Salmonella in Ireland, 2005

Key Points

- **In 2005, the incidence rate of human salmonellosis decreased (8.9/10^5) compared to 2004 (10.6/10^5) from analysis of the clinical notification data**
- **The highest incidence rate was observed in children under 5 years of age**
- **After *S.* Enteritidis (n=145) and *S.* Typhimurium (n=85), the next most common serotypes were *S.* Agona (n=10), and *S.* Virchow (n=9)**
- **21% of cases were reported to be associated with travel outside of Ireland in 2005**

Introduction

Salmonellosis is one of the most common zoonotic diseases in humans in Ireland and worldwide. At present, over 2,460 serotypes of *Salmonella* have been identified. Two serotypes, however, *S. enterica* serotype Enteritidis and *S. enterica* serotype Typhimurium have accounted for the majority of cases of human salmonellosis in recent years.

Salmonellosis presents clinically as an acute enterocolitis, with sudden onset of headache, abdominal pain, diarrhoea, nausea and occasionally vomiting. Fever is almost always present. Dehydration, especially amongst vulnerable populations such as infants, the immunocompromised and the elderly, may be severe. *S.* Typhi and *S.* Paratyphi can cause enteric fever, a severe systemic life threatening condition, but this is very rare in Ireland and mainly travel-associated.

Salmonella is a zoonoses and a wide range of domestic and wild animals, as well as humans can act as the reservoir for this pathogen. Prevention, surveillance and control of *Salmonella* infections is of major public health importance.

Methods

The National Salmonella Reference Laboratory (NSRL) was established in 2000 in the Department of Medical Microbiology, University College Hospital, Galway. This laboratory accepts *S. enterica* isolates from all clinical and food laboratories for serotyping, phage typing and antimicrobial sensitivity testing.

This report reviews data available from the National Salmonella Reference Laboratory (NSRL) and weekly events of

Table 1. Analysis of clinical isolates of S. enterica (n=357) referred to NSRL, (2005) by age-group and gender.

Age group (years)	No. of isolates (%)	Male	Female	Unknown
0-4	75 (21)	28	37	10
5-9	19 (5)	10	7	2
10-14	22 (6)	9	13	0
15-19	18 (5)	7	9	2
20-24	29 (8)	16	13	0
25-34	59 (17)	16	40	3
35-44	35 (10)	19	14	2
45-54	31 (9)	20	10	1
55-64	23 (6)	9	13	1
65+	37 (10)	20	17	0
Unknown	9 (3)	6	3	0
Total	357	160	176	21

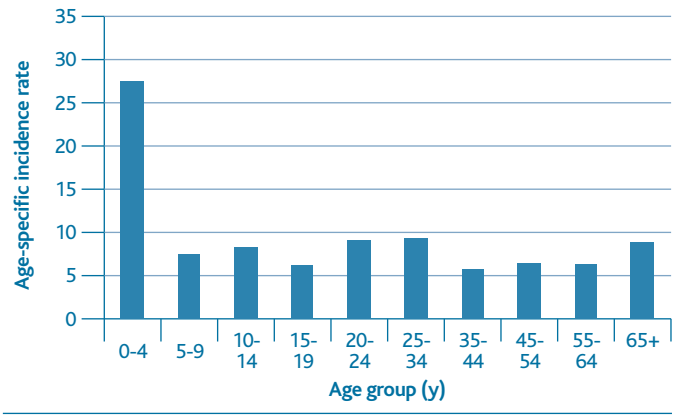

Figure 1. Age-specific incidence rate of human salmonellosis in Ireland, 2005.

salmonellosis extracted from the CIDR system for the year 2004. These data enable us to provide an overview of the epidemiology and burden of disease caused by *Salmonella* infections in Ireland today.

Results

Demographic information

There were 357 clinical isolates of *S. enterica* referred to NSRL in 2005. The male: female ratio was 0.9:1. The age groups and sex of those affected are shown in table 1. The highest number of cases was seen in children under five years of age. When age-specific incidence rates were calculated (Figure 1), the burden of illness in this age group was even more evident.

Seasonality

Analysis of the number of salmonellosis events notified to HPSC by week in 2005, revealed peaks in incidence from mid-August to early October. Seasonal peaks are typically seen each year at this time.

Serotyping, phage typing and antibiotic susceptibility results from NSRL

Serotyping

The breakdown of *Salmonella* serotypes by health board is shown in table 2. It should be noted however that for the NSRL data, health board location refers to the location of the clinical laboratory that the isolate was originally sent to, and may not always correspond with the geographic location of the case.

As has been the trend in recent years, the predominant serotype causing human illness in 2005 was *S.* Enteritidis (n=145), followed by *S.* Typhimurium (n=85). Table 3 shows the changing shift in the more common serotypes in the past number of years. In 2005, after *S.* Enteritidis and *S.* Typhimurium, the next most commonly isolated serotypes were *S.* Agona (n=10), *S.* Virchow (n=9), *S.* Hadar (n=8) and *S.* Dublin (n=5). There were 5 cases of S. Typhi detected in

Phage typing

The predominant phage types of *S.* Typhimurium and *S.* Enteritidis are summarised in Tables 4 and 5. The commonest phage type of *S.* Typhimurium reported in 2005 was DT104 (44%), followed by DT104b (15%). In previous years (1998-2003) PT4 was the predominant phage type of *S.* Enteritidis, but this trend changed in 2004 with PT1 replacing PT4 as the main phage type detected. This trend has continued in 2005 with PT1 accounting for 30% of the isolates. This is followed by PT14b (15%), PT8 (14%) and PT4 (13%).

Travel-association

75 out of 357 isolates (21%) reported to NSRL in 2005 were found to be associated with travel outside of Ireland. The most commonly reported countries were Spain (n=7), Nigeria (n=7), Thailand (n=6), Majorca (n=6) and Tunisia (n=5).

Antimicrobial resistance

The antimicrobial susceptibility patterns of the most commonly isolated serotypes in 2005 are presented in table 6. Analysis of the 2005 AMR data again demonstrated high levels of resistance among *S.* Typhimurium, particularly DT104 isolates.

Table 2. Serotypes of Salmonella enterica by health board, 2005.

Serotype	HSE-ER	HSE-M	HSE-MW	HSE-NE	HSE-NW	HSE-SE	HSE-S	HSE-W	Total
Agona	2	0	0	1	1	6	0	0	10
Anatum	3	0	1	0	0	0	0	0	4
Arechavaleta	2	0	0	0	0	0	0	0	2
Blockley	0	1	0	0	0	0	1	2	4
Braenderup	1	0	0	0	0	0	0	0	1
Bredeney	1	0	1	0	0	1	0	0	3
Bukavu	1	0	0	0	0	0	0	0	1
Concord	0	0	1	0	0	0	0	0	1
Corvallis	1	0	0	0	0	1	0	0	2
Cotham	0	0	0	0	0	0	0	1	1
Dublin	0	0	1	0	0	0	2	2	5
Enteritidis	55	8	8	11	11	15	27	10	145
Give	1	0	0	0	0	0	0	1	2
Goldcoast	1	0	1	2	1	0	0	2	7
Hadar	4	0	1	0	0	1	2	0	8
Indiana	1	0	0	1	0	0	0	0	2
Infantis	2	0	0	0	0	1	0	0	3
Isangi	0	0	0	0	0	1	0	0	1
Java	1	0	1	0	0	0	0	5	7
Javiana	1	0	0	0	1	0	0	0	2
Kedougou	0	0	0	0	0	1	0	0	1
Kentucky	1	1	0	1	0	0	0	1	4
Limete	1	0	0	0	0	0	0	0	1
Livingstone	1	0	0	0	0	0	0	0	1
Mikawasima	0	1	0	0	0	0	0	0	1
Minnesota	0	0	0	0	0	1	0	0	1
Newport	4	0	0	0	1	0	0	0	5
Oranienburg	1	0	0	0	1	0	0	0	2
Paratyphi A	1	0	0	0	0	0	0	0	1
Rissen	1	0	0	0	0	0	0	0	1
Saintpaul	1	0	0	0	0	0	0	1	2
Sandiego	1	0	0	0	0	0	0	1	2
Schwarzengrund	0	0	0	0	0	0	1	0	1
Senftenberg	1	0	0	0	0	0	0	0	1
Stanley	3	0	0	0	0	1	1	1	6
Stanleyville	2	0	0	0	0	0	1	0	3
Telelkebir	2	0	0	0	0	0	0	0	2
Tennessee	1	0	0	0	0	0	0	0	1
Thompson	0	0	0	0	0	0	1	0	1
Typhi	3	1	0	0	0	0	1	0	5
Typhimurium	26	9	3	7	5	19	11	5	85
Uganda	1	0	0	1	0	0	0	0	2
Unnamed	2	1	1	1	0	0	1	1	7
Virchow	5	1	0	0	0	0	2	1	9
Worthington	0	0	0	0	0	1	0	0	1
Total	**135**	**23**	**19**	**25**	**21**	**49**	**51**	**34**	**357**
CIR	**9.6**	**10.2**	**5.6**	**7.2**	**9.5**	**11.6**	**8.8**	**8.9**	**9.1**

CIR: Crude incidence rate per 100,000 population

** 1 case of S. Enteritidis was known to be resident in UK*

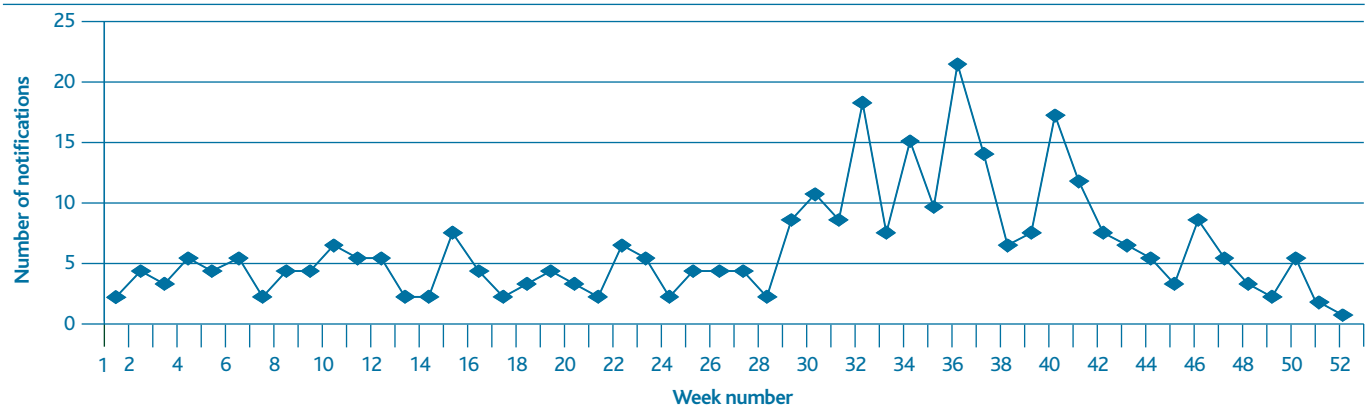

Figure 2. Number of salmonellosis notifications by week, 2005 (data from CIDR).

Table 3. Serotypes of S. enterica referred to NSRL (2000-2005) (%).

Serotype	2000	2001	2002	2003	2004	2005
S. Enteritidis	239 (36)	248 (46)	165 (40)	205 (42)	173 (41)	145 (41)
S. Typhimurium	284 (43)	165 (30)	140 (34)	135 (28)	125 (30)	85 (24)
S. Agona	6 (1)	2 (0.4)	5 (1)	5 (1)	2 (0.5)	10 (3)
S. Virchow	9 (1)	16 (3)	10 (2)	10 (2)	10 (2)	9 (3)
S. Hadar	11 (2)	4 (1)	6 (1)	21 (4)	4 (1)	8 (2)
S. Dublin	12 (2)	12 (2)	9 (2)	5 (1)	4 (1)	5 (1)
S. Kentucky	15 (2)	4 (1)	1 (0.2)	10 (2)	7 (2)	4 (1)
S. Bredeney	24 (4)	11 (2)	2 (0.5)	3 (1)	11 (3)	3 (1)
All others	65 (10)	81 (15)	78 (19)	92 (19)	83 (20)	88 (25)
Total	**665**	**543**	**416**	**486**	**419**	**357**

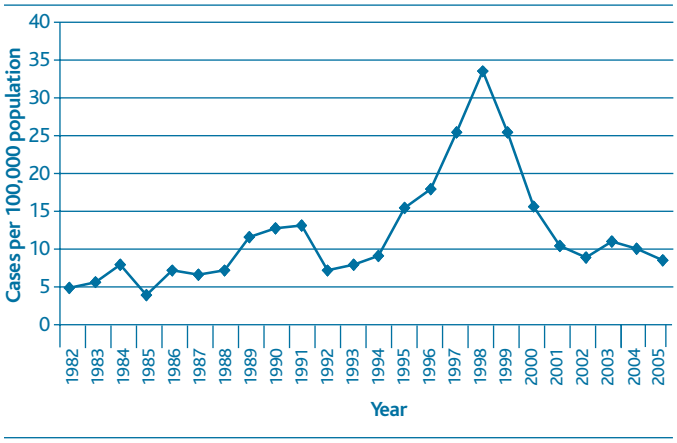

Figure 3. Crude rate of Salmonellosis in Ireland per 100,000 population, 1982-2005 (CIDR)

Clinical notification data

Salmonellosis is a notifiable disease. Medical practitioners have a statutory obligation to report all suspected cases. There were 349 cases notified to HPSC through the weekly notification system in 2005, giving a crude incidence rate of 8.9 per 100,000 population.

Outbreaks

In 2005, there were 17 outbreaks of *S. enterica* notified to HPSC; 3 general and 14 family outbreaks, affecting a total of 52 people. Three of the outbreaks were travel related with Spain, Tunisia and the Czech Republic cited as the countries of infection. The largest outbreak was a community outbreak caused by *S.* Agona that affected 6 people and resulted in 5 hospitalisations.

Discussion

Salmonella enterica continues to be an extremely significant cause of gastroenteritis in Ireland, despite a decrease in the rate of infections due to salmonellosis in 2005 ($8.9/10^5$) compared to 2004 ($10.6/10^5$). The highest incidence was reported in the South East health board region. A similar incidence rate was reported in Northern Ireland ($10.43/10^5$) [*CDSC-NI, 25/08/06 – personal communication*], while higher rates were seen in England and Wales[1,2] ($22.7/10^5$) [*calculated from provisional data 28/09/06*] and Scotland[3] ($22.3/10^5$).

Similar trends regarding the epidemiology of this pathogen were noted in 2005 as in previous years. Males and females were equally affected. All age-groups were affected but the highest incidence was noted in children less than five years of age. It is likely that more specimens are submitted for testing from this age-group, so this should be borne in mind when interpreting these data.

Analysis of serotyping revealed that there were 44 different serotypes identified in 2005. *S.* Enteritidis and *S.* Typhimurium were the causative serotypes identified in 65% of cases. The proportion of cases attributable to *S.* Typhimurium continues to decrease with *S.* Enteritidis and other serotypes increasing in their relative importance. The emergence of more unusual serotypes could be attributable to the increase in the number of cases that are associated with foreign travel (21% in 2005). In addition a significant number of travel-associated typhoid cases are reported each year. Five cases were reported in 2005, one associated with travel to India and two with travel to Pakistan. It is important that travellers are made aware of the measures that can be taken to reduce the risk of developing food-/ water-borne illness whilst abroad and especially that typhoid vaccination is given when travelling to endemic countries.

In previous years (1998-2003) PT4 was the predominant phage type of *S.* Enteritidis, but this trend has changed since 2004 with non-PT4 phage types being detected more and more. In particular the incidence of PT14b and PT8 has increased in recent years, accounting for 3% and 5% respectively of the total phage types detected in 2003 and increasing to 15% and 14% respectively in 2005. This shift in phage type has been observed in many countries in Europe in recent years and could be attributable to factors such as increased travel, global food trade and animal vaccinations.[4,5]

The typing of all human Salmonella cases by the NSRL

Table 4. Phage types of S. Typhimurium in human isolates (2005)

Phage type	No. of isolates (%)
DT104	37 (44)
DT104b	13 (15)
DT193	5 (6)
DT12	3 (4)
DT208	1 (1)
U310	1 (1)
Other	12 (14)
No type	13 (15)
Total	**85**

Table 5. Phage types of S. Enteritidis in human isolates (2005)

Phage type	No. of isolates (%)
PT1	44 (30)
PT14b	22 (15)
PT8	20 (14)
PT4	19 (13)
PT21	12 (8)
PT24var	4 (3)
PT6a	3 (2)
PT6	3 (2)
Other	13 (9)
No type	5 (3)
Total	**145**

Table 6. Antimicrobial susceptibilities of human Salmonella enterica serotypes isolated in Ireland in 2005.

	% Resistance						
Serotype (Number)	**Amp**	**Chl**	**Strep**	**Sulph**	**Tet**	**Trim**	**Nal**
Enteritidis (145)	5	0	0	2	3	2	30
Typhimurium (85)	73	64	72	75	79	8	9
Agona (10)	40	0	40	0	0	0	10
Virchow (9)	22	0	0	44	33	44	89
Hadar (8)	75	0	100	0	100	0	88
Stanley (6)	67	50	33	50	67	17	0
Typhi (5)	20	20	20	20	20	20	40
Kentucky (4)	25	0	25	50	50	0	50
Bredeney (3)	0	0	0	0	0	0	0

Amp = Ampicillin, Chl = Chloramphenicol, Strep = Streptomycin, Sulph = Sulphonamide, Tet = Tetracycline, Trim = Trimethoprim, Nal = Naladixic acid

continues to be an extremely powerful discriminatory tool particularly for cluster/ outbreak detection and especially for the two most common serovars S. Enteritidis and S. Typhimurium. In addition the submission of Irish data to international networks such as Enter-net allows the collation and analysis of serotyping, phage typing and AMR data across international borders and not only allows international outbreaks to be identified but also allows such emerging trends to be identified, monitored and explained.

In September 2005 the NSRL reported an unusual cluster of four human cases of *S.* Agona with a distinctive antibiogram (AS resistant). By November six cases had been identified, five from the HSE-S and one with an epidemiological link to the HSE-S. In addition the NSRL had identified a non-human (poultry) isolate from a poultry plant in the South-East. Despite extensive epidemiological, environmental and microbiological investigations no common source was found. As no further cases were reported, the outbreak was declared over.

In October 2005 an international outbreak of *S.* Goldcoast infection in tourists returning from Majorca was identified by Health Protection Scotland. An alert through Enter-Net and the European Commission's Early Warning and Response system (EWRS) led to an international response with active case finding. In total 148 cases were identified in 10 different countries – including six cases in Ireland. Despite extensive trawling, no testable hypothesis about foods, outlets, or other potential sources of infection could be generated. The outbreak was declared over on the 1st December 2005. Finally analysis of the 2005 AMR data (antimicrobial resistance) of the various *Salmonella* serovars demonstrated high levels of resistance among *S.* Typhimurium isolates, particularly DT104 isolates. The emergence of MDR (multi-drug resistant) S. Typhimurium and DT104 is well documented and constitutes an increasing global public health problem. [6]

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