Evidence-based veterinary medicine

(This is the second article in a new series introducing and discussing the concepts of evidence-based veterinary medicine.)

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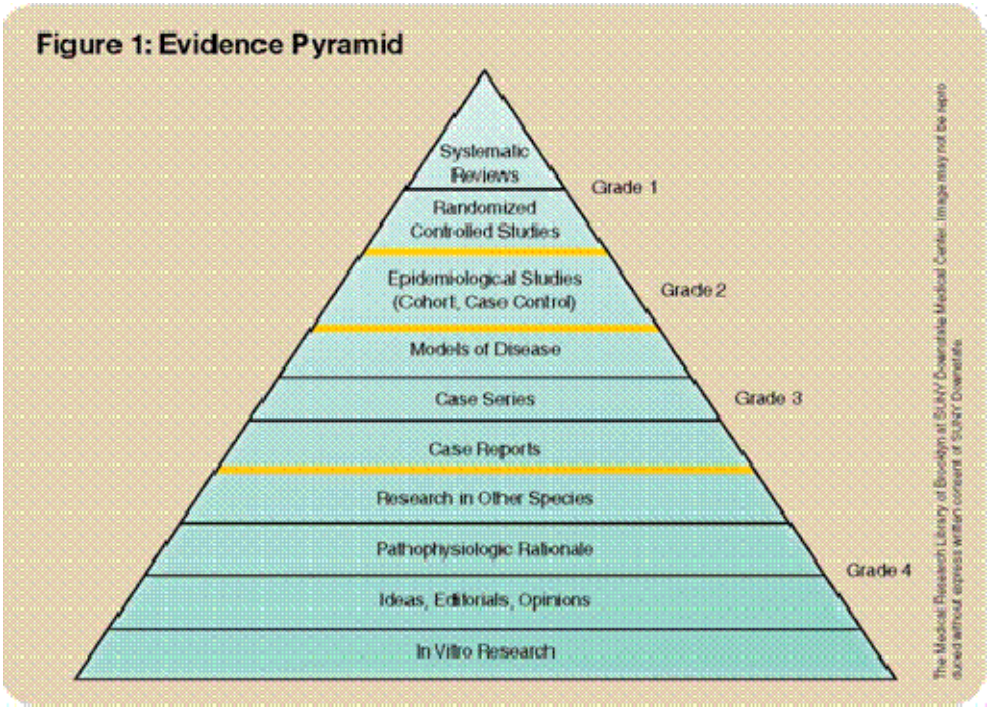
As we discussed in the May/June 2009 issue of the Banfield Journal, evidence-based veterinary medicine (EBVM) uses the best available research evidence along with clinical expertise, client preferences, patient needs and available resources to make the most informed clinical decisions. EBVM may suggest the best approach to a specific clinical problem, but it is the practitioner who integrates all this knowledge to recommend the best course of care. EBVM includes these steps: 1) Ask an answerable clinical question; 2) Find the best evidence to answer the question; 3) Critically appraise the evidence for its validity and usefulness; 4) Apply this evidence by integrating the appraisal results with clinical expertise, patient needs and client values; 5) Implement and evaluate the outcomes.

Finding the best evidence

One of the biggest challenges in identifying information needed to practice EBVM is selecting the appropriate resource. No single database comprehensively provides indexing and abstracting to all literature relevant to the clinical question, so practitioners will need to search a variety of informational resources.[1] Current literature can be found in many databases: MEDLINE, typically accessed through PubMed, is one of the most powerful and available databases, containing journals for human and veterinary medicine. Standardized keyword searching is done using Medical Subject Heading (MeSH) terms. The "clinical query" function helps to narrow searches based on the clinical decision (e.g., etiology, prognosis, diagnosis and treatment). Although MEDLINE does not include all veterinary-specific journals, it is a valuable search tool for the practitioner. CAB Direct is a product of CAB International, a not-for-profit publisher for life sciences books, databases and primary journals, and offers the most comprehensive indexing and abstracting of veterinary literature.[2] One of its strengths is the international coverage of animal health literature. A Database of books and article citations compiled by the U.S. National Agriculture Library.[3] It is not as comprehensive in coverage as CAB Direct or PubMed. International Veterinary Information Service (IVIS) provides free access to electronic books, conference proceedings, short courses, continuing education, and other information products in multiple languages for veterinarians and veterinary students.[4] Registration is required to use this Web site. Veterinary Information Network (VIN) is a subscription-based service; one of its strengths is its message boards, where veterinarians can post questions and seek answers from VIN consultants or other members.[5]

Types of evidence

Each of us, in providing veterinary care, makes a series of decisions—hopefully based on some type of evidence. In EBVM, evidence comes from many of the same sources we traditionally use, however EBVM pro vides a framework by which we can more methodically and systematically rank this evidence. All evidence is not of the same quality; each source of evidence should be evaluated for its potential relevance in the decision-making process. An evidence pyramid ranks the evidence from strongest to weakest (Figure 1) to support appraisal.



Levels of evidence

At the top of the pyramid are systematic reviews and randomized controlled clinical trials (RCCTs), classified as Grade 1 evidence, and considered the "gold standard." Systematic reviews are comprehensive surveys of a particular topic in which all the primary studies of the highest level of evidence have been systematically identified, appraised and then summarized according to explicit and reproducible methodologies. These reviews are a very good source of information, with the best reviews providing unbiased summaries of the available evidence. One challenge in veterinary medicine is that there are very few systematic reviews available.

RCCTs are controlled studies with Pets randomly assigned into either a treatment group (or groups), or control group. Ideally, in these studies, the allocation of treatment is blinded and there is complete follow-up of all study groups. Large, well-done RCCTs provide very strong evidence in support of therapeutic or other interventions. Again, there aren't many of these studies published in the veterinary literature.

The next level of evidence includes epidemiological studies, such as cohort, cross-sectional and case-control studies. These are population-based observational studies which can be more practical and economical than RCCTs to investigate risk factors for disease.

A cohort study is a prospective observational study originating with a disease-free population followed over a specific time period. In the course of follow-up, putative exposures (independent variables) and outcomes (dependent variables) are measured for all Pets in the cohort. The major strengths of this design are the ability to understand the temporal relationship between exposures and outcomes and to make inferences about risk and causality.

A cross-sectional design uses a representative sample of the whole population; data are captured at a single point in time on the population. As with the cohort study, inferences can be made from the relationship between exposures and presence of disease (outcome). However, the study design makes the inference less valid than the cohort study because exposure and disease are measured at the same time. Cross-sectional studies are less resource-intensive than a cohort study and are often used for hypothesis generation.

A case-control study is a retrospective, observational study in which the proportion of cases with a potential risk factor are compared to the proportion of controls (those without the disease) with the same risk factor. Case-control studies, like cross-sectional studies, have the advantage of being easier, quicker and less expensive to perform than cohort studies or RCCTs; however, evidence can be biased by unknown confounders.

Descriptive studies are the next level of evidence. These include surveys, case reports and case series. Much of the veterinary literature consists of case reports or case series. A case report is a report on a single patient, whereas a case series is a collection of case reports on the treatment of a condition or clinical description of a particular condition. Case series provide descriptive data, which can be helpful in recognition of clinical presentation of disease for individuals, however they don't allow for understanding and inference of risk for disease in a population.

At the bottom of the evidence pyramid are the weaker forms of evidence, such as research in other species, pathophysiological rationale, expert opinion and in vitro research. Decisions made in veterinary medicine are based on these types of evidence as this is often the highest level of evidence that can be found to help answer our clinical question.

Evaluating the evidence

Evidence, or information, should be appraised and evaluated for its validity (closeness to the truth), relevance (appropriateness), impact (size of the effect), and application (usefulness in clinical practice). Several different factors should be considered, including study population, study design and bias and statistical inference. To evaluate the merits of a study, one should consider the population of animals in the study, the type of study design used, the applicability of the findings to a particular patient, and other factors that might have influenced the study's conclusions.[6]

The study population is an important consideration. External validity of the findings refers to the generalizability of the findings of a study to the source population from which the study participants were drawn.[6] The study population ideally should be selected to represent the characteristics of the general population. Looking at the study population helps determine the validity of the study. A random sample is ideal because it removes the chance of either intentional or unintentional bias when the study population is selected. Many studies use convenience samples, where the patient population is selected from a particular type of facility, such as a veterinary teaching hospital. This population may be different from the target population and might decrease the validity of the study.

Looking at study designs is also an important consideration. Both observational studies (cohort, case-control, and cross-sectional studies) and experimental studies (RCCTs) have potential limitations. Important questions to ask about any study are: How is the outcome (disease, etc.) defined? Is the outcome readily measurable? Was an appropriate control group used?[6] Experimental studies often give higher degrees of validity, as long as the studies are properly run, randomized, and potential sources of bias eliminated. Observational studies should be evaluated for bias, i.e., systematic errors that result in an incorrect estimate of the association between exposure and risk of disease.[7]

Evaluating the statistical evidence is also important. Factors to consider include sample size, odds ratio, probability and confidence interval. A large sample size increases the reliability of the study and decreases its variability. Studies that have a probability or P value of ≤ .05 are statistically significant, meaning that there is a less than 5 percent chance of the observed finding or association being due to chance. The true magnitude of an effect estimate can be found within the bounds of the confidence interval; the more narrow the interval, the greater the precision of the estimate.[6] It is useful to evaluate the role of chance while providing a measure of the amount of variability that can be attributed to sample size. Ideally, this should be provided in conjunction with the P value. A narrow confidence interval that contains the null value is stronger evidence that there is no association between the exposure and the disease, whereas the role of chance is more difficult to rule out with a wide confidence interval.[7] Further information on statistical analysis and evaluation of articles can be found in many references, with one of my favorites being “Statistics and Evidence-Based Veterinary Medicine: Answers to 21 Common Statistical Questions That Arise from Reading Scientific Manuscripts” in Veterinary Clinics of North America: Small Animal Practice.[8]

Conclusion

As rational veterinarians, we choose the sources of information that we use to make clinical decisions. By using principles of EBVM, this can be an explicit rather than implicit process so that we are aware of the limitations of our knowledge.

In future issues of the Banfield Journal, we will provide reviews of the current literature to demonstrate the process of critical appraisal, evaluate the quality of evidence available from the literature, and distill impact for clinical decision-making. The ultimate goals are to enhance clinical decision-making in veterinary practice and to optimize patient care. EBVM is an excellent tool to help achieve these goals for the profession.

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