Surveillance

Small animal disease surveillance 2020/21: SARS-CoV-2, syndromic surveillance and an outbreak of acute vomiting in UK dogs

THIS is the first report by the Small Animal Veterinary Surveillance Network (SAVSNET) to collate key companion animal health surveillance findings since the start of the SARS-CoV-2 pandemic. The report outlines the impact of SARS-CoV-2 on UK companion animal consultation volume, summarises syndromic surveillance events, comments on our current understanding of SARS-CoV-2 in companion animal species and looks globally to other notable companion animal disease events during these times.

More detail on the impact of SARS-CoV-2 on UK companion animal practice is available on the SAVSNET website.[1]

REPORT SUMMARY

- Fluctuating consultation volumes reflect the patterns of Covid-19 lockdowns and easing of restrictions across the devolved nations of the UK .
- Overview of SARS-CoV-2 infection in pet animals: what do we know so far?
- Veterinary diagnostic laboratory data suggest a role for seasonal factors in canine leptospirosis epidemiology.
- SAVSNET data highlight acute vomiting outbreak in dogs in January 2020.
- Other notable companion animal disease events: seasonal canine illness, rabbit haemorrhagic disease and canine distemper virus.

ABOUT THIS REPORT

This report is the 10th in a series provided to *Vet Record* by the Small Animal Veterinary Surveillance Network (SAVSNET). The other reports in the series are available from https://bvajournals.onlinelibrary.wiley.com/journal/20427670

Anonymised data can be accessed for research by contacting the authors. SAVSNET also welcomes feedback on this report.

More information about SAVSNET is available at www.liverpool.ac.uk/savsnet

Impact of SARS-CoV-2 on companion animal consultations

Over the course of the pandemic to date, the UK has undergone a series of national and regional lockdown periods, bringing varying yet sustained challenges to companion animal practice. In the first section of this report, we summarise the effect of these lockdowns on consultation volume, illustrating overarching effects and hopefully providing useful support to practice decision-making as governmental and profession-specific policy and guidance evolves further.

The report considers electronic health records (EHRs) captured by the SAVSNET project from booked consultations between a client and a veterinary surgeon or nurse, taking place in 219 voluntary collaborating veterinary practices (466 sites) during the period from 2 March 2020 to 10 January 2021 inclusive.

Data were captured from 514,354 canine, 195,349 feline and 56,873 other or unclassified species consultations. A detailed description of the methodology used by SAVSNET to capture EHRs has been previously provided.[2,3]

To assess the impact of SARS-CoV-2 on companion animal consultations, the percentage change in booked consultation numbers submitted to SAVSNET was compared with median 2019 data per weekday. Country-level plotting (Fig 1) encompasses all consultation data for all species and was selected to capture the divergent policy responses occurring across the devolved UK nations over time. Practice representation by country is 181 practices (408 sites) in England, 12 (15) in Northern Ireland, 11 (25) in Scotland and 13 (18) in Wales. Two practices had sites in both England and Scotland.

The dramatic effect of the first national lockdown in March 2020 is seen across each devolved nation, as is the gradual recovery following phased relaxation of lockdown measures over summer 2020, though still with an overall significant and protracted decrease in consultation volume.

Moving into autumn 2020, there is evidence of local variation in line with changing governmental and veterinary profession policy and guidance (eg, moving into devolved 'firebreak' lockdowns such as the lockdown in Wales between 23 October and 9 November 2020).

More recently, the early impact of a return to more strict devolved national lockdowns is evident, both by country and species group. The expected reduction in consultation volume over the Christmas period is visible through all the plots, as is the 'sawtooth' pattern reflecting the fluctuations in consultation schedules on different days of the week.

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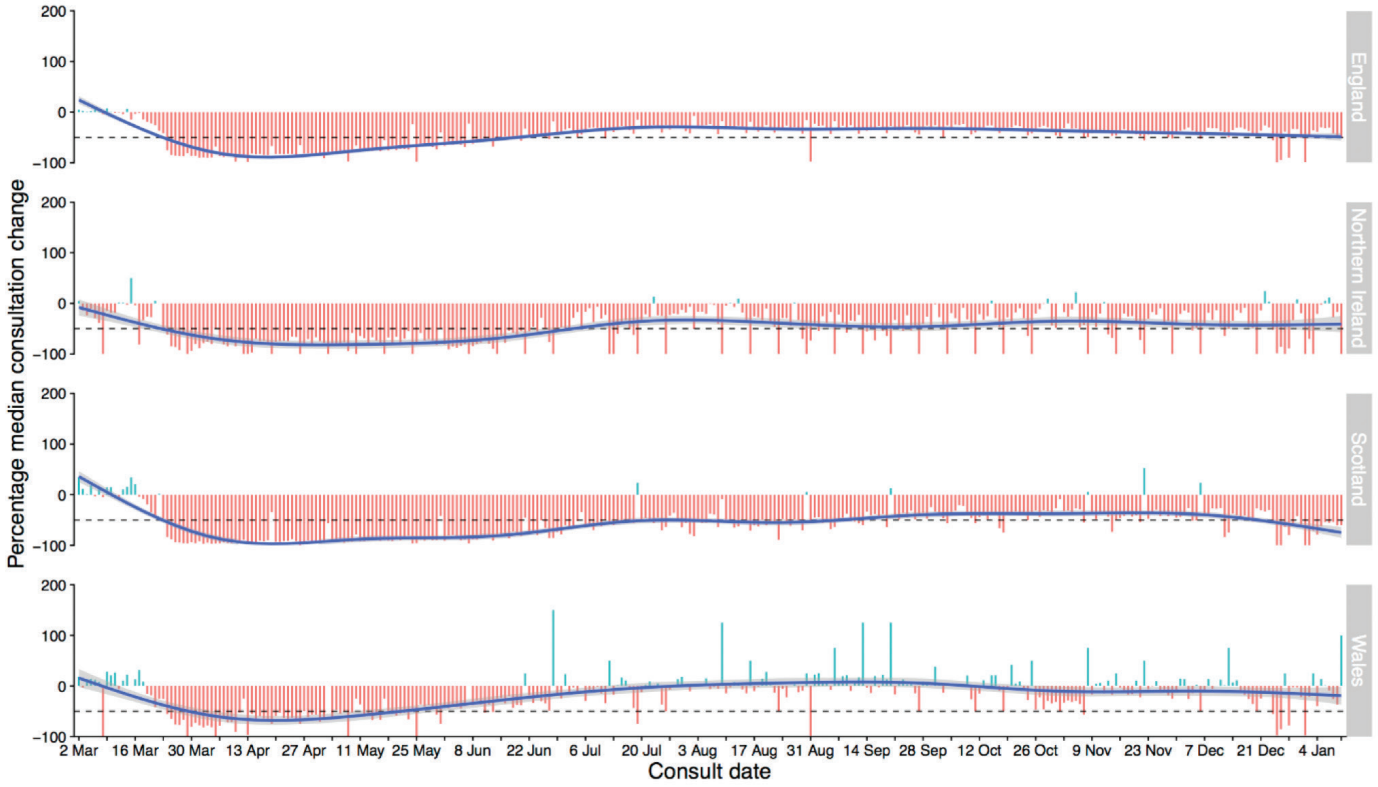

Fig 1: Percentage change in consultation data volume submitted to SAVSNET between 2 March 2020 and 10 January 2021, compared against median 2019 data, by country in which the submitting veterinary practice is located and with the plot trend line, calculated by a generalised additive model, shown in blue. The horizontal dotted line represents a 50 per cent reduction in consultation volume

At the species level, effects over time on consultation volume when compared to median 2019 data are broadly similar, with most notably the large and protracted decrease in consultation volume following the first nationwide lockdown in March 2020 (Fig 2).

As with the country-level data, there is a gradual recovery and levelling, and most recently a decrease as we move into 2021, with the reimposition of stricter lockdowns in response to the latest wave of the evolving pandemic.

It is important to note several points; first, SAVSNET only collects data from booked consultations, so these data do not reflect all practice activities taking place, nor will they capture the full complexity of the fluid and divergent lockdown policies enacted over time. However, we believe that the extended period of data capture means consultation volume can serve as a valid proxy for the impact of the SARS-CoV-2 pandemic on overall practice activity.

Second, the lower level of data received from devolved regions with comparatively fewer practices participating in SAVSNET can result in apparent 'jumps' in the percentage data – such as that seen at points on the Wales plotline in Fig 1. These should not be interpreted as discrete increases in median consultation volume. Based on the data received by SAVSNET, there is some evidence that consultation volumes in Wales returned closer to pre-Covid levels, more so than in other devolved administrations. Whether this is representative of wider differences between regions is unknown.

The dramatic effect of the first national lockdown in March 2020 can be seen across each devolved nation

Third, the work of SAVSNET, while dedicated and ongoing, is not immune to the challenges of these times; points where changes to the flow of data coming into SAVSNET affect the analyses presented here and/or systematic data errors occur are clearly explained in our online reports.[1]

Impact of Covid-19 on leptospirosis and parvovirus laboratory diagnoses

The clear reduction in consultations during the SARS-CoV-2 pandemic raised concerns that reduced vaccination may see an unwelcome resurgence in vaccine-preventable diseases. Indeed, we have noted a reduction in vaccine consultations overall.[1] Alongside veterinary practice data, SAVSNET collects veterinary diagnostic laboratory (VDL) test data on several vaccine-preventable diseases. In this section, we summarise VDL-confirmed reports of leptospirosis and parvovirus in dogs based on PCR testing. As in-practice tests and suspected cases before, or without, diagnostics are not included in these data, the figures should be viewed as a guide to changes in national burden, and not as an indicator to overall prevalence.

Additional data on vaccine-preventable diseases in dogs and cats and vaccine consultations, including broad geographical location of test data, are available in the regular SAVSNET SARS-CoV-2 reports.[1] We have previously explored vaccine uptake[4] and are aiming to coalesce vaccine uptake and vaccine-preventable disease surveillance in the future.

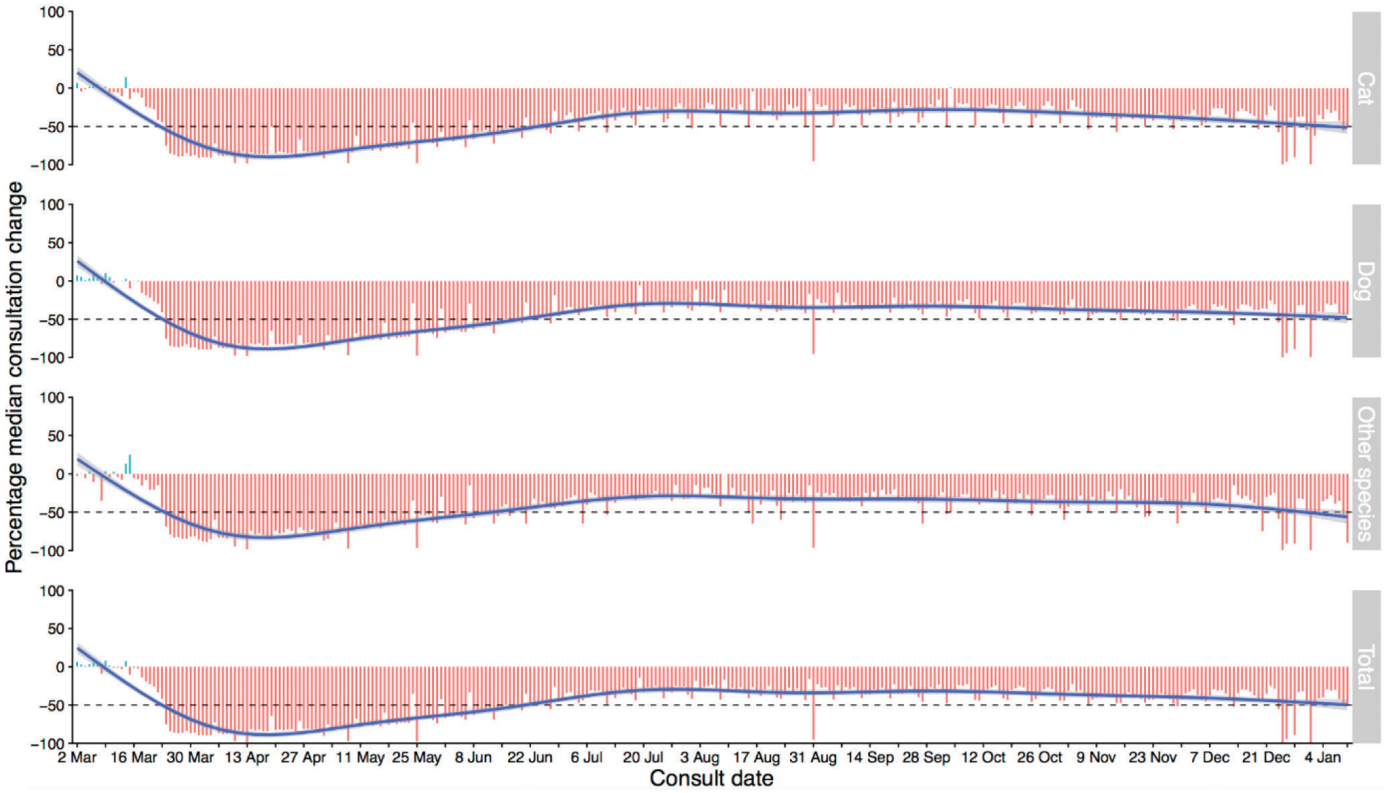

Fig 2: Percentage change in consultation data volume submitted to SAVSNET between 2 March 2020 and 10 January 2021, compared against median 2019 data, in total and by species group, with the plot trend line shown in blue. The horizontal dotted line represents a 50 per cent reduction in consultation volume

Leptospirosis

Between 1 January 2019 and 10 January 2021, 2248 submissions for PCR testing for leptospirosis in dogs were received by five VDLs, originating from 808 veterinary practice sites in the UK. Overall, 8.1 per cent of submissions were positive (n=183, 95 per cent confidence interval [CI] 7.0–9.3) (Fig 3).

The percentage of submissions testing positive varied between 0 and 20 per cent per month over this time, with some evidence for a seasonal pattern; the percentage testing positive was increased between October and December 2019 and in August and September 2020. Since then, the percentage testing positive appears to have normalised to prepandemic rates. These data match those of others, albeit from different climates, which also suggest a role for seasonal factors in disease epidemiology.[5]

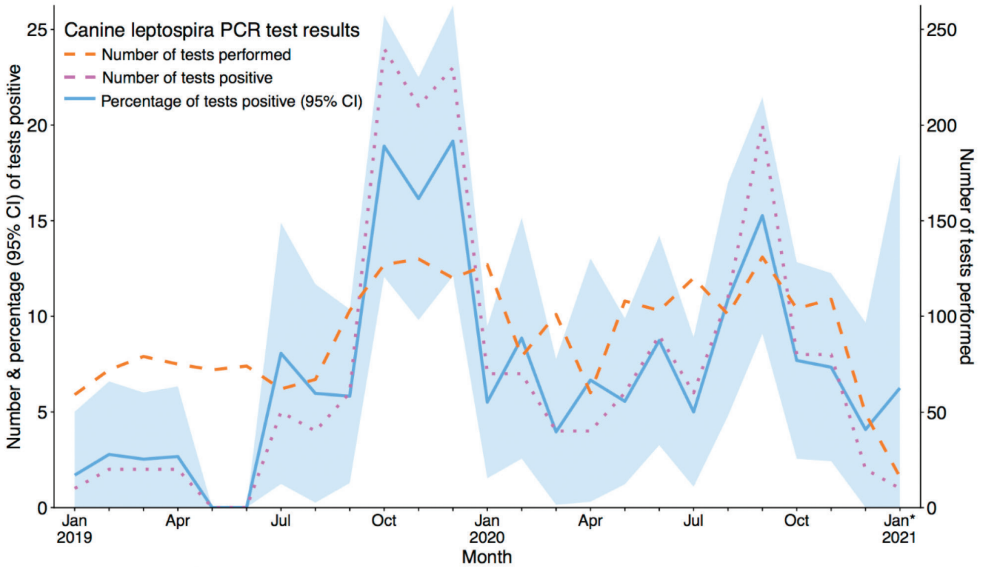

Fig 3: Number and percentage of canine PCR leptospira-positive tests (left axis) and number of tests by month (right axis) received from five veterinary diagnostic laboratories during the period 1 January 2019–10 January 2021 inclusive. The asterisk denotes the incomplete month of January 2021; the blue shaded area represents the 95 per cent confidence interval (95% CI)

Parvovirus

Between 1 January 2019 and 10 January 2021 inclusive, 4286 submissions for PCR testing for parvovirus in dogs were received by seven VDLs, originating from 778 veterinary practice sites in the UK. Overall, 7.4 per cent of submissions tested positive (n=317, 95 per cent CI 6.6–8.2) (Fig 4).

The percentage of canine samples testing positive for parvovirus was broadly consistent over this time,

SARS-COV-2 IN PET ANIMALS: AN OVERVIEW

At the time of writing, SARS-CoV-2 has infected at least 104 million people and caused over 2.2 million deaths worldwide since its first reported emergence in Wuhan, China, on 31 December 2019. SARS-CoV-2 has also been reported in a range of animal species, including companion animals (dogs, cats, ferrets), zoo animals and farmed mink.

Identification of the virus in a small number of pets has raised concern about whether SARS-CoV-2 can cause disease in animals. In addition, the potential role of animals in SARS-CoV-2 epidemiology has been questioned; could pets transmit the virus to humans? Our understanding of SARS-CoV-2 in animals is now improving due to experimental and surveillance studies. The clinical implications of these studies are summarised here.

Infection and clinical signs

Experimental infections with SARS-CoV-2 performed in the USA and China have shown that cats are susceptible to high doses of virus, with virus shedding detected for approximately five days after exposure. However, no experimentally infected cats over four months of age showed any clinical signs of disease. Variable respiratory pathology was identified by histopathology (lymphoplasmocytic rhinitis and mild interstitial pneumonia), but no gross lesions were reported.[6–8] It is unclear whether SARS-CoV-2 can cause disease in cats less than four months old, with only limited results published.

To our knowledge, no severe disease has been reported in any naturally infected domestic cats across the globe. In the UK, only one cat has tested positive (via RT-PCT and serology) for SARS-CoV-2 so far, and this case merely showed signs of mild respiratory infection. It is important to note that this cat also tested positive for feline herpesvirus (FHV), so it is likely that FHV played some role in the clinical signs in this instance.

Dogs are less susceptible to SARS-CoV-2 than cats according to experimental infections. No virus replication was detected after exposure to virus, and no clinical signs of disease were identified. However, two naturally infected asymptomatic dogs in Hong Kong tested positive for the virus on multiple occasions, suggesting infection is possible.[9] Furthermore, SARS-CoV-2-specific antibodies have been detected in dogs after experimental infections, and in pet dogs and cats from Italy.[10]

SARS-CoV-2 has been shown to infect ferrets in experimental infections, and natural infections have occurred in mink.[11] Mild, non-specific signs (fever and inappetence) were reported in a small proportion of the experimentally infected ferrets, but no significant disease occurred. In contrast, severe respiratory disease and death has been reported on numerous mink farms in Europe and the USA.

Diagnosis

SARS-CoV-2 testing for animals uses the same methodology as in humans – quantitative PCR (qPCR). In May 2020 (and subsequently updated on 1 March 2021), the APHA issued a series of guidelines advising which animals should be tested. With significant limitations on human tests available at the start of the UK outbreak, it was recommended that only felids, canids or mustelids that had been in contact with a confirmed or suspect human Covid-19 case in the past three weeks should be screened for virus.

Detecting SARS-CoV-2 infection in animals in the UK meets the criteria for reporting to the World Organisation for Animal Health (OIE) as an emerging infection in accordance with the OIE Terrestrial Animal Health Code.[12,13] As such, UK veterinarians have a regulatory duty to report positive case results to the competent authority – that is, the APHA and chief veterinary officers.

Testing should only be conducted where it is the interest of the health and welfare of the animal; it is also advised that the animal should be showing clinical signs of disease that could be consistent with Covid-19, and that common causes of these symptoms should have been ruled out.[13]

At present there are no commercial tests for SARS-CoV-2 available for pets in the UK. There are a number of clinical research projects that are investigating the incidence of the virus in pets. Our surveillance based on main presenting complaints suggests no rise in clinical disease in dogs and cats that could be associated with Covid-19.

Control and treatment

Study of a subset of cats and dogs that tested positive for SARS-CoV-2 infection has confirmed that virus was transmitted from owner to pet. This has been demonstrated using full genome sequencing.[9,14] To reduce the risk of human-to-animal transmission of the virus, owners with Covid-19 symptoms should maintain good hygiene around their pet. As no confirmed cases of cats or dogs naturally infected with SARS-CoV-2 have been reported to have significant clinical signs, no virus-specific treatment for suspected cases is indicated.

The overwhelming majority of people that get SARS-CoV-2 get it from another person. However, from a public health perspective, animal-to-human transmission of SARS-CoV-2 remains a concern.

There is as yet no evidence this has occurred from cats or dogs. To mitigate this further, it is advised that, if possible, cats from households self-isolating with Covid-19 symptoms should be kept indoors, and that dogs, if necessary, should be exercised by someone else.[15] This reduces the chance that cats and dogs, either infected or as fomites, could transmit the virus to other households.

Outbreaks of SARS-CoV-2 in mink farms in several countries, including the Netherlands, Denmark, USA and Canada, and evidence of zoonotic and anthroponotic transmission in such cases[16] have raised concern regarding the associated animal and human infection risks, including with ferrets kept as pets, working animals or in research, particularly in high-density settings.[17] The APHA has issued guidance for ferret owners and veterinarians on enhanced precautionary biosecurity measures, including a 21-day isolation period for ferrets in Covid-19 self-isolating households or ferrets testing positive for SARS-CoV-2 or brought to the UK from countries outside current travel corridor lists.[18]

Summary

Despite the severity of SARS-CoV-2 infection in humans, there are no reports that show SARS-CoV-2 causes serious disease in dogs and cats. Furthermore, the risk of virus transmission from pets to humans is considered extremely low. Following the standard advice for reducing the risk of SARS-CoV-2 transmission between people (eg, good hand hygiene), and species-specific guidelines where indicated (eg, regarding ferrets), should be sufficient to ensure the risk of virus transmission to and from animals is minimised.

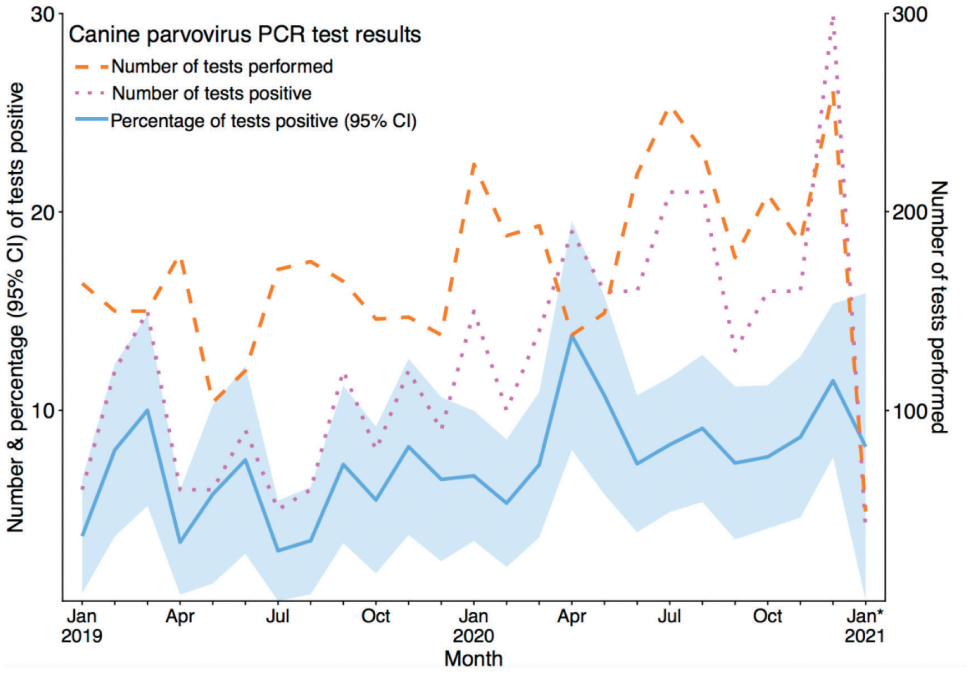

Fig 4. Number and percentage of PCR parvovirus-positive tests (left axis) and number of total tests by month (right axis) received from seven veterinary diagnostic laboratories during the period 1 January 2019–10 January 2021 inclusive. The asterisk denotes the incomplete month of January 2021; the blue shaded area represents the 95 per cent confidence interval (95% CI)

generally between 5 and 10 per cent per month. While April and May 2020 did exceed this typical range, figures now appear to have returned to within normal range. There also appears to be a gradual increase in both the number of parvovirus tests performed and the number of animals testing positive, reaching a peak in December 2020. Whether this represents a change in testing policy or an increase in parvovirus cases in the wider population will need to be monitored.

Update on main presenting complaint temporal trends

An observed prevalence time series of three key main presenting complaints (MPCs; gastroenteric, respiratory and pruritus) for both dogs and cats, from January 2019 to January 2021, highlights an acute vomiting outbreak in dogs and illustrates seasonal changes in the other MPCs (Fig 5).

In January 2020, SAVSNET responded to sporadic reports of acute-onset, prolific vomiting in dogs in various parts of the UK. Syndromic surveillance, text mining and parallel laboratory and questionnaire investigations enabled an early and rapid response to the outbreak and revealed an association with canine enteric coronavirus (CeCoV).[19]

Briefly, over a period of eight weeks, the multidisciplinary investigation evidenced a number of key findings, including:

- a statistical increase in gastroenteric disease in dogs, matched by a concomitant increase in maropitant therapy for rising cases of emesis;
- an increased likelihood of male dogs, and dogs living with other vomiting dogs, being affected (supporting evidence of transmission);
- a significant genomic association of CeCoV with illness; and
- a lack of evidence of effect or transmission to humans or other species.

This efficient response allowed SAVSNET to direct targeted and timely advice to veterinary practitioners about the outbreak, which SAVSNET considered statistically resolved in May 2020.

The plot labelled as 'Gastroenteric' in dogs in Fig 5 (plot A) clearly shows the acute vomiting outbreak. For the summary plot, using a Gaussian process time series allows us to capture seasonal temporal correlation and determine any outliers. The model was trained on observed weekly proportional morbidity data from 1 January 2017 to 8 November 2019. Consultation records classified by the attending veterinary professional as 'unwell' according to MPC were used as a denominator to mitigate a drop in overall consultations as a result of the Covid-19 pandemic.

The figures show predicted prevalence with shaded 95 per cent (dark grey) and 99 per cent (light grey) credible intervals, with extreme prevalence observations highlighted in orange or red. Since April 2020, the observed estimates have appeared less stable than before the SARS-CoV-2 outbreak, likely reflecting changing patterns of consulting throughout Covid-19, such that periods of unusually high or low prevalence have become more common.

As well as the outbreak of gastroenteric disease in dogs, these analyses clearly highlight the apparent seasonality of the respiratory (Fig 5, plot B) and pruritus (Fig 5, plot C) MPCs, which peak around November and September, respectively. In cats, the pruritus (Fig 5, plot F) MPC appears to peak in August, with less distinct seasonality in the gastroenteric (Fig 5, plot D) or respiratory (Fig 5, plot E) MPCs. Understanding such temporal variation will likely shed new light on the aetiologies of the syndromes in both species.

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Global perspective

Seasonal canine illness

New cases fitting the description of seasonal canine illness (SCI) were again being reported in late September 2020 (Promed archive number: 20200924.7803900).

SCI seems to lack a clear case definition. Clinical signs, which are often described as appearing within 24–72 hours of dogs walking in autumnal woodland, include vomiting, diarrhoea and lethargy. While most animals recover with rigorous symptomatic therapy, some have died. Any cause remains

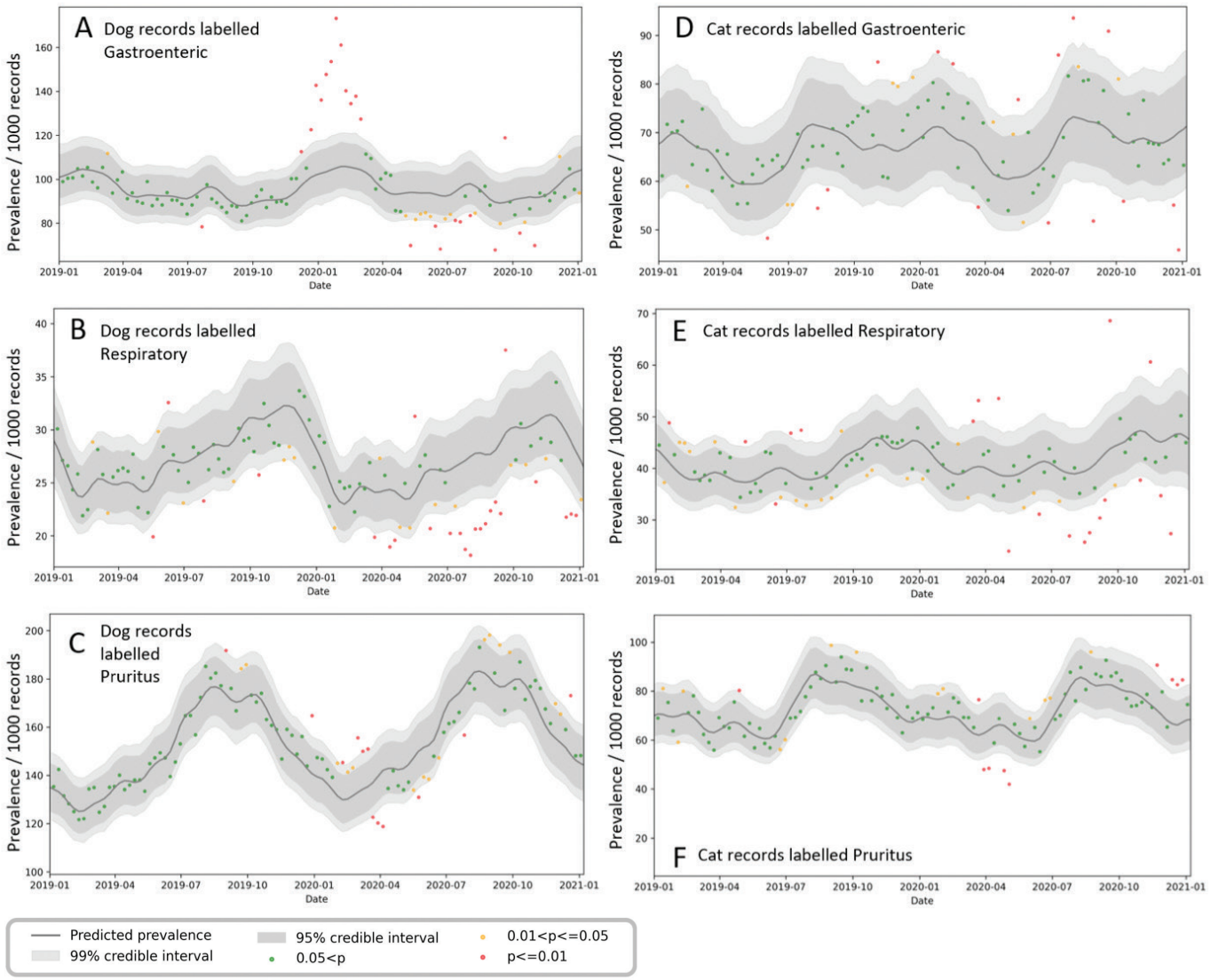

Fig 5: Observed prevalence for gastroenteric (A, D), respiratory (B, E) and pruritus (C, F) main presenting complaints in dogs (A, B, C) and cats (D, E, F) attending SAVSNET-participating practices from January 2019 to January 2021. Red points represent the extreme outliers (outside the 99 per cent credible interval [CI]), orange points represent the moderate outliers (outside the 95 per cent CI but within the 99 per cent CI), and green points represent the average trend (within the 95 per cent CI)

unknown although some have suggested links with bacteria, blue-green algae, fungal spores or harvest mites, but tests have not proved conclusive.

This syndrome was first reported in dogs visiting the Sandringham Estate 'and other woodland areas' in 2009. The SCI syndrome is not to be confused with another seasonal disease of dogs, reported every year from woodlands in England: canine renal glomerular vasculopathy (CRGV, also known as Alabama rot) also lacks a known aetiology but can be characterised and diagnosed by a thrombotic renal microangiopathy. The prognosis of CRGV is poor, although recent cases show recovery is possible.

Understanding such sporadic syndromes remains a challenge for those involved in caring for dogs, especially in the absence of a national health authority. With Dogs Trust funding, SAVSNET agile (www.liverpool.ac.uk/savsnet/savsnet-agile/) is looking to understand what such a surveillance system could look like, and how it might be funded.

Rabbit haemorrhagic disease virus

Outbreaks of rabbit haemorrhagic disease (RHD) have been reported in Wales and, for the first time,

> **Understanding sporadic syndromes remains a challenge for those involved in caring for dogs**

in Northern Ireland.[20] Whereas the original RHD virus (RHDV) caused obvious external signs like haemorrhage, the new RHDV-2 strain, although also frequently lethal, has been associated with less overt outward disease, with wild rabbits often dying underground. As such, it is possible that many cases in wild rabbits are being missed. In an APHA Surveillance Focus article published in *Vet Record*, Duff and colleagues[20] conclude by suggesting 'Wild rabbits can be a source of virus for domestic animals and vice versa. We would encourage rabbit owners and their veterinarians to be aware of local outbreaks and take measures,

including appropriate vaccination and biosecurity, to prevent the disease in domesticated rabbits.'

Canine distemper virus

Some infections pose a threat not just to the original or main host, but can spill over to other species with sometimes drastic effects; canine distemper virus (CDV) is one such disease. The disease can be extremely well controlled in domestic dogs, considered to be the primary host, through vaccination. However, this virus now has a long track record of affecting other species.

A recent study on the Amur tiger (*Panthera tigris altaica*), which has fewer than 550 individuals in Russia and neighbouring areas of China, highlights the threat.[21] Scientists showed that CDV is now established in other local wildlife species, such that vaccination of dogs alone is unlikely to be sufficient to protect the tigers. Instead, control was more likely to be achieved by vaccinating the tigers themselves, a process that, while not without its challenges, could lead to 'substantive reductions in extinction risks'.

CDV has pedigree in this area, with earlier reports of fatal infections in a growing range of species, including giant pandas.[22]

CDV is a virus that needs watching as it spreads its wings. Although not reportable, the OIE has included morbillivirus infections on a list of wildlife diseases that require surveillance 'because of their importance for wild animals and also for early warning purposes, in order to protect human and livestock health'.[23]

> **Canine distemper virus is a virus that needs watching as it spreads its wings**

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