



# Spatial distribution of lymphoma in dogs attending UK primary-care veterinary practices

Schofield I<sup>1</sup>, Pittaway C<sup>2</sup>, Stevens K<sup>1</sup>, O'Neill D<sup>1</sup>, Vineis P<sup>3</sup>, Dobson J<sup>2</sup>, Church D<sup>1</sup> & Brodbelt D<sup>1</sup>  
<sup>1</sup>Royal Veterinary College, London, UK, <sup>2</sup>QVSH, University of Cambridge, UK, <sup>3</sup>Imperial College, London, UK

## Background

Lymphoma is a commonly diagnosed neoplasm in dogs attending primary-care practice. There is increasing interest in the role that environmental risk factors may play in both human and animal cancer incidence<sup>(3)</sup> however very large datasets are required to have sufficient power to find these associations. Lymphoma in dogs and human non-Hodgkin lymphoma bear strong similarities, therefore dogs could act as sentinels for the disease in people and offer a reliable model for these potential associations due to their limited geographical movement and shorter life-span.

## Aims

1. Explore the geographical distribution of lymphoma in UK dogs attending primary-care practices.
2. Apply novel methodology to VetCompass™-derived partial postcode data<sup>(4)</sup> to extract environmental exposure variables.
3. Analyse potential preliminary associations between lymphoma and certain environmental risk factors.

## Methods

### Case definition

- Incident cases of lymphoma in 2013, with a positive laboratory diagnosis (FNA, biopsy, 'Canine lymphoma blood test' or blood smear) as well as cases euthanased or treated with a presumed diagnosis by the veterinarian.

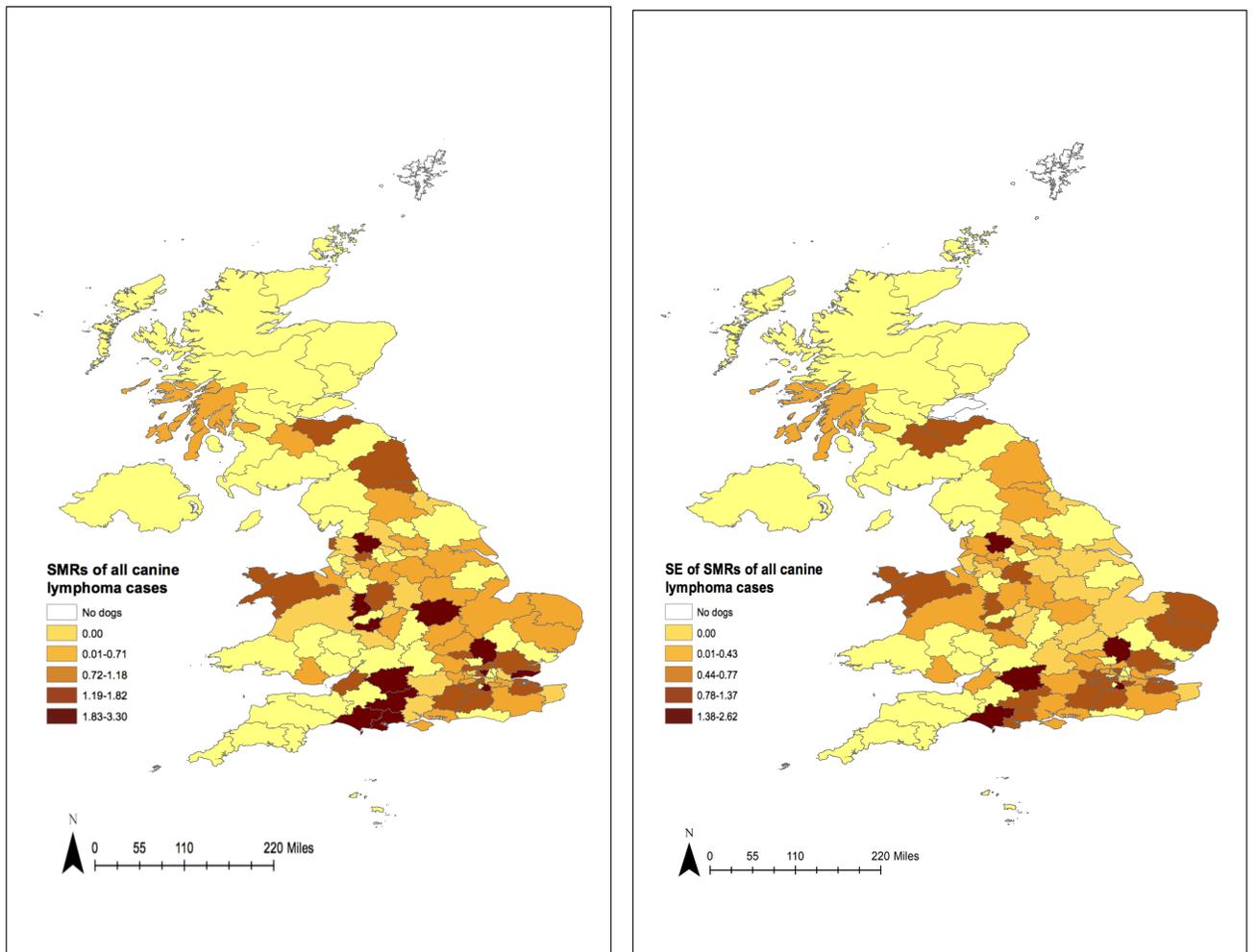
### Data source

- Partial postcodes and demographic data available through electronic patient records of dogs attending VetCompass™ participating primary-care practices using a retrospective cohort study design.

### Data analysis

- Visual summary of Standardized Morbidity Ratios (SMRs) and their corresponding Standard Errors (SEs) of partial postcodes of dog owners' addresses standardized by area with choropleth maps, using ArcGIS (ESRI, CA).
- Spatial autocorrelation was explored with Moran's I statistic and LISA scatterplot using GeoDa<sup>(1)</sup>.
- Logistic regression models analysed lymphoma risk factors for diagnosis and environmental exposures (radon, herbicide and pesticide) using Stata 14 (Stata Corp, Texas). Environmental exposures were extracted from Public Health England and Countryside Survey data in ArcGIS<sup>(2)</sup>.

Figures 1 and 2: The SMRs and corresponding SEs of canine lymphoma cases diagnosed in primary-care veterinary practices across 123 UK counties in 2013. (Denominator: 436041 dogs. Cases: 279 dogs).



## Environmental risk factors

Table 1: Univariable analysis of environmental risk factors for lymphoma in dogs attending UK primary-care practices in 2013.

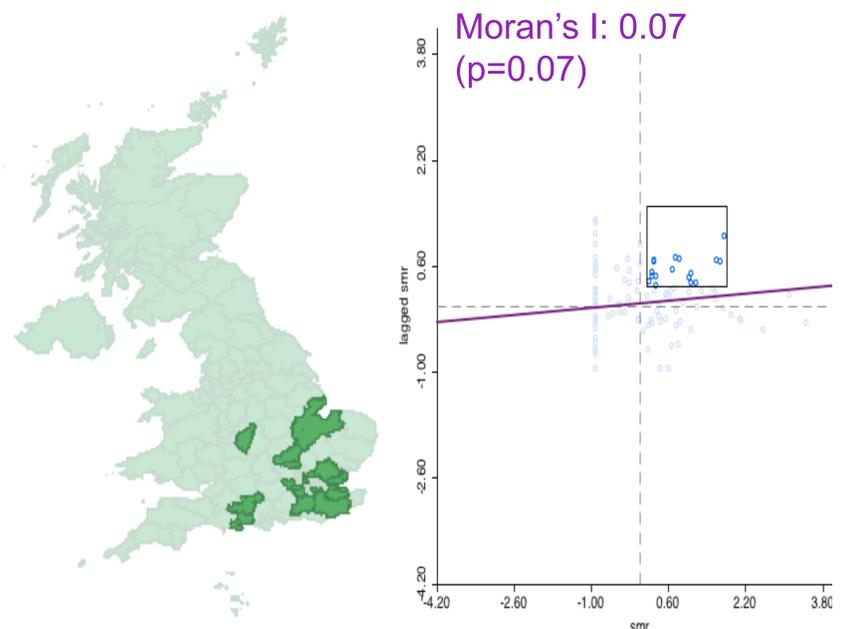
Variable	All cases (%)	Non cases (%)	OR	95% CI	p-value (LRT)
<b>Maximum radon potential (% of homes &gt;200 Bq/m<sup>3</sup>) (n=429018)</b>					
<1%	172 (61.65)	274898 (64.08)	Baseline	-	0.8
1-3%	63 (22.58)	88343 (20.59)	1.14	0.85-1.52	
3-5%	20 (7.17)	27295 (6.36)	1.17	0.74-1.86	
5-10%	12 (3.23)	23383 (5.45)	0.82	0.46-1.47	
10-30%	9 (3.23)	10714 (2.50)	1.34	0.69-2.62	
>30%	3 (1.08)	4385 (1.02)	1.09	0.34-3.43	
<b>Fungicide (kg) (n=402184)</b>					
0	144 (54.34)	240944 (59.63)	Baseline	-	0.17
1-99	48 (18.11)	58267 (14.42)	1.38	0.99-1.91	
100-699	45 (16.98)	58225 (14.41)	1.29	0.93-1.81	
>699	28 (10.57)	46640 (11.54)	1	0.67-1.51	
<b>Herbicide (kg) (n=402184)</b>					
0	137 (51.70)	232273 (57.48)	Baseline	-	0.006
1-99	36 (13.58)	50474 (12.49)	1.21	0.84-1.75	
100-699	63 (23.77)	64664 (16.00)	1.65	1.23-2.23	
>699	29 (10.94)	56665 (14.02)	0.87	0.58-1.30	

- Preliminary univariable analysis suggested an association with herbicide levels and a diagnosis of lymphoma.
- Univariable associations of herbicide and pesticide were largely confounded by age and weight of dogs. Higher concentrations were found in more rural regions therefore suggesting a different demographic of pet ownership in urban versus rural areas.
- **No environmental factors were statistically significant in the final multivariable model.**

## Conclusions

- **Heterogeneous geographical distribution of canine lymphoma in UK primary-care veterinary practices with statistically apparent clustering of disease in London and the South-West.**
- **Application of novel methodology to VetCompass™-derived partial postcode data.**
- **No associations found with radon, herbicide or pesticide levels. However the preliminary univariable association with herbicide could warrant further investigation with larger study size required to detect potential subtle associations.**

Figure 3: The counties with high SMR clustering on the LISA scatterplot and Moran's I statistic showing weak positive autocorrelation.



## References

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3. Gavazza, A., Presciuttini, S., Barale, R., Lubas, G. & Gugliucci, B. 2001. Association between canine malignant lymphoma, living in industrial areas, and use of chemicals by dog owners. *J Vet Intern Med*, 15, 190-5.
4. VetCompass. VetCompass: Health surveillance for UK companion animals. <http://www.rvc.ac.uk/VetCompass> 2018 [cited 2018 March 10].