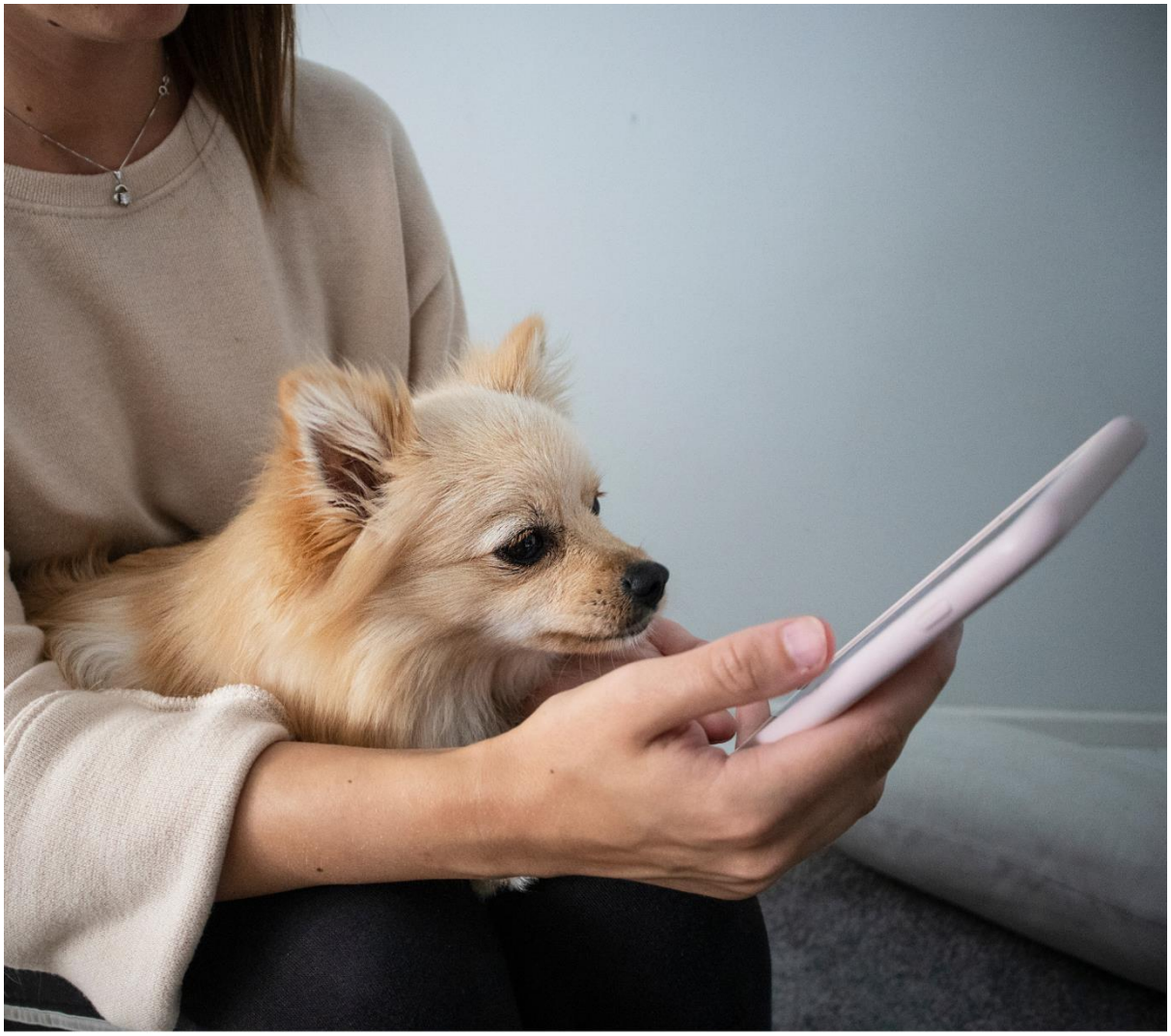

Exploring telemedicine / remote consultations using electronic health data

A report by the Small Animal Veterinary Surveillance Network for the Royal College of Veterinary Surgeons
October 2021

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Contents

Summary.

Based on reading some 1000 telemedicine consultations and 1000 controls face-to-face consultations (study part 1).

- Consultations with dogs were twice as frequent in this dataset as those with cats. Rabbits made up less than 2% of the final dataset (table 3).
- The age distribution of cats appeared broadly similar between cat cases and controls. However, for dogs, there was a trend towards dogs in older life making up a greater proportion of telemedicine cases (figure 3).
- In both dogs and cats, there was an increased tendency in telemedicine cases to either recommend a follow up teleconsultation or to see in practice if no improvement compared with face-to-face consultations, where "no further action" was the most common immediate outcome (figure 5).
- Considering teleconsultations with dogs, behaviour, digestive and musculoskeletal categories were somewhat over-represented compared to control consultations; whereas dental, integument and weight appeared to be under-recorded. For cats, behaviour and urinary categories appeared highest in teleconsultations, whereas dental disease and weight were clearly under-reported (figure 8).
- At the subcategory level, several conditions were less reported in telemedicine consultations including dental disease (gingivitis, plaque, stomatitis, fractured teeth), internal disease (otitis, tumours, murmurs, retained testicles), weight issues, corneal ulcers and deafness (table 4).
- In contrast, enteric signs (diarrhoea and vomiting), lameness including osteoarthritis, skin disease (pruritus, abscess, dermatitis), external masses, epilepsy, anxiety, cystitis, and urinary incontinence were recorded more frequently. Some of these may represent owner's increased time spent observing their pets during lockdown (table 4).
- With regard to prescriptions, there appeared to be an increased use of antimicrobials and anti-inflammatories in both cats and dogs during teleconsultations. In both species, changes in anti-inflammatory prescription were associated with the increased use of NSAIDs. Antimicrobial changes in cats were associated with a switch from cefovecin (n=13 face-to-face controls, n=2 telemedicine cases) to potentiated amoxycillin (n=5 controls, n=34 cases). An increase in neurological prescriptions in teleconsultations was associated in dogs with prescription of diazepam (n=0 controls, n=3 cases), anti-convulsants (n=0 controls, n=6 cases), and analgesics (n=17 controls, n=33) cases including gabapentin, paracetamol, tramadol and codeine.

Based on reading follow-on health records recorded in SAVSNET for 50 telemedicine consultations and 50 control face-to-face consultations for each of five conditions (upper respiratory, vomiting and/or diarrhoea, pruritus, lameness and ocular; study part 2).

- there appeared to be a slight tendency for telemedicine cases to have no related additional follow-up consultations over the subsequent six months (lameness, ocular, respiratory and vomiting and/or diarrhoea) (figure 12).
- In ~60% of the cases for these five selected conditions, it was unclear from subsequent records whether an individual case was resolved or not; this seemed consistent across the

five clinical categories (figure 13). Less frequently, a range of outcomes were explicitly recorded in the six-month follow-up period including ongoing disease, euthanasia and resolution. The pattern of these also appeared to be broadly similar between telemedicine cases and their controls.

Outline

During the COVID-19 pandemic, RCVS issued guidance on how veterinary practices should respond to UK government enhanced social distancing measures (commonly referred to as 'lockdown') to allow ongoing service provision at the national and devolved nation level.

Among guidance measures has been a temporary dispensation permitting the use of telemedicine and remote prescribing regulations to safeguard animal health and welfare and public health. At the time of writing, The RCVS standards committee has decided to end this dispensation on Sunday 21st November 2021, with scope to review in response to future changes in Government advice and policy[1].

In a series of six SAVSNET reports detailing the impact of the COVID-19 pandemic on companion animal practice in the UK in 2020, summary quantitative data from consultations between March 2020 and November 2020 showed an expected rise in remote consulting during the early national lockdown phase, with a gradual reduction in the latter phases of this timeframe, in line with the Government's COVID-19 recovery strategy and allied RCVS guidance[2].

While reported trends may have been affected by significant changes in practice workflow, and much has happened since, these changes may also reflect the gradual return to face-to-face consultations as the profession responded to regulations guiding the phased return towards near-normal operations.

This project was designed to better understand quantitatively and qualitatively how telemedicine consultations were carried out during periods of COVID-19 lockdown, and to explore in a descriptive way, how these might be different to consultations undertaken face-to-face. It made use of electronic health records collected by SAVSNET (the Small Animal Veterinary Surveillance Network), that collects consultation data in real time from a network of over 200 practices across the UK. Each consultation records includes information on the animals age, sex, species, breed, neuter status, treatments, and any free text written during the consultation. Each record is supplemented with a practitioner-derived syndrome label – we call this the Main Presenting Complaint (MPC), which identifies both sick animals (gastrointestinal, respiratory, tumour, trauma, other unwell), and vaccine consultations. In addition, a unique animal ID allows us to track individual animal consultations over time.

These data were used to support two modules of analysis. This report complements the Module 1 and Module 2 spreadsheet databases in Excel created as project outputs for further analysis. The approach to data-gathering through SAVSNET and salient descriptive findings are summarised.

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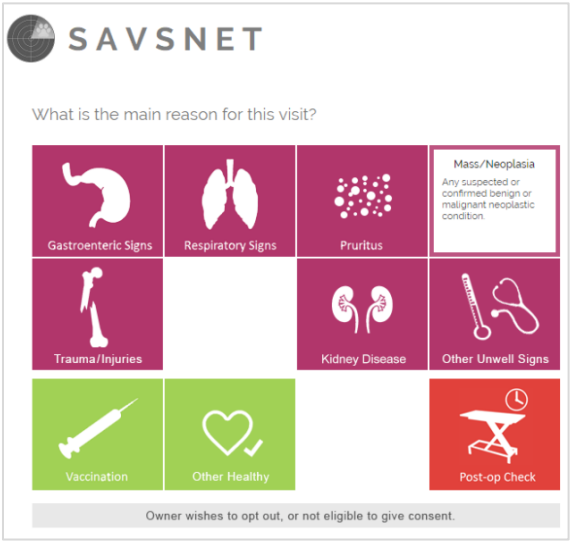
[1] *https://www.rcvs.org.uk/news-and-views/news/standards-committee-agrees-to-end-remote-prescribing/*

[2] *https://www.liverpool.ac.uk/savsnet/covid-19-veterinary-practice-uk/*

Module 1: a descriptive study of remote consultations (performed during lockdown) as compared with conventional face-to-face consultations (pre-lockdown)

SAVSNET consultations were first screened by text mining to identify those consultations where words like 'telemedicine' were mentioned. These were then read by a vet or vet nurse to identify a random sample that were true telemedicine consultations (this was necessary to avoid those consultations that, for example, talk about remote consultations happening in the past or the future). One thousand of these consultations, and 1000 random "control" consultations that were performed in 2019 before COVID-19 were read by a vet or vet nurse and categorised as follows

- Date of the consultation
- Patient signalment (age, sex, breed, neuter, microchip and insurance status)
- The SAVSNET MPC as chosen by the veterinary practitioner (as shown below).



- Treatments prescribed will be described at the level of pharmaceutical family such as antimicrobial (systemic and topical) and anti-inflammatory, and the classification of these treatments (POM-V, POM-VPS, CD).

Each consultation was additionally coded by the domain expert based on the clinical free text, to identify the main **categories** of conditions present. The categories used were adapted from those of the World Health Organisation ICD10[3], and based on a similar approach to that used for the RCVS vaccine project as follows: Euthanased, Auditory, Behaviour, Cardiopulmonary, Dental, Digestive, Endocrine, Immunological, Integumentary, Microchip, Musculoskeletal, Neoplasia, Neurological, Ocular, Parasites, Reproductive, Travel, Urinary, Weight, No Features Found, Other.

Table 1: World health organisation (WHO) category and adapted SAVSNET Category used to classify consultations.

WHO ICD10 CATEGORY		SAVSNET 19 ** CATEGORY	Definition
I	Certain infectious and parasitic diseases	PARASITES	Parasites seen or discussed
II	Neoplasms	TUMOUR / NEOPLASIA	n/a
III	blood and blood-forming organs and certain disorders involving the immune mechanism	IMMUNOLOGICAL	n/a
IV	Endocrine, nutritional and metabolic diseases	ENDOCRINE	eg diabetes, cushings, hyperT et
V	Mental and behavioural disorders	BEHAVIOUR	n/a
VI	nervous system	NERVOUS SYSTEM	Including knuckling
VII	eye and adnexa	OCULAR	Includes periocular skin eg entropion
VIII	ear and mastoid process	AUDITORY	Middle or inner
IX	circulatory system	CARSIORESPIRATORY	Coughing, sneezing, murmur, oedema
X	respiratory system		
XI	digestive system	DIGESTIVE	Excluding teeth and anal glands including from lips and tongue to anus
XII	skin and subcutaneous tissue	INTEGUMENT	Including otitis externa, nails and anal glands
XIII	musculoskeletal system and connective tissue	MUSCULOSKELETAL	eg OA, lameness
XIV	genitourinary system	URINARY	Infection, PU, incontinence
XV	Pregnancy, childbirth and the puerperium	REPRODUCTIVE	include discussions about neutering
XVI	Certain conditions originating in the perinatal period	OTHER	n/a
XVII	Congenital malformations, deformations and chromosomal abnormalities		
XVIII	Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified		
XIX	Injury, poisoning and certain other consequences of external causes		
XX	External causes of morbidity and mortality		
XXI	Factors influencing health status and contact with health services		
XXII	Codes for special purposes		
		WEIGHT	discussed
		TRAVEL	n/a
		MICROCHIP	checked or given
		DENTAL	n/a

[3] https://en.wikipedia.org/wiki/ICD-10

- The main subcategories of conditions present; these were built iteratively, and rather than basing them on pre-defined lists, were informed by the language of the practitioners recorded in the health narrative. This method ensures these subcategories best fit the data (see example in table 2).
- Whether the client was new or existing based on their visit history and clinical narrative
- Immediate outcomes based on what was written in the consultation, to include medication prescribed, advised to be seen in practice or no further action

Table 2; Clinician's text fragment and assigned subcategories for those consultations in the neurological category (**please note:** the text is as written in the health record and therefore includes abbreviations and spelling mistakes).

Text from clinical narrative	Case *	Subcategory
anisocoria	0	Anisocoria
noticed L pupil was more dilated than R this morning. Been fine in herself, a bit noiser than usual but has been like that since other cat passed away in March.	0	Anisocoria
Also worried may have had a (unwitnessed) seizure this morning as seemed wobbly	0	Ataxia / wobbly
still slightly wobbly/lower hindlimbs but otherwise fine	0	Ataxia / wobbly
Marked ataxia on back legs in consult, knuckling and obcious	0	Ataxia / wobbly
could be senile dementia type changes	1	Cognitive disfunction
canine dementia	1	Cognitive disfunction
hen collapsed on her side, seemed a bit stiff and ''kicked'' a bit her back legs.	1	Collapse
highly suspicous of CDRM givne breed and presentaiton	1	Degenerative myelopathy
epiphen	1	Epilepsy (monitor)
medication health check for epilepsy.	1	Epilepsy (monitor)
telecon to confirm zonisamide is within range,	1	Epilepsy (monitor)
Telephone consult to discuss Epilepsy meds.	1	Epilepsy (monitor)
telecon to explain epilepsy,	1	Epilepsy / seizures
fitting	1	Epilepsy / seizures
had a seizure this morning. legs thrashing. chomping on blanket. lasted about a minute	1	Epilepsy / seizures
SEIZURES	1	Epilepsy / seizures
seizures. 5 fits in last 36hours.	1	Epilepsy / seizures
all episodes last 30secs-1mins. adv not full tonic clonic seizure, ?partial seizure.	1	Epilepsy / seizures
Came back, vomited then showed involuntary neuro signs as before believed to be seizures.	1	Epilepsy / seizures
no seizure since Jul 2018, good QoL	1	Epilepsy / seizures
couple of minor seizures	1	Epilepsy / seizures
telecon with owner. no seizures overnight, <<identifier>> is brigth an dhappy this mroning.	1	Epilepsy / seizures
having daily partial seizures and monthly tonic clonic seizures.	1	Epilepsy / seizures
Possible seizure.	1	Epilepsy / seizures
Not had a cluster seizure since October	1	Epilepsy / seizures

owner reports fitting occasionally either once every 4-5 months	1	Epilepsy / seizures
Seizure	0	Epilepsy / seizures
had 2 seizures this am but nothing else since started meds reiterate possible brain lesion	0	Epilepsy / seizures
seizures appear under control but is due for another blood test but has not been fasted today as	0	Epilepsy / seizures (controlled)
face dropping	0	Facial paralysis
funny episodes	1	Funny episodes
Very weak in consult, head tilt to LHS, not holding weight well, doesn't correct limbs from abnormal placement.	0	Head tilt; knuckling
Head tilted to right - also dribbling from the right hand side.	1	Head tilt; ptyalism
flare-ups of presumed IVDD.	1	Intervertebral Disc Disease
This morning O also noticed him standing with L HL knuckled under him and he was just swaying w/o placing leg properly for abt 5 min-	0	Knuckling
lumbosacral dsicomfrot on palp. tail nad. ddx: msuculoskeletal discomfort, neurological.	0	Lumbosacral pain
Tremor.	1	Tremor / twitch
hard to completely Ddx recurrent mild ear prob from a neuro condition with twitching	1	Tremor / twitch
Will need physical exam to determine if issues is orthopaedic or neurological,	1	UNCLEAR
meds check - telephone consult	1	UNCLEAR
rpt presc phone consult	1	UNCLEAR
Re-check. He is better but this morning he had another episode of VS.	0	Vestibular syndrome
suspect Idiopathic old dog vestibular syndrome. Horizontal nystagmus.	0	Vestibular syndrome
loosing his balance -when jumps not as steady.	1	Ataxia / wobbly

** Case 1 = telemedicine consultation. Case 0 = telemedicine control.*

Identified remote consultations were partitioned into two time periods based on the date when RCVS remote prescribing guidance changed to look for changing patterns in remote consultations over time as follows. Time period 1 (1st April 2020 – 28th September 2020) Emergency work only - remote prescribe in the first instance. Time period 2 (29th September 2020 – 22nd March 2021); Wales lockdown easing starts. Essential work for public health and animal health and welfare; see animal under your care in the first instance.

Module 2: a focus on diseases to assess clinical outcome

Based on the findings of Module 1, and following discussion with the RCVS, five subcategories were identified to explore in more detail. Using the consultation records received by SAVSNET, for each of these five subcategories, 50 random cases (remote consultation) and 50 random controls (face-to-face consultation) were read and annotated by domain experts to identify, based on the six-month period following the selected consultation, the

- Number of visits in the six-month period
- Treatments prescribed
- Clinical outcome as recorded in the six-month period

- Time to resolution if resolution occurred in the six-month period

Descriptive data analysis

Descriptive data analyses were carried out using functions in EXCEL and are presented here. In addition, anonymised excel spreadsheets were supplied to RCVS to allow for additional further in-house analyses. Due to the low number of consults relating to other species, descriptive results here focus primarily on cats and dogs.

Results part 1.

On reading the selected 2000 consultations, a small number were removed from the final study data set that did not fit the inclusion criteria; for example, some of the 2019 control consultations were shown to be phone consultations, or the 2020 case consultations took place face-to-face: Accordingly, a final data set of 983 telemedicine cases and 904 controls were available for further analyses.

Consultation date.

All control consultations were selected randomly from 2019, before any COVID-19 restrictions, and case consultations selected randomly within the RCVS-stipulated time periods (figure 1). Case consultations were split into Time Period 1 (1st April 2020 – 28th September 2020) and Time Period 2 (29th September 2020 – 22nd March 2021) (figure 2).

Figure 1; Distribution of cases and controls over time.

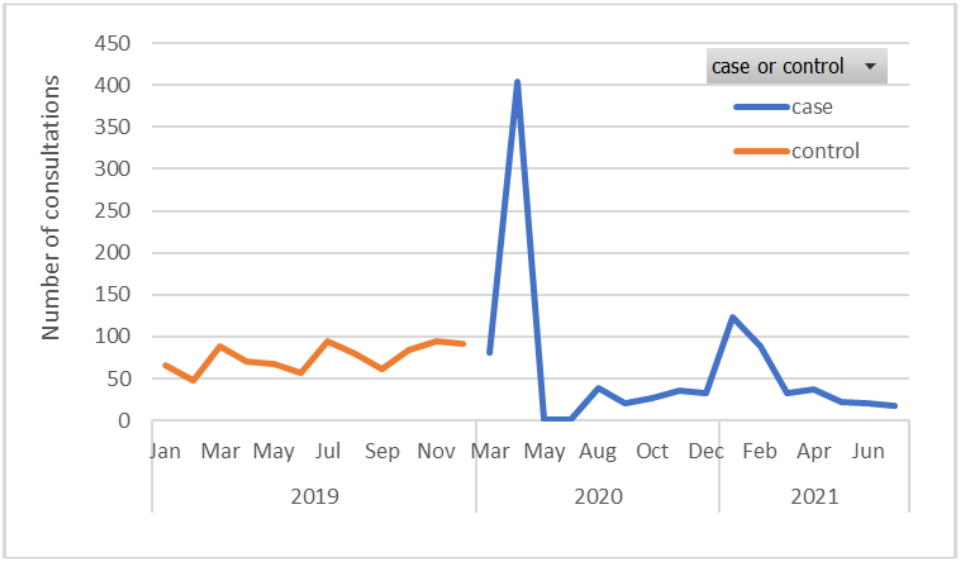
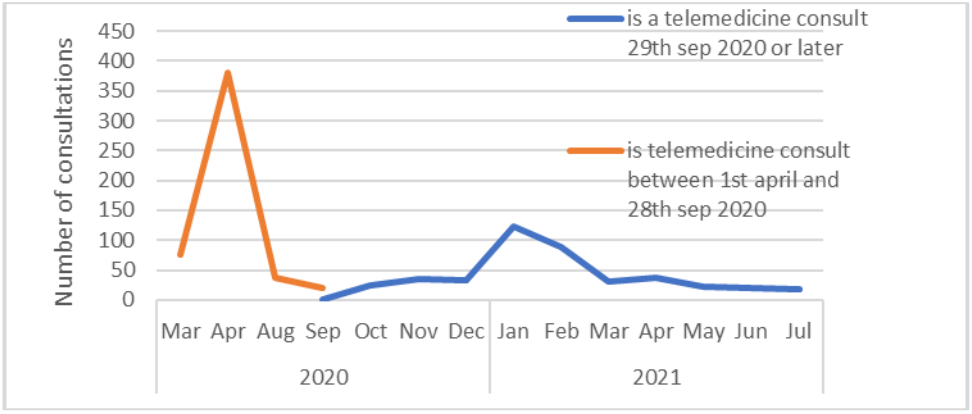


Figure 2; Distribution of cases into two time periods



Species.

As is typical of SAVSNET data, most data were from dogs, and cats, with a smaller number from other species (Table 3).

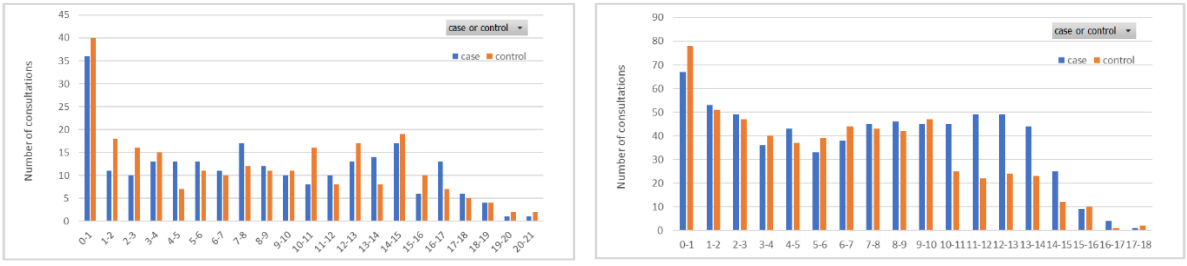
Table 3; species breakdown of telemedicine cases and face-to-face controls.

Species	**Telemedicine *cases***	**Face-to-face *controls***
dog	*681*	*587*
cat	*239*	*249*
Other species		
unknown	*42*	*40*
rabbit	*10*	*17*
hamster	*3*	*1*
guinea pig	*3*	*6*
rat	*2*	*2*
budgerigar	*1*	*1*
mouse	*1*	
duck	*1*	
bearded dragon		*1*
Grand Total	***983***	***904***

Age of consultations.

The age distribution of cats appeared broadly similar between cat cases and controls. However, for dogs, there was a trend towards dogs in older life making up a greater proportion of telemedicine cases (Fig.3)

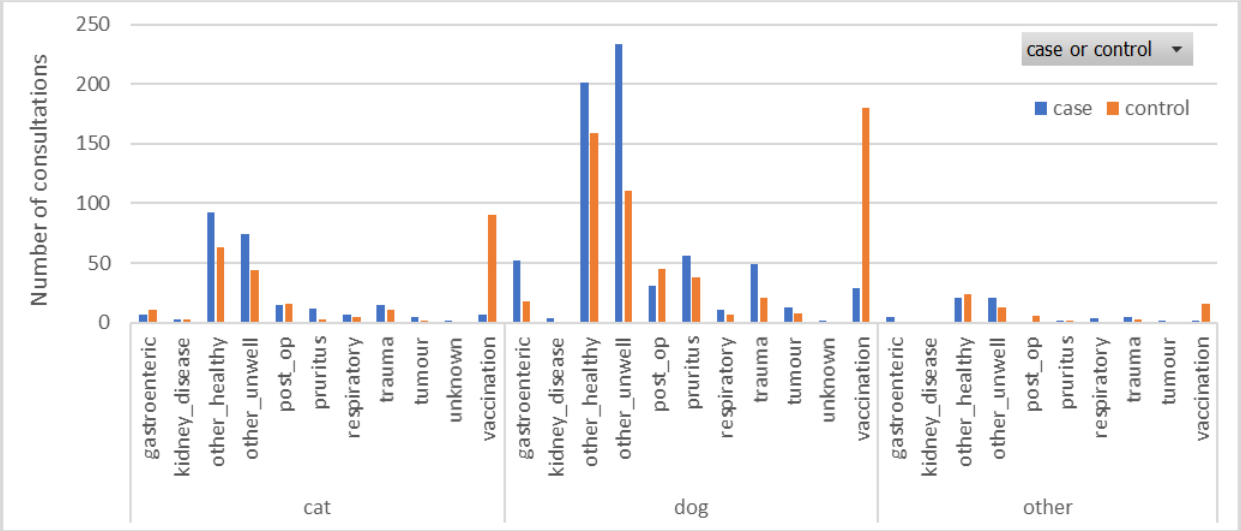
Figure 3; age distribution of cases and controls for cats (left) and dogs (right).



Main presenting complaint

Perhaps not surprisingly there appeared to be some difference between the practitioner recorded main presenting complaint (MPC) for cases (1) and controls (0). Vaccinations were more common in control consultations for both cats and dogs. NOTE: these vaccine consultations would be expected to reduce the proportion of the other MPCs in control consultation (Fig.4).

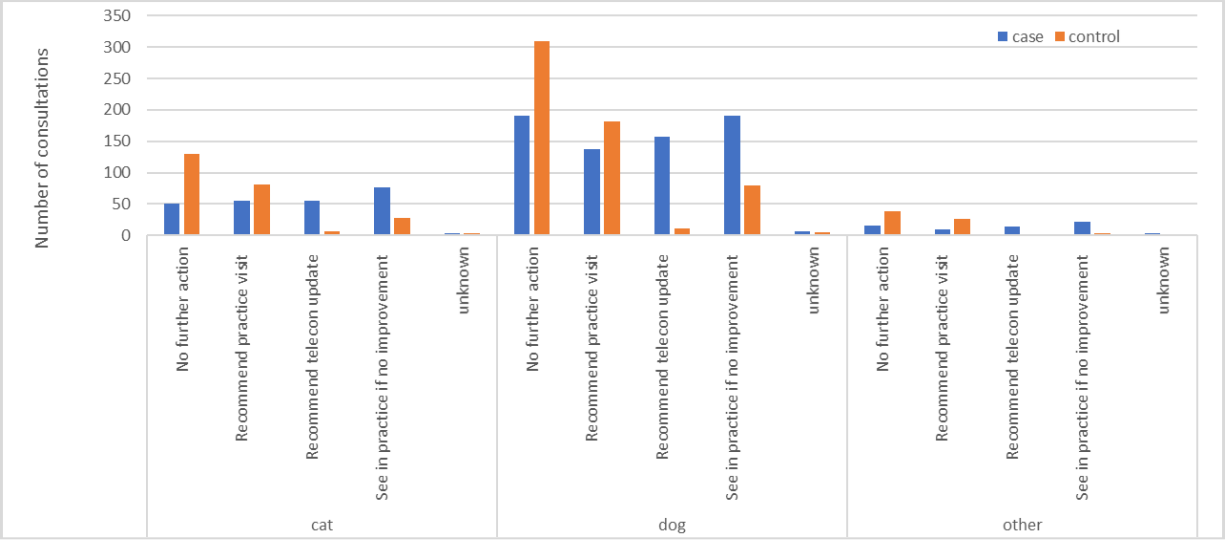
Figure 4; practitioner derived main presenting complaint (MPC) for cats, dogs and other species. Note – "other unwell" are consultations with those animals that don't fit into the specific sick animal categories (gastroenteric, kidney, pruritus, respiratory, trauma, tumour). "other healthy" consultations are those consultations with well animals apart from those involving vaccines.



Immediate outcome

Across all species there was an increased tendency in telemedicine cases (1) to either recommend a follow up teleconsultation or to see in practice if no improvement. For controls (0), "no further action" was the most common immediate outcome (Fig.5).

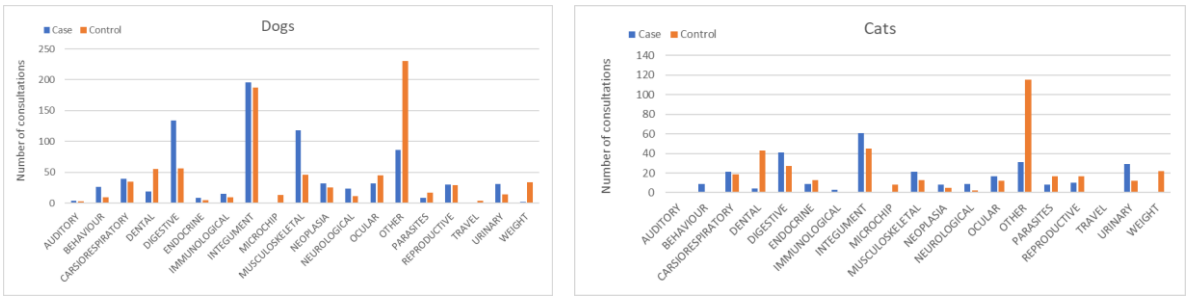
Figure 5; Number of consultations associated with immediate outcome categories on all species.



SAVSNET category

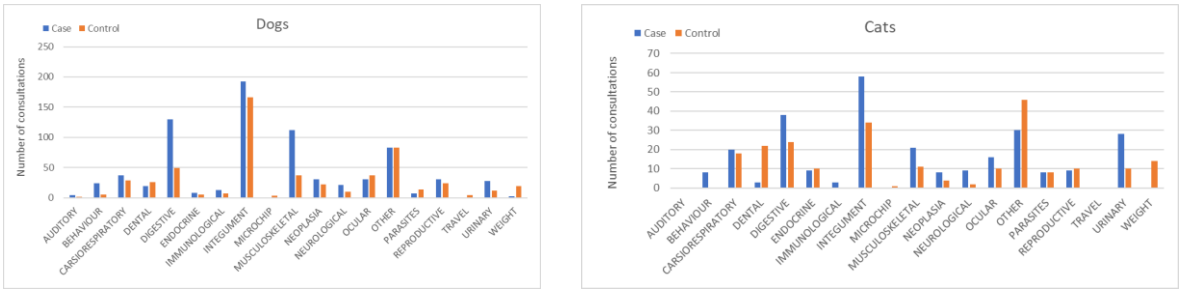
When considering all consultations, the largest SAVSNET category in both species was 'Other', largely because of those subcategories associated with vaccines (Fig.6). These included a wide range of sub-categories including euthanasia, post-op check and general health checks.

Figure 6; Number of SAVSNET categories for teleconsultation cases and face-to-face controls in cats and dogs ***(including the vaccine MPC).***



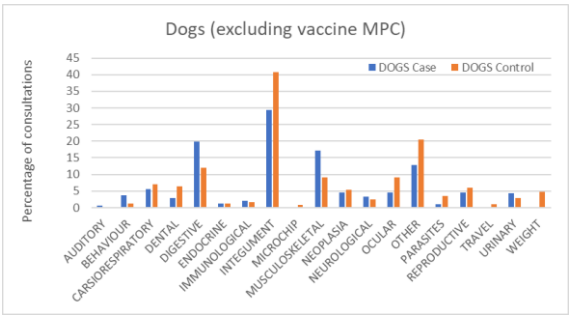
If those consultations categorised as the vaccine MPC are excluded, then for teleconsultations with dogs, behaviour, digestive, musculoskeletal and to a lesser extent urinary subcategories seem somewhat over-represented, whereas weight is under-recorded. For cats, behaviour, digestive, integument, musculoskeletal, urinary are somewhat over-represented in cases, whereas dental disease and weight are largely under-recorded (Fig.7).

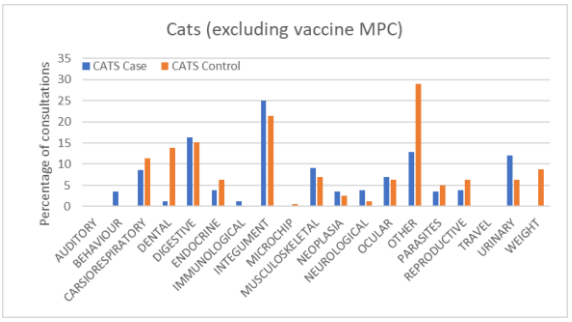
Figure 7; Number of SAVSNET categories for teleconsultation cases and face-to-face controls in cats and dogs ***(excluding the vaccine MPC).***



These differences in categories for each species are perhaps clearest when the vaccine MPC is excluded, and they are expressed as percentages of consultations (figure 8). For dogs, behaviour, digestive and musculoskeletal categories are still high in cases, whereas dental, ocular, integument and weight are under-recorded compared to controls. For cats, behaviour and urinary categories are higher in cases, whereas dental disease and weight issues are clearly under-reported compared to controls. One might speculate that these behavioural and urinary categories (as a proxy for FLUTD) seen more in cat cases than controls, may reflect a lockdown-linked rise in stress responses from a change in routine as has been reported in the media.

Figure 8; Percentage of SAVSNET categories for teleconsultation cases and face-to-face controls in cats and dogs ***(excluding the vaccine MPC).***





SAVSNET subcategories

The subcategories making up each category can be seen in the accompanying Excel spreadsheet by navigating through the relevant red worksheet tabs seen at the bottom of the workbook.

In summary at the subcategory level, several conditions were less reported in telemedicine consultations including dental disease (gingivitis, plaque, stomatitis, fractured teeth), internal disease (otitis, tumours, murmurs, retained testicles), weight issues, corneal ulcers and deafness (table 4). In contrast, enteric signs (diarrhoea and vomiting), lameness (including osteoarthritis), skin disease (pruritus, abscess, dermatitis), external masses, epilepsy, anxiety, cystitis and urinary incontinence were recorded more frequently. Some of these may result from owners increased time spent observing their pets during lockdown (table 4).

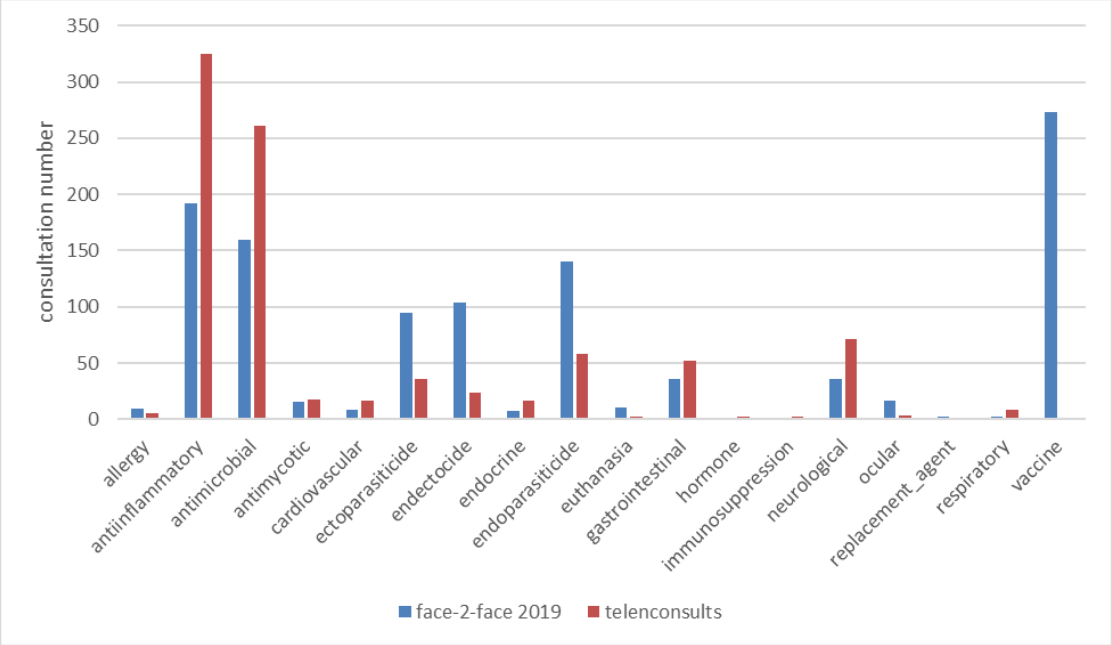
Table 4; A summary of some subcategories with apparent imbalances between teleconsultations and controls are shown below. NOTE- these are not meant to be all inclusive. All analysis is descriptive; inclusion here should not be taken to indicate statistical significance.

Sub-category	category	Tele-consult-ations	controls	bias
tartar / calculus	dental	1	32	decreased in teleconsultations
gingivitis and tartar / calculus	dental	0	11	decreased in teleconsultations
gingivitis	dental	4	15	decreased in teleconsultations
dental disease	dental	3	13	decreased in teleconsultations
tooth; fractured / chipped	dental	0	4	decreased in teleconsultations
Overweight	weight	0	19	decreased in teleconsultations
Anal gland (express)	integument	0	17	decreased in teleconsultations
Anal gland disease	integument	1	9	decreased in teleconsultations
Murmur	cardiopulmonary	0	15	decreased in teleconsultations
Nail (clipped)	integument	0	15	decreased in teleconsultations
Microchip placed	microchip	0	5	decreased in teleconsultations
Checked	microchip	0	15	decreased in teleconsultations
Fleas	parasites	2	12	decreased in teleconsultations
Corneal ulcer	ocular	0	7	decreased in teleconsultations
Epiphora	ocular	0	6	decreased in teleconsultations
Ears dirty	integument	0	6	decreased in teleconsultations
Mass (internal)	neoplasia	0	6	decreased in teleconsultations
Testicle(s) retained	reproductive	0	5	decreased in teleconsultations
Deaf (going)	auditory	0	2	decreased in teleconsultations
Patella luxation	musculoskeletal	0	4	decreased in teleconsultations
Cough	cardiopulmonary	24	15	increased in teleconsultations
diarrhoea	digestive	35	14	increased in teleconsultations
vomit and diarrhoea	digestive	15	6	increased in teleconsultations
diarrhoea (hematochezia)	digestive	14	0	increased in teleconsultations
Mass (external)	neoplasia	24	7	increased in teleconsultations
Osteoarthritis	musculoskeletal	17	7	increased in teleconsultations
Lameness	musculoskeletal	52	6	increased in teleconsultations
Urinary incontinence	urinary	10	4	increased in teleconsultations
Cystitis	urinary	8	2	increased in teleconsultations
Pruritus (ears)	integument	24	4	increased in teleconsultations
Skin disease	integument	13	3	increased in teleconsultations
Dermatitis (trunk)	integument	12	0	increased in teleconsultations
Pruritus (skin)	integument	18	0	increased in teleconsultations
Immune mediated skin disease	immunological	5	0	increased in teleconsultations
Abscess	integument	5	1	increased in teleconsultations
Abscess (cat bite)	integument	6	1	increased in teleconsultations
Epilepsy / seizures	neurological	13	2	increased in teleconsultations
Anxiety	behaviour	8	1	increased in teleconsultations
Lethargy	behaviour	5	0	increased in teleconsultations
Pseudopregnancy; suspect	reproductive	3	0	increased in teleconsultations

Prescription products sold in teleconsultations (Tele) and face to face (F2F) controls at the level of *item family.*

Clearly a large proportion of the face-to-face consultations analysed were associated with vaccines (figure 9). Parasiticide treatment was prescribed more commonly in face-to-face consultations. There appeared to be an increased use of antimicrobials and anti-inflammatories in both cats and dogs during teleconsultations. Note however, some of this effect is likely to be associated with the reduction in sick animals in face-to-face consultations because of the large number of vaccine consultations.

Figure 9; Number (y-axis) of prescriptions for each prescription family (x-axis) – all species.

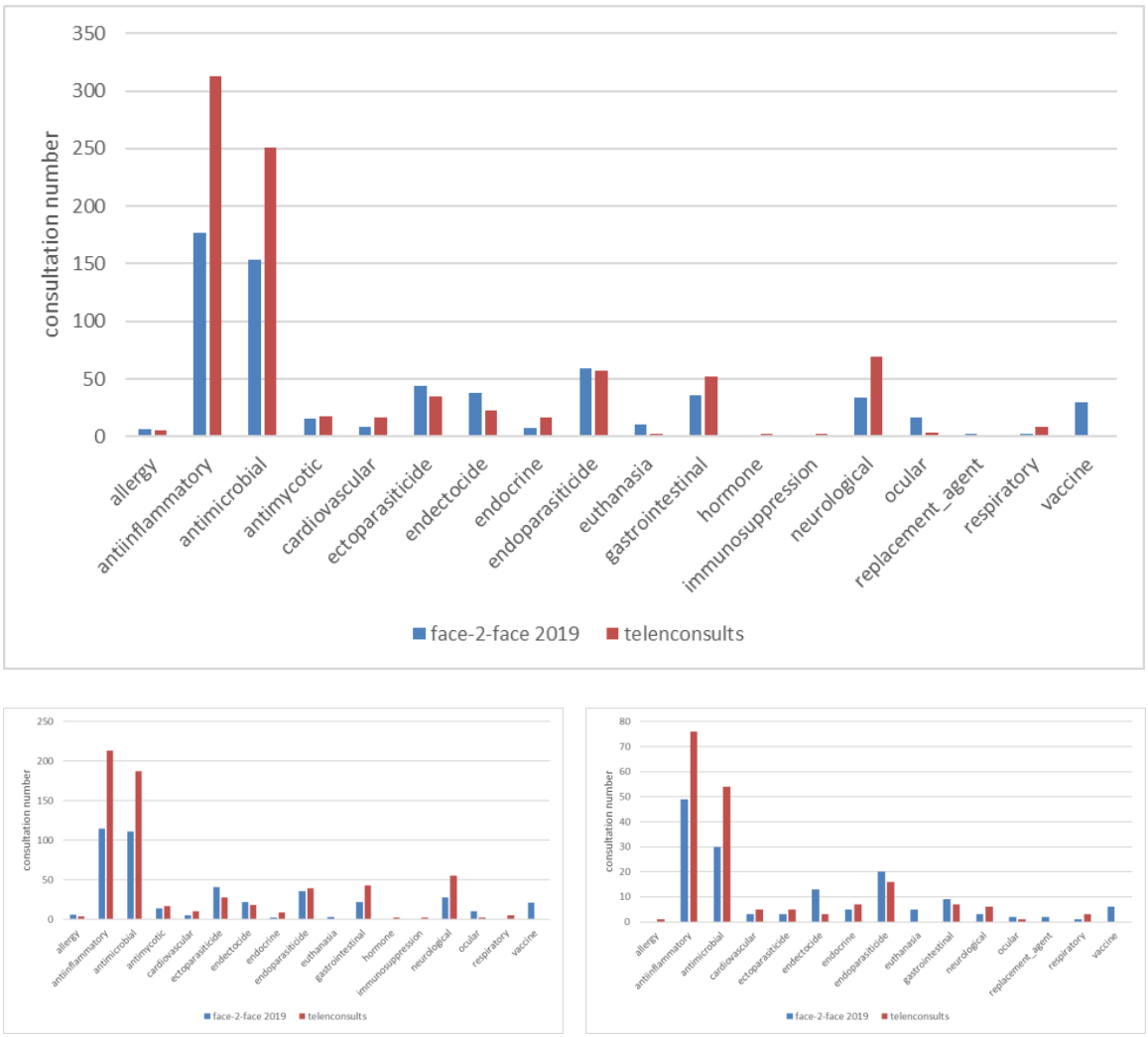


We therefore explored whether these observed differences in therapeutic use remained when vaccine consultations were excluded (figure 10).

The increase of parasiticides previously observed in face-2-face consultations was removed, suggesting their use was primarily associated with vaccine consultations.

However, there still appears to be an increased use of antimicrobials and anti-inflammatories in both cats and dogs during teleconsultations. In both species, anti-inflammatory changes were associated with the increased use of NSAIDs. Notable differences in the use of antimicrobials in cats were with cefovecin (n=13 controls, n=2 teleconsults) and potentiated amoxycillin (n=5 controls, n=34 teleconsults).

Figure 10; Number (y-axis) of prescriptions for each prescription family (x-axis). The charts below ***exclude vaccine MPC consultations****. Top – all species, Bottom left dog only, bottom right cat only.*



Differences noted in the prescription of products for neurological conditions between cases and controls relate to diazepam (n=0 controls, n=3 teleconsults), anti-convulsants (n=0 controls, n=6 teleconsults) and analgesics (n=17 controls, n=33 teleconsults), the latter including gabapentin, paracetamol, tramadol and codeine.

Table 5; Prescription products sold in teleconsultations (Tele) and face to face (F2F) controls at the level of item family. All species. Column 2 and 3 includes all consultation regardless of main presenting complaint (MPC). Columns 3 and 4 excludes vaccine MPC consultations.

Prescription Family and Class	All main presenting complaints (MPC)		Excluding vaccine main presenting complaint	
	F2F	Tele	F2F	Tele
allergy	9	5	6	5
antihistamine	6	5	4	5
immunotherapy	3		2	
antiinflammatory	192	325	177	313
disease_modifying_osteoarthritis_drug	4		3	
glucocorticoid	67	92	64	92
janus1_selective_inhibitor	9	38	8	37
nsaid	107	195	97	184
ocular	5		5	
antimicrobial	160	261	154	251
aminoglycoside	9	8	9	8
amphenicol	19	5	17	5
antim_other	22	33	22	32
beta_lactam	70	127	66	122
fluoroquinolone	6	6	6	6
fusidic_acid	20	45	20	42
lincosamide	5	9	5	8
nitroimidazole	8	20	8	20
nitroimidazole_macrolide		2		2
sulphonamide		1		1
tetracycline	1	5	1	5
antimycotic	15	18	15	18
azole	13	18	13	18
polyene	2		2	
cardiovascular	8	16	8	16
anti_coagulant		1		1
anti_hypertensive	4	6	4	6
cardiovascular		2		2
diuretic	2	4	2	4
positive_inotrope	2	3	2	3
ectoparasiticide	95	36	44	35
ecto_other		1		1
insect_growth_regulator	1	2	1	2
isoxazoline	32	10	19	10
neonicotinoid	61	21	23	20
phenylpyrazole	1	2	1	2
endectocide	104	24	38	23
macrocyclic_lactone	104	24	38	23
endocrine	7	17	7	17
adrenal	1		1	
diabetes_melitus	1		1	
pituitary_adrenal		3		3
thyroid	5	14	5	14
endoparasiticide	140	58	59	57
anthelmintic	16	11	8	11
antiplatyhelminthic	122	43	49	42
antiprotozoal	2	4	2	4

euthanasia	10	2	10	2
euthanasia	10	2	10	2
gastrointestinal	36	52	36	52
anti_emetic	36	50	36	50
poison		1		1
pro_kinetic		1		1
hormone	1	2	1	2
urinary_incontinence	1	2	1	2
immunosuppression	1	2		2
intracellular	1	2		2
neurological	36	71	34	69
anaesthesia	4	3	4	3
analgesic	22	47	20	46
anti_convulsant		7		6
anti_spasmodic	2	2	2	2
anxiolytic	1		1	
behavioural	1	2	1	2
local_anaesthetic	3	1	3	1
muscle_relaxant		4		4
reversal_agent	1		1	
sedative	2		2	
urinary_incontinence		5		5
ocular	17	3	16	3
fluorescein	16	3	15	3
lubricant	1		1	
replacement_agent	2		2	
vitamin_b	2		2	
respiratory	2	8	2	8
bronchodilator		1		1
methylxanthine	1	2	1	2
mucolytic	1	5	1	5
vaccine	273	1	30	
Grand Total	1108	901	639	873

Results part 2.

Five broad clinical categories were selected by the RCVS based on the results of part 1 of this study (upper respiratory; vomiting and/or diarrhoea; pruritus; lameness and ocular) to take forward into an outcome analysis, to explore to what extent outcomes based on SAVSNET measures varied between telemedicine cases and face-to-face controls.

For each of the five broad clinical categories, 50 cases and 50 controls were selected on the basis of matching a subset of relevant subcategories (table 6). Where numbers were sufficient, these were obtained from a random selection of those consultations classified in part 1 of this study. For those conditions that were more common in telemedicine cases, where there were insufficient controls in part 1 of the study (pruritus and lameness), these were supplemented from the same time period (2019). These additional controls were identified by a simple regular expression, and verified by a domain expert (table 6, bottom row).

Table 6; Origin of consultations (50 cases and 50 controls), for use in part 2 of this study.

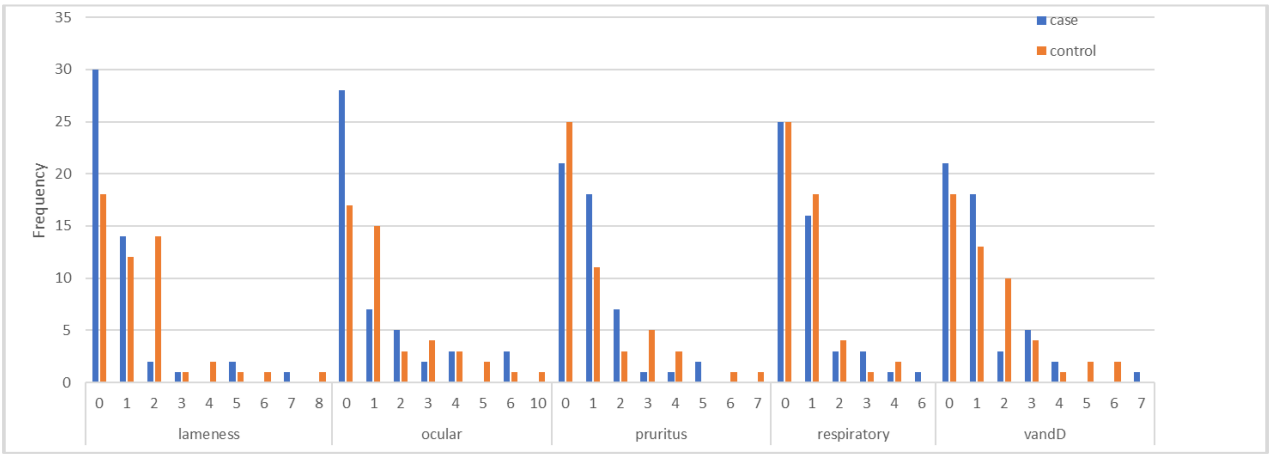
	Upper respiratory	Vomiting and / or diarrhoea	Pruritus	Lameness	Ocular
Subset of existing sub-categories used for part 2 of the study	• Bronchitis • Cough • Cough; collapsing trachea • Cough; nasal discharge • Cough; panting • Cough; sneezing • Feline Respiratory Disease Complex • Nasal discharge • Respiratory crackles • Respiratory disease (non-specific) • Respiratory infection • Sneezing • Sneezing; nasal discharge • Snuffles	• diarrhoea • diarrhoea (?giardia) • diarrhoea (hematochezia) • diarrhoea (iatrogenic) • diarrhoea (improved) • diarrhoea (intermittent) • diarrhoea with blood • diarrhoea; hyporexia • diarrhoea; rectal bleed • hematochezia • vomit • vomit (hematemesis) • vomit (improved) • vomit and diarrhoea • vomit and diarrhoea (hematochezia) • vomit; lethargy • vomit; melaena (suspected) • vomit; retching • vomit; tenesmus • vomiting (improved) • vomiting; anorexia	• Pruritus • Pruritus (anal sac; pedal) • Pruritus (controlled) • Pruritus (ears) • Pruritus (head) • Pruritus (imroved) • Pruritus (leg) • Pruritus (limb) • Pruritus (pedal) • Pruritus (perianal) • Pruritus (skin) • Pruritus (skin/ears) • Pruritus (skin;pedal) • Pruritus (trunk) • Pruritus (trunk;ears)	• Lameness • Lameness (improved) • Lameness (resolved) • Lameness, soft tissue injury • Lameness, stiffness	Random set of all cases and controls from part 1
Regex used to supplement controls	Not necessary – sufficient controls available from part 1	Not necessary – sufficient controls available from part 1	(?<!not\s)(?<!non\s)(?<!non-)(?<!aren't\s)(?<!no longer\s)pruritic	(?<!no\s)(?<!not\s)(?<!inf)(?<!c)(?<!was\s)lame	Not necessary – sufficient controls available from part 1

For each case and control, patients were followed through the SAVSNET database to determine the number of follow up visits in a 6-month period, the number of visits relating to the condition, the outcome as recorded over six months, the time to resolution (where specified in the narrative), and treatments prescribed. It should be noted that SAVSNET only collects data from booked consultations where owners do not opt out – it is therefore likely that for some patients, the number of visits may be an underestimate of the actual total number of visits. That said, a comparison between cases and controls still seems valid.

Number of follow up visits in a 6-month period

There seemed to be a slight skew for lameness and ocular telemedicine cases to have no further consultations compared to controls (figure 11).

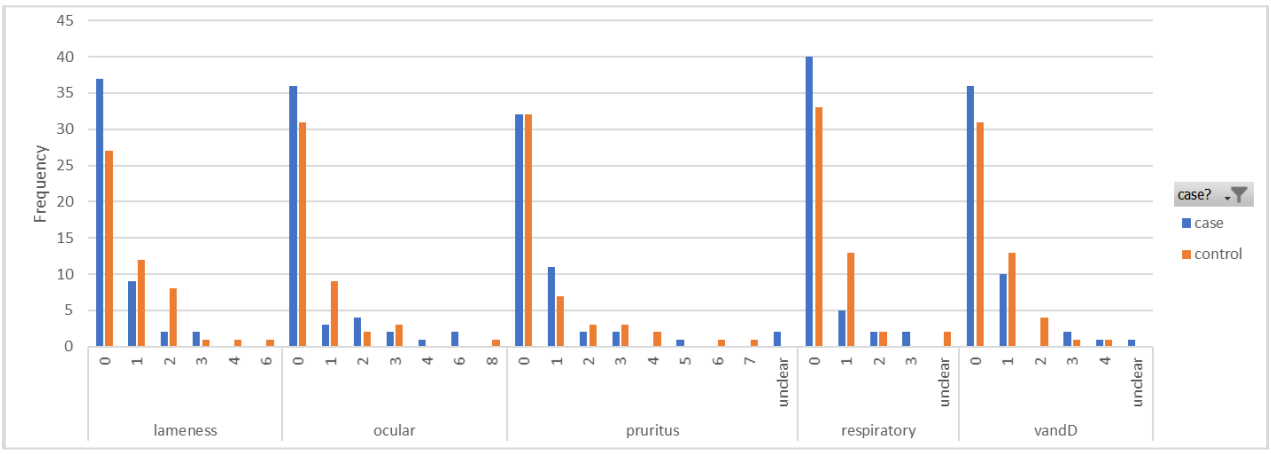
Figure 11; number of consultations occurring over the following six months for teleconference consultations and face-to-face controls.



Number of follow up visits in a 6-month period relating to the condition.

When only consultations relating to the selected case were counted in the proceeding six months, there remained a similar albeit less obvious tendency for telemedicine cases to have no additional follow up (lameness, ocular, respiratory and vomiting and / or diarrhoea) (figure 12).

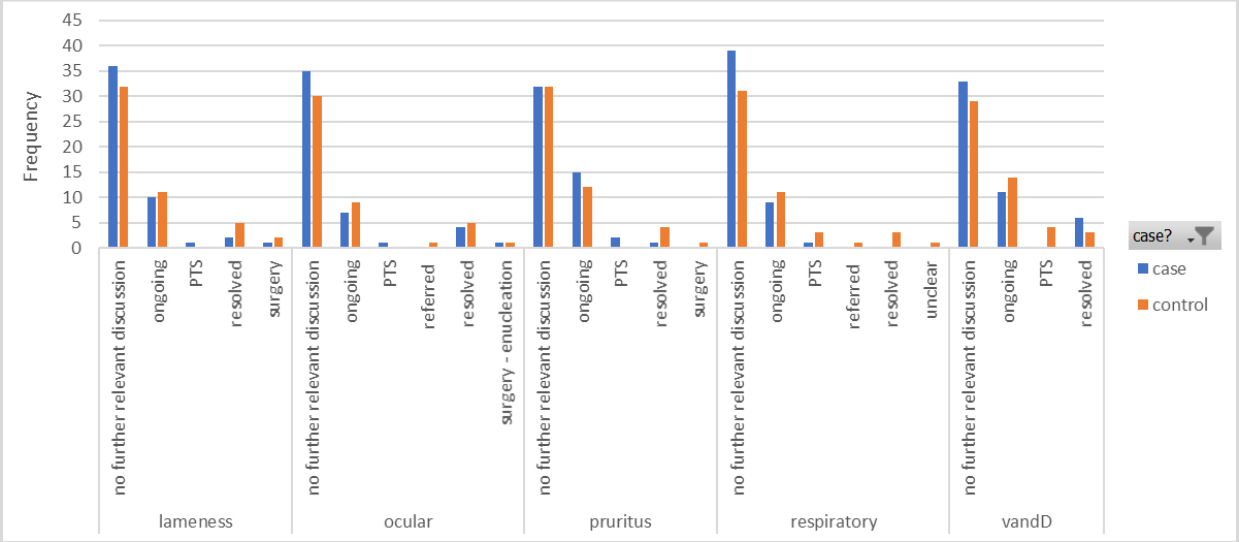
Figure 12; number of related consultations occurring over the following six months.



Outcome as recorded over six months

In the majority of cases (~60% of those read), it was not clear over the proceeding records whether the an individual case was resolved or not (based on no further relevant discussion of the condition of interest); this seemed consistent across the five clinical categories (figure 13). Less frequently, a range of outcomes were explicitly recorded in the six-month follow-up period including ongoing disease, PTS, resolution. The pattern of these also appeared to be broadly similar between telemedicine cases and their controls.

Figure 13; Frequency of outcomes recorded in the following six-month narratives.



Treatments in the following six months.

Treatments most commonly prescribed in the six months following the initial consultation of interest are described in table 6 for species and clinical categories.

It is important to note that not all the treatments prescribed to an animal during consultations in this period may relate to the condition central to the consultation of interest. For example, concurrent treatments for co-morbidities or for subsequent new and unrelated conditions. This is likely to be particular true where the initial presentation was for a more acute and self-limiting disease.

Still, it is interesting to note differences, such as the preference towards injectable treatments (methylprednisolone and cefovecin) in cats attending face-to-face control consultations for pruritus and upper respiratory complaints compared to telemedicine consults for the same conditions. The frequent use of meloxicam in the respiratory category in both species may subjectively suggest a suspicion of Kennel Cough / cat flu, where it might be used to reduce upper respiratory inflammation.

Table 7; most frequent treatments used in the following six months (n in brackets).

Condition	Case or control	Cat	Dog
lameness	case	meloxicam (5)	meloxicam (25)
	control	meloxicam (9)	meloxicam (25)
ocular	case	fusidic acid (7)	fusidic acid (15)
	control	selamectin / robenacoxib / meloxicam / vaccine / praziquantel / clindamycin (2 each)	fluorescein sodium (14)
pruritus	case	prednisolone (5)	oclacitinib (16)
	control	methylprednisolone (5)	prednisolone (19)
respiratory	case	meloxicam (11)	meloxicam (8)
	control	cefovecin (7)	meloxicam (16)
V and/or D	case	meloxicam (4)	omeprazole / praziquantel (10 each)
	control	praziquantel (7)	vaccine / maropitant (10 each)

This work would not have been possible without the data submitted by participating veterinary practices. We are grateful for their involvment in SAVSNET.

We hope this report is a useful aid to your discussions Should you have any questions, please contact us and we would be happy to help.

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