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Title

A Revised Evidence Pyramid for Veterinary Clinical Resources

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Keywords

evidence-based veterinary/methods, evidence hierarchy, evidence pyramid, decision support techniques.

Abbreviations

EBVM: Evidence-based Veterinary Medicine; RCT: Randomized Controlled Trial; CER: Comparative Effectiveness Research; GRADE: Grading of Recommendations Assessment, Development and Evaluation; CEBM: Center for Evidence-based Medicine; SORT: Strength of Recommendation Taxonomy; CAT: Critically Appraised

Topic; BET: Best Evidence Topic; ACP: American College of Physicians; SNOMED CT: Systemized Nomenclature of Medicine – Clinical Terms; JAVMA: Journal of the American Veterinary Medical Association; ACVIM: American College of Veterinary Internal Medicine; VECCS: Veterinary Emergency and Critical Care Society; AAEP: American Association of Equine Practitioners; ASVCP: American Society for Clinical Pathologists; AAHA: American Animal Hospital Association; CAPC: Companion Animal Parasite Council; AVSAB: American Veterinary Society of Animal Behavior; AAFP: American Association of Feline Practitioners; AHS: American Heartworm Society; ISCAID: International Society for Companion Animal Infectious Diseases; ISFM: International Society of Feline Medicine; NASPHV: National Association of State Public Health Veterinarians; ASV: Association of Shelter Veterinarians

Abstract

Veterinary medicine is a field traditionally dependent on textbooks and expert opinion, often in the form of conference proceedings and monitored discussion boards, for clinical decision support. As electronic health record systems evolve with potential to bring more current research to the point of care, interest in evidence-based medicine grows. Evidence-based veterinary medicine integrates the best available research with clinical expertise, patient circumstances, and client values. Teaching of EBVM often relies on a hierarchical pyramid to visually represent studies in terms of their level of evidence. Though considered the highest level of evidence in the original 4S evidence pyramid¹, systematic reviews, and the randomized controlled trial studies on which they are based, are limited in veterinary medicine. In this imperfect information infrastructure, emerging veterinary resources, found in various forms such as critically appraised topics and clinical guidelines, seek to apply current best evidence to everyday clinical problems. Where do

these new resources fit in terms of their level of evidence? While the human medical evidence pyramid was revised to a 5S or 6S model^{2,3} to incorporate newer synopses and summaries, current evidence hierarchies in veterinary medicine are still based on the 4S model. This project reviews current evidence hierarchies and newly emerging veterinary medical evidence resources for placement in a 6S hierarchy model. The revised pyramid provides an educational framework for veterinarians and veterinary students tasked with supporting clinical decisions with evidence in an evolving information environment. This model assumes a best case scenario and cautions that resources must be individually evaluated for quality.

Introduction

While interest in evidence-based veterinary medicine grows, it eludes widespread adoption in clinical settings. Holmes and Cockcroft⁴ have noted the difficulty that clinicians have in formulating the clinical questions necessary to start the EBVM process. A variety of barriers to acquisition of evidence exist. Veterinary medicine is an interdisciplinary field⁵ straddling biomedicine and agriculture, thus multiple databases are needed to search for veterinary literature. Veterinary professionals outside of academia are dispersed without centralized hospital privileges and electronic subscriptions to medical literature⁶. As a result, veterinarians rely heavily on open access electronic information and general search engines. When scholarly databases are consulted, veterinarians are frustrated with search results both because they have difficulty formulating search strategies⁴ and because veterinary medicine lacks studies with higher levels of evidence⁷. Part of their frustration comes from time constraints^{8,9}; lack of time to find evidence and lack of time to learn to find evidence. Even free databases that facilitate searching for peer-reviewed journal articles, such as PubMed, were only accessed by non-clinicians⁸ in one recent study. It has been suggested that summarized high-quality evidence reports readily available at the point

of care⁷ could change that. When veterinarians are able to find evidence, they have a difficult time evaluating and comparing sources⁹, and lack training in the application of evidence to clinical practice¹⁰. Finally, veterinary medicine lacks research, qualitative or quantitative, in how information seeking impacts patient outcomes.

Traditional evidence pyramid

The traditional evidence pyramid is pictured in fig. 1. In 2014, Sargent, Kelton, and O'Connor proposed revisions to differentiate RCTs in field conditions vs. low-density animal studies¹¹. Their proposal might be best accommodated by the Comparative Effectiveness Research (CER) movement¹², and the recent increase in pragmatic RCTs.

The traditional evidence pyramid emphasizes primary studies, with the exception of the expert opinion, review articles and textbooks that veterinarians prefer. Review format articles are the type most frequently found in *In Practice*⁸, and the former *Compendium on Continuing Education for the Practicing Veterinarian*. Journal editors are aware of this need to meet clinicians needs and are adjusting publications to incorporate a wider variety of article formats¹³.

The traditional pyramid is based on the 4S model(fig. 2) described by Haynes in 2001¹. Veterinary medicine has the lower levels of this pyramid model, studies and some systematic review, but is lacking synopses at a higher level and point of care decision support.

Revised evidence pyramid

This revised evidence pyramid for veterinary medicine stemmed from speculation about where newer resources in the form of critically appraised topics and clinical guidelines fit in terms of evidence level in comparison to primary research. The project does not address those resources considered to be under the pyramid, namely trade

publications, blogs, vendor publications, association websites, veterinary consumer websites, discussion boards, and Wikipedia.

It is important to keep in mind the ultimate goal, the development of point of care decision support systems. That goal is reflected in this statement from Frank Davidoff, former editor of the *Annals of Internal Medicine* ¹⁴.

But Cochrane did not go far enough: such summaries, indeed all medical discoveries, are of no use to patients and clinicians if they remain buried in the literature. It is surely an equally great criticism that the medical profession has not developed an effective, efficient system for finding relevant clinical information, extracting it, and delivering it when and where it is needed into the hands of everyone who makes medical decisions.

While attending the 2014 Supporting Clinical Care¹⁵ workshop I found that the discipline of nursing has already proposed changes in the evidence pyramid to accommodate new resources, by revising to a 5S and 6S pyramid (fig. 3)^{2,3}. Complete comparison to human medicine is more difficult outside of basic studies as human point of care resources provide access to multiple levels of evidence. This pyramid assumes a perfect world, it assumes that the discipline has randomized controlled trials on which to base systematic reviews on which to base summaries like clinical guidelines. While our reality is an imperfect infrastructure, the process of defining evidence levels remains worthwhile. While research reporting guidelines bolster lower levels of the pyramid, the pyramid remains a platform for change and discussion. This pyramid is meant to focus on clinical relevance, keeping systems for improving clinical performance and patient outcomes as the goal.

The revised 6S pyramid for veterinary resources is shown in fig.4. Lower layers of the pyramid are essentially the same. Synopses of studies, in the form of Knowledge Summaries, CATs, and BestBETS, have been added between studies and syntheses. Veterinary medicine lacks computerized decision support, but it is important to keep that as the ultimate goal at the top of the pyramid.

Clinical guidelines fall one step below that in their ability to make evidence applicable to practice. What veterinary medicine needs now are synopses of syntheses that identify quality articles and provide clinically oriented commentary. It is important to remember that the individual quality of any resource may result in placement at a higher or lower level of evidence.

Educational framework

The evidence pyramid represents a model for lifelong active learning. Traditional passive learning fails to improve physician performance or patient outcomes, while active information seeking behavior has a positive effect on both¹⁶. An evidence pyramid incorporating more clinically focused resources becomes a tool for information comparison and the identification of gaps. It also helps those new to evidence-based veterinary medicine to disambiguate terminology, allowing them to realize that CATS and Knowledge Summaries are very similar, and reviews and systematic reviews are quite different. A revised pyramid with a greater clinical focus facilitates translational medicine, lowering the barrier between research and practice.

Future needs

Veterinary Medicine can learn from human medicine and start developing workflows to incorporate information seeking¹⁷. While physicians rarely use textbooks or PubMed in exam rooms, they readily use some newer textbook-like electronic interfaces at the point of care. As the quality of clinical studies and systematic reviews improves, there are ways to make it easier for practitioners to evaluate the evidence that is available, starting with consistent use of standards for grading levels of evidence; GRADE, CEBM, or SORT¹⁸. Peer review can be incorporated into synopses of summaries, perhaps through crowdsourcing. Synopses of summaries should be searchable in larger databases, and down to the item level. While there are groups and individuals maintaining lists of clinical guidelines, an open

access guideline database modeled on the National Guideline Clearinghouse will promote awareness and use of guidelines.

Conclusion

Evidence-based veterinary medicine involves critically analyzing resources for their currency, relevancy to the case in question, and level of evidence in relation to other resources. Evidence pyramids evolve with the introduction of new resources. A more clinically focused evidence pyramid provides an educational framework for the teaching of EBVM, and for the future development of workflows and decision support systems that bring evidence to the point of care.

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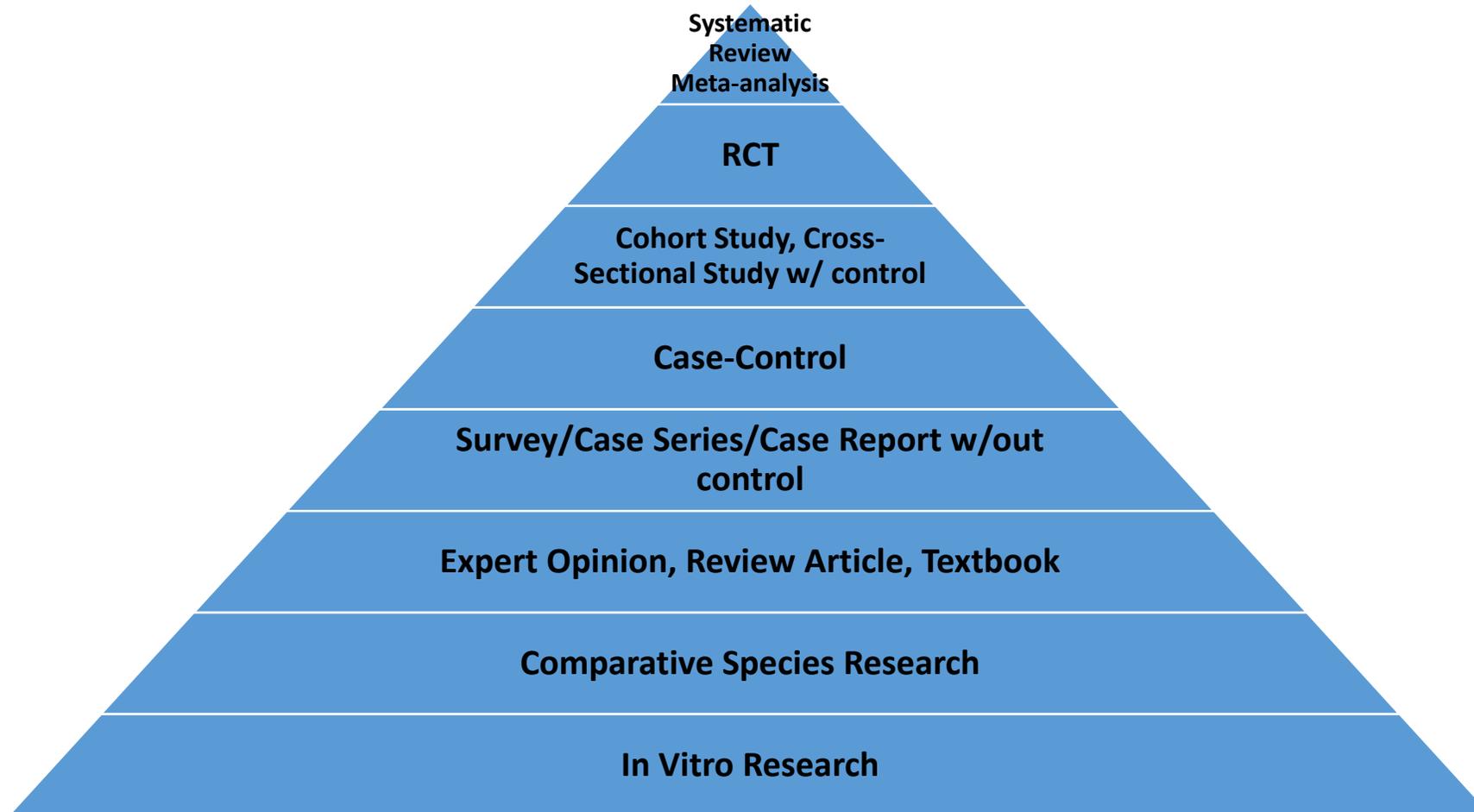


Fig. 1: Traditional Evidence Pyramid

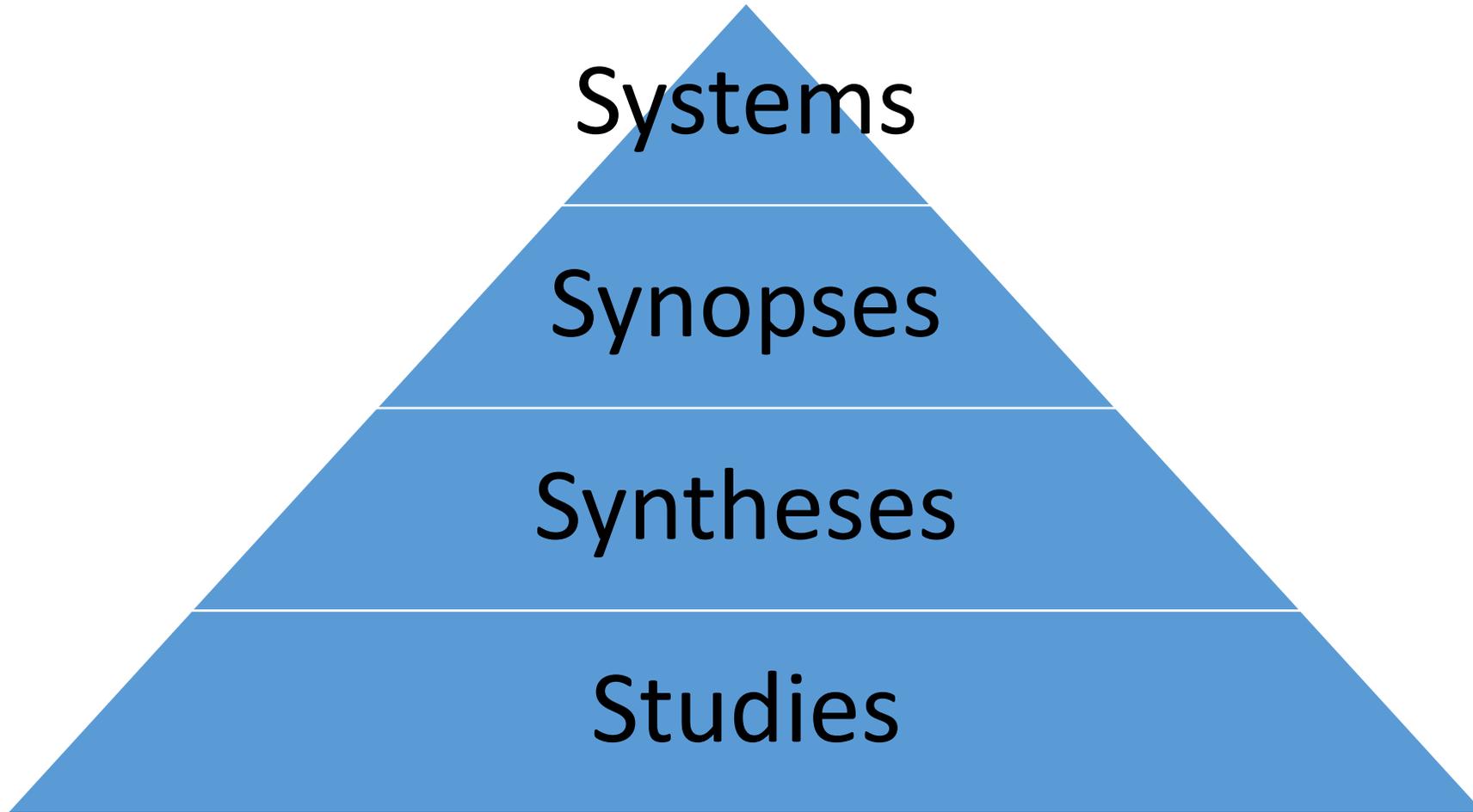


Fig. 2: 4S Pyramid

Haynes RB. Of studies, syntheses, synopses, and systems: the "4S" evolution of services for finding current best evidence. *ACP J Club* 2001;134:A11-13.

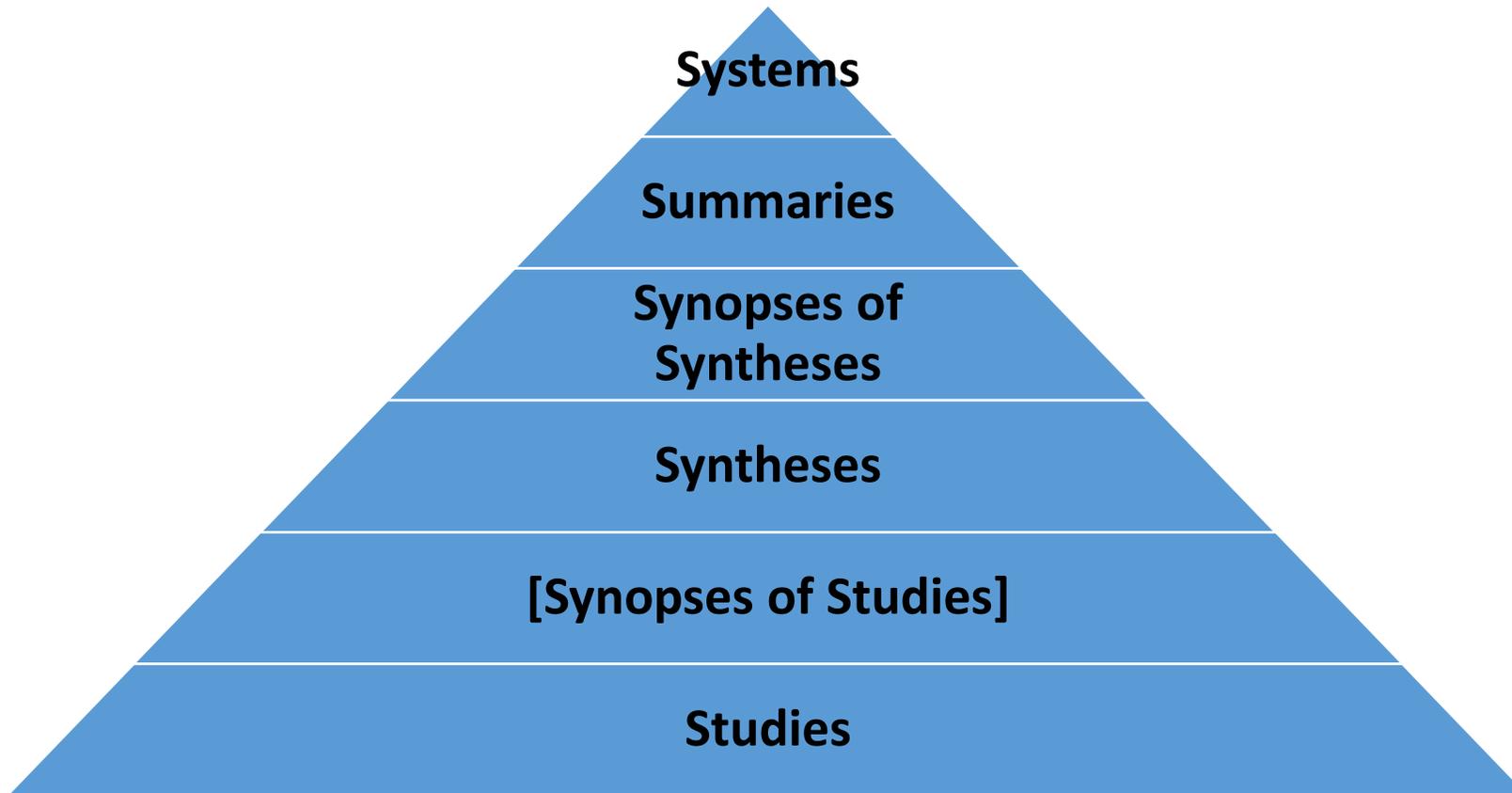


Fig. 3: 5S and 6S Pyramid

Dicenso A, Bayley L, Haynes RB. Accessing pre-appraised evidence: fine-tuning the 5S model into a 6S model. *Evid Based Nurs.* England, 2009;99-101.

Haynes RB. Of studies, syntheses, synopses, summaries, and systems: the "5S" evolution of information services for evidence-based health care decisions. *ACP J Club.* United States, 2006;A8.

Evidence Based Medicine Resources, Dartmouth Biomedical Libraries

http://www.dartmouth.edu/~biomed/resources.html/guides/ebm_resources.shtml

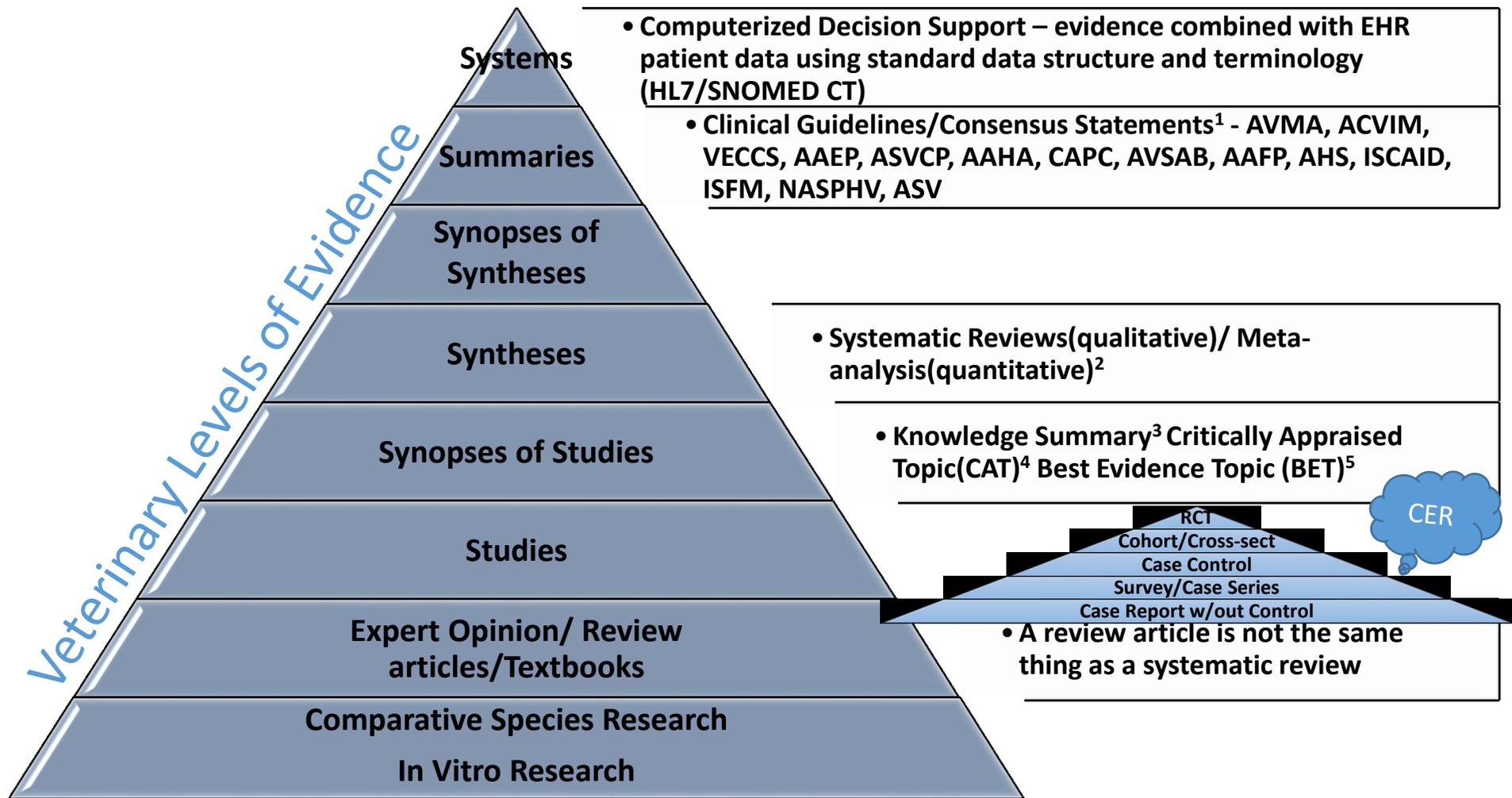


Fig. 4: Revised EBVM pyramid

¹ www.vmdtechnology.com/veterinary-consensus-statement-survival-guide/

² VetSRev Database of Veterinary Systematic Reviews <http://webapps.nottingham.ac.uk/refbase/>

³ RCVS Knowledge <http://knowledge.rcvs.org.uk/evidence-based-veterinary-medicine/knowledge-summaries/>

⁴ Criteria for Critical Appraisal <http://www.cebm.net/?o=1040>

Banfield Applied Research and Knowledge <http://www.banfield.com/veterinary-professionals/resources/research>

⁵ BestBETS for Vets <http://bestbetsforvets.org/>

^{1,2,3,4,5} note level of evidence varies with quality and types of studies

Pyramid adapted from http://www.dartmouth.edu/~biomed/resources.html/guides/ebm_resources.shtml