

An international outbreak of *Salmonella enteritidis* associated with lasagne; lessons on the need for cross-national co-operation in investigating food-borne outbreaks

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SUMMARY

We investigated an outbreak of *Salmonella enteritidis* involving at least 19 British tourists returning from one hotel in another European country. A retrospective cohort study of 47 hotel guests identified lasagne as the most likely vehicle of transmission (RR 11.5; 95% CI 3.0–44.1; $P < 0.0001$). However, difficulties in information exchange and lack of formal mechanisms to agree on the aims of the cross-national investigation hampered efficient management of the outbreak. The factors leading to contamination of the food vehicle were not identified and therefore specific action to prevent reoccurrence could not be taken. There is need to develop protocols for cross-national investigations of outbreaks in Europe which should include specifying objectives, roles and responsibilities of investigators and control agencies, with formal reporting of the outcome of the investigation.

INTRODUCTION

Because of increased movement of people and foods across boundaries, food-borne outbreaks can no longer be regarded as merely local events [1]. In recent years, there have been numerous examples of international food borne outbreaks due to shigella [2], cholera [3], *Escherichia coli* O157 [4], cyclospora [5] and salmonella [6]. This emerging trend in the epidemiology of food-borne infections has increased the need for cooperation between national and international organizations and agencies working with disease surveillance. In response a European Surveillance network for salmonella infections, Salm-Net was established in 1994 [7]. It was later expanded to include other intestinal pathogens, renamed Enter-Net and there have been notable successes [4, 8, 9]. However, there is a need to move on from cooperation on surveillance to the next step of collaborative investigation and control of outbreaks as illustrated in

this report of an outbreak of *Salmonella enteritidis* among British tourists returning from an international holiday.

Infection with *Salmonella enteritidis* is an increasing public health problem throughout Europe [10]. On 13 September 1996, the Communicable Disease Surveillance Centre (CDSC), Wales, was notified by the Consultant in Communicable Disease Control, Gwent Health Authority, of two cases of *Salmonella enteritidis* among a party of tourists. The party consisted of 11 men and 10 women, aged 47–76 years from various parts of the UK and the Republic of Ireland. They travelled by train from London on the 24 August to a European holiday resort, where they stayed at the same hotel until their return on 5 September. Information provided by the 2 cases indicated that other members of the party became ill with gastro-enteritis on the 27 and 28 August.

Responding to this information, CDSC (Wales) decided to undertake a cohort study of guests staying at the hotel on the 25 and 26 August 1996. The

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objective of the investigation was to identify the source of the outbreak to prevent further spread and future reoccurrence.

METHODS

Face-to-face interviews were undertaken with the 2 notified cases on 16 September and then subsequently by telephone with a further 8 members of the party. The national Salm-Net collaborator was informed by telephone and fax on the 17 September and asked for assistance in identifying cases of salmonella which may have been connected with the hotel. The collaborator was also asked for a guest list from the hotel, menus for 25 and 26 August and the results of any tests taken by the local doctor. Because of lack of initial reply, additional contact was made in writing on 27 September, 21 October and 14 November asking for assistance, in particular relating to case finding and local environmental investigation.

All interviewed persons were asked for names of other people attending the hotel at the same time and by this method a second party travelling with another travel agency was identified. A complete list of all hotel guests was requested from both travel companies.

Reference laboratories (Laboratory of Enteric Pathogens, Colindale, London; Salmonella Reference Laboratory, Glasgow) were contacted to confirm serotyping and phage typing results of known cases and were asked to report all salmonella cases of the same type with a history of travel to the country in which the outbreak occurred. A message was sent out by EpiNet [11] to all Consultants in Communicable Disease Control and the PHLS laboratories in England and Wales asking for cases of salmonella with related travel history in August to be identified to CDSC. The Salm-Net co-ordinator was asked to relay a message to all European participants in Salm-Net for any cases of the same type of salmonella with a related history of travel to be reported to him.

A cohort study comprising people known to have stayed at the hotel 25 and 26 August was undertaken using a structured questionnaire including history of any illness and record of food consumption from 48 h before the onset of symptoms in the first case. The data from the first party was collected by telephone. A preliminary report based on these interviews was sent to the National Salm-Net collaborator on 21 October. Members of the second party were sent postal

questionnaires through the travel company as names were not released.

A case was defined as anyone staying at the hotel on the 25 or 26 August 1996 with either a faeces specimen positive for salmonella or diarrhoea (more than three loose stools in 24 h) and one of the following symptoms; fever, vomiting, abdominal pain after 25 August.

RESULTS

The overall response-rate was 81%; 19 out of 21 in the first party and 32 out of 42 in the second party completed questionnaires. Two of the returned postal questionnaires were excluded from analysis because the information given was not coherent and 2 were excluded because their food history was not consistent with the menus offered. No positive reports on additional cases with possible association with the outbreak were received via EpiNet or Salm-Net. Negative replies were received from Spain, Germany, Belgium and Denmark via Salm-Net and the remaining eight participants of Salm-Net did not reply, including the country in which the outbreak occurred.

Forty-seven persons were included in the cohort study; 20 men and 27 women. Nineteen persons fulfilled the case definition, 10 men and 9 women. Four of the cases occurred in 2 families. The onset of symptoms in the first case was at 11 pm on 26 August. Fourteen of the cases had onsets of illness on 27 August (Fig. 1).

Of the 19 cases, 11 submitted stool samples after the return. Of the 9 positive stool samples, 8 were identified as *S. enteritidis* phage type 'untypable', resistant to tetracycline. One was identified as *S. enteritidis* at the local laboratory but because of contamination of the sample received by the reference laboratory no further analysis was possible.

The first common exposure to food for the whole cohort was the evening meal served at the hotel on the evening of 25 August. Chicken or fish was served as main course; gâteau or ice-cream as desert.

Of the 23 people who ate the gâteau, 13 fulfilled the case definition, (attack rate 57%) whereas only 2 out of the 16 people who did not eat the gâteau became cases (relative risk = 4.5; 95% CI = 1.2–17.4; $P = 0.01$). Eight of the postal questionnaires, including four cases, did not include any information on exposure to gâteau.

On 16 August, lasagne or mixed salad was served as first course at the hotel. Of the 27 people responding

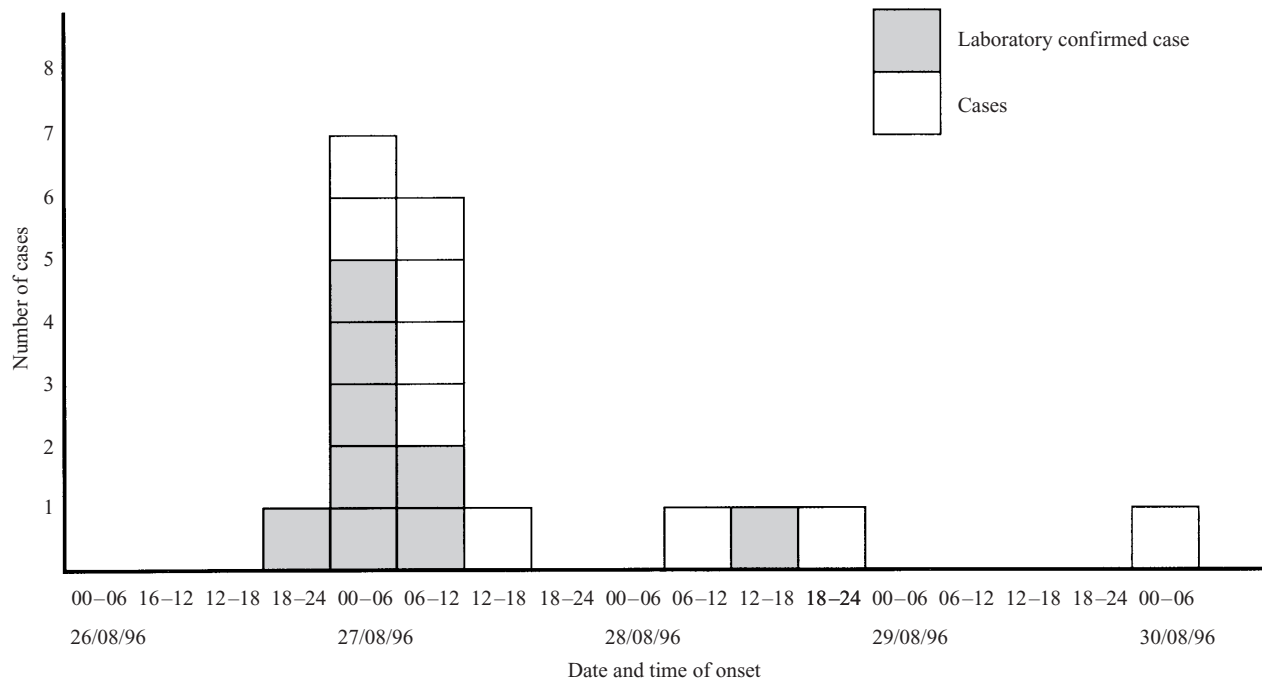


Fig. 1. Cases of gastroenteritis by date and time of onset among a group of British tourists (n = 7), 1996.

Table 1. Stratified analysis; exposure to gateau among British tourists eating and not eating lasagne, 1996

Food	Ill	Well	Total	RR*
Table A: All ate lasagne				
Gateau				
Ate	11	1	12	1.4
Did not eat	2	1	3	(95% CI: 0.6-3.1)
Unknown	4	1	5	
Table B: None ate lasagne				
Gateau				
Ate	2	9	11	
Did not eat	0	13	13	Not defined
Unknown	0	3	3	

* Summary RR: 2.0 (95% CI 0.8-5.1).

that they did not eat lasagne, 2 became cases. Twenty people ate the lasagne and 17 of these became cases (attack rate 85%; relative risk = 11.5; 95% CI = 3.0-44.1; P < 0.0001). Of the 15 people who ate the mixed salad, no one subsequently became a case. The attributable risk for lasagne was 82%.

No other food or drink eaten 25 or 26 August was associated with becoming a case. A stratified analysis was conducted to investigate the respective role of gateau and lasagne in the risk of developing illness. When adjusted for eating lasagne, the relative risk among those eating gateau of becoming a case was 2.05, but with the 95% CI ranging from 0.83 to 5.0

(Table 1). When adjusted for eating gateau, the summary relative risk for eating lasagne and being a case remained significant at 6.6 (95% CI 2.0-21.4) (Table 2).

On 18 December, information was received from the local investigation through the Salm-net collaborator at national level. The hotel had a total of 64 guests staying between 25 and 26 August, including a third party of nine persons of unknown nationality, which we were not aware of at the time of investigation. Five samples from guests were taken locally, all negative for salmonella and shigella. No environmental samples were taken. The lasagne was

Table 2. *Stratified analysis; exposure to lasagne among British tourists eating and not eating gâteau, 1996*

Food	Ill	Well	Total	RR*
Table A: All ate gâteau				
Lasagne				
Ate	11	1	12	5.0
Did not eat	2	9	11	(95 CI: 1.4–17.9)
Unknown	0	0	0	
Table B: None ate gâteau				
Lasagne				
Ate	2	1	3	
Did not eat	0	13	13	Not defined
Unknown	0	0	0	

* Summary RR: 6.6 (95% CI: 2.0–21.4).

suspected to be the vehicle of transmission by the local authorities because it was made with fresh egg pasta. Layers of pasta were boiled and filled with layers of meatballs, mozzarella, hard-boiled eggs, tomatoes, top covered with béchamel sauce made of milk, butter and flour and cooked in the oven.

DISCUSSION

Based on information from two British tourists returning from another European country, we decided to investigate an outbreak of salmonella food poisoning among guests staying at the hotel. Our objective of the investigation was to assist local investigators by identifying the vehicle so that they could identify the causes of the outbreak and prevent future re-occurrence.

We asked the home authorities as well as national and international surveillance institutes for assistance in case finding. We were unable to identify the total number of guests at the hotel at the time of the investigation. No positive reports on additional cases with possible association with the outbreak were received via Epinet or Salm-Net. Negative replies via Salm-net were only received from four countries. It is therefore possible that the total number of affected people exceeded the 19 included in the study. However, submitting questionnaires through the travel companies proved successful with an 81% response rate, and we achieved sufficient power to implicate lasagne as the main vehicle of infection.

Identification of the food vehicle is a major step; identifying the food sources and factors to do with food preparation and storage in a local outbreak is

relatively easy. However, when acting across national borders the lack of clear protocols for field investigation is a major deficiency. In this outbreak, we know from information provided on 17 December that the lasagne made with fresh egg pasta was suspected to be the vehicle of infection by the local authorities at an early stage in the investigation. Since there was no lasagne left for sampling, no microbiological evidence was obtained. However, the epidemiological evidence provided by the retrospective cohort study was sufficient to warrant further review of ingredients and preparation of the lasagne.

International food-borne outbreaks like the North American outbreak of cyclosporiasis associated with imported raspberries [5] have illustrate the need to consider that a local cluster of food-borne illness may be part of a widespread outbreak and to pursue investigation of the source of the implicated vehicle. The possibility of eggs as the source of infection [10] could have led to efforts to tracing the eggs back to the farm of origin. Finding the same strain in cultures from the eggs or the animals would have provided further evidence of the source of the outbreak and support for control strategies, such as use of pasteurized liquid eggs. However, investigators in a different country will have insufficient awareness of the cultural and political context in which such control strategies would need to be implemented.

Field investigations to identify the vehicle of infection in an outbreak which is not clearly linked to the local investigation of causal factors is of limited value and may seem futile. We believe there is an urgent need at the European level to develop protocols for cross-national outbreaks. Common aims need to be agreed upon before the timely launch of an

investigation and the roles and responsibilities of the investigators clearly identified. However, there is presently no structure or mechanism within Europe to facilitate such an agreement. The establishment of informal networks through initiatives such as the European Programme for Intervention Epidemiology Training [12] may well contribute in this process but central co-ordination of reports of the process and outcome of field investigation could be important.

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