Special Report on Verotoxigenic E. coli (VTEC) in 2012 in the Midlands (Laois, Offaly, Westmeath and Longford)

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Basis for this report

Under the Health (Duties of Officers) Order 1949, the Medical Officer of Health (MOH), formerly County Medical Officer, is obliged to publish an annual report, and to *"furnish such special reports and returns as may be required from time to time by the county council*". The Environmental Protection Agency (EPA) has replaced the county councils for a number of environmental functions, and it has requested data about the Verotoxigenic E. coli (VTEC) waterborne disease in 2012 in the Midlands.

This special report provides this data, and is published online in the spirit of the Aarhus Convention.

The report briefly describes:

1. Public health importance of VTEC
2. Brief epidemiology of VTEC in 2012 in the Midlands
3. Source investigation of the VTEC cases
4. Source classification
5. Key points in relation to waterborne disease data

Public health importance of VTEC

Verotoxigenic E. Coli (VTEC) is a priority infectious disease for investigation and control, because of the potentially fatal complication, called haemolytic uraemic syndrome (HUS). About 10% of VTEC cases go on to develop HUS, and of these about 1% die. Those affected by HUS are usually children who suffer acute kidney failure and other serious effects, requiring intensive care treatment. Paediatricians have advised us that even if children overcome the kidney failure, they will be vulnerable to kidney damage all their lives, and may develop kidney failure in adulthood. Some of our cases have had additional serious organ damage including to the brain and heart.

The particular susceptibility of children to VTEC, and the potential for exposure of children to VTEC in shared childcare spaces such as crèches, increases the risk of outbreaks, which occur frequently. VTEC is spread by faecal-oral transmission, so the need to change nappies and the presence of small children who need assistance with hygiene require stringent controls in childcare environments.

VTEC is a zoonotic disease (meaning "*any disease or infection that is naturally transmissible from vertebrate animals to humans"* (World Health Organization)). The reservoir for these infectious toxic microorganisms is in ruminants, particularly in cattle in Ireland. While the animals do not become ill from VTEC, the microorganisms are passed in the animal faeces into the environment. Then they can travel, with water, through the environment, to drinking water sources, or bathing water areas.

The infectious dose may be as low as 1 microorganism, so even trace contamination of an exposure source can be toxic to humans.

Brief epidemiology of VTEC in 2012 in the Midlands

In 2012, there were 82 confirmed cases of VTEC, with 13 of these cases complicated by Haemolytic Uraemic Syndrome. The Midlands region has a very high Verotoxigenic E. Coli (VTEC) notification rate. In 2012 it was 29 cases per 100,000 population compared to the national rate of 12 per 100,000 and the European rate, of 1.93 per 100,000.

Source investigation of VTEC cases

Currently, national VTEC guidance states *"It is important when drinking water is a suspected mode of transmission during a VTEC investigation, that a one-litre aliquot is submitted to a specialist accredited public health laboratory for testing expressly for the suspected VTEC serogroup*" (Public Health Management of VTEC). This was the method used in 2012 to investigate sources of VTEC, whenever possible. We suspect the source could be water when the primary case has been exposed to water that we have concerns may be contaminated.

Of all 82 cases of confirmed VTEC in 2012, 30 cases were secondary to spread in a dual crèche outbreak, and only the first case of this outbreak (the primary case) is relevant for environmental source investigation. We found VTEC in the drinking water used by 26 cases, and contaminated drinking water for a further 6 cases (see Table 1).

Table 1: Waterborne VTEC outbreaks in the Midlands in 2012

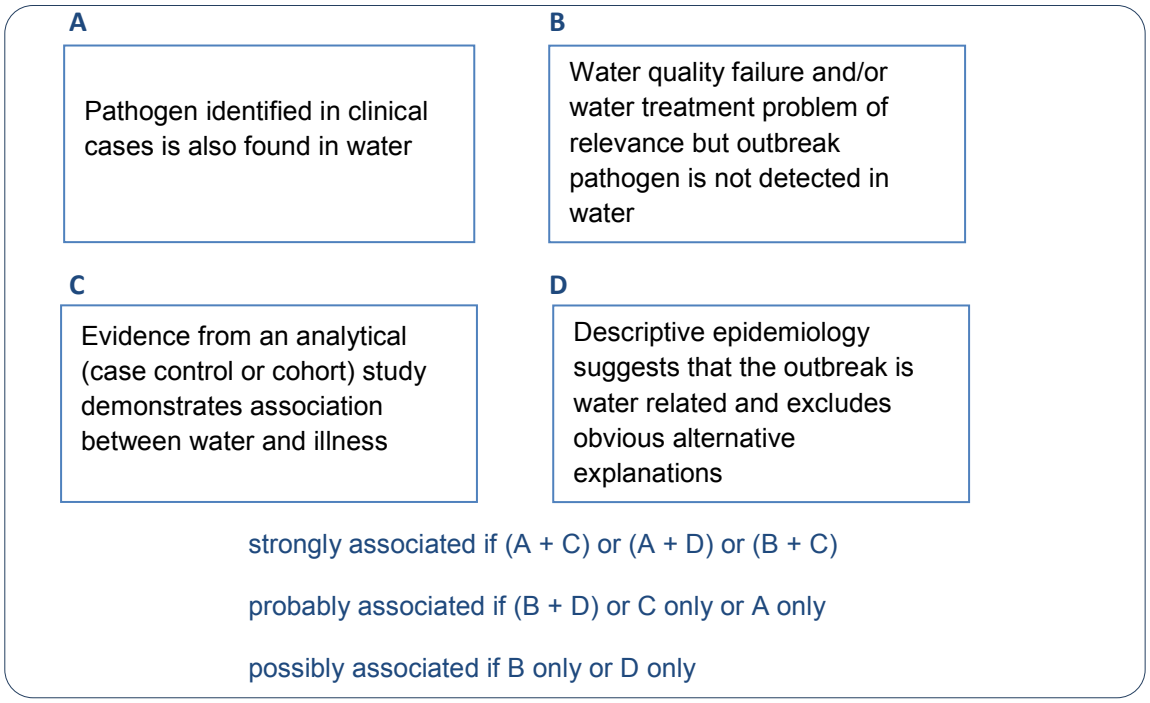
Outbreak	VTEC	No. cases confirmed	Water supply	Water test results
A	O157, VT2	11	Large private	O157, VT2
B	O157, VT1&VT2	5	Private GWS	O157, VT1
C	O26, VT1 and O26, VT1+VT2 and ungroupable VT2	4	Multiple small private	O26, VT1 & VT2
D	O157 VT1 & VT2	2	Small private	O157 VT1 & VT2
E	O157, VT2	2	Multiple small private	O157, VT2
F	O157 (not specified)	2	Small private wells	O157 (not specified)
F	O157, VT2 and O26	2 1	Small private commercial	Reported "contaminated" under food safety legislation – not tested for VTEC
G	O157, VT2	3	Multiple small private	E.coli and coliforms

We found alternative risk factors – farm animal contact and foreign travel - for 8 cases, for one case we could not identify any risk factor and for a further 11 cases, they were exposed to well water that was not found to be contaminated on a single sample (see Table 2).

Source classification

The VTEC exposure and environmental data from 2012 in the Midlands was classified using the methodology described by Tillett et al (see Figure 1).

Figure 1: Classification of waterborne disease



Using this, system, 26 cases had VTEC identified in their drinking water and so were classified A. Six cases were exposed to contaminated drinking water and 11 more were exposed to untreated water, but the VTEC was not detected in the drinking water of these 17 cases – classified B. Therefore these 43 cases, with epidemiological links to water (D), and without obvious alternative explanations were considered strongly and probably associated with water and considered waterborne (see Table 2).

Table 2: Sources of cases of VTEC in 2012 in the Midlands

Most likely source based on exposure	All cases =82 (Primary + Secondary cases)	Primary cases = 52 (environmental source)
Person to person (Secondary)	30	N/A
Farm animal contact	6	6 (11.5%)
Foreign travel	2	2(3.8%)
Unknown	1	1 (1.9%)
Strongly associated with water	26	26 (50%)
Probably associated with water	17	17 (32.7%)
Waterborne (strongly and probably associated)	**43**	**43 (82.7%)**

Key points in relation to waterborne disease data

1. Purpose of investigation– Under Infectious Diseases Regulations 1981 as amended, MOHs have a statutory responsibility to investigate the source of infection and to remove conditions favourable to such infection. There is a dual purpose for testing a well during a VTEC outbreak:

A. To identify a possible source towards improving knowledge on environmental influences on health
B. To ensure the drinking water supply is safe into the future

Therefore, for an untreated supply the aim is to identify if the well was ever contaminated (possible source and a risk into the future), or never contaminated (safe). "Never contaminated" can only be found by an absence of evidence of "ever contaminated", and then only if the testing regime is sensitive enough to identify VTEC when it is ever present.

2. Weaknesses in current testing methodology:

- There is no evidence that a 1 litre sample is sufficient to identify VTEC contamination, given the very low infectious dose for VTEC. The EPA Research Report No. 151 investigators' comparison of 30 litre sampling and 1 litre sampling found a difference in the detection of VTEC. Using data in Table 3.3 of that report, the relative[1] sensitivity of once-off 1 litre sampling in picking up VTEC contamination in raw water in six group water supplies over three sampling periods was 56%.
- VTEC guidance guidance is for once-off sampling, which may or may not pick up intermittent contamination, which is a frequent occurrence in Ireland (see EPA STRIVE Report 89), and may be just as unsafe as continuously contaminated water.

3. Laboratory testing

Confirmatory testing of stool and water was carried out at the national VTEC reference laboratory at Cherry Orchard, Dublin. As mentioned before, water sampling for VTEC requires a one litre sample as per the National VTEC Guidance.

4. Well construction and treatment

Given the apparently rare construction of wells using the best practice Institute of Geology of Ireland Guidelines, many wells are likely to be vulnerable to intermittent contamination, and are also rarely treated, in our experience.

5. Groundwater vulnerability

Many of the wells investigated in 2012 were sited in areas of high groundwater vulnerability as identified in GSI groundwater vulnerability maps.

6. Rainfall

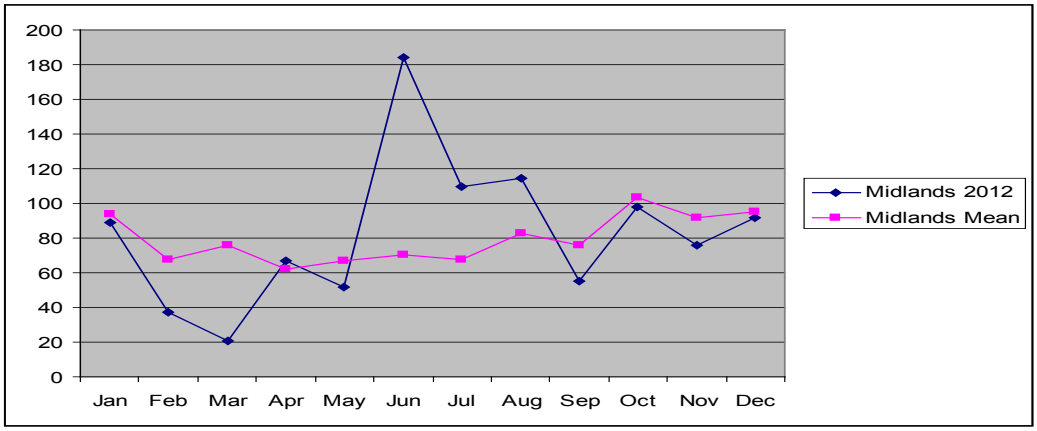
Rainfall data from all fixed weather stations in the Republic of Ireland is published on the Met Eireann website. We used data from four stations in or on the borders of the region - Mullingar, Mount Dillon, Gurteen and Carlow - to estimate the average monthly rainfall in the Midlands in 2012 and compared this with the 30 year mean from the same stations.

Monthly rainfall measured by the 4 stations relevant to the Midlands in 2012, show that rainfall exceeded the mean rainfall (1981-2010 data) at each station by a range of 237-268% in June, 130-198% in July and 110-178% in August (see Figure 2). The pattern of monthly rainfall using an average

[1] Relative to the maximum detection of VTEC from 30 litres tested three times

(arithmetic mean) across the four stations in 2012 and for the 30 year mean indicate a summer peak in 2012.

Figure 2: Average monthly rainfall (mm) in Midlands in 2012 compared with 30 year mean



Source: www.met.ie

7. Other sources of risk assessment data

An audit carried out on one private regulated supply identified a large number of deficits including: lack of enforcement of environmental protections in the context of aquifer vulnerability; abandoned boreholes; and numerous deficits in well construction and treatment.

All of the above suggest the potential for improving investigation methodology towards achieving greater understanding of waterborne risks and disease, with the overall purpose of improving health protection from waterborne disease in Ireland.

Signed

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