Introduction
In late November 2004, during routine review of the state’s disease reporting and tracking system (HAWK), an epidemiologist with the Epidemiologic Service Section (ESS) within the Bureau of Epidemiology and Disease Prevention (BEDP) at the Kansas Department of Health and Environment (KDHE) noticed an increase in number of Salmonella cases reported from Overland Park, Kansas in Johnson County. An Epidemiologist at the Johnson County Health Department (JCHD) had been following this increased number of cases. KDHE suggested that the county continue to monitor the Salmonella cases for any possible common risk factors.

Preliminary information revealed that there were several cases, both confirmed and suspect of Salmonella typhimurium in the southern part of the county. Active surveillance coupled with continued passive surveillance revealed that many of the cases were employees of a retail store or patrons of the store’s food bar. The retail store is a part of a national chain, with several locations in Johnson County. However, only one location was associated with an increased disease occurrence. Review of the information obtained revealed that the number of confirmed cases associated with the retail store was suggestive of an outbreak.
With the cooperation of the retail store (Store X) and their corporate office, JCHD and ESS began an outbreak investigation on December 8. The purpose of the investigation was to determine the scope of the outbreak, to identify potential sources of exposure, and to implement appropriate prevention and control measures.

**Background**

Johnson County is located in northeastern Kansas. The county shares a border with the State of Missouri. It is the largest, and the fastest growing County in Kansas, with a population of 486,515. It is adjacent to Wyandotte, Leavenworth, Douglas, and Miami Counties on the Kansas side and Jackson and Cass Counties on the Missouri side. (Attachment 1). Overland Park is the largest city in the county with a population density of 2627 persons/m².

Store X is one of five stores in Johnson County that are part of the X National Department Store chain. The store is located in a shopping center in a newly developing residential area in southern Johnson County. The store usually employs 110 people, the majority of whom are students working on a part-time basis. Workers are placed in different categories depending on their roles and the section of the store where they primarily work. These categories include Managers, Team Leaders (sectional supervisors), Food Service, Front and Back workers. Front workers include cashiers and those with work in areas located in the front section of the store. Back workers include storage room workers, hardware, etc.

The food bar in Store X is located near the east entrance of the store, opposite the cash registers. The food bar serves pizza, bread sticks, sandwiches, hotdogs, salads, popcorns, frozen yogurts, soda and water. Out of the 110 employees, seven are Food Service workers; ten are cross-trained in Food Service. All other employees in the Front group are required to fill-in in the food service area when the need arises. For example, they attend to a customer in the food bar if the assigned Food Service staff is on break. Approximately, 39 of the employees could potentially work in the food service area.

During the month of November 2004, social gatherings were held at Store X for employees and families in celebration of Thanksgiving. On November 19, a potluck party was held for the employees and the workers brought in food. On November 26, the store held a Thanksgiving party for both employees and families. A local restaurant catered food. Food was left out and available for at least 7 hours during each event. Workers could access the food as their schedule permitted.

The Manager of the Store X reported an increase number of call-ins from workers over the period of late November to first week in December.

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1 U. S. Census Bureau: State and County QuickFacts. [http://quickfacts.census.gov](http://quickfacts.census.gov)
**Outbreak Investigation**

**Epidemiologic Methods**
On December 8, JCHD conducted interviews with the six confirmed salmonella cases (four workers at Store X and two patrons of the food bar) using a simple fact finding questionnaire, the Potential Enteric Worksheet. The Manager at Store X was also interviewed in order to gather information related to the activities at the store’s social events, the foods served and information about employees who called-in sick from late November to the first week in December.

Based on the information collected, a case was initially defined as any person who (a) had a positive *Salmonella typhimurium* laboratory result or (b) experienced vomiting and/or watery or bloody diarrhea (defined as 3 or more loose stools in a 24-hour period) with an onset date of November 16 or later. As we obtained more information, the case definition was modified and a case was defined as any person who (a) had *Salmonella typhimurium*, (b) had an association with Store X, and (c) had onset date of illness beginning November 10 or later.

JCHD and KDHE developed a more detailed questionnaire. The Division of Disease Containment at JCHD administered the questionnaire through face-to-face interviews. At the time of the interviews, there were 100 employees working at Store X. The Division of Disease Containment interviewed 99 of the employees within a two-day period. One person refused to participate in the interviews.

Completed questionnaires were entered into Epi Info 2002 and analyzed using both Epi Info and SAS 9.1. Descriptive statistical analyses and univariate analyses were performed to determine any association between illness and activity and illness and food consumption.

**Environmental Methods**
The Johnson County Environmental Department, Sanitation Division conducted two separate inspections of the Store X food bar. The purpose of the inspections was to determine general compliance with the State statutes and regulations. Inspectors focused on the food preparation procedures, handling of ready-to-eat foods, employee health, and information on the sources and/or supply of the food items.

**Laboratory Methods**
All employees who met the case definition, and had not been tested were requested to submit stool samples for testing to Kansas Department of Health and Environmental Laboratory (KDHEL). A total of nine stool specimens were tested. Since Kansas’ regulations require submission of *Salmonella* isolates to KDHEL, those clinics/hospitals that had not submitted an isolate to KDHEL were contacted. Requests were made for submission of isolates for the purpose of performing pulse-field gel electrophoresis (PFGE) DNA sub-typing. The Missouri State Laboratory was contacted for PFGE results on the isolates of Kansas’ residents sent to Missouri.
**Intervention Methods**

On December 17, JCHD, Division of Disease Containment with the help of the Division of Sanitation, using video presentations conducted an in-house educational training for Store X, Food Service workers. The training emphasized proper hand washing technique, food safety, proper handling of food items and ready to eat foods. The Managers and Supervisors were also trained on the State of Kansas laws regarding isolation of a food handler with vomiting and/or diarrhea from food handling processes.

**Outbreak Investigation Results**

**Epidemiologic Results**

All 99 questionnaires of the Store X employees interviewed were used for data analysis. Of the 99 questionnaires analyzed, 27 (27%) individuals met the case definition. Table 1 summarizes the results of the descriptive statistics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Ill (n=27)</th>
<th>Not Ill (n=73)</th>
<th>χ²</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. (%)</td>
<td>No. (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>11 (41)</td>
<td>31 (43)</td>
<td>0.51</td>
<td>0.775</td>
</tr>
<tr>
<td>Female</td>
<td>16 (59)</td>
<td>41 (57)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Worked in food service</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regularly</td>
<td>1 (4)</td>
<td>5 (7)</td>
<td>0.65</td>
<td>0.723</td>
</tr>
<tr>
<td>Backup</td>
<td>8 (30)</td>
<td>19 (26)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food exposure sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thanksgiving dinner</td>
<td>10 (37)</td>
<td>26 (36)</td>
<td>6.30</td>
<td>0.178</td>
</tr>
<tr>
<td>Team Leader potluck</td>
<td>15 (56)</td>
<td>42 (58)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store X food bar patron</td>
<td>23 (85)</td>
<td>39 (54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean, yrs</td>
<td>26</td>
<td>34</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Median, yrs</td>
<td>24</td>
<td>31</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>Range, yrs</td>
<td>17-56</td>
<td>16-67</td>
<td>16-67</td>
<td></td>
</tr>
</tbody>
</table>

There were no significant difference in demographic characteristics between those who
were ill and those who were not ill. Of the 27 ill employees, 7 (26%) persons had medical visits, 9 (33%) were tested and 6 (22%) were positive for *S. typhimurium*. The median incubation period could not be determined because the specific time illness occurred was not collected.

**TABLE 2. Symptoms Reported by Cases (n=27)**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>27 (100)</td>
</tr>
<tr>
<td>Watery</td>
<td>20 (74)</td>
</tr>
<tr>
<td>bloody</td>
<td>1 (4)</td>
</tr>
<tr>
<td>watery/bloody</td>
<td>6 (22)</td>
</tr>
<tr>
<td>Nausea</td>
<td>22 (81)</td>
</tr>
<tr>
<td>Abdominal cramps</td>
<td>21 (78)</td>
</tr>
<tr>
<td>Headache</td>
<td>19 (70)</td>
</tr>
<tr>
<td>Fever</td>
<td>16 (59)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>14 (52)</td>
</tr>
</tbody>
</table>

**FIGURE 1. Epidemiologic curve of Johnson County Salmonella outbreak 11/2004**
Presenting the number of persons with illness, by onset date and case status.

* Onset data 12/31/2004 was not included. It is more than two incubation periods from the last onset date of 12/11/2004.
Results of the univariate statistical analyses are shown in Table 3. Illness appeared to be associated with eating at the Store X food bar. When illness and exposure to specific individual food items from the food bar were analyzed and compared, varying associations were found, but bread sticks showed the strongest association with illness.

**TABLE 3. Analysis of risk of eating selected individual food items from the food bar and becoming ill**

<table>
<thead>
<tr>
<th>Ate item(s) from the food area</th>
<th>Yes</th>
<th>No</th>
<th>RR</th>
<th>95% C.I.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any food item</td>
<td>23</td>
<td>39</td>
<td>4</td>
<td>33</td>
</tr>
<tr>
<td>Bread sticks**</td>
<td>15</td>
<td>21</td>
<td>12</td>
<td>51</td>
</tr>
<tr>
<td>Turkey sandwich</td>
<td>3</td>
<td>4</td>
<td>24</td>
<td>68</td>
</tr>
<tr>
<td>Pepperoni pizza</td>
<td>9</td>
<td>16</td>
<td>18</td>
<td>56</td>
</tr>
<tr>
<td>Cheese pizza</td>
<td>4</td>
<td>9</td>
<td>23</td>
<td>63</td>
</tr>
<tr>
<td>Drank any soda</td>
<td>12</td>
<td>19</td>
<td>15</td>
<td>53</td>
</tr>
<tr>
<td>Drank water</td>
<td>10</td>
<td>15</td>
<td>17</td>
<td>57</td>
</tr>
</tbody>
</table>

*Significant association
** Some persons had pizza, sauce for dipping with bread sticks; these two items were not separated in the data collection.

**Environmental Results**
During the inspections of Store X food bars, no violations were noted. However, interviews of the Food Service regular and backup staff by the Johnson County Health Department, Division of Disease Containment revealed that some employees did work when they were having diarrhea.

**Laboratory Results**
PFGE DNA subtyping of six of the laboratory confirmed cases had matching TYPX003 pattern.

**Discussion**
Based on the information collected during the outbreak investigation, employees most likely became infected with *S. typhimurium* as a result of consuming food from the food bar. Statistical analyses revealed that employees who ate any food from the food bar had a more than three times higher risk of becoming ill compared to those who did not eat food from the food bar [RR = 3.4; 95% C.I. = 1.3, 9.1]. The sustained number of cases throughout the time period under investigation indicates a possible propagated source outbreak.

“Eating at the food bar” had a statistically significant association with Salmonella infection [RR = 3.4; 95% C.I. = 1.3, 9.1]. Individual item analyses revealed no significant
association other than the single item of breadsticks [RR = 2.2; 95% C.I. = 1.2, 4.1]. Individual analysis of the pizza/dipping sauce could not be conducted because of lack of data. Though Salmonella infections are most often attributed to consumption of foods of animal origin such as poultry, beef, fish, eggs, and dairy products. Fruits, vegetables, and bakery products have been implicated in outbreaks. In this outbreak, it appears that foods of animal origins were a less likely source of infection than an infected person/persons as indicated by the epidemiologic curve. It may be possible that an infected person/employee had the opportunity to contaminate food items that were subsequently served to other employees and patrons.

A food handler infected with Salmonella typhimurium may have contaminated ready-to-eat food served at the food bar. A violation of food handling practices that is a frequent cause of food contamination is lack of hand washing or ineffective hand washing. Inspections of the food bar found no critical violations. When the staff of the JCHD, Division of Disease Containment visited Store X for the interviews, they noticed that there was no warm water in the employee restrooms. Because the outbreak occurred during cold weather, employees could have been discouraged from properly washing their hands after using the restrooms. This could have contributed to the spread of the infection.

**Conclusion**

The Salmonella outbreak at Store X appeared to be associated with eating at the food bar. Epidemiological evidence was highly suggestive of a propagated source transmission, and eating at the food bar was the most likely exposure. The statistically significant association between illness and bread sticks suggests a possible contamination of the bread sticks at the food bar by an infected food handler.

A case-control study was initiated following the cohort study. The cases from Store X who had Salmonella typhimurium TYPX003 pattern and other cases with matching TYPX003 pattern in the Kansas City metro area were used to further investigate the source of the outbreak. The results will be reported in the case-control study final report.

**Limitations**

The outbreak at Store X proved to be a challenge to investigate and analyze because of staff roles and assignments. The source of illness was difficult to identify due to many possible exposures related to employees’ and family social activities. Many employees shared roles in the food bar including the multi-functions of the back-up food handlers and those crossed trained to help in the food bar. This made it difficult for proper identification and isolation of symptomatic food handlers in accordance with the state laws and restricting work during diarrhea illnesses. The actual cause of Salmonella illnesses associated with Store X was not immediately apparent.

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**Recommendations**

- Store X might consider limiting the number of employees that work in the food bar.
- Exclude all employees with diarrhea and/or vomiting from food duties.
- Provide opportunities for employees with diarrhea excluded from food handling to perform other duties.
- Periodic training for food handlers on food safety and proper food handling.
- Ensure that running water in the restroom is at temperature, which will encourage workers to properly wash their hands.

**Attachments**

1. Map of Johnson County, Kansas
2. Kansas Potential Enteric Worksheet
3. Outbreak Investigation Questionnaire
# POTENTIAL ENTERIC OUTBREAK WORKSHEET

## CALLER INFORMATION

<table>
<thead>
<tr>
<th>Name:</th>
<th>__________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agency:</td>
<td>__________________________</td>
</tr>
<tr>
<td>City:</td>
<td>__________________________</td>
</tr>
<tr>
<td>County:</td>
<td>(____) ____________________</td>
</tr>
<tr>
<td>Contact Phone:</td>
<td>__________________________</td>
</tr>
</tbody>
</table>

**Caller Type:**
- Food Inspector
- Laboratorian
- Nurse
- Physician
- Private Citizen
- Other _________________

**Suspected Type of Outbreak Reported:**
- Foodborne
- Person-to-person
- Waterborne

## ILLNESS INFORMATION

| Date First Person Became Ill: | ____/____/_____ |
| Time of First Illness:        | _____ AM PM |

**# of Ill Individuals Reported:**

**Total # of Individuals in Group:**

**Symptoms Reported:**
- Watery Diarrhea
- Bloody Diarrhea
- Abdominal cramping
- Nausea
- Vomiting
- Fever
- Headache
- Dizziness
- Other ______________________

**# of Individuals who:**
- Had doctor visits _____
- Had ER visits _____
- Were hospitalized _____

**# of Stool Samples Collected To Date**
(Note: Attempt to collect some samples if none already taken.)

## EVENT INFORMATION

| Date of First Known Exposure: | ____/____/_____ |
| Time of First Exposure:       | _____ AM PM |

**Place of Exposure:**
- Day care
- Day nursery
- Office setting
- Private Residence
- Private residence
- Reception Hall
- Restaurant
- School
- Other ______________________

**Name of Place:**

**City & County:**

**If catered event:**

Catering Company __________________________

City & County ______________________

**If foodborne, other common meals shared:**

1. __________________________
2. __________________________
3. __________________________

## COMMENTS

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
DIARRHEA ILLNESS INVESTIGATION
JOHNSON COUNTY HEALTH DEPARTMENT

SECTION 1
Name: ___________________________________ DOB: _____________ Age: _______
Address: ________________________________  Sex:    ___Male ___Female
City: ______________________ Zip:________ State: __________
Phone: (      ) _______________________________ Cell Phone/work phone: ________________________
Occupation: ☐ Food worker ☐ Healthcare worker ☐ Daycare Location: ___________________________
If Target employee, which section do you work? _____________________________
Other employments

SECTION 2
Have you experienced any illness since Nov. 14, 2004?   ( ) Yes   ( ) No
(If Yes, please fill out the rest of the information.  If not, go to section 3.)
Date of first illness: ______________ Time of first illness: _____AM/PM
First symptom: _____________________ Date of Last illness _______ Time ________AM/PM
Other symptoms:  ( ) Watery Diarrhea  ( ) Bloody Diarrhea  ( ) Vomiting
                     ( ) Fever  ( ) Abdominal cramping
                     ( ) Headache  ( ) Nausea  ( ) Dizziness
                     ( ) Other:  ____________________________
Was an MD seen?   Yes___ No___ (If yes, name and phone of MD_____________________ )
Was a stool specimen taken?   __________ (Diarrhea is defined as 3 or more loose stools in 24 hours)
Are you still having symptoms? ( ) Yes  ( ) No

SECTION 3
Did you attend the Target Family and Friends Thanksgiving Party on Nov. 26th?   ( ) Yes       ( ) No
(If yes, continue and indicate foods eaten, if no go to section 4)
Food Item
Barbeque Beef ☐ ☐
Beans ☐ ☐
Bread ☐ ☐
Turkey ☐ ☐
Cole slaw ☐ ☐
Soda ☐ ☐
Other foods (Lists)

SECTION 4
Did you attend the Team Leaders meeting on Nov. 19th?   ( ) Yes       ( ) No
(If yes, continue and indicate foods eaten, if no go to section 5)
Food Item
Beef ☐ ☐
Beans ☐ ☐
Bread ☐ ☐
Turkey ☐ ☐
Cole slaw ☐ ☐
Soda ☐ ☐
Other foods (Lists)
**SECTION 5**

Did you eat at the Target Food Service Bar between Nov. 13th and Dec 10th?  
( ) Yes  ( ) No  
*(If yes, continue and indicate foods eaten, if no go to section 6)*

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Yes</th>
<th>No</th>
<th>Food Item</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheese Pizza</td>
<td></td>
<td></td>
<td>Hot Dogs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pepperoni Pizza</td>
<td></td>
<td></td>
<td>Salad</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ham Sandwich</td>
<td></td>
<td></td>
<td>Ice Cream</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turkey Sandwich</td>
<td></td>
<td></td>
<td>frozen Yogurt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chicken Sandwich</td>
<td></td>
<td></td>
<td>Soda</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread Sticks</td>
<td></td>
<td></td>
<td>Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice with Soda/water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Did you use condiments not prepackaged? Please circle, Parmesan, Mustard, Relish, Salad dressings, other _________________________________

Other foods (Lists)__________________________________________________________

**SECTION 6**

Have you eaten in any other restaurant?  
( ) Yes  ( ) No  
*(If yes, continue and list restaurants/places, and foods eaten, if no go to section 7)*

<table>
<thead>
<tr>
<th>Restaurant/location</th>
<th>Date</th>
<th>Food items eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION 7**

Do you have pet reptiles in your home?  
( ) Yes  ( ) No  
Do you have other pet or have you been in contact with other animals?  
( ) Yes  ( ) No  
If yes what kind?

**SECTION 8**

Was anyone else in your family or close friends ill?  
( ) Yes  ( ) No  
Is anyone else in your family still sick?  
( ) Yes  ( ) No  
Did he/she attend the Target Family and Friends Thanksgiving Party on Nov. 26th?  
( ) Yes  ( ) No  
Did he/she eat any of the foods served at the Thanksgiving Party on Nov. 26th?  
( ) Yes  ( ) No  
Did he/she eat any food from the Team Leaders Meeting on Nov. 19th?  
( ) Yes  ( ) No  
Did you bring food from home to share in the employee lounge between Nov.19 and Dec. 7?  
( ) Yes  ( ) No  
*If yes, what______________________________________________________________ Date________

Did you eat any food in the employee lounge?  
( ) Yes  ( ) No  
*If ye, what______________________________________________________________ Date _________

Did any of your family or close friends eat at the Target Food Bar?  
( ) Yes  ( ) No

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other Commnts___________________________________________________________