

Human occupational and recreational exposure to *Escherichia coli* O157 of bovine origin in Scotland, UK.

D.J. Mellor^{1*}, G.T. Innocent¹, M.C. Pearce^{2,3}, W.J. Reilly⁴, H.E. Ternent¹, D.J. Taylor⁵, W.B. Steele⁵, S.A. McEwen⁶, G.J. Gunn³, J.R. Kerr¹, H. Mather⁷, S.W.J. Reid¹

¹Comparative Epidemiology and Informatics, Department of Veterinary Clinical Studies, University of Glasgow Veterinary School, Bearsden Road, Glasgow, G61 1QH, UK, & Department of Statistics and Modelling Science, University of Strathclyde, 26 Richmond Street, Glasgow, G1 1XH, UK. ²Centre for Tropical Veterinary Medicine, University of Edinburgh, Midlothian, EH25 9RG, UK. ³SAC Veterinary Science Division, Drummondhill, Stratherrick Road, Inverness, IV2 4JZ, UK. ⁴Scottish Centre for Infection and Environmental Health, Clifton House, Clifton Place, Glasgow, G3 7LN, UK. ⁵Department of Veterinary Pathology, University of Glasgow Veterinary School, Bearsden Road, Glasgow, G61 1QH, UK. ⁶Department of Population Medicine, Ontario Veterinary College, University of Guelph, Ontario, Canada. ⁷Stobhill NHS Trust, Balornock Road, Glasgow, G21 3UW, UK.

Summary

Visits were made to Scottish farms rearing beef cattle. Bovine faecal pat samples were collected and stool samples were requested from farm workers and their families. All human samples were negative for *E. coli* O157, despite the fact that the organism was present in the cattle population on a number of farms from which human samples were submitted. A pilot study revealed that recreational exposure to rural and livestock-farming environments is a regular occurrence for the majority of Scottish households. The study concludes that the UK countryside should not be considered a high-risk environment from the point of view of *E. coli* O157 infection.

Introduction

Human illness associated with infection with verocytotoxigenic *E. coli* (VTEC) has been recognised as a serious and potentially fatal condition. *Escherichia coli* O157 is by far the commonest VTEC serotype isolated from human patients suffering from gastrointestinal illness in Scotland, with rates of isolation being significantly higher in Scotland than in England and Wales¹.

Much research has focused on identifying the origins of infection, with farmed livestock, especially cattle, being identified as the major source, and on the food chain as the major means of transmission of infection to people. More recently, a number of studies have focused on environmental risks for infection²⁻⁴. A recently published case-control study highlighted contact with animal faeces (other than domestic pet faeces) as a significant risk factor for sporadic cases of human illness associated with *E. coli* O157 infection⁵. However, due to the case-control nature of this and other studies, it is not clear how prevalent these risks are in the population as a whole.

Objectives

As part of a large-scale investigation of the epidemiology and evolution of *Enterobacteriaceae* infections in humans and domestic animals in Scotland, infection, and risk factors for infection, with *E. coli* O157 were investigated among workers and their families (occupational exposure) on Scottish farms. An adjunct study was conducted to assess household recreational exposure to rural and farming environments.

Materials and Methods

Visits were made to Scottish farms rearing beef cattle for human consumption, on a regionally and seasonally representative basis. Faecal pat samples were collected from groups of cattle closest to slaughter, and a questionnaire on cattle management practices was administered. On each premises, stool samples were requested from farm staff and their families. Self-collection kits containing sample collection materials and packaging for prepaid mailing of samples direct to a medical microbiology laboratory were left on premises agreeing to consider submitting samples. Submission forms for completion by the provider of each sample were also included. All samples were processed using a standard ImmunoMagnetic Separation (IMS) procedure for the isolation of *E. coli* O157.

A questionnaire was designed to record details of individual household members' recreational and occupational contact with animals, and with the rural and farming environment, during the previous 3 months. As a pilot study, the questionnaire was mailed to a convenience sample of 41 households in the summer of 2002.

Results

Between January 2002 and August 2003, 8,869 bovine faecal pat samples were collected from 336 farms (approximately 3% of Scottish holdings with fattening cattle, according to the 2002 Scottish Executive Environment and Rural Affairs Department Agricultural Census). *Escherichia coli* O157 was isolated from 368 bovine samples (4.1%) collected from 67 (20%) farms. One hundred and four human stool samples were submitted, representing 17% of kits handed out and 21% of farms accepting kits. All stools were negative for *E. coli* O157, including 18 samples from 14 farms on which cattle shedding *E. coli* O157 were known to be present. Figure 1 shows the age distribution and prevalence of exposure risk factors among respondents.



Figure 1. Age distribution and prevalence of exposure risk factors among respondents.

Thirty-five of 41 households (85%), comprising 95 individuals, responded to the recreational exposure questionnaire. One or more individuals from 33 (94%) households took regular recreational walks in the country during the previous 3 months and these were across farmland grazed or recently grazed by livestock in 25 households (73%). Members of 17 (49%) of households had taken a picnic in the country and this was on farmland grazed or recently grazed by livestock in 6 (17%) of

households. Members of 3 (9%) households had taken part in organised team sport in the previous 3 months on pitches frequently grazed by livestock.

Discussion

It is clear that there is widespread opportunity for recreational and occupational contact with farmed livestock faeces in the UK, and that *E. coli* O157 is prevalent in cattle faeces. It was estimated that there were 551 million person days spent on leisure activity in the UK countryside in 1998⁶. In the same year, there were 1,136 cases of human infection with *E. coli* O157 reported in the UK⁷, which, even if all cases were due to environmental exposure, would give a crude incidence of only 2 cases / million person days in the countryside. A comprehensive exposure assessment would be required to provide much-needed accurate estimates of the true risks.

Among groups with occupational contact with cattle faeces, farmers may be expected to experience the highest level of exposure. Despite the low response rate in our study, it is interesting, and perhaps reassuring, that all samples were negative, even from farms on which the organism was known to be present.

The potential health benefits of active exposure to the rural environment have been well documented⁶. From the evidence presented here, providing sensible personal hygiene and child supervision recommendations are heeded, the rural UK should not be considered a dangerous place from the point of view of *E. coli* O157 infection.

Acknowledgements

This work was funded by the Wellcome Trust under the International Partnership Research Awards in Veterinary Epidemiology (IPRAVE) initiative, and the authors are grateful for the contributions, assistance and advice of the other members of the IPRAVE consortium. In addition, the authors wish to express their thanks to Professor M. Murray, in whose department this work was carried out. Jennifer Kerr was a Wellcome Trust vacation scholar.

References

1. Chapman, P.A., Cowden, J., Curnow, J., Gross, R., Hutchinson, D., Painter, M., Palmer, S.R., Parry, S.M., Salmon, R.L., Schweiger, M., Sharp, C., Simmons, N.A., Rowe, B. and Wight, A. (1995) Interim guidelines for the control of infections with Veroto cytotoxin producing *Escherichia coli* (VTEC). *Communicable Disease Report*, **5**: R77-R81.
2. Valcour, J. E., Michel, P., McEwen, S. A., and Wilson, J. B. (2002) Associations between Indicators of Livestock Farming Intensity and Incidence of Human Shiga Toxin-Producing *Escherichia coli* Infection. *Emerging Infectious Diseases*, **8**: 252-257.
3. Michel, P., Wilson, J., Martin, S., Clarke, R., McEwen, S., Gyles, C., (1999). Temporal and geographical distributions of reported cases of *Escherichia coli* O157:H7 infection in Ontario. *Epidemiology and Infection*, **122**: 193-200.
4. Innocent, G.T., Mellor, D.J., McEwen, S.A., Reilly, W.J., Michel, P. Steele, W.B., Gunn, G., Taylor, D.J., Ternent, H.E. and Reid, S.W.J. (2003) Spatial models of sporadic *Escherichia coli* O157 infection in humans in Scotland. *Proceedings 5th International Symposium VTEC 2003 Conference, Edinburgh, UK*, 200.
5. Locking, M.E., O'Brien, S.J., Reilly, W.J., Wright, E.M., Campbell, D.M., Coia, J.E., Browning, L.M. and Ramsay, C.N. (2001) Risk factors for sporadic cases of *Escherichia coli* O157 infection: the importance of contact with animal excreta. *Epidemiology and Infection*, **127**: 215-220.
6. Pretty, J., Griffin, M., Sellens, M. and Pretty, C. (2003) Green exercise: Complementary roles of nature, exercise and diet in physical and emotional well-being and implications for public health policy. CES Occasional Paper 2003-1, University of Essex: 2003. 1-38.
7. Scottish Centre for Infection and Environmental Health (<http://www.show.scot.nhs.uk/scieh/>), Health Protection Agency (<http://www.phls.co.uk/>), Communicable Disease Surveillance Centre Northern Ireland (<http://www.cdscni.org.uk/>).