Outbreak of Cryptosporidiosis in Carlow Town Spring 2012

FINAL REPORT
February 2015

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Summary

Over a five week period in late Spring, 2012, 12 cases of Cryptosporidiosis, with addresses in Carlow town, were notified to the Department of Public Health. Ten of these were primary and two were secondary cases, in siblings. Eleven cases were *Cryptosporidium parvum*. GP60 analysis of ten cases demonstrated that they were infected with *Cryptosporidium parvum* IIaA20G3R1, not a common GP60 subtype. Upon investigation, the only common risk factor identified was the public water supply, although in one case, this would have meant a (very short) incubation period of only 24 hours.

Increased water sampling by Carlow County Council following reporting of cases by the HSE to them identified *Cryptosporidium muris/andersoni* in the treated water at Sion Cross water treatment plant (0.004-0.015oocysts/10 litre) and on the network (0.004-0.009 oocysts/10 litre). *Cryptosporidium parvum* was subsequently identified in one of two samples of raw water taken at Sion Cross Water Treatment Plant (WTP). Water from Sion Cross and Rathvilly WTPs is stored in three linked chambers in the Brownshill Resevoir where it is blended to some extent. *Cryptosporidium* was not, and never has been, detected in the treated water at Rathvilly WTP.

The HSE advised Carlow County Council that they believed that the water supply from Sion Cross WTP was the most likely source of the *Cryptosporidium* causing this outbreak and, therefore, was not safe to drink. Carlow County Council advised that a supplemental ground water supply, from the Oak Park Wellfield, in which *Cryptosporidium* was not detected, was available and this allowed closure of Sion Cross WTP to facilitate upgrading. This included introducing acid-dosing at the plant to improve coagulation and *Cryptosporidium* removal.

Sion Cross WTP was reopened following the plant upgrade, a satisfactory audit by the Environmental Protection Agency and negative sampling for *Cryptosporidium* to an agreed schedule.

There have been no positive *Cryptosporidium* results on the Carlow Town water supply since the Sion Cross water treatment plant resumed supplying water to the network.

Introduction

There was an outbreak of Cryptosporidiosis in Carlow Town in the late Spring and early Summer of 2012.

On first notification of cases an outbreak control team (OCT) was convened comprising HSE professionals from the Department of Public Health, Environmental Health and Microbiology (Appendix 1). At the same time an incident control team (ICT) (Appendix 2) was convened between the HSE and the Carlow County Council. The OCT met on three occasions from 18th May to 26th June 2012. The ICT met on five occasions from 14th May to 9th July 2012. Following the end of the outbreak the members of the ICT continued to meet as the Carlow Water Quality Liaison Group.

This report describes the outbreak and summarises the investigation and management undertaken by the OCT and ICT.

Epidemiology

First cluster

In Week 19 (ending 13/05/12) four cases of Cryptosporidiosis were notified to the Department of Public Health in the South East. All addresses were in Carlow town. The cases were aged 22 months, two years, four years and 19 years. Onset dates ranged from 24/04/12 to 02/05/12. Possible risk factors included a pet dog, attending a swimming pool during the incubation period, sibling ill following return from Sri Lanka and two children attending different crèches. All cases were on the Carlow Town public water supply.

On 16/05/12 a further case was notified. This was an eight year old who lives in western Graiguecullen, Carlow Town. He had no obvious risk factors for infection with cryptosporidiosis. Water to this part of Graiguecullen is usually supplied by Laois County Council. However, due to a problem at the Laois County Council WTP, water was supplied to this part of Graiguecullen from the Carlow Town supply (see below) from 6pm on 01/05/12 to midday on 03/05/12. The onset of illness in this case was 2nd May 2012. Due to the absence of other risk factors this case raised considerable concern about the Carlow Town water supply. However, the incubation period, for this one case in Graiguecullen, would have to have been approximately 24 hours (which is very short, (1)) for the water supply to be the risk factor.

There had been no cases of cryptosporidiosis in the population served by Carlow Town water supply since an outbreak in 2005[1] (2, 3). Table 1 outlines the rates of Cryptosporidiosis per 100,000 population in Carlow Town and the HSE South East from weeks 1 to 19, 2005 to 2012, including for the Carlow Town outbreak in 2005.

[1] An outbreak of cryptosporidiosis occurred in Carlow Town and environs during spring 2005. Thirty one cases of cryptosporidiosis were notified between February and May. Cases were mainly young children. All cases had consumed water from the Carlow Town water supply. Other risk factors identified were drinking untreated well water, contact with animals, partaking in water sports and contact with other cases (2, 3).

Table 1. Crude Incidence of Cryptosporidiosis per 100,000[2], weeks 1 – 19, 2005 to 2012

	2005	2006	2007	2008	2009	2010	2011	2012
Carlow town PWS	69.9	–	–	–	–	–	–	20.6
Co. Carlow	69.5	4.0	4.0	2.0	5.5	5.5	–	12.8
South East	14.3	5.9	7.8	5.4	4.6	6.6	7.0	11.1
Ireland	7.1	3.6	9.0	4.5	4.8	3.7	5.0	6.0

Speciation of samples from these first cases was requested and results obtained 21/05/13. There was an inadequate sample in one case but the other four were all *Cryptosporidium parvum*.

In the following weeks two further cases were notified to the Department of Public Health. One of these cases was a sibling of the Graiguecullen case (see above). This case (onset 16/05/2012) could have been either a primary or a secondary case. For the purposes of the investigation and report it was considered a secondary case.

Second cluster

On the 13th June 2012 (week 24), four further cases of Cryptosporidiosis resident in Carlow Town were notified, with a final case notified on 18th June. Sion Cross WTP was shut down on the 19th June.

In summary,

There were 12 cases. Ten of these were primary cases and two were secondary cases, in siblings. Most of the cases were notified as two clusters, the 1st in week 19 and the 2nd in week 24. Overall,

- Three cases had been hospitalised;
- Age ranges: 22 months to 19 years, but 10 cases under eight years;
- Onset dates ranged from 24/04 to 08/06 (Figure 1);
- All addresses were in Carlow town (Figure 2);
- The Carlow Town water supply was identified as the only common risk factor for the ten primary cases. One primary case was exposed to water the Carlow Town water supply (which included water from Oak Park Wellfield, see below) for, at most, 24 hours prior to illness onset.

Other possible risk factors identified for primary cases were as follows:

- four cases attended four different crèches;
- two cases visited the same pet farm as part of the same school trip;
- one case visited an open zoo;
- two cases had contact with pets (one dog, one unknown);
- two cases travelled within Ireland;
- the sister of one case had had diarrhoea of unknown aetiology following trip to Sri Lanka (onset of case three weeks after arrival home);
- three cases swam in two different swimming pools;
- one case may have consumed unpasteurised milk;

[2] Crude incidence per 100,000 was calculated for 2005 – 2008 cases using the 2006 census figures CW pop^n =50,349; SE = 460,838; Ire = 4,239,848, and for subsequent years using the 2011 census figures CW pop^n =54,612; SE = 497,578; Ire = 4,588,252,. The Carlow Town Public Water Supply serves a population of 24,330.

- one case may have visited a farm;
- Two cases were household contacts of separate cases of Cryptosporidiosis.

Figure 1 Epidemiological curve of Cryptosporidiosis cases residing in Carlow Town May – June 2012

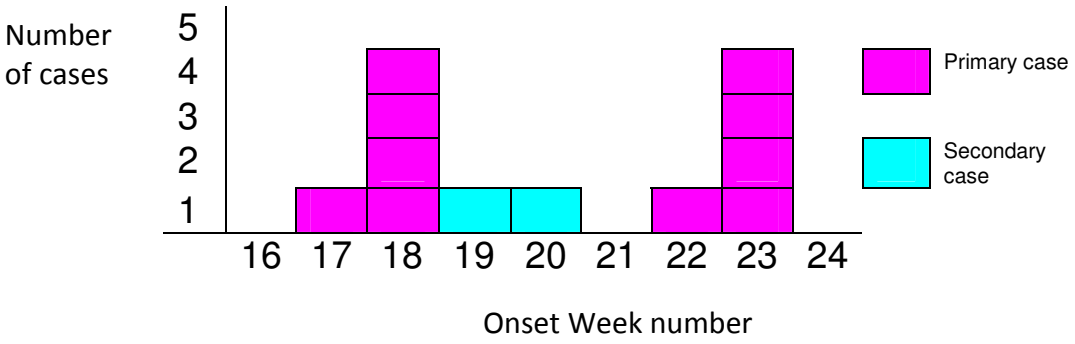
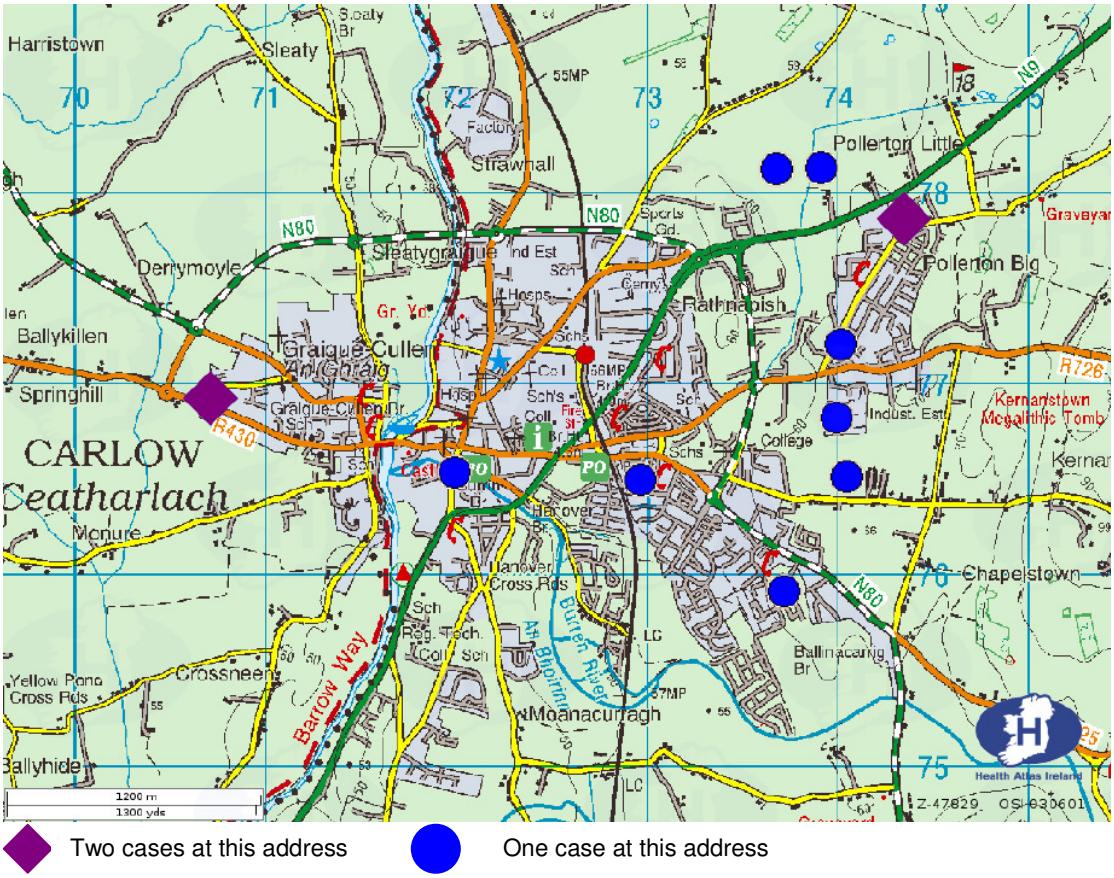


Figure 2 Map of Carlow Town showing home addresses of Cryptosporidiosis cases notified in late Spring and early Summer, 2012



At this stage in 2012 the incidence of Cryptosporidiosis per 100,000 population served by the Carlow Town public water supply was 48.0 per 100,000. This compared with 14.3 per 100,000 population in the HSE South East and 7.9 per 100,000 for Ireland (see Tables 2a and 2b).

Table 2a Number of cases of Cryptosporidiosis notified, weeks 1 – 25, 2005 to 2012.

	2005	2006	2007	2008	2009	2010	2011	2012
Carlow town PWS	17	0	0	0	0	0	0	12
Co. Carlow	35	2	2	1	3	3	3	14
South East	66	27	36	25	23	33	35	71
Ireland	302	153	381	190	218	169	229	365

Table 2b Crude Incidence of Cryptosporidiosis per 100,000 population[2], notified, weeks 1 – 25, 2005 to 2012

	2005	2006	2007	2008	2009	2010	2011	2012*
Carlow town PWS	69.9	–	–	–	–	–	–	49.3
Co. Carlow	69.5	4.0	4.0	2.0	5.5	5.5	5.5	25.6
South East	14.3	5.9	7.8	5.4	4.6	6.6	7.0	14.3
Ireland	7.1	3.6	9.0	4.5	4.8	3.7	5.0	7.9

Microbiology of Human Cases

All samples were analysed in Waterford Regional Hospital Microbiology Laboratory. All samples were forwarded to the Cryptosporidium Reference Unit, Swansea for speciation and sub-typing. Eleven cases were *Cryptosporidium parvum*. It was not possible to speciate one case.

GP60 analysis of ten cases demonstrated that they were infected with *Cryptosporidium parvum* IIaA20G3R1.

HSE investigation

- Case finding was conducted by phoning local GPs, Caredoc and neighbouring Departments of Public Health.
- Local schools were contacted to determine if there was increased absenteeism due to gastrointestinal illness. There were no other cases of gastrointestinal illness among children who had visited a pet farm on a school trip.
- The Midlands Department of Public Health was contacted regarding the pet farm in their area that a number of cases had visited during the incubation period. No other cases associated with the pet farm had been notified to them. Coincidentally, the pet farm had been visited the previous week and the Environmental Health Officer was satisfied with its operation and supervision of hand hygiene within visiting school groups.
- The laboratory at the Midlands Regional Hospital was requested to routinely test diarrhoeal samples for *Cryptosporidium* (this is always done at Waterford Regional Hospital laboratory) for the duration of the outbreak.
- Environmental Health Officers investigated swimming pools in which cases swam during the incubation period. The reports from these investigations were satisfactory.

- All positive samples were sent to the Cryptosporidium Reference Laboratory in Wales for speciation and GP60 subtyping.
- Rainfall at Oakpark Meteorological Station in Carlow was graphed, with dates of case onset. No obvious pattern emerged.
- Enhanced surveillance of all cases using the national Cryptosporidiosis questionnaire with additional questions on possible food exposures was conducted to determine any possible common risk factors. (See Appendices 3 and 4). The only common risk factor was the Carlow Town public water supply. Other possible risk factors included the following:
    - four cases attended four different crèches;
    - two cases visited the same pet farm as part of the same school trip;
    - one case visited an open zoo;
    - two cases had contact with pets (one dog, one unknown);
    - two cases travelled within Ireland;
    - the sister of one case had had diarrhoea of unknown aetiology following trip to Sri Lanka (onset of case three weeks after arrival home);
    - three cases swam in two different swimming pools;
    - one case may have consumed unpasteurised milk;
    - one case may have visited a farm;
    - one case was a household contact of a case of Cryptosporidiosis.

Water Supply

The Carlow Town Water Supply Zone is supplied with drinking water from three sources. Water from treatment plants at Rathvilly and at Sion Cross is fed into three linked chambers at Brownshill Reservoir and distributed to the Carlow Town network from there. The Sion Cross WTP abstracts raw water from the River Burren and Rathvilly WTP from the River Slaney.

Water from the Brownshill Reservoir is also blended with groundwater from three wells at Oak Park and this is fed into sections of Carlow Town and part of Graiguecullen. The western side of Graiguecullen is usually supplied with water from Laois County Council.

Water Supply Risk Score and Sampling History

The overall C*ryptosporidium* risk score for the Sion Cross WTP is very low. This is despite the River Burren catchment area having a high *Cryptosporidium* risk score (due to very intensive levels of agriculture in the catchment).

Between 2010 and 2011 there were 18 treated water samples taken at the Sion Cross WTP. Very low levels of C*ryptosporidium* were detected (range 0.003-0.016oocysts/10L) in three of these samples.

Rathvilly WTP has a moderate C*ryptosporidium* risk score but has a good history on *Cryptosporidium* sampling. Of the 12 samples tested for C*ryptosporidium* from the Rathvilly water treatment plant in 2010-2011 all were negative.

Both treatment plants have coagulation, flocculation, rapid sand filtration, chlorination and fluoridation.

Water was also supplied to Graiguecullen, Co. Laois from Brownshill Reservoir and Oak Park Wellfields (ground water supply) from 6pm 1/5/12 to 12md 3/5/12. The *Cryptosporidium* risk score for the Oak Park Wellfields is extremely low.

County Council investigation

The following investigations were carried out by Carlow County Council as part of the investigation into this outbreak:

- Increased frequency of *Cryptosporidium* testing, with speciation of oocysts identified, at Sion Cross and Rathvilly WTPs, and on the network. The laboratory routinely used by Carlow County Council is Scottish Water. Most samples were sent there. Samples and DNA were also sent to an alternate laboratory, at Backweston.
- Review of turbidity monitoring and results 2011-2012. This illustrated overall values of less than 0.1NTU, as recommended by the EPA (4), with little variability. However, turbidity fluctuated more, with some results up to 0.25NTU in the Spring of 2012. The legal parametric value for turbidity is 1NTU.
- Inspection of source water catchment area was conducted on18th May 2012. No obvious source of *Cryptosporidium* contamination of the River Burren was identified.
- Inspection of Brownshill Resevoir. This did not identify the source of the C*ryptosporidium*.

Microbiology of Water samples

Cryptosporidium detection and speciation in water samples (Table 3) was done by Scottish Water, except for the raw water sample taken on 6th June 2012. For this sample gene sequencing of oocysts on a slide from Scottish Water was carried out at Backweston Cryptosporidium Laboratory. Scottish Water speciate *Cryptosporidium* by Restriction Fragment Length Polymorphism (RFLP).

Table 3. Water sampling results May – June 2012

Sampling Site	Oocysts detected	Species detected
Rathvilly WTP Treated water	None (7 samples)	
Sion Cross WTP Treated water	0.009 – 0.015/10L (5/11 samples positive, 14/5/12-15/6/12)	*C. muris/andersoni*
Sion Cross WTP Raw water	0.015/10L (1 sample, 6/6/12)	*C. parvum*
Distribution Network	0.009 – 0.013/10L (3/19 samples positive, 18/5/12-16/7/12)	*C. muris/andersoni*
Oak Park Wellfields	None (6 samples)	

Consideration of source of outbreak

GP60 analysis of ten cases in this outbreak demonstrated that they were infected with *Cryptosporidium parvum* IIaA20G3R1. Zintl *et al*, 2011 (5) found that this subspecies is not the most common *Cryptosporidium parvum* subspecies in Ireland and accounts for approx 12% of Irish cases and 24% of Leinster cases. This suggests that the cases were linked and from the same source.

There is uncertainty concerning the level of *Cryptosporidium* oocysts in drinking water which may cause human illness (6). Some outbreaks of cryptosporidiosis have been strongly associated with drinking water but few or no *Cryptosporidium* oocysts have been found, while large numbers of oocysts have been found in drinking water with no associated human illness (7).

There is no internationally recognised threshold level of *Cryptosporidium* contamination of water that indicates that human illness is likely to develop. In the past the UK Drinking Water Inspectorate notification level for *Cryptosporidium* in the drinking water was 1 oocyst/10L of water while Scottish Water and Northern Ireland Water set a notification limit of 0.1 oocysts per 10L of water (4). The criterion relating to *Cryptosporidium* in water for rescinding the boil water notice which was imposed on the Carlow Town water supply during the 2005 outbreak was a level of less than 0.05 oocysts/10L. However, the Environmental Protection Agency (2011) (4) state that "While there is no standard for C*ryptosporidium* in Ireland the European Communities (Drinking Water) (No. 2) Regulation 2007 requires water suppliers to ensure that water is wholesome and clean and meets the requirements of the regulations. Furthermore, the regulations state that water must be free from any microorganisms or parasites which constitute a particular danger to human health."

In this outbreak the only common risk factor for all ten primary cases was the Carlow Town water supply. Other possible risk factors were carefully considered and explored by the OCT but none that would explain the outbreak were identified.

There was evidence of water treatment failure for *Cryptosporidium* in that *Cryptosporidium muris/andersoni* was identified in the treated water. *Cryptosporidium parvum*, the organism identified in the cases was not identified in treated water but was detected in the raw water. In addition, *Cryptosporidium muris/andersoni* is larger than *Cryptosporidium parvum* (8) and so failure of the treatment process to remove it may indicate that *Cryprosporidium parvum* might also not be removed. While the treated water turbidity always remained well below the legal parametric value of 1NTU, in the month before the outbreak there were fluctuations with levels above 0.1NTU, the level recommended by the EPA for protection against *Cryptosporidium* (4).

There had been a previous outbreak associated with this water supply in 2005 (2, 3).

For one case to have been associated with Carlow Town water would have meant an incubation period of maximum 24 hours. This is very short, with the typical incubation period for Cryptosporidiosis of four to seven days and a range from 1-28 days reported (1). In addition, the water supply to this case was 80% from the Oak Park Wellfield (which was not implicated as the source of the outbreak) and 20% from the Brownshill Resevoir (including Sion Cross WTP). Prior to the outbreak the Sion Cross WTP had a very low overall *Cryptosporidium* risk score (although the catchment risk score is high).

Decision of OCT as to cause of outbreak

Having given due consideration to all of the factors above, the HSE OCT, in accordance with the Report of the Waterborne Cryptosporidiosis Subcommittee of the Scientific Advisory Committee (2004) (9), concluded that this outbreak of Cryptosporidiosis was "probably associated with water" produced at Sion Cross WTP (Grade B, see Appendix 5), based on the following:

- Descriptive epidemiological evidence suggesting water related illness and excluding other obvious explanations (see above); and
- Water treatment failure at Sion Cross WTP i.e. *Cryptosporidium muris/andersoni* detected in treated water and fluctuations in turbidity of the treated water, with levels above 0.1NTU in the month before the outbreak.

Therefore, the HSE advised Carlow County Council on June 18th 2012 that the water supply from Sion Cross WTP was the most likely source of the *Cryptosporidium* causing this outbreak and, therefore, was not safe to drink and would require a boil water notice. Carlow County Council advised that the sources at Rathvilly and the Oak Park Wellfield had shown no evidence of C*ryptosporidium* being present.

Carlow County Council did not agree that the evidence was completely conclusive with regard to Sion Cross WTP. However, acting on the advice of the HSE, and to protect public health Carlow County Council shut down Sion Cross WTP and implemented process improvements as described below.

The outbreak was declared over on 3rd August 2012.

Improvements implemented to the water treatment process at Sion Cross WTP

The Incident Control Team agreed that Carlow County Council would temporarily shut down the Sion Cross WTP. Carlow County Council was in a position to make up for the loss of the Sion Cross supply by substituting it with water from the Oak Park Wellfield and increasing flows from Rathvilly.

The following works were carried out at Sion Cross WTP:

- Pre-treatment pH adjustment by dosing of Sulphuric Acid prior to the alum dosing at Sion Cross WTP to optimise the coagulation process. This improves the barrier to a number of pathogens and chemicals, including *Cryptosporidium*.
- Post dosing with Sodium Hydroxide to correct pH in final water.
- Removal of inclined tubes and cleaning down of settlement tanks.
- Replacement of sand in the sand filters.
- Assurance of *Cryptosporidium* risk minimisation according to the Report of Waterborne Cryptosporidiosis Subcommittee of the SAC of the NDSC, 2004 (9, p 51) was provided by the County Council.
- Assurance of security of water supply with regard to raw water in the catchment and reservoir security were provided by Carlow County Council.

Criteria agreed for re-introduction of Sion Cross water treatment plant water to the public water supply

- Successful commissioning of pre-treatment pH adjustment via the dosing of Sulphuric Acid prior to the alum dosing at Sion Cross WTP to optimise the coagulation process.
- EPA to complete satisfactory audit at Sion Cross water treatment plant.
- Following commissioning of acid-dosing process, Water sampling at Sion Cross water treatment plant to have zero oocysts on alternate days for two weeks.

Conclusion

The agreed re-introduction criteria were met and water from Sion Cross WTP was reintroduced to the public water supply in December 2012.

No *Cryptosporidium* has been detected on water sampling carried out by Carlow Water Services Authority since 2012.

Report Authors

Dr. Sarah Doyle, Specialist in Public Health Medicine and Dr. Marrita Mahon Surveillance Scientist, Department of Public Health, HSE South East in conjunction with Mr. Dick McGrath, Principal Environmental Health Officer, HSE South, Mr. Jeremiah Crowley, Senior Executive Engineer, Mr. Dan McIntyre, Chief Executive (acting) and Mr. Brian O'Donovan, Senior Engineer, Carlow County Council.

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Appendix 1 Membership of the HSE Outbreak Control Team

Dr. Sarah Doyle, Specialist in Public Health Medicine, Department of Public Health, South East (Chair)
Dr. Catherine Lynch, Specialist in Public Health Medicine, Department of Public Health, South East
Dr. Meave Doyle/ Dr. Brian Carey, Consultant Microbiologist, Waterford Regional Hospital
Mr. Richard McGrath, Principal Environmental Health Officer, HSE South/ Ms Sheelagh Mooney, Environmental Health Officer, HSE South
Dr. Marrita Mahon, Surveillance Scientist, Department of Public Health, South East
Ms Grainne Parker, Communicable Disease Control Nurse, Department of Public Health, South East

Acknowledgements

The HSE Outbreak Control Team would like to acknowledge the assistance and work of Ms. Gemma Leane, Researcher, Department of Public Health and Dr. Rachel Chalmers, Director, Cryptosporidium Reference Unit, Swansea.

Appendix 2 Membership of the HSE – Carlow Water Service Authority Incident Control Team

Mr John Carley, Director of Services, Carlow County Council
Mr. Jeremiah Crowley, Senior Executive Engineer, Carlow County Council
Mr. Sean Laffey, Senior Engineer, Carlow County Council
Dr. Sarah Doyle, Specialist in Public Health Medicine, Department of Public Health, HSE South East
Dr. Catherine Lynch, Specialist in Public Health Medicine, Department of Public Health, HSE, South East
Mr. Richard McGrath, Principal Environmental Health Officer, HSE South/ Ms Sheelagh Mooney, Environmental Health Officer, HSE South
Dr. Marrita Mahon, Surveillance Scientist, Department of Public Health, HSE South East

Appendix 3 Questionnaire for Cryptosporidiosis cases

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

Enhanced Surveillance Form for Cases of Cryptosporidiosis and Giardiasis

hpsc

Name of interviewer_____

Job title

_____

Date of interview

_____

Administered by: telephone ☐ post ☐ in person ☐

Respondent name:

_____

Relationship to patient:

_____

Information leaflet posted to case ☐ Date_____

*Note for respondent: if answering on behalf of a child, please remember that the questions relate **to the child** and not to yourself.*

Case name_____

Tel No _____

Home Address

_____

_____

Date of birth |_|_|_|_|_|_| Age _____ Sex: male ☐ female ☐

Occupation (for children, record as schoolchild/crèche attendee/etc, as appropriate.)

_____

For children/foodhandlers/healthcare workers, name and address of workplace/school/crèche/childminders

_____

Clinical Symptoms

_____

Date of onset |_|_|_|_|_|_| Date of diagnosis |_|_|_|_|_|_|

Patient Type (in-patient, out-patient, GP patient, other, etc.)_____

Hospital of admission_____

Date of admission |_|_|_|_|_|_| Duration of stay _____

GP details

_____

Is case in any way predisposed to developing cryptosporidiosis (e.g. immunocompromised)? Yes ☐ No ☐ Unknown ☐

Travel

In the 2 weeks before onset of illness, was case abroad?

Yes ☐ No ☐ Unknown ☐

Which country was visited? _____

Specify foreign travel dates |_|_|_|_|_|_| to |_|_|_|_|_|_|

In the 2 weeks before onset, did case spend any nights away from home in Ireland?

Yes ☐ No ☐ Unknown ☐

Name of address of accommodation used while away in Ireland

_____

Dates for travel within Ireland |_|_|_|_|_|_| to |_|_|_|_|_|_|

Water consumption

In the 2 weeks before onset of illness, did case drink any cold tap water?

Yes ☐ No ☐ Unknown ☐

In the 2 weeks before onset of illness, did case drink any drinks containing tap water/ice?

Yes ☐ No ☐ Unknown ☐

In the 2 weeks before onset of illness, did case drink any bottled water?

Yes ☐ No ☐ Unknown ☐

Brand name of bottle water:

_____

Home water supply

Home water supply type

Public water supply ☐ Group water scheme (public) ☐ Other ☐

Private well ☐ Group water scheme (private) ☐ Unknown ☐

Name of home water supply _____

Treatment on home supply (tick all that apply) None ☐
Chlorination ☐

Filtration ☐ Membrane filtration ☐ UV treatment ☐ Unknown ☐

Other ☐ Please specify _____

Other water supplies

In the 2 weeks before onset of illness, did case consume water/ice from a water supply other than at home (e.g. school/crèche/workplace/elsewhere)?

Yes ☐ No ☐ Unknown ☐

Locations other than at home where water consumed (tick all that apply):

school ☐ childminders ☐ crèche ☐

workplace ☐ food premises ☐ home of a relative/friend ☐

hotel/guest accommodation ☐ other ☐

Information on up to 2 locations may be recorded below.

Address of first location:

_____

Indicate supply type for first location if known

Public water supply ☐ Group water scheme (public) ☐ Other ☐

Private well ☐ Group water scheme (private) ☐ Unknown ☐

Name of water supply for first location

_____

Address of second location:_____

_____

_____

Indicate supply type for second location if known

Public water supply ☐ Group water scheme (public) ☐ Other ☐

Private well ☐ Group water scheme (private) ☐ Unknown ☐

Name of water supply for second location

_____

Washing fruit/veg

Does case always/almost always wash raw vegetables with cold running water before eating?

Yes ☐ No ☐ Unknown ☐

Does case always/almost always wash fruit with cold running water before eating?

Yes ☐ No ☐ Unknown ☐

Farm contact

Does case live on or is case cared for on a farm? Yes ☐ No ☐ Unknown ☐

Any recent lambing/calving activity on farm? Yes ☐ No ☐ Unknown ☐

Any recent diarrhoeal illness among animals on farm? Yes ☐ No ☐ Unknown ☐

Pet contact

Does case have contact with domestic pets, e.g. dogs, etc?

Yes ☐ No ☐ Unknown ☐

Type of pets (puppy/cat/etc)

_____

Any recent diarrhoeal illness in pet(s)? Yes ☐ No ☐ Unknown ☐

Farm/zoo visits

In the 2 weeks before onset of illness, did case visit a farm, zoo, pet farm or other venue where there was potential for contact with domestic animals/farm animals/birds?

Yes ☐ No ☐ Unknown ☐

If YES, name and address of premises

_____

Date(s) of visit(s): (i) └_|_|_|_|_|_┘ (ii) └_|_|_|_|_|_┘

Types of animals on premises

_____

Swimming/water activites

In the 2 weeks before onset of illness, did case swim in a swimming pool?

Yes ☐ No ☐ Unknown ☐

Name/location of swimming pool

_____

Date(s) of visit(s): (i) └_|_|_|_|_|_┘ (ii) └_|_|_|_|_|_┘

In the 2 weeks before onset, did case take part in any other water-based activity which may have involved swallowing water?

Yes ☐ No ☐ Unknown ☐

Type of water activity (outdoor swimming/windsurfing, etc):

_____

Where did water activity take place?

_____

When did water activity take place? (i) └_|_|_|_|_|_┘ (ii) └_|_|_|_|_|_┘

Symptomatic contacts

Any similar illness in family members/close contacts (please provide details)?

_____

_____

_____

43. Any additional relevant information

_____

_____

_____

_____

****

Appendix 4 Supplementary Food Questions for cryptosporidiosis outbreak, Carlow May 2012

Unpasturised Milk	Yes ☐	No ☐
Dairy Products (e.g. yoghurt / ice-cream / cream)	Yes ☐	No ☐
Soft Cheese	Yes ☐	No ☐
Unpasturised Fruit Juice	Yes ☐	No ☐
Lettuce	Yes ☐	No ☐
Other Salads green	Yes ☐	No ☐
Herbs	Yes ☐	No ☐
Tomatoes	Yes ☐	No ☐
Coleslaw	Yes ☐	No ☐
Raw Vegetables/Fruit	Yes ☐	No ☐
Pâté	Yes ☐	No ☐
Undercooked burger/cold meats	Yes ☐	No ☐
Raw Shellfish	Yes ☐	No ☐
Food Outlets	Yes ☐	No ☐

_____

Eating Out	Yes ☐	No ☐

_____

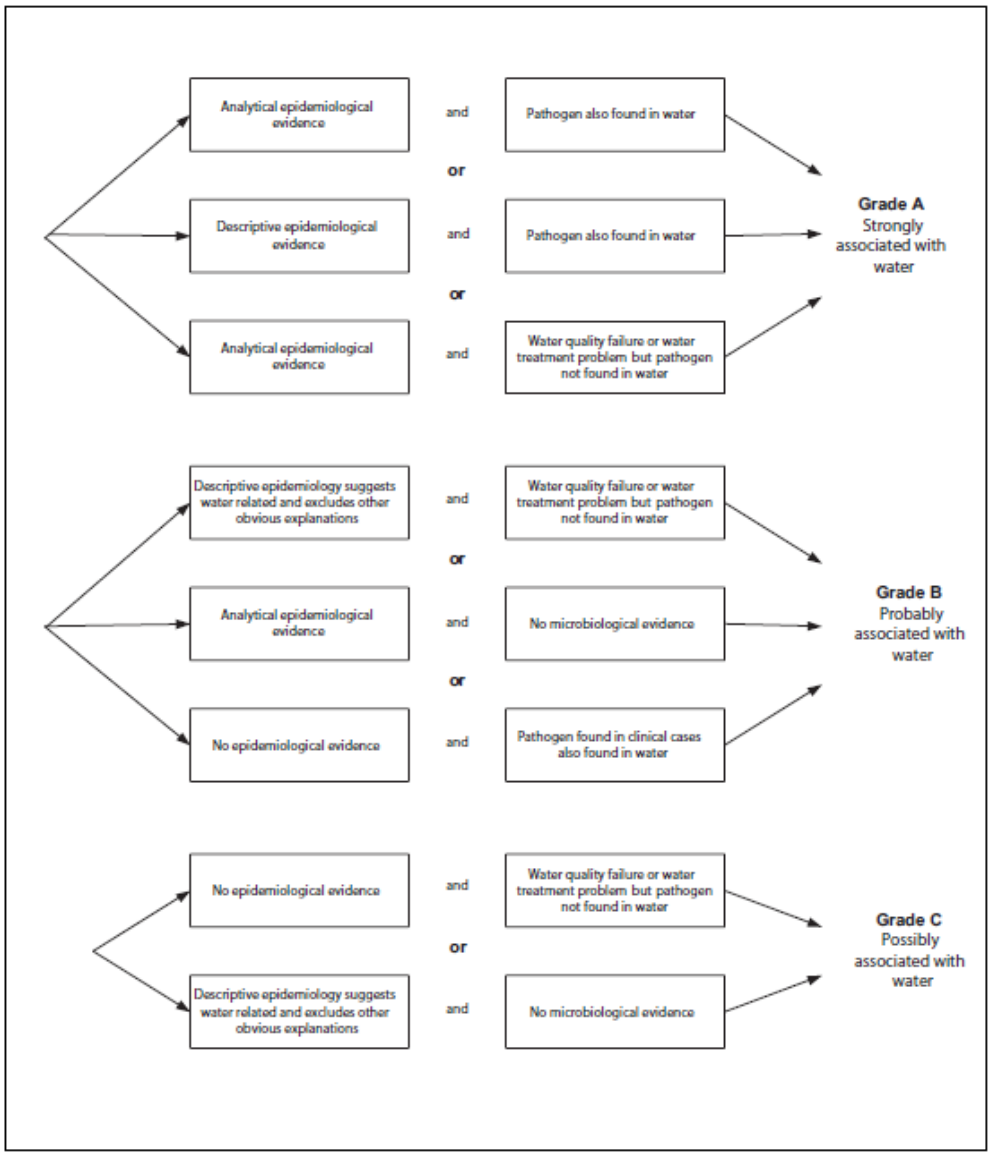
Did you attend any other event e.g. Play game areas etc.

_____

Appendix 5 Algorithm for assessing the strength of association between human illness and water

Appendix 2

Association between Human Illness and Water



Source: Adapted from the UK Public Health Laboratory Service Guidelines on the association between human illness and water (PHLS, 1996).