

Peer-reviewed articles

AN OUTBREAK OF *SALMONELLA* TYPHIMURIUM LINKED TO A KEBAB TAKEAWAY SHOP

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Abstract

This paper describes the public health investigation and response to a *Salmonella* Typhimurium outbreak in June 2010 in the Central Coast of New South Wales. Two complaints from people with acute gastrointestinal illness pointed to food from a kebab takeaway shop as the cause of their illness. Liaison between public health and food authorities ensured timely epidemiological and environmental investigations leading to prompt identification and elimination of the point source. A case series investigation identified 45 outbreak cases including 31 laboratory-confirmed and 14 epidemiologically-linked cases. The food vehicles identified were hommus and tabouli – 93% of cases reported having one or both items in their kebab. *S. Typhimurium* with the same MLVA type was found in stool specimens from outbreak cases and in food (including hommus and tabouli) and environmental samples collected at the kebab takeaway shop. Education of commercial food handlers, reduction of poultry meat contamination and collaboration between public health and food authorities to ensure prompt identification and control of outbreaks are important strategies to reduce *Salmonella* related illness. *Commun Dis Intell* 2012;36(1):101–106.

Keywords: Salmonella, outbreak, foodborne, kebab, cross-contamination

Introduction

Foodborne gastroenteritis is a significant public health problem in Australia, incurring substantial societal and health care costs. Even though the vast majority of the estimated 5.4 million cases of foodborne disease which occur in Australia each year experience a mild and self-limiting illness and do not seek medical attention, foodborne gastroenteritis is estimated to result in 2.1 million days of work lost, 1.2 million doctor visits, 18,000 hospital admissions and over 100 deaths annually.¹

In Australia, non-typhoidal *Salmonella* is responsible for a significant proportion of foodborne gastroenteritis cases¹ and is also the most commonly implicated aetiological agent in outbreaks of foodborne illness.² In the quarter from April to June 2010

Salmonella was the aetiological agent for 10 of the 35 confirmed or suspected foodborne disease outbreaks reported in Australia.³

On Tuesday 8 June 2010, the Central Coast office of the Northern Sydney Central Coast Public Health Unit (PHU) received notification of 2 complaints to the New South Wales Food Authority (NSWFA). The complaints referred to 5 people who had developed acute gastrointestinal symptoms and who had pointed to food from a kebab takeaway shop in the Central Coast (the shop) as the cause of their illness. The shop had been implicated in a *S. Typhimurium* outbreak in April 2007 involving 44 laboratory-confirmed cases. This paper describes the public health response to the notifications received in June 2010.

Methods

Epidemiological investigation

Following receipt of the NSWFA notifications, staff from the PHU interviewed the 5 cases reported. The PHU obtained details of food eaten by the cases over the 3 days prior to the onset of symptoms to determine common exposures. The information obtained supported the hypothesis that the shop that had been identified by the complainants was the likely source of their illness. The PHU requested that the 5 cases attend their general practitioner (GP) to provide stool specimens for testing.

Further cases were identified from laboratory notifications of salmonellosis received by the PHU, which had a specimen collection date in June 2010, or from reports to the PHU of persons meeting the case definition. Enhanced surveillance was initiated by alerts to hospital emergency and pathology departments in the Central Coast about the outbreak and requests to report any cases meeting the case definition.

The NSWFA investigated the presence of illness amongst staff at the shop and their exposure to food from the shop.

Case definition

An outbreak case was defined as any person with acute gastrointestinal illness with onset after eating food from the shop from 30 May. As the investiga-

tion progressed, the case definition became more specific to only include exposures between 30 May and 15 June 2010.

Persons with laboratory-confirmed salmonellosis were interviewed using a suspected foodborne illness investigation form to determine their exposure and to obtain demographic and illness information. Persons with laboratory-confirmed salmonellosis who met the case definition were categorised as outbreak laboratory-confirmed cases. Persons with laboratory-confirmed salmonellosis who were not able to be interviewed after 3 attempts were excluded from the study.

Persons reported as meeting the case definition but who were not tested were categorised as outbreak epidemiologically-linked cases.

Environmental investigation

Based on the initial epidemiological information, the NSWFA conducted an inspection of the shop on Wednesday 9 June. At this time the NSWFA collected food and environmental samples for testing, including cooked and uncooked food items, and swabs of surfaces, equipment and utensils used for food storage and preparation. The NSWFA assessed hygiene and food safety controls and discussed these with the proprietor.

On Tuesday 15 June the NSWFA obtained further food and environmental samples from the shop for testing. The NSWFA requested information from the proprietor of the shop about numbers of kebabs sold in the week up to 9 June. The NSWFA also investigated the suppliers of the various food ingredients used at the shop.

Laboratory investigation

Stool specimens were cultured at several laboratories in the Central Coast and Sydney. Serotyping and multiple locus variable number of tandem repeat analysis (MLVA) were conducted at the Institute of Clinical Pathology and Medical Research (ICPMR) at Westmead, Sydney. Phage typing was conducted at the Microbiological Diagnostic Unit Public Health Laboratory (MDUPHL) at the University of Melbourne. NSWFA samples were cultured at the Division of Analytical Laboratories (DAL) at Lidcombe, Sydney, serotyped and phage typed at the Australian Salmonella Reference Centre in Adelaide and MLVA typed at ICPMR.

Data analysis

Data were entered into and analysed using a Microsoft® Excel spreadsheet.

Results

Epidemiological investigation

The 5 initial cases belonged to 2 unrelated groups. Three cases were part of a group of 4 including 2 residents of the Central Coast and 2 visitors to the Central Coast. Three members of the group ate kebabs from the shop and became sick, while the 4th member ate food from elsewhere and remained well; no other common exposures for the cases could be identified. The 2 cases in the other group belonged to a household of five; the 2 cases shared a kebab from the shop, the other members of the household did not eat any food from the shop and remained well; all other foods consumed by the cases were also eaten by the other members of the household.

Salmonella notifications

The PHU received 52 *Salmonella* notifications for the month of June 2010 including the notifications for two of the initial complainants.

Of the 52 notifications, 29 (55.8%) were identified as outbreak cases. Twenty (38.5%) notifications were not directly linked to the shop and no common exposure was identified for these *Salmonella* infections. Three (5.8%) laboratory-confirmed *Salmonella* notifications could not be contacted after 3 attempts and were excluded from the study.

A further 2 laboratory-confirmed outbreak cases were identified by the PHU at an adjacent region among residents of that region who had visited the Central Coast and consumed food from the shop. Overall, 31 laboratory-confirmed outbreak cases were identified.

Epidemiologically-linked cases

Fourteen cases of acute gastrointestinal illness that met the outbreak case definition but who had not submitted a stool specimen for testing were identified. Thirteen were identified through interviews with laboratory-confirmed outbreak cases and one through a hospital in the Central Coast.

All cases

All 45 cases in this outbreak (31 laboratory-confirmed and 14 epidemiologically-linked) were identified as customers of the food outlet. No cases were reported among staff – staff reported to the NSWFA that they regularly consumed kebabs, including hommous and tabouli, from the shop.

The majority (31/45, 69%) of outbreak cases were female. Age was known for 35 cases and ranged from 7 to 70 years (median = 28).

Illness

Symptom data were available for 43 of the 45 outbreak cases. All but 1 (42/43, 98%) reported diarrhoea, with 4 cases reporting bloody diarrhoea. The second most commonly reported symptom was abdominal cramps (74%), followed by fever (63%), nausea (63%) and vomiting (53%). Sixty per cent of cases reported additional symptoms, such as dizziness and headache.

In those who reported that they had recovered by the time they were interviewed (21 cases), the duration of illness ranged from 1 to 18 days (median = 8). Many cases reported having to take time off work or study for a length of 1 to 10 days (median = 5) because of their illness.

Thirty-one cases sought medical assistance either from a GP (13), hospital (11) or both (7). Eight cases required hospital admission; half of these had visited a GP prior to visiting the hospital and being admitted, while the other four had gone directly to a hospital emergency department. Length of stay in hospital ranged from 2 to 7 days; 3 cases were admitted for 3 days and three for 4 days (median length of stay = 3.5).

A secondary salmonellosis infection occurred in a child who had not consumed food from the shop. The child's parent had developed acute gastrointestinal illness following consumption of a kebab from the shop on 4 June 2010 and cared for the child while ill. The child was admitted to hospital with salmonellosis for 5 days.

Food exposures

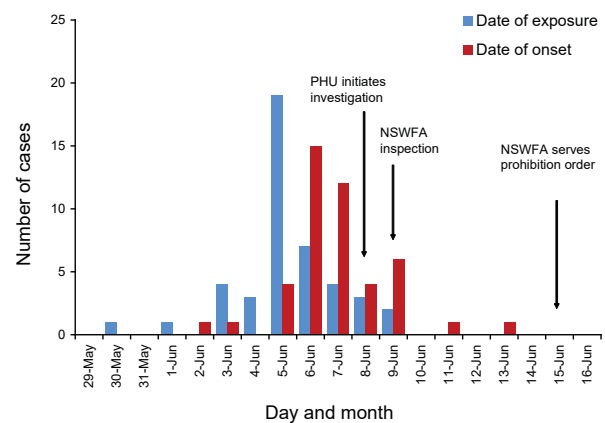
Information on the date of purchase of food at the shop was available for 44 cases. Cases purchased food between 30 May and 9 June 2010 with 59% purchasing food during the weekend of 5–6 June (Figure). Incubation periods ranged from 8 to 100 hours (median = 24.5 hours). The earliest onset date reported was 2 June and the latest was 13 June; the outbreak peaked on 6 June (Figure).

Food consumed

The shop served kebab rolls, vegetarian rolls, falafel rolls and savoury crepes. Chicken and a mix of beef and lamb were the meats used for the kebab rolls and, if requested by the customers, were also used in crepes. A variety of salad items, sauces and other accompaniments were available to be served in rolls and crepes.

All but 1 case reported eating kebabs. Table 1 lists the food items consumed by the 45 cases. Forty-two cases (93%) reported having either hommou or tabouli or

Figure: Number of laboratory-confirmed and epidemiologically-linked cases, by date of exposure* and date of onset of symptoms



* Excludes 1 laboratory-confirmed case with unknown date of exposure.

both in their kebab. Of the cases who did not have hommou nor tabouli, one reported having a beef/lamb kebab, one reported having a chicken crepe (the case with the earliest exposure and onset date), and one reported having a chicken kebab with salad.

Environmental investigation

The shop was situated in the main food court of a busy shopping centre. The shop consisted of a food display and serving area at the front and a rear food preparation and storage area that were not visible to the public. Chicken meat, marinated in-house, was stacked onto a large metal skewer to assemble a chicken meat kebab log; the mixed lamb and beef kebab logs were purchased already assembled; the kebab logs were then cooked in vertical rotisseries in the front area of the shop. The proprietor stated that over 1,000 kebab rolls had been sold in the week up to 9 June 2010.

The initial inspection and interview with staff working at the shop on Wednesday 9 June 2010 identified only minor hygiene defects and potential risks (for example, lack of evidence of consistent use of sanitising step following washing of food utensils and other food contact equipment; storage of sealed bag of raw minced meat alongside bags of vegetables and fruits) but did not reveal any substantial breaches to food handling practices and sanitation. However, the results received on Tuesday 15 June for the tests conducted on samples collected on 9 June 2010 showed the presence of *S. Typhimurium* in food and environmental samples (Table 2).

On Tuesday 15 June 2010, on the basis of these test results, the NSWFA issued an immediate prohibition order to operate and obtained further food and

Table 1: Food items consumed by outbreak cases

Food items consumed	Cases consuming the specific food item N=45	
	Number	Percentage
Kebab	44	98
Crepe	1	2
Kebab/crepe fillings:		
Hommus	40	89
Tabouli	36	80
Tomato	38	84
Lettuce	35	78
Chicken	26	58
Beef/lamb	25	56
Onion	21	47
Cheese	13	29
BBQ sauce	8	18
Garlic sauce	7	16
Tomato sauce	4	9
Hot chilli sauce	3	7
Sour cream	3	7
Sweet chilli sauce	4	9

Table 2: Environmental investigation test results received for samples collected on 9 June 2010

Samples	Results
Food	
Hommus	S. Typhimurium PT 170/108 MLVA type 3-9-7-15-523
Tabouli	
Chicken kebab roll (purchased, contained hommus and tabouli)	
Marinated raw chicken	<i>Salmonella</i> Infantis
Cooked chicken meat	No pathogens
Cooked beef and lamb meat	
Tahini	
Pepper	
Garlic powder	
Paprika	
Environmental	
Coolroom door handle	S. Typhimurium PT 170/108 MLVA type 3-9-7-15-523
Plastic cabbage leaves (used to line trays containing ready to eat vegetables)	
Chilled display unit	
Lower shelf of food preparation bench	S. Typhimurium PT 170/108 and 193 MLVA type 3-9-7-15-523
Slicing machine	No pathogens
Knives	
Metal tongs	
Stick blender	
Support table for chicken	
Plastic apron	

environmental samples for testing. No *Salmonella* was detected in any of the samples obtained on 15 June. No issues were identified by the traceback investigation of suppliers of food items. The food outlet remained closed for several weeks during which time the proprietor renovated the premises. The prohibition order was lifted on 30 July after renovations were completed and the business was able to demonstrate adequate food safety skill and knowledge. The business also undertook to cease in-house preparation of chicken kebab logs to minimise future risk of cross-contamination.

Laboratory investigation

The 31 samples from outbreak cases, which had initially tested positive for *Salmonella* species, were serotyped and found to be *S. Typhimurium*. The MLVA types were 3-9-7-14-523 (16 cases), 3-9-7-15-523 (14 cases), and 3-9-7-13-523 (1 case); MLVA typing results were received several weeks after receiving the respective salmonellosis notification. Phage typing of isolates showed them to be phage type (PT) 170/108.

Three food samples and 4 environmental surface swabs tested positive for *S. Typhimurium* MLVA type 3-9-7-15-523 and PT 170/108 (Table 2).

MLVA types with variation of 1–2 digits (repeat differences) at one of the three inner loci (the 4th locus in these isolates) combined with a clear epidemiological link, as found in this occasion between human cases and the implicated food and environment, indicate that this was the same infectious agent.⁴ The secondary case was *S. Typhimurium* MLVA type 3-9-7-15-523.

Discussion

This investigation identified a point source *S. Typhimurium* PT 170/108 outbreak resulting from consumption of contaminated food from a kebab takeaway shop. A case series study identified 45 outbreak cases including 31 laboratory-confirmed cases of salmonellosis and 14 epidemiologically-linked (not tested) cases. One secondary case of salmonellosis was identified. Compelling laboratory evidence supported the initial suspicion, which arose from the notification of 2 complaints to the NSWFA, that the shop was the source of the cases' illness. The same infectious agent was found in specimens from outbreak cases and in environmental and food samples collected at the shop, in particular, hommus and tabouli that were consumed by 93% of cases.

This study highlights the importance of timely investigation and liaison between agencies to ensure prompt control of foodborne outbreaks. In this particular incident, the first notifications were received in the week that preceded the 12–14 June 2010 long

weekend; the PHU suspected that more people would be consuming food from the implicated shop over a long weekend than on an ordinary weekend. As the shop had been implicated in a relatively large *Salmonella* outbreak 3 years before, there were concerns about a repetition of an incident of similar scale. Close liaison between the PHU and NSWFA from the outset of the incident ensured a timely inspection was conducted, with a food preparation review and cleaning and sanitation undertaken by the implicated shop likely removing the source of infection. The effectiveness of these actions is supported by the observation that no cases reported an exposure after the initial inspection on 9 June.

The outbreak attack rate was estimated at less than 5% (over 1,000 kebabs were sold in the week to 9 June and the investigation identified 43 outbreak cases with exposure in the same period) and was surprisingly low. However, it is likely that the study identified only the cases with more severe illness while milder cases remained unreported. Despite the outbreak's low attack rate, the burden of illness was significant, with almost a fifth of cases being admitted to hospital and many others reporting taking time off work or study because of their illness.

Kebabs, which are a popular takeaway food in Australia, have been identified as potentially posing a food safety risk for consumers.⁵ The mechanisms by which this could occur are many and it is possible that their prevalence has changed over time. A survey of kebab businesses conducted by Food Safety Victoria in 2001 concluded that some of the food handling and meat kebab cooking practices observed could result in foodborne illness.⁶ Education of food industry workers following the survey and implementation of the survey recommendations, such as use of thinner cuts of meat and use of a secondary cooking step, are likely to have had a positive effect on practice and to have prevented potential outbreaks. More recently, poor refrigeration and non-effective sanitation practices and cross-contamination issues between raw and prepared foods were identified as issues of concern by a food safety survey of retail doner kebabs conducted by the NSWFA in 2004.⁷

Salmonellosis resulting from cross-contamination of ready-to-eat foods has been reported in the literature.⁸ Cross-contamination is the most likely explanation for the outbreak being reported here, where hommus and tabouli were found to be positive for *S. Typhimurium* with the same MLVA types as found in the outbreak cases. *Salmonella* is a common contaminant of chicken meat⁹ and it is possible that the hommus and tabouli were cross-contaminated. Uncooked chicken meat samples obtained at the shop on 9 June 2010 tested positive for *Salmonella* *Infantis* but not for *S. Typhimurium* and no pathogens were identified in cooked chicken

meat sampled as part of this investigation. However, it is possible that chicken meat contaminated with *S. Typhimurium* was present at the shop prior to 9 June 2010 and, as a result of cross-contamination was transferred, possibly by spraying of raw meat juices, to surfaces and equipment and via these to the hommus and tabouli.

The outbreak reported here is unusual in that it was the 2nd *S. Typhimurium* outbreak at the same shop in a period of just over 3 years. The April 2007 outbreak, due to *S. Typhimurium* PT U302, was also suspected to have resulted from cross-contamination of ready-to-eat foods from raw meats. At that time the NSWFA provided guidance to the same proprietor who adopted the recommended steps to minimise the risk of an outbreak occurring again. It is likely that the standards of practice at the shop deteriorated since then, even though this was not evident at the time of the inspection on 9 June 2010. No prosecution action was taken in 2007, however, following the 2010 outbreak the proprietor of the shop was prosecuted, convicted of breaches of the relevant legislation and fined accordingly.¹⁰

Further education of commercial food handlers to improve food handling practice and reduction of poultry meat contamination would help reduce the risk to consumers. The recent introduction in New South Wales of food laws, which require retail businesses handling potentially hazardous foods to appoint a Food Safety Supervisor,¹¹ are welcome. Furthermore, the Primary Production and Processing Standard for Poultry Meat, which becomes enforceable in May 2012, will introduce new requirements for the poultry industry, with a view to reducing contamination of poultry meat with *Salmonella* and other pathogens.¹²

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References

1. Hall G, Kirk M. *Foodborne illness in Australia: Annual incidence circa 2000*. Australian Government Department of Health and Ageing: Canberra, Australia; 2005.
2. OzFoodNet Working Group. Monitoring the incidence and causes of diseases potentially transmitted by food in Australia: Annual report of the OzFoodNet Network, 2009. *Commun Dis Intell* 2010;34(4):396–426.
3. OzFoodNet Working Group. OzFoodNet quarterly report, 1 April to 30 June 2010. *Commun Dis Intell* 2010;34(3):345–354.
4. Gilbert GL. Using MLVA to type strains of *Salmonella* Typhimurium in New South Wales. *N S W Public Health Bull* 2008;19(1–2):29–31.
5. NSW Food Authority. Doner kebabs. Accessed on 28 November 2011. Available from: http://www.foodauthority.nsw.gov.au/_Documents/industry_pdf/doner-kebabs.pdf
6. Food Standards Australia New Zealand. *ANZ Food Surveillance Newsletter. Winter 2002. Kebabs and food safety*. Accessed on 2 March 2011. Available from: <http://www.foodstandards.gov.au/scienceandeducation/monitoringandsurveillance/foodsurveillancenewsletter/winter2002.cfm>
7. Jansson E, Bird P, Saputra T, Arnold G. Food safety survey of retail doner kebabs in NSW. *Food Australia* 2008;60(3):95–98.
8. Moffatt CR, Combs BG, Mwanri L, Holland R, Delroy B, Cameron S, et al. An outbreak of *Salmonella* Typhimurium phage type 64 gastroenteritis linked to catered luncheons in Adelaide, South Australia, June 2005. *Commun Dis Intell* 2006;30(4):443–448.
9. Food Standards Australia New Zealand. *Raw chicken meat microbiological survey—summary of results*. Accessed on 2 March 2011 Available from: <http://www.foodstandards.gov.au/scienceandeducation/factsheets/factsheets2010/rawchickenmeatmicrob4764.cfm>
10. NSW Food Authority. Registry of offences (prosecutions). Accessed on 28 November 2011. Available from: <http://www.foodauthority.nsw.gov.au/news/offences/prosecutions/>
11. NSW Food Authority. Guideline to Food Safety Supervisor Requirements. Accessed on 28 November 2011. Available from: http://www.foodauthority.nsw.gov.au/_Documents/industry_pdf/fss_guidelines.pdf
12. Food Standards Australia New Zealand. *Primary Production and Processing Standard for Poultry Meat*. 2010. Accessed 3 March 2011. Available from: <http://www.foodstandards.gov.au/foodstandards/primaryproductionprocessingstandardsaustraliaonly/poultrystandards.cfm>