Epidemiology of Verotoxigenic *E. coli* O157 in Ireland, 2001

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Introduction

E. coli O157 and other VTEC infections cause a wide range of illnesses, from mild diarrhoea to haemorrhagic colitis with severe abdominal pain and bloody diarrhoea. The illness is usually self-limiting and resolves after about eight days. However, in one-third to one-half of diagnosed cases the patient is hospitalised and 2-7% develop haemolytic uraemic syndrome (HUS), a form of renal failure whose fatality rate has been reported to be 3 to 17%. HUS is a more likely complication in young children. In adults, VTEC infection may be followed by thrombotic thrombocytopaenic purpura (TTP).[1]

At present in Ireland there is no statutory requirement to notify *E. coli* O157:H7. We also do not yet have a national reference laboratory facility for confirmation of toxin production and definitive typing of VTEC.
However, since October 2000, the Public Health Laboratory at Cherry Orchard Hospital Dublin has commenced provision of an *E. coli* O157 and non O157 diagnostic service for clinical and food samples. This service includes *E. coli* serotyping and verocytotoxin detection. This service has improved the diagnostic facilities for VTEC infections in the Republic of Ireland and diminishes the prolonged turn-around-times for services available in the United Kingdom. Phage typing for clinical VTEC isolates is accessed at LEP, Colindale.

Methods

In 1999, NDSC 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 NDSC. 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. 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* 0157 from a clinical specimen (asymptomatic or symptomatic), pending confirmation of H7 or Shiga toxin or a clinically compatible case that is epidemiologically linked to confirmed or probable case.
- *Confirmed*: a case that has isolation of *E.coli* 0157:H7 from a specimen or isolation of Shiga toxin-producing *E. coli* 0157:NM (non-motile) from a clinical specimen.

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

Results

In 2001, 52 confirmed cases of VTEC O157 were notified to NDSC. Two of these cases occurred in non-Irish residents and therefore were not included in the estimation of population-based rates. These cases are however, included in the descriptive epidemiology. The incidence of VTEC O157 in Ireland from 1996-2001 is shown in table 1.**Error! Reference source not found.**

Table 1. Number of cases of confirmed VTEC 0157 and crude incidence rate (95% CI) in Ireland, 1996-2001

Year	Numbers of confirmed 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*	37 (42)	1.0 [0.7-1.4]
2001**	50 (52)	1.4 [1.0-1.8]

*42 cases notified, but 5 occurred in non-Irish residents

**52 cases notified, but 2 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 of confirmed cases of VTEC 0157 by health board, Ireland, 2000-2001

	2001		2000	
Health board	**CIR [95% CI] per 100,000**	**ASIR [95% CI] per 100,000**	**CIR [95% CI] per 100,000**	**ASIR [95% CI] per 100,000**
ERHA	0.9 [0.4-1.5]	0.9 [0.4-1.5]	0.5 [0.1-0.9]	0.5 [0.1-1.0]
MHB	2.4 [0.3-4.6]	2.4 [0.3-4.6]	3.4 [0.9-5.9]	3.3 [0.9-5.7]
MWHB	0.9 [0.1-2.0]	0.9 [0.1-2.0]	0.9 [0.1-2.0]	0.9 [0.1-2.0]
NEHB	1.3 [0.0-2.6]	1.3 [0.0-2.5]	0	0
NWHB	0.5 [0.5-1.4]	0.6 [0.5-1.6]	0.5 [0.5-1.4]	0.4 [0.4-1.2]
SEHB	2.6 [1.0-4.1]	2.5 [1.0-4.1]	1.5 [0.3-2.8]	1.5 [0.3-2.8]
SHB	1.3 [0.3-2.3]	1.2 [0.3-2.3]	0.5 [0.0-1.2]	0.5 [0.1-1.2]
WHB	2.0 [0.5-3.5]	2.0 [0.5-3.5]	2.8 [1.1-4.6]	2.9 [1.1-4.7]
Total	1.4 [1.0-1.8]		1.0 [0.7-1.4]	

Gender data were available for 47 cases, of which 28 were female (60%) and 19 (40%) were male. The majority of cases occurred in young children in the 1-4 year age group, followed by the 25-44 age-group. However, when the age-specific incidence rate in cases in Irish residents is examined, the high incidence in the 0-4 year olds is more notably reflected (figure 1).

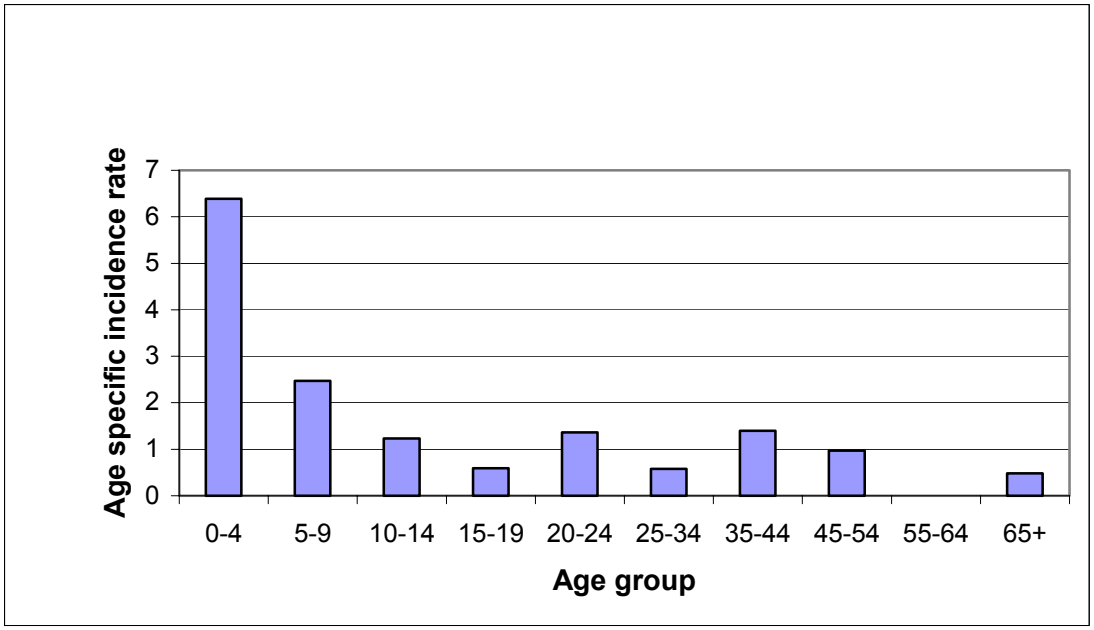

Figure 1. Age-specific incidence rate (per 100,000 population) of confirmed cases of VTEC 0157 in Irish residents, Ireland 2001

Seasonality of VTEC O157

The majority of cases occurred in late summer/ early autumn, with a peak in September (figure 2).

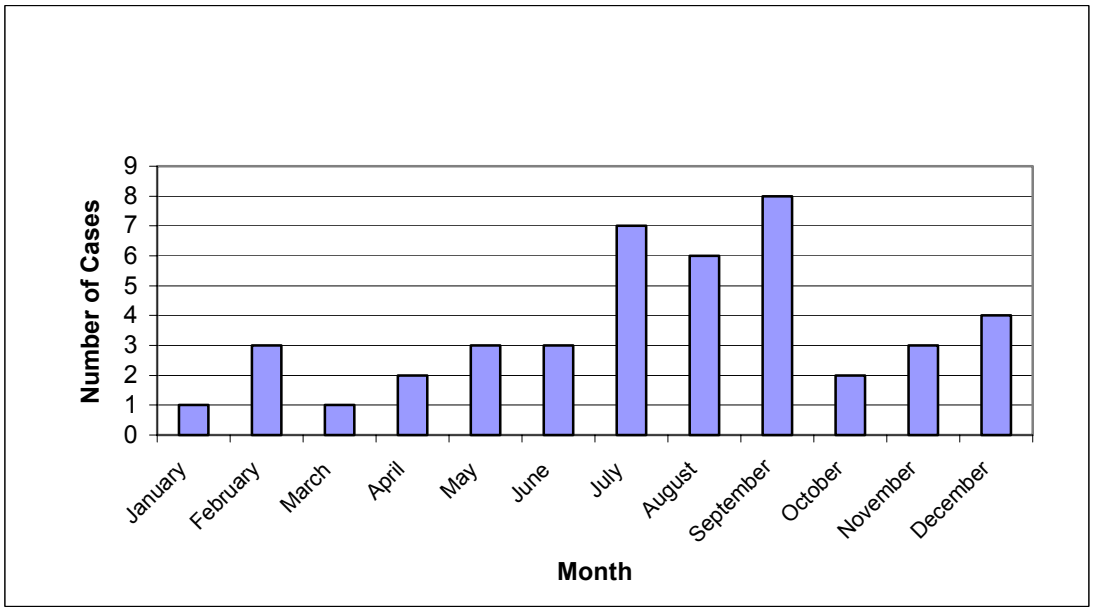

Figure 2. Confirmed cases of E. coli O157:H7 by month of onset of symptoms (or of diagnosis, if asymptomatic), Ireland, 2001

Travel-association
Six cases were travel-associated (table 3). The countries visited within 14 days of onset of illness were Canary Islands (2), Turkey (2), Finland and Canada.

Table 3.The number of confirmed cases of E. coli O157:H7 by phage type, 1999 - 2001

Phage type	Not travel associated	Travel associated	Total
14	2	0	2
32	30	3	33
8	6	2	8
71	0	1	1
N/A	8	0	8
Total	46	6	52

Clinical features
In total, 40 out of 52 confirmed cases (77%) were symptomatic, with 12 cases (23%) being asymptomatic. Reported symptoms included bloody diarrhoea in 24 (60%) of cases, and HUS in 3 cases (8%). The three cases of HUS occurred in children under 12 years of age. Two were female and one was male. Only one of the cases reported was part of an outbreak. The child was attending a crèche and several other children in the crèche became ill. The source of transmission for the index case was suspected to be consumption of water from a private well.

Microbiological investigation
In 2001, a number of food and water samples epidemiologically linked to cases were examined for the presence of VTEC organisms but no positives isolates were found.

Phage typing of isolates revealed that as in previous years, the predominant type detected was PT 32 (table 3). The population of phage types was found to be more homogeneous than that seen in 2000 when although the majority of specimens were still PT 32, the following phage types were also detected viz., PT 2, 4, 8, 14, 21, 21/28, 31, 32, 38, and 39. In contrast in 1999, the only two phage types detected were PT 32 and PT 21/28.

Epidemiological investigation
Active investigation of many of the cases lead to the identification of further, previously undiagnosed VTEC cases. As a result of following up apparently sporadic cases, eleven family outbreaks and one generalised outbreak that occurred in a crèche were detected.

Descriptive epidemiological information was collected on cases in order to attempt to identify potential risk factors for exposure to VTEC. A number of suspect foods were reported by cases but as the majority of these were from sporadic cases it was impossible to epidemiologically link them. No cases reported consumption of unpasteurised milk or cheese.

Of 39 cases where information was collected on water source, the water supply was public in 27 (69%) cases, private well water in 11 (28%) cases, and from a group scheme in one case (3%). Contact with farm animals was reported in 10 (25%) cases (n=40).

Information on whether the case attended a crèche, or was an in-patient in a nursing home, hospital or other institutionalised setting, was also collected.
The index case attended a crèche in 7 cases. In a further 7 cases the index case attended a primary school. Three cases were identified as food handlers. One case was an in-patient in hospital when VTEC was detected. No cases attended a nursing home facility.

Non-O157 VTEC
There were four cases of confirmed VTEC O26 reported in 2001, three cases from the North Western Health Board and one from the Southern Health Board. All the cases were children and one attended a crèche. None of the cases developed HUS.

Discussion
Since the establishment of the NDSC Enhanced Surveillance system for VTEC O157 in 1999, we have been building up a picture of the epidemiology of this group of organisms in Ireland and comparing trends with other countries. The incidence rate in the Republic of Ireland in 2001 was 1.4 per 100,000 population compared to 1.45/100,000 in England & Wales and 4.6/100,000 in Scotland.

Undoubtedly, VTEC infections cause substantial morbidity and mortality. The severe complications that can be associated with infection, namely HUS in children and TPP in adults are associated with significant mortality. In 2001, in Ireland, 60% of cases reported symptoms of bloody diarrhoea and 8% of cases developed HUS.

Studies undertaken worldwide over the past number of years have revealed the full complexity and ecology of VTEC O157 infection. One notable feature has been the range of modes of transmission of this organism. Several modes of transmission from the animal reservoir have been demonstrated (food-, water-, environmental- and animal-person spread). In addition, person-to-person transmission has been demonstrated in households, crèches, hospitals and nursing homes. In particular the emergence of direct or indirect transmission from animal and/or the environment has been demonstrated. In Ireland, in 2001, 28% of cases reported drinking water from a private well and 25% of cases reported contact with farm animals in the period prior to onset of illness.

The notification of VTEC O26 cases again in 2001 highlights the importance of extending the enhanced surveillance system to non-O157 VTEC. A Working Group has been set up by a sub-committee of the NDSC Scientific Advisory Committee to review the clinical management and surveillance of VTEC infections in Ireland. It is hoped that one of the recommendations of this review will be to extend the current enhanced system to include all verotoxin-producing serogroups and also to commence surveillance of cases of HUS.

Acknowledgements
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References
1. Subcommittee of the PHLS Advisory Committee on Gastrointestinal Infections. (2000). Guidelines for the control of infection with Vero cytotoxins producing Escherichia coli (VTEC). *Commun Dis Pub Health* **3(1):** 14-23.