Measuring the success of canine and feline preventative healthcare consultations: a systematic review

Robinson, N.J., BSc VetPath BVetMed PhD MRCVS [a, *]; Belshaw, Z. MA Vet MB PhD Cert SAM Dip ECVIM-CA AFHEA MRCVS [a]; Brennan, M.L., BSc(VB) BVMS PhD PGCHE DipECVPH(PM) MRCVS FHEA [a] and Dean, R.S., BVMS DSAM(fel) MSc PhD MRCVS [a]

[a] Centre for Evidence-based Veterinary Medicine, School of Veterinary Medicine and Science, The University of Nottingham, Sutton Bonington Campus, Loughborough, UK, LE12 5RD.

* Corresponding author. Tel.: +44 115 9516782

Email: natalierobinson1006@gmail.com

Abstract

Preventative healthcare consultations account for a large proportion of the veterinary caseload. This novel study is the first to methodically review all literature on canine and feline preventative healthcare consultations. Previous research has found these consultations to be different from health problem consultations in terms of communication style and content. Identifying relevant evidence and previously validated methods of measuring the success of these consultations will be useful when implementing strategies for optimisation. The aim of this study was to identify and assess the quality of existing literature which describes and/or measures the success of preventative healthcare consultations.

Database searches of CAB Abstracts and Medline were conducted to identify published literature. Google searches were then conducted to identify any additional published or grey literature. Results were systematically screened to determine whether the returned sources were about cats and/or dogs, whether they related to preventative healthcare, and whether they described and/or measured the success of preventative healthcare

consultations. For primary research citations which only described preventative healthcare consultations, data were extracted on the aspects of the consultations described. For citations which additionally measured the success of the consultations, the measures used, sampling technique, key results and key weaknesses were also extracted.

Of 17538 citations identified in total during the database searches, a total of seven relevant primary research citations were identified. All of these citations described aspects of the preventative healthcare consultation, such as consultation length, health problems discussed, actions taken and communication style. Only one primary research citation measured success of the consultation, using veterinarian satisfaction to determine success. In addition, 30 narrative citations, including expert opinion pieces, textbooks, guidelines without transparent methodology and conference presentations were identified. Google searches identified 224 relevant narrative citations, and five of the seven primary research citations identified by the database searches, but did not identify any additional relevant primary research citations.

The results suggest that, despite accounting for around a third of all consultations, there is relatively little evidence describing preventative healthcare consultations and only one measure of success has been described for these consultations. This presents potential challenges when implementing strategies to optimise these consultations, as measures which are useful and relevant to veterinary practice should first be identified. Identifying useful measures of success will allow future strategies designed to maximise the benefits of these consultations to be meaningfully assessed for efficacy.

Keywords: vaccination; preventative healthcare; preventive; consultations; evidence synthesis; veterinary satisfaction; client satisfaction

Introduction

Consultations are the cornerstone of small animal veterinary practice, and previous research has suggested that consultations are highly complex with multiple problems frequently discussed (Robinson et al., 2015). In order to maximise the benefits of veterinary consultations, it is vital to understand how best to measure the success of a consultation, so that any strategies developed to optimise the consultation can be fully assessed for effectiveness. Success of the consultation could potentially be measured in a number of ways, including; by examining client satisfaction, veterinarian satisfaction, prescribing practices, financial implications for the practice and impact upon patient health and/or welfare. The Centre for Evidence-based Veterinary Medicine (CEVM) are currently conducting research to identify appropriate measures of success for 'health problem' consultations (Corah et al., 2018). However, previous research has suggested that preventative healthcare consultations differ considerably from health problem consultations in terms of communication style (Shaw et al., 2008) and content (Robinson et al., 2016), and so appropriate measures of success may also be different for these consultations. In addition, recent research has found that owner and veterinary surgeon expectations of these consultations differs widely between individuals, and so different measures of success may be important to different people (Belshaw et al., 2018b).

Systematic reviews can facilitate the practice of evidence-based veterinary medicine, particularly for busy practitioners with limited time and resources to search for and appraise existing evidence. Systematic reviews are viewed as less prone to bias than narrative reviews, because their search strategies are comprehensive, transparent and repeatable and a more rigorous degree of critical appraisal is usually involved (Cook et al., 1997). Systematic reviews are a valuable way of identifying, evaluating and summarising the current evidence base on a topic, making the available evidence more accessible to those making healthcare decisions (Gopalakrishnan and Ganeshkumar, 2013). A growing database of veterinary systematic reviews exists (VetSRev, 2018),

however to date there have been no systematic reviews collating the evidence base on small animal preventative healthcare consultations.

The aim of this study was to describe the existing published evidence base which reported and/or measured the success of veterinary preventative healthcare consultations involving dogs and/or cats. A secondary aim of this study was to assess the quality of the existing published literature which measured the success of veterinary preventative healthcare consultations involving dogs and/or cats, in order to identify any useful measures on consultation success which could be used in future research.

Methods

Defining preventative healthcare

Prior to conducting the literature search, a definition of preventative healthcare was developed to assist in identifying citations of interest, and to help develop inclusion and exclusion criteria. Preventative healthcare was defined as:

'Any consultation where the main reason for presentation relates to the prevention of health problems, and where a clinical examination and/or assessment of the patient's general health would usually be expected to take place. This includes all consultations where the primary reason for presentation is one of the following, regardless of whether the owner was prompted to present the animal via a vaccination/other reminder, or un-prompted: vaccination; parasite prevention; prevention of season (oestrus); any other routine health check, for example routine new animal or puppy/kitten checks.'

Consultations involving the 'well' patient, in addition to patients with ongoing health problems (provided these health problems were not the primary reason for presentation), were included. Consultations primarily for procedures such as nail clipping, microchipping or any other procedure which may be prophylactic, but where a clinical examination/health check may not routinely be expected, were excluded.

Eligibility criteria

Any published research or grey literature which examined canine and/or feline preventative healthcare consultations performed by a veterinary surgeon were included, regardless of study type or type of information source. Published research or grey literature examining consultations not performed by a veterinary surgeon, not involving canine and/or feline patients, or which did not fit the definition of a preventative healthcare consultation, were excluded. Further information can be found in the full study protocol (see supplementary material).

Database searches

Search strategy

Searches were conducted in two databases using the OVID interface, CAB Abstracts (1910 to 2017) and Medline (including In-Process and Other Non-indexed Citations; 1946 to Present) in April 2016 and updated in January 2018. These databases were chosen as CAB Abstracts has previously been shown to have the widest cover of veterinary journals, while Medline incorporates newer papers; these two databases in combination cover the majority of the veterinary literature (Grindlay et al., 2012). A single search strategy was developed encompassing keywords covering three separate components: species terms (canine, feline and small animal); preventative healthcare terms (as covered by the definition above e.g. 'parasite prevention'); and consultation terms (including terms suggesting a regular schedule of appointments e.g. annual). Appropriate subject headings unique to each database were then identified and added to the search terms (see full study protocol in supplementary material for search terms used for each database).

Screening search results

Searches were initially conducted by one author (NR) on 26th April 2016, and the results downloaded into an Endnote Version 16 library. Duplicates were removed (Figure 1) firstly using the automatic function in the Endnote program, and then any additional

duplicates were identified and removed manually. The remaining citations were screened by examining the citation title to determine whether the inclusion criteria were met. For citations which could not be included or excluded on the basis of title alone, the abstract, and occasionally the full text where necessary, were examined to determine whether the citation should be included. Citations were initially screened to determine whether they were about dogs and/or cats with citations not about these species excluded for that reason. Where dogs or cats were being used as a model for disease in other species, the citation was excluded at this point if it appeared to be primarily about disease in another species. Citations which were about dogs and/or cats were then examined to determine whether they related to preventative healthcare or not (as defined above). Those which described a disease preventable by vaccination but did not mention vaccination or prevention in the title or abstract (e.g. describing the prevalence of dog rabies) were excluded at this stage. Citations relating to types of preventative care not covered by the definition (e.g. neutering) were also removed at this stage. Those which did describe preventative healthcare in dogs and/or cats were then examined to determine whether or not they described a veterinary consultation. Citations which described the preventative treatment only (e.g. vaccination), and did not discuss this in the context of a consultation, were excluded, as were citations which described nurse consultations only. The search was updated on 24th January 2018, downloaded into a new Endnote version 16 library and duplicates removed. This library was then merged with the Endnote version 16 library from the original search, and new search results were identified and screened using the same criteria as during the initial search.

Included citations were categorised as either 'primary research citations' or 'narrative citations'. Primary research citations needed to have a transparent methodology for the derivation of the data to be included. Textbooks, narrative reviews, editorials, conference presentations which did not describe research and letters were categorised as narrative citations. Guidelines without a detailed methods section and research conference presentations with insufficient methods available were also categorised with narrative

citations. Papers describing primary research (e.g. clinical trials, cohort studies and cross-sectional studies) or evidence synthesis (e.g. systematic reviews or meta-analyses), conference presentations describing research where additional detailed information on methods were available and evidence-based guidelines with a transparent methodology were all categorised as primary research citations. Any primary research citations which only contained results presented in greater depth in other primary research citations (e.g. a pilot study or conference presentation presenting data from a published research paper) were then excluded. It was planned that any primary research citations identified which were not in the English language would be translated, but narrative citations would not.

Inter-rater reliability

Categorisation of all citations was conducted by one author (NR). To determine the inter-rater reliability of NR's categorisation of citations, a second author (RD) checked a sample of 10% of all citations (after removal of duplicates). This sample was taken by sorting the Endnote database in alphabetical order and selecting every 10th citation to be reviewed. The second reviewer examined title, plus abstract and full text where necessary, to determine the relevance of each citation. As the full categorisation process was time consuming, the second author simply coded citations as relevant (i.e. a primary research citation or narrative citation which was about veterinary preventative healthcare consultations involving dogs and/or cats) or not relevant.

Google searches

Google searches (as opposed to Google Scholar) were conducted in May 2016 to look for any grey literature not identified in the databased searches. Searches were conducted on a PC with cookies disabled and previous search history cleared, to avoid previous Google searches influencing the Google search results. Due to the Google search function limit of 32 words per search, four separate searches were conducted to cover all aspects of preventative healthcare as defined for the purposes of this review: a general search

(covering 'routine health checks'); a 'vaccination' search; a 'parasite prevention' search; and a 'prevention of season' search (full search terms used for each search are given in the study protocol in supplementary material).

For each of the four searches, the first 500 results were downloaded into a Microsoft Excel V.14.0.6 (2010 Microsoft Corporation) spreadsheet for data management, giving a total of 2000 results examined from the four searches. Each link was examined to see if they fit the population inclusion and exclusion criteria (Table 1). Links which only briefly mentioned preventative healthcare consultations (e.g. veterinary practice webpages listing that they offer vaccination consultations among a list of other services, with no further detail) were excluded. Links which did meet the inclusion criteria were further classified as either primary research citations or narrative citations (including: blog/article; veterinary practice website; academic/research institution website; pharmaceutical or other corporate website). The decision was taken not to update the Google searches in January 2018 alongside updating the database searches, as the initial Google searches had not yielded any additional primary research citations which had not been identified by the database searches.

Data extraction

Data extraction was conducted by the first author. For narrative citations, data were extracted on the type of evidence source only e.g. book, research conference abstract, guideline etc. For all primary research citations identified, data extracted from the citation consisted of journal of publication, study design and aspects of the consultation described (e.g. consultation length, content, communication etc.). For primary research citations measuring success of the consultation, sampling technique, methods used to measure success, key results and key weaknesses were also identified.

Critical Appraisal

Primary research citations which measured the success of preventative healthcare consultations were critically appraised using the AXIS critical appraisal tool for cross-sectional studies (Downes et al., 2016). The AXIS tool assesses quality and identifies potential sources of bias in cross-sectional studies through a series of questions relating to common issues in this study type. For each question the user can answer 'yes', 'no' or 'don't know' and there is additional space for comments. Critical appraisal was conducted separately by two authors (NR and RD) then compared for agreement. It was planned that a third author (ZB) would be consulted, however as no disagreement occurred this was unnecessary.

Results

Database searches

A total of 11358 results were found in CAB Abstracts and 6180 in Medline. Once duplicates had been removed there were a total of 14098 unique citations. Figure 1 shows the final search results. After removing citations which were not about dogs and/or cats, not about preventative healthcare and not about consultations conducted by a veterinary surgeon, there were 39 relevant citations remaining. After excluding 2 pilot studies there were 6 primary research citations which described consultations only and 1 which described the consultation and also measured the success of the consultation through veterinary surgeon satisfaction. Of the 30 citations classed as narrative citations, there was a mix of opinion pieces (n=8), conferences presentations (n=6) and guidelines (n=5) among other information sources.

There was complete inter-rater agreement in the citations categorised as relevant and not relevant in the 10% random sample of citations examined by two authors (NR and RD). Several foreign language citations were identified, but all could be categorised as narrative citations based on title and abstract, and so these were not translated.

A wide range of narrative citations were identified in the existing literature (Table 1). Many of these were published opinion articles or book chapters, though several of these were not available in the English language. There had also been five non-research based conference presentations about preventative healthcare consultations over the past decade or so, in particular at conferences in the United States aimed at veterinary practitioners. Three different guidelines included guidance around preventative healthcare consultations, and had supporting material to assist in implementation of the guidelines. However none of these guidelines had accompanying transparent, detailed methodologies, so it is unclear how they were developed. One Critically Appraised Topic (CAT) had been published on improving veterinary preventative healthcare, however the papers identified by this CAT were all from human rather than veterinary healthcare.

Table 1. Summary of the 30 narrative citations describing veterinary preventative healthcare consultations which were identified during the systematic review. This included guidelines and research conference abstracts which did not have a detailed methods section and so were not included as primary research citations.

Type of evidence	Reference
Guidelines	• AAHA canine life stage guidelines (Bartges et al., 2012) • AAFP-AAHA feline life stage guidelines (Hoyumpa Vogt et al., 2010) • WSAVA guidelines for the vaccination of dogs and cats (Day et al., 2007)
Guidelines (supporting material)	• Development of new canine and feline preventive healthcare guidelines designed to improve pet health (AAHA Task Force, 2011) • Have you implemented the AAFP-AAHA feline life stage guidelines? (Buffington, 2011)
Non-research conference abstracts	• Remaking the annual visit (Anon, 2005) • The first pediatric visit (Davis and Pritchard, 2011) • Feline preventive care review (Faunt, 2007) • Best practices: how to implement twice-a-year wellness exams (Myers, 2005) • First puppy/kitten visit: starting off on the right paw (Sharp and Voglewede, 2010)
Research conference abstracts	• Abnormalities detected during routine examination at annual vaccination in dogs (Williams and Grudzien, 2015)
Critically appraised topics (CATs)	• Critically Appraised Topics: Improving preventive pet care (LeFebvre, 2012)
Books	• Veterinary paediatrics: dogs and cats from kitten to six months (Anon, 1990) • Top 100 consultations in small animal general practice (Hill et al., 2011)
Narrative reviews (English)	• Wellness examination 101 (Anon, 2011) • Small animal vaccination: a practical guide for vets in the UK (Day, 2017) • Vaccine use and disease prevalence in dogs and cats (Horzinek, 2006) • Preventive health program for dogs (Hoskins, 1988) • The puppy's first veterinary examination: physical examination and preventive health program (Hoskins, 1991)

	• Comprehensive preventive care and early disease detection: Taking preventive care to the next level (Miller, 2011) • Another perspective on the vaccination controversy: redefining the annual visit (Norsworthy, 1999) • DOI and booster vaccination - dealing with the issue at practice level in France (Poubanne, 2006)
Foreign language (narrative reviews or book sections)	• The large health check (Anon, 2014a) • The great health check: the nuts and bolts for dogs and cats (Anon, 2014b) • Prevention is better than cure (Anon, 2014c) • Dogs and cats as patients (Anon, 2014d) • The puppy's first veterinary visit: clinical examination and preventative medicine programme (Scotti, 1993) • The work required of veterinarians in small animal practice (health checks) (Svendsen, 1992)
Letters	• Survey on booster vaccination consultations (Robinson et al., 2016) • Annual examination may serve many purposes (Walshaw, 1998)

Google searches

A total of 2000 Google search results, 500 from each of the four searches conducted, were examined (Table 2). While five primary research citations were identified in two of the Google searches, all of these had already been identified during the database searches. All remaining relevant webpages were classified as narrative citations, with a total of 224 relevant narrative citations identified. The majority of these (n=195/224; 87.1%) were veterinary practice webpages describing the purpose or content of their own preventative healthcare consultations. An additional 22 narrative citations were online articles, ebooks or blogs, four were webpages from academic institutions and three were webpages from corporate sources.

Table 2. Summary of the findings from the four Google searches conducted to identify grey literature on various aspects of preventative healthcare consultations. The number of results excluded because they did not discuss dogs/cats, were not about preventative healthcare, or were not about preventative healthcare consultations conducted by a veterinary surgeon, are given for each search. For relevant results, the type of grey literature identified is given.

		Search				
		General	**Vaccination**	**Parasite prevention**	**Prevention of season**	**Totals**
Excluded	Dogs/cats	59	29	83	219	**390**
	Preventative healthcare	231	108	89	239	**667**
	Consultations	97	287	295	35	**714**

Relevant	Primary research citations		3	2	0	0	**5**
	Narrative citations	Article/blog/book[1]	15	2	4	1	**22**
		Veterinary[2]	91	71	28	5	**195**
		Academic[3]	2	1	0	1	**4**
		Corporate[4]	2	0	1	0	**3**
		Totals	**500**	**500**	**500**	**500**	**2000**

[1]Article, blog or book written by a veterinary surgeon, veterinary nurse, veterinary paraprofessional, pet owner or other expert

[2]Veterinary practice webpage

[3]Academic or research institution webpage

[4]Pharmaceutical company, pet food company or other similar corporate webpage

Primary research citations

The seven primary research citations describing aspects of canine and feline preventative healthcare consultations (Table 3) covered consultation length, problems discussed during the consultation, actions taken during or following the consultation and/or communication styles during the consultation. All seven papers described a cross-sectional study.

Table 3. Summary of the aspects of the preventative healthcare consultations described by each of the seven cross sectional studies identified in the systematic review.

Research citation	**Country**	**Consultation length**	**Problems discussed**	**Actions taken**	**Communication style**
Banyard (1998)[1]	Australia	No	Yes	No	No
Robinson et al. (2014)[2]	UK	Yes	No	No	No
Robinson et al. (2016)[2]	UK	No	Yes	Yes	No
Roshier and McBride (2013)[2]	UK	No	Yes	Yes	No
Shaw et al. (2006)[3]	Canada	No	No	No	Yes
Shaw et al. (2008)[3]	Canada	Yes	No	No	Yes
Shaw et al. (2012)[3]	Canada	No	No	No	Yes

[1]Australian Veterinary Journal

[2]Veterinary Record

[3]Journal of the American Veterinary Medical Association

313 Only one of these seven (Shaw et al., 2012) measured the success of the consultation,
314 and did so using measures of veterinary satisfaction. In this study, a previously
315 developed 20-item physician satisfaction scale (Suchman et al., 1993) which had been
316 validated for use in human healthcare research (construct validity measured by
317 examining predictors which paralleled the basic meaning of each subscale for significant
318 associations with that subscale) was used to measure veterinary surgeon visit-specific
319 satisfaction. The results of the critical appraisal of this study are shown in Table 4.
320
321
322 Table 4. Critical appraisal of the paper (Shaw et al. 2012) which measured the success of
323 veterinary preventative healthcare consultations conducted and reported according to
324 the AXIS guideline
325

Title	Veterinarian satisfaction with companion animal visits
Authors and year	J.R. Shaw, C.L. Adams, B.N. Bonnett, S. Larson, D.L. Roter (2012)
Journal	Journal of the American Veterinary Medical Association
Sampling strategy	Random sample of companion animal veterinarians in Southern Ontario, Canada. Veterinarians were contacted until 50 agreed to take part in the study. All clients presenting to each veterinarian were invited to take part until at least 3 health problem and 3 preventative healthcare consultations were included.
Key findings	• Veterinarian satisfaction scores were higher for preventative healthcare compared with health problem consultations ($p<0.01$) • Veterinarians felt more confident in discussing preventative healthcare compared with health problem consultations ($p<0.01$) • Higher global veterinarian satisfaction was positively associated with proportionately more client (positive and negative) talk compared to veterinarian talk and a higher veterinarian self-esteem score • Various other measures were found to be associated with different individual aspects of veterinarian satisfaction (which had four subcomponents of: veterinarian-client-patient relationship; data-gathering process; effective use of time during the visit; cooperative nature of client) • The measure most consistently associated with higher veterinary satisfaction during preventative healthcare consultations was veterinarian self-esteem (which was positively associated with global veterinarian satisfaction as well as all four subcomponents of veterinarian satisfaction)
Key weaknesses	• No justification for the sample size used, therefore the study may be underpowered • No information about 'non-responders'/those who declined to take part • Measures used were validated in the medical but not veterinary literature • Full range of statistical analyses conducted, and cut-offs used for interpretation, is unclear

326

Discussion

This is the first time globally that literature relating to preventative healthcare consultations have been reviewed. Preventative healthcare consultations account for a large proportion of the daily caseload of veterinary surgeons in the UK (Robinson et al., 2015), yet the evidence base describing these consultations is very limited and of poor quality and low strength. The evidence found in this review was dominated by expert opinion as opposed to primary research, yet many guidelines have been written in this area. In order to maximise the benefits of preventative healthcare consultations, additional useful measures of consultation success need to be identified and validated.

Only seven primary research citations describing preventative healthcare consultations were found, with all studies identified being cross-sectional studies. While this study design was appropriate to address the aims of these studies, which often focused on describing preventative healthcare consultations, no higher levels of evidence examining preventative healthcare consultations through clinical trials or cohort studies were identified. The large number of narrative citations and guidelines identified suggest that veterinary surgeons do have some information available to guide them in their decision-making during these consultations. However, proponents of evidence-based medicine have previously highlighted that while expert opinion can be useful in the absence of other forms of evidence, it is also potentially more prone to bias and so considered a weaker form of evidence both when looking at 'levels of evidence' (Howick et al., 2011) and the more recently developed 'evidence staircase' (Arlt and Heuwieser, 2016). Where primary research is limited, expert opinion can still be harnessed in an evidence-based way, using methods such as Delphi consensus panels (Powell, 2002). Such methods have been used with increasing frequency to develop veterinary guidelines in other areas of veterinary medicine, such as behavioural signs of pain in cats (Merola and Mills, 2016), cardiovascular-renal axis disorders (Pouchelon et al., 2015) and neurology learning objectives for veterinary undergraduates (Lin et al., 2015). Until new primary research can be conducted focusing on preventative healthcare consultations, harnessing

356 expert opinion in a more systematic and evidence-based way to develop guidance could
357 prove to be a useful resource for veterinary surgeons conducting these consultations.
358 The CEVM are currently using consensus methods to develop evidence-based guidance
359 and practical recommendations to optimise canine and feline preventative healthcare
360 consultations (Belshaw, pers comms).
361
362 A large proportion of the literature identified in the database and Google searches
363 described preventative healthcare in dogs and/or cats but were excluded as they did not
364 discuss the consultation itself. This suggests that while there may be a considerable
365 amount of evidence available to veterinary surgeons on the preventative medicines
366 themselves, and also to pet owners via Google searches, the evidence on the
367 consultations themselves is disproportionately limited. This is supported by recent work
368 which involved in-depth interviews of veterinary surgeons and pet owners around their
369 experiences and expectations of preventative healthcare consultations. While
370 interviewees were predominantly asked about the consultations rather than the
371 preventative medicines, many of the interviewee responses focused on the discussion of
372 preventative medicines themselves (Belshaw et al., 2018a). Where the consultation was
373 discussed, experiences and expectations of the consultation appeared to vary widely,
374 both between owners and veterinary surgeons, and between individuals within these
375 subgroups (Belshaw et al., 2018b). There has been some controversy in recent years
376 around pet vaccination, with some describing 'vaccinophobia' amongst pet owners (Day,
377 2017). It may be that a focus on the risks and benefits of vaccination, and of other
378 preventative medicines, has drawn focus away from thinking about other important
379 aspects of the preventative healthcare consultation.
380
381 Only one research citation measured the success of the consultation, and this focused
382 solely on veterinarian satisfaction and did not consider any other measures of success
383 (Shaw et al., 2012). This study was generally of good quality, though the success
384 measure used had primarily been validated in medical and not veterinary consultations,

and so ideally additional validation should be conducted to establish the usefulness of this measure. Satisfaction is not the only measure which needs to be considered when determining the success of the consultation, as the impact on clinical outcomes, wellbeing of all parties involved and financial implications also needs to be considered (Corah et al., 2018). No studies were identified which measured the success of the consultation in terms of owner satisfaction, short and long term outcomes for pet health and welfare, and other potential measures of success such as dispensing behaviour and compliance. Future work should focus on identifying and validating other measures of success for preventative healthcare consultations. This will allow future strategies designed to maximise the benefits of these consultations to be meaningfully assessed for efficacy.

There are various limitations of this study, including that relevant evidence was potentially missed as only two databases were searched. However, the databases used were picked for their comprehensive coverage of the veterinary literature (Grindlay et al., 2013) and so the risk of missing relevant literature was minimised. In addition, Google searches were not updated when updating of the database searches were performed. While it is possible that this may have resulted in relevant literature being missed, this seems unlikely given that no useful additional primary research citations were identified in the initial Google searches. In addition, only 2000 results in total were examined across the four Google searches, so it is possible that some relevant results were missed, however the decision to examine this number of results was based on previous work within the CEVM utilising Google searches (Downes et al., 2013). Citations covering consultations conducted by veterinary nurses or veterinary paraprofessionals, and consultations involving species other than dogs and/or cats were excluded, as were citations about human healthcare consultations. This could mean some useful measures of success which could be applied to canine and feline preventative healthcare consultations were missed. However, given the large number of search results identified, widening the search terms further would have resulted in an unmanageable number of

citations to categorise. Additional work found that validated measures of success were similarly limited for canine and feline 'health problem' consultations (Corah et al., 2018). Further research is currently underway to develop more useful measures of success for these consultations (Corah, pers comms), the results of which may have some applicability to preventative healthcare consultations also.

This novel study has identified an important gap in the existing veterinary literature surrounding preventative healthcare consultations. While the existing evidence base is currently dominated by expert opinion, this expert opinion along with the existing primary research, could be harnessed in an evidence-based way to provide useful guidance for veterinary surgeons conducting these consultations.

Ethical approval

Ethical approval was obtained from the ethics committee at the School of Veterinary Medicine and Science, The University of Nottingham. The study complied with The University of Nottingham (2016) Code of Research Conduct and Research Ethics.

Acknowledgements

This study was supported by a grant from MSD Animal Health. NR and ZB's time was funded by MSD Animal Health, and RD and MB's time was covered by The University of Nottingham. The topic of study, study design, statistical analysis, interpretation of the results, decision to publish and writing of the manuscript were undertaken independently of the funders.

References

AAHA Task Force. 2011. Development of new canine and feline preventive healthcare guidelines designed to improve pet health. J. of the Am. Anim. Hosp. Assoc. 47, 306-11.

441 Anon. 1990. Veterinary paediatrics: dogs and cats from kitten to six months. Saunders,
442 Philadelphia
443 Anon. 2005. Remaking the annual visit. Atl. Coast Vet. Conf.
444 Anon. 2011. Wellness examination 101. Compendium: continuing education for
445 veterinarians. 33, E1
446 Anon. 2014a. The large health check. Praktische Tierarzt. 95, 4-12.
447 Anon. 2014b. The great health check: the nuts and bolts for dogs and cats. Schlutersche
448 Verlagsgesellschaft GmbH & Co KG, Hannover.
449 Anon. 2014c. Prevention is better than cure. Schlutersche Verlagsgesellschaft GmbH &
450 Co KG, Hannover
451 Anon. 2014d. Dogs and cats as patients. Schlutersche Verlagsgesellschaft GmbH & Co
452 KG, Hannover
453 Arlt, S.P., Heuwieser, W. 2016. The staircase of evidence – a new metaphor displaying
454 the core principles of Evidence-based Veterinary Medicine. Vet. Evid. 1 (1).
455 Available at:
456 https://www.veterinaryevidence.org/index.php/ve/article/view/18/28 (Accessed
457 22nd March 2018)
458 Banyard, M.R.C. 1998. Prevalence of intercurrent disease in dogs and cats presented for
459 vaccination at a veterinary practice. Aust. Vet. J. 76, 600-1.
460 Bartges, J., Boynton, B., Hoyumpa Vogt, A., Krauter, E., Lambrecht, K., Svec, R.,
461 Thompson, S. 2012. AAHA canine life stage guidelines. J. of the Am. Anim. Hosp.
462 Assoc. 48, 1-11
463 Belshaw, Z. Developing practical recommendations for preventative healthcare
464 consultations involving dogs and cats. Personal communication.
465 Belshaw, Z., Robinson, N.J., Dean, R.D., Brennan, M.L. 2018a. Motivators and barriers
466 for dog and cat owners and veterinary surgeons in the United Kingdom to using
467 preventative medicines. Prev. Vet. Med. (In Press)

468 Belshaw, Z., Robinson, N.J., Dean, R.D., Brennan, M.L. 2018b. Owners and veterinary
469 surgeons disagree about what should happen during a small animal vaccination
470 consultation. Vet. Sci. 5, 7.
471 Buffington, C.A.T. 2011. Have you implemented the AAFP-AAHA feline life stage
472 guidelines? Vet. Med. 106, 509-12.
473 Cook, D.J., Mulrow, C.D., Haynes, R.B. 1997. Systematic reviews: synthesis of best
474 evidence for clinical decisions. Ann. of Intern. Med. 126, 376-380.
475 Corah, L., Mossop, L., Cobb, K., Dean, R. 2018. Measuring the success of specific health
476 problem consultations in cats and dogs: a systematic review. Vet. Rec., Published
477 Online First: 15 March 2018. Available at:
478 http://veterinaryrecord.bmj.com/content/early/2018/03/15/vr.104759 (Accessed
479 22nd March 2018) DOI: 10.1136/vr.104759.
480 Corah, L. Developing measures of success for use in canine and/or feline specific health
481 problem consultations. Personal communication.
482 Davis, G., Pritchard, W.R. 2011. The first pediatric visit. North Am. Vet. Conf.
483 Day, M.J., Horzinek, M.C., Schultz, R.D. 2007. WSAVA guidelines for the vaccination of
484 dogs and cats: compiled by the Vaccination Guidelines Group (VGG) of the World
485 Small Animal Veterinary Association (WSAVA). J. of Small Anim. Pract. 48, 528-
486 41.
487 Day, M.J. 2017. Small animal vaccination: a practical guide for vets in the UK. In Pract.
488 39, 110-118.
489 Downes, M.J., Dean, R.S., Stavisky, J.H., Adams, V.J., Grindlay, D.J.C., Brennan, M.L.
490 2013. Methods used to estimate the size of the owned cat and dog population: a
491 systematic review. BMC Vet. Res. 9, 121.
492 Downes, M.J., Brennan, M.L., Williams, H.C., Dean, R.S. 2016. Development of a critical
493 appraisal tool to assess the quality of cross-sectional studies (AXIS). BMJ Open.
494 5, e011458.
495 Faunt, K.K. 2007. Feline preventive care review. North Am. Vet. Conf.

496 Gopalakrishnan, S. and Ganeshkumar, P. 2013. Systematic reviews and meta-analyses:
497 Understanding the best evidence in primary healthcare. J. of Fam. Med. and Prim.
498 Care. 2, 9-14.
499 Grindlay, D.J., Brennan, M.L., Dean, R.S. 2012. Searching the veterinary literature: a
500 comparison of the coverage of veterinary journals by nine bibliographic
501 databases. J. of Vet. Med. Educ. 39, 404-12.
502 Hill, P., Warman, S., Shawcross, G. 2011. Top 100 consultations in small animal general
503 practice. Wiley-Blackwell, Oxford.
504 Horzinek, M.C. 2006. Vaccine use and disease prevalence in dogs and cats. Vet.
505 Microbiol. 117, 2-8
506 Hoskins, J.D. 1988. Preventive health program for dogs. Vet. Tech. 9, 187-92.
507 Hoskins, J.D. 1991. The puppy's first veterinary examination: physical examination and
508 preventive health program. Vet. Tech. 12, 521-4.
509 Hoyumpa Vogt, A., Rodan, I., Brown, M., Brown, S., Buffington, C.A., Larue Forman,
510 M.J., Neilson, J., Sparkes, A. 2010. AAFP-AAHA feline life stage guidelines. J. of
511 the Am. Anim. Hosp. Assoc. 12, 43-54.
512 Howick, J., Chalmers, I., Glasziou, P., Greenhalgh, T., Heneghan, C., Liberati, A.,
513 Moschetti, I., Phillips, B., Thornton, H. 2011. The 2011 Oxford CEBM Evidence
514 Levels of Evidence (Introductory Document). Oxford Centre for Evidence-based
515 Medicine. Available at: https://www.cebm.net/2016/05/ocebm-levels-of-
516 evidence/ (Accessed 22nd March 2018)
517 LeFebvre, S. 2012. Critically appraised topics: improving preventive pet care. Banfield J.
518 8, 3-8.
519 Lin, Y., Volk, H.A., Penderis, J., Tipold, A., Ehlers, J.P. 2015. Development of learning
520 objectives for neurology in a veterinary curriculum: part 1: undergraduates. BMC
521 Vet. Res. 11 (2).
522 Merola, I., Mills, D. 2016. Behavioural signs of pain in cats: an expert consensus. PLoS
523 ONE. 11, e0150040.

524 Miller, D. 2011. Comprehensive preventive care and early disease detection: Taking
525 preventive care to the next level. Banfield J. 7, 9-11
526 Myers, W.S. 2005. Best practices: how to implement twice-a-year wellness exams. Atl.
527 Coast Vet. Conf. 2005.
528 Norsworthy, G.D. 1999. Another perspective on the vaccination controversy: redefining
529 the annual visit. Vet. Med. 94, 736-42.
530 Poubanne, Y. 2006. DOI and booster vaccination - dealing with the issue at practice level
531 in France. Vet. Microbiol. 117, 86-92.
532 Pouchelon, J.L., Atkins, C.E., Bussadori, C., Oyama, M.A., Vaden, S.L., Bonagura, J.D.,
533 Chetboul, V., Cowgill, L.D., Elliot, J., Francey, T., Grauer, G.F., Luis Fuentes, V.,
534 Syndey Moise, N., Polzin, D.J., Van Dongen, A.M., Van Israel, N. 2015.
535 Cardiovascular-renal axis disorders in the domestic dog and cat: a veterinary
536 consensus statement. J. of Small Anim. Pract. 56, 537-552.
537 Powell, C. 2002. Methodological issues in nursing research. The Delphi technique: myths
538 and realities. J. of Adv. Nurs. 41, 376-382.
539 Robinson, N.J., Dean, R.S., Cobb, M., Brennan, M.L. 2014. Consultation length in first
540 opinion small animal practice. Vet. Rec. 175, 486.
541 Robinson, N.J., Brennan, M.L., Cobb, M., Dean, R.S. 2015. Capturing the complexity of
542 first opinion small animal consultations using direct observation. Vet. Rec. 176,
543 48.
544 Robinson, N.J., Brennan, M.L., Cobb, M., Dean, R.S. 2016. Investigating preventive-
545 medicine consultations in first-opinion small-animal practice in the United
546 Kingdom using direct observation. Prev. Vet. Med. 124, 69-77.
547 Robinson, N.J., Dean, R.S., Brennan, M.L. 2016. Survey on booster vaccination
548 consultations. Vet. Rec. 179, 231-232.
549 Roshier, A.L., McBride, E.A. 2013. Canine behaviour problems: discussions between
550 veterinarians and dog owners during annual booster consultations. Vet. Rec. 172,
551 235.

552 Scotti, C. 1993. The puppy's first veterinary visit: clinical examination and preventative
553 medicine programme. Professione Veterinaria. 3, 41-6.
554 Sharp, S., Voglewede, C. 2010. First puppy/kitten visit: starting off on the right paw.
555 North Am. Vet. Conf. 2010.
556 Shaw, J.R., Bonnett, B.N., Adams, C.L., Roter, D.L. 2006. Veterinarian-client-patient
557 communication patterns used during clinical appointments in companion animal
558 practice. J. of the Am. Vet. Med. Assoc. 228, 714-21.
559 Shaw, J.R., Adams, C.L., Bonnett, B.N., Larson, S., Roter, D.L. 2008. Veterinarian-client-
560 patient communication during wellness appointments versus appointments
561 related to a health problem in companion animal practice. J. of the Am. Vet. Med.
562 Assoc. 233, 1576-86.
563 Shaw, J.R., Adams, C.L., Bonnett, B.N., Larson, S., Roter, D.L. 2012. Veterinarian
564 satisfaction with companion animal visits. J. of the Am. Vet. Med. Assoc. 240,
565 832-41.
566 Suchman, A.L., Roter, D.L., Green, M. 1993. Physician satisfaction with primary care
567 office visits. Med Care. 31, 1083-92.
568 Svendsen, C.K. 1992. The work required of veterinarians in small animal practice (health
569 checks). Dansk Veterinaertidsskrift. 75, 677-8.
570 Walshaw, S.O. 1998. Annual examination may serve many purposes. J. of the Am. Vet.
571 Med. Assoc. 213, 202.
572 Williams, D., Grudzien, A. 2015. Abnormalities detected during routine examination at
573 annual vaccination in dogs. Br. Small Anim. Vet. Assoc. Congress 2015, 500.
574 VetSRev. 2018. Database of veterinary systematic reviews. Available at:
575 http://webapps.nottingham.ac.uk/refbase/ (Accessed 22nd March 2018)
576 University of Nottingham, The. 2016. Conduct of research conduct and research ethics.
577 Available at:
578 https://www.nottingham.ac.uk/educationstudentintranet/resources/research/cod
579 e-of-research-conduct-and-research-ethics-version-6-2016.pdf (Accessed 22nd
580 March 2018)