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JOURNAL TITLE: Veterinary Record

PUBLISHER: BMJ Publishing Group

PUBLICATION DATE: 29 March 2018 (online)

DOI: 10.1136/vr.k1426

Small animal disease surveillance: respiratory disease

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ABSTRACT

- Presentation for respiratory (RD) disease comprised 1.3 per cent of cat, 1.1 per cent of dog, and 1.3 per cent of rabbit consultations, from January to December 2017.
- Sneezing was the most frequent respiratory sign reported in cats (45.2 per cent); in dogs it was coughing (71.7 per cent).
- Canine respiratory coronavirus (CRCoV) was identified in 43 samples from dogs, the highest percentage testing positive in autumn and winter, with a peak in September (5.6 per cent).
- From 2010 to 2017, there were 198 laboratory samples from which *Streptococcus equi subs. zooepidemicus* was cultured, 22 from cats, 145 from dogs and 31 from Guinea Pigs. Of the 136 canine samples for which anatomical location was known, 75 (55.1 per cent) were from the respiratory tract (nose, trachea or oropharynx).

Report summary

This report is the fifth in a series by the Small Animal Veterinary Surveillance Network (SAVSNET). This report focuses on respiratory disease in companion animals and analyses one year of data from 392 veterinary premises across the United Kingdom (UK), from January to December 2017.

In the first section, we focus on surveillance for respiratory disease from the SAVSNET veterinary practices. Next we describe canine respiratory coronavirus (CRCoV) infections in dogs and we present the results from the laboratory-confirmed cases in dogs across the country. This is followed by an update on the temporal trends of three important syndromes in companion animals, namely gastroenteritis, pruritus, and respiratory disease, from 2014 to 2017. A third section presents a brief update on *Streptococcus equi subspecies zooepidemicus* in companion animals. The final section summarises some recent developments pertinent to companion animal health, namely eyeworm infestations *(Thelazzia callipaeda)* and canine influenza virus in the United States of America and Canada.

Key words: small animal, disease surveillance, respiratory disease, canine respiratory coronavirus, *Streptococcus equi subs. zooepidemicus*

Syndromic surveillance of respiratory disease

Respiratory diseases are common in companion animals. Although clinical signs such as coughing and dyspnoea are commonly referable to primary problems of the respiratory tract, they may also occur secondary to disorders of other organ systems (e.g., cardiac failure). Both young and aged animals are at increased risk of developing respiratory disease. At birth, the respiratory and immune systems are incompletely developed; this facilitates the introduction and spread of pathogens within the lungs. In aged animals, chronic degenerative changes may render the lungs more vulnerable to airborne pathogens and toxic particulates (Kuehn 2018).

The present report considers an update of companion animals presented with respiratory disease to the SAVSNET, from January to December 2017.

This report is based on EHRs for 311,646 consultations in cats, 737,056 consultations in dogs and 16,172 consultations in rabbits (including repeat consultations for the same animal). Presentation with respiratory disease, as indicated by the veterinary surgeon's categorisation, comprised 1.3 per cent of cat, 1.1 per cent of dog, and 1.3 per cent of rabbit consultations. Compared to our previous report from April 2016 (Sánchez-Vizcaíno and others 2016), when presentation for respiratory disease comprised 2.3 per cent of cat, 1.7 per cent of dog and 2.5 per cent of rabbit consultations; in 2017 we observed a decrease of number of consultations for respiratory disease of 42 per cent in cats, 35 per cent for dogs and 48 per cent for rabbits, respectively. Considering that in 2016, we collected a similar number of EHRs (1,000,245), our current results show an overall decrease of number of consultations for respiratory disease.

Short questionnaires were completed for 988 cats and 2089 dogs randomly selected from those animals presenting with respiratory disease. The most common presenting sign in dogs was the cough (71.7 per cent), compared to cats which frequently manifested sneezing (45.2 per cent), nasal discharge (28.2 per cent) and coughing (27.1 per cent) (Figure 1, Table 1). The majority of clinical signs were acute, observed for less than a week (42.1 per cent of cats and 49.1 per cent of dogs). These results are in line with our previous report for respiratory disease (Sánchez-Vizcaíno and others 2016). However, 36.4 per cent of cats and 28.7 per cent of dogs had persisting clinical signs of one month and longer. Therefore, it was perhaps of no surprise that the surveyed animals were equally frequently presented for a first visit (47.6 per cent of cats 56.3 per cent of dogs) as for a subsequent check-up (51.6 per cent of cats and 42.1 per cent of dogs). These results require further investigations regarding risk factors for persistence of moderate and chronic respiratory illness.

Spatial distribution of respiratory disease

The spatial distribution of the relative risk (RR) for respiratory disease was evaluated in dogs and cats in England and Wales for each season of the surveillance period (Figure 1). Estimates for Scotland and Northern Ireland were not ascertained because SAVSNET geographical coverage in these areas is currently limited. Overall we estimated the RR for respiratory disease, by dividing the number of cases for respiratory disease by the number of consultations presented for a cause other than respiratory disease (gastrointestinal and pruritus) per 5 km area and a bandwidth of 50 km. Details of the method are described elsewhere (Sánchez-Vizcaíno and others 2015).

In cats, the areas of highest RR (higher than 0.51) were fragmented and seemed transient depending on the season. For example, central areas of England and Wales had an increased RR in autumn and summer, and coastal areas of England and Wales in spring and winter. In comparison, dogs showed relatively few areas of variable RR, with zones with higher than 0.41 appearing in spring in Cumbria and in winter in Gwynedd. These patterns in cats and dogs were similar to those from our previous report on respiratory disease (Sánchez-Vizcaíno and others 2016). We intend to further investigate the underlying factors that contribute to variations of RR.

Laboratory-based investigations of Canine respiratory coronavirus

Canine respiratory coronavirus (CRCoV) was relatively recently identified by polymerase chain reaction (PCR) in tracheal and lung samples from dogs residing in a high turnover UK rescue center with enzootic respiratory disease despite regular vaccination. From 40 samples tested, 7 were found to be positive by PCR and subsequent hybridization (17.5 per cent) (Erles and others 2003). Since then, CRCoV has been reported worldwide.

Infected dogs show clinical to subclinical respiratory illness with coughing, sneezing, nasal discharge and eventually bronchitis. Dogs of all ages are susceptible to infection, with a peak of CRCoV cases between 2 and 8 years of age (Erles and Brownlie 2008). No CRCoV vaccines are available so isolation of infected dogs is necessary to minimize transmission. Treatment consists of supportive therapy. There is no evidence that CRCoV can infect other animal species or people (Erles and Brownlie 2008).

Data collected from January 2010 to December 2017 were used to identify trends in the proportion of canine samples testing positive by a PCR-based assay following sample submissions to UK-based laboratories participating in SAVNET. In total, CRCoV was identified in 43 samples. There were 2.3 times more positive samples from male (*n*=28) than female dogs (*n*=12); in a further four cases, sex was not recorded. Although CRCoV was diagnosed in each calendar month across all years, overall positive cases were higher in autumn and winter (Figure 2), in particular in September 2017 (12.9 per cent of positive samples from submissions for that given month) and October 2013 (12.5 per cent of positive samples from submissions for that given month). An earlier longitudinal study conducted among dogs from training centres in England also showed a seasonal pattern of CRCoV infection, with most cases being reported in October and November (Erles and Brownlie 2005). However, further studies in the UK should evaluate if CRCoV appears to be getting more or less common.

Update on the temporal trends of the main syndromes in companion animals

This section briefly describes the temporal trends in the syndromic surveillance of gastroenteritis, pruritus and respiratory disease as recorded by veterinary practices participating in SAVSNET in 2017, and compared to all previous years (2014-2016) (Figure 3).

In 2017 we consultations for gastrointestinal disease constituted on average 19 per 1000 weekly consultations in cats and 29 per 1000 weekly consultations in dogs. As in earlier reports (Sánchez-Vizcaíno and others 2015; Arsevska and others 2017), in 2017 gastrointestinal disease showed a seasonal pattern which was particularly apparent in dogs, where animals were less likely to present in summer and early autumn. The week with the highest rate of canine consultations reported with gastroenteritis in 2017 was in December (38 per 1000 consultations in week 52). In cats, the highest weekly rate of consultations were observed in December and February (26 per 1000 consultations in weeks 6 and 52, respectively). Similar patterns of seasonality of gastrointestinal disease were also observed in previous years, with however a higher rate of consultations. For example in dogs the highest weekly rate of visits for gastrointestinal disease was 80 per 1000 consultations in week 53 in 2016 and 60 per 1000 consultations in week 52 in 2014. In cats the rate of visits was 54 per 1000 consultations in week 52 in 2014 and 44 per 1000 consultations in week 53 in 2016. High rates in these weeks may reflect variable presentation to veterinary practices associated with Christmas holidays.

On average throughout 2017, pruritus was reported more commonly in dogs (44 per 1000 weekly consultations) than cats (22 per 1000 weekly consultations). Overall, pruritus in dogs appeared to have a seasonal pattern, with increased percentages of consultations in autumn; a similar although less pronounced pattern was observed for cats (Figure 3). In 2017, the week with the highest proportion of consultations for pruritus in cats and dogs was in November (weeks 43 and 44) with 53 per 1000 consultations in dogs and 30 consultations per 1000 consultations in cats. Compared to previous years, in 2017 we observed a decrease in the number of visits for pruritus (the weekly average rate in previous years in dogs was 60 per 1000 weekly consultations and 34 per 1000 weekly consultations in cats) (Arsevska and others 2017).

In 2017, respiratory disease was more commonly recorded in cats (average of 11 per 1000 weekly consultations) than dogs (on average 9 per 1000 weekly consultations). The trend of respiratory disease was more stable throughout all months of the year (Figure 3). As for the other syndromes, the overall rate of consultations recorded for respiratory disease in 2017 decreased in comparison to the period 2014 to 2016 (on average 18 per 1000 weekly consultations in cats and 13 per 1000 weekly consultations in dogs).

Update on *Streptococcus zooepidemicus* in companion animals

Streptococcus equi subsp. *zooepidemicus* (*S. zooepidemicus*) is a gram positive, beta-haemolytic bacterium that has been associated for many years with opportunistic infections, predominantly in the reproductive tract, in horses and curiously with lymphadenitis in guinea pigs (Gruszynski and others 2015). In recent years the bacterium has emerged as a significant cause of pneumonia in dogs, notably those housed in kennels or rehoming centres, and particularly amongst racing greyhounds (Priestnall and Erles 2011).

Infection is usually sporadic but often serious, resulting in severe, and not infrequently fatal, pneumonia. The source of infections is usually unknown but presumed to be introduced into a canine population by a carrier animal. Although transmission from horses to dogs has been considered as the main primary source of infection (Acke and others 2010), it is now thought (similar to canine influenza) that transmission and infection now occurs mainly directly between dogs without the need for contact with horses. Close contact is required to transmit from one animal to another and densely housed dogs or those with a weakened immune response due to concurrent respiratory viral infection appear to the most severely affected. The bacteria produces various exotoxins and it is thought the most serious disease manifestations are as a result of the animal's immune response to these so-called "superantigens", resulting in a "cytokine storm", similar to toxic shock syndrome in humans (Paillot and others 2010; Priestnall and others 2010).

A number of outbreaks of haemorrhagic pneumonia in dogs have been reported from around the world attributed to infection with *S. zooepidemicus*, usually occurring as infection with a single clone of the bacterium within a shelter and resulting in high rates of morbidly and mortality (Byun and others 2009; FitzGerald and others 2017; Pesavento and others 2008).

Dogs infected with *S. zooepidemicus* may begin with clinical signs of upper respiratory tract infection (nasal discharge, coughing); this initial presentation resembles 'kennel cough' such that specific diagnosis may be missed. Affected dogs can rapidly progress to pyrexia, lethargy, inappetance and, if untreated, hypovolemic shock. Key warning signs for pneumonia development would be pyrexia and marked lethargy. In confirmed cases, treatment is largely supportive aimed at rapid, intravenous broad-spectrum antibiotic administration and fluid therapy. Dogs can recover from infection if treated early. Clinicians should be alert with any fatality due to respiratory disease in groups of dogs prompting swift investigation (Jaeger and others 2013). At necropsy dogs have severe fibrino-suppurative, necrotising and haemorrhagic pneumonia with copious haemorrhagic pleural effusion and often petechial haemorrhages on the pleural surfaces (Priestnall and others 2010).

Confirmation of infection can be done via routine bacterial culture from oropharyngeal, or preferably nasal swabs. More rapid (real-time PCR-based) diagnostics have been developed and when validated, should provide for more timely diagnosis and earlier treatment. There are few differential diagnoses for haemorrhagic pneumonia in dogs but in the last 3 or 4 years cases of extra-intestinal *E.coli* infection have produced similar rapidly progressing clinical signs and pneumonia in intensively housed young dogs.

Infected dogs should be quarantined and the environment thoroughly disinfected to prevent spread as the bacterium is relatively resistant when residing within mucus from nasal secretions. Water and food bowls, bedding and even leads can be a source of infection for other dogs. The bacterium is, as the name implies, zoonotic and has been isolated from a wide range of different species including humans where it has been linked albeit rarely with severe infections (Eyre and others 2010; Pelkonen and others 2013) and in at least one case this has been linked directly back to contact with a dog suffering from pneumonia (Abbott and others 2010).

Data from SAVSNET between 2010 and 2017 records 145 canine samples from which *S. zooepidemicus* was cultured; for 136 of these the anatomical location was known (Table 2). Seventy five (55.1%)

samples were from the respiratory tract (nose, trachea or oropharynx). The next most frequent site for *S. zooepidemicus* culture were abscesses (16.2%). There was no seasonal pattern for the cultured samples from *S. zooepidemicus.* Infection with the bacterium is not always associated with clinical disease, and 'carrier' animals may occur, and thus there are likely to be as yet unknown host and environmental factors which are involved in the clinical expression of disease. Indeed, infections with *S. zooepidemicus* are more frequent in kennelled/shelter dogs, but then they are rarely actually swabbed and PCR analysis performed and consequently the infection in this population is likely underestimated (Priestnall and others 2010). Although it is rarer in family pets, SAVSNET is keen to highlight the signs to owners, particularly if they regularly visit kennels or attend events where large groups of animals gather. Current research is focussed on a greater understanding of the bacterium genetically and whether specific sequence types are associated with more severe disease.

Global perspective

Eyeworm (*Thelazzia callipaeda*) in imported dogs

Thelazzia callipaeda (T. calliaeda) is a vector borne nematode transmitted by fruit flies. Adults live in ocular and periocular tissues in a wide range of mammals including dogs, cats and humans. The disease is endemic and locally transmitted in wide areas of mainland Europe. Cases are now being seen in the UK in dogs that have recently come to the UK, including rescue animals (Graham-Brown et al, 2017). Clinical signs range from inapparent to severe corneal ulceration. To date only milbemycin and moxidectin have been licensed for the treatment of ocular thelaziosis. A search of consultation data from veterinary practices participating in SAVSNET found no reference to the disease, confirming infection is likely to be currently rare. However, the intermediate host in Europe, the fruit fly *Phortica variegate*, which transmits larvae while feeding on lacrimal secretions, are already resident in southern England, creating the potential for the disease to become established here.

Canine Influenza virus in the *United States of America* and now Canada

Canine influenza (CI) is caused by two strains of influenza, H3N8 that crossed the species barrier from horses to dogs in the United States of America (USA), and H3N2, that was probably transmitted from birds to dogs in Asia and subsequently imported into the USA, possibly by dogs being rescued. Both viruses continues to circulate in the USA. In January 2018, the first cases of CI H3N2 were confirmed in Canada. Neither virus is known to infect humans. Vaccines are licensed for control in the USA, and owners there are advised to avoid areas crowded with dogs when the virus is known to be actively circulating. To date there is no evidence for the virus in the UK, but clearly dog travel is one route that it may arrive.

Conclusion

This is the fifth Small Animal Disease Surveillance (SADS) report, which highlights the importance of respiratory infections in UK pet animals, and in particular infection with *Streptococcus zooepidemicus* due to its severe nature and its zoonotic potential. As we collect data for longer, our estimates of changes in disease burden will become more refined, allowing more targeted local and perhaps national interventions. Anonymised data can be accessed for research by contacting the authors. SAVSNET welcomes your feedback.

Acknowledgements

SAVSNET is based at the University of Liverpool. It is currently funded by BBSRC and BSAVA. The SAVSNET team is grateful to the veterinary practices and diagnostic laboratories that provide health data and without whose support these reports would not be possible. We especially wish to thank, in alphabetical order, Batt Laboratories Ltd, BioBest, CAPL, CTDS, CVS, Idexx, Lab Services Ltd, Langford Veterinary Services, NationWide Laboratory Services, PTDS, SRUC, TDDS, Teleos, Test A Pet and Microbiology Diagnostics Laboratory at University of Liverpool, and VetSolutions (the suppliers of RoboVet and PremVet). It would also like to thank Susan Bolan, SAVSNET project administrator, for her help and support.

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Tables

Table 1: Number and percentage of the main clinical signs in 988 cats and 2089 dogs presenting with respiratory disease* to SAVSNET veterinary premises in the UK, from January 2017 to December 2017.

Clinical sign	Number (%) of cats	Number (%) of dogs
Coughing	268 (27.1)	1498 (71.7)
Sneezing	447 (45.2)	272 (13)
Nasal discharge	279 (28.2)	157 (7.5)
Dyspnoea	222 (22.5)	275 (13.2)
Conjunctivitis and/or ocular discharge	138 (14)	48 (2.3)
Lethargy	100 (10.1)	110 (5.3)
Pyrexia	43 (4.4)	76 (3.6)

* The same animal could present with more than one clinical sign per consultation

Table 2: Number and percentage of 198 laboratory samples where *Streptococcus equi subsp. zooepidemicus* was isolated, from 2010 to 2017.

Sampling site	Number of cats (%)	Number of dogs (%)	Number of guinea pigs (%)
Abscess/ swelling		22 (15.17)	
Ear	9 (40.91)	4 (2.76)	1 (3.23)
Eye		2 (1.38)	4 (12.90)
Oro/pharyngeal		6 (4.14)	
Lymph node		1 (0.69)	1 (3.23)
Nasal	8 (36.36)	53 (36.55)	16 (51.61)
Not specified		9 (6.21)	
Tracheal/ bronchoalveolar	3 (13.64)	16 (11.03)	2 (6.45)
Urine		1 (0.69)	
Vaginal		19 (13.10)	
Wound		11 (7.59)	1 (3.23)
Total	**22**	**145**	**31**

Figures

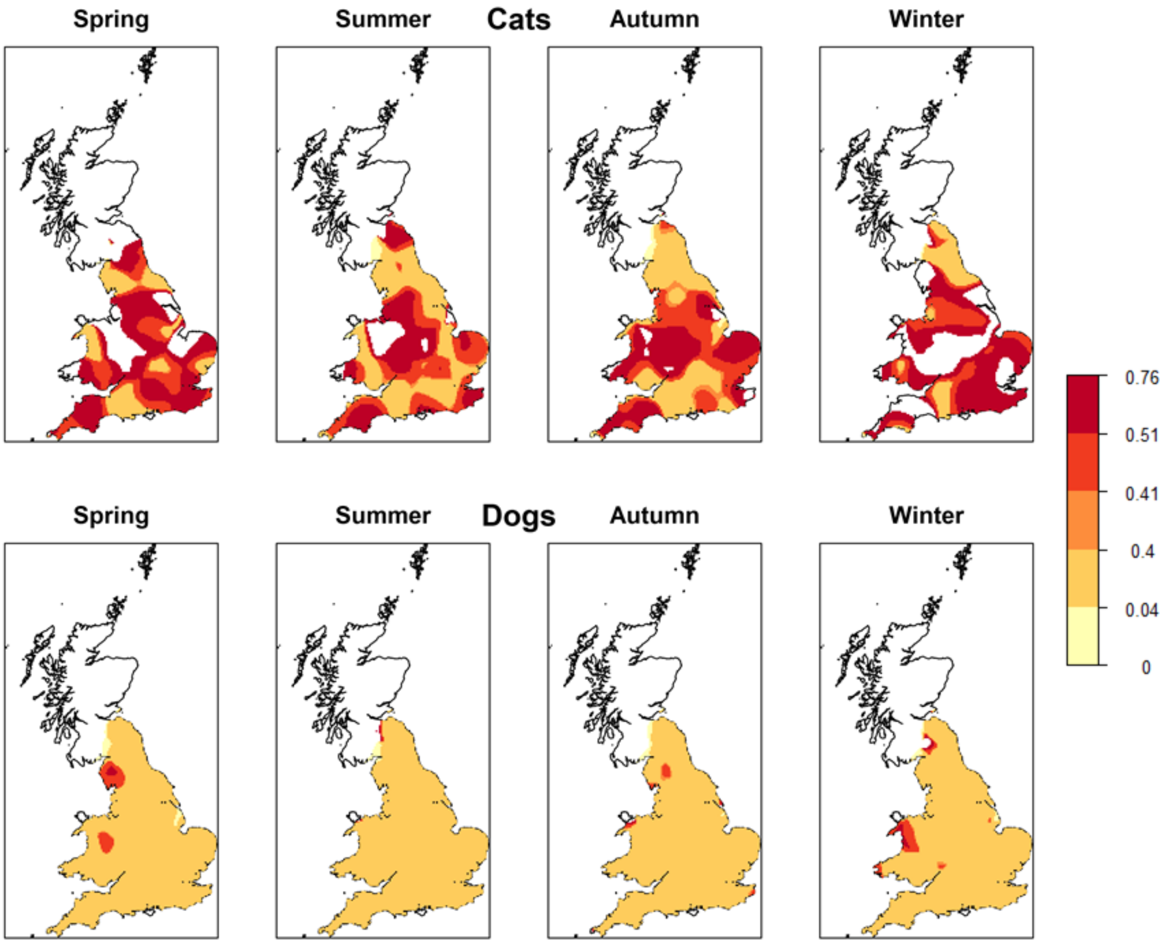

FIG 1: Kernel intensity ratio surface of England and Wales showing the relative risk of cats and dogs being presented with respiratory disease by season from January 2017 to December 2017. The colours for relative risk have been categorised using the four cut-offs that divide the results obtained from cats during spring into five equal-size groups (quintiles) each containing 20 per cent of all results. The areas with not enough data for estimation of the relative risk are coloured in white.

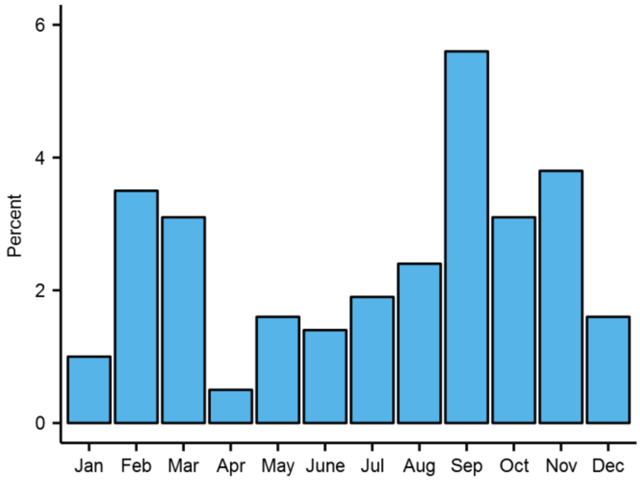

FIG 2: Monthly percentage of dog sample submissions testing PCR positive for canine respiratory coronavirus, from January 2011 to December 2017.

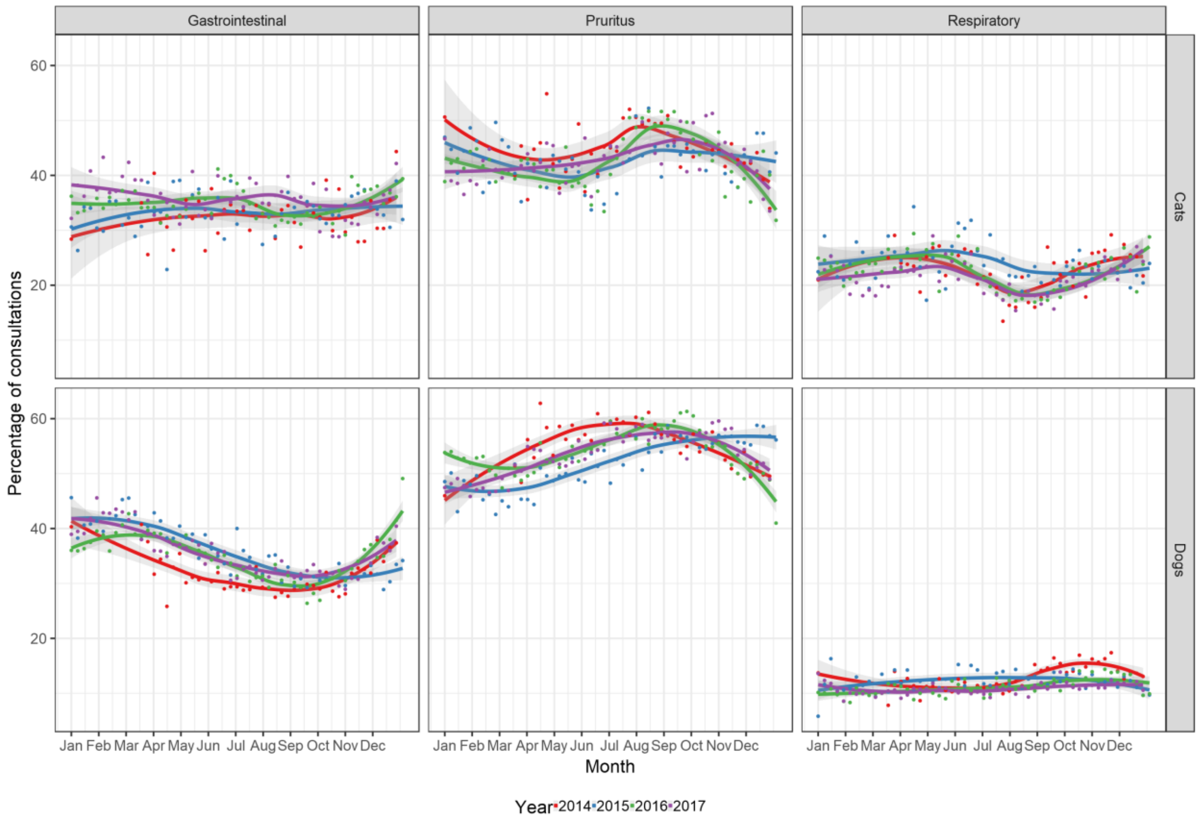

FIG 3: Percentage of weekly and monthly consultations for gastrointestinal, pruritus and respiratory disease in a UK veterinary-visiting population of cats and dogs, between January 2014 and December 2017. The shaded areas around the solid lines depict a smoothing 95% Confidence Intervals of the weekly values by a locally weighted regression (Cleveland and Devlin 1988).