An outbreak of staphylococcal food poisoning in a commercially catered buffet

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Abstract

Staphylococcal food poisoning is a common cause of foodborne illness. In Australia, since 2000, approximately 30% of foodborne *Staphylococcus aureus* outbreaks reported to OzFoodNet have been associated with foods prepared by commercial caterers. We conducted a retrospective cohort analysis of an outbreak of gastrointestinal illness among participants of an elite sporting event during which 22 individuals became ill after eating a commercially catered buffet dinner in June 2012. All recalled eating fried rice which had been intended for lunch service earlier that day and 20 of the 22 reported eating chicken stir-fry. Though no food samples were available for analysis, laboratory analysis conducted on four faecal specimens resulted in *S. aureus* being cultured from one specimen and *S. aureus* enterotoxin detected in another. The known epidemiology of staphylococcal food poisoning suggests a food contaminated by an infected food handler which was subject to temperature abuse may have caused the outbreak. As *S. aureus* foodborne outbreaks are often underreported, this investigation is a valuable contribution to the evidence-base and understanding of foodborne illness due to *S. aureus* and staphylococcal enterotoxin.

Keywords: Staphylococcus aureus, enterotoxins, outbreak, foodborne, rice, chicken

Introduction

Staphylococcal food poisoning (SFP) is a common cause of foodborne illness worldwide.[1-7] SFP occurs following ingestion of staphylococcal enterotoxins which are heat resistant and are produced in food following contamination by staphylococci, typically *Staphylococcus aureus*. Foods including sliced meat, meat products, salads, pastries, custards, raw milk and cheese products present a particular contamination risk.[2] Such a large population of staphylococci is indicative of unhygienic food handling procedures and temperature abuse over a period of time to allow for bacterial growth.[3]

In Australia, little published information exists describing past SFP outbreaks. OzFoodNet, however, collects information on all reported foodborne illness outbreaks. Between January 2000 and March 2012, OzFoodNet recorded 14 *S. aureus* outbreaks affecting 429 people (25 hospitalised; 1 death). In just under a third of these outbreaks, meals containing chicken were implicated. Twenty-nine per cent of these outbreaks were associated with food prepared by a commercial caterer (OzFoodNet Outbreak Register. June 2012. Unpublished data).

The outbreak

On 2 June 2012, 22 individuals who had participated in an elite sporting event in Sydney experienced gastrointestinal symptoms after eating a buffet dinner served by the commercial catering company servicing the event. The day of the outbreak was the final day of the two week event and reportedly less busy at dinner time than previous meals. The 22 individuals were part of a larger cohort of up to 40 people who queued for dinner service earlier than the other 500 attendees due to the timing of their responsibilities at the event. Within hours of eating, all 22 fell ill with symptoms including vomiting, diarrhoea and abdominal cramping. Six people were transported to hospital. The event organiser reported that only the early dining group was affected.

This report summarises the epidemiological and microbiological investigations into the cause of the outbreak.

Methods

Epidemiological investigation

As this epidemiological investigation was conducted as part of the required public health response to a reported outbreak, it was not necessary to obtain ethical approval.

In order to develop hypotheses regarding the cause of the outbreak, preliminary interviews were conducted by telephone with several of the cases who attended the emergency department (ED) due to the severity of their symptoms. We drafted a food exposure questionnaire based on information from these interviews and information from a copy of the menu provided by the caterers. The questionnaire sought basic demographic details, food exposures (lunch and dinner), symptom description and duration, and illness history. Individuals were also

asked whether they were aware of anyone who had been ill with gastrointestinal symptoms prior to or following the outbreak.

A case was defined as anyone who ate the catered buffet dinner on 2 June 2012 at the early time (16:00 to 17:30) and experienced vomiting and/or diarrhoea and abdominal cramping commencing between 17:45 and 21:15. A confirmed case was someone meeting the case definition with *S. aureus* or *S. aureus* toxin detected in a stool specimen.

The names of the cases as well as others who were thought to have dined early were provided by the event organisers, Ambulance Service NSW, and other interviewed attendees. Based on the knowledge gleaned from these interviews, we conducted a retrospective cohort investigation to identify risk factors for developing illness. Interview data were collated and attack rates and risk ratios were calculated for specific food exposures. Analysis was conducted using SAS© software (version 9.3).

Microbiological and environmental investigations

No food samples were available for testing. Faecal specimens were collected from 5 of the individuals who attended the ED. Initial testing for *Clostridium difficile*, *Salmonella, Shigella* and *Campylobacter* species and norovirus was conducted by the hospital laboratory.

Four specimens were available to be sent to Queensland Health Forensic and Scientific Services laboratory where they were cultured for a full range of enteric pathogens (including *Salmonella*, *Shigella* and *Campylobacter* species) and toxin-mediated foodborne illness causing bacteria (*S. aureus* and *Bacillus cereus*). Samples were cultured on Baird Parker Agar for two days at 37°C for *S. aureus* and Phenol-Red Egg Yolk Polymixin Agar for *B. cereus*. Three faecal samples were tested for staphylococcal enterotoxin using the Tecra enzyme-linked immunosorbent assay (TECRA). A site inspection was conducted by NSW Food Authority and is the subject of a separate internal report.

Results

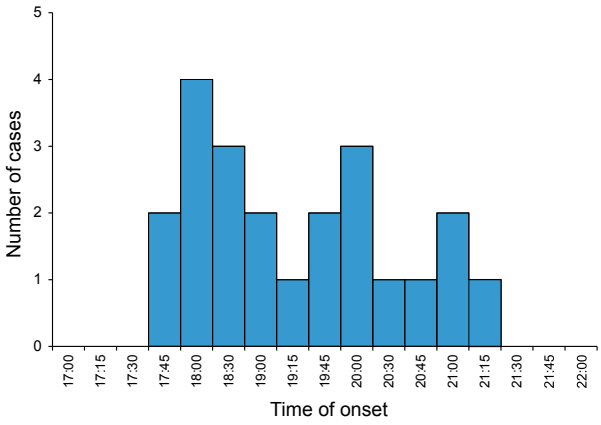
Epidemiological results

A total of 36 persons who ate an early dinner served by the caterer were interviewed, with the majority interviewed 2 to 3 days after the incident. The median age of people interviewed was 40 years (range 12 to 72 years); 78% were female. Among the 36 persons interviewed, 22 (61%) were identified as cases, including two persons with laboratory-confirmed illnesses.

Of the 22 cases, 18 (82%) were female, ranging from 12 to 69 years old (median 34 years). Of those who did not fall ill, 10 (71%) were female, ranging from 21 to 72 years old (median 46 years).

Dinner times reported by cases ranged from 16:00 to 17:30. The epidemic curve illustrates the time distribution of symptom onsets among cases ranging over a 4 hour period on 2 June (Figure 1). Incubation periods ranged from 1 hour to 4.75 hours (average 2.5 hours). Illness typically began with the sudden onset of vomiting, followed by a period of concurrent vomiting and diarrhoea, with a median duration of 4 hours (range 2 to 13 hours). Of the 22 cases, 21 experienced vomiting (96%); 17 had diarrhoea (77%) and 10 reported abdominal cramping (46%). Six people (27%) were transported to a local ED. No interviewees were aware of others with symptom onset of gastrointestinal illness prior to or following the outbreak.

Figure 1: Number of cases of gastrointestinal illness after the catered dinner on 2 June 2012, by time of onset (n=22)



A number of food items were served during lunch and dinner. A selection of bread, cold meats (ham, chicken, turkey and silverside), salad and fried rice were available at lunch. Green salad, coleslaw, meatballs, cannelloni, boiled rice, fried rice, chicken stir-fry, bread rolls, jelly and yoghurt were served for dinner. Fried rice intended for lunch service on the day of the outbreak was reportedly served to the early diners because the boiled rice for dinner service was not ready in time.

All interviewees had eaten dinner early at the catered buffet while only 14 (39%) ate lunch there. Ninety-one per cent of cases ate both chicken stir-fry and fried rice at dinner with attack rates and rate differences of 74% for chicken stir-fry and 71% for fried rice (Table 1). The risk ratios for both dishes were undefined. Similarly, we were unable to conduct further analysis using stratification. Therefore it was not possible to identify an association with either chicken stir-fry or fried rice.

Table 1: Relative risks and attack rates for food items consumed by the cohort

Salad	5	7	71	17	29	59	1.22 (0.70-2.13)	0.68
Coleslaw	2	2	100	20	34	59	1.70 (1.28-2.25)	0.51
Meatballs	15	24	63	7	12	58	1.07 (0.61-1.89)	1.00
Cannelloni	14	25	56	8	11	73	0.77 (0.47-1.27)	0.47
Fried rice	22	31	71	0	5	0	undefined	0.005
Chicken stir-fry	20*	27	74	0	7	0	undefined	0.0006
Yoghurt	5	8	63	17	28	61	1.03 (0.56-1.90)	1.00
Jelly	8†	13	62	13	22	59	1.04 (0.60-1.81)	1.00
Bread roll	11‡	17	65	7	14	50	1.29 (0.69-2.43)	0.48

* 2 missing
† 1 missing
‡ 5 missing

Microbiological and environmental results

Initial screening results for all five specimens were negative for norovirus, *C. difficile, Salmonella, Shigella* and *Campylobacter* species.

Queensland Health Forensic and Scientific Services laboratory cultured *S. aureus* in one specimen. Another specimen tested positive for *S. aureus* enterotoxin.

Though no food samples remained for laboratory testing, the catering company confirmed that food handling policies were in place to prevent contamination as well as time and temperature abuse. No evidence of time and temperature abuse was observed during the site inspection. The catering company also reported that no staff members were known to be suffering from gastrointestinal illness during the sporting event.

Discussion

S. aureus is one of the most common pathogens in humans, estimated to colonise approximately 25% of healthy adults.[2] Multiple pathogenic strains produce enterotoxins which, when ingested, can cause gastroenteritis.[8] In Australia, *S. aureus* intoxication accounted for 1% of all suspected and confirmed foodborne outbreaks reported to OzFoodNet between January 2000 and March 2012. Meals including chicken, beef, seafood, and lamb, as well as pasta salad and rice dishes have all been implicated as source of infection in these *S. aureus* enterotoxin outbreaks (OzFoodNet Outbreak Register. June 2012. Unpublished data).

Our findings suggested that chicken stir fry and/or fried rice were the food vehicles responsible for illness. Although it was not possible to determine risk ratios for fried rice and chicken stir-fry, the attack rates and rate differences calculated support this conclusion. It was not possible to consider these exposures independently as all cases who were able to recollect reported eating both food items.

SFP outbreaks result from contamination of food with *S. aureus* from food handlers either through skin infection on uncovered hands or arms, or via coughing or sneezing over food that is not subjected to further cooking. Current industry guidelines require food handlers to ensure their bodies, and anything from their bodies or clothing, do not contaminate food or food preparation areas.[9] For the bacteria to grow to sufficient numbers, the contaminated food must be left in temperature conditions where the bacteria are able to proliferate. *S. aureus* produces pre-formed toxins that have an emetic and diarrheal effect.[3]

In this investigation, there was no evidence of temperature abuse and we were unable to definitively identify a cause of the outbreak. The environmental investigation revealed no food safety breaches, and the absence of food samples made it impossible to identify the food vehicle responsible for the outbreak. The only apparent difference in foods served to the early diners was the fried rice which had been intended for lunch service.

To prevent toxin-based outbreaks, it is important that commercial food providers adhere to strict temperature protocols and ensure good food handling practices. Management and staff need to be alert to the presence of infected skin lesions or discharges from nasal passages, ears or eyes in food handlers. Appropriate measures should be taken to ensure that no ill individuals can contaminate food or food contact surfaces.[10]

Investigation of toxin-mediated foodborne illness is particularly problematic due to short onset times and duration of symptoms. Furthermore, as *S. aureus* is not a notifiable disease outbreaks often go undetected. This outbreak was only likely to have been reported due to the nature of the sporting event and the large number of individuals affected.

Limitations

This investigation was limited in several ways. Though interviews were conducted as soon as possible following the outbreak, a number of individuals had difficulty remembering all foods consumed. A high proportion of individuals who dined early strongly believed that the fried rice intended for lunch was the infection source. Moreover, participants had extensively discussed the outbreak and theories on its cause, predominantly through social media, potentially introducing bias to the investigation.

The microbiological investigation was also impacted by limitations. Firstly, initial analyses of faecal specimens were restricted to in-house PCR assays and not cultured as per the NSW Health outbreak protocol which specifies that all faecal specimens related to potential outbreaks undergo routine enteric culture. Nevertheless, *S. aureus* is unlikely to be grown using routine culture, and the delay which ensued from the need to transport samples to Queensland for toxin testing would have decreased the yield when appropriately cultured there. Given the time delay between onset and receipt of the samples and the variable storage temperatures of the samples during that time, it is unsurprising that only 1 positive result was returned. This underlines the importance of good communication between public health investigators and laboratories so that specimens are tested according to the clinical and epidemiological picture. Additionally, vomitus specimens would have been preferable for analysis as staphylococcal enterotoxin is cleared from the gut quite quickly. Unfortunately, no samples of vomitus were collected as this is not a routine practice in EDs and vomiting had resolved before the public health investigation commenced.

Conclusion

Information obtained from case interviews and the results of microbiological testing of human specimens support a conclusion that enterotoxigenic *S. aureus* bacteria were responsible for this outbreak. We were unable to definitively identify a food vehicle in this outbreak. *S. aureus* associated outbreak reports are rarely published in Australia despite being such a common cause of foodborne illness worldwide. This investigation improves our understanding of the epidemiology of foodborne *S. aureus* outbreaks in Australia.

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