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Concise Communications

An Outbreak of *Salmonella typhimurium* at a Teaching Hospital

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ABSTRACT

An outbreak of *Salmonella typhimurium* infection in December 1996 affected 52 patients, relatives, and staff of a large teaching hospital in southeast Queensland. Assorted sandwiches were identified as the vehicle of transmission. This article describes the outbreak investigation and demonstrates the importance of food hygiene and timely public health interventions (*Infect Control Hosp Epidemiol* 1998;20:55-56).

The Brisbane Southside Public Health Unit (BSPHU) was notified by the infectious disease physician of a large teaching hospital in Brisbane on December 12, 1996, of the occurrence of 11 cases of diarrhea among maternity patients and their neonates. An investigation was conducted by the BSPHU and infection control and occupational health staff of the hospital. This report describes epidemiological, clinical, microbiological, and environmental health aspects of that investigation.

METHODS

A case-control study of maternity patients was conducted using a self-administered food-history questionnaire. A case was defined as any maternity patient with a date of onset of illness between December 8-15, 1996, who developed vomiting, diarrhea, or nausea, plus one other symptom listed in the Table, or had *Salmonella* isolated from a fecal or blood culture. A control was defined as any maternity patient from the same ward who was an inpatient for at least 72 hours during this interval, with no symptoms and no *Salmonella* isolated from fecal examination. After the case-control study was completed, subsequent non-maternity cases were defined as patients, family members, or staff who developed vomiting, diarrhea, or nausea, plus one other symptom listed in the Table, or had *Salmonella* isolated from a fecal specimen, rectal swab, or blood culture following the consumption of hospital sandwiches.

Data were analyzed using Epi Info (version 6.04, Centers for Disease Control and Prevention, Atlanta, GA, 1994). Crude odds ratios (OR) with 95% confidence intervals (CI₉₅) were calculated to estimate measures of association between exposures and illness. Two-tailed chi-square or Fisher's Exact tests were used for statistical significance testing.

Fecal specimens also were obtained from staff members, patients, and their family members who complained of the above gastrointestinal symptoms with an onset of ill-

ness after December 8, 1996. Rectal swabs were obtained from all hospital kitchen staff. Blood cultures were collected from patients with systemic illness.

Kitchen facilities were inspected, and processes were audited using the Hazard Analysis Critical Control Point system.¹ Sandwiches, sandwich fillings, and ingredients were sampled and examined microbiologically, as were environmental swabs and utensils used in mixing ingredients.

RESULTS

Fifty-two cases were identified in this outbreak: 27 staff members (4 kitchen staff), 17 patients, and 5 spouses and 3 babies (secondary cases) of maternity patients. Forty-six (94%) primary cases had symptoms (Table). Ten cases required treatment with antibiotics. One elderly patient died. Eleven maternity patients met the case definition, and a further 41 cases were identified by enhanced clinical and microbiological surveillance and screening. The median age of the 49 primary cases was 37 (range 15-91) years. There were 28 females (57%) and 21 (43%) males. All 52 cases had onset of illness between December 8-13, with a peak on December 11 (Figure). The case-control study included all 11 eligible maternity cases and 23 controls. Analysis of risk factors showed a significant association between consumption of assorted sandwiches and illness (OR, 7.0; CI₉₅, 1.0-62.0; *P*=.02). No other food items or beverages were significantly associated with illness.

Forty-two fecal specimens (including four rectal swabs) were positive for *Salmonella typhimurium*. The four rectal swabs were from kitchen staff, of whom two were symptomatic. *S typhimurium* also was detected in blood cultures from three primary cases and one secondary case. All isolates were sensitive to commonly used antibiotics. The typing of *S typhimurium* isolates did not conform to a recognized phage type. However, all food and human isolates identified in this outbreak returned the same pattern on pulsed-field gel electrophoresis.

S typhimurium was isolated from curried egg sandwiches and curried egg mixture prepared on December 13 and from assorted sandwiches that were prepared earlier that week and retrieved from staff facilities. However, eggs and curry powder sampled on December 13 were negative for *Salmonella*. No other food items, ingredients, utensils, or environmental swabs tested positive. The sandwich fillings were mixed using plastic spatulas. Several of these spatulas were kept in a drawer in the sandwich preparation area. One was found to have food encrusted on it, and others had a greasy film on them. Time out of refrigeration during preparation (up to 3 hours) and transport of sandwiches (up to several hours before consumption at hospital functions) were important factors.

TABLE
FREQUENCY OF SYMPTOMS RESULTS AMONG 46 SYMPTOMATIC
PRIMARY CASES AND FREQUENCY OF *SALMONELLA TYPHIMURIUM*
CULTURE-POSITIVE RESULTS FOR EACH SYMPTOM

Symptoms	No. (%)	Culture-Positive (%)
Diarrhea	42 (91)	32 (76)
Fever	37 (80)	30 (81)
Cramps	35 (76)	26 (74)
Chills	33 (72)	28 (85)
Nausea	32 (70)	25 (78)
Vomiting	15 (33)	12 (80)

DISCUSSION

Initial investigations on December 12 resulted in the withdrawal from distribution of all raw or uncooked food items, including sandwiches, that may have been a potential source of the outbreak. This was an important intervention, as no further cases were identified with an onset date after December 13. The case-control study subsequently identified assorted sandwiches as the probable vehicle of transmission, and this was confirmed later by microbiological analysis.

All primary cases had consumed hospital sandwiches prior to their removal from circulation on the evening of December 12. The restricted distribution of curried egg sandwiches to certain wards and hospital staff meetings may have contributed to the limited spread of this outbreak. However, the range of onset dates and the isolation of *S typhimurium* from sandwiches prepared several days apart suggest that patients and staff were exposed to this organism over a number of days.

None of the four infected kitchen staff were involved in the preparation of sandwiches during this period or immediately preceding the outbreak. All gave a history of consuming hospital sandwiches, which suggests that they were not the source of contamination of the sandwiches. The literature asserts that asymptomatic infected food handlers are an unlikely source of such outbreaks, given the observance of normal food hygiene practices.^{2,3} The inability to isolate *Salmonella* from curry powder or eggs suggests that the contaminated curried egg mixture used on the sandwiches was inoculated by cross-contamination from another source. These findings and the kitchen audit suggest that cross-contamination was an important factor in the development of this outbreak. The time periods for delivery and retrieval of food items for staff meetings and after-hours duty staff allowed a further potential for food to be stored or handled inappropriately, which may have contributed to the outbreak.

Reported outbreaks of nosocomial salmonellosis have been associated with the use of contaminated utensils and working surfaces, the use of raw contaminated eggs, inadequate cooking of contaminated meat and poultry, food handlers, and person-to-person transmission.^{4,7} Although a contaminated vehicle of infection was detected in this outbreak, it was not possible to determine the source of infec-

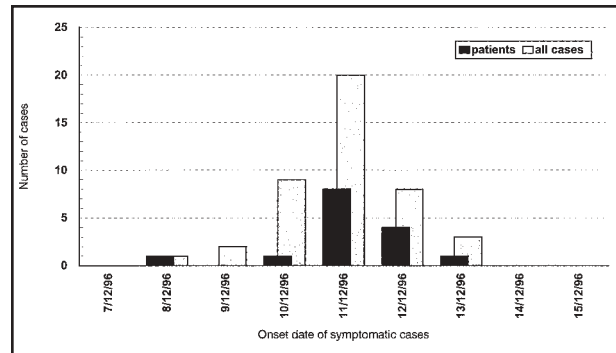


FIGURE. Epidemic curve of cases with known onset dates.

tion or how the prepared sandwiches became contaminated. Consequently, the interventions in this outbreak consisted of removing the vehicle of transmission and addressing food hygiene in the workplace (kitchen and hospital), with particular attention to the storage and handling of food and the cleaning of equipment.

This outbreak has emphasized the importance of food hygiene in the hospital environment. Hospitals should ensure that all food handlers are trained adequately in food hygiene and handling, with periodic review of that training. The storage, preparation, and handling of food should be according to the principles of the Hazard Analysis Critical Control Point system. Education of all hospital staff in the issues of food hygiene and handling would further decrease their risk of acquiring foodborne infection in the hospital environment.

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