Epidemiology of Verotoxigenic *E. coli* O157 in Ireland, 2003

Patricia Garvey and Paul McKeown

National Disease Surveillance Centre
25-27 Middle Gardiner Street, Dublin 1, Ireland

Introduction

Verotoxigenic *E. coli* (VTEC) are so-called because of their ability to produce one or both of two verotoxins (VT1 and VT2). They cause a wide range of illnesses, from mild diarrhoea to haemorrhagic colitis with severe abdominal pain and bloody diarrhoea. Illness is usually self-limiting and resolves after about eight days. Historically 9% of symptomatic Irish cases have developed haemolytic uraemic syndrome (HUS), a form of renal failure (1). In children under 15 in Ireland, one in eight with confirmed VTEC O157 develop HUS (one in seven of symptomatic cases).

The primary reservoir is cattle, although VTEC have been isolated from a variety of healthy animal carriers including sheep, horses, goats and wild birds. While this organism was first recognized as a foodborne pathogen (the 'burger bug'), it is now known that it can also be transmitted through water, the environment and by direct contact with animal carriers. Person-to-person spread is important in households, crèches and institutions.

E. coli O157 is the most commonly reported VTEC in Ireland (1), the UK and the US, although other serogroups are capable of causing the same spectrum of illness, including O26, O111, O103 and O145. The Public Health Laboratory at Cherry Orchard Hospital, Dublin has provided an *E. coli* O157 and non-O157 diagnostic service for clinical and food samples, including *E. coli* serotyping and verotoxin detection. Phage typing for VTEC O157 is carried out at the Central Public Health Laboratory, Colindale, London.

Methods

This is the fifth year that NDSC, in co-operation with Directors of Public Health in each health board region, have operated the epidemiological surveillance system for VTEC O157. Details on how this system operates, and the case definitions used have been outlined in previous reports (1).

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 flagellar antigen 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 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

Eighty-six confirmed cases of VTEC O157 were reported to NDSC that had a date of onset of symptoms during 2003, an incidence rate of 2.1 per 100,000. The numbers of

confirmed cases and the crude incidence rates of VTEC O157 in Ireland from 1996-2003 are shown in table 1.

Table 1. Number of cases of confirmed VTEC O157 and crude incidence rate (95% CI) in Ireland, 1999-2003

Year	Numbers of cases (incl. non-residents [a])	Crude incidence rate[b] (95% CI) per 100,000 population
1999	51	1.4 (1.0-1.8)
2000	37(42)	0.9 (0.6-1.3)
2001	50 (52)	1.3 (0.9-1.6)
2002	68 (70)	1.7 (1.3-2.2)
2003	82 (86)	2.1 (1.6-2.6)

[a] Cases diagnosed/investigated in Ireland but who are not resident in Ireland

[b] Data from 1996 census was used to calculate the rate in 1999 while the 2002 census were used to calculate rates from 2000-2003, rates exclude non-residents.

Regional distribution

As in previous years, regional variation was noted in the numbers of cases reported (Table 2 and Figure 1), with the highest incidence rates this year in the South-Eastern, Midland, Southern and North-Western Health Boards.

Table 2. Number, crude incidence rate (CIR) and age-standardised incidence rate (ASIR) with 95% confidence intervals of confirmed cases of VTEC O157 by health board of residence, Ireland, 2003

Health Board	Number of cases (incl. non-residents)	CIR (95% CI) per 100,000	ASIR (95% CI) per 100,000
ERHA	12	0.9 (0.4-1.3)	0.9 (0.4-1.3)
MHB	8	3.5 (1.1-6.0)	3.4 (1.0-5.7)
MWHB	6 (8)	1.8 (0.4-3.2)	1.8 (0.4-3.2)
NEHB	1	0.3 (0.3-0.8)	0.3 (0.2-0.8)
NWHB	7	3.2 (0.8-5.5)	-*
SEHB	20 (21)	4.7 (2.7-6.8)	4.7 (2.7-6.8)
SHB	20	3.4 (1.9-5.0)	3.5 (1.9-5.0)
WHB	8 (9)	2.1 (0.6-3.6)	-*
Total	**82 (86)**	**2.1 (1.6-2.6)**	

All rates in this table exclude non-resident cases

*age was not reported for all cases in these health boards

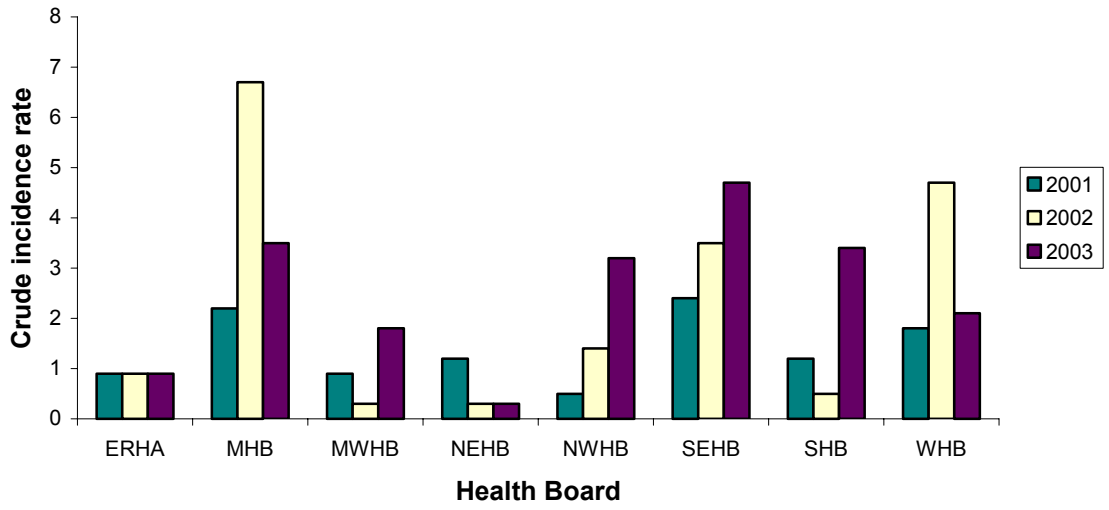

Figure 1: Crude incidence rate (CIR) of confirmed resident cases of VTEC O157 by health board of residence, Ireland, 2001-2003

Age-sex distribution

The highest incidence was recorded in young children (Figure 2), a trend also noted over the last few years. This was particularly pronounced among male cases. There was a slightly higher incidence among adult females than adult males.

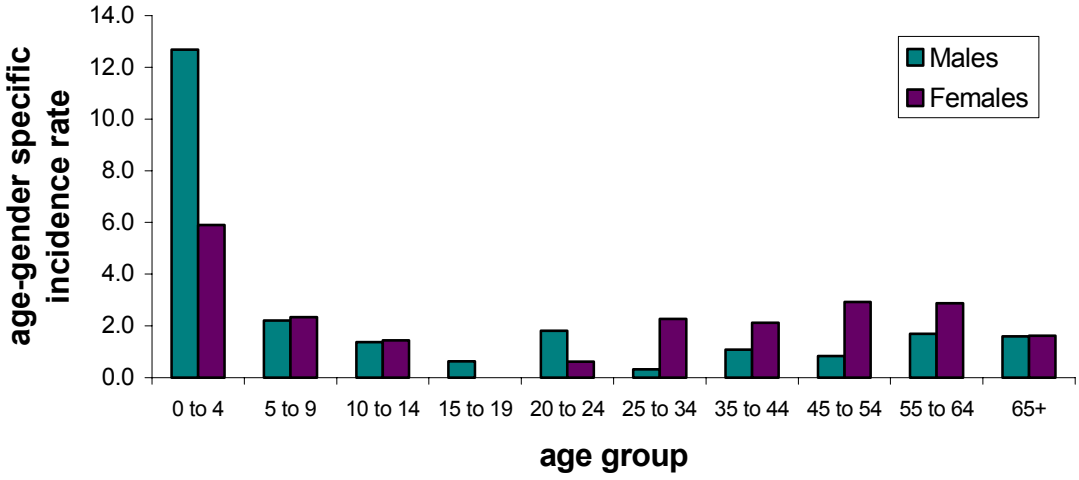

Figure 2. Age-specific incidence rate (per 100,000 population) of confirmed cases of VTEC O157, Ireland 2003

Clinical Features

In total, 68 out of the 86 confirmed cases (79%) were reported as symptomatic. Reported symptoms included: bloody diarrhoea in 31 cases (46%), and HUS in 4 cases (6%). Of the 4 cases of HUS, 3 occurred in children under 15 years of age and there was one adult case.

Seasonality of VTEC O157 cases
The largest number of cases in 2003 occurred in the third quarter, with a peak in August (Figure 3), very similar to the trend observed in 2002.

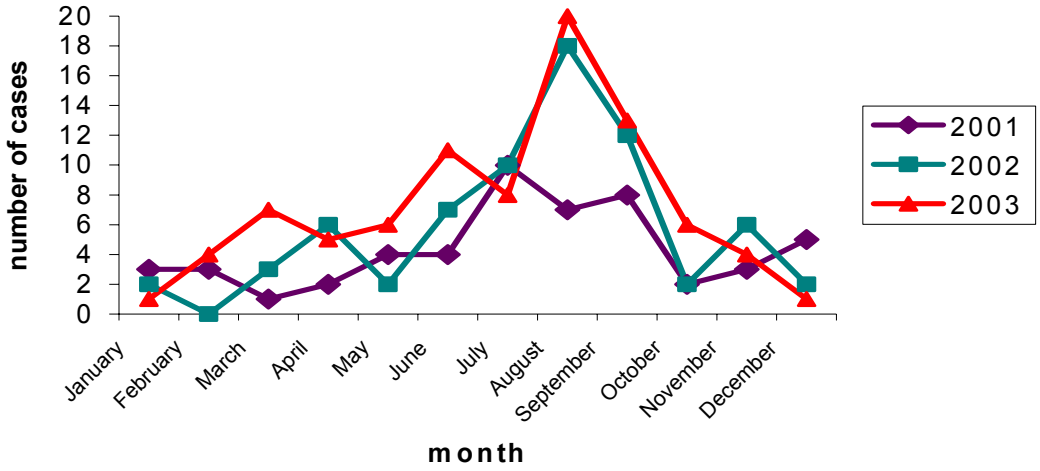

Figure 3. Confirmed cases of VTEC O157 by month of onset of symptoms, Ireland, 2001-2003

Travel-association
Eight cases were travel-associated. The countries visited within 14 days of onset of illness were Canary Islands (4), Italy (2), Austria/Germany (1) and Turkey (1).

Epidemiological Investigation
Two general outbreaks of VTEC O157 occurred during the summer of 2003 (3). Both were centred in hotel restaurants in the ERHA. Five confirmed, twelve probable and over 100 possible cases were reported in one outbreak; seven cases were hospitalised. Investigations found no relationship between any specific food or drink and the development of illness. In the second outbreak, 3 confirmed cases including one who developed HUS, and over 30 possible cases were reported; there were two hospital admissions. Similarly, the source of this outbreak was not established. Actions taken during both outbreaks included reviews of restaurant procedures and retraining of staff.

As a result of following up apparently sporadic cases in 2003, an additional 13 family/household outbreaks were detected by health board personnel among 36 confirmed cases but no links were confirmed with any food or water sources.

For six households served by private water supplies (comprising 10 confirmed cases), there was documented evidence of either coliforms or *E. coli* in the water supply. However, *E. coli* O157 was not detected in any instance.

Risk exposures
Descriptive epidemiological information was collected on all reported cases in an attempt to identify potential risk factors for exposure to VTEC. Three (3.5%) cases reported consumption of unpasteurised milk or cheese. Contact with farm animals was reported in

17 (20%) cases. Of 56 cases where information was collected on water source, the water supply was public in 36 (64%) cases, private well water in 17 (31%) cases, from a group scheme in 2 (3.6%) cases and recorded as other (not public and not well) in 1 (1.8%) cases.

Non-O157 VTEC

Non-O157 VTEC, in particular VTEC O26, remain a concern in Ireland. While the enhanced surveillance system did not routinely collect information on these subtypes in 2003, four confirmed cases of VTEC O26 (1 in SEHB, 2 in NWHB and 1 in MWHB) were reported to the surveillance system. Most importantly, one child developed HUS in 2003 as a consequence of infection with *E. coli* O26.

Discussion

The enhanced surveillance system for VTEC O157 has been operating for 5 years and provides valuable information on the epidemiology of VTEC O157 in Ireland. Eighty-six confirmed cases of VTEC O157 infection (2.1 per 100,000 population) were reported in Ireland in 2003, the highest annual number on record. This compares with provisional incidence rates of 3.12/100,000 in Northern Ireland (4), 2.93/100,000 in Scotland (Mary Locking SCIEH personal communication) and 1.3 in England and Wales (Sue Le Baigue, CDSC Colindale, personal communication) in 2003.

A further 4 cases of VTEC O26 were reported to the enhanced surveillance system, increasing the overall VTEC rate to 2.2 per 100,000. The potential for illness by non-O157 VTEC should not be overlooked; cases of VTEC O26 have been reported in Ireland every year since 1999.

A large proportion of cases in 2003 were reported in late summer with almost 48% per cent of cases having a date of onset between July and September. While a higher incidence during this time is a feature of VTEC infection, the particularly high rate in the summer of 2003 was in part influenced by the occurrence of 2 general outbreaks centred in the ERHA involving 8 cases, and in part by the reporting of 8 confirmed VTEC O157 cases with a date of onset in August from the SHB alone. The SHB cases included one family outbreak of 3 cases, and while geographical and temporal clustering was noted among 4 of the remaining 5 cases, no epidemiological links were identified and 4 different phage types were represented, making a general outbreak unlikely.

No sources or transmission routes were definitively identified for any of the VTEC cases reported in 2003 although person-to-person transmission is likely to have played some role in family/household outbreaks. In several case control studies internationally, contact with farm animals and farming environments has been shown to be a strong risk factor for VTEC infection among sporadic cases (5); 20% of cases here in 2003 reported contact with farm animals although it has not been demonstrated that this was the route in which infection occurred in these instances. In Ireland, there is increasing concern about the potential of water as a possible transmission route. Those who consume water from supplies other than public water supplies are over represented among VTEC cases. The

2002 census recently reported that 72% of persons in Ireland were served by public water supplies (6); only 64% of VTEC O157 cases in 2003 had public water supplies. Moreover, for a number of households served by private supplies, there was documented evidence of either coliforms or *E. coli* in their water supply, although *E. coli* O157 was not detected in any instance.

The importance of co-operation in surveillance at national and international level was demonstrated during epidemiological investigations of some of the VTEC cases reported here. A number of foreign tourists were involved in the 2 general outbreaks in Ireland in the summer of 2003. Some had travelled on to other regions of the country prior to diagnosis and some had even travelled home prior to diagnosis, necessitating international collaboration.

Significant changes have been made in 2004 in the reporting of cases of VTEC. Illness caused by enterohaemorrhagic *E. coli* (EHEC) became a notifiable disease on January 1st 2004. . Previously, VTEC were notified under the category of 'Food Poisoning (bacterial other than Salmonella)'. Under EHEC, all verotoxin positive *E. coli*, and *E. coli* of serogroups O157, O26, O111, O103, O145 regardless of whether verotoxin producers, are reported.

Patricia Garvey and Paul McKeown, NDSC

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