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Annual Epidemiological Report

June 2019

VTEC infection in Ireland, 2017

Key Facts

- 10% increase in VTEC infection in Ireland in 2017
- Ireland had highest incidence rate for VTEC among EU Member States, reporting ten times the European average in 2017
- Highest incidence of VTEC infection was in children under five years of age
- VTEC O157 and VTEC O26 were the commonest serogroups
- Person-to-person spread, waterborne transmission from improperly managed private water supplies and animal contact remain the most common transmission routes for VTEC infection

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Background

For many years, Ireland has had the highest verotoxigenic *Escherichia coli* (VTEC) notification rate in Europe, with the exception of 2011 when Germany reported the highest rate due to a large VTEC O104 outbreak linked to fenugreek seeds.[1-2] In 2017, the notification rate for confirmed VTEC cases in the European Union/European Economic Area was 1.66 per 100,000 and the highest country-specific rates were in Ireland, Switzerland and Norway (16.6, 8.2 and 7.3 per 100,000 population, respectively).[3]

The dominant transmission routes reported for VTEC infection in Ireland have been person-to-person spread, especially in childcare facilities and among families with young children, and waterborne transmission associated with exposure to water from untreated or poorly treated private water sources.[4-8] 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.[2, 9-10]

Methods

VTEC is a notifiable disease in Ireland under the Infectious Disease Regulations and cases should be notified to the Medical Officer of Health. Notifications are reported using the Computerised Infectious Disease Reporting system (CIDR) which is described here. Further information on the process of reporting notifiable infectious diseases is available here. The case definition in use in 2017 is available here. For this report, data on notified cases reported to CIDR in 2017 were extracted from CIDR as of 10th December 2018.

Results

Incidence

In 2017, 923 cases of VTEC were notified in Ireland, equating to a crude incidence rate (CIR) of 19.4 per 100,000 (95% CI 16.4-18.8). Compared with 2016 (17.6 per 100,000) there was a 10% increase in the incidence of VTEC. Of the 923 VTEC notifications in 2017, 811 (88%) were classified as confirmed cases, 111 (12%) as probable cases and one as a possible case. The criteria under which notified cases were reported in 2017 are outlined in Table 1.

Of the 916 cases with laboratory evidence of infection, 731 were culture confirmed, 187 were confirmed by PCR but were culture negative with one serodiagnosed case (Table 1, Table 2 and Figure 1).

Table 1. VTEC notifications by criteria for notification and case classification, Ireland, 2017

Notification criteria	Confirmed	Probable	Possible	Total
Laboratory confirmation by culture[a]	653	78		731
Laboratory confirmation by PCR only[b]	157	27		184
Reported solely on the basis of epidemiological link		6		6
Clinical HUS not meeting lab or epi criteria			1	1
Laboratory confirmation by serodiagnosis	1			1
Total	**811**	**111**	**1**	**923**

[a] Symptomatic culture confirmed cases are classified as confirmed cases, while asymptomatic culture confirmed cases are classified as probable cases

[b] Symptomatic PCR-confirmed cases are classified as confirmed cases, while asymptomatic PCR-confirmed cases are classified as probable cases

Laboratory typing

The serogroup and the verotoxin profiles of VTEC isolates/samples referred to the VTEC-NRL at PHL, Cherry Orchard Hospital are presented in Table 2. The most common serogroup reported among culture positive notifications was *E. coli* O26 (n=239), followed by *E. coli* O157 (n=205). Among the other serogroups listed by the World Health Organization as having the highest association with Haemolytic Uraemic Syndrome (HUS) internationally, there were 60 *E. coli* O145, 35 *E. coli* O103 cases and 15 *E. coli* O111. Other serogroups with significant numbers of cases in Ireland in 2017 included O5, O146 and O91.

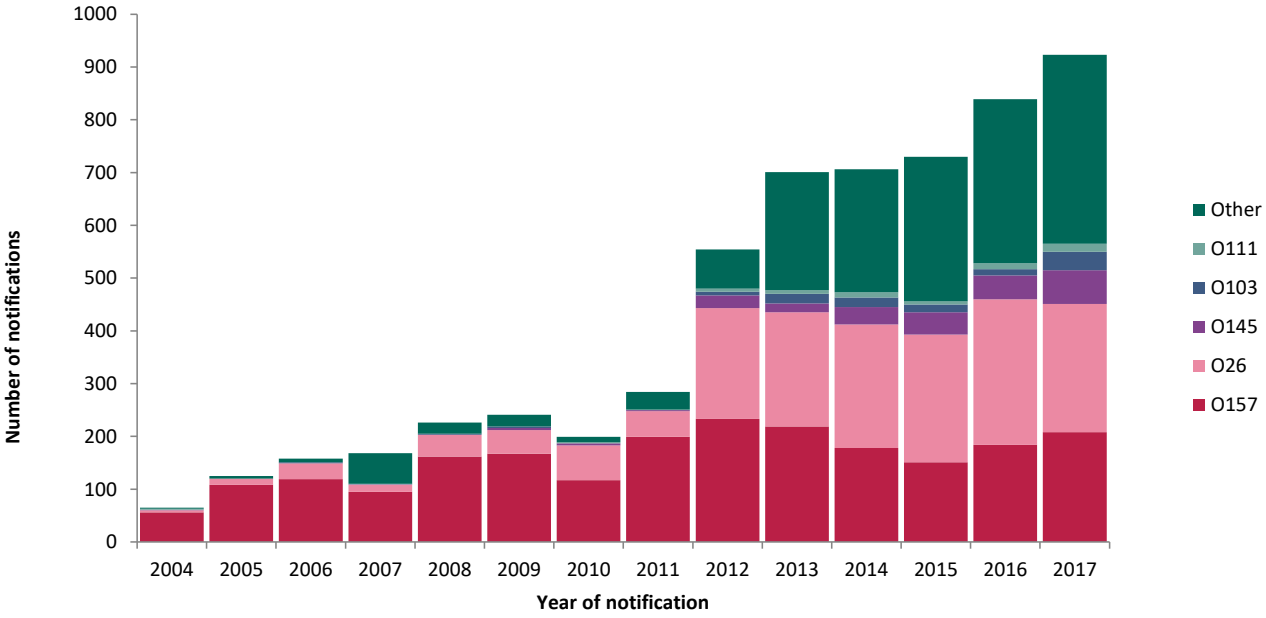
As usual among *E. coli* O157 cases in Ireland, isolates containing the genes for *vt2* were more common (64%) than strains containing genes for both *vt1* and *vt2*. Among the VTEC O26 strains, those containing the genes for both *vt1* and *vt2* accounted for the majority (61%), followed by *vt1* only (33%) and those containing *vt2* making up the remaining 6% of *E. coli* O26 cases (Table 2).

Table 2. Serogroup and verotoxin (vt) profiles of strains associated with laboratory confirmed VTEC cases, as determined at the VTEC-NRL at PHL, Cherry Orchard Hospital, 2017

Criteria for reporting	Serogroup	VT1	VT1+VT2	VT2	Not reported	Total
Culture confirmed	O26	79	146	14		**239**
	O157		73	130	2	**205**
	O145	2	2	55	1	**60**
	O103	30	3	2		**35**
	O5	10	7			**17**
	O111	3	12			**15**
	O146	6	5	3		**14**
	O91	3	9	1		**13**
	O182	8	1	1		**10**
	O128		6	1		**7**
	Other	48	27	36	5	**116**
PCR positive culture negative	O145			4		**4**
	O157		2	1	1	**4**
	O26	3				**3**
	Other	46	46	69	13	**173**
Serodiagnosed	**O26**	**-**	**-**	**-**	**-**	**1**

Figure 1 shows the changing distribution in the reported number of notifications by serogroup since 2004, which has been strongly influenced by changes in laboratory practice during that time.

Figure 1. VTEC notifications by serogroup and year, Ireland 2004-2017



Note: Other includes cases notified as PCR positive culture negative as well as culture positive notifications with serogroups other than the top five.

Severity of illness

Of the 923 notified cases in 2017, 763 were symptomatic (86% of cases where data were available). Among symptomatic cases (and where information available), 710/763 (93%) reported diarrhoea, 279/715 (39%) reported vomiting, 215/668 (32%) reported fever, 278/586 (47%) reported nausea, 447/658 (70%) reported abdominal pain and 261/718 (36%) developed bloody diarrhoea, rates very similar to the rates reported for 2016. Two hundred and ninety-five VTEC cases were hospitalised (32% of all notified cases; 39% of symptomatic). Four deaths occurred among VTEC cases, one of which was directly attributed to VTEC infection.

Twenty-seven individuals developed HUS (2.9% of all notifications; 3.5% of symptomatic cases). This is a 25% reduction in the number of HUS cases compared to 2016. Seven were culture confirmed with *E. coli* O26, seven with *E. coli* O145, four with *E. coli* O157, two with *E. coli* O103, two with O111, and one each with *E. coli* O182 and O98 (Table 3). One was reported on the basis of a PCR positive result without culture confirmation, one was

serodiagnosed, and one was a possible case (i.e. clinical HUS, without meeting laboratory or epidemiological criteria). HUS cases ranged in age from 11 month to 84 years and 74% (n=20) were under 15 years of age. Nineteen of the HUS cases were considered sporadic; four were part of family outbreaks and four were part of general outbreaks.

Table 3. VTEC notifications by serogroup, verotoxin and HUS status, Ireland, 2017

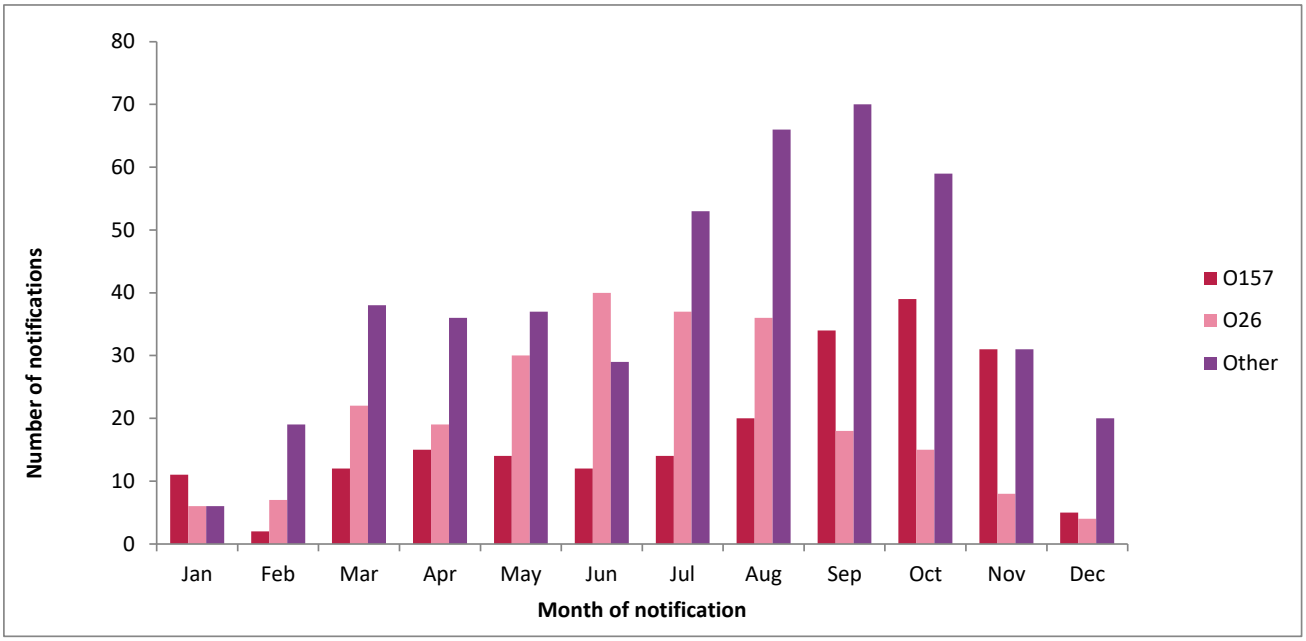
Criteria for reporting	Serogroup[a]	Verotoxin	HUS	non-HUS	Total	% with HUS
Laboratory confirmation by culture	O26	*vt1*	0	79	**79**	0%
		vt2	2	12	**14**	14%
		vt1+vt2	5	141	**146**	3.4%
		Not reported	0	0	**0**	0%
	O157	*vt1*	0	0	**0**	0%
		vt2	4	126	**130**	3.1%
		vt1+vt2	0	73	**73**	0%
		Not reported	0	0	**0**	0%
	Other	*vt1*	1	109	**110**	0.9%
		vt2	9	90	**99**	9.1%
		vt1+vt2	3	69	**72**	4.2%
		Not reported	0	6	**6**	0%
Laboratory confirmation by PCR only		*vt1*	0	49	**49**	0%
		vt2	1	73	**74**	1.4%
		vt1+vt2	0	48	**48**	0%
		Not reported	0	14	**14**	0%
Reported solely on the basis of epidemiological link		-	0	6	**6**	0%
Clinical HUS not meeting lab or epi criteria		-	1	0	**1**	100%
Serodiagnosed			1	0	**1**	100%
Total		**-**	**27**	**896**	**923**	2.9%

[*] For simplicity mixed infections were recorded as O157 if at least one strain was O157, as O26 if at least one strain was O26 but not O157, and as Other if only non-O157 or non-O26 strains were detected.

Seasonal distribution

Figure 2 shows the seasonal distribution of notifications in 2017 by serogroup. As in previous years, VTEC O26 cases peaked earlier in the year, with higher numbers of cases reported in the May-August period with VTEC O157 being more prevalent later between July and October; infections due to all serogroups were uncommon in winter months.

Figure 2. Seasonal distribution of VTEC notifications by serogroup, Ireland, 2017

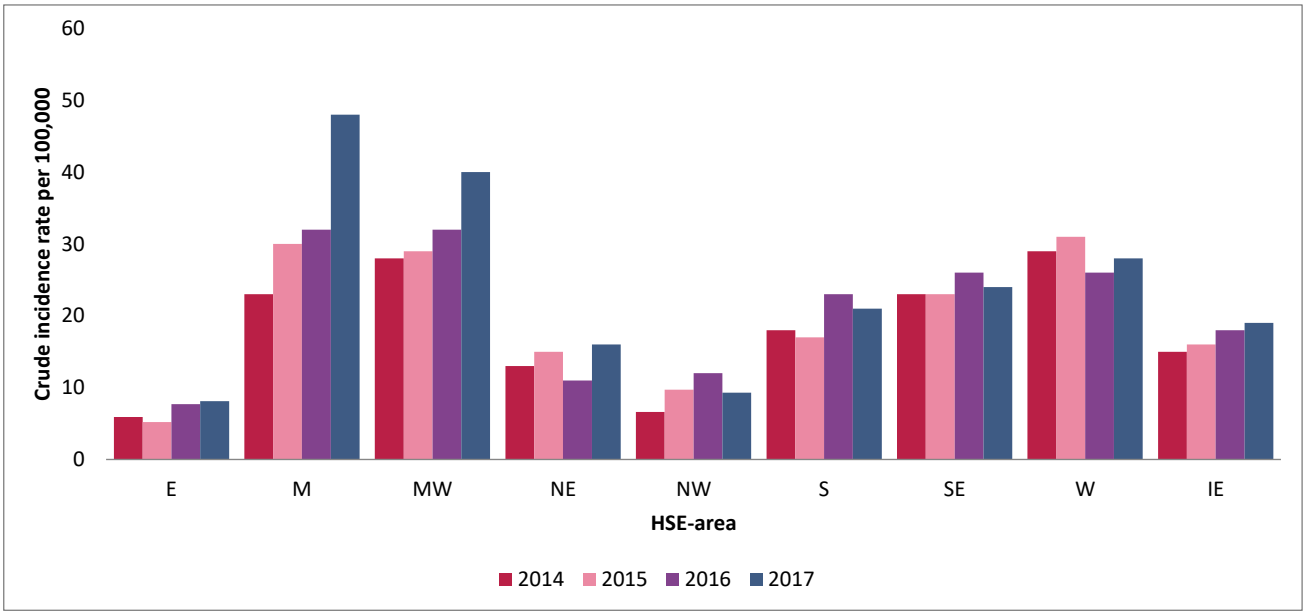


For simplicity mixed infections were recorded as O157 if at least one strain was O157, as O26 if at least one strain was O26 but not O157, and as Other if only non-O157 or non-O26 strains were detected.

Regional distribution

The increase in overall incidence in 2017 appears due to increased incidence in the HSE-M and HSE-MW compared with previous years. These areas had consistently reported the highest incidence rates over the previous three years. All other HSE-areas reported similar rates to previous years, HSE-E as usual reporting the lowest incidence followed by HSE-NW and HSE-NE.

Figure 3. Crude incidence rate VTEC by HSE area, Ireland, 2014-2017

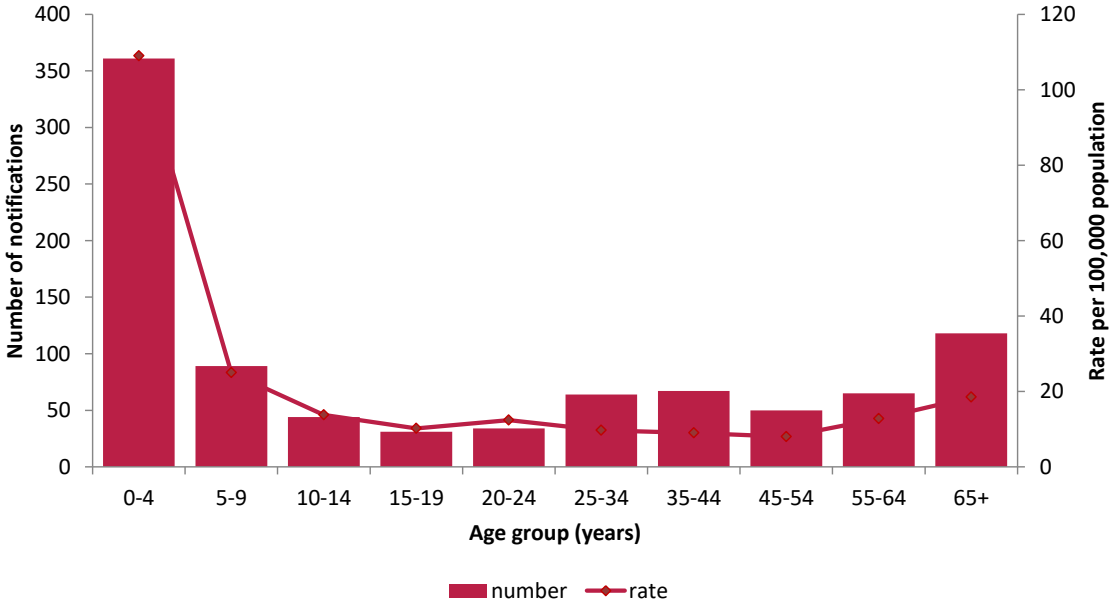


Note: For simplicity mixed infections were recorded as O157 if at least one strain was O157, as O26 if at least one strain was O26 but not O157, and as Other if only non-O157 or non-O26 strains were detected.

Age-sex distribution

Consistent with previous years, the highest reported age-specific incidence rate in 2017 was in the 0-4 year age group (109 per 100,000) (Figure 4).

Figure 4. Age-specific incidence rates VTEC notifications, Ireland, 2017



Risk factors

Under the enhanced surveillance system for VTEC, risk factor information is routinely collected on all notifications (Table 4). Very similar proportions of cases reported exposure to the key risk factors assessed compared to 2016. Exposure to farm animals or their faeces and exposure to private well water were relatively common among cases in 2017; 36% and 41% reported these exposures, respectively. According to CSO data, in the general population, around 10.6% of households are served by private wells, indicating that, on a national basis, exposure to private wells appears to be more common among VTEC cases than among the general population.

Table 4. Number of cases of VTEC (and percentage where information available) for selected risk factors, Ireland, 2017 (n=923)

Risk factor	Yes (% of known)	No	Unknown or not reported
Food suspected	48 (8.3%)	528	347
Exposure to farm animals or their faeces	283 (36%)	495	145
Exposure to private well water[a]	288 (41%)	414	221
Travel-associated[b]	40 (4.6%)	825	58
Attendance at a CCF[c]	160 (20%)	632	131
Attendance at a CCF[c] (among <5 yrs)	143 (47%)	162	56

[a]Composite variable recoded from two different water supply exposure enhanced variables in CIDR
[b]Inferred from CIDR core variable *Country of Infection*
[c] *CCF=childcare facility*

Unlike salmonellosis, foreign travel plays only a minor role in VTEC infection in Ireland, with the majority of infections being non-travel related (95%). Where the information was available, a fifth of VTEC cases in 2017 were attending a childcare facility (CCF). When these analyses were restricted to notified VTEC under five years of age, 47% reported attendance at a childcare facility. This is similar to the proportion of children in the general population who use non-parental childcare (42%) as reported by the Central Statistics Office.[11]

Outbreak and environmental investigations

The outbreak surveillance system plays a key role in our understanding of the transmission of VTEC infection in Ireland. Thirteen general outbreaks in 2017 resulted in 78 persons becoming ill, with six hospitalised. Of these, six occurred in CCFs; two small CCF outbreaks were reported as due to person-to-person spread but transmission route reported as unknown for the remaining four CCF outbreaks. The largest CCF outbreak resulted in 44 confirmed cases of infection (mostly serogroup O145) - none of these cases developed HUS.

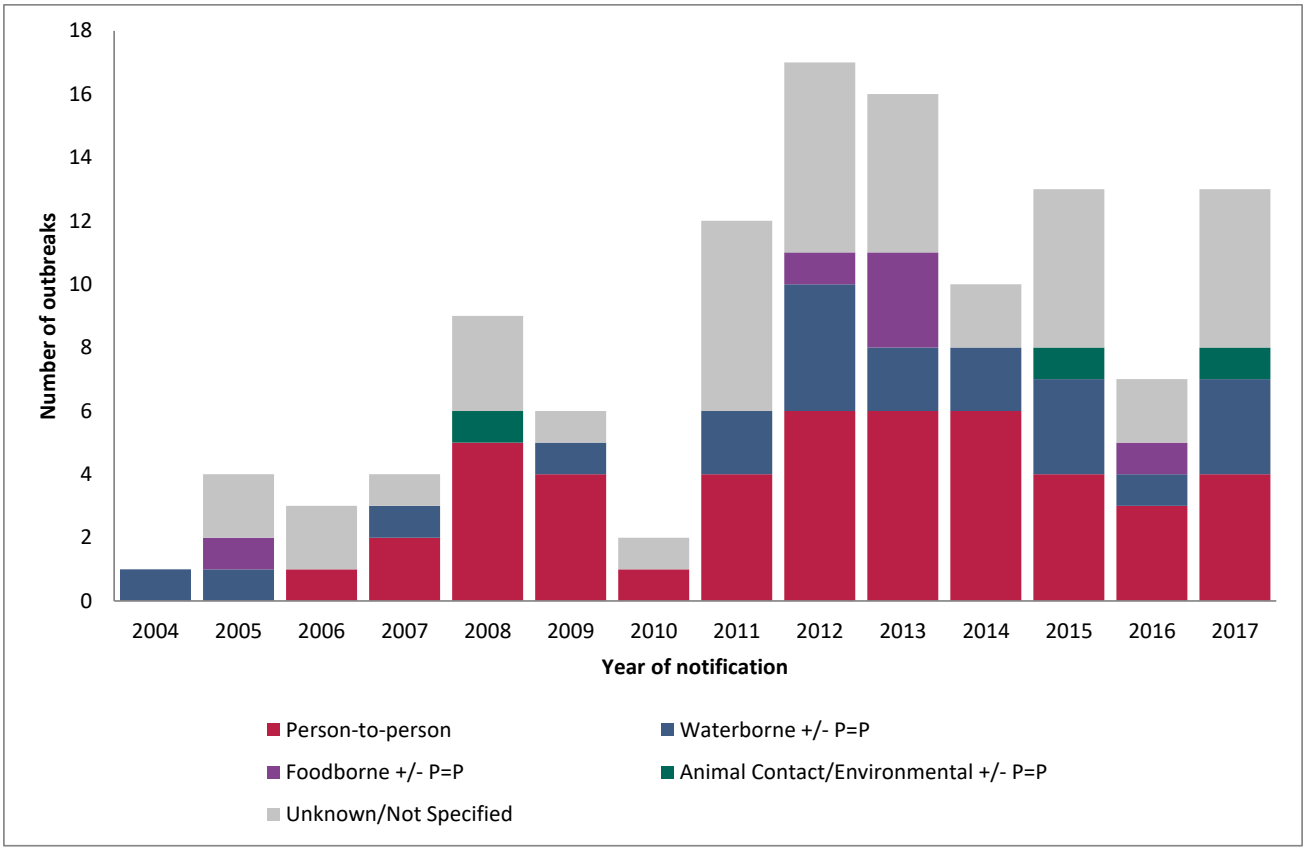
Among the remaining seven general outbreaks, waterborne transmission was reported to have contributed to two small community outbreaks (with two and five people ill) and to a small outbreak at a childminder. Animal contact was suspected for an outbreak of two children in a school, person-to-person transmission for two further small general outbreaks (two persons at a residential facility and two in a private home outbreak), while the transmission route was reported as unknown for the final small general outbreak in a private home (Table 5 & Figure 5).

Table 5. General VTEC outbreaks by suspected mode of transmission, Ireland, 2017

Transmission route	Number of general outbreaks	Number ill
Person-to-person	4	6
Waterborne +/- person-to-person	3	8
Animal contact/Environment +/- person-to-person	1	2
Unknown/Not specified	5	68
Total	**13**	**84**

Note: this table does not include family outbreaks reported

Figure 5. Number of general VTEC outbreaks by suspected transmission route and year, Ireland, 2004-2017



Note: This figure does not include family outbreaks Reported transmission routes were grouped for simplicity. Any outbreak where food contributed was reported as foodborne, any outbreak where water contributed was reported as waterborne, any other outbreak where animal contact contributed was reported as animal contact. Person-to-person outbreaks include only those outbreaks reported as being due only to person-to-person transmission.

Discussion

The number of VTEC notifications in Ireland continued to rise in 2017, and within the European Union, Ireland continues to have the highest incidence rate for VTEC, reporting ten times the European average in 2017.[3] Over the last 10 years, nine other countries in the EU also reported increasing trends.

The upward trend observed in Ireland in recent years of non-O157 notifications reflects the more widespread use by the primary hospital laboratories of diagnostic methods that detect a broader range of *E. coli* serogroups, and the use of more sensitive molecular methods that detect verotoxin genes directly in stool samples.[12] In particular in 2017, the proportion of laboratory-confirmed cases that were PCR positive culture negative had increased to around one fifth of cases. National guidance developed for the laboratory diagnosis of human VTEC in Ireland provides a coordinated approach to VTEC diagnosis in Ireland.[13]

Other EU Member States with relatively high incidence rates include Sweden (CIR=5.0 per 100,000) and Denmark (CIR=4.6 per 100,000). EFTA countries with relatively high rates include Norway (CIR=7.3 per 100,000) and Switzerland (CIR=8.2 per 100,000). EFSA and ECDC however, note that some countries report very high proportions of hospitalised cases but low notifications rates, and suggests that the surveillance systems in these countries likely only capture the most severe cases, and that it may not be appropriate to make direct comparison of incidence rates between countries with substantially different surveillance systems.[3]

The most common serogroups among human cases continue to be O26 and O157, with other serogroups identified by the WHO as commonly being associated with HUS making up the top five serogroups. Atypically, VTEC O145, along with O26, was the most common serogroup associated with HUS in Ireland in 2017; there were seven HUS associated with O145 compared with only ten VTEC-O145 associated HUS in the previous ten years. Six of the seven were *vt2* positive, and four of these were reported in the HSE-M. VTEC O145 *vt2* was also associated with a large CCF outbreak reported in the HSE-E, however, there were no HUS cases associated with this outbreak.

Transmission by person-to-person spread remained the most common transmission route reported in VTEC outbreaks and was involved in four of the 13 general outbreaks. Hand-washing and exclusion of cases in risk groups from high risk settings remain key prevention measures for VTEC.[14, 15]

Contaminated drinking water was the second most commonly suspected mode of transmission among general outbreaks. Exposure to water from contaminated untreated or poorly treated private water supplies has historically been recognised as a strong risk factor for VTEC infection in Ireland.[6-8, 15] This has been particularly pronounced following periods of heavy rainfall.

Animal contact was reported for one general outbreak in a school. This has long been recognised as a risk factor for VTEC infection [9-10] and cases due to this transmission route are not unexpected in Ireland given the large cattle population, the high proportion of rural dwellers, and the large number of farming families.[8] Advice is available on the HPSC website on how to minimise the risk of gastrointestinal infections following exposure to farm animals and environments, and for the safe recreational use of farmland.[16]

Further information available on HPSC website

Further information about VTEC infection is available at http://www.hpsc.ie/a-z/gastroenteric/vtec/

Publications on VTEC infection in Ireland available at http://www.hpsc.ie/a-z/gastroenteric/vtec/publications/

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