Outbreak of *Salmonella mbandaka* in Manitoba, Summer 2007  
October 12, 2007

**Reason for Investigation**

Between June 6 and August 10, 2007, eight cases of *S. mbandaka* were reported to the Winnipeg Regional Health Authority (WRHA). This was a notable increase compared to previous years. Prior to May 2007, the last reported case of *S. mbandaka* in Manitoba was in 2004 (2004=1 case; 2003= 5 cases). Because the number of cases of *S. mbandaka* was higher than expected, an outbreak of *S. mbandaka* was suspected and an investigation was initiated.

**Background**

In 2007, the number of cases of *S. mbandaka* reported in Canada was higher than in previous years. According to the National Enteric Surveillance Program (NESP)\(^1\), there were 41 cases reported nationally from December 31, 2006 to August 18, 2007. During the same time period, there were 27 cases in 2006, nine in 2005 and 18 in 2004.

In addition, the Canadian Food Inspection Agency (CFIA) issued a number of health alerts between June 7 and August 14, 2007 advising of possible contamination of sesame seeds with *Salmonella*. None of the affected sesame seeds were sold in Manitoba. However, the CFIA did confirm that some of the recalled sesame seeds were contaminated with *S. mbandaka*.

**Investigation**

By August 9, 2007, the WRHA public health epidemiologist notified the provincial communicable disease (CD) epidemiologist of the possible outbreak. The provincial CD epidemiologist confirmed that there were two additional cases of *S. mbandaka* in another region of Manitoba – the Central Regional Health Authority.

In consultation with Manitoba Health and the Public Health Agency of Canada (PHAC), the WRHA Public Health Nurses re-interviewed all Winnipeg cases using a modified version of a more detailed hypothesis-generating questionnaire to help determine the possible source of exposure. The Central Health Region Medical Officer of Health (MOH) also decided to use the same questionnaire and re-interview cases accordingly.

On August 16, 2007, the Environmental Health Officers (EHO) from the City of Winnipeg and Manitoba Health were notified of the recent increase in *S. mbandaka*, including the CFIA recall specific to contaminated sesame seeds.

On August 20, 2007, there were 16 reported cases, with 11 cases in the Winnipeg Health Region (WHR) and five in the Central Health Region (CHR). Detailed questioning of cases revealed that several had eaten at a Winnipeg restaurant (restaurant X) within three days prior to becoming ill. There were no other common exposures noted.

The WRHA took the lead in the outbreak investigation, as the majority of cases were in the Winnipeg Health Region and the suspect food service establishment was located in Winnipeg. An EHO inspected restaurant X on August 22, 2007. At that time, a number of deficiencies were noted. Management was not aware of any illness amongst the staff. The restaurant was asked to correct the deficiencies by August 29, 2007. The EHO returned to restaurant X on a number of occasions, including August 28, 29 and 30. A few minor deficiencies were noted again, however the restaurant management addressed each promptly.

1. **Case Count**

As of September 12, 2007, there were a total of 20 cases of *S. mbandaka* in Manitoba. Of these, 15 cases resided in the Winnipeg Health Region, and five cases resided in the Central Health Region. One case from the Central Health Region refused to be interviewed, and another case from Winnipeg refused to respond to the detailed questionnaire following a preliminary shorter interview. Therefore, exposure information for these 2 individuals was less detailed or unavailable. Thirteen of the 20 (65%) cases ate at restaurant X within three days prior to becoming ill.

2. **Environmental Inspections**

The Environmental Health Officer (EHO) inspected restaurant X on a number of occasions.

The dates and results of the inspections are listed below.

**Inspection of August 22, 2007:**
- Some foods were kept for excessive periods of time after preparation.
- Some refrigerated foods on the cooking line were not maintained at ideal temperatures.
- Some reheated foods were not brought to ideal temperatures prior to serving.
- The restaurant purchased bulk sesame seeds in January 2007 from a Canadian food distribution wholesaler from B.C. that was not on CFIA’s list of sesame seed products known to be contaminated with salmonella species (including *S. mbandaka*). The number of meals on the menu that included sesame seeds was very limited.
- Management was not aware of any illness amongst the staff.
- Four of 11 kitchen staff had received food handler training and certification.
Inspection visit of August 28, 2007:
- EHO collected two samples of mashed potatoes and one sample of sesame seeds, which were sent to ALS Laboratory for analysis.

Inspection of August 29, 2007:
- Some refrigerated foods on the cooking line were not maintained at ideal temperatures.
- Cook used bare hands to scoop food instead of using utensils.
- Cooked meat stored next to raw meat in the main cooler.

Inspection of August 30, 2007:
- Some refrigerated foods on the cooking line were not maintained at ideal temperatures after adjustment of the thermostat. Therefore, higher risk products were moved to the coldest part of the cooler.
- All other deficiencies had been corrected.

3. Communications

An alert regarding the outbreak was made on the Canadian Integrated Outbreak Surveillance Centre website on August 13, 2007.

Data Collection and Analysis

Data were collected from cases using a modified PHAC questionnaire and were entered into Epi Info 6.04d by the WRHA epidemiologist and a Community Medicine Resident from the University of Manitoba. The data were then analyzed using Epi Info 6.04d.

Descriptive Epidemiology

1. Case Definition

Cases were identified if they had a stool, blood or urine culture positive for *S. mbandaka* between May 1, 2007 and September 13, 2007 and were residents of Manitoba.

2. Epidemic Curve

Figure 1 shows the distribution of cases of *S. mbandaka* in Manitoba by pulsed field gel electrophoresis (PFGE) pattern. The PFGE patterns of cases are described using the MbaXAI enzyme. For 18 of the cases that demonstrated indistinguishable MbaXAI patterns, a second enzyme – MbaBNI – was also used.

The epidemic curve suggests a continuing common source outbreak.
3. Clinical Description of Cases

a. Age and Gender

Of the 20 cases, 12 were female and eight were male. The mean age was 64 years, with a range from 12 to 93 years. Thirteen cases were over the age of 65 years.

b. Symptoms and Signs

Table 1 illustrates the signs and symptoms reported by the 20 cases. In total, 18 cases had symptoms of gastroenteritis. One case had symptoms of chronic urinary tract infections without gastrointestinal symptoms. One case did not provide any information regarding symptoms.

Table 1. Symptoms and Signs

<table>
<thead>
<tr>
<th>Symptoms and Signs</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diarrhea</td>
<td>18</td>
<td>95</td>
</tr>
<tr>
<td>Bloody diarrhea</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Nausea</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Vomiting</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Fever</td>
<td>11</td>
<td>55</td>
</tr>
<tr>
<td>Other*</td>
<td>15</td>
<td>75</td>
</tr>
</tbody>
</table>
* Includes: abdominal pain (4), abdominal cramps (3), headache (4), malaise (3), and chronic urinary tract infection (1)

c. Severity of Illness

Table 2 shows the severity of illness in the cases. Nine of the twenty cases made visits to an emergency room or were admitted to hospital. There were no reported deaths.

<table>
<thead>
<tr>
<th>Indicator of Severity</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Room Visit</td>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>Hospitalization*</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* Hospitalization is defined as admission to hospital and length of stay greater than or equal to 1 day.

Laboratory Investigations

1. Clinical Samples

Cultures positive for *S. mbandaka* were obtained from either stool, urine or blood samples. Sixteen cases had a stool sample positive for *S. mbandaka*. Of those with positive urine samples, two had gastrointestinal symptoms, one had chronic urinary tract infections without gastrointestinal symptoms, and one did not provide information on symptoms.

<table>
<thead>
<tr>
<th>Specimens Collected</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stool*</td>
<td>16</td>
<td>80</td>
</tr>
<tr>
<td>Blood</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Urine</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

* One client had a positive blood and a positive stool sample.

All specimens were sent to the Cadham Provincial Laboratory (CPL) for PFGE analysis. Six distinct PFGE patterns of *S. mbandaka* were obtained from the clinical samples (Table 4).

None of the *S. mbandaka* subtype patterns isolated from the Manitoba cases matched those found in contaminated sesame seeds affected by the CFIA recall.

Table 4 below reports the PFGE patterns obtained from the 20 cases. The majority of cases had the MbaXAI.0018 pattern. The MbaXAI.0018;MbaBNI.0012 isolate represented a small mutation, and was essentially considered indistinguishable from the MbaXAI.0018;MbaBNI.0006 isolate. The two MbaXAI.0015 isolates however were considered not closely related as they showed marked differences in MbaBNI PFGE patterns.
Table 4. PFGE Patterns in Cases (N=20)

<table>
<thead>
<tr>
<th>PFGE Pattern Combination</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>MbaXAI.0018; MbaBNI.0006</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>MbaXAI.0018; MbaBNI.0012</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>MbaXAI.0005</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>MbaXAI.0015; MbaBNI.0011</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>MbaXAI.0015; MbaBNI.0010</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>MbaXAI.0019</td>
<td>1</td>
<td>5</td>
</tr>
</tbody>
</table>

The results of the PFGE typing show impressive differences between those who reported eating at restaurant X and those who did not. Ninety two percent of cases who reported exposure to the restaurant had the MbaXAI.0018 pattern. Of those who did not report exposure to restaurant X, only 57% had the MbaXAI.0018 pattern. These differences are illustrated in Table 5 below.

Table 5. PFGE Pattern in Cases by Reported Exposure to Restaurant X

<table>
<thead>
<tr>
<th>PFGE Pattern Combination</th>
<th>Number of cases</th>
<th>Ate at Restaurant X (N=13)</th>
<th>Did not eat at Restaurant X (N=7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MbaXAI.0005</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MbaXAI.0015; MbaBNI.0011</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MbaXAI.0015; MbaBNI.0010</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>MbaXAI.0018; MbaBNI.0006</td>
<td>11</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>MbaXAI.0018; MbaBNI.0012</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MbaXAI.0019</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

2. Food Samples

The three food samples (two of mashed potatoes and one of sesame seeds) obtained from restaurant X were negative for *Salmonella* species.

Analysis of Possible Sources of Exposure

Table 6 reports the possible sources of exposure obtained from case interviews. One case gave a partial interview, and one case refused to be interviewed. Therefore, Table 6 below only includes 19 cases for which data are available. Thirteen cases reported eating at restaurant X. Of note, only one case reported consuming sesame seeds. No cases reported consuming sprouts of any kind. Two cases reported having pet reptiles.
Table 6. Number of Cases (N=19) by Possible Source of Exposure

<table>
<thead>
<tr>
<th>Possible Source of Exposure</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any sit down restaurant</td>
<td>14</td>
<td>74</td>
</tr>
<tr>
<td>Restaurant X</td>
<td>13</td>
<td>68</td>
</tr>
<tr>
<td>Fast food restaurant</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>Pasteurized milk</td>
<td>14</td>
<td>74</td>
</tr>
<tr>
<td>Potatoes (fresh; not frozen)</td>
<td>13</td>
<td>68</td>
</tr>
<tr>
<td>Eggs</td>
<td>12</td>
<td>63</td>
</tr>
<tr>
<td>Tomatoes bought from store</td>
<td>9</td>
<td>47</td>
</tr>
<tr>
<td>Cucumber</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>Bananas</td>
<td>8</td>
<td>42</td>
</tr>
<tr>
<td>Creamy salad dressing</td>
<td>7</td>
<td>37</td>
</tr>
<tr>
<td>Salad made from lettuce or greens</td>
<td>7</td>
<td>37</td>
</tr>
<tr>
<td>Chicken prepared away from home</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Ground beef prepared at home, not including hamburger patties</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Strawberries</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Grapes</td>
<td>6</td>
<td>32</td>
</tr>
<tr>
<td>Veal</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Pizza from a pizzeria</td>
<td>5</td>
<td>26</td>
</tr>
<tr>
<td>Sesame seeds</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Sprouts (alfalfa, bean, other)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Peanut butter</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pet reptile including turtles, iguanas, snakes, lizards</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td>Travel outside Manitoba</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Because 13 of the cases ate at restaurant X, a separate analysis was completed for these cases. The case interview administered to all cases included questions on all foods consumed in the three days prior to becoming ill. The most common foods consumed at restaurant X were potatoes (70%) and cooked vegetables (50%). Because of the absence of uninfected controls for comparison, no conclusions could be drawn between S. mbandaka infection and any foods consumed at restaurant X.

A separate analysis was also done for those cases with PFGE MbaXAI.0018, as it was felt that these cases may have experienced a common source of exposure, regardless of attendance at restaurant X. The most common exposures or foods consumed reported by cases who were infected with PFGE MbaXAI.0018 were attendance at restaurant X (75%), potatoes (75%), and pasteurized milk (75%). Once again, because of the absence of controls for comparison, no conclusions could be drawn between PFGE MbaXAI.0018 S. mbandaka infection and any reported exposures.
Discussion and Conclusions

An increased number of cases of *S. mbandaka* was noted in Manitoba in the summer of 2007. All cases resided in either the Winnipeg Health Region or the Central Health Region.

The epidemic curve suggested a continuing common source outbreak. A common place of exposure was identified for 13 of the 20 cases. These cases all consumed meals at restaurant X within three days prior to becoming ill. In addition, 12 of the 13 cases that ate at restaurant X had the same PFGE pattern. This is highly suggestive that restaurant X may have acted as a source for the outbreak. In support of this hypothesis, after the initial restaurant inspection on August 22, there were no further cases of *S. mbandaka* in Manitoba as of September 13, 2007.

Although the majority of cases reported eating at restaurant X, there were seven cases that did not. Some of these cases did not provide a food history. As the questionnaire did not specifically ask about exposure to restaurant X, some may have eaten at the restaurant and not reported this exposure to Public Health. One of these cases had symptoms of chronic urinary tract infections and it was therefore not possible to determine when this case acquired their infection.

Twelve of 13 cases that ate at the restaurant had identical PFGE patterns. Of those who didn’t report eating at the restaurant, 4/7 also had the same PFGE pattern. Although they may represent cases who ate at the restaurant but did not report this exposure, they may also represent secondary transmission, or they may have had a different source of exposure. Three of the 7 who did not eat at the restaurant had completely different PFGE patterns. These cases likely had different sources of exposure representing “background” cases not linked to the outbreak.

Although restaurant X was linked to the outbreak of *S. mbandaka* in Manitoba in the summer of 2007, it was not possible to determine what specific food handling practices or foods were responsible for disease transmission. There was no discernable pattern observed from the food histories obtained from cases implicating one specific food. It is possible that a staff member at restaurant X was a chronic carrier of *Salmonella mbandaka*, and transmitted the illness through poor personal hygiene. However, this hypothesis was not explored, as food handlers were not tested for *S. mbandaka* carriage.

Epidemiologic evidence linked restaurant X to the outbreak and closing the premise was considered. However, no cases of *S. mbandaka* were reported after the initial inspection and correction of deficiencies.

Limitations and Challenges

This investigation was descriptive in nature. It was not a case-control study. Because there were no controls, we do not know what the rates of exposure to various possible sources of the outbreak are in the general population.
Second, the cases were sometimes interviewed weeks after becoming ill. Several were not always able to remember exactly what exposures they had during the three days prior to the onset of symptoms. In addition, some cases were elderly and had poor recall. Two cases refused to be interviewed.

Third, we were not able to determine what specifically was contributing to the outbreak at restaurant X. The restaurant did have a number of deficiencies, many of which could lead to bacterial contamination of food. It is important to note that the reporting of new cases ceased after the initial restaurant inspection of August 22, 2007. All three food samples were negative for *Salmonella* species; however, they were obtained on August 28th, two weeks after the last reported case.

Fourth, a significant minority of cases were not linked to restaurant X. As mentioned previously, this could partly be due to incomplete exposure and food reporting. However, some of these cases likely occurred as a result of separate, unknown exposures.

**Recommendations**

Currently, according to City of Winnipeg bylaws, food service establishments with five or less employees on duty at any one time only require the person in charge to be a Certified Food Handler. If there are more than 5 persons on duty at any one time, only one Certified Food Handler needs to be present at any one time during all operating hours.

Relevant city bylaws and provincial regulations (governed by *The Public Health Act*) should be reviewed. It may be reasonable to consider recommending that food handling certification be required for ALL food handlers in food service establishments within the Winnipeg Health Region where access to food handler training is adequate.

**Acknowledgments**

The WRHA worked closely with a number of partners who comprised the Outbreak Response Team, in investigating, managing and analyzing the outbreak. The valued contributions of the following organizations are gratefully acknowledged:

- City of Winnipeg Environmental Health Services
- Central Regional Health Authority
- Manitoba Health Public Health Branch
- Public Health Agency of Canada
- University of Manitoba, Department of Community Health Sciences, Community Medicine Residency Program
- Cadham Provincial Laboratory, Manitoba Health