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Epidemiology of Verotoxigenic *E. coli* in Ireland, 2007

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Introduction

Verotoxigenic *E. coli* (VTEC), and in particular *E. coli* O157, are an important cause of gastroenteric illness in Ireland. [1] In 2006, the latest year for which data is available across the EU, only two countries (Malta and the Czech Republic) reported a higher incidence rate for VTEC than Ireland.[2] Unlike more common forms of gastroenteritis such as norovirus, illness can be very severe with up to 10% of patients developing haemolytic uraemic syndrome (HUS). The reported incidence of VTEC disease in Ireland has risen from 2.4 per 100,000 in 2003 to 3.7 per 100,000 in 2006, with children most commonly affected and at higher risk of complications.[1, 3,4] Person-to-person transmission is common, both within households and in child-care facilities. In Ireland and elsewhere, drinking untreated water from private wells has been identified as an important risk factor for infection. [1, 3,4] Other important transmission routes include food (often minced beef products and most recently fresh produce such as lettuce and spinach), and contact with infected animals or contaminated environments.[5,6]

Materials and Methods

Infection due to Enterohaemorrhagic *E. coli* (EHEC) is a notifiable disease (S.I. 707 of 2003) since 2004. This report focuses on cases that conform to the case definition used for VTEC enhanced surveillance (http://www.ndsc.ie/hpsc/A-Z/Gastroenteric/VTEC/SurveillanceForms/) Enhanced information was supplied as in previous years by HSE personnel, and typing data were provided by the HSE Dublin Mid Leinster Public Health Laboratory at Cherry Orchard Hospital. Although not notifiable, this definition includes suspected cases of VTEC reported by clinicians, i.e. cases of HUS or TTP of possible infective aetiology, for which there was no laboratory or epidemiological evidence of VTEC infection. Data from the CSO 2006 census was used to calculate incidence rates, and thus rates quoted for 2004-2006 may differ from those previously published.

Results

Incidence

In 2007, 167 confirmed and probable cases of VTEC were notified to HPSC, a crude incidence rate (CIR) of 3.9 per 100,000 (table 1). It should be noted however, that this includes 52 probable cases associated with a single outbreak. If only confirmed VTEC cases are considered, the 115 confirmed cases notified this year represent a 25% decrease on the number of confirmed cases notified in 2006.

Table 1. Number and crude incidence rates confirmed and probable VTEC, Ireland 2004-2007

Year	Confirmed cases	Probable cases	Total VTEC	CIR VTEC* (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)

* Data from the 2006 census were used to calculate rates

As in previous years, the most common serogroups reported among confirmed cases were VTEC O157 (n=94), followed by VTEC O26 (n=13), with eight additional cases of other serogroups. One VTEC O157 was co-infected with a VTEC O103 strain and one VTEC O26 case was co-infected with a VTEC O113 strain. Although not notifiable, one additional (HUS) case was reported as suspected VTEC case.

Regional Distribution

Regional variation was noted in the numbers of cases reported (table 2). The highest incidence rate for VTEC overall was reported in the HSE-NW (in part due to the 52 probable cases reported associated with an outbreak during August 2007), however, even when only confirmed cases are included, the incidence rate there was 7.2 per 100,000. The HSE-M also reported a relatively high incidence rate of 7.2 per 100,000. As in previous years, the HSE-E reported the lowest incidence rate, possibly reflecting the low percentage of the population living in a rural environment.

The HSE-E and HSE-NW reported the highest numbers of non-O157 VTEC infections (table 2). While it is possible that this reflects a true geographical difference in risk, it is more likely that this to some extent reflects regional differences in laboratory diagnostic practice for non-O157 infections.

Table 2. Number of confirmed and probable VTEC cases by quarter and HSE area, crude incidence rate and age-standardised incidence rate by HSE area, Ireland 2007

Quarter	E	M	MW	NE	NW	SE	S	W	Total
Q1	2	0	0	2	4	0	0	2	**10**
Q2	4	5	6	4	1	3	2	0	**25**
Q3	6	12	9	5	59‡	4	9	3	**107‡**
Q4	7	1	2	1	5	2	3	4	**25**
VTEC O157	11	18	15	11	60‡	8	13	9	**145‡**
Non-O157 VTEC	8	0	1	3	9	1	1	0	**20**
Mixed infection	0	0	1	1	0	0	0	0	**2**
Total	**19**	**18**	**17**	**12**	**69‡**	**9**	**14**	**9**	**167**
CIR VTEC* (95% CI)	**1.3 (0.7-1.8)**	**7.2 (3.9-10.5)**	**4.7 (2.5-7.0)**	**3.0 (1.3-4.8)**	**29.1 (22.2-36.0) ‡**	**2.0 (0.7-3.2)**	**2.3 (1.1-3.4)**	**2.2 (0.8-3.6)**	**3.9 (3.3-4.5)**

*Rates calculated using CSO census 2006

‡ Includes 52 probable cases linked to a VTEC O157 outbreak

Age-sex distribution

The reported disease incidence was highest among young children (median age =10 years), which is consistent with previous years, and there were similar numbers of male (n=81) and female (n=86) cases.

Clinical features

Information on symptoms was available for 158 notified cases, of whom 136 (86%) were reported as symptomatic. Reported symptoms included bloody diarrhoea in 40 cases, and haemolytic ureamic syndrome (HUS) in five cases. This is a decrease on the number of VTEC-associated HUS cases reported compared to the last 2 years (17 reported in each year). HUS cases ranged in age from 1 to 7 years, and notably, two HUS cases (40%) were associated with non-O157 VTEC (one VTEC O145 and one Ungroupable strain). The reporting of asymptomatic cases is reflective of the more extensive investigation of outbreaks that occurs now when compared even with 4-5 years ago.

Phage and verotoxin typing

In 2007, 117 VTEC isolates were referred to the HSE PHL Dublin Mid Leinster, Cherry Orchard Hospital (table 3). As in previous years, PT32 was the commonest phage type reported (n=44),

accounting for 47% of the confirmed VTEC O157 reported. The second most common phage type this year was PT51.

Table 3. Verotoxin and phage typing results for VTEC isolates referred to the PHL HSE Dublin Mid Leinster, Cherry Orchard Hospital in 2007

Serogroup	PT	VT1 only	VT2 only	VT1 & VT2	Total
O157	**2**	0	5	0	**5**
	4	0	5	0	**5**
	8	0	0	9	**9**
	14	0	7	0	**7**
	31	0	1	0	**1**
	32	0	37	7	**44**
	33	0	1	0	**1**
	34	0	1	0	**1**
	43	0	1	0	**1**
	51	0	12	0	**12**
	21/28	0	5	1	**6**
	RDNC	0	1	0	**1**
	N/K	0	1	0	**1**
O26	**-**	12	0	1	**13**
O ungroupable	**-**	1	4	0	**5**
O103	**-**	0	1	0	**1**
O111		1	0	0	**1**
O113	**-**	0	1	0	**1**
O128	**-**	0	1	0	**1**
O145	**-**	0	1	0	**1**
Total	**-**	14	85	18	**117**

Note that for fifty-two probable cases reported on the basis of epidemiological linkage, isolates were not available for typing. Table 3 includes all strains isolated from mixed VTEC infections. All phage typing was undertaken at the HPA Laboratory of Enteric Pathogens (LEP), Colindale, UK

The verotoxin profiles of VTEC strains were typical. Eighty-two per cent of VTEC O157 strains carried the genes for VT2 only while 18% carried the genes for both VT1 and VT2 (table 3). In contrast, 61% of non-O157 VTEC isolates carried the genes for VT1 only, 35% for VT2 only, and 4% VT1 and VT2.

Outbreak investigations

Twenty-one VTEC outbreaks were reported in 2007, comprising 67 of the 115 confirmed cases notified, plus the 52 probable cases. Four outbreaks were described as general outbreaks and 17 as family outbreaks. Sixteen were due to VTEC O157, three due to VTEC O26, one was caused by an Ungroupable strain and one was a mixed VTEC strain outbreak. The suspected modes of transmission reported are listed in table 4.

Person-to-person spread is an important mode of VTEC transmission in households, child-care facilities and institutions, and was suspected to have played a role in nine VTEC outbreaks in 2007. These included two outbreaks associated with crèches.

One general VTEC outbreak in 2007 was linked to a hotel in the HSE-NW. There were four confirmed cases (one from the Republic of Ireland and three from Northern Ireland) and an additional 52 probable cases identified through case finding among hotel guests. Foodborne transmission was suspected although no specific food was implicated during investigations.

PFGE performed by HSE DML-PHL at the time of the outbreak was invaluable in distinguishing outbreak cases from other sporadic cases reported in Ireland around this time, supporting the findings of the outbreak investigators.

For one general outbreak and for one sporadic case in 2007, examination of water from the private wells of the affected households confirmed the presence of *E. coli* O157. For the general outbreak, the separate private wells of adjacent homes were contaminated. Drinking water from untreated private water supplies remains a very important risk factor for VTEC infection in Ireland.

Table 4. VTEC outbreaks in Ireland 2007 by suspected mode of transmission

Suspected mode of transmission*	Number of outbreaks	Number confirmed cases	Number ill
Animal contact	1	4	1
Foodborne	1	4	56
Person-to-person	9	34	27
Waterborne	2	10	8
Unknown/Not specified	8	19	11
Total	**21**	**71**	**103**

Discussion

While there was a small increase in the overall number of notifications for VTEC in 2007, there was actually a 25% decrease in the number of confirmed cases relative to 2006. There were also considerably fewer VTEC-associated HUS cases than were reported in 2005 and 2006 (5 cases compared to 17 in each of the previous 2 years). The decrease in the number of confirmed cases was noted both among VTEC O157 and non-O157 infections, and the ratio of VTEC O157 to non-O157 VTEC infections was similar to 2006 (VTEC O157 comprised 78% of cases in 2006 and 82% of confirmed cases in 2007).

The HSE-E has consistently reported a lower incidence rate than other more rural parts of the country, suggesting that rural exposure is an important risk factor for VTEC infection in Ireland. Transmission routes that are associated with rural settings include direct contact with farm animals and their environments, exposure to well water contaminated with agricultural runoff and consumption of raw milk. Untreated drinking water from private wells has repeatedly been highlighted as a risk factor for VTEC disease in Ireland, [1, 3, 4] and may again have been responsible for the higher number of VTEC cases notified during late summer 2008.[7,8]

Person-to-person spread is an important mode of transmission for VTEC infection, and was the most common suspected mode of transmission for VTEC outbreaks reported in 2007. In particular there were two outbreaks in crèches with a total of 11 persons reported ill where person-to-person spread was believed to have been the primary mode of transmission. Given the readiness with which VTEC infections can be passed between young children in congregate settings, and the potential for severe complications following VTEC infection in this age group, good hygiene practices, and adherence to policies of exclusion, are crucial elements of the management of outbreaks in crèches.

The general outbreak associated with the hotel in the HSE-NW highlights the potential for international outbreaks associated with settings which serve an international clientele, and the

value of good communication channels with partner agencies in other jurisdictions. In this instance, the first reported cases were from Northern Ireland –the North-West being a popular holiday destination for Northern Ireland holidaymakers. In fact, only one of the four confirmed cases was from the Republic of Ireland. The intensive case finding activities of the outbreak control team identified probable VTEC illness in 52 other guests, highlighting the fact that reporting of laboratory confirmed cases will sometimes only give a partial representation of the case distribution within an outbreak.

Increasingly, molecular typing is being used during outbreak investigations. Laboratory investigations during this outbreak served to highlight the value of molecular typing methods as a tool to distinguish between cases which were known to be epidemiologically linked to the outbreak location, and other unrelated *E coli* O157 cases which were occurring both locally and across Ireland during the same time period, but which were not linked to the outbreak. Studies such as this lead to savings both of time and resources by targeting public health action towards those cases which are truly part of the outbreak.

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