



Feidhmeannacht na Seirbhíse Sláinte  
Health Service Executive



# 2006

## **EPIDEMIOLOGY OF SALMONELLOSIS IN IRELAND**



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## Acknowledgements

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### **Further information:**

For further information on salmonellosis in Ireland, please see:  
<http://www.ndsc.ie/hpsc/A-Z/Gastroenteric/Salmonellosis/>

## Summary

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- There was an increase in the rate of human cases of salmonellosis in 2006 (10.0/100,000) compared to 2005 (8.4/100,000)
- The highest incidence rate was observed in children under 5 years of age
- After *S. Enteritidis* (n=158) and *S. Typhimurium* (n=101), the next most common serotypes were *S. Hadar* (n=11), *S. Infantis* (n=11) and *S. Virchow* (n=10)
- 21% of cases were reported to be associated with travel outside of Ireland in 2006

## Introduction

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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 and birds, 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.

## Case Definitions

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### Clinical description

Clinical picture compatible with salmonellosis e.g. diarrhoea, abdominal pain, nausea, and sometimes vomiting. Cases may also be asymptomatic. The organism may cause extra-intestinal infections.

### Laboratory criteria for diagnosis

Isolation of *Salmonella* sp. (non-typhi, non-paratyphi) from a clinical specimen

### Case classification

Possible: N/A

Probable: A laboratory confirmed isolate without clinical information or a case with clinical symptoms that has an epidemiological link

Confirmed: A clinically compatible case that is laboratory confirmed

Taken from Case Definitions for Notifiable Diseases. Infectious Diseases (Amendment No. 3) Regulations 2003 (SI No. 707 of 2003). Available at <http://www.hpsc.ie>

## Materials and Methods

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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 salmonellosis extracted from the CIDR system for the year 2006. These data enable us to provide an overview of the epidemiology and burden of disease caused by Salmonella infections in Ireland today.

Data analysis for this report was performed using Business Objects Reporting in CIDR and MS Excel. Census of Population 2006 figures were used as denominator data in the calculation of incidence rates. The salmonellosis data from CIDR presented in this report are based on data extracted from the CIDR system on 23<sup>rd</sup> July 2007. These figures may differ from those published previously, due to ongoing updating of notification data on CIDR.

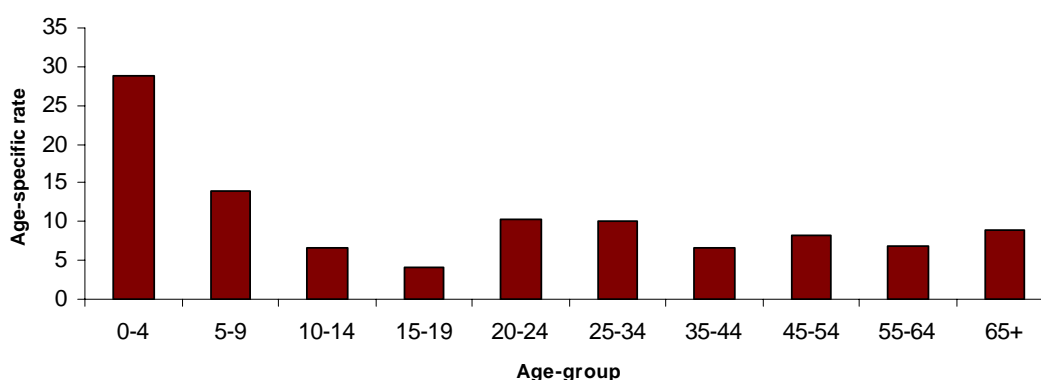
## Results

### Demographic information

There were 430 clinical isolates of *S. enterica* referred to NSRL in 2006. The female:male ratio was 1.3:1. 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.

**Table 1.** Analysis of clinical isolates of *S. enterica* (n=430) referred to NSRL, (2006) by age-group and gender.

Age Group (Years)	No of isolates (%)	Male	Female	Unknown
0-4	87 (20)	34	41	12
5-9	40 (9.3)	10	22	8
10-14	18 (4.2)	12	6	0
15-19	12 (3)	7	5	0
20-24	35 (8)	14	20	1
25-34	73 (17)	28	40	5
35-44	42 (10)	13	26	3
45-54	43 (10)	22	21	0
55-64	28 (6.5)	12	15	1
65+	41 (9.5)	17	24	0
Unknown	11 (2.5)	5	6	0
<b>Total</b>	<b>430</b>	<b>174</b>	<b>226</b>	<b>30</b>



**Figure 1.** Age-specific incidence rate of human salmonellosis in Ireland, 2006.



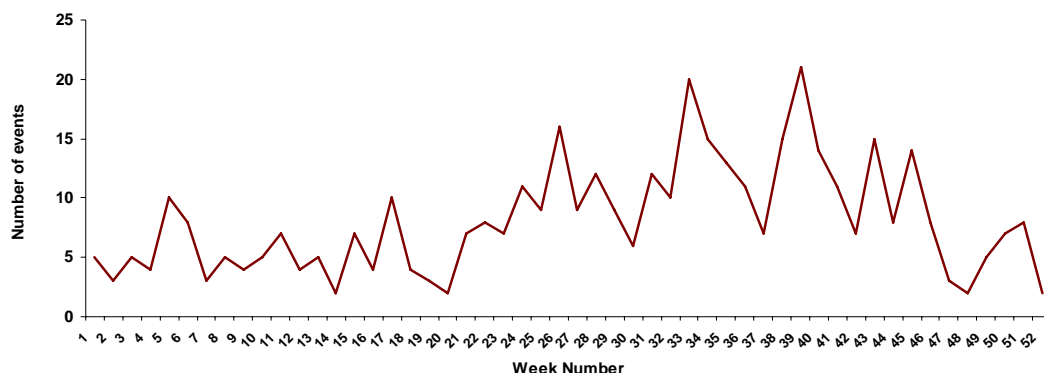
**Table 2. Number of cases and CIR of human salmonellosis in Ireland, 2006 (CIDR)**

HSE Area	No cases	CIR incl. 95% CI
HSE-E	157	10.5 [8.8 - 12.1]
HSE-M	36	14.3 [9.6 - 19.0]
HSE-MW	31	8.6 [5.6 - 11.6]
HSE-NE	32	8.1 [5.3 - 11.0]
HSE-NW	38	16.0 [11.0 - 21.1]
HSE-SE	33	7.1 [4.7 - 9.6]
HSE-S	52	8.3 [6.1 - 10.6]
HSE-W	43	10.4 [7.2 - 13.4]
<b>Total</b>	<b>422</b>	<b>10.0 [9.0 - 11.0]</b>

### Seasonality

Analysis of the number of salmonellosis events notified to HPSC by week in 2006, revealed peaks in incidence from mid-August to early October.

Seasonal peaks are typically seen each year at this time.



**Figure 2.** Number of salmonellosis notifications by week, 2006 (data from CIDR).

### Serotyping, phage typing and antibiotic susceptibility results

#### Serotyping

The breakdown of *Salmonella* serotypes by health board is shown in Table 3. As has been the trend in recent years, the predominant serotype causing human illness in 2006 was *S. Enteritidis* (n=158), followed by *S. Typhimurium* (n=101). Table 4 shows the changing shift in the more common serotypes in the past number of years. In 2006, after *S. Enteritidis* and *S. Typhimurium*, the next most commonly isolated serotypes were *S. Hadar* (n=11), *S. Infantis* (n=11) and *S. Virchow* (n=10). There were seven cases of *S. Typhi* and one isolate of *S. Paratyphi A* detected in 2006.

**Table 3.** Serotypes of *Salmonella enterica* by health board, 2006 (NSRL)

Serotype	HSE-E	HSE-M	HSE-MW	HSE-NE	HSE-NW	HSE-SE	HSE-S	HSE-W	Total
Abony	1	0	0	0	0	0	0	0	1
Agama	0	0	0	0	0	0	0	1	1
Agona	1	0	1	1	1	1	0	0	5
Athinani	1	0	0	0	0	0	0	0	1
Bareilly	3	0	0	0	0	0	1	0	4
Blockley	0	0	0	1	0	0	0	0	1
Braenderup	1	1	0	0	0	0	0	0	2
Brandenburg	1	1	0	0	0	0	0	0	2
Bredeney	3	0	2	0	0	0	0	0	5
Chester	1	0	0	0	0	0	0	0	1
Colindale	1	0	0	0	0	0	0	0	1
Concord	0	0	0	0	0	0	1	0	1
Corvallis	1	0	0	0	0	0	0	1	2
Derby	2	0	0	0	0	0	0	0	2
Dublin	1	0	1	0	1	0	1	0	4
Ealing	0	0	0	0	0	1	0	0	1
Enteritidis	59	11	13	8	17	14	18	18	158
Florida	0	0	0	0	0	0	1	0	1
Freetown	0	1	0	0	0	0	0	0	1
Gatuni	1	0	0	0	0	0	0	0	1
Give	0	0	0	0	0	0	0	1	1
Glostrup	0	0	0	0	0	0	0	1	1
Hadar	4	0	1	0	0	1	3	2	11
Haifa	1	0	0	0	0	0	0	0	1
Heidelberg	1	0	0	0	0	0	0	0	1
Havana	0	1	0	0	0	0	0	0	1
Indiana	1	0	0	1	0	0	0	0	2
Infantis	3	2	0	1	1	0	0	4	11
Java	1	1	0	0	0	0	0	0	2
Kentucky	0	0	0	2	1	0	1	0	4
London	0	0	0	1	0	0	0	0	1
Livingstone	1	0	0	0	0	0	0	0	1
Manhattan	1	1	0	0	0	0	0	0	2
Mbandaka	0	0	0	1	0	0	0	0	1
Meleagridis	1	0	0	0	0	0	0	0	1
Mikawasima	3	0	0	0	1	0	0	0	4
Minnesota	1	0	0	0	0	0	0	0	1
Monschau	0	0	0	0	0	1	0	0	1
Montevideo	1	0	0	0	0	0	0	0	1
Muenster	1	0	0	0	0	0	0	0	1

Muenchen	0	1	0	0	0	0	0	0	1
Napoli	1	0	0	0	0	0	0	0	1
Newport	5	0	0	2	1	1	0	0	9
Ohio	0	1	0	0	0	0	0	0	1
Oranienburg	0	0	1	0	0	0	0	1	2
Orion	1	0	0	0	0	0	0	0	1
Panama	0	0	0	0	0	0	3	0	3
Paratyphi A	1	0	0	0	0	0	0	0	1
Poona	1	1	0	0	0	0	1	0	3
Potsdam	1	0	0	0	0	0	0	0	1
Reading	1	0	0	0	0	0	0	0	1
Saintpaul	5	0	1	0	0	0	0	2	8
Schwarzengrund	1	0	1	0	0	1	0	0	3
Senftenberg	2	0	0	0	1	0	0	0	3
Stanley	0	1	2	0	0	3	0	0	6
Tennessee	1	1	0	0	0	0	0	0	2
Thompson	0	0	0	0	0	1	1	0	2
Typhi	5	0	0	1	0	1	0	0	7
Typhimurium	28	10	7	8	14	7	17	10	101
Unnamed	6	0	0	2	0	3	1	3	15
Virchow	5	1	0	1	0	2	1	0	10
Weltevreden	1	0	0	0	0	0	0	0	1
Wien	0	0	0	0	0	1	0	0	1
Worthington	0	0	0	0	0	1	0	0	1
Zanzibar	1	0	0	0	0	0	1	0	2
<b>Total</b>	<b>163</b>	<b>35</b>	<b>30</b>	<b>30</b>	<b>38</b>	<b>39</b>	<b>51</b>	<b>44</b>	<b>430</b>

**Table 4.** Serotypes of *S. enterica* referred to NSRL (2000-2006)

Serotype	2000	2001	2002	2003	2004	2005	2006
<b>S. Enteritidis</b>	239 (36)	248 (46)	165 (40)	205 (42)	172 (41)	145 (41)	158 (37)
<b>S. Typhimurium</b>	284 (43)	165 (30)	140 (34)	135 (28)	125 (30)	85 (24)	101 (23)
<b>S. Agona</b>	6 (1)	2 (0)	5 (1)	5 (1)	2 (0.5)	10 (3)	5 (1)
<b>S. Virchow</b>	9 (1)	16 (3)	10 (2)	10 (2)	10 (2)	9 (3)	10 (2)
<b>S. Hadar</b>	11 (2)	4 (1)	6 (1)	21 (4)	4 (1)	8 (2)	11 (3)
<b>S. Dublin</b>	10 (1.5)	12 (2)	9 (2)	5 (1)	4 (1)	5 (1)	4 (1)
<b>S. Kentucky</b>	15 (2)	4 (1)	1 (0.2)	10 (2)	7 (2)	4 (1)	4 (1)
<b>S. Bredeney</b>	24 (4)	11 (2)	2 (0.5)	3 (1)	11 (3)	3 (1)	6 (2)
<b>All others</b>	63 (10)	81 (15)	78 (19)	92 (19)	83 (20)	88 (25)	131 (30)
<b>Total</b>	<b>661</b>	<b>543</b>	<b>416</b>	<b>486</b>	<b>418</b>	<b>357</b>	<b>430</b>

### **Phage typing**

The predominant phage types of *S. Typhimurium* and *S. Enteritidis* are summarised in Tables 5 and 6. The commonest phage type of *S. Typhimurium* reported in 2006 was DT104b (30%), followed by DT104 (25%). PT 4 was the commonest phage type of *S. Enteritidis* detected (21%).

**Table 5.** *Phage types of S. Typhimurium in human isolates (2006)*

Phage Type	No. of isolates (%)
<b>DT104b</b>	30 (30)
<b>DT104</b>	25 (25)
<b>DT193</b>	11 (11)
<b>U302</b>	7 (7)
<b>DT41</b>	4 (4)
<b>DT2</b>	2 (2)
<b>DT85</b>	2 (2)
<b>Others</b>	11 (11)
<b>RDNC</b>	7 (7)
<b>Unknown</b>	2 (2)
<b>Total</b>	<b>101</b>

RDNC – reacts but does not conform

**Table 6.** *Phage types of S. Enteritidis in human isolates (2006)*

Phage Type	No. of isolates (%)
<b>PT4</b>	33 (21)
<b>PT1</b>	29 (18)
<b>PT21</b>	26 (16)
<b>PT14b</b>	19 (12)
<b>PT8</b>	17 (11)
<b>PT6</b>	4 (3)
<b>PT3</b>	4 (3)
<b>PT5</b>	3 (2)
<b>PT6b</b>	2 (1)
<b>Others</b>	7 (4)
<b>Untypeable</b>	2 (1)
<b>RDNC</b>	11(7)
<b>Unknown</b>	1 (1)
<b>Total</b>	<b>158</b>

### Travel-association

92 out of 430 isolates (21%) reported to NSRL in 2006 were found to be associated with travel outside of Ireland. The most commonly reported countries were Spain (n=17), India (6), Turkey (6), Croatia (5), Portugal (5), Tunisia (4) and Bulgaria (4).

### Antimicrobial resistance

The antimicrobial susceptibility patterns of the most commonly isolated serotypes in 2006 are presented in Table 7. The most notable feature of the data as in previous years was the significant percentage of *S. Typhimurium* isolates which were multi- drug resistant (four or more antibiotics). High levels of the penta-resistance phenotype ACSSuT were seen amongst *S.T.* predominantly DT104 or closely related groups.

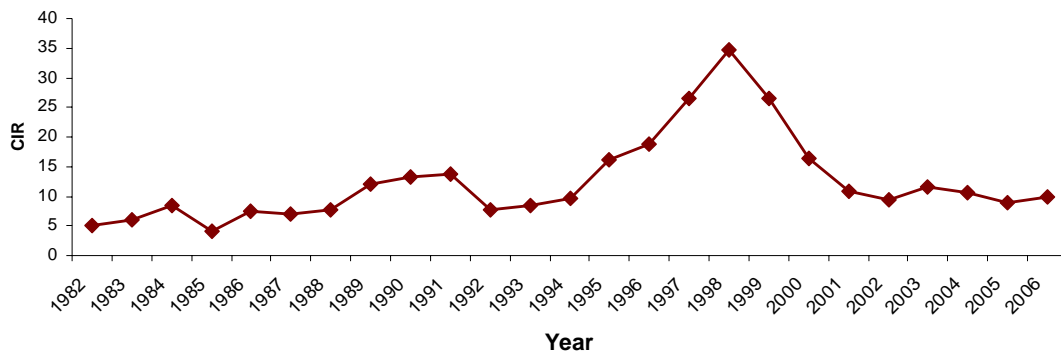
**Table 7.** Antimicrobial susceptibilities of human *Salmonella enterica* serotypes isolated in Ireland in 2006 (NSRL).

Serotype	% resistance						
	Amp	Chl	Strep	Sulph	Tet	Trim	Nal
Enteritidis (158)	8	0.6	2	2	0.6	0.6	0
Typhimurium (101)	69	58	64	68	66	6	6
Agona (5)	20	0	20	40	20	0	40
Virchow (10)	30	20	30	60	50	60	100
Hadar (11)	45	0	100	18	100	18	45
Stanley (6)	33	0	50	50	50	33	0
Typhi (7)	43	43	43	43	0	43	57
Kentucky (4)	25	0	25	25	25	0	25
Bredeney (6)	0	0	0	0	0	0	0

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

### Clinical notification data

Salmonellosis is a notifiable disease. Medical practitioners have a statutory obligation to report all suspected cases. There were 422 salmonellosis events on CIDR in 2006 giving a crude incidence rate of 10.0 per 100,000 population which was an increase in the rate observed in 2005 (8.4/100,000).



**Figure 3.** Crude rate of Salmonellosis in Ireland per 100,000 population, 1982-2006 (CIDR)

### Outbreaks

In 2006, there were 20 outbreaks of *S. enterica* notified to HPSC; 5 general and 15 family outbreaks. All of these were small outbreaks, with no more than five persons reported ill in any outbreak. Eleven of the outbreaks were reported to have been associated with travel outside of Ireland. Of the general outbreaks, one was associated with a crèche and four were travel-associated.

## Discussion

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*Salmonella enterica* continues to be an extremely significant cause of gastroenteritis in Ireland, with an increase in the incidence of salmonellosis in 2006 (10.0/100,000) compared to 2005 (8.4/100,000). In 2006, the highest incidence was reported from the HSE-NW region and the lowest rate from the HSE-SE region. A similar incidence was reported in Northern Ireland<sup>1</sup> in 2006 (11.7/100,000), but higher rates were reported from England and Wales<sup>2</sup> (23.2/100,000) (provisional) and Scotland<sup>3</sup> (20.3/100,000).

Many of the demographic features of the disease are quite consistent from year to year. However, there were slightly more female than male cases in 2006 (ratio 1.3:1.0). All age-groups were affected in 2006 but, as seen in previous years, the highest incidence was noted in children less than five years of age. There is probably a bias here linked to more specimens being submitted from this age-group for testing.

Analysis of serotyping data in 2006 revealed that there were 65 different serotypes identified by NSRL. Over a fifth of cases were reported to be associated with foreign travel in 2006 (21%). This is undoubtedly an underestimate and it is thought that many of the more unusual serotypes detected are acquired abroad. *S. Enteritidis* and *S. Typhimurium* remain the commonest serotypes detected being identified in 60% of isolates in 2006.

From 2004 to 2006, there was a change in trend of *S. Enteritidis* phage types with non-PT4 types being more common. However in 2006, PT4 emerged again as the most common, contributing to 21% of all S.E. isolates. This is quite a notable increase from 13% in 2005. This phage type is primarily associated with egg and egg products.

In 2006, the NSRL launched a new molecular method for the analysis of *S. Typhimurium* DT104. PFGE has been shown to be of very limited value in subdividing DT104 isolates into smaller groups. The new method 'multiple-locus variable number tandem-repeat analysis', often referred to as MLVA is based on repetitive DNA sequences called variable number of tandem repeats (VNTR)<sup>4</sup>. Initial results from NSRL are very promising and this method should enhance the surveillance and outbreak detection of *Salmonella* Typhimurium in Ireland.

The array of typing methods now being performed by the NSRL continues to be an extremely discriminatory tool for cluster/ outbreak detection especially for our commonest serovars, *S. Enteritidis* and *S. Typhimurium*.

A National Zoonoses Committee has been recently established in Ireland. It is hoped that through harmonisation of surveillance of salmonella in animals, feed, food and humans efforts can be targeted to control this zoonotic agent which still accounts for a significant burden of illness in Ireland each year.



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