# The Epidemiology of Verocytotoxigenic *E. coli* in Ireland, 2005

**Key points:**

- **In 2005, there were 125 cases of VTEC reported, 32% higher than the number reported in 2003 (the highest year prior to this) and over twice the number reported in 2004**
- **Increasing numbers of cases of non-O157 are reported (17 this year), possibly reflecting increased awareness of non-O157 VTEC and improved diagnosis and reporting**
- **High numbers of VTEC-confirmed HUS cases were reported in 2005 -17 HUS cases versus 4-6 per annum in the years 2001-2004, demonstrating the benefits of thorough microbiological investigation of HUS cases**
- **Private water supplies again raise concern as the MW report a large outbreak (18 confirmed cases) that was linked with a private group water scheme**

***Introduction***

Verotoxigenic *E. coli* (VTEC) are so-called because of their ability to produce one or both of two verotoxins (VT1 and VT2). They are an important cause of gastroenteric illness because of the severity of illness they can cause and in the requirement for prompt public health action to prevent further transmission. About 9% of cases develop haemolytic uraemic syndrome (HUS), a life-threatening complication. *E. coli* O157 was the first *E. coli* serogroup to be associated with this distinctive illness. Additional VT-producing serogroups frequently reported include O26, O111, O103 and O145. Infection can be transmitted through food, contaminated water, the environment and by direct contact with animal carriers. Person-to-person spread is an important mode of transmission in households, child-care facilities and institutions.

***Data sources and methods***

Enhanced information on notified VTEC cases was supplied as in previous years by HSE personnel, and typing data were provided by the Public Health Laboratory HSE Dublin Mid Leinster at Cherry Orchard Hospital which offers specialist diagnostic and typing services for VTEC. Although not notifiable, clinicians were also requested to report suspected cases of VTEC, i.e. cases of HUS or TTP of possible infective aetiology, for which there was no laboratory or epidemiological evidence of VTEC infection.

***Results***

In 2005, 125 confirmed cases of VTEC were notified to HPSC, a crude incidence rate (CIR) of 3.2 per 100,000 (table 1). There were 108 cases of VTEC O157 (2.8/100,000), 12 VTEC O26,

*Table 1. Number and crude incidence rates confirmed VTEC and VTEC O157 infection, Ireland 2001-2005*

| Year | Nos. of VTEC O157 cases | CIR VTEC O157* (95% CI) | Number VTEC ‡ cases | CIR VTEC* (95% CI) |
|---|---|---|---|---|
| 2001 | 52 | 1.3 (0.9-1.6) | N/A | N/A |
| 2002 | 70 | 1.7 (1.3-2.2) | N/A | N/A |
| 2003 | 88 | 2.2 (1.8-2.7) | 95 | 2.4 (1.9-2.9) |
| 2004 | 52 | 1.3 (1.0-1.7) | 61 | 1.6 (1.2-2.0) |
| 2005 | 108 | 2.8 (2.3-3.3) | 125 | 3.2 (2.6-3.8) |

* Data from the 2002 census were used to calculate rates
‡ Includes serogroup O157

*Table 2. Number of confirmed VTEC cases by quarter and HSE area, CIR and age-standardised incidence rate (ASIR) by HSE area, Ireland 2005*

| Quarter | E | M | MW | NE | NW | SE | S | W | Total |
|---|---|---|---|---|---|---|---|---|---|
| Q1 | 2 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 6 |
| Q2 | 5 | 1 | 1 | 1 | 3 | 3 | 2 | 3 | 19 |
| Q3 | 15 | 7 | 4 | 2 | 2 | 10 | 6 | 4 | 50 |
| Q4 | 13 | 3 | 21 | 4 | 0 | 2 | 1 | 6 | 50 |
| **Total** | **35** | **12** | **26** | **7** | **5** | **16** | **10** | **14** | **125** |
| CIR (95% CI) | 2.5 (1.7-3.3) | 5.3 (2.3-8.3) | 7.7 (4.8-10.6) | 2.0 (0.5-3.5) | 2.3 (0.3-4.3) | 3.8 (1.9-5.7) | 1.7 (0.6-2.8) | 3.7 (1.8-5.6) | **3.2 (2.6-3.8)** |
| ASIR (95% CI) | 2.5 (1.7-3.4) | 5.0 (2.2-7.8) | 7.7 (4.7-10.6) | 2.0 (0.5-3.6) | 2.2 (0.3-4.1) | 3.7 (1.9-5.5) | 1.7 (0.7-2.8) | 3.7 (1.7-5.6) | - - |

*Table 3. Confirmed VTEC cases by method of laboratory confirmation, Ireland 2005.*

| | HUS | Non-HUS | Total |
|---|---|---|---|
| Isolation of NSF VTEC O157 | 9 | 94 | 103 |
| Isolation of SF VTEC O157 | 2 | 1 | 3 |
| Serodiagnosed as *E. coli* O157 | 2 | 0 | 2 |
| Isolation of non-O157 VTEC | 4 | 13 | 17 |
| Total | 17 | 108 | 125 |

two VTEC O ungroupable, and one each of VTEC O152, O21 and O123. In addition, five HUS cases were reported as suspected VTEC cases which are not included in the following analyses.

### *Regional and seasonal distribution*

Regional variation was noted in the numbers of cases reported (table 2), with the highest incidence rates in the HSE-MW and HSE-M. A single outbreak was largely responsible for the atypically high incidence in the HSE-MW, while three small family outbreaks accounted for 8 of the 12 cases in the HSE-M[1]. In the HSE-ER in 2005, the number of VTEC cases was almost 3-fold higher than reported in previous years (35 cases in 2005 versus 12 cases in each year 2002-2004)[2]. Seven of these cases were non-O157 VTEC. Non-O157 VTEC were widely distributed throughout the country with cases reported from 7 of the 8 HSE areas. Large numbers of VTEC cases were notified in quarter 3, and atypically also in quarter 4, in particular in November (table 2).

### *Age-sex distribution*

The highest incidence was recorded in young children, which is consistent with previous years (Figure 1). There were similar numbers of male (n=65) and female (n=59) cases. As in 2004, a higher proportion of VTEC infections notified in persons less than 5 years were due to non-O157 VTEC (10/50) than for other older groups (7/75), possibly reflecting the likelihood that children less than 5 years are tested for non-O157 VTEC more often than older patients.

### *Clinical features*

Information on symptoms was available for 117 cases, of whom 87 (74%) were reported as symptomatic. Reported symptoms included bloody diarrhoea in 53 cases, and HUS in 17 cases. HUS cases ranged from 8 months to 68 years, and as in previous years, a higher proportion of paediatric (13/70) than adult (4/55) cases developed HUS. Notably, four HUS cases were caused by non-O157 VTEC -three by VTEC O26 and one by VTEC O21.

### *Travel-association*

Nine infections were travel-associated. The countries visited within the potential incubation period were Spain (2), Greece (2), UK (1), Croatia (1), Hungary (1), Belgium (1) and Turkey (1), reflecting to some extent the frequency of travel by Irish residents to these destinations.

### *Microbiology*

Among the 108 VTEC O157 infections reported, typical non-sorbitol fermenting (NSF) VTEC O157 were isolated from 103 cases, sorbitol-fermenting (SF) VTEC O157 from three cases, and two confirmed *E. coli* O157 cases were diagnosed by serodiagnosis alone. All 17 non-O157 VTEC cases were culture confirmed. Table 3 showed the number of HUS and non-HUS cases by method of laboratory confirmation.

Table 4 shows the phage types of the VTEC O157 strains isolated in 2005. As in previous years, PT32 was the commonest phage type reported, accounting for 56% of the VTEC O157 reported.

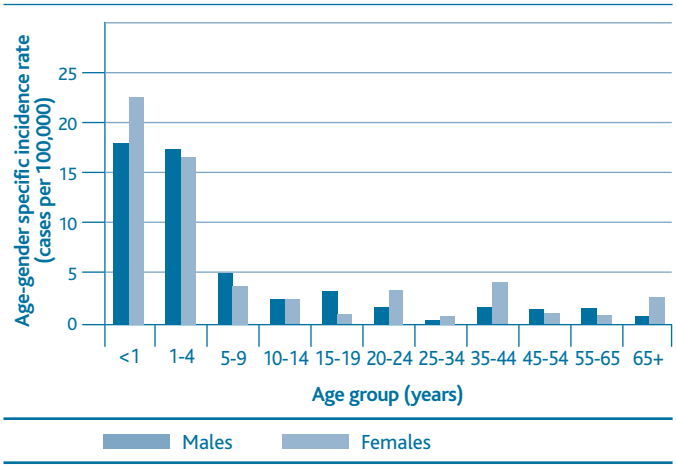


*Figure 1. Age-specific incidence rate (per 100,000 population) of confirmed cases of VTEC, Ireland 2005*

*Table 4 Phage Types of VTEC O157 isolates referred to the PHL HSE Dublin Mid Leinster, Cherry Orchard Hospital in 2005*

| Phage type | Number (%) |
|---|---|
| PT32 | 59 (56%) |
| PT21/28 | 13 (12%) |
| PT8 | 12 (11%) |
| PT31 | 6 (6%) |
| PT4 | 4 (4%) |
| PT14 | 4 (4%) |
| PT88 | 3 (3%) |
| PT1 | 1 (1%) |
| RDNC | 1 (1%) |
| PT51 | 1 (1%) |
| PT49 | 1 (1%) |
| PT54 | 1 (1%) |
| Total | 106 (100%) |

Note that 2 E. coli O157 infections were diagnosed by serodiagnosis and thus isolates were not available for typing.

In 2005, 89% of VTEC O157 strains carried the genes for VT2 only while 11% carried the genes for both VT1 and VT2 (table 5). In contrast, 41% of non-O157 VTEC isolates carried the genes for VT1 only, 12% for VT2 only, and 47% VT1 and VT2.

***Outbreak investigations***

In 2005, 19 outbreaks were reported, comprising 65 of the 125 confirmed cases reported. Four outbreaks were described as general outbreaks and 15 as family outbreaks. Seventeen were due to VTEC O157 and two to VTEC O26. The suspected modes of transmission reported are listed in table 6.

The most significant VTEC O157 outbreak in Ireland in 2005 occurred in the MW in October/November 2005.[1] Nine people were reported ill, including 2 children who developed HUS. A further nine asymptomatic contacts were confirmed as being infected with the outbreak strain and two persons with non-O157 VTEC strains. All cases recovered. This was the largest VTEC outbreak reported in Ireland to date. No food or water samples tested positive for VTEC, but results from a case-control study indicated that potential exposure to drinking water from a vulnerable local private group water scheme was a risk. The implicated GWS drew water from areas of agricultural land with close proximity to cattle and slurry spreading. VTEC O157 indistinguishable from the outbreak strain was isolated from an animal/farm sample.

***Discussion***

In 2005, 125 confirmed cases of VTEC were notified to HPSC (CIR 3.2 per 100,000). This is 32% higher than the number reported in 2003 (the highest year prior to this) and is over twice the number notified in 2004. Non-O157 VTEC have been recognised for many years in continental Europe as causing a significant proportion of VTEC infections, notably in Germany and Denmark.[3] The rise in the reported incidence of non-O157 infection in Ireland may be due to increased awareness nationally of non-O157 VTEC and improved diagnosis and reporting.

The seasonal distribution of cases was unusual in 2005, with an atypically high number of cases in quarter 4. This was due in part to a single large outbreak that occurred in the MW at this time, and also to the large number of VTEC O157 cases that were notified in the HSE-ER in November.[1] Three family outbreaks accounted for ten of the 13 ER cases. The existence of one large undetected outbreak in the ER at this time is unlikely as, in all, 5 different phage types were represented among the 13 cases reported.

For the first time in Ireland, cases of VTEC O157 due to sorbitol-fermenting VTEC O157 were reported. There were three cases, two of which were epidemiologically linked and were foreign travel-associated. Typically, most VTEC O157 are unable to ferment sorbitol, and it is this feature that facilitates their identification. Human infections due to sorbitol-fermenting VTEC O157 strains have been reported from Germany and the Czech Republic and most recently in the UK.[4]

In 2005, high numbers of VTEC-confirmed HUS cases were reported –17 HUS cases versus 4-6 per annum in the years 2001-2004. Eight of the 17 HUS cases notified in 2005 were diagnosed as VTEC either by serodiagnosis alone (n=2), by investigation for non-O157 VTEC (n=4) or by investigation for

*Table 5. Verotoxin typing results for VTEC isolates referred to the PHL HSE Dublin Mid Leinster, Cherry Orchard Hospital in 2005*

| | VT1 only | VT2 only | VT1 and VT2 | Total |
|---|---|---|---|---|
| O157 | 0 | 94 | 12 | 106 |
| O26 | 4 | 0 | 8 | 12 |
| O21 | 0 | 1 | 0 | 1 |
| O123 | 1 | 0 | 0 | 1 |
| O152 | 1 | 0 | 0 | 1 |
| O ungroupable | 1 | 1 | 0 | 2 |

Note that two E. coli O157 infections were diagnosed by serodiagnosis and thus isolates were not available for typing.

*Table 6. VTEC outbreaks in Ireland 2005 by suspected mode of transmission.*

| Suspected modes of transmission* | Number of outbreaks | Confirmed cases | Number ill |
|---|---|---|---|
| P-P | 4 | 12 | 7 |
| P-P and animal contact | 2 | 4 | 6 |
| P-P and foodborne | 2 | 4 | 4 |
| Foodborne | 2 | 6 | 3 |
| P-P and waterborne | 1 | 3 | 2 |
| P-P, waterborne and animal contact | 1 | 18 | 9 |
| Foodborne and animal contact | 1 | 2 | 2 |
| Unknown/Not specified | 6 | 16 | 17 |
| **Total** | **19** | **65** | **50** |

*P-P denotes person-to-person transmission

SF VTEC O157 (n=2), and would not have been recognised as VTEC had they been examined solely for the typical NSF VTEC O157. This demonstrates the benefits of thorough microbiological investigation of HUS cases.

A variety of sources and transmission routes have been demonstrated worldwide for VTEC, including food, water, environmental and direct animal contact as well as person-to-person transmission. For the VTEC outbreaks reported in Ireland 2005, multiple possible transmission routes were reported for many of the outbreaks, with person-to-person transmission suspected to have played a role in ten, food in five, water in two and animal contact in three outbreaks. For most of the outbreaks, the evidence for these transmission routes was circumstantial, but for the large outbreak in the HSE MW, there was epidemiological evidence both for person-to-person transmission and for waterborne spread. This re-enforces the concerns raised in the 2004 HPSC VTEC annual report in relation to the proper management of private water supplies (both private wells and private group schemes), especially those that have the potential to serve large numbers of people.[2]

Internationally, there were several foodborne outbreaks of VTEC in 2005. Notable VTEC outbreaks include a large outbreak of VTEC O157 in Wales in which sliced cooked meats were implicated.[5] Another VTEC O157 outbreak was associated with beef burgers in France in October 2005.[6] In Sweden, an outbreak VTEC O157 was epidemiologically linked to lettuce that had been irrigated with water from a small stream.[7] And more recently an outbreak of VTEC O103 was reported in Norway associated with a cured meat sausage.[8] These outbreaks serve as reminders of the potential role of a variety of foods in both VTEC O157 and non-O157 outbreaks.

In February 2006, the HPSC sub-committee on VTEC published a document for health professionals on VTEC.[9] It provides guidance for clinicians, public health professionals, environmental health professional and infection control personnel in relation to VTEC. Further guidance for laboratory personnel is in preparation.

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