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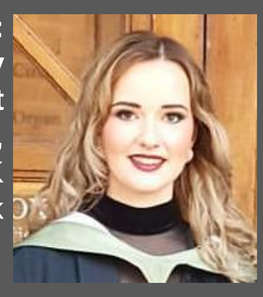

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Can Google search query data be useful to veterinary epidemiology?

An example from Dogslife

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Background

- Increasing numbers of people are turning to the web for healthcare advice,[1,2] which has led to the development of "infodemiology": the study of the internet to reveal the distribution and determinants of health information[3,4]
- Google Trends (a source of search query data from Google) has been used to study a range of health conditions including multiple scleroisis[5], depression[6], and zika[7] in humans and tick paralysis in cats and dogs[8]
- We aim to use Google Trends to compliment Dogslife; an internet-based, longitudinal study of UK Kennel-Club Labrador Retrievers

Objectives

1. To extract Google Trends data and investigate patterns in canine veterinary health related internet browsing in the UK
2. To identify whether Google Trends data correlates with Dogslife

Methods

Dogslife

- Owners were asked to report their dogs' illnesses regularly
- Data for this study were collected between July 2010 and October 2017
- Data was cleaned prior to analysis to remove erroneous dates and duplications

Choosing search terms:

- Most common Dogslife diagnoses were identified
- Free-text boxes in Dogslife were mined to identify canine disease terminology
- We used Google Trends 'related queries' to identify other similar search terms

Google Trends

- Google Trends data was extracted using the 'GTrendsR' package in R
- UK data for search terms between July 2010 and October 2017 was scraped 17 times over a 2 month period
- Mean values were calculated to reduce the effects of data caching

To investigate correlations between Google Trends and Dogslife:

- Google Trends and Dogslife data were converted to time series and normalised
- The seasonal, trend and remainder components were decomposed
- Seasonal correlations were investigated using Pearson's correlation coefficient

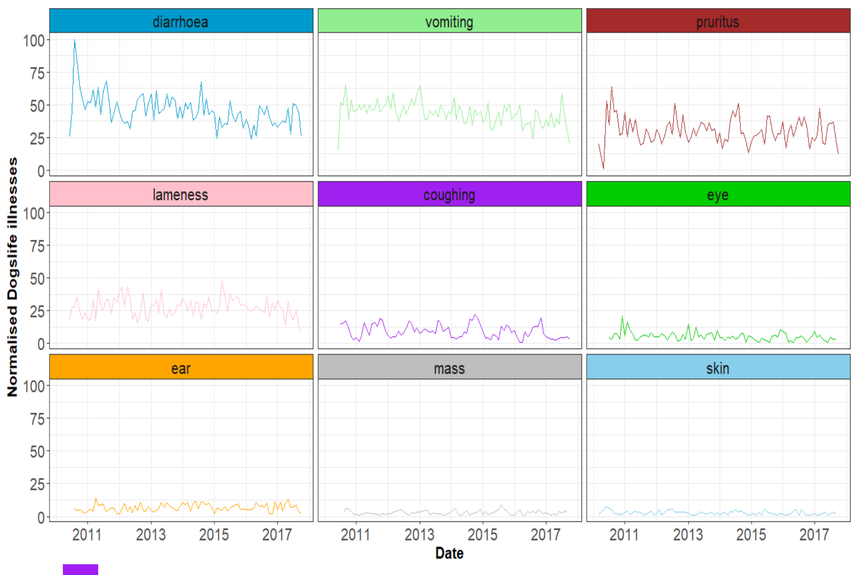
Results

Table 1 The correlation between the seasonality components of Google search indexes and Dogslife diagnosis report indexes

Dogslife diagnosis		Google search terms*	Correlation	95% CI	P value#
Coughing	&	Coughing/Cough	0.949	0.924 – 0.967	<0.001
Diarrhoea	&	Diarrhoea/Diarrhea/Gastroenteritis	0.913	0.870 – 0.942	<0.001
Pruritus	&	Chewing/Itch/Itching/Itchy/Licking/Scratching	0.683	0.553 – 0.781	<0.001
Skin	&	Dermatitis/Eczema/Pyoderma/Rash	0.501	0.325 – 0.643	<0.001
Vomiting	&	Vomiting/Gastroenteritis/Sick/Sickness	0.286	0.082– 0.478	0.006
Lameness	&	Lame/Lameness/Limp/Limping	0.238	0.030 – 0.426	0.026
Eye issue	&	Conjunctivitis	-0.204	-0.396 – 0.006	0.057
Ear issue	&	Otitis	-0.192	-0.386 – 0.018	0.074
Mass	&	Lump/Mass/Cyst/Swelling	0.046	-0.165 – 0.253	0.670

* Data was extracted from Google Trends with the words 'dog', 'dogs', 'puppy', 'puppies', 'pup', 'pups', 'doggy', doggie', and 'canine' preceding each of the terms listed and the mean was taken from

We advise that P values <0.006 should be considered statistically significant accor



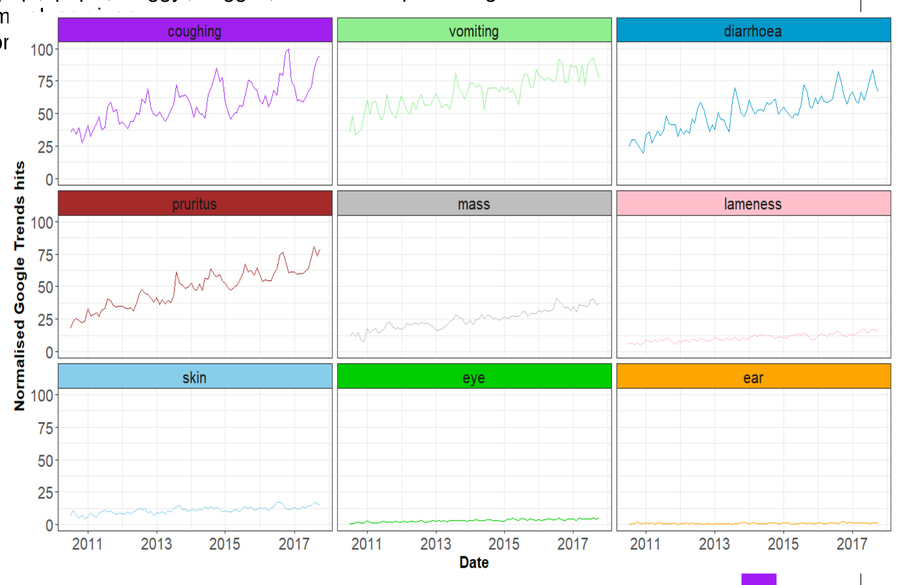


Figure 1 Normalised monthly Dogslife illness diagnoses between 2010 and 2017

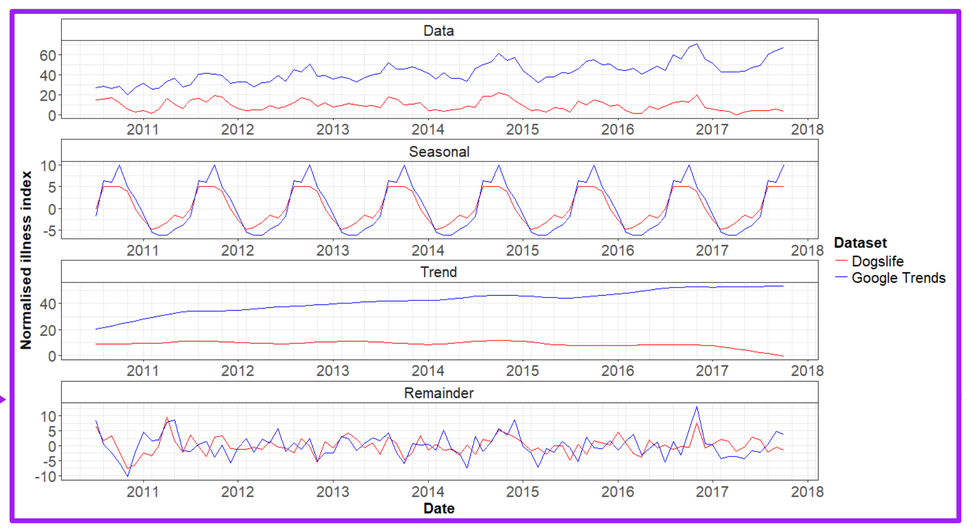


Figure 2 Normalised monthly Google search coughing-related queries between 2010 and 2017

Figure 3 Normalised monthly Dogslife coughing diagnoses and Google search coughing-related queries in any given year between 2010 and 2017, decomposed into seasonal, trend and remainder data

Conclusions

- We report significant correlations in the seasonality of various canine disease phenotypes in the UK between Google Trends data and Dogslife diagnoses over the same time period
- This confirms previous research that has demonstrated the likely primary nature of these diseases, for example infectious causes as the primary aetiologies for diarrhoea or coughing and allergen exposure for pruritus and skin disease
- Search query data is unique in that it is able to provide insights into the health of dogs that do not necessarily visit veterinary practices
- We demonstrate that Google Trends data is a useful additional source of information to validate, compliment and provide new insights into veterinary epidemiological studies

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