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National Disease Surveillance Centre,

25-27 Middle Gardiner St
Dublin 1,
Ireland

Tel: +353 (0)1 **876 5300**
Fax: +353 (0)1 **856 1299**
info@ndsc.ie
www.ndsc.ie

Cryptosporidium Outbreak in a Continuously Tested Public Water Supply

Introduction

The Department of Public Health and Planning in the Midland Health Board (MHB) was notified of nine confirmed and two suspected cases of cryptosporidiosis on the 3 June 2004. All of the cases were on the same water supply that services approximately 25,000 people. This supply had been the source of an outbreak of cryptosporidiosis in April/May 2002.[1] As a result of the 2002 outbreak a filtration system was installed in December 2003. However, due to a high demand on the water supply and an inability of the system to deal with the high turbidity of the water the local authority added unfiltered water to the filtered water at a ratio of 1:4. The local authority carried out testing for *Cryptosporidium* on a daily basis when they started using the unfiltered water. The water supply had also been tested for *Clostridium perfringens,* an indicator organism for *Cryptosporidium*.

An outbreak control team (OCT) meeting was convened on the 3 June 2004. Initial investigation indicated that the water supply was the most likely source of the outbreak. The local authority was informed of the situation and advised to either issue a boil water notice or to supply only filtered water to the public. They agreed to switch to a completely filtered water supply. A memo was sent to all hospitals in the area to reiterate the importance of using boiled water at all times for those who were immunocompromised.

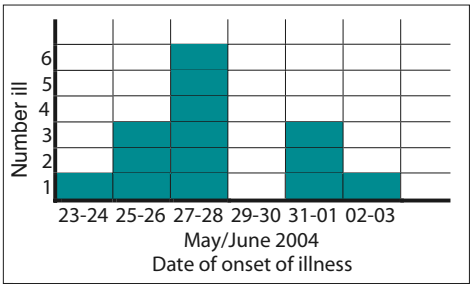

Figure 1. Epidemic curve

Epidemiological Investigation

A case control study was undertaken. All cases were laboratory confirmed and controls were family or household members who were not ill. In total, fourteen cases were laboratory confirmed with the onset of symptoms ranging from 25 May to 3 June 2004 (Figure 1).

As all of the *Cryptosporidium* positive cases drank water, it was not possible to determine the relative risk of drinking water versus not drinking water. Therefore, the effect of the quantity of water consumed on the probability of becoming ill was investigated. Patients and controls were assigned an exposure score for water consumption relative to a base-line of one, which was taken to be all those who consumed one or less glasses of water per day (Table 1). Analysis for Linear Trend in Proportion (Table 2) showed there was a linear trend between the quantity of water consumed and the likelihood of becoming ill (p<0.001).

Table 1. Exposure score relative to quantity of water consumed

Quantity of water in glasses (250ml)	Exposure score	Number of Cases	Number of Controls
0-1	1	1	12
2-3	2	1	3
4-7	4	7	6
7-11	8	5	1

Other possible sources of infection were investigated. However, in this outbreak no significant risk factor, other than the volume of water consumed, was established.

Environmental Investigation

Testing for *Cryptosporidium* carried out by the local authority was positive on the 8 –9 May 2004 (0.0015/10L). Four samples tested for *C. perfringens* prior to the outbreak were all negative. Samples taken on the 3 June 2004 from the 4:1 filtered/unfiltered supply and on the 5 June 2004 from the fully filtered supply were both negative for *Cryptosporidium*. A sample of the raw water source taken on 4 June 2004 was found to have one *Cryptosporidium*-like body/400L water.

Table 2. Odds ratios for water exposure

Exposure score	Odds ratio (relative to baseline)
1	1
2	4
4	14
8	60

Chi square for linear trend: 10.95; p value: 0.00094

Discussion

This outbreak was epidemiologically shown to be linked to the water supply. The shape of the epidemic curve (Figure1) would suggest that there was a common source of exposure over a short period of time in this outbreak rather than a continuing source. Analysis demonstrated that the probability of becoming ill increased with the quantity of tap water consumed (Table 3) (P<0.001). These results suggest that the level of *Cryptosporidium* peaked in the supply for a short period of time. However, this water supply was being tested for *Cryptosporidium* on a daily basis at this time and the only positive results were outside the incubation period for this outbreak and were below generally accepted levels of *Cryptosporidium* in a water supply. The UK Water Supply (Water Quality) Amendment Regulations 1999 S.I. 1524, have defined as a treatment standard, a level of less than one *Cryptosporidium* oocyst per 10 litres when sampled over a 24hr period. No numerical standard for *Cryptosporidium* is set in the revised Drinking Water Directive (98/83/EC). Outbreaks of cryptosporidisois associated with drinking water have occurred where oocysts counts have been below the UK limit (<1/10L).[2]

Anecdotal information indicated that there was extensive diarrhoeal illness in the community at the time. This suggests there may have been unidentified cases of cryptosporidiosis associated with this outbreak.

Cryptosporidium was not isolated from the water source during the incubation period for this outbreak which indicates that testing a water supply is not sufficient to determine the risk of a *Cryptosporidium* outbreak. Active surveillance of cases is required to identify an outbreak in a timely manner thus allowing prompt control measures to be implemented.

The work of the environmental health officers, laboratory staff and public health staff is acknowledged.

C. Eve O'Toole, Phil Jennings, Gerard Meagher and Ina Kelly, MHB

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CAMPYLOBACTERIOSIS IN IRELAND, 2002

Introduction

Infections due to *Campylobacter sp* are the commonest bacterial cause of human gastrointestinal illness in Ireland. *C. jejuni* is the predominant species associated with human illness, with the remainder mostly being *C. coli and C. lari.* Campylobacteriosis presents as a diarrhoeal illness. There may be bloody diarrhoea and frequently acute abdominal pain. Symptoms may subside after a number of days or may persist for weeks. Rarely, some long-term sequelae may develop such as arthritis and approximately one in every 1000 cases leads to a severe neurological disorder called Guillain-Barré Syndrome (GBS).

This review presents data from the fourth year of the NDSC national survey of the incidence of human campylobacteriosis in Ireland.

Methods

NDSC requested public health doctors and laboratories to provide disaggregated information on all laboratory-confirmed cases of campylobacteriosis diagnosed in 2002. The following minimum dataset was requested: identifier, date of birth/age, sex, address and date of onset/isolation/reporting. In regions where laboratory surveillance systems were in place, this information was requested from the laboratory databases. Duplicates were removed where detected. Data were assigned a health board and a county, where address was supplied. Analyses were carried out using MS Access and SPSS. Direct methods of standardisation were applied using the Irish population as the standard population. Population data were taken from the 2002 census. Species differentiation of isolates was not requested.

Results

Information on *Campylobacter* was obtained from all health boards. Information on age was missing in 2% of cases and on sex in 4% of cases.

Incidence

In total, 1336 cases of laboratory-confirmed campylobacteriosis were reported in Ireland in 2002 (including 5 non-resident cases). This gives a crude incidence rate (CIR) of 34.0 per 100,000 population resident in Ireland (Table 1). This compared with a CIR of 32.8 per 100,000 in 2001 (based on 2002 census data). The number of cases by year since 1999 is shown in Figure 1.

Table 1. Number of cases and CIR per 100,000 population of human campylobacteriosis in Ireland by health board, 2002 (excluding non-resident cases).

Health Board	No of cases	CIR (incl 95% C.I.)
ERHA	467	33.3 [30.3 - 36.3]
Midland	90	39.9 [31.7 - 48.2]
Mid-Western	71	20.9 [16.0 - 25.8]
North Eastern	50	14.5 [10.5 - 18.5]
North Western	87	39.3 [31.0 - 47.5]
South Eastern	208	49.1 [42.4 - 55.8]
Southern	173	29.8 [25.4 - 34.3]
Western	185	48.6 [41.6 - 55.7]
Total	**1331**	**34.0**

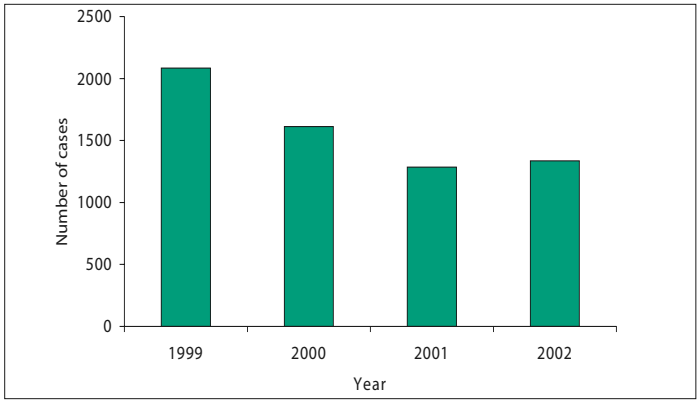

Figure 1. Number of laboratory-confirmed cases of campylobacteriosis in Ireland, 1999-2002

Age standardised rates were calculated to allow comparisons to be made between health board regions without the confounding effects of age (Figure 2). In 2002, the highest incidence was recorded in the WHB (48.9/100,000) followed by the SEHB (48.6/100,000), with the lowest incidence rate seen in the NEHB (14.0/100,000).

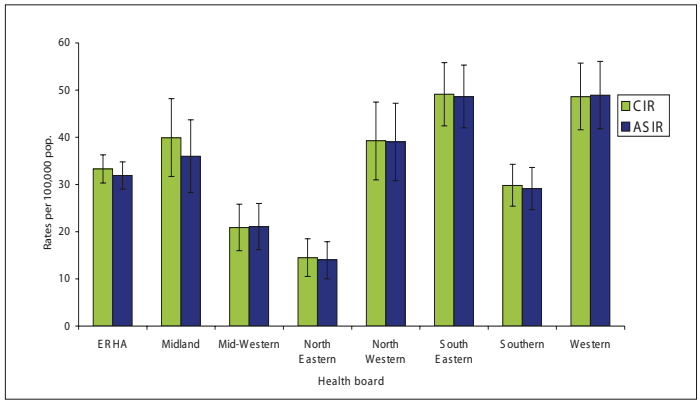

Figure 2: Age standardised incidence rates (ASIR) compared to CIR in each health board, 2002.

Seasonality

The distribution of cases by week is shown in Figure 3. A peak was seen in week number 22 in 2002. *Campylobacter* is known to have a well-characterised seasonal distribution with a peak seen in early summer each year.

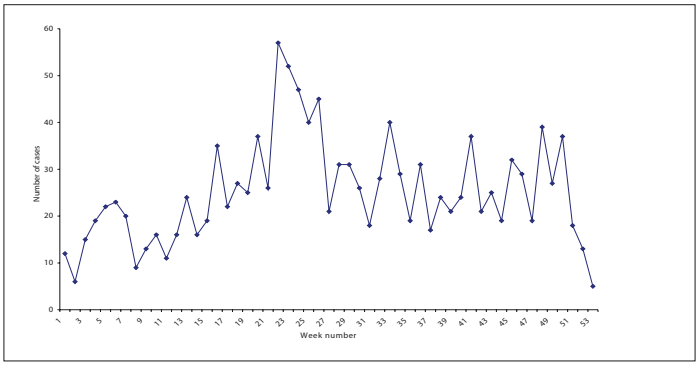

Figure 3: Total cases of campylobacteriosis by week of notification (2002) in Ireland

Age

When age-specific incidence rates for each age group are examined, it is evident that by far the highest burden of illness

is seen in children under 5 years (Figure 4). This was also seen in previous years and is a feature of the illness worldwide.

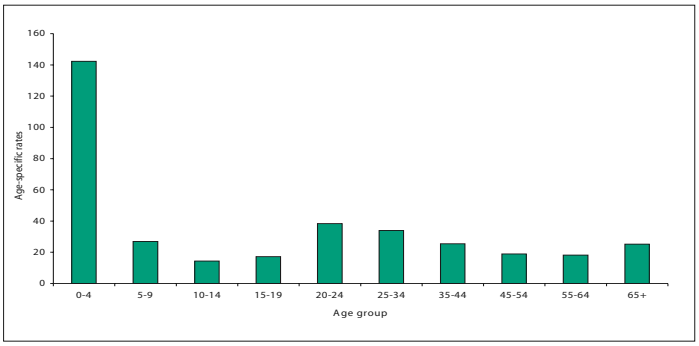

Figure 4. Age-specific incidence rates for campylobacteriosis in Ireland, 2002

Gender distribution

The variance in gender distribution that was noted in previous years was again evident from analysis of the data in 2002, with males accounting for 51.0% of cases and females 45.3% (3.7% missing). In every age-group except 15-19 years there was a predominance of male cases. This is seen in Figure 5 when the data are adjusted for age and sex.

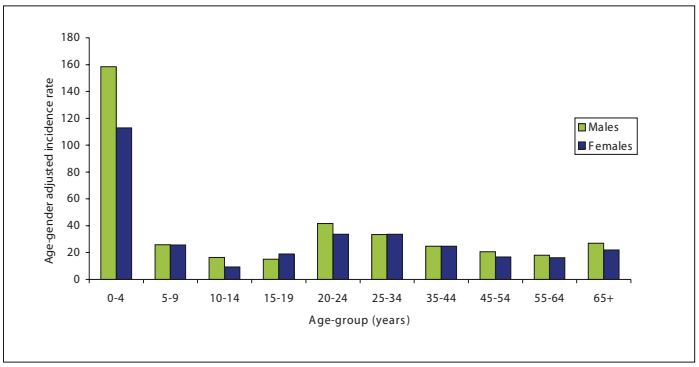

Figure 5: Age-gender adjusted incidence of campylobacteriosis according to age-group in 2002.

Outbreak data

There was one outbreak of *Campylobacter jejuni* reported to NDSC in 2002. It occurred in a restaurant and was responsible for seven persons being ill. The mode of transmission was suspected to be foodborne although no implicated food item was identified during the course of the investigation.

Discussion

This paper presents data from the fourth year of the national survey of incidence of human campylobacteriosis in Ireland and has provided valuable information regarding the epidemiology of this pathogen. It is evident that campylobacteriosis remains the single biggest cause of bacterial gastroenteric infection in Ireland (more than three times the number of salmonellosis cases reported in 2002). It should also be noted that these are laboratory confirmed cases and the true burden of illness is probably much higher.

The CIR was seen to increase slightly in 2002 (34.1 cases/100,000 persons) compared to 2001 (32.8/100,000). The increase was most notable in the South Eastern and Midland Health Board regions. The Western Health Board however, has consistently the highest incidence rate over the past number of years when the data are standardised for age (ASIR = 48.9/100,000). High rates were seen in 2002 for Northern Ireland[1] (48.2/100,000), England and Wales[2] (90.7/100,000) and Scotland[3] (101.3/100,000).

Many of the epidemiological trends noted since this annual survey began in 1999 have been found again on examination of the 2002 data. The incidence rate of this pathogen is consistently higher in young children and there is a bias towards male cases in almost all age-groups. It was recognised that research was needed in Ireland, to provide answers to some of these epidemiological questions. In order to address this, a matched case-control study was initiated in the ERHA region in 2003. The objective was to identify and assess risk factors for sporadic cases of campylobacter in Ireland. The study is being carried out by the Department of Public Health in the ERHA, and NDSC. It is expected to be completed by the end of 2004, after which the results will be disseminated.

Another notable feature of this organism is the seasonal pattern of infection seen each year. In 2002, a sharp peak in cases was seen in week 22 (Figure 3). An international study, in which Ireland was involved, has been undertaken by the WHO European Centre for Environment and Health (ECEH) to examine the effects of global climate change on a number of gastroenteric pathogens including *Campylobacter sp.*[4] The role of climate variability on laboratory-confirmed cases of campylobacter infections from Europe, Canada, Australia and New Zealand was examined. The findings of this important study are due to be published shortly.

There are many questions that remain unanswered regarding this pathogen. The lack of typing data on all isolates often hinders public health investigations, particularly in trace-back through the food chain to find the source of infection. Detailed antimicrobial resistance profiling of isolates is also essential to monitor trends that have been highlighted in recent years such as the emergence of quinolone-resistant *Campylobacter sp* isolates.[5]

This review again highlights the significance of this gastroenteric pathogen and the considerable public health burden it constitutes. Emphasis must be placed on control measures throughout the food chain in order to attempt to reduce the incidence of human disease caused by this organism.

Barbara Foley and Paul McKeown, NDSC

Acknowledgements

NDSC acknowledges all those who provided information for the fourth year of this report, in particular: public health doctors, surveillance scientists, medical microbiologists, medical laboratory scientists and environmental health officers.

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Tetanus Notifications in Ireland, 1988-2004

Introduction

Tetanus is an acute, often fatal illness caused by a toxin produced by the anaerobic, spore-forming bacillus, *Clostridium tetani*. The spores are widespread in the environment (soil, animal and human faeces) and remain viable for years. Transmission occurs when spores are introduced into the body through a puncture wound but also through trivial, unnoticed wounds, through injecting drug use, and occasionally through abdominal surgery.[1] The incubation period is usually between 3 and 21 days (range one day to several months), depending on the character, extent and location of the wound.

Diagnosis of tetanus is entirely clinical and does not depend upon bacteriological confirmation. *C. tetani* is isolated in only about 30% of cases and can be isolated from patients without the disease.

The disease can present with local or generalised muscle rigidity and painful spasms. Symptoms of generalised tetanus range from mild trismus ("lock jaw"), neck stiffness and/or abdominal rigidity to full-blown tetanus, including general spasticity, dysphagia, respiratory difficulties, severe and painful muscle spasms, and autonomic dysfunction. The case fatality rate is about 10% and depends on age, being higher in the older and younger age groups.

In Ireland, those considered most at risk of developing tetanus are in the older age groups, many of whom never had active immunisation, a finding also reported in other countries.[2] In the UK, a recent tetanus outbreak among injecting drug users (IDUs) has been associated with subcutaneous injection of heroin ("skin popping"). The majority of cases had full-blown tetanus; one case is known to have died. None are believed to have been fully vaccinated.[3]

Tetanus is a vaccine preventable disease and has been notifiable in Ireland, since 1981. Although rare, in recent years there has been an increase in the number of cases reported to NDSC.

Summary of tetanus cases in Ireland, 1981 to June 2004

Nine cases of tetanus have been reported during the period 1981 to 30 June 2004 (data for 2004 are provisional). Seven of these cases have occurred since 1998. Four (44%) cases were male, three (33%) were female and two (22%) were of unknown gender. Seven (78%) cases were 50 years of age or older, with a median age of 58 years (range 15-84 years). Female cases were on average older than male cases (median age 65 years and 40 years respectively).

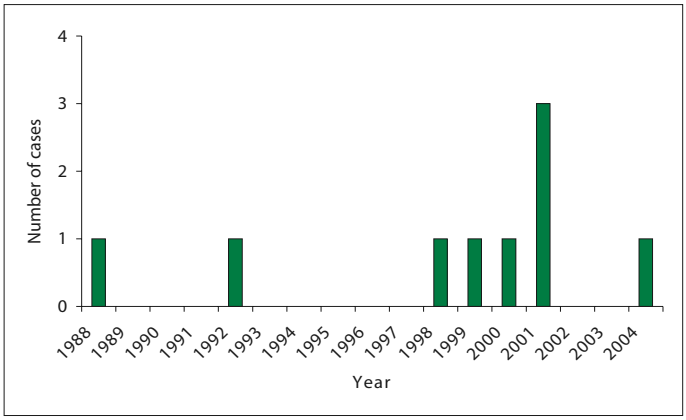

*Figure 1. Tetanus cases reported in Ireland, 1988- June 30 2004**
** provisional data*

Risk factors for infection

The following wound injuries were reported (n=5): dog bite (1); wound from kitchen knife (1); gardening associated leg wound (1); leg scratches in an avid gardener (1); and hand injury in a construction worker who also worked with horses (1).

Clinical course

The mean number of days between injury and onset of symptoms was 16.8 days (range 6-29 days) (n=4). The most commonly reported presenting complaint among cases was muscle stiffness particularly of jaw or neck, accompanied by muscle spasms in two cases. Five patients required assisted ventilation. There were two deaths, both in older females. The overall case fatality rate was 22%.

Immunisation status

Information on immunisation status was available on two cases only. One had received 3 doses of vaccine and the other received one dose. Three patients received TIG (it is unknown at what stage after injury TIG was received), one did not, and information was unavailable on the remaining five cases.

Prevention of tetanus

Immunisation protects by stimulating production of antitoxin, which provides immunity against the effects of the toxin. Tetanus vaccine has been available in Ireland since the 1930s.

Primary immunisation consists of three doses of a tetanus toxoid-containing vaccine, routinely administered at 2, 4 and 6 months of age. A booster dose should be given at school entry with a further dose between the ages of 11-14 years.[4] Further boosters may be required at the time of injury.

Immunisation of persons aged ten years or over (unimmunised)
Three doses of tetanus toxoid (Td) are recommended with intervals of at least one month between doses. A booster dose of tetanus toxoid should be given 10 years after the primary course and again 10 years later.[4]

Following a wound, case management is dependent on the type of wound and history of prior vaccination with tetanus toxoid.[4]

Importance of surveillance

Every tetanus case should be notified and each case thoroughly investigated. Reasons for incomplete or non-immunisation should be identified and measures taken to improve immunisation and wound management among those at risk.

Key points

Tetanus, a notifiable disease, is vaccine preventable.
Since 1981, nine cases of tetanus (including two deaths) were notified in Ireland. Seven of these cases have occurred since 1998. Whether the recent increase in cases reported is a true increase in incidence or reflects improved surveillance is unknown.

Although no tetanus cases have been reported in IDUs in Ireland in recent years, they are considered to be at risk of tetanus. IDUs who have not received five doses of tetanus-containing vaccine or are unsure about their vaccination status, should receive additional tetanus-low dose diphtheria (Td) vaccination.

Each tetanus case reported should be thoroughly investigated to identify reasons for inadequate tetanus prophylaxis, so that vaccination uptake and case management can be optimised.

Sarah Gee and Suzanne Cotter, NDSC

Acknowledgements
NDSC wishes to thank all the health board staff who sent in data on tetanus cases.

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