Annual Report on Salmonella in Ireland, 2003

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Introduction

Salmonella is a bacterial zoonotic pathogen that is a relatively common cause of foodborne illness in Ireland and worldwide. At present there are over 2,500 known serotypes of *Salmonella*. In recent years, two serotypes, namely, *S. enterica* serotype Enteritidis and *S. enterica* serotype Typhimurium have accounted for the majority of cases of human salmonellosis.

Salmonellosis presents 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.

A wide range of domestic and wild animals, as well as humans can act as the reservoir for this pathogen, although chronic carriage is rare in humans.

Prevention, surveillance and control of *Salmonella* infections is of major public health importance. Measures have been implemented from farm to fork in an attempt to control spread of this zoonotic agent.

Materials and 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 clinical notifications for the year 2003. 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 486 clinical isolates of *S. enterica* referred to NSRL in 2003. The male: female ratio was 1:1. The age groups and sex of those affected are shown in Table 1. The highest number of cases in seen in children under five years of age. However, when age-specific incidence rates are calculated (Figure 1), the burden of illness in this age group is even more evident.

Table 1. *Analysis of clinical isolates of S. enterica (n=416) referred to NSRL, (2003) by age-group and gender.*

Age Group (years)	No. of isolates (%)	Male	Female	Unknown
0-4	81 (17)	43	29	9
5-9	32 (7)	20	10	2
10-14	24 (5)	12	12	-
15-19	29 (6)	11	18	-
20-24	52 (10)	19	30	3
25-34	80 (16)	36	42	2
35-44	58 (12)	32	25	1
45-54	49 (10)	22	27	-

55-64	22 (5)	15	7	-
65+	41 (8)	17	24	-
Unknown	18 (4)	8	9	1
Total	**486**	**235**	**233**	**18**

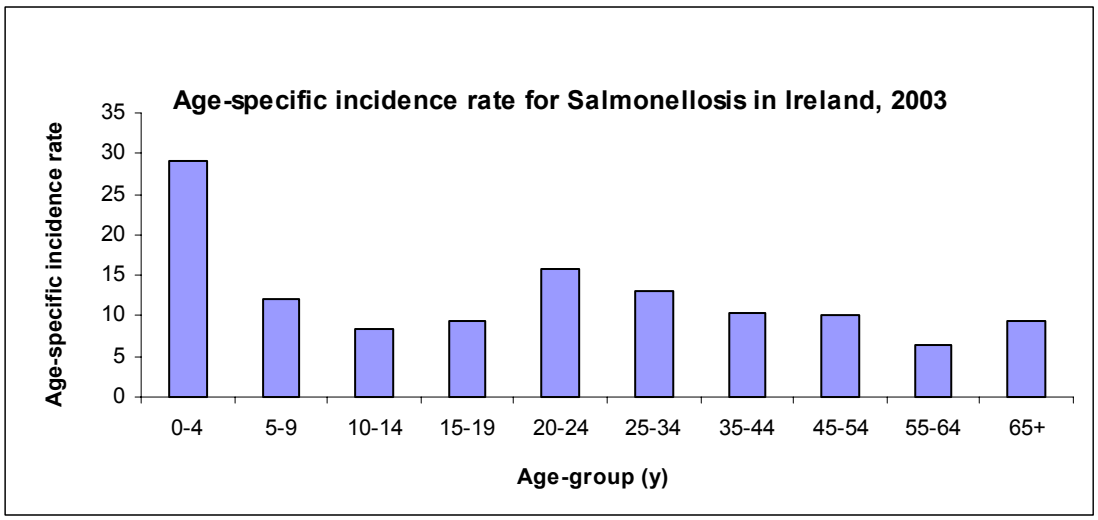

Figure 1. *Age-specific incidence rate of human salmonellosis in Ireland, 2003.*

Seasonality

There was a marked seasonal pattern seen in the number of clinical salmonellosis cases reported through the weekly notification system in 2003, with a sharp peak seen in week number 36.

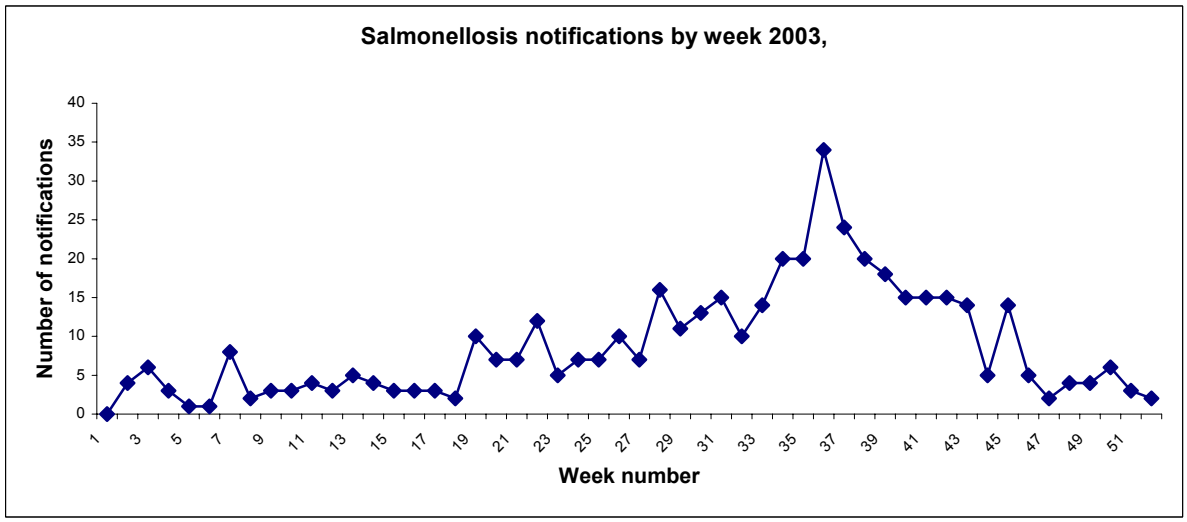

Figure 2. *Number of salmonellosis notifications by week, 2003 (NDSC).*

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.

The predominant serotype causing human illness was *S*. Enteritidis (42% of isolates) followed by *S*. Typhimurium (28%). Table 3 demonstrates the shift between these two serotypes in the past number of years. The next most commonly isolated serotypes in 2003 were *S*. Hadar (n=21), *S.* Virchow (n=10) and *S*. Kentucky (n=10). There were nine cases of *S*. Typhi detected in 2003, which is an increase on 2002 when there were five cases reported.

Table 2. *Serotypes of Salmonella enterica by health board, 2003.*

Serotype	ERHA	MHB	MWHB	NEHB	NWHB	SEHB	SHB	WHB	Total
Agbeni	1	0	0	0	0	0	0	0	**1**
Agona	4	0	0	0	0	0	0	1	**5**
Anatum	4	0	0	0	0	0	0	1	**5**
Blockley	1	0	0	0	0	1	0	0	**2**
Bovismorbificans	0	0	0	1	0	0	0	0	**1**
Braenderup	2	1	0	0	0	0	0	0	**3**
Brandenburg	1	0	0	0	0	0	1	0	**2**
Bredeney	2	0	1	0	0	0	0	0	**3**
Cerro	0	0	0	0	0	1	0	0	**1**
Corvallis	1	0	0	0	0	0	1	1	**3**
Cotham	1	0	0	0	0	0	0	0	**1**
Derby	0	0	0	0	0	0	0	1	**1**
Dublin	0	0	2	1	0	0	0	2	**5**
Enteritidis	65	17	9	15	9	37	34	19	**205**
Hadar	2	0	3	13	1	1	1	0	**21**
Havana	0	0	1	0	0	0	0	0	**1**
Heidelberg	1	0	0	0	0	0	0	0	**1**
Indiana	0	0	0	0	0	1	0	0	**1**
Infantis	2	0	0	0	0	0	0	2	**4**
Java	0	0	0	0	0	0	1	0	**1**
Javiana	1	0	0	0	0	0	0	0	**1**
Kentucky	3	0	1	1	0	5	0	0	**10**
Kottbus	1	1	0	0	0	1	0	2	**5**
Litchfield	1	0	0	0	0	0	0	0	**1**
Manhattan	0	0	1	0	0	0	0	0	**1**
Mbandaka	1	0	0	0	1	0	0	1	**3**
Muenchen	1	0	0	0	0	0	1	0	**2**
Newport	2	1	0	0	0	0	0	2	**5**
Ohio	0	0	0	0	1	0	0	0	**1**
Ohlstedt	0	0	0	0	0	0	1	0	**1**
Panama	0	0	0	0	0	0	0	1	**1**
Paratyphi A	1	0	0	3	0	0	1	1	**6**
Paratyphi B	0	0	0	0	0	0	1	0	**1**
Poona	1	0	0	0	0	0	0	0	**1**
Reading	2	0	0	0	0	0	0	0	**2**
Rissen	0	0	0	0	0	0	1	0	**1**
Saintpaul	1	1	0	0	0	0	1	1	**4**
Sandiego	1	0	0	0	0	0	1	0	**2**

Senftenberg	1	0	0	0	0	0	0	0	**1**
Stanley	3	0	0	1	0	0	0	0	**4**
Tennessee	0	0	0	0	0	1	0	0	**1**
Typhi	3	0	2	0	2	0	2	0	**9**
Typhimurium	54	10	4	5	20	15	13	14	**135**
Virchow	3	1	1	1	2	1	0	1	**10**
Wangata	1	0	0	0	0	0	0	0	**1**
Welikade	1	0	0	0	0	0	0	0	**1**
Weltevreden	1	0	0	0	0	0	0	0	**1**
Unknown	4	1	0	1	1	0	0	1	**8**
Total	**174**	**33**	**25**	**42**	**37**	**64**	**60**	**51**	**486**
CIR	**12.4**	**14.6**	**7.4**	**12.2**	**16.7**	**15.1**	**10.3**	**13.4**	**12.4**

CIR: Crude incidence rate per 100,000 population

Table 3. *Serotypes of S. enterica referred to NSRL (1998-2003)*

Serotype	1998	1999	2000	2001	2002	2003
S. Enteritidis	60 (8)	155 (33)	239 (36)	248 (46)	165 (40)	205 (42)
S. Typhimurium	578 (80)	200 (42)	286 (43)	165 (30)	140 (34)	135 (28)
S. Bredeney	15 (2)	55 (12)	24 (4)	11 (2)	2 (0.5)	3 (1)
S. Kentucky	14 (2)	12 (3)	15 (3)	4 (1)	1 (0.2)	10 (2)
All other serotypes	54 (7)	52 (11)	101 (15)	115 (21)	108 (26)	133 (27)
Total	**721**	**474**	**665**	**543**	**416**	**486**

Phage typing

The predominant phage types of *S*. Typhimurium and *S*. Enteritidis are summarised in Tables 4 and 5.

The incidence of *S*. Typhimurium DT104b has increased in recent years and it represented 50% of all Typhimurium isolates tested in 2003.

PT4 has been the predominant phage type in Enteritidis isolates since 1998 (comprised 28% of all Enteritidis isolates in 2003), however the incidence of PT1 appears to be on the increase (26% of all Enteritidis isolates in 2003).

Table 4. *Phage types of S Typhimurium in human isolates (2003)*

Phage Type	No. of isolates (%)
DT104b	67 (50)
DT104	22 (16)
DT12	8 (6)
U302	8 (6)
U310	6 (4)
DT193	4 (3)
U311	3 (2)
Others	12 (9)
No type	5 (4)
Total	**135**

Table 5. *Phage types of S. Enteritidis in human isolates (2003)*

Phage type	No. of isolates (%)
PT4	58 (28)
PT1	53 (26)
PT21	21 (10)
PT6	13 (6)
PT6a	11 (5)
PT8	10 (5)
PT14b	7 (3)
PT5c	6 (3)
PT13a	5 (2)
Others	18
No type	3
Total	**205**

Travel-association

72 isolates (14.8%) reported to NSRL in 2003 were found to be associated with travel outside of Ireland. The majority of these cases were associated with travel to Spain (n=26). The next most common countries reported were Portugal (n=6) and Thailand (n=6), followed by Pakistan (n=5), India (n=3) and the UK (n=3).
Six of the nine isolates of *S.* Typhi received by NSRL in 2003 were reported to be travel-associated. Three of these were associated with travel to Pakistan; two with travel to India and one was unknown.

Antimicrobial resistance

The antimicrobial susceptibility patterns of the most commonly isolated serotypes in 2003 are presented in Table 6. The same trend that was noted in previous years with high levels of resistance found amongst S. Typhimurium isolates, particularly S. Typhimurium DT104 was again found in the 2003 data. Many of these isolates were found to have the penta resistance phenotype (ACSSuT) that was also reported in previous years.

Table 6. *Antimicrobial susceptibilities of human Salmonella enterica serotypes isolated in Ireland in 2003.*

	% Resistance						
Serotype (Number)	**Amp**	**Chl**	**Strep**	**Sulph**	**Tet**	**Trim**	**Nal**
S. Enteritidis (205)	8	0	3	4	4	1	33
S. Typhimurium (135)	77	58	66	79	76	21	3
S. Hadar (21)	81	0	95	0	81	0	100
S. Virchow (10)	30	0	0	30	2	20	90
S. Kentucky (10)	50	10	50	60	5	20	70
S. Typhi (9)	11	11	11	11	11	11	44
S. Dublin (5)	0	0	0	0	0	0	0
S. Stanley (4)	25	25	50	50	50	0	25
S. Bredeney (3)	33	0	0	33	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. Information on trends in salmonellosis notifications shows that the crude incidence rate rose in the 1990s to peak in 1998, decreased until 2002 but an increase was again seen in 2003 (Figure 3). The total number of notifications in 2003 was 449.

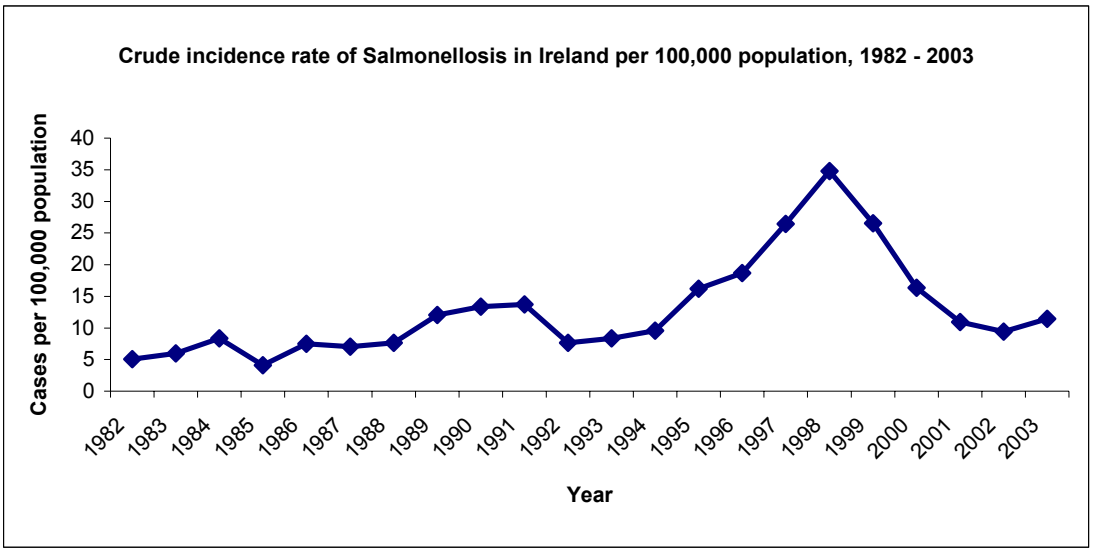

Figure 3. Crude rate of Salmonellosis in Ireland per 100,000 population, 1982-2003

Discussion

The significant burden of human illness caused by *Salmonella enterica* is evident from the data presented in this review of the epidemiology of salmonellosis in Ireland in 2003. Of particular note is that the incidence of disease of human salmonellosis in Ireland was seen to increase in 2003 (CIR 11.5 per 100,000 population) for the first time since 1998. The highest incidence was reported in the North-Western health board region. Higher rates were seen for the same period in Northern Ireland[1] (12.4), England and Wales[2] (28.3) and Scotland[3] (24.8).

Similar trends regarding the epidemiology of this pathogen were noted in 2003 as in previous years. All age-groups were seen to be affected but the highest incidence was again noted in children under 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. Males and females were equally affected.

Salmonella has a well characterised seasonal distribution and a sharp rise in cases was noted in week 36 in 2003. A Europe-wide study has been undertaken by the WHO European Centre for Environment and Health (ECEH) to examine the effects of global climate change on a number of gastroenteric pathogens including *Salmonella sp*. The first results from this study examining the effect of temperature on the incidence of salmonellosis were published in 2004[4].

The detailed typing methods being employed by the National Salmonella Reference Laboratory are dramatically improving our ability to monitor epidemiological trends, identify clusters and outbreaks, and assist in trace back through the food chain. Analyses of the serotyping results revealed that in 2003, *S*. Enteritidis still remained the predominant serotype, followed by *S*. Typhimurium. These two serotypes represent 70% of the total salmonellas affecting humans. A diverse number of other serotypes comprise the remaining 30% of human isolates, with forty-five serotypes other than Enteritidis or Typhimurium detected by NSRL in 2003.
Phage typing provides an additional level of sub-typing detail. The trends in Enteritidis and Typhimurium isolates are particularly interesting (Tables 4 and 5). DT104b has taken over from DT104 as the predominant Typhimurium phage type in humans. A decrease has been seen in *S*. Enteritidis PT4 across Europe in recent years[5]. In Ireland, *S*. Enteritidis PT4 decreased from 85% of all Enteritidis isolates in 1998 to 28% in 2003. A corresponding increase has been seen of PT1, which comprised 26% of Enteritidis isolates in 2003.

When the AMR (antimicrobial resistance) patterns of the various *Salmonella* serotypes were examined, the trend that has been reported over the past number of years of high levels of resistance among S. Typhimurium DT104 isolates, was again seen in 2003. This continues to be cause for concern.

In 2003, the use of the Enter-net network and hub again proved to be extremely beneficial for sharing knowledge and expertise in the area of surveillance and control of gastrointestinal disease, and as a particularly efficient alert system to aid in the investigation of clusters and epidemics of *Salmonella* and VTEC *E. coli*.

Finally, analyses of the 2003 data reveal that it is becoming evident that an increasing number of cases of illness of salmonellosis are linked to travel outside of Ireland, with 15% of cases in 2003 being reported as travel-associated. It is quite likely that many of the 'unusual' serotypes that we are seeing each year are acquired abroad. Of particular note in 2003 was the increase in the number of typhoid cases seen (n=9) compared to five isolates in 2002. This highlights the need for reinforcing awareness amongst travellers to endemic countries.

It is evident from the data presented in this review that Salmonella continues to be an extremely significant public health problem, and especially in light of the increase in cases seen in 2003, control measures must be enforced throughout the food chain to help to reduce this burden of disease.

References

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4. Kovats R. S., Edwards S. J., Hajat S., Armstrong B.G., Ebi K.L., Menne B., and The Collaborating Group. The effect of temperature on food poisoning: a time-series analysis of salmonellosis in ten European countries. *Epidemiol Infect* (2004) **132**: 443-453.

5. Enter-net website. http://www.hpa.org.uk/hpa/inter/enter-net_menu.htm

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