

***Salmonella* Heidelberg Infections Associated with a Restaurant Chain**

August-December

Beltrami County

On September 11, 2017, the Minnesota Department of Health (MDH) Public Health Laboratory (PHL) identified a cluster of three *Salmonella* Heidelberg isolates with indistinguishable pulsed-field gel electrophoresis patterns (Minnesota designation SH43). Only one case had been interviewed, but all three were from the same region of the state. The PHL identified an additional 11 isolates of *S. Heidelberg* SH43 in this cluster over the next 10 days. Supplemental questionnaires with questions about restaurants and other exposures identified from previously interviewed cases were administered to new cases, and to those who had already been interviewed. On September 22, five cases were interviewed and reported eating at the locations of Restaurant Chain A on the north side of Bemidji in the week before their illness onset. Two people had previously reported eating at this restaurant, bringing the total with this exposure to 7 of 11 interviewed. MDH Environmental Health was contacted, and a full investigation was initiated.

A confirmed case was defined as a Minnesota resident infected with *S. Heidelberg* of the outbreak PFGE pattern and closely related by whole genome sequencing (WGS). A probable case was defined as a person who experienced diarrhea (≥ 3 stools in a 24-hour period) that was ≥ 3 days in duration or accompanied by a fever, after eating at one of two locations of Restaurant Chain A in Bemidji, since August 1, 2017. Confirmed cases were interviewed with a routine surveillance questionnaire and, if available for re-interview, a restaurant-specific questionnaire. Probable cases were interviewed using a restaurant-specific questionnaire only.

Sanitarians from MDH Environmental Health visited the facility on September 22 to interview food workers, check the employee illness log, evaluate food preparation and handling, and obtain records related to employee work schedules and food sales. All food workers were required to submit stool samples for testing at the PHL. Food workers reporting recent illness or who submitted stool samples that tested positive for *Salmonella* were excluded from food service until two consecutive stool samples collected at least 24 hours apart tested negative for *Salmonella*.

Additional visits by sanitarians were required as new cases were identified with meal dates after the interventions were put in place on September 22. Sanitarians interviewed employees at the south location on November 2, and ordered additional cleaning at both locations on that date. On November 30, both restaurants closed voluntarily following new patron and employee cases from the past two weeks.

As the receipts available did not have any patron name information, itemized receipts and product mix reports from September 1-8 were collected by sanitarians. These were used to determine the proportion of meals containing each menu item and groups of menu items; this information was used in binomial distribution models to determine if cases consumed any food item more than would be expected in the population of people eating at this north location. Receipts were also used in a case-control analysis in which each receipt was assessed to determine the number of patrons served, and each patron's meals were entered as a control meal. This assumed that all of these patrons were not ill.

Stool samples from consenting patrons and employees were tested for *Salmonella* at the MDH PHL by culture, and isolates were sequenced. Sequence analysis was performed by the Centers for Disease Control and Prevention PulseNet Laboratory.

A total of 36 confirmed cases and 10 probable cases were identified. All confirmed cases were identified through routine surveillance. Probable cases included meal companions and household contacts of confirmed cases, a person who tested positive for *Salmonella* at a clinical laboratory whose infection was not confirmed at the PHL, and restaurant patrons who called the foodborne and waterborne illness hotline following the closure of the restaurants and publicity about the outbreak.

Twenty-seven of the confirmed cases were interviewed fully, four did partial interviews, and four were unable to be reached or refused interview. Onset dates ranged from August 12 through December 8. One confirmed case lived in the same household as confirmed case with an earlier onset date and was, therefore, classified as a secondary case. Of the 31 confirmed primary cases who were at least partially interviewed, 26 reported definitely or possibly eating at a Restaurant Chain A location in Bemidji. Five cases denied eating at Restaurant Chain A. Three of those who denied eating at Restaurant Chain A in the week before their illness onset resided in different long-term care facilities in different cities in Northern Minnesota. Their infections could have been secondary to an infected caretaker or food handler, but no additional illnesses were identified at any of the facilities.

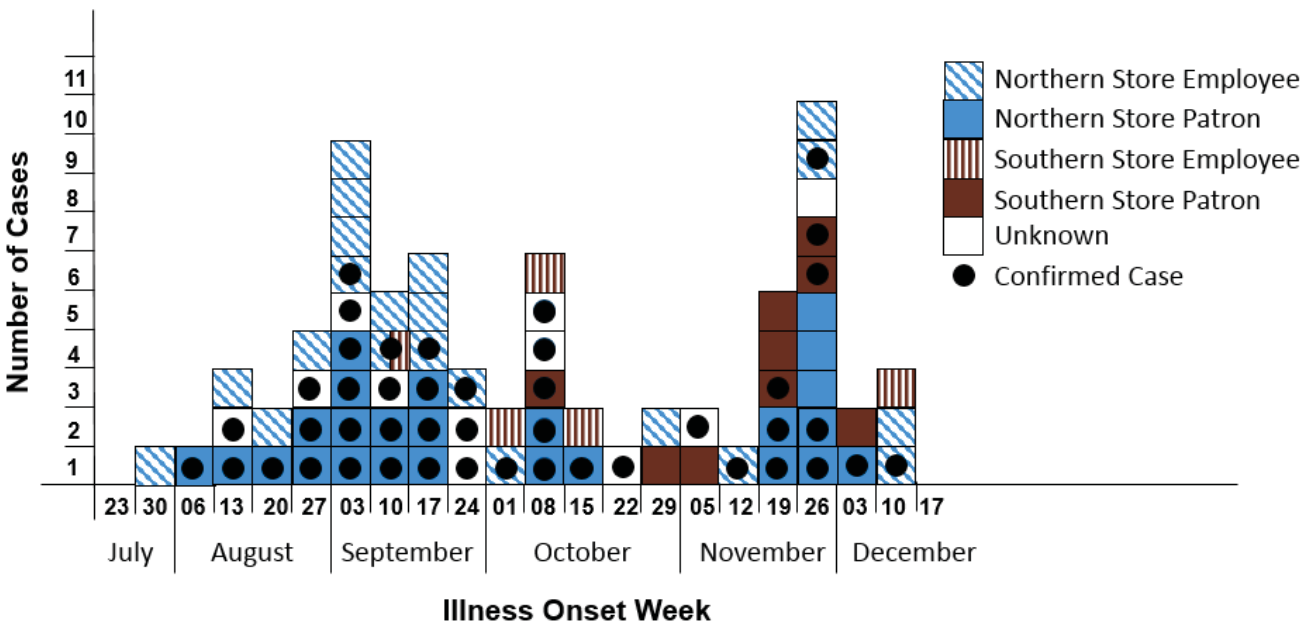
Symptom information was collected from 29 confirmed primary cases. All reported diarrhea, 24 (92%) cramps, 24 (91%) cramps, 12 (41%) blood in stool, and 9 (37%) vomiting. The median incubation time for the three confirmed cases with known specific meal and illness onset dates and times was 55 hours (range, 27 to 170 hours). Eight additional cases could not indicate a specific meal or illness onset time, but could report a date for both variables. For these 11 cases, the median incubation was 2 days (range, 1 to 7 days). Thirteen confirmed cases reported likely eating at a Restaurant Chain A location in Bemidji in the week before their illness, but could not provide a specific meal date. The median duration of illness for the four confirmed cases who were able to provide an onset and recovery date and time was 9 days (range, 7 to 19 days). For the 16 cases with an onset and recovery date but no specific times, the median duration was 11 days (range, 7 to 19 days). Nine (36%) of the confirmed cases were hospitalized, and one died.

There are two Restaurant Chain A locations in Bemidji. At first, cases only reported eating at the location on the north side of Bemidji, along with one case who was unsure of which location he would have eaten at. Meal dates reported by the first cases were August 11, and September 1, 2, 5 (3 confirmed cases), 15, or 19 (1 confirmed and 1 probable case); six cases could not provide a specific meal date.

Interventions to stop transmission were implemented at the north location on September 22. However, additional illnesses were identified with meal dates after these interventions were implemented. Three cases reported eating at the north location during the first week of October (exact dates were unknown) and had illness onsets of October 9, 14, and 16. In addition, one case was identified who ate at the south location in Bemidji during the first week of October. This restaurant is owned by the same entity as the north location. They do not typically share workers. However, one employee moved from the north location to the south location during this outbreak, and was later identified as an asymptomatic carrier. During the week of these later meal dates, asymptomatic, infected employees were working at both locations prior to their infections being identified.

On November 22, a local hospital reported that an employee from the north location was hospitalized and had tested positive for *Salmonella*. One week later, the same hospital reported another case of *Salmonella* infection. When interviewed, this case reported that both he and multiple ill family members had eaten at the south location in late November.

Salmonella* Heidelberg Cases Associated with Restaurant Chain A by Week of Illness Onset



* If onset not available, collection date of first positive stool sample collected used

Analyses of food consumption was limited to confirmed cases from the north location with meal dates before September 22. Twelve confirmed cases were able to provide a probable list of foods eaten, though many had difficulty recalling exact menu items or if they had made any changes to the standard toppings. All reported eating food with a beef patty; half had the large patty and half had the small patty.

Analysis of the receipts provided by the north location indicated that 67% of meals contained a beef patty. The product mix reports supported that around 67% of entrée-style meals contained beef patties. Using the binomial distribution model, the proportion of cases eating beef was significantly higher than would be expected (12 of 12 cases vs. 67% of all patrons of the north location; $p = 0.01$).

Receipts from September 1 were also used in a case-control analysis. In this analysis beef patties (12 of 12 cases vs. 365 of 545 controls; odds ratio [OR], undefined; $p = 0.012$) along with condiments only served on beef patties (ketchup [11 of 12 cases vs. 335 of 545 controls; OR, 6.9; 95% confidence interval [CI], 0.9 to 53.8; $p = 0.04$], mustard [8 of 12 cases vs. 130 of 545 controls; OR, 6.4; 95% CI, 1.9 to 21.5; $p = 0.002$]) were associated with illness. All hamburger patties except for those served with barbeque sauce are served with ketchup, and all small hamburger patties without barbeque sauce are served with both ketchup and mustard. Both lettuce (2 of 12 cases vs. 213 of 545 controls; OR, 0.31; 95% CI, 0.07 to 1.4; $p = 0.14$) and tomato (1 of 12 cases vs. 158 of 545 controls; OR, 0.22; 95% CI, 0.03 to 1.7; $p = 0.19$) were assessed in the ingredient specific analysis; neither was associated with illness. Recall from the cases on exact toppings was poor, so multivariate ingredient-specific analyses were not performed.

Environmental Health Assessment

All 36 people employed at the north location on September 22 were interviewed, and 12 reported recent gastrointestinal illness or fever. These 12 were excluded from work in food service until they submitted two consecutive stool specimens collected 24 hours apart that tested negative for *Salmonella*. Five employees, none whom reported illness, quit after the interview and refused to provide stool kits for testing. The other 31 employees provided at least one stool kit. Of these, five employees tested positive for the outbreak strain of *Salmonella* Heidelberg. Of the five positive food workers, two reported illness (onsets of September 9 and September 22), one denied illness when interviewed by sanitarians but was noted on the illness log as reporting vomiting on September 12, and two reported no illness symptoms to either management or sanitarians.

One of the workers was initially reported to have quit when food workers were contacted to submit stool samples for *Salmonella* testing. However, he did subsequently submit a stool sample to the PHL that was collected on September 28 and received at the PHL on October 6, and this sample tested positive for the outbreak strain. When the employee was called to inform him of the positive result on October 12, he reported he had started working at the south location on September 24. He was excluded from work there, and management was notified. At that time, no illnesses had been associated with the south location.

In addition to interviewing employees, initial interventions implemented at the north location on September 22 included a thorough cleaning and sanitizing of the store, evaluation of the food flow, evaluation of temperature controls, and assessment of handwashing and food handling. The kitchen had a single hand sink that was located by the manager's office, and was not easily accessed from the sandwich cooking and preparation area. While observing food preparation, workers were seen washing hands before donning gloves and working on the prep line, but limited handwashing and glove changes occurred after this initial instance. Employees working in the cash register area also were limited in their access to the sink, and these people move from working with money to preparing drinks, ice cream, and bagging food with no handwashing step.

The manager stated that he had observed employees during busy times using gloved hands to load burger patties into the broiler, rather than use the tongs designated for this task. The same workers who load the raw meat in the broiler also make sandwiches. These practices pose a risk for cross-contamination from raw meat to ready-to-eat foods through gloved-hand contact. During interviews with employees, one described not always wearing gloves when preparing sandwiches when the kitchen was busy, and observing the same practice in fellow employees.

The sandwich preparation area is divided into two lines, with chicken sandwiches prepared on one and beef on the other. Workers were observed staying on one side during the portion of the shifts observed by sanitarians, but occasionally workers move between these lines.

On November 2, environmental health staff contacted the owner of the stores to inform him of the patron cases identified with meal dates during the first week of October, after the initial interventions had been implemented, from both the north and south locations. Both locations were ordered to clean and sanitize all surfaces. Employee illness screening had been ongoing at the north location, and ill employees were being excluded and tested for *Salmonella* at the PHL. All 20 employees at the south location were interviewed about recent illness and if they reported illness they were excluded from

work until they had two consecutive negative stool tests. Three workers were excluded, and none tested positive for *Salmonella*.

When an employee of the north location was reported as positive for *Salmonella* by a local hospital on November 22, environmental health staff contacted the owner to ensure that the employee was excluded from work until he submitted two consecutive negative stool samples, and to order them to again clean and sanitize. In addition, positive employees who had returned to work on a restricted basis (no food or drink contact) were excluded from work.

With the addition of new patron cases with meal dates in November, the owner voluntarily closed both locations on November 30 at the request of MDH. The stores brought in an outside company to clean and sanitize all surfaces, all employees were excluded from work until they tested negative for *Salmonella* in two consecutive stool samples submitted at least 24 hours apart, the north location was required to install an additional hand sink, employee training on handwashing was performed, and all food was discarded.

The Minnesota Department of Agriculture (MDA) performed food product testing and collected environmental samples. On December 7, MDA and MDH staff visited the north location and collected 4 samples of ground beef patties and 30 environmental swab samples. All samples tested negative for *Salmonella*. Restaurant Chain A also hired a private laboratory to collect samples from the same surfaces, and all samples collected by this laboratory were negative for *Salmonella* as well.

The north location was cleared to reopen on December 11 after they had cleaned thoroughly (including having a third party cleaning company use a sanitizing fog), installed an additional hand sink in the kitchen, and enough staff were cleared to return to work. The south location reopened on December 14 following the same cleaning and staffing requirements.

Ongoing employee illness screening continued through January 9, 2018.

In total, eight employees tested positive for the outbreak strain of *S. Heidelberg* including three who were asymptomatic. Symptomatic employees reported illness onsets of September 9, September 12, September 22, November 16, and December 1. The earliest positive specimen collection dates ranged from September 24 through December 12. One employee sought medical care and was hospitalized.

Employee work schedules for the weeks with case meal dates in August and September were collected. On September 5, the date that three confirmed cases report eating at the north location, multiple workers did not show up for work, or called in sick, leading to fewer workers than normal. High turnover of workers was also identified, with at least one third of the staff turning over while the outbreak was ongoing. New workers are trained in food safety using a corporate video training and on-the-job training, but with at least 10 new workers in a month, this training may not have been adequate. Properly training new employees on food safety was emphasized to the owner and managers.

This was a foodborne outbreak of *Salmonella Heidelberg* infections associated with two Restaurant Chain A locations with common ownership. Transaction receipts and product mix reports were used in place of a traditional case-control study. These analyses identified an association between illness and consuming a beef patty-containing food item; however, case recall issues prevented more detailed analyses. Therefore, a specific ingredient could not be identified as the vehicle. Multiple *Salmonella*-

positive food workers, and possible opportunities for cross-contamination by food workers facilitated by improper handwashing and glove use, were identified. *Salmonella* could have been introduced to the facilities by a food product or a food worker, and then disseminated through infected food workers and cross-contamination.