

An outbreak of cryptosporidiosis associated with an animal nursery at a regional fair

Rosie H Ashbolt,¹ David J Coleman,¹ Avner Misrachi,¹ Joe M Conti,¹ Martyn D Kirk²

Abstract

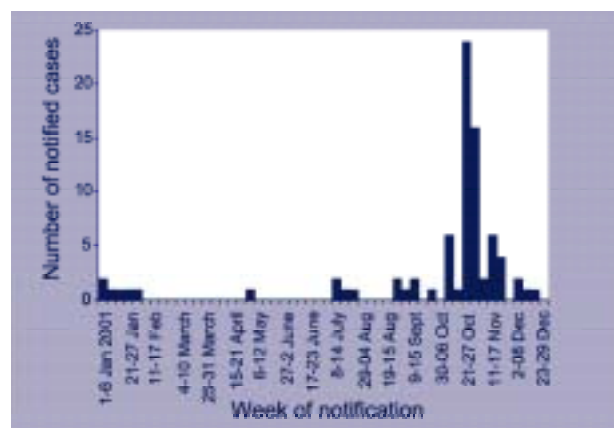
Cryptosporidiosis is a common gastrointestinal illness that is transmitted from infected persons, animals, or contaminated water or food. This article reports on an outbreak of cryptosporidiosis associated with an animal nursery at an agricultural show held in northern Tasmania during October 2001. Eighty-one per cent of cases (38/47) notified to the Tasmanian Department of Health and Human Services over a 35 day period were interviewed to determine potential sources of infection. Eighty-one per cent of interviewed cases (29/36) reported that they had attended the agricultural show, and 75 per cent (27/36) reported contact with animals in the animal nursery. Cases occurring more than one incubation period after the agricultural show were significantly more likely to have had contact with someone else with diarrhoea ($p < 0.01$). This is the first reported outbreak of cryptosporidiosis associated with an animal nursery in Australia. The outbreak demonstrates the importance of infection control policies and hygiene measures in the animal nursery setting. *Commun Dis Intell* 2003;27:244–249.

Introduction

Cryptosporidium is an important and widespread cause of enteric infection in humans and animals. The incubation period for cryptosporidiosis is 1–12 days¹ and the main symptoms are watery diarrhoea and stomach cramps. Infection is usually spread through contaminated drinking or recreational water, contact with infected animals, and contact with infected persons.^{2,3,4} In Australia, reported outbreaks of cryptosporidiosis have generally been associated with swimming pools.^{5,6} The association between dairy farming and cryptosporidiosis is well-documented, although it is not commonly described in Australia.^{7,8}

In Tasmania, cryptosporidiosis is a notifiable disease reported by laboratories. In 2001 the rate of cryptosporidiosis in Tasmania was 16.5 cases per 100,000 population compared with background rates of 10.8 cases per 100,000 population and 9.3 cases per 100,000 population in the years 2000 and 2002 respectively. Over this three year period, 98 per cent of all notified *Cryptosporidium* infections occurred in the north of the state and 61 per cent of all cases were reported in spring. The seasonal distribution of cases for 2001 is presented in Figure 1.

Figure 1. Notified cases of laboratory-confirmed cryptosporidiosis, Tasmania, 2001



On 22 October 2001, a laboratory in northern Tasmania reported a cluster of 10 cases of cryptosporidiosis. A further 38 cases were notified over the following 34 days.

Public health officers from the Tasmanian Department of Health and Human Services investigated this cluster of cryptosporidiosis cases to determine a source for the infections and to implement appropriate public health action.

Methods

Cases notified to the department from 22 October 2001 were considered part of the outbreak investigation. Investigation reports for cases prior to 22 October 2001 were reviewed and the cases were not considered to be part of the outbreak. A standard hypothesis-generating questionnaire was used. The questionnaire contained information on basic demographics, symptoms, and exposure to potential risk factors. Information on contacts, household members and others that may have been ill at the same time was also sought. Staff from public and environmental health and local council environmental health officers administered the questionnaire using telephone interviews.

Once the outbreak was identified, surveillance was enhanced for diarrhoeal disease in the local area by increasing the timeliness and reporting of laboratory tests. General practitioners were alerted to the outbreak and requested to lower their threshold for the investigation of gastrointestinal illness.

The regional Environmental Health Officer investigated potential environmental sources for the outbreak. Public health officers also made inquiries with the government veterinary laboratory about the incidence of diarrhoeal disease in animals.

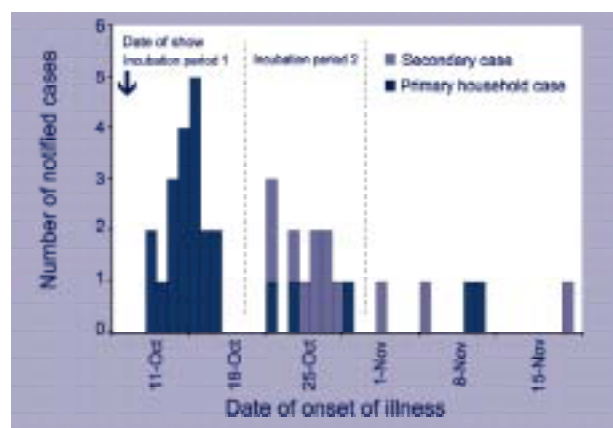
Results

There were 48 cases of cryptosporidiosis notified during the outbreak period, 22 October to 24 November 2001. Laboratories serving the northern part of Tasmania notified 98 per cent (47/48) of these cases. Eighty-one per cent (38/47) of these northern laboratory-confirmed cases were interviewed. Seven cases were unable to be contacted, and two were not interviewed for other reasons.

The ages of case patients had a bimodal distribution with peaks in children aged 1–9 years and adults aged 20–34 years. Forty per cent of cases were male. Cases were resident across seven local council areas, with the majority of cases resident within the Greater Launceston Statistical Subdivision. The symptoms most frequently reported were: diarrhoea (94%), vomiting (88%), abdominal cramps (69%), and nausea (65%). Eleven per cent (4/38) of cases were hospitalised. The duration of symptoms was difficult to determine as most cases were still symptomatic when interviewed.

The reported date of onset of symptoms for two cases was greater than three months prior to collection of the faecal specimen and therefore these cases were not included in analyses of potential exposures. The epidemic curve (Figure 2) depicts the distribution of cases by onset date during the outbreak period.

Figure 2. Cases of cryptosporidiosis among persons living in northern Tasmania, 14 October to 21 November 2001, by date of onset of patient's symptoms



The shape of the epidemic curve suggested that cases separated into two subgroups: cases within an initial wave, and cases in a second wave. As the route of infection may have differed for the two sub-groups, the prevalence of risk factors was described for each sub-group (Table 1).

Table 1. Prevalence of risk factors for infection in cases of cryptosporidiosis among persons living in northern Tasmania, 14 October to 21 November 2001, by date of onset of patient's symptoms

	Cases in first wave (n=19)		Cases in second wave (n=17)	
	n	%	n	%
Male	6	32	10	59
Attended childcare centre	3	16	3	18
Overseas travel	0	0	1	6
Contact with pets	15	79	14	93
Attendance at agricultural show A	16	84	13	76
Attendance at the agricultural show on 11 October 2001	15	79	13	76
Contact with animals in the animal nursery (at the agricultural show)	14	74	13	76
Contact with animals on a farm	4	21	4	24
Untreated water consumed	1	5	1	6
Swimming at pool A	4	21	3	18
Contact with an ill person prior to illness	0	0	12	71

The shape of the epidemic curve and the prevalence of risk factors were consistent with an initial point source infection followed by secondary transmission.

The time period for the initial wave was 12 days (equivalent to the incubation period for cryptosporidiosis), commencing on the opening date for the agricultural show. Eighty-four per cent of cases in the initial wave (16/19) attended the local agricultural show. Of those who attended the show, 88 per cent (14/16) also reported attending the animal nursery at the show with most cases reporting that they touched the animals.

While a similar proportion of cases in the second wave attended the agricultural show, secondary transmission was the probable route of infection. Cases in the second wave were significantly more likely to have had contact with someone else who was ill compared with cases in the initial wave ($p < 0.01$). All cases reporting a family member ill prior to their own illness were in the second wave of cases.

Cases who reported that other family members were also ill also reported that 80 per cent of these ill family members attended the agricultural show with the case. Typically, cases report family groups attended the agricultural show with one member contacting cryptosporidiosis (either confirmed or unconfirmed) and transmitting the infection to other family members.

It is also possible to interpret the epidemic curve as a point source infection followed by an extended tail, which is plausible if these later cases were considered to have a longer than usual incubation period of 14–28 days, rather than the expected 1–12 days. There was no difference in the age distribution of cases in the two waves.

The number of confirmed cases in the latter part of the outbreak may have been influenced by enhanced surveillance and lower testing thresholds.

Overall, 81 per cent (29/36) of all cases had attended the local agricultural show, and 75 per cent (27/36) of cases had contact with animals at the animal nursery. Four cases reported attending swimming lessons at a single venue prior to becoming ill, with one case reporting attendance after the onset of illness. The five children that attended child care went to four different child-care centres. In this outbreak, drinking water or contact with recreational water was not likely to be the source of infection as these exposures did not account for a high proportion of cases.

Public health response

Investigation of the animal nursery

The three-day agricultural show had ended by the time the investigation commenced. The regional Environmental Health Officer interviewed organisers of the agricultural show and reported that animals were obtained from various sources within the community and included goats, lambs, sheep, calves, pet rats, dog and puppies, rabbits, chickens, some poultry and native animals. All animals remained in the animal nursery for the duration of the show except for some pet rabbits. An organiser indicated that some of the calves showed symptoms of diarrhoea, but could not provide information on the date or duration of symptoms. Toilet facilities and hand basins were provided nearby for attendees of the agricultural show.

Swimming pools

Four cases reported attending swimming lessons at one swimming pool and one case reported swimming after the onset of symptoms. This swimming pool was widely used for learn-to-swim and toddler classes. As a precautionary measure, the local council advised the swimming pool to hyper-chlorinate and backwash the filters. During the outbreak, there was no evidence of further spread of *Cryptosporidium* infection through swimming pool usage.

Veterinary investigations

As the agricultural show had ended prior to the investigation, animal faecal samples were not collected. Thus no specific animal could be microbiologically linked with the outbreak, however calves at the animal nursery were reported as having diarrhoea. The government

veterinary laboratory also reported the presence of *Cryptosporidium* in scours from cattle tested at the time of the outbreak (personal communication, K Formiatti, veterinary microbiologist, Mt Pleasant Laboratories, 9 November 2001).

Communication

A newspaper article provided the community with information on the outbreak and how to avoid further transmission. The laboratories and local council environmental health officers were given a summary report at the conclusion of the outbreak.

Following a review of the outbreak, a public health advisory letter was sent to relevant organisations such as the education department, agricultural show societies, and wildlife parks for further dissemination. The advice given was based on the most recently published Centers for Disease Control and Prevention Recommendations: Farm Animal Contact, September 2001.⁹

Discussion

This article reports on a localised outbreak of cryptosporidiosis associated with an animal nursery at an agricultural show. While cryptosporidiosis has been linked to farm visits by children elsewhere,^{10,11} this is the first reported outbreak of cryptosporidiosis in Australia in which an animal nursery in the agricultural show setting has been implicated.

The show was held over a three-day period, however all but one case reported attending the show on the first day. No ruminants were removed from the animal nursery during the three-day event, but the spoiled hay was removed each day. It is feasible that the mode of transmission was infected faeces in the hay.

This investigation was limited to laboratory confirmed cases, however it is expected that many more were ill as evidenced by 42 per cent of interviewed cases reporting other household members ill with similar symptoms. Many of the cases reported later in this outbreak could be attributed to person-to-person transmission as reflected in the epidemic curve and exposure histories.

Among cases occurring over the outbreak period, the other principal source of infection reported was exposure to scouring calves in the

farm setting. Two of the three cases who did not attend the show reported exposure to scouring calves at home. Additionally, a review of seven cases notified to public and environmental health staff prior to the outbreak indicated that four of these cases were exposed to cattle prior to illness.

In future outbreaks of cryptosporidiosis, the genotyping of *Cryptosporidium* could be used to confirm epidemiological findings. *Cryptosporidium parvum* is the most commonly identified etiologic agent of human cryptosporidiosis and can be divided into two distinct sub-populations: genotype 1, found almost exclusively in humans, and genotype 2 which is found in both ruminants and humans.¹² In this outbreak we did not determine the species or genotype of *Cryptosporidium* present. Clearly such typing would have helped in the identification of the pathway to *Cryptosporidium* infection.

In springtime, agricultural shows are very much a part of the fabric of regional Australia. In this outbreak, close contact with young animals in an animal nursery at an agricultural show was linked to cryptosporidiosis. This finding highlights the infectious hazard posed by contact with animals in this setting and brings to our attention the potential for other more dangerous infections to be acquired. Elsewhere, outbreaks of Shiga-like toxin producing *Escherichia coli* O157 infection have been reported in the animal nursery setting.^{13,14}

It is important that both staff and visitors are educated about the risks associated with animal contact and are alerted to the simple precautions that can prevent the transmission of infections. These include the mandatory provision of dedicated hand-washing or disinfecting facilities, obvious and prominent warning signage and the separation of animal contact from food sale and eating areas.

The South Australian Department of Human Services has prepared comprehensive guidelines for infection control for petting zoos which could provide a useful model for national guidelines.¹⁵

Acknowledgements

We gratefully acknowledge the local government environmental health officers for completing case interviews, the regional environmental health officers for the investigation of the animal nursery, and private and public laboratories for the timely notification of disease. Rosie Ashbolt and Martyn Kirk are funded by the Department of Health and Ageing OzFoodNet program of work.

References

1. Chin J, editor. *Control of Communicable Diseases Manual* 17th edition. Washington: American Public Health Association, 2000.
2. MacKenzie WR, Hoxie NJ, Proctor ME, Gradus MS, Blair KA, Peterson DE, *et al.* A massive outbreak in Milwaukee of *Cryptosporidium* infection transmitted through the public water supply. *N Engl J Med* 1994;331:161–167.
3. Robertson B, Sinclair MI, Forbes AB, Veitch M, Kirk M, Cunliffe M, *et al.* Case control studies of sporadic cryptosporidiosis in Melbourne and Adelaide, Australia. *Epidemiol Infect* 2002;128:419–431.
4. Hannah J, Riordan T. Case to case spread of cryptosporidiosis: evidence from a day nursery outbreak. *Public Health* 1988;102:539–544.
5. Stafford R, Neville G, Towner C, McCall B. A community outbreak of *Cryptosporidium* infection associated with a swimming pool complex. *Commun Dis Intell* 2000;24:236–239.
6. Puech MC, McAnulty JM, Lesjak M, Shaw N, Heron L, Watson JM. A statewide outbreak of cryptosporidiosis in New South Wales associated with swimming at public swimming pools. *Epidemiol Infect* 2001;126:385–396.
7. Lengerich EJ, Addiss DG, Marx JJ, Ungar BL, Juranek DD. Increased exposure to cryptosporidia among dairy farmers in Wisconsin. *J Infect Dis* 1993;167:1252–1255.
8. Miron D, Kenes J, Dagan R. Calves as a source of an outbreak of cryptosporidiosis among young children living in an agricultural closed community. *Pediatr Infect Dis J* 1991;10:438–441.
9. Centers for Disease Control and Prevention. Recommendations: Farm animal contact. Centers for Disease Control and Prevention, Atlanta, Georgia, Foodborne and Diarrheal Diseases Branch. Available from: http://www.cdc.gov/ncidod/dbmd/outbreak/recomm_farm_animal.htm

-
10. Elwin K, Chalmers RM, Roberts R, Guy EC, Casemore DP. Modification of a rapid method for the identification of gene-specific polymorphisms in *Cryptosporidium parvum* and its application to clinical and epidemiological investigations. *Appl Environ Microbiol* 2001;67:5581–5584.
 11. Sayers GM, Dillon MC, Connolly E, Thornton L, Hyland E, Loughman E, *et al.* Cryptosporidiosis in children who visited an open farm. *Commun Dis Rep CDR Rev* 1996;6:R140–R144.
 12. Peng MM, Xiao L, Freeman AR, Arrowood MJ, Escalante AA, Weltman AC, *et al.* Genetic polymorphism among *Cryptosporidium parvum* isolates: evidence of two distinct human transmission cycles. *Emerg Infect Dis* 1997;3: 567–573.
 13. Crump JA, Sulka AC, Langer AJ, Schaben C, Crielly AS, Gage R, *et al.* An outbreak of *Escherichia coli* O157:H7 infections among visitors to a dairy farm. *N Engl J Med* 2002;22: 555–560.
 14. Heuvelink AE, Van Heerwaarden C, Zwartkruis-Nahuis JTM, Van Oosterom R, Edink K, van Duynhoven YT, *et al.* *Escherichia coli* O157 infection associated with a petting zoo. *Epidemiol Infect* 2002;129:295–302.
 15. Petting Zoo Infection Control Guideline for petting zoo operators, environmental health officers and education and childcare services. Department of Human Services, Adelaide, 2002. Available from: <http://www.health.sa.gov.au/pehs/PDF-files/petting-zoos-guidelines.pdf>. Accessed on 29 September 2002.