

Antimicrobial susceptibility testing (AST) can be a powerful diagnostic tool to guide antimicrobial therapy selection and help predict outcomes for bacterial infections in animals. Reasons that AST is often underutilized include the lower cost of empirical therapy compared with the cost of bacterial culture and AST, the challenges in obtaining representative samples (e.g., from the lower respiratory tract), and the delay between sample submission for culture and AST and the availability of results.

While a valuable tool, AST is not necessary in every case of infection. When AST is performed, careful interpretation of the results is necessary to support antimicrobial stewardship.ⁱ

Veterinarians are encouraged to submit samples for AST only when warranted and to carefully review the results to ensure appropriate interpretation. The following are important points to consider.

// EMPIRICAL SELECTION OF ANTIMICROBIALS PRIOR TO AST //

Veterinarians might choose to prescribe and administer antimicrobials when patients first present and before AST results are available. Clinical resources can help guide this initial choice. Resources include evidence-based consensus guidelines (e.g., for skin, urinary tract, or respiratory tract infections in cats and dogs) and local antibiograms or cumulative AST reports, which provide the proportion of bacteria that have been interpreted as susceptible to antimicrobials in a comparable patient population.

// OPTIMIZE SAMPLE COLLECTION AND SUBMISSION //

Obtaining reliable AST results starts with a fresh, properly collected clinical specimen that is submitted to the diagnostic laboratory in the recommended transport medium and accompanied with complete history and case information. Proper collection includes sampling before initiating antimicrobial therapy, avoiding contamination during collection, and properly storing the sample prior to shipping. Contact the diagnostic laboratory to help ensure appropriate transport medium is used and correct shipment processes are followed.

// SOMETIMES CULTURE ALONE IS THE MOST VALUABLE RESULT //

Many diagnostic laboratories combine culture and AST services; however, there are scenarios where the culture results alone will suffice. For example, if *Corynebacterium pseudotuberculosis* is cultured from small ruminant abscess, AST is contraindicated because antimicrobials typically are not indicated in such cases. Additionally, if enteric pathogens (e.g., *Salmonella* and *E. coli*) are cultured, this finding alone can be used to guide treatment and infection control procedures because there are no established antimicrobial breakpointsⁱⁱ for enteric pathogens.

// WHEN AST IS MOST USEFUL //

The most reliable predictions of susceptibility to a particular antimicrobial are those based on breakpoints that have been approved for the same animal species and bacterial species as those in the clinical case. Breakpoints are approved based on a specific therapeutic drug regimen (i.e., dose, route, duration, and frequency). Therefore, breakpoints are only predictive of outcome when the same regimen will be used in the animal(s) in question. Guidance is available for extrapolating breakpoints to other animal or bacterial species when specific host/pathogen breakpoints are unavailable, but confidence in the predictive ability of AST to guide treatment decisions will be lower in those situations.

// DRUGS THAT ARE TESTED IN AST //

Clinical microbiology laboratories test each bacterial isolate against a panel of antimicrobials that are selected by the laboratory or by the commercial manufacturer of test plates. Specific AST panels can vary by bacteria (gram positive vs. gram negative) and animal species. The drugs commonly tested include approved drugs, drugs commonly used in an extralabel manner, and drugs for which approved breakpoints exist for interpreting susceptibility.

Laboratories sometimes selectively report results, which might not reflect all antimicrobials tested. This is to discourage the use of antimicrobials that are reserved for more resistant isolates. For multidrug-resistant bacteria, additional antimicrobials might be reported in the AST results, or veterinarians might request the testing of additional antimicrobials. These requests are best made

after consulting with laboratory personnel or consultants (e.g., clinical microbiology, clinical pharmacology, or internal medicine) as available through the laboratory or veterinary teaching hospitals.

// USING AST RESULTS TO SELECT DRUGS //

Careful review and interpretation of AST reports are important to maximize their diagnostic utility. Consider the following limitations:

- The interpretation “S” (susceptible) does not necessarily indicate that the antimicrobial is a good choice for treatment. “S” does not mean that the antimicrobial will work under all circumstances, nor that drug regimens different from the one used to establish the breakpoints are likely to be effective.
- When the laboratory uses breakpoints that have been approved for different animal species (or for humans), exercise caution and see Clinical and Laboratory Standards Institute (CLSI) report VET09 for additional guidance. For example, there are no approved breakpoints for use in sheep, goats, camelids, birds, small mammals, or exotic animals. Although AST might be useful in these species, consultation with your clinical laboratory and an expert in clinical pharmacology or clinical microbiology is recommended for interpretation of results.
- AST results from samples collected after initiating antimicrobial therapy should be interpreted carefully. Consider the consequences of current or previous therapy and concurrent infections or comorbidities.
- For enteric infections, no breakpoints are available for predicting clinical outcomes. Therefore, testing generally should only be used for identifying the infectious agent.
- Topical antimicrobials (e.g., for ear, eye, and skin infections) have no breakpoints for predicting clinical outcomes. Often, the achievable concentrations of topically administered antimicrobials are significantly higher in target tissues than if administered systemically, but predictive criteria currently do not exist. Therefore, testing should only be used for identifying the infectious agent.

// ADDITIONAL RESOURCES //

AVMA Committee on Antimicrobials. What veterinarians need to know about antimicrobial susceptibility testing (avma.org/AntimicrobialTools):

- Non-culture-based antimicrobial resistance genetic panels in animals
- Dogs
- Cats
- Cattle
- Food fish

CLSI. *Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals*. 5th ed. CLSI standard VET01. Clinical and Laboratory Standards Institute; 2018.

CLSI. *Performance Standards for Antimicrobial Disk and Dilution Susceptibility Tests for Bacteria Isolated From Animals*. 6th ed. CLSI supplement VET01S. Clinical and Laboratory Standards Institute; 2023.

CLSI. *Understanding Susceptibility Test Data as a Component of Antimicrobial Stewardship in Veterinary Settings*. 1st ed. CLSI report VET09. Clinical and Laboratory Standards Institute; 2019.

ⁱ Antimicrobial stewardship refers to the actions of clinicians, both individually and as a profession, to preserve the effectiveness and availability of antimicrobials through conscientious oversight and responsible medical decision-making while safeguarding animal, public, and environmental health.

ⁱⁱ Breakpoints are the minimal inhibitory concentration (in mg/L or µg/mL) or zone-of-inhibition diameter (in mm) used by a diagnostic laboratory to categorize an organism as susceptible (S), susceptible-dose-dependent (SDD), intermediate (I), or resistant (R).