

## 3.3 Verotoxigenic *E. coli*

### Summary

Number of cases, 2009: 241  
 Number of cases, 2008: 226  
 Crude incidence rate, 2009: 5.7/100,000

Reported verotoxigenic *E. coli* (VTEC) incidence rates in Ireland have been rising steadily over the last five years, such that in 2008, Ireland reported the highest VTEC incidence rate of any Member State in the European Union.<sup>1</sup> The dominant transmission routes for VTEC in Ireland appear to be person-to-person spread and waterborne transmission associated with exposure to water from untreated or poorly treated private wells.<sup>2,3,4</sup> Other important transmission routes identified internationally include food, and contact with infected animals or contaminated environments.<sup>5</sup> Full details on how surveillance of VTEC is conducted in Ireland are available at <http://ndsc.newsweaver.ie/a3xarrpcw5bqkeph6tk9uv?email=true>

### Incidence

In 2009, there were 241 confirmed and probable cases of VTEC notified, equating to a crude incidence rate (CIR) of 5.7 per 100,000 (table 1). If only confirmed VTEC cases are considered, the 238 confirmed cases (CIR=5.6 [4.9-6.3]) notified this year represent a 12%

increase on the number of confirmed cases notified in 2008. Non-O157 VTEC made up 31% of cases in 2009.

One additional (HUS) case was reported as a suspected VTEC case.

### Regional and seasonal distribution

The highest crude incidence rates for VTEC overall this year were reported in the HSE-MW and HSE-NW, where the rates were almost twice the national crude rate. As in previous years, the HSE-E reported the lowest overall crude incidence rate (Table 2), one third of the national rate this year. The crude incidence rate in the HSE-NE was also low this year.

Historically, the HSE-NW has reported relatively high numbers of VTEC O26, and this year almost three-quarters of VTEC cases in the NW were associated with serogroup O26. While it is possible that there is a true geographical difference in risk for different serogroups, it is also possible that regional variation in the serogroup-specific incidence to some extent reflects regional differences in laboratory diagnostic practice for non-O157 infections.

Typically, VTEC cases are most commonly associated with late summer; overall this year, almost 40% of cases were reported in quarter 3, although this varied by HSE-

Table 1. Number and crude incidence rates confirmed and probable VTEC, Ireland 2004-2009

Year	Confirmed cases	Probable cases	Total VTEC	CIR VTEC <sup>a</sup> (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 <sup>b</sup>	238	3	241	5.7 (5.0-6.4)

<sup>a</sup>Data from the 2006 census were used to calculate rates

<sup>b</sup>Confirmed cases include 167 VTEC O157 cases, 45 VTEC O26 cases and 26 VTEC strains of other serogroups. Three probable cases were reported on the basis of detection of verotoxin genes without isolation of the implicated strain (all Ungroupable strains).

area with the HSE-MW and HSE-NW reporting their highest incidence in quarter 4 and the HSE-W reporting their highest number of cases in quarter 2 (Table 2).

### Age-sex distribution

The reported disease incidence was highest among young children (median age =6 years), which is consistent with previous years. While there were roughly equal numbers of male and female cases, there were more females reported this year among adult cases and more males in younger age groups.

### Severity of illness and clinical features

154 notified cases were reported as symptomatic, 71% of the cases for whom this information was available (n=218). Reported symptoms included bloody diarrhoea in 76 cases (39%), and HUS in 24 cases (11%). Ninety VTEC cases were admitted to hospital in 2009 (37%), and an adult male in his sixties died due to VTEC infection.

Of the 24 HUS cases, twenty were paediatric HUS cases and there were four adult HUS cases. Thirteen (54%) of the 24 HUS cases were infected with VTEC O157 strains, five (21%) were infected with VTEC O26, two (8%) with VTEC O145, two (8%) with Ungroupable VTEC strains, and one (4%) each with VTEC O5 and VTEC O78 strains. The additional HUS case reported as a suspected VTEC case was a young child from whom a verotoxin-negative strain of *E. coli* O111 was cultured. *E. coli* O111 is one of the serogroups listed by the World Health Organisation as being frequently associated with HUS.<sup>6</sup> It is possible that during the course of the patients' illness that the strain had lost its' verotoxin genes. The loss of verotoxin genes during infection among HUS patients has been previously documented by Schimmer *et al* (2008) and Bielaszewska *et al* (2007).<sup>7,8</sup>

The year 2009 had the highest annual number of non-O157 VTEC-associated HUS cases notified since VTEC surveillance was extended to include all VTEC strains in 2003, and the highest overall annual number of confirmed or probable VTEC-associated HUS cases since that time.

### VTEC typing

In 2009, 238 human VTEC isolates were confirmed and typed at the HSE PHL Dublin Mid Leinster, Cherry Orchard Hospital (Table 3). In addition, laboratory findings are included in Table 5 from three probable VTEC cases identified on the basis of detection of verotoxin genes in the absence of obtaining an isolate.

As in previous years, PT32 was the commonest phage type (PT) reported among VTEC O157 strains (96/167), accounting for 57% of the confirmed VTEC O157 reported. Other common phage types in 2008 were PT21/28 (n=13), PT8 (n=11), PT31 (n=12) and RDNC (n=9) –Table 3. Two sorbitol-fermenting VTEC O157 were reported, one each PT31 and RDNC. All phage typing was undertaken at the HPA Laboratory of Enteric Pathogens (LEP), Colindale, UK

The verotoxin (VT) profiles of VTEC O157 strains were similar to those reported historically for human isolates in Ireland (Table 3). Eighty-nine per cent of VTEC O157 strains carried the genes for VT2 only while 11% carried the genes for both VT1 and VT2. In contrast, 38% of non-O157 VTEC isolates carried the genes for VT1 only, 26% for VT2 only, and 36% VT1 and VT2.

There are new developments in the National VTEC Service provided at the DML-PHL in Cherry Orchard in relation to VTEC typing from 2010. Phage typing data will no longer be provided and the DML-PHL in Cherry Orchard will instead undertake timely molecular typing (i.e. pulsed field gel electrophoresis (PFGE)) of all human VTEC isolates, as this provides greater discrimination between isolates than phage typing, allowing more timely public health decision-making and intervention in the event of outbreaks.

### Country of infection

At least seven VTEC cases (2.9%) in 2009 were considered to be foreign travel-associated. The countries of infection reported were France (n=2), Spain (n=2), Nigeria (n=1), Turkey (n=1) and Egypt (n=1). The overwhelming majority of infections in 2009 were as usual acquired in Ireland.

Table 2. Number and crude incidence rate of confirmed and probable VTEC by quarter and HSE area, Ireland 2009

Quarter	E	M	MW	NE	NW	SE	S	W	Total
Q1	0	4	5	0	2	1	1	2	15
Q2	8	5	8	1	8	5	15	12	62
Q3	12	11	12	5	6	19	25	5	95
Q4	8	0	15	2	10	9	15	10	69
VTEC O157	14	19	29	7	6	28	38	26	167
VTEC O26	7	1	5	1	19	3	6	3	45
Other VTEC	7	0	6	0	1	3	12	0	29
Total	28	20	40	8	26	34	56	29	241
CIR VTEC* (95% CI)	1.9 (1.2- 2.6)	8.0 (4.5- 11.4)	11.1 (7.7- 14.5)	2.0 (0.6- 3.4)	11.0 (6.8- 15.2)	7.4 (4.9- 9.9)	9.0 (6.7- 11.4)	7.0 (4.5- 9.6)	5.7 (5.0-6.4)

\*Rates calculated using CSO census 2006

## Outbreak and environmental investigations

Forty-two VTEC outbreaks were notified in 2009, which included 115 of the 238 confirmed cases notified. Six outbreaks were described as general outbreaks and 36 as family outbreaks. Two general outbreaks occurred in childminding facilities and one general outbreak was suspected to be linked to a food outlet. The remaining three occurred in private houses, and in two instances included either the families' childminder or another child who was minded in that home.

Twenty-seven outbreaks (64%) were caused by VTEC O157, eight (19%) caused by VTEC O26, three (7%) by other non-O157 and four (10%) were caused by a mixture of VTEC strains. The suspected modes of transmission reported are listed in table 4.

Person-to-person spread is an important mode of VTEC transmission particularly between young children,

and was suspected to have played a role in 16 VTEC outbreaks in 2009 in which 35 persons were reported ill. These included the two outbreaks associated with childminding facilities mentioned above.

The second most common transmission route reported for outbreaks in 2009 was waterborne, with drinking water believed to have contributed to 12 outbreaks. For three family outbreaks, there was definitive microbiological evidence implicating their drinking water supply in transmission. These included two outbreaks where household private wells were implicated and one outbreak where a group water scheme was contaminated. Examination of water in all three outbreaks confirmed the presence of the same VTEC strain in the water as was identified in some or all of the associated patients in each of the outbreaks. For one further outbreak, although the VTEC strain identified in water from the household

Table 3. Verotoxin (VT) and phage typing (PT) results for VTEC referred to the PHL HSE Dublin Mid Leinster, Cherry Orchard Hospital in 2009

Serogroup	PT <sup>c</sup>	VT1 only	VT2 only	VT1 & VT2	VT type not reported	Total	
O157	1			1		1	
	2		3			3	
	8		1	10		11	
	14		6	1		7	
	31		12			12	
	32		95	1		96	
	49		1			1	
	51		2			2	
	54				1	1	
	63		1			1	
	21/28			13		13	
	RDNC <sup>b</sup>			7	2		9
	Untypable			1			1
N/K			6	2	1	9	
O26	-	19	3	23		45	
O Ungroupable <sup>a</sup>	-	2	7	4		13	
O145	-		4			4	
O103	-	3				3	
O105ac	-		3			3	
O128	-	1				1	
O21	-		1			1	
O3	-	1				1	
O5	-	1				1	
O55	-	1				1	
O78	-		1			1	
<b>Total</b>		<b>28</b>	<b>167</b>	<b>45</b>	<b>1</b>	<b>241</b>	

<sup>a</sup>Includes information on laboratory findings from 3 probable cases identified on the basis of detection of vt genes in the absence of obtaining an isolate.

<sup>b</sup> RDNC –reacts but does not conform to a designated phage type.

<sup>c</sup>All phage typing was undertaken at the HPA Laboratory of Enteric Pathogens (LEP), Colindale, UK

Table 4. VTEC outbreaks in Ireland 2009 by suspected mode of transmission

Suspected mode of transmission	Number of outbreaks	Number ill	Number confirmed cases
Animal contact	1	4	4
Foodborne	1	1	3
Foodborne/waterborne	2	6	6
Person-to-person	11	26	32
Person-to-person & foodborne	2	4	4
Person-to-person & waterborne	3	5	9
Waterborne	7	14	19
Unknown/Not specified	15	34	38
<b>Total</b>	<b>42</b>	<b>94</b>	<b>115</b>

private well was not identical to the strain detected in the associated cases, the detection of VTEC in their drinking water was strongly suggestive that their private well was responsible for their infections. For seven further outbreaks, evidence implicating water as the transmission route was circumstantial in that *E. coli* and/or coliforms were detected in the suspected water samples. These included outbreaks where household private wells (n=5) and group water schemes (n=2) were suspected. No water result was available for the private well suspected in the remaining outbreak.

In addition for four sporadic VTEC cases, environmental investigations identified VTEC of the same type in private household well samples as was found in the associated cases. In total, these reported waterborne incidents (outbreaks and sporadic cases) gave rise to 39 VTEC cases, four of whom developed HUS. Drinking water from untreated/inadequately treated private water supplies remains a very important risk factor for VTEC infection in Ireland.

Food was reported as a suspected transmission route in five outbreaks with 11 persons ill (Table 4). No definitive evidence was reported implicating any specific food. And animal contact was reported as the suspected transmission route for one outbreak with four persons ill. For one third of VTEC outbreaks, no suspected transmission route was reported.

### Seasonal distribution of VTEC cases and private well water supply exposure data

As in previous years, the highest number of VTEC cases was reported between July and September, with an additional smaller peak this year in incidence in November (Table 5)

Among the enhanced data collected on VTEC cases is information on water supply exposures. In 2009, 90 VTEC cases (37% of cases) reported exposure to private well water prior to onset of their illness (Table 5). The number and proportion of cases reporting this exposure was highest in the months of July and November [18 cases (66.7%) and 17 cases (63.0%), respectively]. Annual rainfall totals in Ireland in 2009 were well above normal, with the summer period being extremely wet and with November being the wettest November on record since records began at many weather stations in Ireland.<sup>9</sup> Thus there may be a correlation between the incidence of VTEC disease that might be due

to exposure to private well water and rainfall. This suggests that private wells can be vulnerable during times of high rainfall and that householders who have private wells should be vigilant for changes in their water quality during periods of high rainfall.

### References

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Table 5. Number and percentage of VTEC cases exposed to private well water during incubation period by month of notification, Ireland 2009

Exposed to private well?	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Yes			4	5	5	6	18	10	10	5	17	10	90
No	3	1	1	10	14	9	5	12	24	8	7	8	102
Unknown	2		4	6	4	3	4	2	10	3	3	8	49
<b>Grand Total</b>	<b>5</b>	<b>1</b>	<b>9</b>	<b>21</b>	<b>23</b>	<b>18</b>	<b>27</b>	<b>24</b>	<b>44</b>	<b>16</b>	<b>27</b>	<b>26</b>	<b>241</b>
% exposed to private well	0.0%	0.0%	44.4%	23.8%	21.7%	33.3%	66.7%	41.7%	22.7%	31.3%	63.0%	38.5%	37.3%