Are patterns of human cryptosporidiosis in Scotland consistent over time?

Ternent, H.E.[1], Pollock, K.G.J[2], Mellor, D.J.[1,2], Reid, S.W.J.[1] and Innocent, G.T.[1]

[1] Comparative Epidemiology and Informatics, Department of Animal Production and Public Health, Institute of Comparative Medicine, Faculty of Veterinary Medicine, University of Glasgow, Bearsden Road, Glasgow G61 1QH, UK.
[2] Health Protection Scotland, Clifton House, Clifton Place, Glasgow, G3 7LN, UK.

Introduction

Cryptosporidium species are intestinal parasites that cause disease in both animals and humans. Health Protection Scotland (HPS) have received an average of 665 reports of laboratory confirmed cases of cryptosporidiosis each year over the past 12 years (Table 1). The most important human pathogens are *C. hominis* and *C. parvum*. *Cryptosporidium hominis* primarily infects humans, where as *C. parvum* has been shown to infect numerous animal species which then serve as potential reservoirs of infection for humans (1).

Two data sets of human cryptosporidiosis are compared to show patterns in the epidemiology of human infection in Scotland. The first data set is from December 1999 to February 2002 (2) and the second from June 2005 to June 2007.

Table 1. Annual totals of human cryptosporidiosis cases

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Cryptosporidium	618	690	879	598	867	569	646	805	465	709	610	528

Data source: Health Protection Scotland

Data

Human case data were accessed through the database held by Health Protection Scotland (HPS). The data from December 1999 to February 2002 comprises all reported cases of human cryptosporidiosis, cases were reported as COWP 1 (*C. hominis*) or COWP2 (*C. parvum*). The data set from June 2005 to June 2007 comprises sporadic cases of laboratory-confirmed *Cryptosporidium hominis* or *parvum* infection in which only members of a single household were affected and where secondary spread was ruled out. Human population data were based on the 2001 census. Data for the Scottish average rainfall were obtained from the Met Office web site. (http://www.metoffice.co.uk/climate/uk/stationdata)

Figure 1. Number of cases by species and average rainfall for Scotland by month of the year, December 1999 to February 2002.

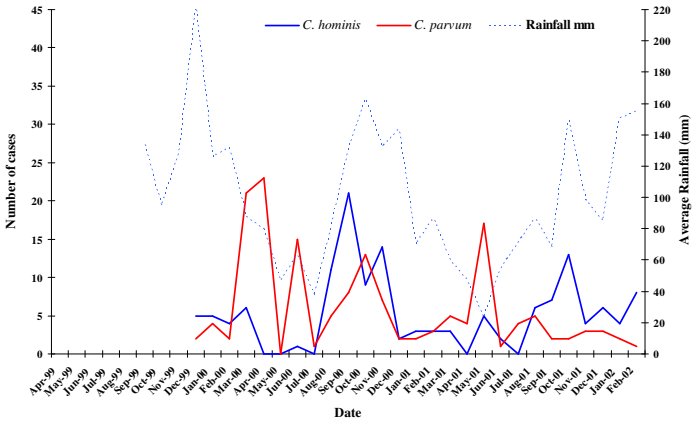


Figure 2. Number of cases by species and average rainfall for Scotland by month of the year, June 2005 to June 2007.

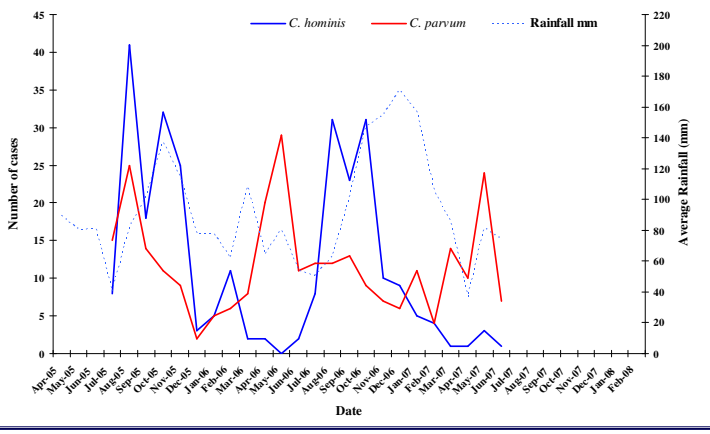


Figure 3. Cases of *C. hominis* and *C. parvum* in Scotland from December 1999 to February 2002.

C. hominis - Dec 1999 to Feb 2002 | *C. parvum* - Dec 1999 to Feb 2002

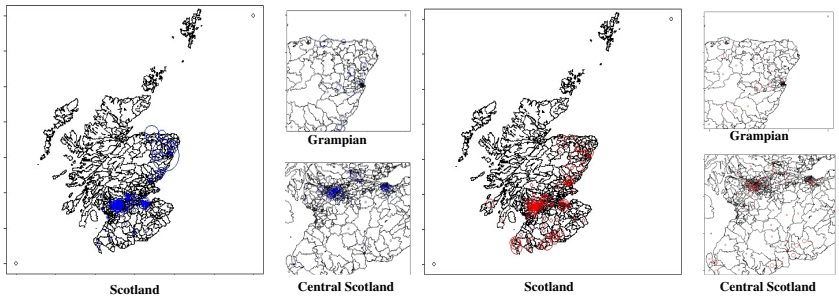
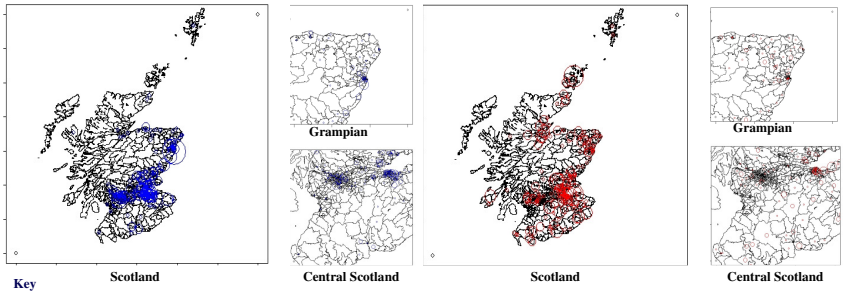


Figure 4. Cases of *C. hominis* and *C. parvum* in Scotland from June 2005 to June 2007.

C. hominis - Jun 2005 to Jun 2007 | *C. parvum* - Jun 2005 to Jun 2007



Key

C. hominis - The size of the circle increases with number of cases. Cases are centred to postcode sector.

C. parvum - The size of the circle increases with number of cases. Cases are centred to postcode sector.

Analysis

Exploratory data analysis was carried out on 299 cases and 560 cases in the first and second data set respectively. Data for May 2000 (77 cases) were removed due to cases being linked to an outbreak in Glasgow. Univariate analyses were conducted using a generalised linear model (GLM) with case diagnosis as a dichotomous outcome variable and exploratory variables age, month and year.

Results

Figures 1 and 2 show the temporal patterns of human cryptosporidiosis and Figures 3 and 4 show the spatial spread in the data over the two study periods. *Cryptosporidium hominis* cases are situated around urban areas where as *C. parvum* cases are more sporadic in rural locations.

The results of the univariate analyses showed no significant difference between species with age or year in both sets of data. Month was important, Table 2 shows the results of the univariate analyses for months with January as the comparative value.

Table 2. Odds ratios for the significant variables of the univariate analyses for human cryptosporidiosis cases in Scotland, Dec 1999 to Feb 2002 and Jun 2005 to Jun 2007.
***C. parvum* = cases *C. hominis* = controls**

	March	April	May	June	July	August	September	October	November
Data set 1 1999-2002	**4.10**	**80.88**	**4.68**	**6.93**	**16.18**	0.88	0.54	1.11	0.84
Data set 2 2005-2007	**4.09**	**5.53**	**9.68**	2.61	1.13	**0.33**	**0.42**	**0.21**	**0.30**

Data significant at p less than or equal to 0.05 data not significant at p=0.05

Conclusion

- Both cryptosporidium species in the data occurred at similar overall frequency. Both were commoner in the younger age groups, with less than 10% of all cases occurring in those aged 45 or over.
- There is an increase in number of cases of *C. parvum* in spring and an increase in number of cases of *C. hominis* in late summer, autumn. This can be seen in both sets of data, however statistical significance is lower in the first data set due to smaller numbers of cases.
- Spatial patterns of the cases are different for the two species and these patterns are repeated in the two time periods.
- This initial analysis of cryptosporidiosis in humans in Scotland over time shows similar spatio-temporal patterns in the distribution of cases.

References:

1. Xiao, L., Rayer, R., Ryan, U., and Upton, S.J. (2004). *Cryptosporidium* taxonomy: recent advances and implications for public health. *Clin Microbiol Rev.* 17: 72-97.
2. Reid, S.W.J., Knox, K.M.G., Browning, L., Reilly, W.J., Mellor, D.J., Mohammed, H.O., Smith, H., Wastling, J., Tait, A. and Innocent, G.T. (2003). Spatial, temporal and risk factor studies on the epidemiology of human and bovine cryptosporidiosis in Scotland. *Proceedings of the 10th International Symposium on Veterinary Epidemiology and Economics.*

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