An Introduction to Systematic Reviews and Meta-Analyses for Exotic Animal Practitioners

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KEYWORDS

• Systematic review • Meta-analysis • Risk of bias • Applicability
• Veterinary medicine • Limitations • Guidelines

KEY POINTS

- Developing and conducting systematic reviews and meta-analyses is a complex process.
- How to develop, conduct, and report these research studies is discussed.
- Veterinary clinicians should seek systematic reviews to address their research questions.
- Criteria for including meta-analyses in a systematic review are also presented.
- Before applying the findings of systematic reviews and meta-analyses to a particular patient, clinicians should weigh a variety of issues. Consulting high-quality systematic reviews is particularly important in this context.

CHARACTERISTICS OF SYSTEMATIC REVIEWS AND META-ANALYSES

Introduction

Systematic reviews synthesize the current best evidence on a particular research question and are considered to provide the highest level of medical evidence.[1,2] This top validity ranking depends on the quality of conducting and reporting of these reviews. Cochrane systematic reviews of interventions are regarded as the reference standard for performing and reporting such reviews.[3]

Conducting systematic reviews of clinical studies has become common practice in medicine since the early 1990s and forms the foundation of evidence-based medicine.

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The number of PubMed-indexed articles labeled "Systematic Review" or "Meta-analysis" has been growing exponentially since 1986 to more than 28,000 new articles published in 2014 alone.[4] Veterinary medicine has been slower at adopting these reviews than human health care,[5] but a database of veterinary systematic reviews is now available.[6]

This article (1) explains what systematic reviews and meta-analyses do and how they differ from narrative reviews, (2) assesses their strengths and limitations, and (3) gives an overview of how to conduct and report them and how to implement their findings in clinical practice. This article provides an introduction to these research procedures.

Systematic Reviews Versus Narrative Reviews

Before the 1990s data from multiple studies were synthesized in narrative reviews, which were usually conducted by a single topic expert.[7] These traditional reviews have several limitations,[7,8] such as (1) personal bias of the reviewer; (2) bias in the selection of studies and the extraction and analysis of data; (3) difficulty in reproducing these reviews, because methods are often not systematic and transparent; (4) becoming less useful when large numbers of studies are available, because in those circumstances it becomes difficult to assess the appropriate weight of individual studies and how different covariates influence outcomes.[7]

To avoid these limitations, researchers from the 1990s onward have moved away from narrative reviews and have started to implement systematic reviews. The differences between narrative and a high-quality systematic review are presented in **Table 1**.[5,9–11] The parameter of high quality is a crucial characteristic of a systematic review, as explained later. The 4 key principles on which systematic reviews are based are (1) systematic use of tested research methods, (2) methodologic rigor, (3) transparency, and (4) reproducibility.[8,9,12] Systematic reviews have been adopted by various sciences,[2] but this article focusses exclusively on such reviews in health care.

Why Systematic Reviews Are Important and for Whom

Systematic reviews are important for a variety of reasons: (1) unlike single studies, systematic reviews are representative of the total body of evidence on a research question and provide the highest level of evidence[1,2]; (2) systematic reviews assign a quality score to the total body of evidence, which is essential for the confidence in their outcomes; (3) a systematic review accompanied by a meta-analysis facilitates decision making, because it provides the best estimate of the effect and its precision; (4) systematic reviews include a broader range of patients than individual studies, and their outcomes therefore generally have a wider external validity; (5) they save considerable time, energy, and resources for a wide variety of stakeholders (this issue should be considered in the context of the unmanageable amounts of health care research that are published every year and that searching of the literature and critically appraising research evidence requires specific knowledge and skills[2,12]); and (6) systematic reviews identify the current knowledge status on a specific health issue. This information helps to plan future research agendas. For example, when the quality of evidence is high, no further research is probably necessary on this topic, which avoids wasting additional resources. In contrast, when the quality of evidence is low, researchers can learn from the deficiencies of the eligible studies by improving research methods and possibly fine-tuning or even formulating new research questions.

These 6 reasons explain why systematic reviews are so important for medical decision making and for developing clinical guidelines.[13] Health care providers,