SYSTEMATIC REVIEW

Infectious complications of dental procedures in dogs and cats, and the impact of antimicrobial prophylaxis: a systematic review

J. S. Weese *,[1], M. Soltero-Rivera[†], H. E. Weese[‡] and K. Scahill[§]

*Department of Pathobiology, Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada
[†]Department of Veterinary Surgical and Radiological Sciences, University of California, Davis, California, USA
[‡]Independent Researcher, Moffat, Ontario, Canada
[§]International Veterinary Evidence-Based Guidelines Centre, Department of Veterinary Clinical Sciences, University of Copenhagen, Frederiksberg C, Denmark

[1]Corresponding author email: jsweese@uoguelph.ca

Objectives: To identify and describe available evidence pertaining to the local and systemic infectious complications in dogs and cats that have undergone dental procedures and the impact of peri-procedural antimicrobial prophylaxis.

Materials and Methods: A systematic review was performed based on Preferred Reporting Items for Systematic Reviews and MetaAnalysis guidelines.

Results: No studies clearly reported the incidence of sepsis or infective endocarditis data associated with dental procedures. The pooled prevalence of post-dental procedure bacteraemia was 47% (95% confidence interval 23% to 74%). Two studies investigated both dogs undergoing dental procedures and controls. Neither showed a clear association of dental procedures and bacteraemia. Bacteraemia was not associated with any clinical consequences based on these data, but data were very limited, with a very low level of certainty of evidence.

No studies evaluated the impact of peri-procedural antimicrobial on endocarditis, sepsis or other infectious complications. Two relevant studies that used bacteraemia as the outcome were identified. Both studies were deemed to have some concerns of bias. Certainty of evidence was deemed to be very low. No data were available to assess the impact of post-procedural antimicrobials on infectious complications.

Clinical Significance: The evidence base to assess the incidence and risks of infectious complications after dental procedures and impact of antimicrobial prophylaxis in dogs and cats is severely limited. This highlights a major research gap for a common patient population and hampers development of evidence-based guidelines for peri-procedural antimicrobial administration in dogs and cats.

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INTRODUCTION

Dental disease is common in dogs and cats, and dental procedures are commonly performed (Jackson et al., 2025; O'Neill, James, et al., 2021; O'Neill, Mitchell, et al., 2021). Dental procedures create the risk for transient bacteraemia through disruption of the oral mucosa in a location with an abundant microbiota (Blazevich & Miles, 2024; Bolukbasi et al., 2012; Wilson et al., 2007). While

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bacteraemia can be a transient and clinically unremarkable state, liberation of bacteria within the bloodstream is a foundational step for systemic infectious sequelae, particularly infective endocarditis (Kussainova et al., 2024; Wilson et al., 2007, 2021). However, a clear link between dental procedure-associated bacteraemia and infectious sequelae has not been proven in dogs and cats.

In humans, bacteraemia risks and prevention of infectious sequelae such as infective endocarditis have received abundant study (Bolukbasi et al., 2012; Kussainova et al., 2024; Maharaj et al., 2012; Rahman et al., 2024; Sperotto et al., 2024). In some situations, antimicrobial prophylaxis has been shown to be protective (Sperotto et al., 2024), but overuse is common (Chate, 2008; Sivertsen et al., 2013; Suda et al., 2018). Clinical guidelines recommended peri-procedure prophylaxis only in a small subset of patients who are deemed at high risk of infectious complications (Sollecito et al., 2015; Wilson et al., 2007, 2021). Professional dental cleaning is an important antimicrobial stewardship area given perceived overuse and its consequences, including adverse drug effects and antimicrobial resistance.

Peri-procedural antimicrobials are commonly administered for dental procedures in dogs and cats (Soltero-Rivera et al., 2024; Weese et al., 2023). A large proportion of use is likely unnecessary (Montebello et al., 2023; Soltero-Rivera et al., 2024; Volk et al., 2025; Weese et al., 2023); however, data regarding infectious complications are very limited for veterinary dentistry. Similarly, while position statements regarding antimicrobial prophylaxis in companion animals have been developed (Bellows et al., 2019; Niemiec et al., 2020), they have been expert opinion-based. This is common with veterinary guidelines, but the veterinary guideline field is advancing and a core component of guideline development is evidence synthesis, even when evidence may be limited.

The objective of this systematic review was to identify and describe available evidence pertaining to the local and systemic infectious complications in dogs and cats that have undergone dental procedures and the impact of peri-procedural antimicrobial prophylaxis on local and systemic infectious complications. It was designed to inform evidence-based guideline development for peri-procedural antimicrobial administration in dogs and cats.

METHODS

Two systematic reviews were performed based on the Preferred Reporting Items for Systematic Reviews and MetaAnalysis guidelines (Moher et al., 2015). The study protocol is accessible at https://hdl.handle.net/10214/28712.

The following changes were made after registration:

- Full texts in any language were included (not just English, French and German).
- Risk of bias assessment for incidence studies was changed from a critical assessment checklist (Munn et al., 2015) to ROBINS-E (Higgins et al., 2024) (based on consensus that this was a more robust tool).
- PECO (population, exposure comparator, outcome) questions were changed to CoCoPop (condition, context, population) questions when a comparator was not present (to allow for reporting of prevalence).
- Pooled prevalence meta-analysis was added (to provide meta-prevalence analysis for pooled prevalence estimates).

The first review evaluated endocarditis, bacteraemia and sepsis in dogs and cats that undergo dental procedures. It was designed to address background information to inform guideline discussions and provide context, through the CoCoPop, PECO and narrative background questions listed below.

CoCoPop 1: In dogs and cats undergoing dental procedures, what is the incidence of bacteraemia, sepsis or endocarditis?

PECO 1: In dogs and cats undergoing dental procedures, does peri-procedural bacteraemia increase the risk of endocarditis, sepsis or other infectious sequelae?

Background question: In dogs and cats undergoing dental procedures, what are risk factors for bacteraemia, sepsis or endocarditis?

The second review evaluated the efficacy of antimicrobial prophylaxis for dental procedures in dogs and cats through the PICO (population, intervention, comparator, outcome) questions listed below.

PICO 1: In dogs and cats undergoing dental procedures, does peri-procedural administration of antimicrobials reduce the incidence of endocarditis, sepsis, bacteraemia or other infectious complications?

PICO 2: In dogs and cats undergoing dental procedures, does post-procedural administration of antimicrobials reduce the incidence of endocarditis, sepsis, bacteraemia or other infectious complications?

Review questions were developed using an iterative process involving a guideline panel that was aiming to develop clinical guidelines for antimicrobial prophylaxis. This panel was also used to determine critical outcomes.

Types of studies

Randomised controlled trials, observational studies (prospective or retrospective cohort trials, case–control study and longitudinal observational studies), case series, case reports and conference research abstracts were eligible. Relevant review articles from peer-reviewed journals were eligible for full-text screening to search reference lists but were excluded from data extraction. Reviews from conference proceedings and experimental studies were excluded.

Study participants

Studies involving dogs and cats with naturally occurring disease were included without restrictions. Human or animal ethical approval was not required.

Primary outcomes

Critical outcomes were evaluated through an online survey of panel participants who were asked to rank the importance of the following outcomes on a 1 (unimportant) to 9 (very important) scale. The panel consisted of veterinary dentists ($n=5$), general practitioners ($n=2$) and veterinary internists ($n=2$). The following outcomes were queried as follows: mortality, infectious endocarditis, bacteraemia, sepsis, local tissue inflammation, local tissue infection, abscess

development, other infectious sequelae and adverse effects. Sepsis, infective endocarditis, local tissue infection and adverse events were included as critical outcomes (median score 7 to 9). While bacteraemia is not a direct clinical outcome and would be of limited use for guideline development, it was included to provide background information and because of the a priori assumption that it might provide the most data and that there could be value in evaluating it as a proxy measure if clinical outcome data were lacking.

Search methods

Web of Science, Medline (*via* OVID) and CAB Abstracts were searched (Supplementary Data 1 – Appendices 1 and 2). There were no language or year limits. Reference lists of included manuscripts were also searched for any additional relevant citations.

Selection of studies

Search results were imported into Covidence for Level 1 (Title and Abstract) and Level 2 (full-text) screening. Two reviewers evaluated each reference. Consensus was generated for any conflicts by discussion of the two reviewers, who were blinded to their original assessment. After approximately 10% of the title/abstract search was performed by the two reviewers, a calibration step was performed to evaluate agreement. If less than 90% agreement was achieved, the inclusion and exclusion criteria would have been evaluated by the reviewers.

Review 1: Endocarditis, bacteraemia and sepsis in dogs and cats that undergo dental procedures.

Level 1: Title and abstract screening were performed using the following criteria:

1. Does the title and/or abstract describe the occurrence or incidence of bacteraemia, sepsis or endocarditis associated with dental procedures in dogs or cats?
2. Is the reference a randomised controlled trial, cohort, case–control study, case series or conference research abstract, or is it a treatment guideline or a peer-reviewed review article (for reference list screening)?

Full texts were obtained for references that fulfilled Level 1 criteria. Full texts were screened by two reviewers using the following criteria:

1. Is the reference a randomised controlled trial, cohort, case–control study, case report or case series, or conference research abstract?
2. Does the study describe the occurrence or incidence of bacteraemia, sepsis or endocarditis associated with dental procedures in dogs or cats?
3. Is the full text available?

Review 2: Efficacy of antimicrobial prophylaxis for dental procedures in dogs and cats.

Level 1

1. Does the title and/or abstract describe the use of antimicrobials in dogs and/or cats undergoing professional dental cleaning/COHAT (comprehensive oral health assessment and treatment), with or without extractions?
2. Is the reference a randomised controlled trial, cohort, case–control study, case series or conference research abstract, or is it a treatment guideline or a peer-reviewed review article (for reference list screening)?

Level 2

1. Is the full text available?
2. Is the reference a randomised controlled trial, cohort, case–control study or case series, or conference research abstract?
3. Does the study describe the use of antimicrobials peri- and/or post-procedurally for undergoing professional dental cleaning/COHAT, with or without extractions in dogs and/or cats?
4. Are one or more of the following infectious outcomes reported: local infection, bacteraemia, infectious endocarditis, sepsis?

Data extraction and management

Data were extracted by two reviewers ([JSW and HEW] for Review 1, [JSW and KS] for Review 2). Retrieved data included study characteristics (authors, date of publication, year or year range, country, type of report (randomised controlled trial, cohort study, case–control study, case series, case report)), population characteristics (number of patients, age, procedure(s), comorbidities or risk factors), intervention (peri-operative antimicrobial regimens (dose, duration, timing), other treatments, post-operative antimicrobial regimens (dose, duration), follow-up method), comparison (type of control, *e.g.* placebo) and outcome (incidence of infectious complications (infective endocarditis, sepsis, bacteraemia)). Case reports were included in Review 1 to describe reported putative risk factors or adverse event outcomes. Because of the likelihood of publication bias in case reports and small case series, case reports and case series of <10 animals were not included for PICO, PECO and CoCoPop questions.

Assessment of risk of bias of included studies

Risk of bias in randomised controlled trials was assessed by two reviewers (JSW and KS) using the Cochrane Risk of Bias 2 (RoB 2) tool (Higgins et al., 2011; Sterne et al., 2019). Risk of bias for incidence studies was performed using the ROBINS-E tool (Higgins et al., 2024). Results were visualised using the Robvis tool (https://www.riskofbias.info/welcome/robvis-visualization-tool) and RevMan Web (The Cochrane Collaboration, Available at revman.cochrane.org).

Effect measures and data synthesis methods

Data were described. Within-study data for studies with different groups were combined for pooled prevalence estimation. For studies that reported multiple observation points, overall prevalence (bacteraemia at any timepoint) was included. If that was not reported, the timepoint with the highest prevalence was included. Pooled prevalence estimation was performed using a random-effects model with a double arcsine (Freeman–Tukey)

transformation for stabilisation of variance across studies using the metaprop function from the meta package in R. A random-effects model was employed, using the inverse variance method, with the DerSimonian–Laird estimator for between-study variance. The Hartung–Knapp adjustment was applied to improve the accuracy of confidence intervals. Forest plots were generated to visualise pooled estimates, with 95% confidence intervals, both overall and for relevant subgroups.

For evaluation of PECOs and PICOs, risk ratio and 95% confidence interval were calculated using a random-effects model. Results were presented as Forest plots. Analysis was performed using Revman (Review Manager. Version 9.5.2. The Cochrane Collection. Available at revman.cochrane.org).

Certainty of evidence

The GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) approach was used to assess certainty of evidence for PICO 1 (Guyatt et al., 2025). Certainty of evidence judgements were made by the author team (two reviewers independently with consensus). We did not establish clinical thresholds (trivial, small, moderate and large) with stakeholders, but for the forthcoming clinical guideline certainty assessments will be made together with a guideline panel. Imprecision for PICO 1 was judged by JSW and KS using clinical judgement applied to the absolute risk difference (per 1000 animals) and its 95% confidence interval. GRADEpro (https://www.gradepro.org) was used to calculate the absolute effect and produce a summary of findings table.

Updating of the search

The search was repeated on February 5, 2026, using the same search strategy as described above.

RESULTS

For Review 1, a total of 362 references were screened: 170 from Web of Science, 108 from Medline, 80 from CAB Abstracts and four from reference list reviews (Fig 1). Twelve relevant studies were identified: two randomised controlled trials (RCTs), five cross-sectional studies, one case–control study and four case reports.

For Review 2, 3031 references were screened: 1172 from Web of Science, 1222 from Medline, 636 from CAB Abstracts and one from reference list review (Fig 2). Three RCTs were identified. However, data extraction was not performed for one because of a lack of specific data for outcomes of interest. No additional eligible references were identified when the search was updated.

Results pertaining to the specific CoCoPop, PICO and PECO questions are addressed below.

CoCoPop 1: in dogs and cats undergoing dental procedures, what is the incidence of bacteraemia, sepsis or endocarditis?

No studies clearly reported sepsis or infective endocarditis data. One study (Blazevich & Miles, 2024) reported follow-up 2 weeks after the procedure to assess the oral cavity, where it is reasonable to assume that systemic consequences would also have been noted. Another indicated owners were contacted by telephone after discharge from hospital but no timeframe or other details were provided (Harari & Gustafson, 1991). No post-operative complications were reported among 33 dogs between the two studies.

As a result of the limited of data pertaining to clinical outcomes, bacteraemia was used as a surrogate outcome. Seven studies evaluated the incidence of bacteraemia following dental procedures, two RCTs and five observational studies (Table 1). The overall pooled prevalence was 47% (95% confidence interval 23% to 74%), with two studies being obvious outliers (Black et al., 1980; Nieves et al., 1997) (Fig 3). There were no apparent explanations for why these were outliers. Bacteria that were identified in the four studies that reported specific bacterial data (Blazevich & Miles, 2024; Harari et al., 1993; Nieves et al., 1997) are listed in Table 2.

Two studies investigated both dogs undergoing dental procedures and controls. Neither showed a clear effect of dental procedure on bacteraemia, in large part because of the high reported bacteraemia rate in dogs that did not undergo a dental procedure.

PECO 1: in dogs and cats undergoing dental procedures, does peri-procedural bacteraemia increase the risk of endocarditis, sepsis or other infectious sequelae?

There was limited investigation of the clinical implications of bacteraemia. Two studies noted above (Blazevich & Miles, 2024; Nieves et al., 1997) reported limited follow-up data and no complications were reported on the 22 dogs with bacteraemia or the 11 dogs without. Analysis was not performed because of the limited data.

Background question: in dogs and cats undergoing dental procedures, what are risk factors for bacteraemia, sepsis or endocarditis?

One case–control study evaluated the association of numerous factors, including recent dental procedures, with endocarditis through study of 76 dogs with endocarditis and 80 controls (Peddle et al., 2009). None of the dogs with endocarditis had undergone a dental procedure in the preceding 3 months.

Four case reports were identified. Details are presented in Table 3. These described potential risk factors in individual cases but cannot provide any evidence linking putative risk factors with disease.

Bacteraemia was not associated with any clinical consequences based on these data, but there was very limited information and a very low level of certainty of evidence.

PICO 1: in dogs and cats undergoing dental procedures, does peri-procedural administration of antimicrobials reduce the incidence of endocarditis, sepsis, bacteraemia or other infectious complications?

No studies that evaluated the impact on endocarditis, sepsis or other infectious complications were identified. Two studies used bacteraemia as the outcome. One RCT evaluated the impact of clindamycin

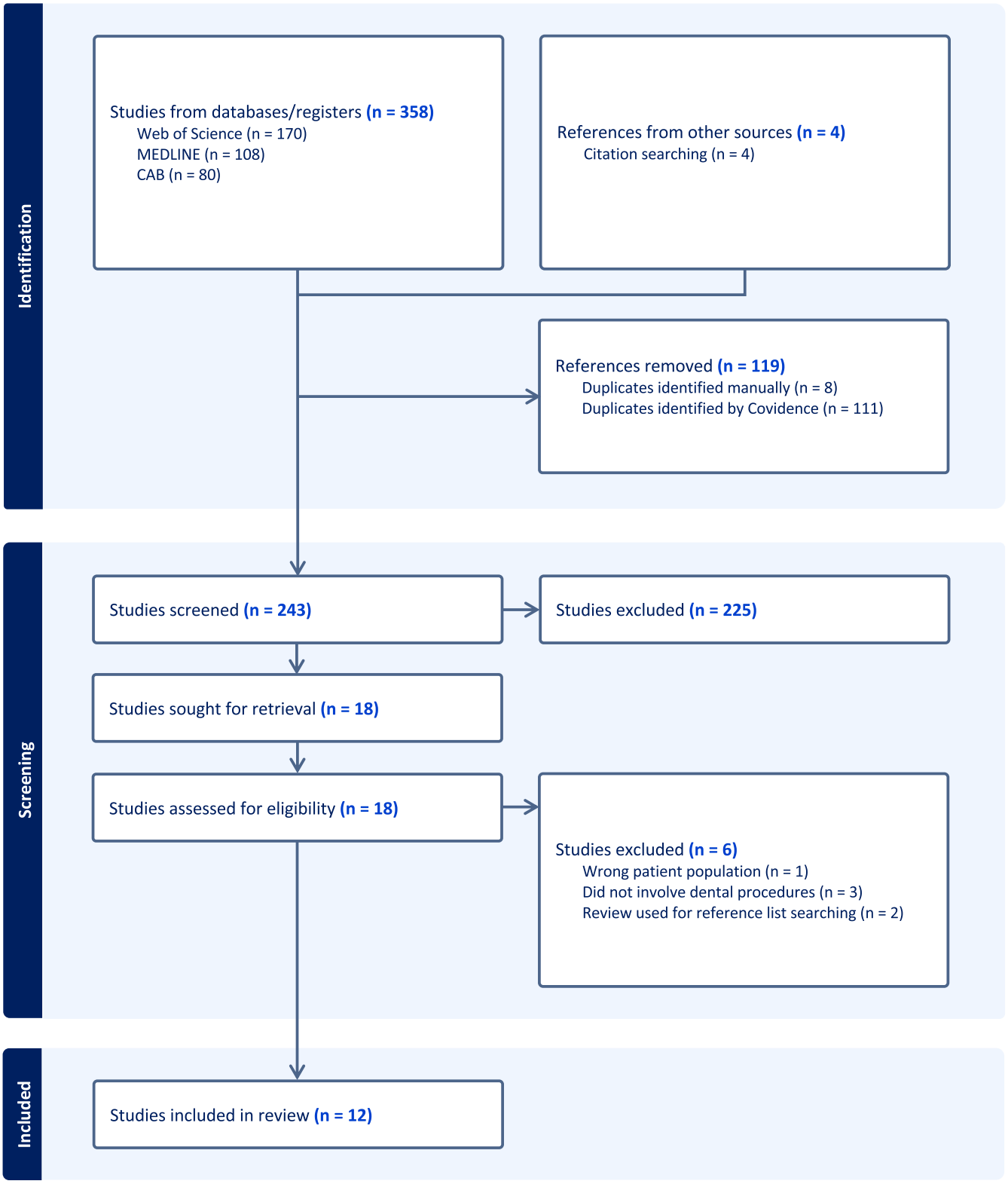

FIG 1. PRISMA diagram outlining the search and screening process for Review 1; a systematic review of endocarditis, bacteraemia and sepsis in dogs and cats that undergo dental procedures.

(5.5 to 11 mg/kg q24h for 5 days) prior to dental scaling in dogs with periodontitis on bacteraemia, compared to chlorhexidine rinse and untreated controls (Bowersock et al., 2000). The sample size was small ($n = 8$ per group) and there was no identifiable impact of clindamycin treatment on bacteraemia immediately after completion of the procedure on the first side of the mouth (3/8 (38%) in

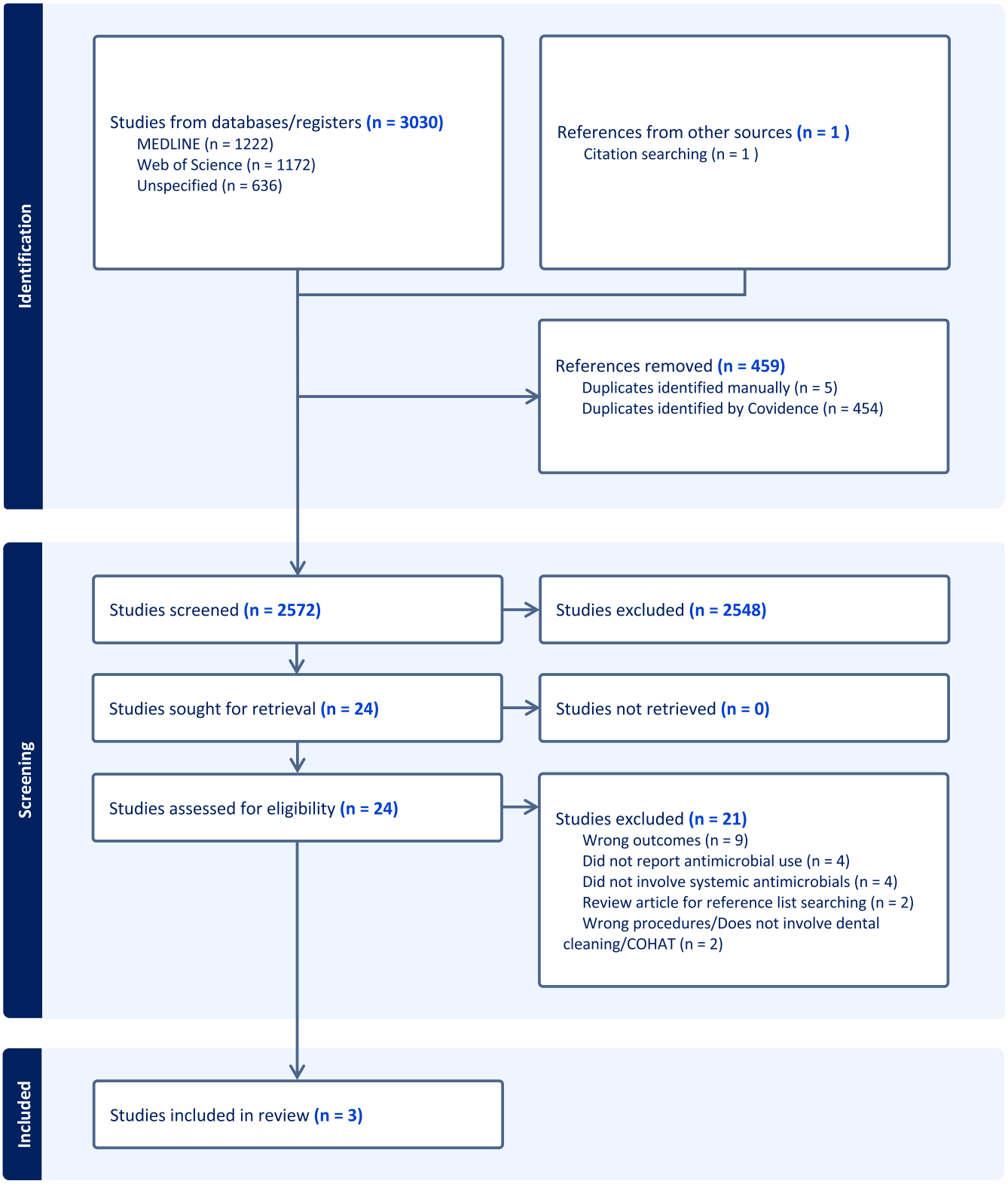

FIG 2. PRISMA diagram outlining the search and screening process for Review 2; a systematic review of the efficacy of antimicrobial prophylaxis for dental procedures in dogs and cats.

the clindamycin group *vs.* 0/8 (0%) in the control group, $P=.2$), after the second side of the mouth (0/8 in the clindamycin group *vs.* 2/8 (25%) in the control group, $P=.47$) or cumulatively (3/8 (38%) in the clindamycin group *vs.* 2/8 (25%) in the control group, $P=1.0$) (Fig 4). There was no indication of follow-up to evaluate the clinical impact of bacteraemia.

Table 1. Studies reporting the incidence of bacteraemia in dogs and cats following dental procedures

	Species	Dental disease	Dental procedure	*N*	Bacteraemia	Prevalence
Blazevich and Miles (2024)	Canine	Mild to severe periodontitis	Scaling, root planing, extractions	13	5 minutes after starting scaling and probing	2 (15%)
				13	5 minutes after first extraction	5 (38%)
				13	End of all procedures	1 (7.7%)
				13	1 hour post procedures	0
				13	Any timepoint	5 (38%)
Harari and Gustafson (1991)	Feline	Periodontal disease	Scaling and extraction	11	Pre-anaesthesia	0
					Any timepoint	4/11 (36%)
Harari et al. (1993)	Canine	Requiring extractions	Scaling, simple extractions	30	Any timepoint	9 (30%)
		Anaesthesia, no procedures	NA	15	Any timepoint	5 (33%)
		Sedation, no procedures	NA	15	Any timepoint	5 (33%)
Nieves et al. (1997)	Canine	Variable, research colony dogs	Supragingival and subgingival scaling, root planning, gingival curettage	20	Within 20 minutes of start of procedure	17 (85%)
					10 minutes after completion of the procedures	1 (5%)
Ramos et al. (2011)	Canine	Moderate to severe periodontitis	Scaling and root planning ($n=6$), extraction ($n=7$)	13	After anaesthetic induction	2 (15%)
					Immediately after procedure	5 (38%)
					30 minutes after procedure	3 (23%)
		None ($n=6$) or mild gingivitis ($n=5$)	None (controls)	11	Two samples 30 minutes apart	3 (27%)
						1 (9%)
		Severe gingivitis	None (feeding only)	6	Immediately after feeding/30 minutes after feeding*	2 (33%)
						2 (33%)
						1 (16%)
		Severe gingivitis	None (tooth brushing)	7	Before tooth brushing	0
					Immediately after tooth brushing	2 (29%)
					30 minutes after teeth brushing	2 (29%)

*2 sampling times were indicated but three undifferentiated timepoint results were reported. First sampling timepoint might be before feeding

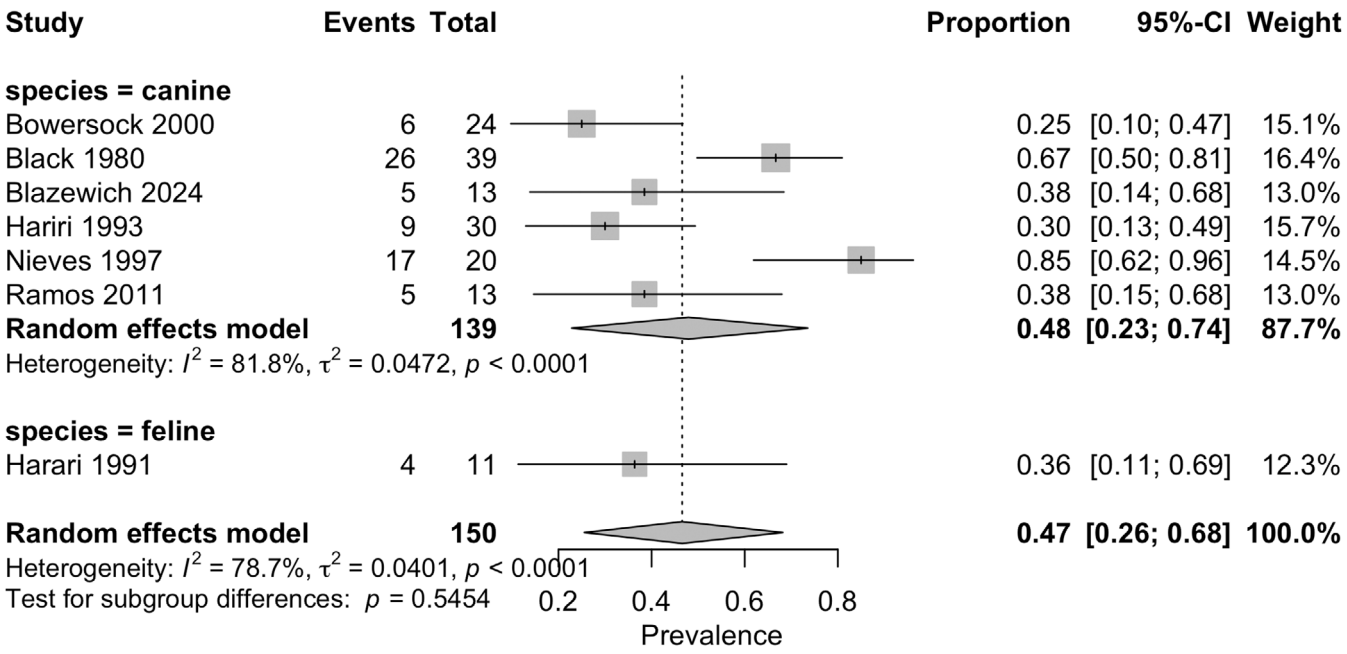

FIG 3. Meta-analysis presenting the pooled prevalence and 95% confidence intervals for bacteraemia associated with dental procedures in dogs and cats.

The other RCT evaluated the impact of prophylactic crystalline penicillin (40,000 IU/kg) on bacteraemia in dogs undergoing ultrasonic teeth scaling and extractions (Black et al., 1980). The sample size was larger than the other RCT but was still modest, with 22 treated and 17 untreated dogs. Blood samples were collected 5 and 30 minutes after completion of the procedure. Bacteraemia at any timepoint was identified in 15/22 (68%) treated dogs and 11/17 (65%) controls. Statistical analysis was not reported in the paper, but no significant difference is present with these data (chi square $P=.82$).

The only available outcome was bacteraemia. The absolute effect of peri-procedural antimicrobials on bacteraemia was 47 more per 1000 animals treated, with a 95% CI from 156 fewer to 348 more per 1000 animals. This was judged unacceptably wide for decision-making and we downgraded two additional levels for imprecision. It was also downgraded two levels for indirectness

due to serious concerns that this surrogate outcome may not translate into effects on patient-important outcomes such as infective endocarditis, sepsis and local infectious complications. Together with some concerns for risk of bias in both trials (Fig 5), the overall certainty of evidence for PICO 1 was rated very low. Final certainty ratings will be confirmed by the guideline panel in the subsequent guideline development process.

PICO 2: in dogs and cats undergoing dental procedures, does post-procedural administration of antimicrobials reduce the incidence of endocarditis, sepsis, bacteraemia or other infectious complications?

No data were available to assess this question.

Table 2. Bacteria isolated on blood culture from dogs and cats after dental procedures

Species	Bacterium (*n*)*
Canine	*Pasteurella* spp. (8) *Pseudomonas* spp. (7) *Streptococcus* sp. (5) *Bacteroides* spp. (5) *Actinomyces* spp. (4) *Corynebacterium* sp. (4) *Pasteurella/Actinobacillus* spp. (3) *Clostridium* spp. (2) *Propionibacterium* spp. (2) *Staphylococcus* sp. (1) *Moraxella* sp. (1) *Neisseria* sp. (1) *Peptostreptococcus* sp. (1) *Porphyromonas* sp. (1) *Prevotella* sp. (1) *Fusobacterium* sp. (1) *Lactobacillus* sp. (1)
Feline	*Propionibacterium acnes* (2) *Pasteurella multocida* (1) *Staphylococcus epidermidis* (1)

*One study, Nieves et al. (1997), only reported isolates that were found both in blood and plaque

DISCUSSION

Limited data are available regarding dental procedure-associated endocarditis, sepsis or bacteraemia. There was no information about the efficacy of dental prophylaxis for clinically relevant outcomes such as endocarditis, sepsis or local infections. As a result, bacteraemia was studied as a surrogate outcome. This review can conclude that bacteraemia is common following, during and shortly after dental procedures, but that bacteraemia rates may decline shortly after completion of the procedure. However, the value of bacteraemia as an outcome measure that should be used to assess risk or guide antimicrobial decisions is questionable as no data were identified that demonstrated a clinical impact of bacteraemia. Indeed, the high pooled prevalence for a common veterinary procedure where anecdotally significant clinical consequences are rarely reported highlights the fact that bacteraemia is likely a common and most often clinically inconsequential event. The case–control study that did not show any association between recent dental procedures and infective endocarditis further supports that assumption. It is reasonable to extrapolate a risk of bacteraemia for some specific subpopulations from humans (*e.g.* individuals with significant structural cardiac defects), given similarities in dental procedures and presumably similar consequences of bacteraemia. Yet, direct data are lacking and study of the risk of clinically relevant outcomes in these subpopulations is needed. These major evidence gaps complicate assessment of optimal practices and development of evidence-based guidelines and are particularly concerning given the commonness of dental disease and dental procedures.

Despite the assumed association between dental procedures and bacteraemia, this review did not identify clear supportive evidence, although bacteraemia was common. Two studies included dogs that had not undergone a dental procedure, and bacteraemia rates of up to 33% were reported. Whether this indicates the commonness of transient bacteraemia, concerns about contamination and false positive results, or other issues, is unclear. As a result, all that

Table 3. Case reports of septic sequelae in dogs and cats after having undergone dental procedures

Species	Age	Dental procedure	Comorbidities	Peri-procedural antimicrobial prophylaxis	Clinical complication	Outcome	Onset time after procedure	References
Feline	9 years	Scaling and extractions	Stomatitis	Clindamycin for 3 days before until 10 days after	Pericarditis, *Peptostreptococcus* spp.	Recovered	Unclear onset, Examined 4 months after procedure	Lobetti (2007)
Feline	8 years	Scaling	Severe dental disease	Amoxicillin for 5 days prior to 3 days after, peri-procedure single dose ampicillin	Pneumonia, *Salmonella choleraesuis*	Recovered	1 week, examined 7 weeks after procedure	Rodriguez et al. (1993)
Feline	8 years	Full mouth extractions	Tooth root abscesses involving all teeth	Enrofloxacin + clindamycin	Endophthalmitis, *Actinomyces*	Enucleation. Recovered	Next day	Westermeyer et al. (2013)
Canine	9 years	Scaling	Mitral valve regurgitation secondary to myxomatous valvular degeneration	No	Mitral valve endocarditis. *Streptococcus bovis* blood culture	Died. Chronic myxomatous valvular degeneration and secondary valvular endocarditis	"Immediately". Examined 3 days later	Tou et al. (2005)

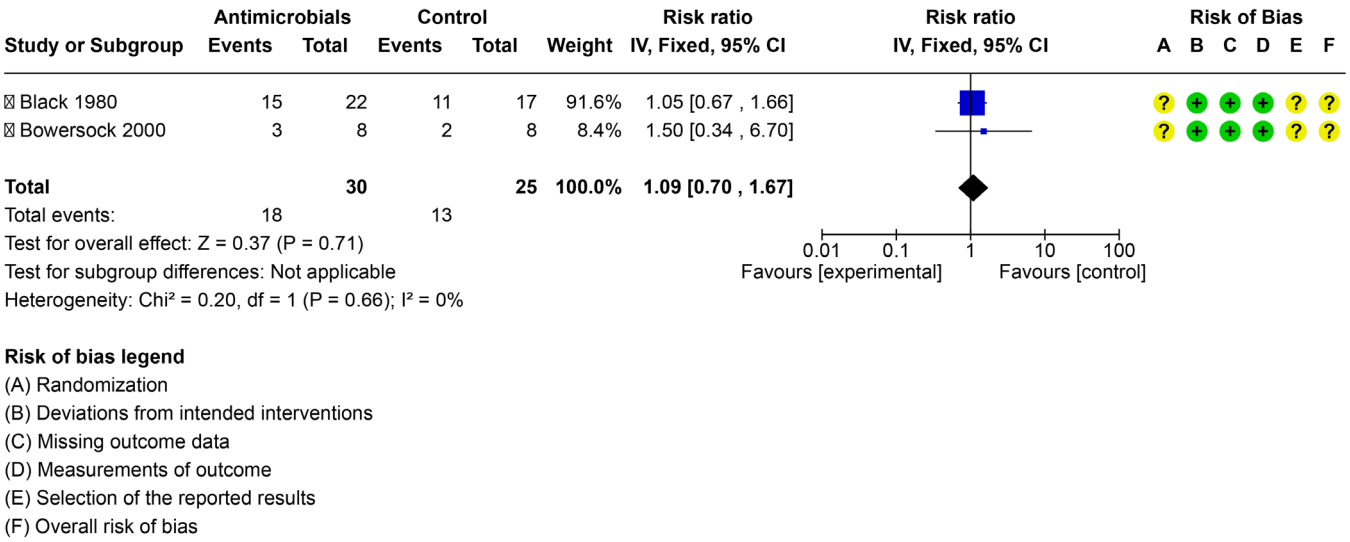

FIG 4. Forest plot and risk of bias assessment of a randomised controlled trial evaluating the impact of peri-procedural antimicrobials on bacteraemia in dogs.

Certainty assessment							№ of patients		Effect		Certainty	Importance
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	prophylactic antimicrobials	no antimicrobials	Relative (95% CI)	Absolute (95% CI)		
Infectious sequela (SSI, endocarditis, sepsis)												
2	randomised trials	serious	not serious	very serious	extremely serious	none	18/30 (60.0%)	13/25 (52.0%)	**RR 1.09** (0.70 to 1.67)	**47 more per 1,000** (from 156 fewer to 348 more)	⨁◯◯◯ Very low	

CI: confidence interval; **RR:** risk ratio

FIG 5. Certainty of evidence assessment for meta-analysis of the effect of antimicrobial prophylaxis on bacteraemia in dogs and cats undergoing dental procedures.

can be stated with certainty is that bacteraemia is common in animals undergoing dental procedures. Risk factors and, most importantly, clinical consequences remain inadequately studied.

Antimicrobials are widely used in veterinary dentistry and are likely profoundly overused (Hardefeldt et al., 2017; Soltero-Rivera et al., 2024; Volk et al., 2025). Antimicrobial stewardship efforts in humans have focused on restricting antimicrobials to very defined, high-risk populations, mainly individuals with severe structural cardiac defects, prior infective endocarditis or implanted materials. Analogues of these would rarely be encountered in veterinary practice. The two RCTs that evaluated the impact of antimicrobial prophylaxis on bacteraemia (Black et al., 1980; Bowersock et al., 2000) were both small, did not identify a beneficial effect and were deemed to be of very low certainty. Larger controlled trials, ideally including study of potential higher risk populations, are needed.

Ultimately, there is a need for larger longitudinal studies with robust follow-up to determine the clinical relevance of bacteraemia. Further, there is a need for specific study of potential high-risk groups, including animals with cardiac disease, immunocompromised individuals, and those with orthopaedic implants, groups that are more likely to receive antimicrobial prophylaxis (Soltero-Rivera et al., 2024).

Only two randomised controlled trials were identified (Black et al., 1980, Bowersock et al., 2000), and the small sample sizes limit conclusions that can be drawn about the impact of antimicrobials on bacteraemia associated with dental procedures due to the limited power of the statistical tests to detect significant differences. The case–control and incidence studies provided some insight but very low certainty data.

Data on endocarditis were very limited, despite endocarditis risk being a driving factor for peri-dental antimicrobial prophylaxis. The case–control study of dogs with and without endocarditis (Peddle et al., 2009) did not identify a history (past 3 months) of recent dental procedures in any dogs with (or without) endocarditis. This could suggest that dental procedures are not a dominant risk factor for endocarditis, but data are inadequate to properly assess risks from dental procedures.

In humans, there is a clear association between invasive dental procedures and infective endocarditis in high-risk populations (Kussainova et al., 2024; Sperotto et al., 2024). No data were identified in these reviews to define "high risk" for dogs and cats.

It is reasonable to assume that similar risks are present in comparable companion animal populations undergoing comparable dental procedures, but this cannot be assured, and species- and procedure-specific study is desirable. The lack of direct evidence of the risk and information of the effectiveness of mitigation approaches complicates routine patient management, as well as clinical guideline development.

Case reports provide very low-level data but can be useful in the absence of other data for background and hypothesis generation. A variety of clinical outcomes were reported with a variety of microorganisms, including those found commonly in the oral cavity (*Streptococcus, Peptostreptococcus, Actinomyces*), as well as a gastrointestinal organism (*Salmonella*). An actual link with the dental procedure cannot be determined with case reports, but the organisms and timing are supportive for the three animals with infections caused by oral microorganisms. Perhaps the strongest link was the case report in a dog that had underlying valvular disease and which developed infective endocarditis from *Streptococcus bovis*, as streptococci are common oral commensals in dogs (Elliott et al., 2005; Flancman et al., 2018) and are also implicated in infective endocarditis in humans (Chamat-Hedemand et al., 2023). This was the only one of the four case reports where peri-procedural prophylaxis was not administered and could perhaps have been the case where it would have been most justifiable given the presence of underlying valvular disease. However, in humans, while antimicrobial prophylaxis was previously recommended for patients with myxomatous mitral valve disease (Dajani et al., 1997), this is no longer recommended in the absence of other complications such as previous infective endocarditis (Nishimura et al., 2017). In the report of *Salmonella* pneumonia, the authors postulated that pre-operative antimicrobials might have facilitated overgrowth of *Salmonella* (Rodriguez et al., 1993). However, when one considers the commonness of dental procedures, it is reasonable to presume that if infectious complications were not very rare, there would be more case reports in the veterinary literature. While absence of evidence *versus* evidence of absence cannot be properly inferred, the limited number of case reports perhaps adds more weight to the hypothesis that significant clinical complications are very rare.

Numerous information gaps exist. More data were available for dogs than cats. Peri-operative prophylaxis guidance for small animals (Bellows et al., 2019; Niemiec et al., 2020) has not differentiated between dogs and cats but data are lacking to evaluate whether this is appropriate. There are plausible differences in risk because of different oral microbiotas and differences in dental diseases between dogs and cats that could result in different risks. Further, there was very limited information to assess the clinical ramifications of peri-dental bacteraemia. While bacteraemia rates were often high, clinical consequences were not reported. It was unclear whether this was because of a lack of disease or limited duration of post-procedural surveillance. As indicated by the case reports, dental-associated bacterial diseases can develop within 24 hours of the procedure but may also have a slow or more insidious onset. Study with longer and more clearly defined, active surveillance is required to better understand the clinical risks.

Despite the commonness of dental disease and dental procedures in dogs and cats, there is a paucity of literature describing clinically relevant infectious complications and prevention approaches. The role of antimicrobial prophylaxis is inadequately defined. This review highlights significant knowledge gaps that hamper evidence-based approaches to prevention of dental procedure-associated infectious consequences.

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Author contributions

H. E. Weese Investigation; methodology; writing – review and editing. **J. S. Weese** Conceptualization; investigation; writing – original draft; methodology; validation; writing – review and editing; formal analysis; project administration; data curation. **M. Soltero-Rivera:** Conceptualization; investigation; writing – review and editing. **K. Scahill:** Investigation; writing – review and editing; methodology; validation; formal analysis.

Conflict of interest

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Artificial intelligence disclosure

The authors did not use the assistance of any Artificial Intelligence Generated Content (AIGC) tools to develop any portion of the manuscript.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Appendix S1.