3.3 Verotoxigenic *E. coli*

Summary

Number of cases, 2010: 199
Number of cases, 2009: 241
Crude incidence rate, 2010: 4.7/100,000
Number of VTEC-Associated HUS 2010: 19

Introduction

Reported verotoxigenic *E. coli* (VTEC) incidence rates in Ireland have been rising steadily over the last five years, such that in 2008 and 2009, Ireland reported the highest VTEC incidence rate of any Member State in the European Union.[1, 2] In Ireland, infection has historically been most commonly associated with VTEC serogroup O157, with smaller numbers of non-O157 VTEC reported, although this may reflect diagnostic bias as the techniques for the detection of non-O157 VTEC are more complex than for VTEC O157, and different policies may exist in different laboratories for the routine examination of stool specimens.

The dominant transmission routes for VTEC in Ireland appear to be person-to-person spread, especially in creches/childminding facilities and among families with young children, and waterborne transmission associated with exposure to water from untreated or poorly treated private wells. Other important transmission routes identified internationally include food (often minced beef products or fresh produce such as lettuce and spinach), and contact with infected animals or contaminated environments.

Data Source and Methods

Infection due to Enterohaemorrhagic *E. coli* (EHEC) is a notifiable disease (S.I. 707 of 2003) since 2004. This chapter focuses on cases that conform to the case definition used for VTEC enhanced surveillance (http://www.ndsc.ie/hpsc/A-Z/Gastroenteric/VTEC/SurveillanceForms/).

Incidence

In 2010, there were 199 confirmed and probable cases of VTEC notified, equating to a crude incidence rate (CIR) of 4.7 per 100,000 (Table 1). If only confirmed VTEC cases are considered, the 197 cases (CIR=4.7 [4.0-5.3]) notified this year represent a 17% decrease overall on the number of confirmed cases notified in 2009. Non-O157 VTEC made up 41% of cases in 2010, however, and this overall change in VTEC case numbers was made up of a 30% decrease in the number of VTEC O157 cases and an 11% increase in non-O157 VTEC cases reported compared to 2009 (Figure 1).

Interesting in 2010 in Scotland, there was also a decrease in the VTEC O157 incidence rate to 4.1 per 100,000 (11% decrease) and in England and Wales, VTEC O157 case numbers fell by 23%. [3, 4] The CIR for VTEC overall of 4.7 per 100,000 population in Ireland, however, remains high relative to Europe [1,2]

Table 1. Number and crude incidence rates confirmed and probable VTEC, Ireland 2004-2010

Year	Confirmed cases	Probable cases	Total VTEC	CIR VTEC[a] (95% CI)
2004	61	0	61	1.4 (1.1-1.8)
2005	125	0	125	3.0 (2.4-3.5)
2006	153	5	158	3.7 (3.2-4.3)
2007	115	52	167	3.9 (3.3-4.5)
2008	213	13	226	5.3 (4.6-6.0)
2009	238	3	241	5.7 (5.0-6.4)
2010 [b]	197	2	199	4.7 (4.0-5.4)

[a] Data from the 2006 census were used to calculate rates
[b] Confirmed cases include 116 VTEC O157 cases, 67 VTEC O26 cases and 14 VTEC strains of other serogroups. Two probable cases were reported on the basis of being epidemiologically linked to laboratory confirmed cases (VTEC O157 in one instance and VTEC O121 in the second instance).

The reported VTEC incidence in 2009 at European community level was 0.7 VTEC cases per 100,000 population, with Denmark (2.90/100,000), Sweden (2.46/100,000) and the United Kingdom (2.19 per 100,000) reporting the next highest rates after Ireland.

Of 192 cases where information was available on symptoms, 147 (77%) were symptomatic, 75 (51%) of which developed bloody diarrhoea. Nineteen individuals (9.5%) developed HUS compared to 24 (10%) last year (21% decrease). And where reported, 42% of notified cases required hospitalisation (72/173).

The reduction of 21% in the VTEC-associated HUS numbers suggests that the decrease in the overall reported incidence of VTEC in 2010 was a true decrease.

Seasonal distribution

Typically, VTEC cases are most commonly associated with late summer; overall this year, 48% of cases were reported in quarter 3. However, the seasonal distribution varied by serogroup, with VTEC O26 being more common in quarter 2 while VTEC O157 remained more common in quarter 3. It is possible that the overall seasonal distribution noted previously was biased by the dominance of VTEC O157 in the national dataset, and that these variations in seasonal distribution by serogroup may reflect a seasonal difference in sources or transmission routes for different serotypes.

Regional distribution

Overall the highest VTEC incidence rates were reported in the HSE-MW and HSE-NW, where the rates were over twice the national crude rate (Table 2). As in previous years, the HSE-E reported the lowest overall crude incidence rate (Table 2), just over one quarter of the national rate this year. The crude incidence rate in the HSE-NE is also consistently low relative to other areas.

When the incidence by HSE-area is examined by serogroup, the incidence rate across HSE-areas for VTEC O157 is similar across six of the HSE-areas, with only HSE-E and HSE-NE showing lower incidence rates (Table 2 and Figure 3). The elevated overall incidence rates in the HSE-MW and HSE-NW were strongly influenced by their high reported incidence rates for non-O157 infections. Historically, the HSE-NW (and more recently the HSE-MW) have reported relatively high numbers of non-O157 VTEC infections. While it is possible that there is a true geographical difference in risk for different serogroups, it is likely that this regional variation in reported non-O157 VTEC incidence to some extent reflects regional differences in laboratory diagnostic practice for non-O157 infections.

Review of regional HUS incidence due to confirmed or probable VTEC infection gives a slightly different perspective on the relative importance of VTEC by region (Table 2 and Figure 3). The HSE-S reported the highest VTEC-associated HUS incidence rates in 2010, followed by HSE-M, HSE-MW and HSE-NW. The eastern part of Ireland including HSE-E, HSE-SE and HSE-NE displayed the lowest VTEC-associated HUS incidence rates.

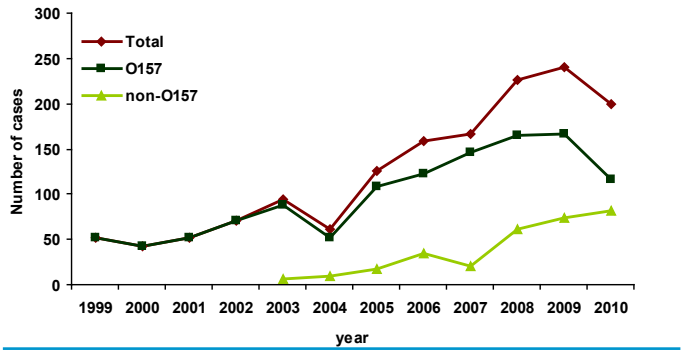

Figure 1. Annual number of confirmed and probable VTEC cases by serogroup, Ireland 1999-2010

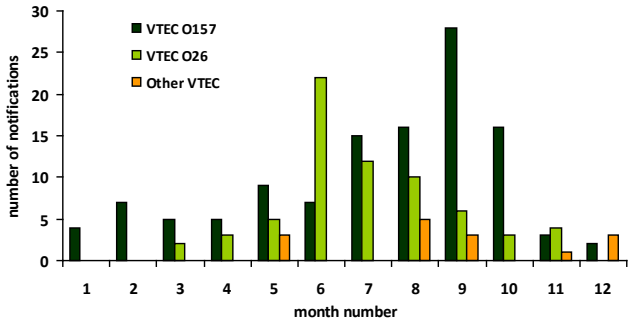

Figure 2. Seasonal distribution of VTEC cases by serogroup, Ireland 2010

Table 2. Number and crude incidence rate confirmed and probable VTEC by serogroup and HSE area, and number and crude incidence rate VTEC-associated HUS by HSE-area, Ireland 2010

HSE-area	Number [CIR (95% CI)] VTEC O157	Number [CIR (95% CI)] non-O157 VTEC	Number [CIR (95% CI)] all VTEC	Number [CIR (95% CI)] VTEC-associated HUS
East	11 [0.7 (0.3-1.2)]	7 [0.5 (0.1-0.8)]	**18 [1.2 (0.7-1.8)]**	3 [0.2 (-0.0-0.4)]
Midlands	11 [4.4 (1.8-7.0)]	6 [2.4 (0.5-4.3)]	**17 [6.8 (3.5-10.0)]**	2 [0.8 (-0.3-1.9)]
Mid-West	13 [3.6 (1.6-5.6)]	26 [7.2 (4.4-10.0)]	**39 [10.8 (7.4-14.2)]**	3 [0.8 (-0.1-1.8)]
North-East	7 [1.8 (0.5-3.1)]	1 [0.3 (-0.2-0.8)]	**8 [2.0 (0.6-3.4)]**	1 [0.3 (-0.2-0.8)]
North-West	9 [3.8 (1.3-6.3)]	25 [10.5 (6.4-14.7)]	**34 [14.3 (9.5-19.2)]**	2 [0.8 (-0.3-2.0)]
South-East	17 [3.7 (1.9-5.4)]	0 [0.0 (0.0-0.0)]	**17 [3.7 (1.9-5.4)]**	0 [0.0 (0.0-0.0)]
South	30 [4.8 (3.1-6.6)]	10 [1.6 (0.6-2.6)]	**40 [6.4 (4.4-8.4)]**	6 [1.0 (0.2-1.7)]
West	19 [4.6 (2.5-6.7)]	7 [1.7 (0.4-2.9)]	**26 [6.3 (3.9-8.7)]**	2 [0.5 (-0.2-1.2)]
Ireland	117 [2.8 (2.3-3.3)]	82 [1.9(1.5-2.4)]	**199 [4.7 (4.0-5.4)]**	19 {0.5 (0.3-0.7)]

*Rates per 100,000 calculated using CSO census 2006 for denominator data

VTEC typing

In 2010, all isolates from the 197 confirmed VTEC cases were referred to the HSE PHL Dublin Mid Leinster, Cherry Orchard Hospital and their serotype and verotoxin profiles are displayed in Table 3. As usual among VTEC O157 in Ireland, isolates containing the genes for verotoxin 2 (*vt2*) were more common (86%) than isolates containing both *vt1* and *vt2*. VTEC O26 isolates containing only *vt1* made up 55% of all VTEC O26 reported, with 36% of VTEC O26 containing the genes for both *vt1* and *vt2*.

HUS cases in 2010 were associated with VTEC O157 isolates containing *vt2* or both *vt1* and *vt2*, and with VTEC O26 containing *vt2 or* both *vt1* and *vt2*, but not with any of the VTEC O26 strains containing *vt1* alone.

In 2010, the DML-PHL at Cherry Orchard introduced a new more highly discriminatory typing service whereby all human VTEC isolates were routinely typed by pulsed field gel electrophoresis (PFGE) rather than referred to the Health Protection Agency laboratory in the United Kingdom for phage typing. This confirmed that no large undetected clusters/outbreaks occurred among laboratory confirmed VTEC cases in Ireland in 2010. On a small number of occasions, indistinguishable isolates were identified among pairs of cases reported as sporadic (and sometimes between a family cluster and another case reported as sporadic). On these occasions, the HSE PH departments were informed and review of case histories undertaken, however, no epidemiological evidence of links were uncovered on any of these occasions.

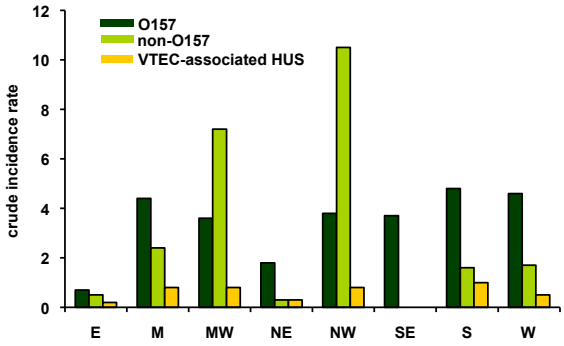

Figure 3: Crude incidence rate VTEC O157, non-O157, and VTEC-associated HUS by HSE-area, Ireland 2010

Risk factors

Under enhanced surveillance for VTEC, risk factor information is routinely collected on VTEC notifications (Table 4).

Among VTEC cases in Ireland in 2010, exposure to farm animals or their faeces and exposure to private well water were common among cases; 52.4% and 42.9% reported these exposures respectively. This is consistent with the low incidence of VTEC infection among residents in the largely urban HSE-E population and the higher incidence recorded in more rural parts of the country.

Unlike salmonellosis, foreign travel plays only a minor role in VTEC infection in Ireland, with the majority of infections acquired indigenously. The countries where the small number of travel-associated Irish VTEC cases had travelled to during their potential incubation periods were Bulgaria, Cyprus, Sri Lanka and United Kingdom (n=2).

Table 3. Serotype and verotoxin (VT) profiles for VTEC isolates as determined at the PHL HSE Dublin Mid Leinster, Cherry Orchard Hospital in 2010 by HUS status as recorded on CIDR

Strain		HUS [a]	Non-HUS [a]	Unknown	Total
O157	**VT1 + VT2**	1	14	2	**17**
	VT2	11	86	3	**100**
O26	**VT1**		35	1	**36**
	VT1 + VT2	4	19	1	**24**
	VT2	2	4		**6**
Other –non O157 VTEC	**VT1**		6		**6**
	VT1 + VT2		6		**6**
	VT2		2		**2**
Total		**18**	**172**	**7**	**197**

[a] One HUS and one non-HUS case in 2010 were reported on the basis of being epidemiologically linked to laboratory confirmed cases, and thus no isolates were available for inclusion in this table

Table 4. Number of cases (and percentage where information received) for which specified risk factor was reported, Ireland 2010

Risk factor	Number 'Yes' and % where reported	Number 'No' and % where reported	Number where risk factor was unknown or not reported
Food suspected	19 (12.2%)	137 (87.8%)	43
Exposure to farm animals or their faeces	97 (52.4%)	88 (47.6%)	14
Exposure to private well water[a]	73 (42.9%)	97 (57.1%)	29
Foreign travel	6 (3.3%)	176 (96.7%)	17

[a]This is a composite variable recoded from two different water supply exposure variables in CIDR

For the 19 cases where food was suspected as the cause of illness, burgers and other minced beef products were listed as suspected for seven cases, sausages were listed for three cases, and other meat products and foods for five cases. Where tested, no foods were found positive for the VTEC strains implicated in the human cases, although one raw sausage product tested was found positive for an unrelated VTEC O8 strain.

Outbreak and environmental investigations

Forty-five VTEC outbreaks were notified in 2010, which included 103 of the 199 VTEC notifications. The majority of outbreaks (96%) were family outbreaks with only two general outbreaks notified. Both general outbreaks involved private households and childcare arrangements/creche facilities: five persons in total were reported ill between these two outbreaks. One general outbreak was reported as being due to person-to-person spread while the transmission route for the second general outbreak was reported as unknown.

Twenty-four outbreaks (53%) were caused by VTEC O157, sixteen (36%) by VTEC O26, four (9%) by other non-O157 and one (2%) was caused by a mixture of VTEC strains. The suspected modes of transmission reported are listed in table 5.

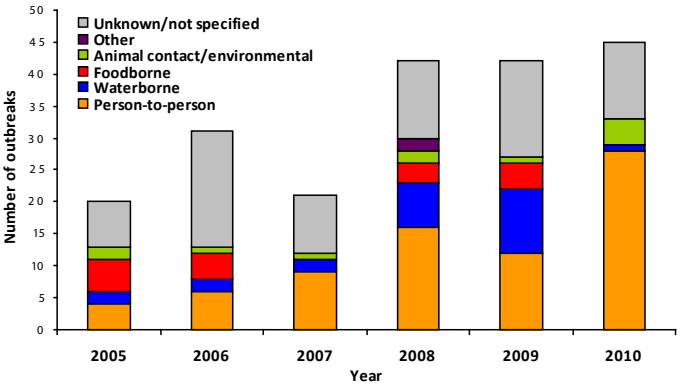

Figure 4. Number of VTEC outbreaks by suspected transmission route and year, Ireland 2004-2010

Note: In this figure, reported transmission routes were grouped for simplicity. Any outbreak where food was suspected to have contributed was reported as foodborne, any outbreak where water was suspected to have contributed was reported as waterborne, any outbreak where animal contact was suspected to have contributed was reported as Animal contact. Person-to-person outbreaks include only those outbreaks reported as being due only to person-to-person transmission.

Table 5. VTEC outbreaks in Ireland 2010 by suspected mode of transmission

Suspected mode of transmission	Number of outbreaks	Number ill	Number confirmed cases
Animal contact	2	3	4
Person-to-person & animal contact	2	3	4
Person-to-person	27	60	58
Person-to-person & airborne	1	2	2
Waterborne	1	1	2
Unknown/Not specified	12	30	33
Total	45	99	103

Person-to-person spread is an important mode of VTEC transmission particularly between young children, and was suspected to have played a role in 30 (67%) VTEC outbreaks in 2010 in which 65 persons were reported ill.

Unusually, the second most common transmission route reported for VTEC outbreaks in 2010 was animal contact, which was reported to have contributed to four outbreaks (9%).

Unlike previous years, when exposure to private well water was a commonly reported transmission route (Figure 4) , there was only one VTEC outbreak reported as waterborne in 2010 (Figure 4). This family outbreak was reported associated with an untreated private well. No VTEC organisms were identified in the suspected water supply.

Separately, a family outbreak of two VTEC cases was reported to the United Kingdoms' outbreak reporting system comprising two UK residents who had returned home following a visit to Ireland. Follow-up investigation by the HSE-E showed the outbreak also to be waterborne. A private well water sample taken from a premises at which they had stayed was found positive at the DML-PHL for a VTEC strain indistinguishable from one of their infections.

Unlike previous years, no foodborne VTEC outbreaks were reported in 2010 (Figure 4). But for over one quarter (n=12) of VTEC outbreaks, the transmission route was reported as unknown.

In 2010, one sporadic VTEC case was reported in a laboratory worker who had exposure to VTEC during the course of their work.

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