EPI*REVIEW*

COMMUNICABLE ENTERIC DISEASE SURVEILLANCE, NSW, 2000–2002

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This article describes a review of communicable enteric disease surveillance, hospitalisation, and outbreak data, for NSW during the period 2000–2002.

BACKGROUND

Communicable enteric disease (CED), and in particular foodborne disease (FBD), is a major cause of illness in Australia.[1] For the purpose of this article, the term CED encompasses both diarrhoeal and foodborne diseases, which includes illness caused by toxins.

It is estimated that FBD costs the Australian community over $2.6 billion each year.[2] The incidence of FBD in Australia is increasing.[3] Salmonella infection notification rates almost doubled in NSW from 1992 (14 per 100,000) to 1998 (30 per 100,000); however, they declined slightly in 2001 (27 per 100,000).[4]

There are many factors that can influence the incidence of FBD such as: changes in the pattern of food consumption; changes in consumer demand for food; and changes in the method of manufacture, distribution, storage, and selling of food. In addition, the proportion of the Australian population susceptible to CED is increasing, as the elderly are more vulnerable.[3]

Surveillance is key to understanding the epidemiology of CED, estimating its burden on the community, controlling risks, and identifying emerging pathogens. Essential to CED surveillance is clinician and laboratory reporting, analysis, and outbreak investigation.[3]

METHODS

Surveillance

The NSW Department of Health maintains a Notifiable Diseases Database (NDD) that houses data describing communicable diseases notifiable under the *NSW Public Health Act 1991*. The CEDs included in this review were salmonellosis, listeriosis, typhoid, paratyphoid, shigellosis, hepatitis A, haemolytic uraemic syndrome (HUS), and verotoxin producing *E. coli* infections (VTEC). We reviewed notification data for CEDs for the period 2000–2002, including demographic information about cases where available. Area health services were classified as urban or rural according to the NSW Health classification.[5] Notification rates per 100,000 population were calculated using population estimates from Australian Bureau of Statistics (ABS) population data, accessed via the Health Outcomes Information and Statistical Toolkit (HOIST), a data warehouse operated by the Centre for Epidemiology and Research, NSW Department of Health, as at 30 June for each calendar year during the study period.

Hospitalisations due to CEDs were determined using the NSW Inpatients Statistic Collection (ISC) databases and the 10th Revision of the International Classification of Diseases, Australian Modification (ICD-10-AM) codes for principal diagnosis. Data was available for the period January 2000 to June 2002. Analysis was based on admission date.

Outbreaks

All NSW public health units were asked to complete an OzFoodNet outbreak reporting form for all outbreaks of CED identified for the period 2000–2002. All other reports of such outbreaks received by NSW Health for the study period were also included.

We defined institutional settings as: aged care facilities, hospitals, schools, childcare facilities, military institutions, correctional centres, organised camps, and institutional settings not otherwise specified. Non-institutional settings were defined as: restaurants, take-away outlets, fast food franchises, commercial caterers, cruise ships and airlines, grocery stores or delicatessens, fairs and festivals and other temporary–mobile services, picnics, and private residences.

A FBD outbreak was defined as a CED outbreak where two or more people experienced a similar illness after consuming a common food or meal and:

- epidemiological analyses and/or microbiological analyses implicated a food or meal as the source of illness (foodborne);
- a specific food or meal was suspected, but person-to-person transmission could not be ruled out (suspected foodborne).

Surveillance data were accessed through HOIST and were extracted and analysed in February–March 2003 using SAS version 8.[6] The outbreak data were analysed with Microsoft Access 2000 and Microsoft Excel 2000.

RESULTS

Surveillance

The notification rate of CEDs over the three-year period increased from 37.6 per 100,000 population in 2000 (*n*=2431) to 65.6 per 100,000 population in 2002 (*n*=4316).

Over the three-year period, salmonellosis was the most frequently notified CED (Table 1), with notification rates increasing from 20.6 per 100,000 population in 2000 (*n*=1,334) to 32.7 per 100,000 population in 2002 (*n*=2,153). The highest rate of salmonellosis occurred in children less than five years of age and the rate decreased steadily with increasing age. The rate was higher in rural areas than in metropolitan areas. The most frequently reported salmonella serovar during 2000–2002 was *Salmonella* Typhimurium phage type 9, which accounted for 10.3 per cent of all salmonella infections.

The rates of hepatitis A and shigellosis were highest in males, in urban area health service populations and in the 20–39 year old age group. The highest rates of typhoid were noted in urban areas and in the 5–9 and 20–39 year old age groups. The demographics of paratyphoid cases were similar, with the highest rates in the urban areas and in the 20–39 year old age group. Rates of listeriosis were highest in the elderly, in males, and in urban areas. Rates of HUS and VTEC were highest in children in the 0–4 year old age group. The rate of VTEC was higher in females than males and in urban areas. VTEC infections were identified in six of the eighteen cases of HUS.

There were 994 hospitalisations during the 30-month period, January 2000 to June 2002, for which the principal diagnosis was a CED (Table 2). The majority were due to salmonellosis (68 per cent), with the next most common hepatitis A (12 per cent). The median length of stay for patients hospitalised with CEDs ranged from three days (salmonellosis) to 17 days (listeriosis).

Outbreaks

All NSW public health units provided outbreak summary data for the period 2000–2002. There were 308 CED outbreaks reported, of which 191 (62 per cent) occurred in institutional settings, 111 (36 per cent) occurred in non-institutional settings, and six (two per cent) were community-wide. These outbreaks resulted in 6,247 individual cases of illness, 240 hospitalisations, and no deaths. For the majority of CED outbreaks (*n*=235; 76 per cent), a cause was not identified. The most commonly identified causes were enteric virus infection (*n*=45; 15 per cent) and salmonella infection (*n*=19; six per cent). Other causes include infection with campylobacter (*n*=2; one per cent), hepatitis A (*n*=1; 0.3 per cent), ciguatera poisoning (*n*=1; 0.3 per cent), giardia (*n*=2; one per cent), and *Clostridium perfringens* (*n*=3; one per cent).

Setting

Outbreaks in institutional settings

The 191 CED outbreaks in institutional settings included 4,710 individual cases of gastrointestinal illness. Among the institutional outbreaks, the most common settings were

TABLE 1

COMMUNICABLE ENTERIC DISEASE NOTIFICATIONS AND CRUDE RATE PER 100,000 POPULATION, NSW, JANUARY 2000 TO DECEMBER 2002

	Salmonellosis		Hepatitis A		Shigellosis**		Typhoid		Paratyphoid		Listeriosis		HUS***		VTEC***	
	n	r	*n*	r	*n*	r	*n*	r	*n*	r	*n*	r	*n*	r	*n*	r
Gender																
Male	2590	26.6	377	3.9	144	2.2	40	0.41	18	0.19	24	0.25	10	0.10	1	0.01
Female	2544	25.8	168	1.7	69	1.0	40	0.41	18	0.18	17	0.17	8	0.08	5	0.05
Age (Years)																
0–4	1554	110.0	15	0.7	16	1.5	6	0.24	2	0.16	1	0.07	5	0.31	2	0.16
5–9	481	30.8	31	1.9	7	0.7	13	0.75	2	0.07	0	0.00	2	0.15	0	0.00
10–19	643	20.8	57	1.8	12	0.7	14	0.41	4	0.11	0	0.00	3	0.07	2	0.07
20–39	1286	21.5	285	4.7	104	2.6	35	0.61	22	0.36	1	0.02	1	0.02	1	0.02
40–59	712	13.2	115	2.2	61	1.7	11	0.21	6	0.12	2	0.04	4	0.08	1	0.02
60+	479	14.3	43	1.3	15	0.7	2	0.06	0	0.00	37	1.10	3	0.09	1	0.03
Area Health Service																
Urban	3641	24.0	479	3.2	196	1.9	79	0.52	35	0.23	36	0.24	14	0.09	6	0.04
Rural	1509	34.4	65	1.5	19	0.6	1	0.02	1	0.02	5	0.11	4	0.09	1	0.02
Total	**5155**	**26.4**	**546**	**2.8**	**215**	**1.6**	**81**	**0.41**	**36**	**0.18**	**41**	**0.21**	**18**	**0.09**	**7**	**0.04**

Note: Totals for each condition may differ within groupings due to missing demographic values

r = average annual crude rate per 100,000 population

** for 2001 and 2002 only

*** HUS = haemolytic uraemic syndrome; VTEC = verotoxin producing *E. coli* infections.

Source: Communicable Diseases Branch, NSW Department of Health.

TABLE 2

CASES OF COMMUNICABLE ENTERIC DISEASE, HOSPITALISATIONS AND NOTIFICATIONS, NSW, JANUARY 2000 TO JUNE 2002

Condition	Hospitalisations *n*	Notifications *n*	Average annual rate of hospitalisation per 1000 notifications	Median age of patients hospitalised (years)	Median length of stay (days)
Salmonellosis	677	4299	62.99	17	3
Hepatitis A	123	486	101.23	33	3
Shigellosis[a]	59	170	231.37	32	3
Typhoid	56	73	306.85	22	6
Paratyphoid	15	29	206.90	28	5
Listeriosis	22	34	258.82	74	17
HUS *	40	15[b]	1066.67	10	5
VTEC *	2	5	160.0	45	6
Total *	**994**	**5111**	**77.79**	**-**	**-**

[a] Shigellosis only notifiable since 2001 in NSW

[b] the number of HUS notifications are underestimated.

* HUS = haemolytic uraemic syndrome; VTEC = verotoxin producing *E. coli* infections.

Source: Communicable Diseases Branch, NSW Department of Health.

aged care facilities (*n*=92; 48 per cent), childcare facilities (*n*=49; 26 per cent), and hospitals (*n*=34; 18 per cent), followed by schools (*n*=4; two per cent), organised camps (*n*=4; two per cent), military institutions (*n*=1; 0.5 per cent), correctional centres (*n*=1; 0.5 per cent), and institutions not otherwise specified (*n*=6; three per cent).

For the majority of CED outbreaks in institutional settings, person-to-person spread was identified as the most likely means of transmission (*n*=178; 93 per cent). Two (one per cent) of the outbreaks in institutional settings were of suspected foodborne transmission and one outbreak (0.5 per cent) was of suspected waterborne transmission. The mode of transmission was not known in 10 (five per cent) of these institutional outbreaks. In 45 (24 per cent) of the outbreaks, a viral cause was confirmed by laboratory tests of stool samples of those ill (Table 3).

TABLE 3

COMMUNICABLE ENTERIC DISEASE OUTBREAKS IN NSW: JANUARY 2000 TO DECEMBER 2002

Cause	Outbreaks		Cases		Hospitalised	
	n	%	*n*	%	*n*	% of cases
Viral	46	14.9	1140	18.2	58	5.1
Enteric viruses*	45	14.6	1132	18.1	58	5.1
Hepatitis A	1	0.3	8	0.1	0	0
Bacterial	24	7.8	897	14.4	58	6.5
Salmonella	19	6.2	746	11.9	58	7.8
Campylobacter	2	0.6	6	0.1	0	0
Clostridium perfringens	3	1.0	145	2.3	0	0
Protozoan	2	0.6	23	0.4	0	0
Giardia	2	0.6	23	0.4	0	0
Chemical	1	0.3	7	0.1	6	85.7
Ciguatera	1	0.3	7	0.1	6	85.7
Confirmed cause	73	23.7	2067	33.1	122	5.9
Unknown cause	235	76.3	4180	66.9	118	2.8
Total	**308**	**100**	**6247**	**100**	**240**	**3.8**

*Norwalk-like virus, rotavirus, small round-structured virus

Source: Communicable Diseases Branch, NSW Department of Health.

Outbreaks in non-institutional settings

The 111 CED outbreaks that occurred in non-institutional settings included 1,277 individual cases of gastrointestinal illness. The most common settings were restaurants (*n*=54; 49 per cent) and take-away outlets (*n*=25; 23 per cent), followed by private residences (*n*=8; seven per cent), commercial caterers (*n*=7; six per cent), fast food franchises (*n*=6; five per cent), and grocery stores or delicatessens (*n*=6; five per cent). The mode of transmission was confirmed foodborne in 18 (16 per cent), suspected foodborne in 52 (47 per cent), and suspected waterborne in one (one per cent) of these outbreaks. For all others, the mode of transmission was either unknown (*n*=37; 33 per cent) or suspected person-to-person transmission (*n*=3; three per cent).

Community-wide outbreaks

There were six community-wide CED outbreaks during the study period, which accounted for 260 individual cases of gastrointestinal illness. Four of these outbreaks were investigations conducted as a result of a temporal increase in particular *Salmonella* serovars in the community. The agents responsible for these were *S.* Typhimurium PT 9, *S.* Bovismorbificans PT24, *S.* Potsdam, and *S.* Ohio. The mode of transmission was suspected as foodborne for three of the four salmonella outbreaks. Norovirus was identified as the cause for one community-wide outbreak. The cause was not identified for the other community-wide outbreak.

Mode of transmission

Of the 308 CED outbreaks reported during the study period there were 74 (24 per cent) outbreaks in which the mode of transmission was classified as foodborne. The remainder were classified as suspected person-to-person (*n*=183; 59 per cent), suspected waterborne (*n*=2; one per cent), or unknown (*n*=50; 16 per cent).

Foodborne disease outbreaks

Of the 74 FBD outbreaks 24 (32 per cent) were classified as confirmed FBD outbreaks in which the food vehicle was identified and implicated by epidemiological and/or microbiological evidence (Table 4). The remaining 50 (68 per cent) FBD outbreaks were suspected foodborne transmission with varying degrees of evidence. There was no formal study undertaken for 33 (45 per cent) of the FBD outbreaks. A case series investigation was the most common method of investigation (*n*=16; 22 per cent), followed by a cohort study (*n*=15; 20 per cent), and a case control study (*n*=10; 14 per cent).

There were a large proportion of FBD outbreaks in which the cause was unknown (*n*=52; 71 per cent). The most common cause of all FBD outbreaks with a known pathogen was *Salmonella* (*n*=17; 23 per cent), the most common serovar *S.* Typhimurium (*n*=11), and the most common phage type STM 9 (*n*=5). Other aetiological agents include hepatitis A (*n*=1; one per cent), ciguatera poisoning (*n*=1; one per cent), and *Clostridium perfringens* (*n*=3; four per cent).

The most common settings for FBD outbreaks were restaurants (*n*=25; 34 per cent) and takeaway food outlets–franchised fast food outlets (*n*=24; 32 per cent). The most commonly reported food vehicle responsible for FBD outbreaks was poultry (22 per cent). Together, meat and poultry were responsible for 41 per cent of all FBD outbreaks (Table 4).

TABLE 4

IMPLICATED FOOD VEHICLES IN FOODBORNE DISEASE OUTBREAKS, NSW, JANUARY 2000–DECEMBER 2002

Pathogen (number of outbreaks)	Food vehicles implicated and type of evidence *					
	Meat	Poultry	Seafood	Salad or vegetables	Multiple foods	Other–miscellaneous
	n	*n*	*n*	*n*	*n*	*n*
Salmonella spp. (17)	1 L	3 1S,1L,1N	0	1 N	4 1S,1C,2N	8 a
Ciguatera poisoning (1)	0	0	1 L	0	0	0
Clostridium perfringens (3)	3	0	0	0	0	0
Hepatitis A (1)	0	0	0	0	1 N	0
Unknown (52)	10 1S,6C,3N	13 1L,1S,6C,5N	7 1S,1L,2C,3N	0	10 6C,4N	12 b
Total (74)	**14**	**16**	**8**	**1**	**15**	**20**

* L = Laboratory evidence; S = Statistical evidence; C = compelling supportive information; N = no specific evidence.

[a] = deep-fried ice-cream[S,L] (two outbreaks); tahini[L] (one outbreak); caesar dressing[L] (one outbreak); peanuts[L] (one outbreak); cream-filled cake[S] (one outbreak); baked beans–chilli con carne[S] (one outbreak); mango mousse[S] (one outbreak).

[b] = pizza[C,N,S] (six outbreaks); fried rice[N] (two outbreaks); cake[S,N] (two outbreaks); pasta[S] (one outbreak); seafood sauce[N] (one outbreak).

Source: Communicable Diseases Branch, NSW Department of Health.

The major factors identified as contributing to the outbreaks were provided for 35 (47 per cent) of the 74 FBD outbreaks. More than one contributing factor was cited in many outbreaks. Of these 35 FBD outbreaks that identified contributing factors the most commonly cited was 'insufficient cooking' (*n*=16; 46 per cent) and 'inadequate refrigeration–foods left at warm–room temperature' (*n*=16, 46 per cent), followed by 'food handler contamination' (*n*=10; 29 per cent), 'cross contamination from raw ingredients' (*n*=10; 29 per cent), 'toxic substance or part of tissue' (*n*=10; 29 per cent). Other contributing factors identified were 'inadequate hot holding temperature–delay between preparation and consumption–slow cooling' (*n*=8; 23 per cent), 'ingestion of contaminated raw products' (*n*=4; 11 per cent) and 'contaminated equipment–environment–inadequate cleaning of equipment' (*n*=4; 11 per cent).

The level of evidence varied for the factors contributing to contamination from 'assumed or suspected' to 'confirmed with measured evidence'. Of those outbreaks that cited contributing factors, only 18 (51 per cent) were confirmed with evidence, with the highest level of evidence cited as only 'assumed or suspected' in 17 (49 per cent).

DISCUSSION

This study demonstrates that there is a substantial burden of illness associated with CED in NSW. For all CED outbreaks, the most common causes were viruses and the most common settings were institutional, particularly aged care facilities, in which the mode of transmission was mostly person-to-person. For FBD outbreaks with a known pathogen, the most commonly identified cause was *Salmonella*, which is consistent with Australian and international findings.[7–9] The most common setting in which foods were prepared were restaurants and takeaways and the most commonly implicated food vehicle was poultry. Insufficient cooking, inadequate refrigeration, cross contamination from raw ingredients, and food handler contamination, were common factors associated with FBD outbreaks during this period.

There are several limitations to the surveillance and outbreak data. First, surveillance data are likely to substantially under-represent the number of people with CEDs in NSW, as many people with gastroenteritis may not present to a medical practitioner.[9] The proportion of those that do present and then have a stool sample taken is also unknown, but is likely to be small. Second, the outbreak data may be incomplete because many outbreaks, especially if small and self-limited, may not be reported to public health units.[10] Third, the detail provided on outbreaks in this review may be deficient, as many of the outbreak summary forms were incomplete due to the retrospective nature of the survey. Fourth, for the majority of outbreaks, the cause and factors contributing to FBD outbreaks were unknown, and there was a lack of epidemiological and/or microbiological evidence to confirm food vehicles and contributing factors. Finally, regulated health care settings, such as nursing homes and hospitals, may be more likely to report outbreaks than other settings because of the training of staff and their close contact with public health personnel, and because such settings often include long-term residents who are closely observed.

The results of this study are largely consistent with those reported for the whole of Australia during the same period, in particular the age distribution of cases within specific conditions.[7] In NSW, the rates of salmonellosis, shigellosis, listeriosis, and VTEC were lower, and rates of typhoid and HUS were slightly higher, than rates reported for Australia. The majority of typhoid and paratyphoid cases in Australia have acquired their condition overseas.[7] Many of these cases living in Sydney may be born overseas and have acquired the infection on return to their country of birth.[11] The higher rate of hepatitis A and shigellosis among males aged 20–39 years is believed to be largely due to a proportion of cases being men who have sex with men, who are at greater risk of contracting these conditions.[12,13] The noticeably higher salmonellosis rates in rural area health services compared to urban area health services remains unexplained.

The large proportion of institutional outbreaks that were transmitted from person-to-person suggests the need to strengthen infection control strategies in institutions. To help prevent and control outbreaks, it has been recommended that aged-care facilities have infection control guidelines and outbreak management plans in place.[14] These results also indicate food handler contamination is a major contributing factor towards FBD outbreaks, suggesting a need to better educate food handlers on the transmission of FBD and safe food practices.

There was a large amount of missing data. The quality of data obtained on FBD outbreak summary forms would improve if they were completed, by the person responsible for the investigation, within one month of the conclusion of the outbreak. Simplifying the existing data collection form may improve the completeness of data obtained from the public health unit.

Given the cost of CED to the community, and the apparent increasing incidence of FBD, ongoing surveillance and monitoring of FBD in NSW is essential. The information obtained from these outbreak investigations will assist with the identification of the underlying causes of future outbreaks and the development of systems for prevention and control.

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