Epidemiology of Verotoxigenic *E. coli* O157 in Ireland, 2000

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Introduction
Verocytotoxin producing *Escherichia coli (VTEC)* of which *E coli* O157:H7 is the most common member is a serious global public health concern. VTEC produce toxins that can lead to symptoms of non-bloody diarrhoea, haemorrhagic colitis, haemolytic uraemic syndrome (HUS) and thrombotic thrombocytopenic purpura (TTP).

In Ireland, there is no statutory requirement to notify *E coli* O157:H7. In addition, there is no national reference laboratory facility for confirmation of verocytotoxin production, or definitive typing of VTEC, and samples are sent to the Public Health Laboratory Service (PHLS), Colindale for this purpose. This presents many challenges in management of clinical cases, and in national collation of information on *E coli* O157:H7. In practice, clinical microbiologists report suspect cases, pending confirmation of verocytotoxin production, to public health colleagues so that appropriate public health action can be taken.

Methods
In 1999, the National Disease Surveillance Centre, in co-operation with Directors of Public Health in each health board region, established an epidemiological surveillance system for VTEC O157:H7. Since 1999, specialists in public health medicine and area medical officers have participated in a system whereby a standard dataset of information is collected on each case identified and reported to the National Disease Surveillance Centre. This information includes socio-demographic data, clinical data, possible risk factors and information on links between cases. An initial notification to NDSC is made on the date of notification of the case to the health board, and follow-up information is returned when available. Due to the current arrangements for definitive typing, there can be a considerable delay between initial notification to NDSC and complete information on each case. Several participants in the system also notify other non-O157:H7 verocytotoxin-producing *E coli*.

The case definitions that have been used in this system are as follows:

Suspected*:*
A case of post-diarrhoeal HUS or TTP
Probable:
- A case with isolation of *E coli* O157 from a clinical specimen (asymptomatic or symptomatic), pending confirmation of H7 or Shiga toxin or
- A clinically compatible case that is epidemiologically linked to a confirmed or probable case

Confirmed
A case that has isolation of *E coli* O157:H7 from a specimen or isolation of Shiga toxin-producing *E coli* O157:NM(non motile) from a clinical specimen

Probable cases that were subsequently confirmed as not H7 or Shiga toxin producing were removed from the database. A travel-associated case was defined as one where there had been international travel within two weeks prior to onset of illness.

Results

In 2000, 41 cases of VTEC O157 were notified to NDSC. Six of these cases occurred in non-Irish residents, and therefore were not included in the estimation of population-based rates. These six cases are however included in the descriptive epidemiology.

The incidence of VTEC O157 in Ireland is shown in Table 1.

Table 1: Number of cases of VTEC O157 and crude incidence rate (95% CI) in Ireland, 1996-2000

Year	Number of reported cases	Crude incidence rate [95% CI] per 100,000 population
1996	8	0.2 [0.1-0.4]
1997	31	0.8 [0.5-1.2]
1998	76	2.1 [1.6-2.6]
1999	51	1.4 [1.0–1.8]
2000	35 (41)*	1.0 [0.6–1.3]

* 41 cases notified, but 6 occurred in non Irish residents

There has been some regional variation in the numbers of cases reported (Table 2).

Table 2: Crude incidence rate (CIR) and age standardised incidence rate (ASIR) with 95% confidence intervals by health board, Ireland, 1999-2000.

	2000		1999	
Health Board	CIR [95% CI] per 100,000	ASIR [95% CI] per 100,000	CIR per 100,000	ASIR [95% CI] per 100,000
ERHA	0.5 [0.1-0.9]	0.5 [0.1-0.9]	0.7	0.7 [0.2-1.1]
MHB	3.4 [0.9-5.9]	3.3 [0.8-5.7]	4.4	5.6 [2.5-9.1]
MWHB	0.6 [0.2-1.5]	0.6 [0.2-1.5]	3.8	3.9 [1.7-6.0]
NWHB	0.5 [0.4-1.4]	0.4 [0.4-1.1]	0.9	1.0 [0.4-2.3]
SEHB	1.5 [0.3-2.8]	1.5 [0.3-2.7]	1.5	1.5 [0.3-2.7]
SHB	0.4 [0.1-0.9]	0.4 [0.1-0.8]	1.6	1.7 [0.6-2.7]
WHB	2.8 [1.1-4.6]	2.9 [1.1-4.7]	0.6	0.5 [0.2-1.2]
NEHB	0	0	0	0
Total	1.0 [0.6-1.3]		1.4 [1.0-1.8]	

In 2000 and in 1999, the crude incidence rates and age-standardised incidence rates varied by health board, but these differences were not statistically significant.

Twenty-two (54%) cases occurred in females and 19 (46%) occurred in males. Most cases occurred in young children in the 1-4 year age group (Table 3). Looking at the age specific incidence rate in cases in Irish residents, the age group at highest risk was the 0-4 year olds. (Figure 1)

Table 3: Cases of VTEC O157 by age group, 2000.

Age group	Number of cases	Percent
< 1 years	1	2
1-4 years	15	37
5-9 years	4	10
10-14 years	1	2
15-24 years	3	7
25-44 years	6	15
45-64 years	6	15
65 + years	5	12
Total	41	100

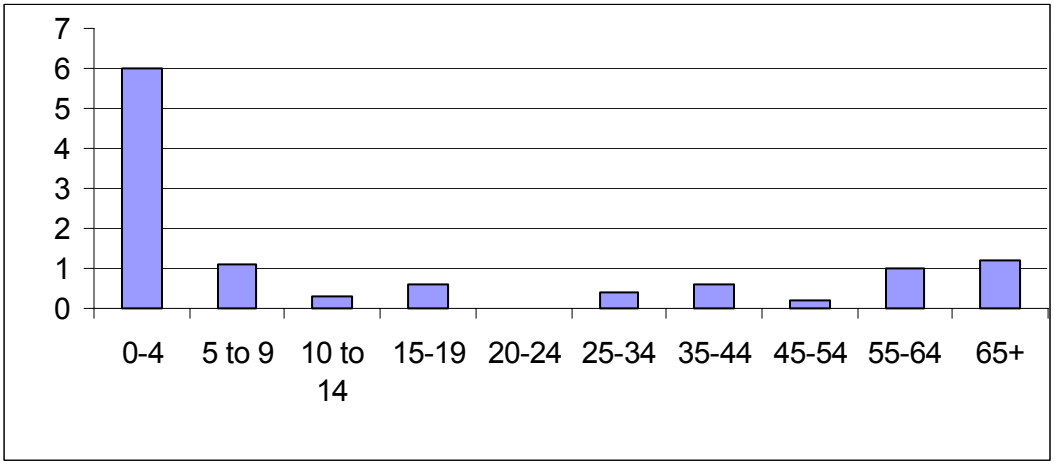

Figure 1: Age specific incidence rate of VTEC O157 in Irish residents, Ireland 2000

Seasonality of VTEC O157

There were two peaks in occurrence of cases, in March and in September. (Figure 2)

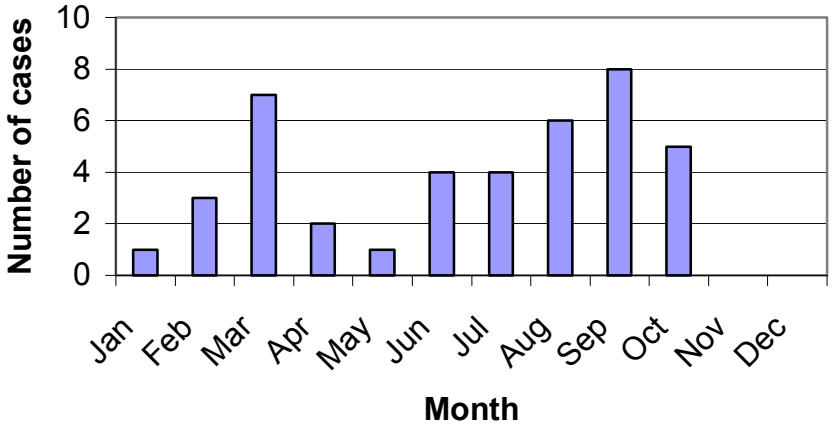

Figure 2: Cases of *E coli* O157:H7 by month of onset of symptoms (or of diagnosis, if asymptomatic), Ireland, 2000.

Eight (20%) cases were travel associated, and 32 (80%) were not travel associated. The countries visited within 14 days of onset of illness were UK (3), Spain (3), and Canada (2).

Clinical features
In total, 40 cases (98%) had symptoms, and only one case was asymptomatic. Reported symptoms included bloody diarrhoea in 26 (64%) cases, and haemolytic uraemic syndrome in 5 cases (12%). The five cases of HUS occurred in persons ranging in age from 2 to 17 years. Three were female and two were male. All these cases reported bloody diarrhoea. Four of the cases with HUS recovered from their illness. One person died from HUS in 2000. This case occurred in a male in the 5 to 9 year age group, and was associated with travel to Spain. The phage type in this case was PT4.

Microbiological investigation
One case of HUS was identified on serology alone. This case was included as a case, as there were typical clinical features, and the case developed HUS. In 2000, following investigation of a travel associated case in Spain in a 17-year-old female; VTEC O157 was isolated from frozen hamburger samples taken from a restaurant where she had eaten. Diagnosis of VTEC in this case had been made using serology only, and no isolate was available for genetic testing and investigation of a possible link. No other food or water sample was linked microbiologically to a case of VTEC in 2000.

Limited information was available nationally on test results from water sampling. In five cases, there was documented contamination of the water supply with coliforms and with *E coli*. In no case was *E coli* O157 detected in water.

Phage typing of strains showed that PT32 was the predominant type found. The pattern of phage types found in travel-associated cases was different to non-travel associated cases.

Table 4: Phage type, association with international travel and countries visited within 14 days of onset of illness, for cases of *E coli* O157:H7, Ireland, 2000.

Phage type	Not travel associated	Travel associated	Countries	Total
14	0	2	Canada (2)	2
2	1	0		1
21	1	0		1
21/28	0	2	UK (2)	2
31	1	0		1
32	24	2	Spain(1) UK(1)	26
38	1	0		1
39	1	0		1
4	0	2	Spain (2)	2
8	1	0		1
Not available	3	0		3

Table 5: Phage types of cases of *E coli* O157:H7 in Irish residents by health board, Ireland, 2000

Health Board	32	4	21	31	2	38	39	8	Not available
EHB	3	2	0	0	1	0	0	0	1
MHB	6	0	0	0	0	0	0	0	1
MWHB	2	0	0	0	0	0	0	0	0
NWHB	0	0	0	0	0	0	0	1	0
SEHB	5	0	0	0	0	0	1	0	0
SHB	2	0	0	0	0	0	0	0	0
WHB	6	0	1	1	0	1	0	0	1
Total	24	2	1	1	1	1	1	1	3

The range of phage types detected was more diverse than that found in Ireland in 1999, where only two different phage types were detected, PT32 in 66.7% and PT21/28 in 33.3%.

Epidemiological investigation

On active investigation of many of the cases identified in 2000, further previously undiagnosed cases of VTEC were identified. Of 35 cases with this information, 8 cases (23%) occurred in association with other cases, and 27 cases (77%) were sporadic. Three family outbreaks of VTEC O157 were detected. There was no generalised outbreak of *E coli* O157:H7 detected in 2000. As a result no food item was linked epidemiologically to VTEC.

Of 27 cases where consumption patterns of unpasteurised cheese and/or milk were known, three cases (3/27) reported this exposure. Fifteen cases (50%) reported exposure to farm animals (n=30). Information on the source of the water supply was available in 31 cases. Of these, the water supply was public in 14 (45.2%) cases, well water in 10 (32.2%), and from a group water scheme in 7 (22.6%) cases.

Information on whether the case attended a crèche, or was an in-patient in a nursing home, hospital or in another institutionalised setting, was also gathered. Of 33 cases where information was available, 3 attended a crèche. Two patients were in-patients in hospital with other conditions when VTEC O157 was detected. Following investigation, no further cases were detected in these hospitals. Twenty-seven cases were not in a high-risk category.

Non-O157 VTEC

All cases of non-O157 VTEC reported to NDSC occurred in the Eastern Regional Health Authority (ERHA). In summer 2000, a case of HUS in a child with a history of diarrhoea was notified to the Department of Public Health in the ERHA. Stool samples were negative for *E coli* O157 and other non-O157 VTEC. However five siblings and cousins of the case with HUS provided specimens identified as *E coli* O26, verocytotoxin positive.

Discussion

Each case of VTEC identified is investigated thoroughly, and family and other at risk contacts are screened as recommended according to PHLS guidelines[1]. This means that cases with mild symptoms, which would otherwise not come to medical attention, are identified, and are reported. By systematically collating information on each case identified, the epidemiology of VTEC in Ireland is emerging. It is clear that young children are most at risk of disease, and given the potential for rapid spread in crèches, prompt action is taken when a case is identified, as well as efforts at primary prevention, through education of parents and staff about the need for very good hygiene practices, and not attending the crèche if a child has diarrhoea.

The three main routes of infection with VTEC O157 are via contaminated food or water, person-to-person spread and through direct contact with farm animals. This descriptive epidemiology is identifying significant exposures to farm animals. Those who visit farms should be made aware of the risks and all those who are in contact with farm animals should have access to adequate hand washing facilities for use after being in contact with them.

Proper cooking of meat will kill the organism, and as good weather approaches and the barbeque season begins, the important message is to cook meat until the juices run clear, and the meat is brown throughout.

The majority of cases of VTEC in 2000 occurred in persons whose source of water was not from a public water supply. In five cases notified to NDSC, water quality around the time of identification of illness in the index case was not adequate. It is important that the public has access to a clean water source, as contaminated water has been implicated as the source of large outbreaks of VTEC internationally[2].

The lack of a national reference laboratory for confirmation of toxin production and definitive typing of VTEC in Ireland is a cause for concern. Ireland should be in a position to rapidly investigate any possible case of this serious and potentially fatal illness, rather than have to refer outside the country.

The emergence of outbreaks of non-O157 VTEC in Ireland highlights the importance of improving national surveillance of non-O157 VTEC. As was seen in 2000, non-O157 VTEC can be associated with serious illness.

Acknowledgements

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References

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