Prevalence estimates and risk factors for *Escherichia coli* O26 on cattle farms in Scotland

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Introduction

•The aim of this study was to estimate the prevalence and describe possible risk factors for the presence of *E. coli* O26 on Scottish cattle farms.

Data

• 338 farms were selected randomly throughout Scotland using a five stage sampling plan.
• Faecal pat samples were taken from the group closest to slaughter/sale.
• Samples were analysed for the presence of *E. coli* O26 using IMS. *E. coli* O26 isolates were then examined with a multiplex PCR for Vt(Verotoxin)1, Vt2, *eae* (intimin) and *ehl* (enterohaemolysin) genes.
• On each farm, a questionnaire was administered (via interviewer) regarding farm management factors and other possible risk factors.

Farm prevalence estimates for *E.coli* O26

Analysis

For the adjusted prevalences, the mean percentage of farms with shedding cattle were estimated using generalised linear mixed models (GLMMs) with a binomial response term and a logit link function. Farm cluster was fitted as a random effect. The GLMM parameter estimations were converted into mean prevalences using both the transformed means and random effects (as described by Condon *et al.* 2004).

Results and Discussion

Table 1. Observed and Adjusted Prevalence Estimates for *E.coli* O26

	Number of positive farms	Observed prevalence[1]	Adjusted prevalence[2]
E. coli O26	68	20% (16-25%)	**22% (13-34%)**
E. coli O26 Vt+	38	11% (8-15%)	12% (6-24%)
E. coli O26 Vt+ *eae*+	32	9% (7-13%)	11% (5-23%)
E. coli O26 Vt+ *eae*+ *ehl*+	26	8% (5-11%)	**9% (4-21%)**

- The estimates above can be regarded as minimum estimates as both the sensivity of the IMS diagnostic test and the method of faecal sampling have previously been considered to result in prevalence underestimation (Hall *et al.* 2006; Pearce *et al.* 2004).

- Table 1 shows that O26 has a similar overall prevalence in Scotland (22%) to the calculated prevalence of *E. coli* O157 in the SEERAD (18.68% (14.92-22.55)) and IPRAVE (21.89% (19.54-24.26)) studies (unpublished). The number of *E. coli* O26 human cases is much lower (Willshaw *et al.* 2001) than for *E.coli* O157. This may be due, in part, to the relatively low farm prevalence of the more pathogenic O26 strains (Vt+*eae*+*ehl*+ isolates) (9%(4-21%)).

Farm level risk factors for the presence of *E.coli* O26

Analysis

A farm was classified as being positive for *E. coli* O26 if one isolate was recovered from all samples. All continuous variables were reduced to quartiles and a single variate analysis was carried out using either the Chi square or Fisher's Exact test. Odds ratios and 95% confidence intervals were calculated for each variable level. Twenty eight variables with p value<0.3 were carried forward into the multiple variate logistic regression analysis which was conducted in SAS using the GLIMMIX procedure. Animal Health District and Season of sampling were forced into the model as design factors. A forward selection and a backward elimination approach with swapping was used.

Results and Discussion

Five variables arose as significant in the analysis (p value <0.05). These are summarised in Table 2. These results need to be interpreted with caution due to the high degree of collinearity between variables and the small sample sizes involved.

Table 2. *E.coli* O26 Multiple-Variate Analysis: Variables significant at p<0.05

Variable	Level	Coefficient	SE	P value	OR	95% CIs
Intercept		0.872	1.0612	0.2258		
Season of sampling	Spring	-0.8169	0.5438	0.134	0.442	0.152-1.288
	Summer	0.9816	0.4088	0.0169	2.669	1.194 - 5.965
	Autumn	0.6363	0.4177	0.1286	1.889	0.831-4.298
	Winter	*	*	*	*	*
Categorised number of faecal pats sampled	**1-14**	-1.5366	0.4402	0.0005	0.215	0.09 – 0.511
	15-17	-1.079	0.5863	0.0666	0.34	0.107-1.077
	18-22	-0.1415	0.3905	0.7174	0.868	0.403-1.872
	23-64	*	*	*	*	*
Categorised number of finishing store cattle	0-7	-0.1106	0.4278	0.7963	0.895	0.386-2.077
	8-30	-0.195	0.4152	0.639	0.823	0.364-1.862
	31-72	-1.4864	0.5044	0.0034	0.226	0.084 – 0.610
	73-630	*	*	*	*	*
Use of manure from other farms	**Absent**	-2.4617	0.8863	0.0058	0.085	0.015 – 0.488
	Present	*	*	*	*	*
Brought on livestock other than cattle	**Absent**	-0.7622	0.3208	0.0181	0.414	0.248-0.877
	Present	*	*	*	*	*

- **Brought on livestock other than cattle** and **using manure from other farms** may act as transmission vehicles for O26.

- *Farms with between 31 – 70* ***finishing cattle*** *have a decreased odds of detection of E. coli O26. This is likely to be associated with other risk factors. The amount of finishing cattle is related both to the main management type of the farm (dairy/beef) (X = 7.83 , p =0.05) and the total number of cattle present on the farm (Fisher statistic = 58.55 , p<0.001).*

-**Season** may affect the absolute number of cattle shedding but it may also affect the degree of shedding by individual cattle leading to increased numbers of positive samples (Hall *et al.* 2006) and affect the survival of O26 in bovine faeces (Fukushima *et al.* 1999). Environmental and housing factors may be associated with this relationship.

- *There is a significant association between* ***number of faecal pats sampled*** *and the detection of E. coli O26. The number sampled is highly associated with categorised total farm cattle population (p= 0.008), cattle management type (Fisher test statistic = 58.55, p <0.001). This suggests that E. coli O26 detection is correlated with herd size either due to the increased number of samples taken or due to the size of the cattle population.*

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