	83	22	1.98 0.85-4.60
Carrots	16	69	19	21	37	36	0.41 0.19-0.88
Pears	28	82	25	8	23	26	0.98 0.39-2.44
Milk	22	46	32	3	10	23	1.59 0.40-6.38

* The odds ratio (OR) is the odds of disease among the exposed divided by the odds of disease among the non-exposed¹.

§ The confidence interval is an estimated range of values within which the true OR is likely to fall 95% of the time.

Environment

Inspections of the schools' kitchens were conducted on April 3. At the high school, one critical violation was noted; a salad bar item was above the proper cold hold temperature. At the intermediate school there were also critical violations observed; two hand-washing violations. Forty-six employees were surveyed, 41 from the high school and five from the intermediate school. One food handler from each of the schools reported illness, although specific onset dates of illness for both employees are unknown. One ill employee reported gastrointestinal illness symptoms while the other did not list specific symptoms on the survey.

Laboratory

All three stool specimens and the vomitus specimen tested positive for norovirus genogroup I. The three stool specimens were forwarded to Minnesota Department of Health Laboratory for sequencing.

DISCUSSION

An outbreak of gastroenteritis caused by norovirus occurred in students and teachers at Cottonwood Intermediate School in Seward County Kansas. Three specimens collected from ill students and one specimen collected from an ill teacher all tested positive for norovirus. Ten students reported illness consistent with norovirus prior to the evening of Monday, March 31; however, from the evening of March 31 until April 2, 65 students and teachers reported becoming ill. This large increase in illness over a short time period is consistent with a point source outbreak. This cohort study revealed that the pancake-on-a-stick that was served for lunch on Monday, March 31, was significantly associated with illness.

The ten cases that occurred prior to or just after Monday's lunch along with 34 students reporting at least one other household member ill indicates that community transmission and secondary transmission of norovirus has occurred.

During the environmental assessment, two hand-washing violations were noted at the intermediate school and at least one employee did report illness on their survey. Specific clinical information about employee illness is not known because some of the employee surveys were not filled out completely.

Norovirus is a highly contagious pathogen that requires as few as 10 organisms to cause infection, and shedding of the virus has shown to occur prior to the onset of symptoms². Transmitted primarily through the fecal-oral route, norovirus particles may be spread through direct contact or through consuming fecally contaminated food or water. Spread via aerosolized vomitus is also possible. Historically, norovirus outbreaks have been associated with fecally contaminated foods, especially ready-to-eat foods such as salads, sandwiches, ice, cookies, and fruit³. Humans are the only known reservoir of norovirus. Special care should be taken to avoid norovirus contamination of ready-to-eat foods. Food handlers should be educated on proper hand washing and discouraged from bare hand contact with such foods. Ill food handlers should be excluded from work while experiencing gastrointestinal symptoms.

LIMITATIONS

Low response rate for the cohort study

Initially passive consent letters and surveys were to be sent home with the students. Those students not returning completed surveys or signed consent letters were to fill out surveys at school on Monday. However, only those surveys that were returned on Monday were given to KDHE. No students filled out surveys on Monday. In addition, only one teacher and no other staff members returned surveys.

Misclassification

Specific onset time of illness is not known for students included in the cohort study. Students were asked if they had become ill in the morning, afternoon, or evening. Students were included in the study if they became ill within the incubation period of norovirus. Because exact times are not known estimates of onset time of illness were used. This could have led to inclusion or exclusion of students that became ill within the incubation period of norovirus in the analysis of food items served on Monday or Tuesday.

Incomplete Employee Surveys

Although the surveys were offered in both English and Spanish, the food employee surveys were only in English. This could have affected the completeness and quality of the information collected for the food employee surveys.

Acknowledgements

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Our Vision and Mission

As the state's environmental protection and public health agency, KDHE promotes responsible choices to protect the health and environment for all Kansans.

Through education, direct services, and the assessment of data and trends, coupled with policy development and enforcement, KDHE will improve health and quality of life. We prevent injuries, illness, and foster a safe and sustainable environment for the people of Kansas.

References:

- 1 Last, JM, ed. A Dictionary of Epidemiology. 3rd edition. New York: Oxford University Press, 1995.
- 2 Goller JL, Dimitriadis A, Tan A, Kelly H, Marshall JA. 2004. J. Hosp. Infect. 58(4):286-91.
- 3 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).