

UK Small Animal Disease Surveillance Report focusing on respiratory disease

Fernando Sánchez-Vizcaíno ^{1*}, Janet M Daly ², Philip H Jones ¹, Susan Dawson ³, Rosalind Gaskell ³, Tarek Menacere ¹, Bethaney Heayns ¹, Maya Wardeh ¹, Jenny Newman ¹, Sally Everitt ⁴, Michael J Day ^{4,5}, Katie McConnell ⁴, Peter JM Noble ³ and Alan D Radford ¹

¹ Institute of Infection and Global Health and ³ School of Veterinary Science, University of Liverpool, Leahurst Campus, Chester High Road, Neston, CH64 7TE, UK.

² School of Veterinary Medicine and Science, University of Nottingham, Sutton Bonington Campus, Leicestershire, LE12 5RD, UK

⁴ BSAVA, Woodrow House, 1 Telford Way, Waterwells Business Park, Quedgeley, Gloucestershire, GL2 2AB, UK.

⁵ University of Bristol, School of Veterinary Sciences, University of Bristol, Langford, BS40 5DU, UK.

* Corresponding author - fsvb@liverpool.ac.uk

ABSTRACT

This second Small Animal Disease Surveillance report focuses on syndromic surveillance of i) respiratory disease in veterinary practice and ii) feline calicivirus (FCV) based on laboratory diagnosis, in a large veterinary-visiting pet population of the UK between January 2014 and December 2015. Presentation for respiratory disease comprised 1.7%, 2.3% and 2.5% of canine, feline and rabbit consultations, respectively. In dogs, the most frequent respiratory sign reported was coughing (71.1% of consultations), whilst in cats it was sneezing (42.6%). Cats had a higher number of geographical regions at high relative risk for respiratory disease compared with dogs in England and Wales. The mean percentage of samples testing positive for FCV was 30.1% (95% CI: 28.2–32.2%) in the year 2014 and 27.9% (95% CI: 26.2–29.7%) in 2015. January was the month with the highest percentage of FCV positive samples in both years. The report also gives an update on influenza A virus in dogs and cats. Finally, in its section about topical developments in companion animal infection worldwide, the report briefly reminds us of the zoonotic potential of leptospirosis.

Format of the report

This report comprises five sections. The first two summarise some practice- and laboratory-based surveillance, respectively: this report is focused on respiratory disease in practices and on laboratory-confirmed diagnosis of feline calicivirus (FCV) infection. The third section provides an update on the syndrome (gastrointestinal disease) analysed in the previous report for the study period between 1st October and 31st December 2015. The fourth section presents an update on influenza virus in dogs and cats. The final section describes other recent and relevant infectious disease events occurring in a global context that, have the potential to impact on small animal populations in the UK and the owners of those animals.

1. Syndromic surveillance of respiratory disease

The term 'respiratory disease' includes a wide range of conditions of the respiratory tract. Infections, especially viral infections, are an important cause of respiratory disease. Clinical signs may include coughing, sneezing, nasal and ocular discharges, lethargy and difficulty breathing. Here we describe animals presented primarily with respiratory disease to 199 veterinary practices (428 premises) between 1st January 2014 and 31st December 2015. The data were obtained from the Small Animal Veterinary Surveillance Network (SAVSNET). A detailed description of the methods used by SAVSNET to capture electronic health records (EHRs) may be found elsewhere (Sánchez-Vizcaíno *et al.*, 2015). In total, EHRs for 1,000,245 consultations were collected (including repeat consultations for the same animal), of which 69.4% were from dogs, 26.5% cats, 1.5% rabbits, 1.3% other species and 1.3% where the species was not noted. Presentation for respiratory disease, as indicated by the veterinary surgeon's categorisation comprised 1.7%, 2.3% and 2.5% of canine, feline and rabbit consultations, respectively. Short questionnaires relating to presenting signs, diagnostic tests and treatments (Sánchez-Vizcaíno *et al.*, 2015) were completed for 3,596 animals based on a single questionnaire per patient. The results related to the clinical signs at presentation are shown in Table 1. A high proportion of dogs (55.6%) and cats (45.8%) were presented after only a short history of illness (average of six days). Diagnostic tests were planned in 18.7% of dogs and 19.6% of cats with respiratory disease, with radiography and haematological/biochemical analyses being most common.

Table 1. Percentage of clinical signs in 2,419 dogs and 1,177 cats presenting with respiratory disease to veterinary practices in the UK. The same animal could present with more than one sign per consultation.

Clinical signs	Number (%) of dogs	Number (%) of cats
Conjunctivitis and/or ocular discharge	60 (2.5)	190 (16.1)
Coughing	1,719 (71.1)	308 (26.2)
Drooling	16 (0.7)	22 (1.9)
Dyspnoea	329 (13.6)	251 (21.3)
Generalised depression/lethargy	108 (4.5)	107 (9.1)
Mouth ulcers	4 (0.2)	17 (1.4)
Nasal discharge	176 (7.3)	329 (27.9)
Pyrexia	90 (3.7)	69 (5.9)
Sneezing	366 (15.1)	502 (42.6)
Other signs	254 (10.5)	157 (13.3)

The spatial distribution of the relative risk for respiratory disease was evaluated in dogs and cats in England and Wales for each season of the year (Figure 1). Estimates for Scotland and Northern Ireland are not included in this report because SAVSNET geographical coverage in these areas is currently limited. Animals were considered as “cases” if, during the season assessed, they were presented for respiratory disease at one or more consultations. A kernel smoothing method was used to smooth the spatial variation of the relative risk for respiratory disease throughout England and Wales. The relative risk of dogs being presented with respiratory disease was estimated as the ratio of kernel-smoothed intensities (i.e. mean number of events estimated per unit area) of dogs presented with respiratory disease (cases) compared with all dogs presented to SAVSNET veterinary practices for a cause other than respiratory disease (controls); the same approach was conducted for cats. Estimations were made using a grid cell of 5 km and a bandwidth of 50 km.

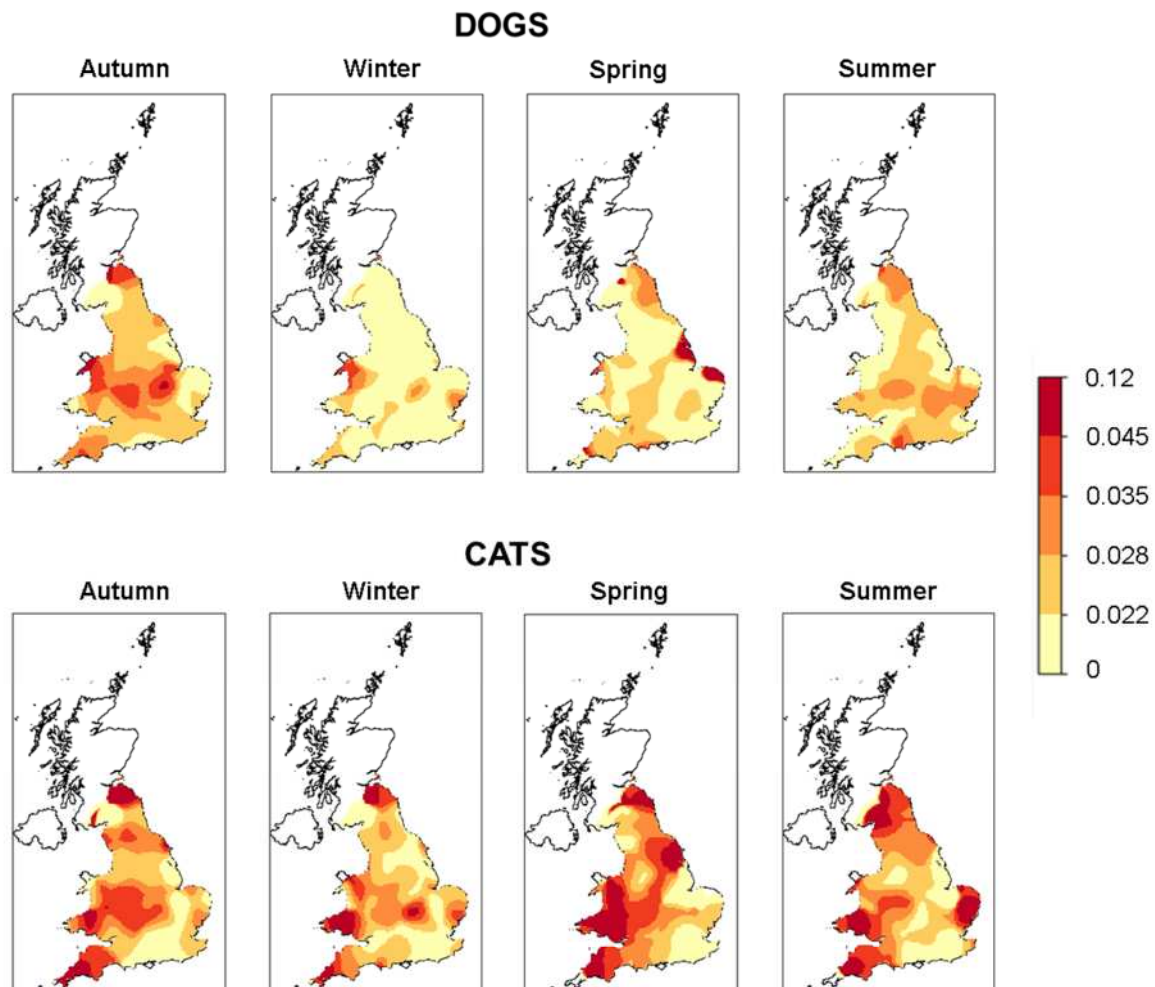


Figure 1. Kernel intensity ratio surface of England and Wales showing the relative risk of dogs and cats being presented with respiratory disease by season. The colours for relative risk have been categorised using the four cut-offs that divide the results obtained from cats during spring into five equal-size groups (quintiles) each containing 20% of all results.

In dogs, a low number of zones at high relative risk for respiratory disease were identified in autumn and spring, with winter and summer having no zones of high relative risk. In contrast, cats had a higher number of zones at high relative risk for respiratory disease compared with dogs. Most of these areas appeared transient, although some areas in Wales and South West of England seemed to have a higher relative risk throughout the year. Together, these data reaffirm the different pattern of presentation for respiratory disease between cats and dogs, and suggest that the relative risk for respiratory disease varies spatially and temporally. It should be noted these zones may not equate to outbreaks; SAVSNET is currently developing models to allow outbreaks to be identified.

2. Laboratory-based surveillance of feline calicivirus in the UK

Feline calicivirus (FCV) is one of the two most important viral causes of respiratory infection in cats, the other being feline herpesvirus 1 (FeHV-1) (Radford and others 2009). Acute signs of FCV include fever, conjunctivitis, nasal discharge, sneezing, and lameness, although perhaps the most consistent sign is oral ulceration. More rarely, pneumonia may develop with secondary bacterial infections. On recovery from clinical disease, many cats develop a carrier state and continue to shed the virus. As a result, approximately 10% of clinically normal cats test positive for FCV, although much higher figures can be found where cats are housed in groups.

SAVSNET data gathered from participating laboratories (Sánchez-Vizcaíno *et al.*, 2015) were used to identify temporal and geographical trends in the proportion of samples testing positive for FCV using either virus isolation or PCR (Figure 2). Proportions are currently used to protect the case loads of participating laboratories. Samples were submitted from 116 of the 121 postcode areas in use in the UK. The mean percentage of samples testing positive for FCV was 30.1% (95% CI: 28.2–32.2%) in the year 2014 and 27.9% (95% CI: 26.2–29.7%) in 2015. January was the month with the highest percentage of positive samples in both 2014 (31.7%, 95% CI: 24.0–40.4%) and 2015 (36.0%, 95% CI: 29.5–43.1%). However, the confidence intervals (95% CI) indicate that the real percentage of samples testing positive for FCV could be the same for all months; in a future analysis we will determine whether this apparent temporal trend continues. From postcode areas that submitted 25 or more samples in each year, the highest percentage of samples testing positive were from Gloucester (48% in 2014) and Bristol (39% in 2015). In total, 10 postcode areas in 2014 and 14 in 2015 submitted only negative samples; these areas only had low sample numbers. Colchester in 2014 and Liverpool in 2015 submitted the highest numbers of these negative samples (13 and 8, respectively). These apparent temporal and spatial variations suggest a potential different epidemiology for FCV infection across the country, and will need further study. Results presented here should currently be interpreted with caution as some postcode areas of the UK had small numbers of submissions during this sample period. Similar results for other pathogens including FeHV-1 are available in near-real time through the SAVSNET website.

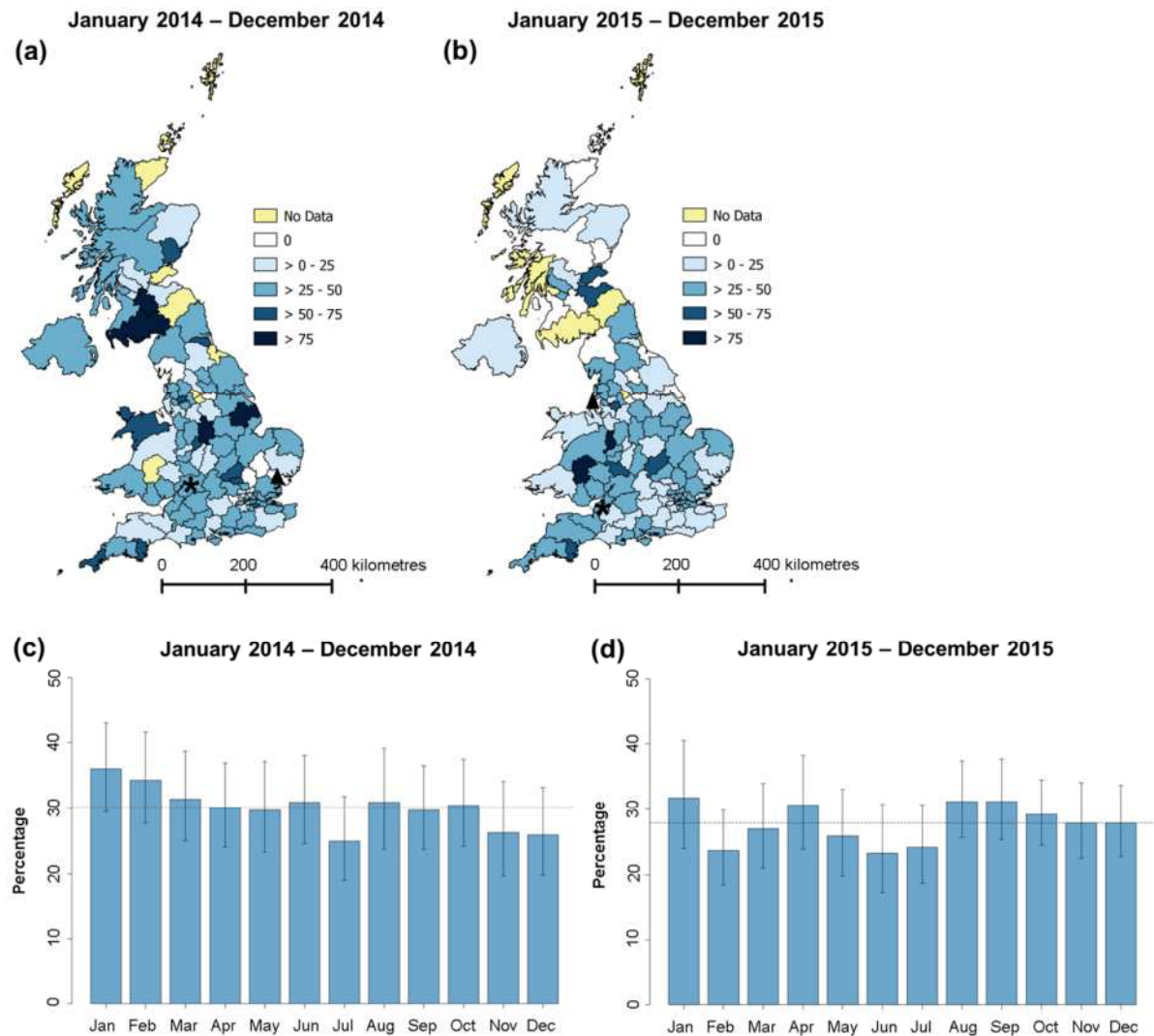


Figure 2. Temporal and geographical trends in feline calicivirus (FCV) diagnosis. a) and b) Geographical distribution of the percentage of samples testing positive for FCV by postcode area. An asterisk (*) identifies the area with the highest percentage of positive FCV samples in each year from those postcode areas that submitted at least 25 samples. A triangle (▲) identifies the FCV negative postcode area which submitted the highest number of samples in each time period. c) and d) Percentage of samples which test positive for FCV by month (the dotted line indicates the mean percentage of samples testing positive in each year).

3. Update on previous reports.

Update on gastrointestinal disease

In total, EHRs for 342,031 individual consultations were recorded from 174 practices (366 sites) between October and December 2015. Of these, 68.5% were from dogs, 28.1% cats, 1.1% rabbits, 0.9% other species and 1.3% where the species was not noted. Presentation for gastrointestinal (GI)

disease comprised 4.1% of canine consultations and 3.1% of feline consultations. These figures were slightly lower than those obtained for the same monthly period in the year 2014 (4.4% and 3.3% of canine and feline consultations, respectively).

In total, 2,623 GI disease questionnaires (1,934 dogs, 612 cats) based on a single questionnaire per patient were collected between October and December 2015. The two most frequent GI clinical signs reported in dogs and cats were vomiting without blood (39.8% of dog GI disease consultations and 35.1% of cat GI disease consultations) and diarrhoea without blood (37.6% and 36.3%, respectively). A high proportion of dogs (52.8%) and cats (40.2%) were presented after only a short history of illness over the previous two days. Diagnostic tests were planned in 23.8% of dogs and 30.9% of cats with GI disease, with haematological/biochemical analyses being most common.

The spatial distribution of the relative risk for GI disease in dogs and cats was assessed in England and Wales for each season of the year using data for two completed years between 2014 and 2015. The results obtained from the GI disease questionnaires and the pattern of presentation for GI disease found in dogs and cats (results not presented here) were similar as the one shown in a previous study using data from January 2014 to September 2015 (Sánchez-Vizcaíno *et al.*, 2015).

4. Update on influenza virus in dogs and cats.

We all know Influenza viruses are an important cause of respiratory disease in humans. Here we present an update on their evolving interaction with our cats and dogs.

Influenza A viruses are archetypal emergent viruses; their segmented RNA genome makes them highly adaptable. They are classified into many different subtypes based on their surface glycoproteins: haemagglutinin (HA) and neuraminidase (NA). Waterfowl are important reservoir hosts of the majority of influenza A subtypes. Historically, certain subtypes have 'spilled over' into mammalian species, occasionally establishing themselves in their new host (reviewed in Short *et al.*, 2015).

Transmission of avian influenza viruses to domestic fowl has occurred with apparently increasing frequency in recent decades. In chickens and turkeys, H5 or H7 subtypes can evolve from low pathogenicity to highly pathogenic avian influenza (HPAI) (Short *et al.*, 2015). Instead of being restricted to the respiratory tract, these HPAI viruses are disseminated throughout the body: such viruses are notifiable. Mammals coming into close contact with HPAI infected birds (e.g. tigers fed carcasses of infected chickens in a zoo) are exposed to high doses of virus and can also become infected. These individuals are generally considered dead-end hosts. Apart from isolated incidences of HPAI infections, other influenza A viruses had not been associated with disease in dogs or cats until earlier this century.

In 2005, researchers in the US reported that an equine-origin H3N8 influenza virus was responsible for a respiratory disease outbreak in greyhounds in Florida (Crawford *et al.*, 2005). Serological analysis confirmed that the virus had probably been circulating in racing greyhounds since the late 1990s. This virus has now moved into other dog populations (e.g. dogs in animal shelters), spreading across the USA and now has endemic status; vaccines against it are available.

Has this virus occurred outside the USA? A retrospective study in the UK implicated a closely related equine influenza A H3N8 virus in at least one outbreak of respiratory disease in English foxhounds (Daly *et al.*, 2008). Dogs also became infected during an H3N8 influenza A outbreak in Australian horses (Kirkland *et al.*, 2010). That these viruses have not yet established in dog populations outside the USA is possibly due to the more isolated nature of the dogs in which the initial spill-over events occurred. The risk to the UK comes from importation of infected animals from the USA or from sporadic new spill-over events where horses and dogs are kept in close proximity.

There have also been isolated cases of confirmed human influenza A H1N1 virus infection in dogs and cats (e.g. ProMED: 20091128.4079) (Sponseller *et al.*, 2010). Of current interest, avian H3N2 influenza emerged in dogs in Korea in 2007 (Song *et al.*, 2008), arriving in the US in 2015, possibly with imported rescue dogs (ProMED: 20150413.3293591). This virus has subsequently spread, resulting in its co-circulation with H3N8 virus in dogs in the USA. Vaccines containing the H3N2 strain have been granted a conditional license for use in susceptible dog populations.

In the UK, clinicians should be aware of the potential for influenza virus infection in dogs (or cats) with respiratory disease in some rare circumstances. These include close contact with horses or people with influenza-like illness, and potential exposure through travel to, or contact with, animals from the USA or the Far East. People should also be aware of the possibility of transmission to cats when/if there is an outbreak of HPAI in birds in their area; veterinarians should remember that this disease is notifiable.

Typical clinical signs of mammalian influenza are similar across different species and include fever, cough and malaise. Nasal discharge, that is initially serous, may become mucopurulent due to secondary bacterial infection. HPAI infection of cats is often fatal. Treatment of influenza is symptomatic (rest and hydration), but administration of antibiotics may be warranted if secondary bacterial infection occurs. Diagnostic testing for influenza virus is generally not routinely performed for cats and dogs presenting with acute respiratory disease in the UK. However, several laboratories now offer a Respiratory Pathogen PCR screening test that includes detection of influenza A virus. A preliminary screen of laboratory data submitted to SAVSNET shows that positive tests are occasionally recorded and suggests further work on the role of these viruses in UK dog and cat populations is warranted.

References

- CRAWFORD, P.C., DUBOVI, E.J., CASTLEMAN, W.L., STEPHENSON, I., GIBBS, E.P., CHEN, L., SMITH, C., HILL, R.C., FERRO, P., POMPEY, J., BRIGHT, R.A., MEDINA, M.J., JOHNSON, C.M., OLSEN, C.W., COX, N.J., KLIMOV, A.I., KATZ, J.M., DONIS, R.O. (2005). Transmission of equine influenza virus to dogs. *Science* 310, 482-485.
- DALY, J.M., BLUNDEN, A.S., MACRAE, S., MILLER, J., BOWMAN, S.J., KOLODZIEJEK, J., NOWOTNY, N., SMITH, K.C. (2008). Transmission of equine influenza virus to English foxhounds. *Emerging Infectious Diseases* 14, 461-464.
- KIRKLAND, P.D., FINLAISON, D.S., CRISPE, E., HURT, A.C. (2010). Influenza virus transmission from horses to dogs, Australia. *Emerging Infectious Diseases* 16, 699-702.
- SHORT, K.R., RICHARD, M., VERHAGEN, J.H., VAN RIEL, D., SCHRAUWEN, E.J.A., VAN DEN BRAND, J.M.A., MÄNZ, B., BODEWES, R., HERFST, S. (2015). One health, multiple challenges: The inter-species transmission of influenza A virus. *One Health* 1, 1-13.
- SONG, D., KANG, B., LEE, C., JUNG, K., HA, G., KANG, D., PARK, S., PARK, B., OH, J. (2008). Transmission of avian influenza virus (H3N2) to dogs. *Emerging Infectious Diseases* 14, 741-746.
- SPONSELLER, B.A., STRAIT, E., JERGENS, A., TRUJILLO, J., HARMON, K., KOSTER, L., JENKINS-MOORE, M., KILLIAN, M., SWENSON, S., BENDER, H., WALLER, K., MILES, K., PEARCE, T., YOON, K.J., NARA, P. (2010) Influenza A pandemic (H1N1) 2009 virus infection in domestic cat. *Emerging Infectious Diseases* 16, 534-537.

5. A global perspective on companion animal infection

The last three months of 2015 were relatively quiet for global infection stories in small pet animal species. Of course quite rightly, everyone is talking about Zika virus and its worrying implications particular for pregnant woman. In this report it is perhaps worth emphasising that apart from monkeys, there is no evidence to suggest Zika virus causes disease in other animals such as cats, dogs, rabbits and other small pet animals or that these pet animals are involved in transmission (<http://www.cdc.gov/zika/transmission/qa-animals.html>).

Leptospirosis. A fatal case of human leptospirosis was investigated by Public Health England (PHE) at an Animal Shelter in the UK in December 2015, a reminder of the zoonotic potential of this organism. PHE investigates 50-100 cases of leptospirosis per year, with most associated with animal or water exposure (Schuller et al., 2015, <https://www.gov.uk/guidance/leptospirosis>). The most frequently implicated animals include rats, cattle and pigs. Clearly dogs can also carry leptospirosis, and dog to human transmission is described, but seems rare (Sykes et al., 2011, LEVETT 2001). Cats can also be infected with leptospires, but clinical signs are rarely described.

The bacteria enter the body through abrasions or cuts in the skin and through the lining of the nose, mouth and eyes. Clinical signs are not always present in dogs but where they are they can be severe reflecting renal, hepatic and respiratory impairment, and less frequently disseminated intravascular coagulation. Diagnosis is not always straightforward and includes serology (microscopic agglutination test) as well as PCR on blood or urine. Data reported to SAVSNET shows that ~6% and 9% of blood and urine samples test PCR positive respectively, testament to the ongoing significance

of this pathogen in dogs. Treatment includes intravenous penicillin derivatives or oral doxycycline, coupled with specific treatment relating to individual organs affected. Vaccination of dogs is recommended in countries where there is a significant risk of infection (Schuller et al., 2015, Day et al., 2016).

According to the Health and Safety Executive, farmers are now the main risk group for *Leptospira* infection (<http://www.hse.gov.uk/pubns/indg84.pdf>). Other people who have contracted leptospirosis in recent years include veterinarians, meat inspectors, butchers, and abattoir and sewer workers. Workers in contact with canal and river water are also at risk.

Simple precautions can reduce the risk of contracting leptospirosis: cover cuts, scratches or sores with a waterproof plaster and thoroughly clean cuts or abrasions; wear appropriate protective clothing, gloves or protective footwear; wash or shower promptly after water sports, especially if you fall in; wear thick gloves when handling rats; wash hands after handling any animal, and before eating.

Conclusion

This is the second UK SADS report highlighting the importance of respiratory disease in UK pet animals. In the future, we will expand to other syndromes including skin disease and tumours. 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

The SAVSNET team is extremely grateful to the veterinary practices and diagnostic laboratories that participated in this study by providing data and without whose support these reports would not have been possible. We especially wish to thank, in alphabetical order, BioBest, CAPL, CTDS, CVS, Idexx, Lab Services Ltd, Langford Veterinary Services, NationWide Laboratory Services, PTDS, SRUC, Teleos, TDDS and VetSolutions (the suppliers of RoboVet and PremVet). We would also like to thank Susan Bolan, SAVSNET project administrator, for her help and support.

References

DAY, M.J., HORZINEK, M.C., SCHULTZ, R.D., SQUIRES, R.A. (2016). WSAVA Guidelines for the vaccination of dogs and cats. *Journal of Small Animal Practice* 57, E1-E45.

LEVETT, P.N. (2001). Leptospirosis. CLINICAL MICROBIOLOGY REVIEWS, Vol. 14, No. 2 p. 296–326.

RADFORD, A.D., ADDIE, D., BELÁK, S., BOUCRAUT-BARALON, C., EGBERINK, H., FRYMUS, T., GRUFFYDD-JONES, T., HARTMANN, K., HOSIE, M.J., LLORET, A., LUTZ, H., MARSILIO, F., PENNISI, M.G., THIRY, E., TRUYEN, U., HORZINEK, M.C. (2009). Feline calicivirus infection. ABCD guidelines on prevention and management. Journal of Feline Medicine and Surgery 11, 556-564.

SÁNCHEZ-VIZCAÍNO, F., JONES, P.H., MENACERE, T., HEAYNS, B., WARDEH, M., NEWMAN, J., RADFORD, A.D., DAWSON, S., GASKELL, R., NOBLE, P.J., EVERITT, S., DAY, M.J., MCCONNELL, K. (2015). Small animal disease surveillance. Veterinary Record 177, 591-594.

SCHULLER, S., FRANCEY, T., HARTMANN, K., HUGONNARD, M., KOHN, B., NALLY J.E., SYKES J. (2015). European consensus statement on leptospirosis in dogs and cats. Journal of Small Animal Practice 56, 159–179.

SYKES, J.E., HARTMANN, K., LUNN, K.F., MOORE, G.E. STODDARD R.A., GOLDSTEIN R.E. (2011). 2010 ACVIM Small Animal Consensus Statement on Leptospirosis: Diagnosis, Epidemiology, Treatment, and Prevention. Veterinary Internal Medicine 25, pages 1–13.