



A UK-based survey of cat owners' perceptions and experiences of antibiotic usage

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Abstract

Objectives The aim of this study was to explore owners' knowledge of antibiotics, experience of antibiotic use in their cats and involvement in decision-making regarding antibiotic prescriptions.

Methods Cat owners were recruited via social media and veterinary practices to complete a survey designed to evaluate general knowledge of antibiotics, attitudes to antibiotic stewardship and experiences of antibiotic use in their own cat between November 2017 and March 2018. Data were analysed descriptively.

Results A total of 1436 surveys were completed; 247 respondents (17.2%) had a veterinary background. The majority of the remaining respondents correctly identified that antibiotics treat bacterial infections (84.0%; n = 999) but do not treat viral infections (72.8%; n = 865). A minority (n = 338; 28.4%) agreed that antibiotic resistance was a problem in cats in the UK; 92.3% (n = 1097) identified that resistance was a problem in human medicine. Seventy percent (n = 832) of the respondents' cats had received antibiotics; 29.6% (n = 246) received a long-acting injectable antibiotic (14 days' duration). Diagnostic tests were performed before antibiotic prescription in 38.7% (n = 322) of cats; 1.4% (n = 7) of respondents reported declining suggested tests and 65.8% (n = 778) indicated that they would be happy to pay for diagnostic tests to allow selection of the most appropriate antibiotic. Most respondents (95.8%; n = 792) indicated that they were happy to follow their veterinarian's advice and recommendations; however, 49.2% (n = 405) had expected antibiotics to be prescribed.

Conclusions and relevance Cat owners demonstrated good knowledge of antibiotic action; however, greater owner education regarding the potential for veterinary antibiotic resistance, requirement for diagnostic testing and training in the administration of oral medication with first-line antibiotics, as well as the use of veterinary antibiotic guidelines, will improve antibiotic stewardship. Good communication between veterinarians and owners is necessary for rational antibiotic use.

Keywords: Antibiotic; antimicrobial stewardship; AMS; owner; survey

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Introduction

Antimicrobial resistance (AMR) is a recognised global threat to human health and focus is increasingly being placed on antimicrobial stewardship (AMS) in veterinary practice. The true extent of antibiotic usage in small animal practice in the UK is uncertain, with estimates that 21–45% of consultations or 1749 in every 10,000 feline consultations result in antibiotic prescriptions,^{1–3} which is much higher than the 12% of consultations or 30.1% of patients prescribed at least one antibiotic per year in human medicine,^{4,5} although direct comparison is challenging, given different methods of calculation.

Between 36% and 80% of the prescriptions made for cats have been reported to involve the administration

of drugs classified as critically important antimicrobials (CIAs) in human healthcare,^{2,3} such as cefovecin (Convenia; Zoetis UK), a third-generation, long-acting injectable cephalosporin; this is despite only 0.4% of cefovecin feline prescriptions being made following appropriate antimicrobial testing in one study.⁶

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Veterinarians commonly cite owner factors, including unwillingness to pay for diagnostic testing and poor owner compliance, especially with cats, which are frequently considered difficult for owners to medicate, as the primary barriers to responsible AMS. Over two-thirds of veterinarians also report pressure from pet owners to prescribe antibiotics.⁷ Conversely, owners perceive veterinarians to be poor at discussing the costs involved in veterinary testing and/or treatment in general,⁸ poor at discussing treatment options⁹ and unable to judge owner compliance.^{10,11}

Only one study has investigated the vet-owner interaction specifically with regard to antibiotic usage; interviews of a small number of veterinarians and pet owners (cats, dogs and rabbits)¹² identified poor knowledge of AMR in owners and a mismatch between perceptions of the interactions; again, veterinarians perceived pressure from owners to prescribe antibiotics, whereas owners felt that veterinarians overprescribed and ultimately were responsible for prescribing decisions.

The aims of this study were to explore owners' knowledge of antibiotics and experience of antibiotic use in their cats. A secondary aim was to investigate how owners were involved in decision-making regarding antibiotic prescriptions, in particular considering microbiological testing and choice of treatment type.

Materials and methods

A web-based survey was designed and hosted on the University of Bristol Online Survey (BOS) program. The survey comprised 29 questions for cat owners divided into three sections: (1) demographic data (owners and cats); (2) general knowledge of antibiotics and attitudes to antibiotic stewardship; and (3) experiences of antibiotic use in their own cat. Question format included selection of a single option from a dropdown menu, ticking checklists and Likert scales. One question required an answer only in 'free-text' form; seven questions allowed owners to enter free text if an appropriate answer was not provided in a checklist (see survey in the supplementary material). A pilot of 10 surveys was conducted with cat owners, and amendments to the design and function of the survey online were made.

Any cat owner was eligible to complete the survey; if they had a multi-cat household, they were asked to base their responses on the first named cat when all of the household cats' names were listed alphabetically. All responses were anonymous; however, on completion of the survey, participants could choose to be entered into a prize draw for gift vouchers, as an incentive to encourage survey completion. Veterinarians named by the participants were entered into a separate prize draw for gift vouchers, as an incentive to promote survey distribution.

Participants were recruited via social media (Facebook and Twitter), mailing lists maintained by Vet Professionals

(an organisation run by a Royal College of Veterinary Surgeons (RCVS) feline specialist) and by circulation of postcards containing details of the survey to veterinary practices. Participants were also recruited in person at the Supreme Cat Show (Governing Council of the Cat Fancy). At this event, and the authors' own practices, cat owners were able to complete a paper copy of the survey; data were subsequently entered onto the BOS program manually. The survey was open for completion from November 2017 to March 2018. The full survey is available in the supplementary material.

Ethical approval for the study was granted from the ethics committee of the University of Bristol (reference number: VIN/17/001).

Statistical analysis

Data were exported into Microsoft Excel and descriptive statistics performed. All the answers for each criterion were plotted and the percentage was calculated for each category.

Results

A total of 1436 surveys were received; 1409 were completed in full and 27 surveys had 1–2 missing responses.

Demographics

Two-hundred and forty-seven respondents had a veterinary background, of whom 84 were qualified veterinarians (5.8% of the total respondents) and 163 (11.4%) were registered veterinary nurses (VNs), student VNs or veterinary undergraduates. These data were excluded from the analysis except for responses to four questions relating to antibiotic prescription, formulation and diagnostic testing performed in their own cats.

Most of the non-veterinary respondents did not have any medical or healthcare training (n = 893; 75.1%). Table 1 summarises the type of training received by the remaining 296 respondents.

Most respondents were female (n = 1083; 91.1%). The age of respondents is summarised in Table 2.

Table 1 Medical or healthcare training received by respondents in a UK-based survey of cat owners' perceptions and experiences of antibiotic usage*

Type of training	n (%)
Human medic/nurse	82 (6.9)
Academic/non-prescribing clinical roles; eg, science degrees, physiotherapists	76 (6.4)
Layman qualifications; eg, first-aid courses (human or animal), carers, animal care assistants, veterinary receptionists	138 (11.6)

*Data exclude 247 owners with a veterinary background

Table 2 Age of respondents in a UK-based survey of cat owners' perceptions and experiences of antibiotic usage*

Age (years)	18–25	26–35	36–45	46–55	56–65	66–75	76+
n (%)	85 (7.1)	253 (21.3)	281 (23.6)	264 (22.2)	202 (17.0)	93 (7.8)	11 (0.9)

*Data exclude 247 owners with a veterinary background

Table 3 Respondents' rating of statements intended to assess general antibiotic (AB) knowledge and attitudes to responsible antibiotic usage in a UK-based survey of cat owners*

Statement (number of responses)	n (%)				
	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
ABs are effective against bacteria in cats (n = 1189)	331 (27.8)	668 (56.2)	164 (13.8)	20 (1.7)	6 (0.5)
ABs are effective against viruses in cats (n = 1188)	43 (3.6)	118 (9.9)	162 (13.6)	323 (27.2)	542 (45.6)
ABs should always be prescribed for cat flu (n = 1187)	50 (4.2)	137 (11.5)	496 (41.8)	328 (27.6)	176 (14.8)
ABs do not have side effects in cats (n = 1187)	7 (0.6)	49 (4.1)	390 (32.9)	566 (47.7)	175 (14.7)
Cats need ABs after routine neutering (castration/spaying) (n = 1188)	26 (2.2)	128 (10.8)	333 (28.0)	469 (39.5)	232 (19.5)
A cat bite abscess will usually heal without ABs (n = 1189)	30 (2.5)	149 (12.5)	326 (27.4)	522 (43.9)	162 (13.6)
AB resistance is a problem in cats in the UK (n = 1188)	61 (5.1)	277 (23.3)	773 (65.1)	71 (6.0)	6 (0.5)
AB resistance is a problem in human medicine in the UK today (n = 1189)	637 (53.6)	460 (38.7)	80 (6.7)	10 (0.8)	2 (0.2)
Bacteria can become resistant to ABs used in cats (n = 1189)	451 (37.9)	537 (45.2)	173 (14.6)	11 (0.9)	17 (1.4)
The use of ABs in animals can reduce the effectiveness of ABs in humans (n = 1189)	245 (20.6)	269 (22.6)	419 (35.2)	213 (17.9)	43 (3.6)
The more ABs we use in society, the higher the risk that AB resistance develops and spreads (n = 1189)	819 (68.9)	325 (27.3)	35 (2.9)	5 (0.4)	5 (0.4)
It would be good to be able to buy ABs over the counter at a pharmacy or online, without my cat being examined by a vet (n = 1189)	36 (3.0)	90 (7.6)	72 (6.1)	393 (33.1)	598 (50.3)
I am confident that drug companies will develop new ABs in the future (n = 1189)	80 (6.7)	411 (34.6)	449 (37.8)	214 (18.0)	35 (2.9)

*Data exclude 247 owners with a veterinary background

The majority of respondents were UK based (n = 1065; 89.6%); 25 (2.1%) were non-UK based and 99 (8.3%) did not state their country of origin.

General knowledge of antibiotics and attitudes to antibiotic stewardship

Respondents were asked to rate a series of statements intended to assess general antibiotic knowledge and attitudes to responsible usage (Table 3). Eighty-four percent (n = 999) agreed that antibiotics are effective against bacteria in cats. Four statements resulted in greater numbers of respondents selecting 'neither agree or disagree': 'antibiotics should always be prescribed for cat flu' (n = 496; 41.8%), 'antibiotic resistance is a problem in cats in the UK' (n = 773; 65.0%); 'the use of antibiotics in animals

can reduce the effectiveness of antibiotics in humans' (n = 419; 35.2%); and 'I am confident that drug companies will develop new antibiotics in the future' (n = 449; 37.8%).

Two-hundred and six respondents (17.3%) indicated they would keep leftover antibiotics for future use; 884 (74.3%) would not and 97 (8.2%) were unsure. Most respondents (n = 1086; 91.3%) indicated they would finish a course of antibiotics even if their cat got better half way through; 46 (3.9%) were unsure.

Experience of antibiotic use in respondents' own cats

Seventy percent (n = 832) of the respondents' survey-designated cats had received antibiotics; 7.8% (n = 65) in the week prior to completion of the survey, 8.8% (n = 73)

Table 4 Respondents' opinions on medicating their cats with antibiotics (AB) in a UK-based survey of cat owners*

Statement (number of responses)	n (%)				
	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Fewer tablets to give each day is important (n = 1181)	197 (16.7)	405 (34.2)	354 (30.0)	168 (14.2)	57 (4.8)
It is more important to me that the vet prescribes the most appropriate AB for my cat, rather than one with an easy method of administering it (n = 1183)	587 (49.6)	453 (38.3)	87 (7.4)	50 (4.2)	6 (0.5)
I would be happy to try to tablet my cat twice daily for 2 weeks if required (n = 1183)	434 (36.7)	411 (34.7)	101 (8.5)	167 (14.1)	70 (5.9)
I would prefer to have a single long-acting injection of AB, rather than tablets or liquid, even if a long course of AB was not needed (n = 1183)	252 (21.3)	285 (24.1)	265 (22.4)	294 (24.9)	87 (7.4)
I would be prepared to pay for additional diagnostic tests to choose the most appropriate AB for my cat (n = 1182)	258 (21.8)	520 (44.0)	290 (24.5)	106 (9.0)	8 (0.7)
I would like my vet to give me more training/advice on how to best medicate my cat; eg, demonstrating tablet administration (n = 1182)	167 (14.1)	356 (30.1)	350 (29.6)	255 (21.6)	54 (4.6)

*Data exclude 247 owners with a veterinary background

between 1 week and 1 month prior, 23.4% (n = 195) between 1 and 6 months prior and 60.0% (n = 499) >6 months prior.

Oral preparations (tablet, liquid or capsule) were most commonly prescribed (n = 438; 52.6%), with tablets more frequently (n = 331; 39.8%) than liquids (n = 75; 9.0%) or capsules (n = 32; 3.8%). Long-acting injections were administered to 246 cats (29.6%). The remaining cats received a short-acting injection (n = 97; 11.7%) or topical therapy (n = 32; 3.8%). Nine cats (1.1%) had received a combination of antibiotics (eg, an injection followed by tablets); 10 respondents (1.2%) did not indicate the type of antibiotic administered.

Considering the veterinary background group, a similar proportion of respondents' cats had received antibiotics (66%; n = 163), with a comparable distribution of formulations prescribed (oral antibiotics in 98 cats [60.1%], long acting injections in 46 [28.2%], short-acting injections in 13 [8.0%], topical therapies in five cats [3.1%] and an intravenous injection in one cat [0.6%]).

The most common reason for antibiotic prescription was skin disease (n = 320; 38.5%) followed by urinary disease (n = 105; 12.6%), gastrointestinal problems (n = 92; 11.1%), dental disease (n = 81; 9.7%) and sneezing, ocular or nasal discharge (n = 73; 8.8%).

Respondents were asked to rate a series of statements regarding medicating their cats with antibiotics (Table 4). The most polarised response was for the statement 'It is more important to me that the vet prescribes the most appropriate antibiotic for my cat, rather than one with an easy method of administering it', with 87.5% (n = 1040) of respondents in agreement.

Diagnostic testing pre-antibiotic prescription

Respondents were asked if their vet performed any tests to identify an infection before antibiotic prescription; 35.0% (n = 291) indicated that 'their vet discussed tests and they agreed to them', 3.7% (n = 31) selected the statement 'yes, my vet ran a test(s), but I was not given an option about whether the test was run'. The remaining 61.3% of respondents (n = 509) indicated 'no tests were performed'. Responses from those with a veterinary background were almost identical, with tests performed in 36.8% of cats (n = 60) pre-prescription.

Of the 509 cats in which testing was not performed, 75.6% of these respondents (n = 385) indicated that 'their vet did not suggest that tests were needed', 23.0% (n = 117) indicated that 'their vet suggested trial treatment and to run tests only if their cat did not get better' and only 1.4% (n = 7) reported declining tests. Owner reasons for consenting to tests are shown in Table 5.

Antibiotics in relation to respondents' own cats

Respondents whose cats had received antibiotics were asked to rate agreement with statements relating to the most recent prescription; results are shown in Table 6.

Discussion

This was the first large-scale study to interrogate owners' perceptions and experiences of antibiotic usage in cats; although respondents with a veterinary background were excluded, the 1189 remaining responses represent a considerably larger cohort than previous UK-based veterinary surveys^{9,11,13} and compares favourably to similar human-based surveys.¹⁴⁻¹⁸ The significant female response

bias (91.1%) is well-recognised in both veterinary and human surveys. This may be due to increased willingness of women to express opinions via a survey, female caregiver status, greater engagement in social media or wider exposure to survey recruitment strategies.^{19,20}

Respondents' level of general knowledge regarding antibiotics and the existence of AMR was relatively high; for example, 84% knew that antibiotics were effective

against bacteria and 72.8% disagreed that antibiotics were effective against viruses, demonstrating a good grasp of the basic mechanism of action of antibiotics. Similarly, 96.2% agreed that increased use of antibiotics in society increases the risk of resistance developing and that bacteria become resistant to antibiotics in cats (83.1%). These results are comparable to a recent Swedish human antibiotic survey, where the highest level of public antibiotic knowledge in Europe is reported.¹⁶ The majority of respondents also demonstrated examples of responsible attitudes to AMS; only 10.6% of respondents agreed that it would be good to buy antibiotics without seeing a veterinarian, and 91.3% indicated that they would finish a course of antibiotics even if their cat got better half way through.

In contrast respondents demonstrated poorer knowledge of veterinary AMR, the mechanisms of development of AMR and inter-species transmission, comparable to previous studies;¹² for example, only 28.4% agreed that antibiotic resistance was a problem in cats in the UK, with a further 65.1% choosing a neutral answer, in comparison to the 92.3% who correctly identified that antibiotic resistance was a problem in human medicine. This could reflect a lack of effective veterinary specific owner education or better AMR/AMS educational strategies in human medicine, although Micallef et al¹⁴ proposed that human antibiotic survey respondents may recall specific facts regarding antibiotics, possibly linked to specific media campaigns, rather than having a global understanding of

Table 5 Reasons for respondents agreeing to diagnostic tests prior to prescription of antibiotics in a UK-based survey of cat owners' perceptions and experiences of antibiotic usage*

Reason	n (%)
I wanted my cat to have the most appropriate treatment	237 (81.4)
My vet explained that this was the best thing to do	147 (50.5)
Inappropriate use of antibiotics can lead to bacterial resistance	52 (17.9)
Costs do not matter to me	39 (13.4)
I struggle to medicate my cat and wanted to ensure medication was definitely required	32 (11.0)
Other	7 (2.4)
My cat had had antibiotics before that did not work	5 (1.7)

*Multiple answers were possible (291 respondents gave a total of 519 reasons); data exclude 247 owners with a veterinary background

Table 6 Respondents' experiences of antibiotic (AB) prescription in their own cats in a UK-based survey of cat owners' perceptions and experiences of antibiotic usage*

Statement (number of responses)	n (%)				
	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
My vet provided the treatment they felt was most appropriate. I was not consulted (n = 815)	134 (16.4)	268 (32.9)	73 (9.0)	245 (30.1)	95 (11.7)
My vet discussed the costs of medications with me (n = 823)	174 (21.1)	259 (31.5)	111 (13.5)	216 (26.2)	63 (7.7)
I was happy to follow my vet's recommendation and advice (n = 827)	377 (45.6)	415 (50.2)	27 (3.3)	7 (0.8)	1 (0.1)
I received adequate information about the AB treatment (n = 824)	253 (30.7)	384 (46.6)	130 (15.8)	45 (5.5)	12 (1.5)
I completely understood what disease my cat was being treated for (n = 823)	317 (38.5)	380 (46.2)	75 (9.1)	44 (5.3)	7 (0.9)
I expected ABs to be prescribed (n = 822)	150 (18.2)	255 (31.0)	277 (33.7)	114 (13.9)	26 (3.2)
I felt that the vet spent enough time with me in the consult (n = 825)	356 (43.2)	391 (47.4)	46 (5.6)	27 (3.3)	5 (0.6)
I was actively involved in deciding which treatment type would be best tolerated by my cat; eg, AB tablet vs liquid, capsule, if not topical (n = 630)	136 (21.6)	186 (29.5)	103 (16.3)	148 (23.5)	57 (9.0)
The AB treatment was effective (n = 821)	335 (40.8)	375 (45.7)	72 (8.8)	32 (3.9)	7 (0.9)

*Data exclude 247 owners with a veterinary background

the topic. This could explain the apparent discrepancy in respondent's ability to apply general human AMR or AMS knowledge to feline medicine.

The prescribing trends identified were comparable to previous studies,⁶ with skin, gastrointestinal and urinary tract issues the predominant reasons for antibiotic use, and tablets the most common formulation prescribed. A third of cats were administered a long-acting injection considered most likely to be cefovecin as the only long-acting antibiotic preparation currently licensed in the UK (question stem stated duration of 14 days). This was a much lower proportion of prescriptions than has been previously recorded,³ although it was not possible to ascertain whether these prescriptions represented responsible AMS or off-label use. Almost half (45.4%) of respondents indicated that they would prefer a long-acting injection rather than oral medications, even if it was not necessary, and a similar number (49.2%) expected antibiotics to be prescribed, higher than the 19.5–43% reported in human studies.^{17,18} This highlights the potential challenges faced by veterinarians in balancing responsible AMS with owner expectations and medication compliance in cats.

Despite the more unique challenges of medicating cats, there was some discrepancy when respondents were asked about medication choices; 50.9% of respondents indicated that fewer tablets to give daily was important, yet 71.4% agreed that they would be happy to try and tablet their cat daily for 2 weeks if necessary. However, almost 45% of respondents agreed with the statement that 'I would like my vet to give me more training/advice on how to best medicate my cat, eg, demonstrating tablet administration', suggesting that a large proportion of owners, with the right support, could be encouraged to medicate their cat with the most appropriate antibiotic, rather than the most convenient one; a similar finding was reported in owners medicating hyperthyroid cats.¹¹ It is vital that veterinarians use this opportunity to improve compliance to enable utilisation of first-line antibiotics wherever possible and to reserve CIAs. Engagement of owners in formulation choices, teaching owners how to administer or effectively disguise medications in pill pockets or treats, choosing palatable formulas and directing owners to educational video medication administration guides online (eg, <https://www.youtube.com/user/iCatCare>) could enhance compliance.

Practical AMS requires diagnostic testing to confirm the presence of a bacterial infection and allow selection of an appropriate antibiotic. Only 38.7% of respondents recalled their cats having any diagnostic testing prior to antibiotic prescription. Of those respondents whose cats received antibiotics without any prior diagnostic testing, the majority indicated 'it was not suggested by the veterinarian that testing was required' (75.6%). Less than

2% of respondents reported declining suggested tests and 65.8% indicated that they would be happy to pay for diagnostic tests to allow selection of the most appropriate antibiotic. This potentially challenges the veterinary-held perception that owners are the main barrier to responsible prescribing, especially as 95.8% of respondents indicated that they were happy to follow their veterinarian's advice and recommendations. While this discrepancy between veterinarian and owner attitudes could be attributed to communication failures between groups, respondents with a veterinary background reported similar levels of antibiotic use and diagnostic testing pre-prescription in their own cats. Given the absence of typical owner barriers in these prescribing decisions, it was expected that lower levels of antibiotic prescriptions and higher proportions of diagnostic testing would have been identified if owner factors were the principle barrier to responsible AMS.

Similarly, only half of respondents agreed that costs or the formulation of antibiotic to be used were discussed with them, despite financial limitations and difficulties with administration of medication being cited by veterinarians as factors leading to poor AMS.⁷ These results suggest that veterinary factors, in addition to owner factors, may be important obstacles to responsible AMS; however, reasons for injudicious antibiotic prescribing are complex and expert consensus recently concluded that poor choice of antibiotic and unnecessary prophylaxis were the main drivers, with client and colleague interactions the next most important factors.²¹ One respondent commented, 'my cat was treated for cystitis; however, it turned out this was actually stress related and not an infection and reducing the stress and treating with Metacam works just as well as antibiotics and Metacam!', exemplifying the need for more rational antibiotic prescribing. The incorporation of clinic-based antibiotic guidelines has been shown to effectively improve veterinary AMS,²² and there are now several sets of guidelines widely available to veterinarians to facilitate this, eg, International Society for Companion Animal Infectious Diseases consensus guidelines^{23,24} and British Small Animal Veterinary Association Protect Guidelines.²⁵

Encouragingly, of the 322 respondents who reported that diagnostic tests were performed, 90.4% agreed to tests following a discussion between themselves and their veterinarian. Indeed, respondents' reasons for agreeing to diagnostic tests in their cats prior to antibiotic prescription was primarily trusting their veterinarians' judgements and wanting the best, most appropriate treatment for their cat. Over 80% of owners agreed that they received adequate information during the consultation, understood exactly what their cat was being treated for and felt that the veterinarian spent enough time with them. While this could suggest client

satisfaction and shared decision-making, providing a foundation for improved AMR education and AMS, studies assessing client satisfaction with regard to human antibiotic prescription are conflicting; patients need to feel like they have received a tangible benefit for their time and effort in attending the consultation, and this has been achieved via clinical examinations rather than antibiotic prescription in some human studies.^{26,27}

A possible strategy to ensure client satisfaction, while practising responsible AMS, might be more frequent use of rapid, inexpensive, in-house diagnostics. Considering dermatological and urinary tract disease were common reasons for antibiotic prescription, cytological analysis of skin and urine samples could provide evidence for rational prescriptions, while persuading clients that they are receiving both value for money and the most appropriate treatment for their cat.

Limitations of this study include selection bias, with some owners recruited via veterinarians who were likely to be interested in responsible AMS and potentially providing veterinary advice and prescriptions in line with this. Respondent recall bias and social desirability may have affected the accuracy and truthfulness of answers. Furthermore, it was not possible to assess non-response bias; respondents possessing less knowledge or poor attitudes to responsible AMS may have been less willing to complete the survey. Lack of corresponding veterinary records meant owner information regarding prescriptions and diagnostic testing could not be validated.

Conclusions

The barriers to responsible AMS in veterinary practice are numerous and complex; however, good communication between veterinarians and cat owners is necessary for rational antibiotic use. Cat owners had high levels of knowledge regarding antibiotic action and human AMR, but inferior knowledge of veterinary AMR and inconsistent attitudes to responsible AMS. However, owners suggested that they had a high level of trust in their veterinarians and would be willing to engage in increased diagnostics. Strategies such as owner education regarding the potential for veterinary AMR and guidance on how to administer oral first-line antibiotics, as well as use of antibiotic guidelines by veterinarians, could promote responsible AMS.

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Supplementary material The following file is available online: Appendix 1: A copy of the survey used in the study.

Conflict of interest Angie Hibbert is a panel member for the GRAM initiative (Guidance for the Rational use of Antimicrobials; CEVA-Santé Animale 2016).

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