Salmonella Infections in Food Workers Identified through Routine Public Health Surveillance in Minnesota: Impact on Outbreak Recognition

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ABSTRACT

The frequency of Salmonella-infected food workers identified through routine surveillance from 1997 to 2004 in Minnesota was determined in order to evaluate the impact of surveillance on the detection of outbreaks in restaurants and to quantify the duration of Salmonella shedding in stool. Of 4,976 culture-confirmed Salmonella cases reported to the Minnesota Department of Health, 110 (2.2%) were identified as food workers; this was less than one-half the number expected based on the incidence of Salmonella in the general population. Twenty food workers (18%) were associated with outbreaks. Twelve were involved in nine independent outbreaks at the restaurants where they worked. The identification of the index food worker in six of these outbreaks was critical to the initiation of outbreak investigations that revealed much larger problems. Among food workers who submitted specimens until at least one negative result was obtained (n = 69), the median duration of shedding was 22 days (range, 1 to 359 days). Among the four most common serotypes (Enteritidis, Typhimurium, Heidelberg, and Newport) the median duration of shedding was significantly longer for Salmonella Newport (80 days; P = 0.02) and for Salmonella Enteritidis (32 days; P = 0.04) than for Salmonella Heidelberg (8 days). Food workers should be considered an important source of Salmonella transmission, and those identified through surveillance should raise a high index of suspicion of a possible outbreak at their place of work. Food service managers need to be alert to Salmonella-like illnesses among food workers to facilitate prevention and control efforts, including exclusion of infected food workers or restriction of their duties.

Despite efforts to improve the safety of food in the United States, rates of nontyphoidal Salmonella infection have not declined in the last 10 years (2). Efforts to reduce the incidence of Salmonella have focused largely on reducing contamination of foods of animal origin in processing plants (23, 26). However, commercial food establishments should also be targets for more focused prevention measures. For example, Foodborne Disease Active Surveillance Network (FoodNet) case-control studies of salmonellosis found that eating eggs outside the home was a risk factor for Salmonella Heidelberg infection (9) and that eating runny eggs and chicken outside the home were risk factors for Salmonella Enteritidis infection (12, 15). In addition, outbreaks of salmonellosis frequently occur in commercial food establishments. During 1998 to 2002, the 585 Salmonella enterica outbreaks reported to the Centers for Disease Control and Prevention accounted for 49% of all bacterial outbreaks (21). Forty-eight percent of Salmonella outbreaks occurred in commercial food establishments, the most common setting for Salmonella outbreaks (13).

Outbreaks of salmonellosis at commercial food establishments frequently involve direct transmission to patrons from undercooked foods of animal origin or cross-contamination from these foods. However, numerous nontyphoidal Salmonella outbreak investigations have implicated food workers as the source of the outbreak or strongly suggested transmission from food workers (4, 7, 8, 10, 11, 14, 16).

A survey conducted by the Environmental Health Specialist Network in conjunction with FoodNet found that 8.4% of respondents older than the age of 15 years reported working in food service facilities. Among food service workers, 4.7% reported having worked while ill with diarrhea or vomiting in the past year (5). Even if food workers stay home while ill, Salmonella can be shed in the stool for a prolonged period following recovery (17, 18). Thus, inadequate hand hygiene may allow infected food workers to contribute to ongoing transmission of Salmonella to patrons (6, 30).

The objectives of this study were to (i) determine the impact of identifying Salmonella-infected food workers through public health surveillance on the detection of salmonellosis outbreaks and (ii) quantify the duration of
Salmonella shedding in the stool of food workers identified through routine surveillance. The goal was to improve our understanding of the contribution of food workers to the complex epidemiology of salmonellosis.

MATERIALS AND METHODS

Data sources. Food workers with Salmonella infections were identified during the routine surveillance activities at the Minnesota Department of Health (MDH). Salmonellosis is reportable to MDH. Patients sought medical care for their diarrheal illness, and the health care provider asked the person to submit a stool specimen for testing at the clinical laboratory. The person was diagnosed as having salmonellosis when Salmonella was isolated from that specimen. As required by reporting rules, Salmonella isolates were submitted by the clinical laboratory to the MDH Public Health Laboratory, where they were confirmed, serotyped, and subtyped by pulsed-field gel electrophoresis (1). Clinicians were required to report the patient’s name, demographic information, contact information, and occupation. However, the receipt of the isolate by the Public Health Laboratory was frequently the first notification of the case to MDH. As part of routine active surveillance for Salmonella activities, all clinical laboratories serving health care providers in Minnesota were routinely audited to ensure complete ascertainment of culture-confirmed cases.

Attempts are made by MDH staff to contact all patients by telephone. Patients who agree to answer a questionnaire are interviewed about illness history, treatment, potential exposures, and occupation.

A food worker was defined as a person who during their interview reported working in a commercial food service establishment such as a restaurant, catering business, delicatessen, or bakery or who worked with fresh produce, regardless of specific duties. Examples include patients who worked as cooks, servers, hosts, bartenders, or stocked produce at a grocery store.

When infected food workers were identified through routine surveillance interviews, they were either excluded from work or restricted in work activities to duties that did not involve contact with food or clean utensils by MDH. The exclusion or restriction was removed when the food worker tested negative for Salmonella on two successive stool samples collected at least 24 h apart. The patient could submit stools for testing to a health care provider or submit stools to the MDH Public Health Laboratory free of charge. Outbreak-associated food workers submitted stool specimens for testing at the MDH Public Health Laboratory or the Minneapolis Health Department Laboratory.

Measures of interest. For the first objective of this study, we identified food workers in surveillance (defined above) and ascertained if those persons were part of a newly identified Salmonella outbreak or of an ongoing investigation. An outbreak was defined as two or more temporally clustered cases of salmonellosis with a common exposure (e.g., patients had patronized or worked at a restaurant in common, attended a common event, consumed the same contaminated food, or had another exposure other than food in common), and epidemiologic evaluation implicated that exposure as the source of the outbreak in Minnesota. In addition, the numbers of days from illness onset until the cases were reported were calculated.

For the second objective, duration of Salmonella shedding in the stool was calculated as the date of illness onset to the collection date of the last positive stool specimen. If onset was unknown, shedding was calculated as the first positive specimen collection date to the last positive specimen collection date (complete shedding). Shedding in patients who stopped submitting stools before any negative results were obtained was calculated by using the last positive specimen collection date (incomplete shedding). To provide an estimate of the length of time that food workers were excluded or restricted from work, time from onset to first and second negative stool specimens was also calculated. If the onset date was unknown, the first positive specimen collection date was used instead.

To compare the incidence of Salmonella in food workers to the incidence of Salmonella in the general population, estimates of the size of the labor force and the percentage of food workers in the labor force were obtained from the U.S. Bureau of Labor Statistics and the National Restaurant Association (19, 28). Salmonella case rates were calculated as the number of cases reported from 1997 to 2004 among food workers and nonfood workers ≥16 years of age per 100,000 person-years participation in the labor force.

Statistical analysis. The Wilcoxon two-sample test was used to compare medians at a 0.05 significance level. Descriptive and summary statistics were generated by SAS 9.1 and SAS Enterprise Guide 2.0 (Cary, NC).

RESULTS

From 1997 through 2004, 4,976 culture-confirmed Salmonella cases were reported to MDH. Of these, 110 (2.2%) were food workers identified through routine surveillance (range, 9 to 21 per year). The four most common Salmonella enterica serotypes isolated from stool specimens of these food workers were Enteritidis (28 cases, 25%), Typhimurium (25 cases, 23%), Heidelberg (14 cases, 13%), and Newport (6 cases, 5%). The leading three serotypes also were the most common serotypes for all Salmonella cases in Minnesota in the same time period; Salmonella Typhimurium accounted for 27% of all cases, Salmonella Enteritidis for 16%, and Salmonella Heidelberg for 8%. Seventy-two (65%) of the food worker Salmonella cases were female. The median age was 25 years (range, 15 to 68 years). Among the 95 food workers who provided a clear description of their duties, 39 (41%) reported cooking or food preparation as their responsibility. The remaining 56 (59%) worked as servers, bartenders, managers, cashiers, hosts or hostesses, or dishwasher and had other noncooking responsibilities.

During this time period, there was an average of approximately 2.8 million persons ≥16 years of age in the Minnesota labor force, of whom 8% were food workers. Based on these estimates, there were approximately 6 reported cases of Salmonella infection per 100,000 food workers per year and 16 reported cases of Salmonella infection per 100,000 persons ≥16 years of age who were not food workers.

Outbreak-associated food worker Salmonella cases. Eighteen (16%) of the 110 food worker Salmonella cases identified through routine surveillance were part of recognized outbreaks of salmonellosis. Two additional food workers were part of a restaurant outbreak that was not recognized or investigated at the time. Twelve (60%) of the 20 outbreak-associated food workers were part of nine
outbreaks at the restaurants where they worked (Table 1). The identification of food workers through surveillance led to the investigation of six of these nine outbreaks. Among the other food workers, six (30%) were patron cases of outbreaks at restaurants other than their place of work, and two (10%) were part of outbreaks that did not involve restaurants.

Of the nine outbreaks in restaurants associated with infected food workers, one was not recognized at the time and was not investigated. Two food workers and four patrons infected with Salmonella Enteritidis during 1997 were retrospectively linked to this restaurant (Table 1). For six outbreaks, investigations were initiated after cases in food workers were linked to the occurrence of one to four patron cases. In two outbreaks, investigations were initiated after three or four patron cases were linked. Infected food workers at both of these restaurants were identified through surveillance shortly after the initiation of these investigations. Index food workers in the nine outbreaks sought health care 0 to 15 days (median, 5.5 days) after onset of symptoms. Salmonella isolates were forwarded to the MDH 2 to 7 days (median, 5.5 days) after collection of stool. Food workers were interviewed by MDH 0 to 16 days (median, 6 days) after the isolates were received and 5 to 23 days (median, 9 days) after the first point of contact with health care. This represents a potential delay in the initiation of an outbreak investigation, during which additional patron cases may have occurred.

Salmonella shedding and treatment. Of the 110 food workers identified, 25 (23%) were excluded from analyses because they did not submit any additional stool specimens for testing (n = 17), or because they followed up at their clinic but the dates of specimen collection were not reported to MDH (n = 8). Data for duration of shedding were collected for the other 85 (77%) food workers. Complete shedding data were available for 69 food workers, including 67 with two negative stools and 2 with one negative stool. Incomplete shedding data were available for 16 food workers: 2 food workers submitted stool specimens to their own health care provider, but negative results were not reported to MDH; and 14 food workers stopped submitting stool specimens before any negative results were obtained. Six of these quit working in food service and eight were lost to follow-up.

The median duration of shedding for food workers with complete data was 22 days (range, 1 to 359 days). This was shorter than the duration of shedding for those with incomplete shedding data (median, 53 days; range, 7 to 373 days; P = 0.006). For both groups combined (n = 85), the median duration of shedding was 27 days (Table 2).

The duration of Salmonella shedding in the stool varied by serotype. Among the four most common serotypes, the median duration of shedding for food workers with complete and incomplete data ranged from 80 days for food workers with Salmonella Newport infection to 8 days for Salmonella Heidelberg (Table 3). The median duration of shedding was significantly longer for Salmonella Newport (P < 0.05) and for Salmonella Enteritidis (P < 0.05) than for Salmonella Heidelberg. There was no significant difference in the median duration of shedding between Salmonella Typhimurium and the other three most common serotypes or between Salmonella Enteritidis and Salmonella Newport.

Antimicrobial treatment information was available for 83 of the 85 food workers included in the analysis. Sixty-three (76%) food workers were treated for their infection. Among the 22 food workers who were hospitalized for their illness, 19 (86%) were treated with antimicrobials. Specific treatment information was not available for 2 of the 63 food workers who were not hospitalized; among the remaining 61, 44 (72%) were treated with antimicrobials. The median duration of shedding for all food workers (i.e., those with complete and incomplete shedding data) who were treated with antimicrobials (n = 63) was 25 days (range, 1 to 373 days). This was not significantly different from the median duration of shedding for all food workers who were not treated with antimicrobials (n = 20) (median, 28 days; range, 4 to 170 days). Excluding those with incomplete shedding information, the median duration of shedding if treated with antimicrobials (n = 50) was 21 days (range, 1 to 359 days), compared with 28 days (range, 4 to 170 days) if not treated (n = 18) (not significant).

Infected food workers were restricted or excluded from work for prolonged periods. The median time from the date of illness onset to collection date of the first negative stool specimen (n = 65) was 36 days (range, 4 to 541 days). The median time from the date of illness onset to collection date of the second negative stool specimen (n = 61) was 42 days (range, 6 to 450 days) (Table 2).

DISCUSSION

We previously demonstrated that food workers were frequently infected during Salmonella outbreaks in restaurants (16). Results of this study further demonstrate that a substantial proportion (18%) of the Salmonella-infected food workers identified through routine public health surveillance were part of outbreaks, many at the restaurant where they worked. The identification of food worker salmonellosis cases through surveillance at the same time as patron cases from the same restaurant triggered outbreak investigations in 25% (6 of 24) of the Salmonella outbreaks identified in Minnesota from 1997 to 2004. Thus, the rapid identification and follow-up of food workers among reported cases of salmonellosis is important to the early detection and control of outbreaks in restaurant settings. Importantly, even hostesses, servers, bartenders, and others who theoretically have limited food preparation duties can serve as sentinels of transmission within the restaurant.

In each of the outbreaks referenced above, additional infected food workers not identified in routine surveillance were identified by testing of stool specimens of all food workers conducted as part of the outbreak investigation. Because these infected food workers may have contributed to ongoing transmission to patrons, the interval between onset of illness for the index food worker and the initiation of the outbreak investigation represents a window during
which preventable illnesses may have occurred. The first opportunity to recognize these outbreaks would have come when the food worker developed diarrhea. Food workers are mandated to report gastrointestinal illness to the food service manager, who should assess the risk for transmission to patrons, query other food workers regarding recent gastrointestinal illnesses, and consult with public health officials to discuss potential interventions if needed. These could range from obtaining stool cultures from ill food workers to a full-scale outbreak investigation.

The second opportunity for outbreak recognition is at the point of medical care. In the outbreaks summarized in this report, food workers sought medical attention ranging from the day of onset of symptoms to 15 days later. Clinicians should be aware of the food worker's occupation and have a low threshold for testing patients with gastrointestinal illness. If a clinician suspects a Salmonella-like illness in a person known to be a food worker, the clinician should order a stool culture and promptly report the case to the health department (before culture results are available). This would have reduced the reporting delay by 2 to 7 days, identified these cases as high priority for public health follow-up, and ensured timely public health access to information on the case.

The final opportunity to improve outbreak detection is at the health department level. For these outbreaks, food workers were interviewed the same day as the MDH received the isolate from the clinical laboratory or up to 23 days later. In order to interview cases earlier, rather than waiting for the clinician's report, the health department should actively contact clinicians who have not yet submitted the reportable information. In addition, routine and timely pulsed-field gel electrophoresis subtyping of Salmonella isolates, coupled with efficient and timely communication between the health department laboratory and epidemiologists, is essential for linking case clusters to a common exposure.

Salmonella shedding in this food worker population was relatively long (median, 27 days) and varied by serotype, among the most common serotypes the median duration of shedding for Salmonella Newport and Salmonella Heidelberg was longest. The median number of days from illness onset or collection date of the first positive stool to the collection date of the second positive stool was 42 days. During this time, food workers in Minnesota were excluded from work or restricted in their work duties, so the financial burden of individual food workers was substantial. This issue highlights the problem of food workers often not receiving sick leave. According to the Bureau of Labor Statistics, only 30% of accommodation and food service employees have paid sick leave available (27).

### Table 1: Number of food worker and patron illnesses and time line for reporting index food worker cases associated with Salmonella outbreaks in Minnesota restaurants, 1997 to 2004a

<table>
<thead>
<tr>
<th>Yr</th>
<th>Salmonella serotype</th>
<th>No. of cases reported before initiating outbreak investigation</th>
<th>Intervals (days) between time line events for index food worker</th>
<th>Total no. of cases identified as part of the outbreak</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Patrons</td>
<td>Food workers</td>
<td>Stool collection to report</td>
<td>Patrons</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>interval to interview</td>
<td>Food workers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>interval to interview</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td>Enteritidis</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1997</td>
<td>Braenderup</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1998</td>
<td>Heidelberg</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1999</td>
<td>Montevideo</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>1999</td>
<td>Heidelberg</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2000</td>
<td>Typhimurium</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>Newport</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2002</td>
<td>Typhimurium</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>Enteritidis</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

*a Outbreaks in restaurants in which Salmonella cases were identified in food workers through surveillance. b ND, not determined (outbreak not recognized or investigated at the time).
TABLE 2. Duration of shedding in food workers<sup>a</sup>

<table>
<thead>
<tr>
<th>Time line interval</th>
<th>n</th>
<th>Minimum (days)</th>
<th>Lower quartile (days)</th>
<th>Median (days)</th>
<th>Upper quartile (days)</th>
<th>Maximum (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shedding (overall)</td>
<td>85</td>
<td>1</td>
<td>7</td>
<td>27</td>
<td>71</td>
<td>373</td>
</tr>
<tr>
<td>Shedding (complete data)</td>
<td>69</td>
<td>1</td>
<td>6</td>
<td>22</td>
<td>54</td>
<td>359</td>
</tr>
<tr>
<td>Shedding (incomplete data)</td>
<td>16</td>
<td>7</td>
<td>31</td>
<td>53</td>
<td>93</td>
<td>373</td>
</tr>
<tr>
<td>Time to first negative</td>
<td>65</td>
<td>4</td>
<td>25</td>
<td>36</td>
<td>65</td>
<td>541</td>
</tr>
<tr>
<td>Time to second negative</td>
<td>61</td>
<td>6</td>
<td>28</td>
<td>42</td>
<td>67</td>
<td>450</td>
</tr>
</tbody>
</table>

<sup>a</sup> Duration from date of onset of symptoms or collection date of the first positive specimen to the collection date of the last positive specimen; complete data, negative stools were submitted; incomplete data, no negative stools were submitted.

Practical solutions to encourage food workers to not work while ill are needed.

Antimicrobial treatment of *Salmonella* infections has been shown to prolong the duration of shedding (17, 20, 32) and sometimes result in symptom relapse after a negative test (3, 20). At best, there may be no difference in shedding after treatment with antimicrobials (22, 25). Despite the abundant evidence on the lack of benefit of treating cases of uncomplicated *Salmonella* gastroenteritis and the possible prolongation of *Salmonella* shedding in the stool, a high proportion of the food worker patients (76%) in our study were treated with antimicrobials. We detected no difference in shedding after treatment. Therefore, our findings add to the evidence that antimicrobial therapy of uncomplicated salmonellosis in food workers is not beneficial in reducing the duration of *Salmonella* shedding. Because of the small sample size and incomplete data on the specific antimicrobial taken, analysis by individual antimicrobial class was not possible.

The Food and Drug Administration’s Food Code does not exclude or restrict food workers with a nontyphoidal *Salmonella* infection (29). Although restriction of food workers infected with *Salmonella* after resolution of symptoms is not a national standard, the prolonged duration of shedding, evidence that food workers have been the source of foodborne outbreaks (4, 7, 8, 10, 11, 14), evidence that food workers work while ill (5), and evidence of inadequate hand hygiene practices (6, 30), exclusion or restriction of infected food worker duties is a reasonable public health measure. At a minimum, potential for transmission and how to prevent it should be discussed with the food worker and their manager.

During the study period, food workers comprised 2% of *Salmonella* cases reported in Minnesota. However, the estimated incidence of *Salmonella* among food workers was less than one-half of the estimated incidence among the rest of the Minnesota population at least 16 years of age. This suggests that a high proportion of food workers who were infected with *Salmonella* may not have sought health care for their illness. This seems likely, given that having health insurance has been associated with seeking health care among persons reporting an acute diarrheal illness (24) and that most restaurants do not offer health insurance to food workers. Given the apparent reduced rate of seeking health care among food workers, the estimated multiplier of 38 cases for each reported case (31), and the observed duration of shedding of *Salmonella* by infected food workers, we estimate that at any given time, as many as 100 Minnesota food workers could be shedding *Salmonella*. Most of these shedding will be asymptomatic at any one point in time, and most will not cause recognized outbreaks. However, they may provide an important source of exposure for sporadic infections. This may also provide a partial explanation for the lack of success of control efforts to reduce the incidence of *Salmonella* over the past decade. The biology of *Salmonella* and the epidemiology of salmonellosis are complex; food workers may be an underappreciated part of that complexity. In order to decrease the incidence of *Salmonella* infections in the United States, current prevention and control efforts should consider food workers as an important source of *Salmonella* transmission.

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TABLE 3. Duration of shedding data for the four most common serotypes<sup>a</sup>

<table>
<thead>
<tr>
<th><em>Salmonella</em> serotype</th>
<th>n</th>
<th>Minimum (days)</th>
<th>Lower quartile (days)</th>
<th>Median (days)</th>
<th>Upper quartile (days)</th>
<th>Maximum (days)</th>
<th>P value&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newport</td>
<td>6</td>
<td>8</td>
<td>21</td>
<td>80</td>
<td>200</td>
<td>204</td>
<td>0.02</td>
</tr>
<tr>
<td>Enteritidis</td>
<td>25</td>
<td>1</td>
<td>10</td>
<td>32</td>
<td>70</td>
<td>373</td>
<td>0.02</td>
</tr>
<tr>
<td>Typhimurium</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>24</td>
<td>38</td>
<td>164</td>
<td>0.3</td>
</tr>
<tr>
<td>Heidelberg</td>
<td>10</td>
<td>2</td>
<td>4</td>
<td>8</td>
<td>18</td>
<td>38</td>
<td>Reference</td>
</tr>
</tbody>
</table>

<sup>a</sup> Duration from date of onset of symptoms or collection date of the first positive specimen to the collection date of the last positive specimen for food workers with complete (negative stools were submitted) and incomplete (no negative stools were submitted) shedding data. The duration of shedding for each serotype was compared with the duration of shedding for *Salmonella* Heidelberg infections.

<sup>b</sup> Wilcoxon two-sample test, two-sided.
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REFERENCES