

2022 AAFP/AAHA Antimicrobial Stewardship Guidelines

Erin Frey, DVM, MPH, DACVPM[†], Michael Costin, DVM, MBA, Jennifer Granick, DVM, MS, PhD, DACVIM (Small Animal Internal Medicine), Matthew Kornya, BSc, DVM, J. Scott Weese, DVM, DVSc, DACVIM, FCAHS

Introduction

The Antimicrobial Stewardship Guidelines in companion animals are designed to aid practicing veterinarians in choosing appropriate antimicrobial therapy to best serve their patients and minimize the development of antimicrobial resistance and other adverse effects. The Guidelines presented below were developed by an expert task force and provide a recommended framework for judicious antimicrobial use in companion animals.

Position Statement

Antimicrobial stewardship, as defined by the American Veterinary Medical Association (AVMA), refers to the actions veterinarians take individually and as a profession to preserve the effectiveness and availability of antimicrobial drugs through conscientious oversight and responsible medical decision-making, while safeguarding animal, public, and environmental health. Stewardship involves:

- Preventing common diseases through preventive and management strategies.
- Using evidence-based approaches to make decisions about antimicrobial drugs.
- Using antimicrobial drugs judiciously and sparingly while evaluating therapeutic outcomes.¹

The American Animal Hospital Association (AAHA) and the American Association of Feline Practitioners (AAFP) endorse this definition and urge companion animal veterinarians to follow the five core principles of antimicrobial stewardship as defined by the AVMA: commit to stewardship, advocate for a system of care to prevent common

diseases, select and use antimicrobial drugs judiciously, evaluate antimicrobial drug use practices, and educate and build expertise.²

Veterinarians agree to protect animal and public health when they pledge the Veterinarian's Oath. It is the responsibility of veterinarians to maintain patient health by routine examinations, preventive strategies, and client education. When a medical condition exists, it is important to obtain an accurate clinical diagnosis whenever possible, including determining the likelihood of a bacterial infection that warrants antimicrobial use. Once the decision is made to use antimicrobial therapy, veterinarians should strive to optimize therapeutic efficacy, minimize resistance to antimicrobials, and protect public and animal health.

AAHA and the AAFP are committed to the following as described by the AVMA's policy, Judicious Therapeutic Use of Antimicrobials.³

Judicious Therapeutic Use of Antimicrobials in Cats and Dogs

Judicious use of antimicrobials in animals requires the oversight of a veterinarian.

- Judicious use of antimicrobials and extralabel use of antimicrobials should meet all requirements of a valid veterinarian-client-patient relationship (VCPR—see glossary).

Preventive strategies, such as appropriate husbandry and hygiene, routine health monitoring, and vaccinations, should be emphasized.

Routine preventive healthcare in cats and dogs includes the following:

AFFILIATIONS

Assistant Research Professor, Department of Clinical Sciences, College of Veterinary Medicine, North Carolina State University (E.F.); Assistant Director, Division of Animal and Public Health, American Veterinary Medical Association (M.C.); Associate Professor, Department of Clinical Sciences, College of Veterinary Medicine, University of Minnesota (J.G.); ACVIM (SAIM) Resident, Ontario Veterinary College, University of Guelph (M.K.); Professor, Ontario Veterinary College and Director, Centre for Public Health and Zoonoses, University of Guelph (J.S.W.)

Correspondence: erin_frey@ncsu.edu

[†] E. Frey is the chair of the AAFP/AAHA Antimicrobial Stewardship Guidelines Task Force.

IDEXX Laboratories, Inc. and Zoetis generously supported the development of the 2022 AAFP/AAHA Antimicrobial Stewardship Guidelines and resources through an educational grant to AAHA.

- Adherence to the AAEP's guidelines for feline vaccinations and AAHA's guidelines for canine vaccinations.
- Parasite control, nutritional counseling, and dental health care.
- Client education and involvement to successfully adopt good preventive health care programs.
- Appropriate hygiene and husbandry is especially important in multiple pet households.

The routine prophylactic use of antimicrobials should never be used as a substitute for good animal health management.

- The use of antimicrobials to prevent infection (e.g., prophylaxis)⁴ can only be justified in cases where bacterial infection is likely to occur or where the implications of infection are particularly high (e.g., central nervous system surgery).

Recognize risk factors for infections in cats and dogs and prevent or correct them whenever possible. These include, but are not limited to:

- Urinary catheterization
- Intravenous catheters
- Wounds
- Environmental factors (i.e., stress, crowding, poor hygiene, transportation, temperature extremes, poor ventilation, and high humidity)
- Feline leukemia virus, feline immunodeficiency virus infection, or debilitating disease
- Immunosuppressive drugs (e.g., chemotherapeutic agents and glucocorticoid therapy)
- Endocrine diseases (i.e., diabetic cats are more prone to urinary tract, skin, and mouth infections; dogs with hyperadrenocorticism are more prone to skin and urinary tract infections)

Therapeutic alternatives should be considered before, or in conjunction with, antimicrobial therapy.

- This includes supportive care, such as correction of fluid and electrolyte abnormalities, maintaining acid-base balance, and ensuring adequate nutrition.
- Surgical intervention may be necessary in some cases, such as abscessation, empyema, or other diseases requiring source control.
- Consider supportive care, including dietary therapy and probiotics for acute, nonfebrile diarrhea.^{5,12,13}
- Consider antiseptic preparations and topical (e.g., skin) or locally applied antimicrobials (e.g., oral cavity) as alternatives to systemic antimicrobials.^{6,7}

Considerations should be made whether to delay or alter antimicrobial therapy based on patient status.

- Use delayed prescribing or watchful waiting if a patient's disease might not be caused by a bacterial infection or in certain situations in which patients are expected to clear an infection on their own.
- Reassess the need for and choice of antimicrobial drugs throughout the course of therapy (antimicrobial "time out").^{2,8}

Therapeutic antimicrobial use should be confined to appropriate clinical indications.

- A definitive diagnosis that indicates antimicrobial therapy is appropriate should be established whenever possible, and empirical use of antimicrobials should be avoided.
- Practitioners should strive to rule out viral infections, parasitism, mycotoxicosis, nutritional imbalances, neoplasia, and other ailments that will not respond to antimicrobial therapies.
- Antimicrobial therapy is not indicated in most upper respiratory infections (e.g., feline herpesvirus or calicivirus and canine infectious respiratory disease complex) not suspected to be complicated by secondary bacterial infection.
- Most cases of pancreatitis in dogs and cats are not associated with bacterial infection.
- Most cases of feline lower urinary tract disease do not involve bacterial infection, particularly in cats younger than 10 years of age, and in such cases, antimicrobials are not indicated.
- Systemic antimicrobials are usually not indicated for routine dental prophylaxis or after tooth extractions. In cases of periodontitis, systemic antimicrobials are not a substitute for surgical treatment. In most cases of periapical tooth root abscesses, debridement of infective tissue is sufficient to control infection.⁹
- Most cases of acute diarrhea are not due to pathogenic bacterial infections or are self-limiting, so antimicrobials are not indicated, do not hasten time to clinical resolution, and may cause further dysbiosis.¹⁰⁻¹³

Therapeutic antimicrobial use should be applied appropriately in the surgical setting.

- Administration of antimicrobials should not replace appropriate sterile technique.
- Surgical antimicrobial prophylaxis is the use of a very brief course of an antimicrobial agent initiated 30–60 minutes before the first incision. Surgical antimicrobial prophylaxis is not usually needed for clean procedures.
- Sterile technique and proper tissue handling should eliminate the need for prophylactic antibiotics in ovariohysterectomies, orchietomies, and most other sterile procedures.
- Ongoing postoperative antimicrobial therapy is rarely required.¹⁴

Antimicrobials considered important in treating refractory infections in human or veterinary medicine should be used in animals only after careful review and reasonable justification.

- Consider using other antimicrobials for initial therapy.
- Drug side effects or interactions should be considered when choosing an appropriate antimicrobial.
- Ensure any use of antimicrobials considered important in treating refractory infections is supported by the lack of another antimicrobial option, the presence of cytology, culture and susceptibility testing, and a reasonable chance for a cure. Consultation with an expert in infectious disease and antimicrobial therapy should be undertaken when appropriate and available.^{7,15-19}

Diagnostic testing, including culture and susceptibility testing, aids in the appropriate selection of antimicrobials.

- When a urinary tract infection (UTI) (also known as bacterial cystitis) is suspected, urine collected by cystocentesis can help distinguish true bacteriuria from contamination but is not able to distinguish infection from subclinical bacteriuria.
- Poor urine concentrating ability is a risk factor for bacteriuria. Urine culture coupled with the presence of lower urinary tract signs may be the only way to identify infection in such cases.¹⁵
- The presence of bacteriuria, in the absence of lower urinary tract signs, does not necessarily indicate a UTI and is considered subclinical bacteriuria, which generally does not require antimicrobial treatment.¹⁵
- Antimicrobial susceptibility testing to provide an interpretation of susceptible, intermediate, or resistant to antimicrobial drugs should be done to guide the selection of antimicrobials. Veterinarians should ensure that their reference laboratories use species-specific (i.e., cats and dogs) susceptibility testing breakpoints where available.
- Performing cytological evaluation of patient samples or body sites is important in advance of and as a complement to culture and antimicrobial susceptibility testing.
- Because certain antimicrobials are more effective against gram-positive or gram-negative organisms, interim antimicrobial decisions can be based on gram stain and the site of infection.

Regimens for therapeutic antimicrobial use should be optimized using current pharmacological information and principles.

- The antimicrobial chosen should be effective against the organism and be able to penetrate the affected body site in an adequate concentration to eliminate the offending organism.
- Consider the intrinsic resistance of pathogens to antimicrobials.^{20,21}
- Consider patient- and site-specific factors that may limit response to antimicrobial therapy (e.g., protected body site and local tissue factors).¹⁹
- Consider patient factors that may influence drug metabolism (e.g., renal or hepatic disease) or concurrent medications that may affect drug levels.
- For information on dose, route, frequency, and duration of administration, refer to label indications, laboratory standards, and current guidelines from veterinary professional organizations.
- Risks to patients from antimicrobials should be considered and discussed with owners before use (e.g., enrofloxacin-induced retinotoxicity and aminoglycoside-induced nephrotoxicity).

Duration of therapy should be based on scientific and clinical evidence in order to obtain the desired health outcome while minimizing selection for antimicrobial resistance.

- For specific conditions, refer to appropriate resources and consensus guidelines.^{7,15,16}

Antimicrobial therapy must be prescribed in accordance with all local, state, and federal laws (e.g., extralabel usage in the United States).

Accurate records of treatment, outcome, and indication for use should be maintained to evaluate therapeutic regimens.

Veterinarians should work with animal owners and caretakers to ensure the judicious use of antimicrobials.

- Administration instructions for antimicrobials must be made clear and labeled correctly (e.g., doxycycline capsules or tablets must be followed by a liquid to avoid esophageal stricture).
- Clients should be advised to administer medications as directed by their veterinarian, including medication timing and duration of use.
- As with all medications, proper client instruction in administration techniques is crucial to ensure compliance and safety of the pet and the owner.
- Clients should be warned of potential adverse reactions and instructed on what to do if any such reactions occur (e.g., stop medication and call your veterinarian for further recommendations).
- Animal owners should consult with their veterinarian before any antibiotic use, even for antibiotics available without a prescription, to ensure positive outcomes and prevent complications.

Minimize environmental contamination with antimicrobials whenever possible.^{22,23}

- Minimize environmental contamination with antimicrobials by following local, state, and federal guidelines for disposal.²⁴

Glossary

Antibiotic—a chemical substance produced by a microorganism that has the capacity, in dilute solutions, to inhibit the growth of or to kill other microorganisms. Often used interchangeably with “antimicrobial agent.”⁴

Antimicrobial—an agent that kills microorganisms or suppresses their multiplication or growth. This includes antibiotics and synthetic agents. Often used interchangeably with “antibiotic.”⁴

Antimicrobial resistance—a property of microorganisms that confers the capacity to inactivate or elude antimicrobials or a mechanism that blocks the inhibitory or killing effects of antimicrobials.⁴

Extralabel—actual use or intended use of a drug in a manner that is not in accordance with the approved labeling. This includes, but is not limited to, use in species not listed in the labeling, use for indications (disease or other conditions) not listed in the labeling, use at dosage levels, frequencies, or routes of administration other than those stated in the labeling, and deviation from the labeled withdrawal time based on these different uses.

Intrinsic resistance—inherent or innate (not acquired) antimicrobial resistance, which is reflected in all or almost all representatives of a bacterial species.¹⁹

Minimal inhibitory concentration (MIC)—the lowest concentration of an antimicrobial agent that prevents visible growth of a microorganism in an agar or broth dilution susceptibility test.¹⁹

Monitoring—includes periodic health surveillance of the population or individual animal examination.

Therapeutic—treatment, control, and prevention of bacterial disease.⁴

Antimicrobial prevention of disease (synonym: prophylaxis):

- 1) Prevention is the administration of an antimicrobial to an individual animal to mitigate the risk of acquiring disease or infection that is anticipated based on history, clinical judgment, or epidemiological knowledge.
- 2) On a population basis, prevention is the administration of an antimicrobial to a group of animals, none of which have evidence of disease or infection, when transmission of existing undiagnosed infections, or the introduction of pathogens, is anticipated based on history, clinical judgment, or epidemiological knowledge.

Antimicrobial control of disease (synonym: metaphylaxis):

- 1) Control is the administration of an antimicrobial to an individual animal with a subclinical infection to reduce the risk of the infection becoming clinically apparent, spreading to other tissues or organs, or being transmitted to other individuals.
- 2) On a population basis, control is the use of antimicrobials to reduce the incidence of infectious disease in a group of animals that already has some individuals with evidence of infectious disease or evidence of infection.

Antimicrobial treatment of disease:

- 1) Treatment is the administration of an antimicrobial as a remedy for an individual animal with evidence of infectious disease.
- 2) On a population basis, treatment is the administration of an antimicrobial to those animals within the group with evidence of infectious disease.

Antimicrobial time-out—an active reassessment of an antimicrobial prescription 48–72 hours after first administration to allow medical staff to take into account laboratory culture and susceptibility testing results and the patient’s response to therapy and current condition.⁸

Watchful waiting—an approach to patient care in which the veterinarian believes a patient’s illness will likely resolve on its own but remains vigilant in case an antibiotic is later needed. The pet owner is provided with instructions on when and why to follow up with the veterinarian and given recommendations for nonantibiotic approaches to improve the patient’s comfort.⁸

Veterinarian/Client/Patient Relationship (VCPR)—a VCPR exists when all of the following conditions have been met:

1. The veterinarian has assumed the responsibility for making clinical judgments regarding the health of the animal(s) and the need for medical treatment, and the client has agreed to follow the veterinarian’s instructions.
2. The veterinarian has sufficient knowledge of the animal(s) to initiate at least a general or preliminary diagnosis of the medical condition of the animal(s). This means that the veterinarian has recently seen and is personally acquainted with the keeping and care of the animal(s) by virtue of an examination of the animal(s) or by medically appropriate and timely visits to the premises where the animal(s) are kept.
3. The veterinarian is readily available for follow-up evaluation, or has arranged for emergency coverage, in the event of adverse reactions or failure of the treatment regimen. ■

The Task Force has updated the 2014 AAFP/AAHA Basic Guidelines for Judicious Therapeutic Use of Antimicrobials and thanks past contributors for their work.

REFERENCES

1. American Veterinary Medical Association. Antimicrobial Stewardship Definition and Core Principles. Available at: <https://www.avma.org/resources-tools/avma-policies/antimicrobial-stewardship-definition-and-core-principles>. Accessed March 30, 2022.
2. American Veterinary Medical Association. Veterinary Checklist for Antimicrobial Stewardship. Available at: <https://www.avma.org/sites/default/files/2020-06/Veterinary-Checklist-Antimicrobial-Stewardship.pdf>. Accessed March 30, 2022.
3. American Veterinary Medical Association. Judicious Therapeutic Use of Antimicrobials. Available at: <https://www.avma.org/resources-tools/avma-policies/judicious-therapeutic-use-antimicrobials>. Accessed April 1, 2022.
4. American Veterinary Medical Association. AVMA Definitions of Antimicrobial Use for Treatment, Control, and Prevention. Available at: <https://www.avma.org/resources-tools/avma-policies/avma-definitions-antimicrobial-use-treatment-control-and-prevention>. Accessed March 30, 2022.
5. Fenimore A, Martin L, Lappin MR. Evaluation of metronidazole with and without *Enterococcus Faecium* S68 in shelter dogs with diarrhea. *Top Companion Anim Med* 2017;32(3):100–103.
6. Bellows J, Berg ML, Dennis S, et al. 2019 AAHA Dental Care Guidelines for Dogs and Cats. *J Am Anim Hosp Assoc* 2019;55(2):49–69.
7. Hillier A, Lloyd DH, Weese JS, et al. Guidelines for the diagnosis and antimicrobial therapy of canine superficial bacterial folliculitis (Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases). *Vet Dermatol* 2014;25(3):163–e43.
8. University of Minnesota. Handbook of Antimicrobial Stewardship in Companion Animal Veterinary Settings, 1st ed. Saint Paul, MN: UMN, 2020. Available at <https://arsi.umn.edu/handbook>. Accessed April 1, 2022.
9. Davis ST, Weese JS. Oral microbiome in dogs and cats: dysbiosis and the utility of antimicrobial therapy in the treatment of periodontal disease. *Vet Clin North Am Small Anim Pract* 2022;52(1):107–119.
10. Werner M, Suchodolski JS, Straubinger RK, et al. Effect of amoxicillin-clavulanic acid on clinical scores, intestinal microbiome, and

- amoxicillin-resistant *Escherichia coli* in dogs with uncomplicated acute diarrhea. *J Vet Intern Med* 2020;34(3):1166–1176.
11. Pilla R, Gaschen FP, Barr JW, et al. Effects of metronidazole on the fecal microbiome and metabolome in healthy dogs. *J Vet Intern Med* 2020;34(5):1853–1866.
 12. Nixon SL, Rose L, Muller AT. Efficacy of an orally administered anti-diarrheal probiotic paste (Pro-Kolin Advanced) in dogs with acute diarrhea: A randomized, placebo-controlled, double-blinded clinical study. *J Vet Intern Med* 2019;33(3):1286–1294.
 13. Shmalberg J, Montalbano C, Morelli G, Buckley GJ. A randomized double blinded placebo-controlled clinical trial of a probiotic or metronidazole for acute canine diarrhea. *Front Vet Sci* 2019;6:163.
 14. Budsberg SC, Torres BT, Sandberg GS. Efficacy of postoperative antibiotic use after tibial plateau leveling osteotomy in dogs: A systematic review. *Vet Surg* 2021;50(4):729–739.
 15. Weese JS, Blondeau J, Boothe D, et al. International Society for Companion Animal Infectious Diseases (ISCAID) guidelines for the diagnosis and management of bacterial urinary tract infections in dogs and cats. *Vet J* 2019;247:8–25.
 16. Lappin MR, Blondeau J, Boothe D, et al. Antimicrobial use Guidelines for Treatment of Respiratory Tract Disease in Dogs and Cats: Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases. *J Vet Intern Med* 2017;31(2):279–294.
 17. Weese JS, Blondeau JM, Boothe D, et al. Antimicrobial Use Guidelines for Treatment of Urinary Tract Disease in Dogs and Cats: Antimicrobial Guidelines Working Group of the International Society for Companion Animal Infectious Diseases. *Vet Med Int* 2011;2011:263768.
 18. Weese JS, Giguère S, Guardabassi L, et al. ACVIM consensus statement on therapeutic antimicrobial use in animals and antimicrobial resistance. *J Vet Intern Med* 2015;29(2):487–498.
 19. Clinical and Laboratory Standards Institute. VET09. Understanding Susceptibility Test Data as a Component of Antimicrobial Stewardship in Veterinary Settings, 1st ed. July 2019. Available at: <https://clsi.org/standards/products/veterinary-medicine/documents/vet09/>. Accessed April 1, 2022.
 20. Clinical and Laboratory Standards Institute. VET01S. Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals, 5th Ed. 2020. Available at: <https://clsi.org/standards/products/veterinary-medicine/documents/vet01s/>.
 21. American Veterinary Medical Association Committee on Antimicrobials. Antimicrobial Resistant Pathogens Affection Animal Health in the United States. Schaumburg, IL: AVMA, 2020. Available at: <https://www.avma.org/sites/default/files/2020-10/AntimicrobialResistanceFullReport.pdf>. Accessed April 1, 2022.
 22. Stull JW, Bjorvik E, Bub J, Dvorak G, Petersen C, Troyer HL. 2018 AAHA Infection Control, Prevention, and Biosecurity Guidelines. *J Am Anim Hosp Assoc* 2018;54(6):297–326.
 23. American Veterinary Medical Association. Best Management Practices for Pharmaceutical Disposal. Available at: <https://www.avma.org/resources-tools/avma-policies/best-management-practices-pharmaceutical-disposal>. Accessed April 1, 2022.
 24. American Veterinary Medical Association. Waste disposal by veterinary practices: What goes where? Available at: <https://www.avma.org/resources-tools/one-health/waste-disposal-veterinary-practices>. Accessed April 1, 2022.