

EGG-ASSOCIATED *SALMONELLA* OUTBREAK IN AN AGED CARE FACILITY, NEW SOUTH WALES, 2008

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Abstract

Salmonellosis is a bacterial disease that causes acute gastroenteritis, with sudden onset of headache, abdominal pain, diarrhoea, nausea and sometimes vomiting. Infection is often associated with the consumption of foods prepared using raw eggs. During July to August 2008 an outbreak at an aged care facility (ACF) in New South Wales was confirmed as *Salmonella* Typhimurium phage type 44 (Stm 44) in eight of 45 residents. Two additional probable cases also occurred. Cases were located in each unit of the ACF and for 5 cases, onset of diarrhoea was between 45 to 64 hours (median of 46 hours) after consumption of a dessert containing raw eggs. Onset for 5 further cases occurred up to 9 days after this meal. Eggs were supplied to the ACF from a local farm. Stm 44 was detected on an egg in an unopened box at the ACF from this supplier. The raw-egg dessert was epidemiologically implicated as the likely source of the *Salmonella* and delayed onset cases may have resulted from ingestion of a smaller dose of *Salmonella*, or ongoing transmission through cross-contamination of kitchen machinery or surfaces. This outbreak demonstrates that inadequate cooking of eggs continues to pose a risk for *Salmonella* infection in settings with vulnerable populations. The findings of the investigation provide support for the importance of food safety regulations and demand further advocacy for measures to reduce the risks associated with the distribution, storage and preparation of shell eggs. *Commun Dis Intell* 2009;33:50–53.

Keywords: disease outbreak, *Salmonella* Typhimurium, aged care, eggs

Introduction

In Australia, between 7,000 and 9,500 *Salmonella* infections are notified each year to state and territory health departments. In 2007, of the 9,484 notified cases of *Salmonella*, 1,039 (11.0%) occurred within recognised foodborne outbreaks.¹ The most common *Salmonella* serotype notified in Australia is *S. Typhimurium*. In 2007, eggs and egg based dishes were the most common food vehicles implicated in outbreaks of *S. Typhimurium* and were responsible for 15% (22/149) of reported foodborne outbreaks.¹ *Salmonella* Typhimurium phage type 44 (Stm 44)

has commonly been associated with eggs, with 12 of 18 Stm 44 outbreaks reported in Australia between 2001 and 2007 associated with raw egg exposure.²

On 7 August 2008, the OzFoodNet site at Hunter New England Population Health (HNEPH) was notified that seven of 45 residents in an aged care facility (ACF) had gastroenteritis. On 8 August, when *Salmonella* was isolated in stool samples from 2 cases, HNEPH and the New South Wales Food Authority (NSWFA) launched an investigation into the cause of the outbreak.

Methods

A site investigation was conducted at the ACF from 10 to 12 August. Case finding was conducted by interviewing staff and by reviewing each resident's clinical notes for evidence of diarrhoea or vomiting during the outbreak period. Clinical notes provided the cases' symptom profiles. Through heightened surveillance from 8 August, all residents with loose stools had a sample submitted for parasitic, bacterial and viral pathogen examination.

A probable case of *Salmonella* was defined as a resident having at least 1 episode of diarrhoea between 31 July and 11 August 2008. A confirmed case also had a positive stool culture for Stm 44.

HNEPH conducted a cohort study, obtaining details from the nursing manager or residents' clinical notes. Details included residential unit, room number, age, sex, nature of diet, dietary practices, nutritional supplements, medications and attendance at group activities. Interviews to obtain staff and resident food histories were attempted. Infection control practices were reviewed using records in clinical notes and by direct observation. Data were entered into a Microsoft Excel database. STATA™ (version 8.0, Stata Corporation, College Station, Texas, USA) was used to calculate relative risks using the Fisher's exact test.

The menu for residents was reviewed for high risk food and ingredients and a site inspection for hygiene and food preparation practices was conducted.

The NSWFA collected samples for microbiological testing on 11 and 12 August. These included: food samples (2 cooked chicken meals, fruit salad, roast lamb meal, red lentil soup, frozen mixed berries);

eggs with intact, cracked, or dirty shells from both opened and unopened bulk cartons; and 14 environmental swabs (5 different food mixer appliances, ice cream scoops, utensil drawer, stainless steel food preparation bench tops and frequently used handles).

A trace-back investigation of the eggs used by the ACF resulted in visits to the egg farm and grading/distribution facility on 20 and 21 August, and 17 September. Egg samples were selected from all 4 chicken sheds, and from first and second quality eggs rejected through the grading (candling) process. Chicken feed, filtered bore water supplied to the sheds, and chicken faecal matter were sampled and environmental swabs were taken in each shed. At the egg grading facility, swabs of the grading equipment and a cleaning cloth were obtained for testing. All samples were tested for *Salmonella*.

Results

Descriptive epidemiology

Ten of 45 residents (22%) of the ACF met the definition for a case, with Stm 44 confirmed in eight. The median age of cases was 81.5 years and eight were female. Nine cases experienced more than 1 diarrhoeal episode and one had bloody diarrhoea. Four cases experienced vomiting, one reported fever and one reported nausea. For the 4 cases where date of symptom cessation was recorded, the median symptom duration was 73 hours (range 30 minutes – 6.25 days).

A point-source outbreak with ongoing transmission was suggested by the epidemic curve of diarrhoea onset (Figure). The 5 initial cases occurred on 2 and 3 August, between 45 to 64 hours (median 46 hours) after consumption of a chocolate mousse dessert

containing raw eggs. 5 subsequent cases had onset dates between 6 and 9 August. The median incubation period from consuming mousse to onset for all cases was 103 hours (5.4 days). The confirmed case with onset on 9 August had only 1 episode of mild diarrhoea.

No cases were admitted to hospital. Two residents with confirmed *Salmonella* and complex pre-existing medical conditions died during the fortnight after their symptoms resolved. Both residents' treating clinicians determined that salmonellosis was not an important factor contributing to their death.

The ACF houses residents in 3 units, according to the level of care required. The first 5 residents affected were distributed across all units in the ACF (Figure). Four of the last 5 cases occurred in the high care unit. The attack rate in residents in the high care unit was 46% (6/13) compared with 12.5% in both the low care (3/24) and dementia (1/8) units.

Between 2 and 10 August, there were at least 3 documented times when a nurse cared for both well residents and residents affected by gastroenteritis during the same shift; strict cohorting of residents and staff was fully implemented on 10 August.

Analytical epidemiology

Cases were not able to be interviewed about their food history due to very poor recall and/or cognitive impairment. Staff were unable to reliably report case food histories and the ACF did not accurately record the foods consumed by each resident. It was recommended that these records be kept in the future.

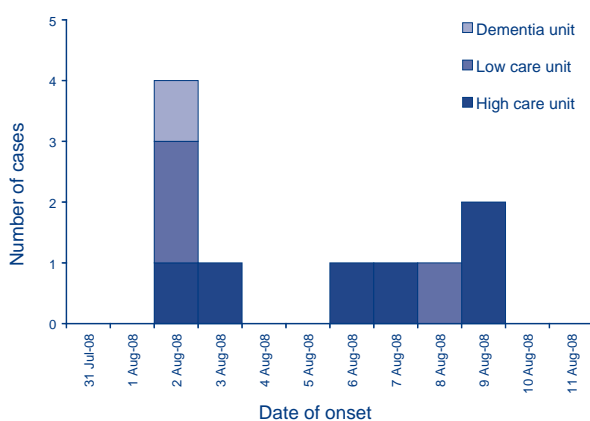
Twenty-two of 45 residents ate pureed or soft food and 15 required assistance with feeding. Cases were more likely to have eaten pureed foods (RR=4.2, 95% C.I. 1.0, 17.6, $P = 0.029$) and to have had assistance with feeding (RR =8.0, 95% C.I. 1.9, 33.1, $P = 0.009$) than non-cases.

Fourteen residents (including 3 cases) were taking protein pump inhibitors (PPIs) to reduce gastric acidity. PPIs have previously been associated with increased susceptibility to gastrointestinal infections.^{3,4} Eight residents received nutritional supplements. There was no association between disease and use of PPIs, supplements or attendance at exercise or bingo sessions. No cases had received laxative medications in the 24 hours prior to diarrhoea onset.

Environmental investigation

Meals at the ACF were prepared in a central, on-site kitchen according to a rotating 4 week menu. Between 27 July and 2 August, one particularly high

Figure. Epicurve of diarrhoea onset in residents at the New South Wales aged care facility, 31 July to 11 August 2008, by residential care unit



risk meal was identified; a chocolate mousse containing raw egg yolks and whites was served at lunch on 31 July. This dessert was prepared on 30 July by 1 kitchen staff member from 9 whole eggs, whipped cream, margarine and melted chocolate. This staff member indicated that they had been well, all equipment had been clean and that food was under temperature control. Prior to serving for lunch on 31 July, the mousse was plated into individual serving dishes using an ice cream scoop and tinned fruit was added. The covered plates were stored in the cool room. The mousse was served to all residents except 2 lactose intolerant residents (who were not cases). Nursing staff reported that desserts are usually eaten by all residents to whom they are served, although there was no accurate record of individual consumption or amount of mousse consumed. The kitchen mixer used for mousse preparation was also utilised in the preparation of other ready-to-eat foods, particularly foods for residents on a pureed diet.

Each week, the ACF used approximately 174–270 free-range second-grade eggs, supplied by a local farm. Between one and 3 eggs in each tray of 30 were observed to be cracked or visibly dirty in an unopened carton of eggs. No raw eggs were reported to have been included in other dishes served prior to or during the outbreak. The ACF was advised to immediately cease serving raw egg foods or undercooked eggs, to only purchase first grade eggs and reject cracked and/or dirty eggs, and to use different mechanical mixing devices for raw eggs or products containing raw eggs and for ready-to-eat foods. A subsequent visit demonstrated compliance with an official NSWFA Improvement Notice.

Microbiology

All 8 residents with confirmed *Salmonella* were infected with Stm 44, with an identical MLVA pattern (3-10-9-9-523). The rinse of an uncracked egg in an unopened carton of eggs supplied from the local farm on 7 August 2008, yielded Stm 44 with the same MLVA pattern identified in human isolates. There were no remaining eggs from batches received by the ACF on 22 or 29 July for sampling. No other samples had evidence of Stm contamination.

Discussion

Chocolate mousse made with contaminated raw eggs was implicated as the likely source of infection with Stm 44 during this outbreak in an ACF. Whilst there were no remaining eggs of the batch used by the ACF in the implicated mousse, Stm 44 was isolated from the shell of an egg that was sampled from an unopened carton of a subsequent batch supplied to the ACF by the same local farm. Initial cases occurred within a compatible incubation period fol-

lowing consumption of the mousse and occurred in each ACF unit, suggesting a point-source foodborne infection.

In the kitchen, the same equipment was used for both raw and ready-to-eat foods, and there were a number of unsafe food handling practices that could facilitate cross-contamination, as well as some inadequate cleaning practices. All eggs used were 'seconds', with evidence of some being cracked and dirty, and there was no procedure for rejecting cracked or dirty eggs at time of receipt. Using cracked and dirty eggs increases the risk of *Salmonella* contamination of foods, the environment and persons handling the eggs.^{5,6}

New cases occurred over 9 days following consumption of the mousse on 31 July. The initial cases occurred following the usual incubation period of *Salmonella*, of 6 to 72 hours.⁷ There are 3 possible explanations for the occurrence of cases with symptom onsets between 6 and 9 August. Longer median incubation periods of up to 8 days^{8–10} have been observed during *Salmonella* outbreaks when the infectious dose is low. Extremely long incubation periods for *S. Typhimurium* of up to 27 days have occasionally been observed.⁸ Neonates, the elderly and immunocompromised individuals are more likely to become infected and symptomatic when exposed to a lower infectious dose than other population groups.⁴ The later cases may have ingested a lower dose of *Salmonella* if it was not well distributed through the mousse, if they ate a smaller portion, or if other ready-to-eat food was cross contaminated with Stm 44 through a shared-use kitchen implement or machine. It is also possible that cases were exposed to *Salmonella* through food served on multiple days by this latter mechanism. Blenders may be difficult to clean, so may provide a reservoir for bacteria to accumulate.^{4,11} The lever ice cream scoops used for serving foods such as chocolate mousse and mashed potato, pumpkin or ice cream, may also be difficult to clean providing an avenue for cross contamination. However, environmental swabs of the blenders and ice cream scoops did not detect *Salmonella* and they were clean on visual inspection. Kitchen staff stated they were cleaned and sanitised directly after each use.

In addition to being used in the mousse, eggs from the same batch were used in other cooked meals possibly until 6 August. Presuming this batch of eggs was contaminated with Stm 44, contamination of other foods or surfaces/implements/machines in the kitchen may have occurred.

Finally, it is possible that person-to-person spread occurred within the facility.^{7,12} Initially, nursing staff were exposed to stools from symptomatic residents during the same shifts they worked with well resi-

dents. Transmission of *Salmonella* from nurses, food handlers or visitors to residents may have been possible although there was no evidence to support this hypothesis.

Conclusion

This outbreak highlights the need to avoid high risk foods, including raw-egg foods and undercooked eggs, in settings with vulnerable populations—particularly aged care facilities—and the potential value of clearer guidelines relating to egg risks for these facilities. The need for routine optimal food preparation and infection control practices to prevent the spread of pathogens in food is reinforced, and the findings of the investigation provide support for the importance of regulations such as Standard 3.3.1 – Food Safety Programs for Food Service to Vulnerable Populations¹³ and demand further advocacy to reduce the risk associated with the distribution, storage and preparation of shell eggs.

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