Measurement Uncertainty (MU) in Veterinary Diagnostics

TEa guidelines for hematology and biochemistry tests for veterinary species are available on the ASVCP Quality Assurance and Laboratory Standards webpage.

Measurement uncertainty (MU) is a parameter that characterizes the dispersion of possible values around a laboratory result. Just as a patient's history and clinical presentation are critical to interpreting results, MU should also be considered. In an ideal world, all sources of variation around lab results would be identified and eliminated. Unfortunately, this is not possible. While clinicians, clinic staff, and laboratorians can mitigate some sources of potential variation through proper sample handling, some sources of variation cannot be avoided. Two important examples of unavoidable sources of variation are **biologic variation** and **analytical error.**

Biologic Variation

Refers to the normal and expected variation of a measurand that occurs within an individual over time (CVi, intraindividual variation) and between individuals of the same population (CVg, interindividual variation). For some measurands, this variation can be significant. For example, in cats, CVi and CVg for neutrophils are 25.3% and 21.0%, respectively; in dogs, CVi and CVg for serum calcium are 1.2% and 9.0%, respectively. The greater the biologic variation is for any measurand, the more impact it may have on the range of the subsequent population-based reference interval. Curious to learn more? Check out sources such as www.vetbiologicalvariation.org for a deeper dive into biologic variation.

Analytical Error

Refers to the expected "wiggle room" around a laboratory result. Technology, while very good, is never perfect. Imagine running a sample through an analyzer 20 consecutive times. Rather than producing 20 identical results, even the highest-functioning analyzer will instead output a range of values. Calculations can determine the analyzer's bias (the difference between the mean of the results and the sample's "true" result), as well as its imprecision (the amount of variation around the mean, expressed as the standard deviation or coefficient of variation [CVa]) for the test in question. Bias and imprecision are used to calculate a test's **total error (TE).**

The American Society of Veterinary Clinical Pathology (ASVCP) sets guidelines around the amount of error that is allowable **(total allowable error, or TEa)** for a given test. For example, TEa for creatinine is 20% while the TEa for total calcium is 10%. These guidelines are determined through consensus following discussion that considers clinical decision thresholds and clinical outcomes, as well as analytic performance criteria (e.g., limitations of current testing technology) and biologic variation of the analyte.

Human diagnostic laboratories are required by federal and state laws to uphold quality standards, including analytic performance criteria, such as TEa. Adherence to quality standards guidelines in veterinary laboratories is not mandatory. Therefore, it is up to each diagnostic laboratory to set its own set of quality standards and to determine how it will ensure that those standards are met.