## Knowledge Synthesis in Animal and Veterinary Research Blog #1

By Lee Wisener on March 26, 2019

**Why read this blog series?**

**To learn about the science of putting animal and veterinary research knowledge together using 'knowledge synthesis' tools.**

This blog may interest you if:

- You use research to make decisions and keeping up is a challenge
- You have been confused by conflicting study results
- You refer to existing research to support your own research
- You help to direct research funding
- You just want to make sense of so much research generated in a field of interest

In this series we'll cover the concept of '**knowledge synthesis', its tools,** and how each is used to gather the research, summarize it, and sort out why all study results are not the same (e.g. bias, sampling error (chance), inherent differences in studies and the subjects being studied)

We will start with definitions and some resources.
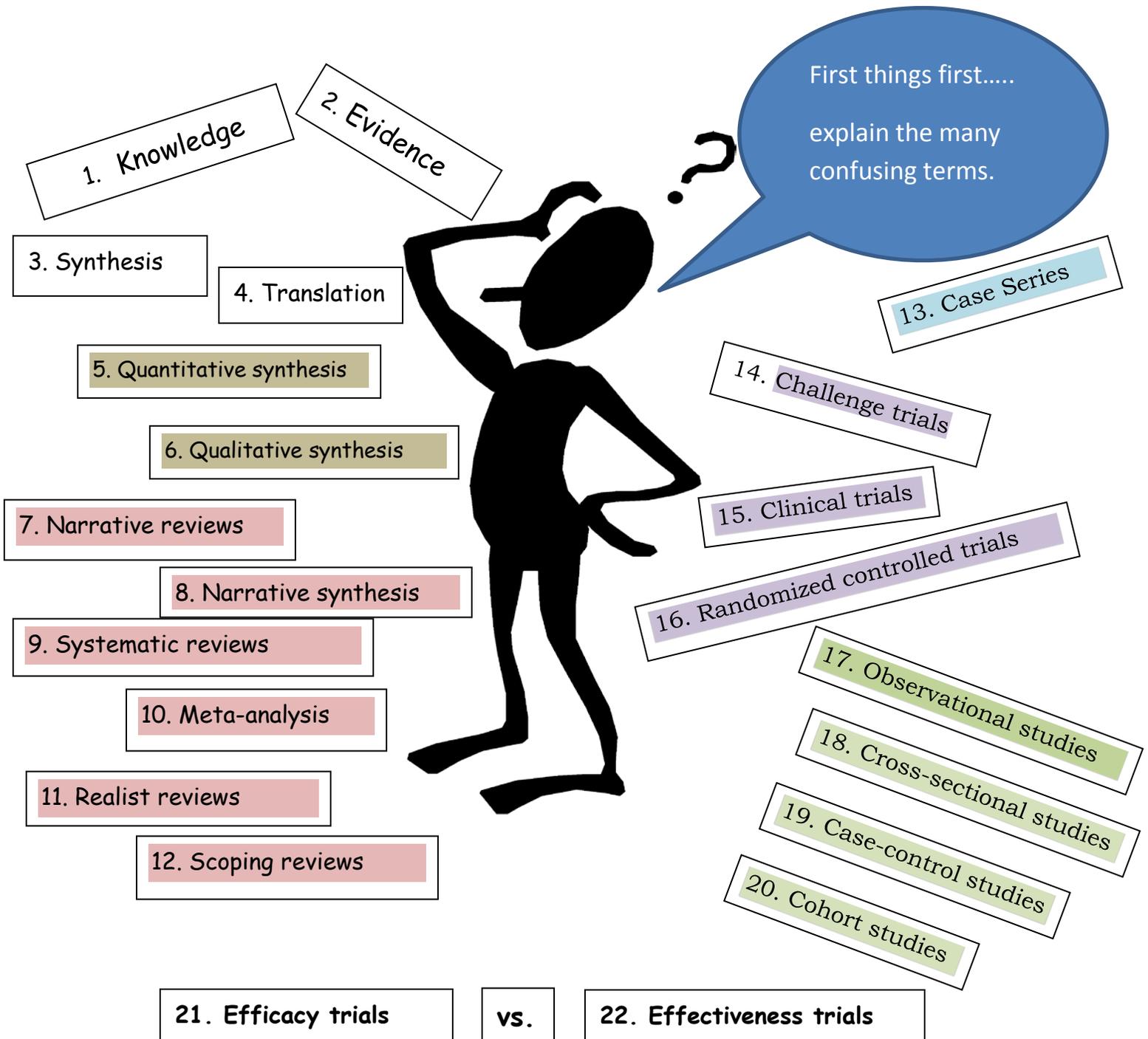
## Knowledge synthesis definitions and resources

1. Knowledge

2. Evidence

3. Synthesis

4. Translation

5. Quantitative synthesis

6. Qualitative synthesis

7. Narrative reviews

8. Narrative synthesis

9. Systematic reviews

10. Meta-analysis

11. Realist reviews

12. Scoping reviews

First things first…..

explain the many confusing terms.

13. Case Series

14. Challenge trials

15. Clinical trials

16. Randomized controlled trials

17. Observational studies

18. Cross-sectional studies

19. Case-control studies

20. Cohort studies

21. Efficacy trials      vs.      22. Effectiveness trials

# Table of knowledge **synthesis terms**, definitions, and resources

| | Term | Scientific definition and resources | Plain language definition |
|---|---|---|---|
| 1. | Knowledge | Knowledge comes from various sources such as experience, tradition, or education and forms a basis of knowledge-based practice. | Information used to make a decision or have an opinion. |
| 2. | Evidence | Evidence comes from scientific research and forms a basis for evidence-informed practice. | The type of information that comes from using the scientific method. |
| 3. | Synthesis [i.e. knowledge synthesis] | The Canadian Institutes of Health Research (CIHR) defines **synthesis** as 'the contextualization and integration of research findings of individual research studies within the larger body of knowledge on the topic. <u>A synthesis must be reproducible and transparent in its methods</u>, using quantitative and/or qualitative methods. It could take the form of a systematic review; result from a consensus conference or expert panel and may synthesize qualitative or quantitative results. Realist syntheses, narrative syntheses, meta-analyses, meta-syntheses and practice guidelines are all forms of synthesis.' http://www.cihr-irsc.gc.ca/e/41382.html | A rigorous method of combining and assessing evidence and knowledge. One example is to combine the results from multiple trials answering the same question. |
| 4. | Translation [i.e. knowledge translation] | The CIHR defines **knowledge translation** as "a dynamic and iterative process that includes the synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the healthcare system'. This definition highlights the importance of knowledge synthesis in knowledge translation activities." http://www.cihr-irsc.gc.ca/e/41382.html | The process of finding, synthesising, sharing, and applying knowledge. |
| 5. | Quantitative synthesis | Combines numerical data based on statistical theory from primary quantitative studies to summarize the scientific findings. It aims to answer the question "did it work?" or "how much exists?" or "how does this diagnostic test compare to another test?" (Petticrew et al., (2013). *Journal of Clinical Epidemiology 66: 1230-1243*). | Combines number type information from multiple studies. An example is to describe how well a treatment worked overall across numerous studies considering |

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| | | | differences in the results between studies. |
| 6. | Qualitative synthesis | Qualitative synthesis is a method for aggregating, integrating and/or interpreting qualitative studies. Qualitative studies evaluate participant experiences, perceptions, and contextual considerations regarding the implementation of an intervention or research study. (Sandelowski, M., & Barroso, M. (2007). *Handbook for synthesizing qualitative research*. New York: Springer). | Combines word type information from multiple studies. An example is to describe how patients feel and experience a program or treatment in terms of a social or behavioural theoretical framework. |
| 7. | Narrative reviews | "**Narrative** literature **review** articles are publications that describe and discuss the state of the science of a specific topic or theme from a theoretical and contextual point of view. These types of review articles do not list the types of databases and methodological approaches used to conduct the review nor the evaluation criteria for inclusion of retrieved articles during databases search." (Bernardo WM., et. al., 2004, Rev Assoc. Med Bras. 50(1):1-9). | Typically, a narrative review is a descriptive summary of the knowledge on a particular topic. The author(s) find and summarize the studies on the topic without clearly adhering to stipulated plan/protocol developed before starting the review |
| 8. | Narrative synthesis | "'*Narrative' synthesis'* refers to an approach to the systematic review and synthesis [i.e. combining] of findings from multiple studies that relies primarily on the use of words and text to summarise and explain the findings of the synthesis. Whilst narrative synthesis can involve the manipulation of statistical data, the defining characteristic is that it adopts a textual approach to the process of synthesis to 'tell the story' of the findings from the included studies. Narrative synthesis refers to a process of synthesis that can be used in systematic reviews focusing on a wide range of questions, not only those relating to the effectiveness of a particular intervention." (Popay, J, et al., 2006. Guidance on the Conduct of Narrative Synthesis in Systematic Reviews). | A narrative synthesis combines the findings of studies into a text based synthesis to 'tell a story'. It can focus on a wider range of questions than just the effectiveness of a particular intervention. |
| 9. | Systematic reviews | "Systematic reviews differ qualitatively from traditional [i.e. narrative] reviews by explicitly defining a specific review question, employing methods to reduce bias in the selection and inclusion of studies that address the review question (including a systematic and specified search strategy, and selection of studies based | A systematic review uses rigorous methods to find, select, and combine the findings of multiple similar studies to arrive at an overall numeric summary of the |

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| | | on explicit eligibility criteria), an assessment of the risk of bias for included studies and objectively summarizing the results qualitatively [i.e. narrative] or quantitatively (i.e. via meta-analysis)."<br>(Sargeant and O'Connor, 2014, Zoonoses and Public Health, 61 [Supplement]).<br><br>"A systematic review attempts to collate all the empirical evidence that fits pre-specified criteria in order to answer a specific question". "Many systematic reviews contain meta-analyses".<br>(Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.handbook.cochrane.org. | effectiveness of a particular intervention in a particular group.<br><br>It answers the question "Is this intervention significantly better than no intervention or another intervention?" |
| 10. | Meta-analysis | "When a sufficient number of studies with similar outcomes are available, a formal statistical combination of the data from multiple studies (meta-analysis) can be performed. Meta-analysis is an effective way of increasing power and detecting intervention effects where the results in individual studies are unclear or conflicting."<br>(Sargeant and O'Connor, 2014, Zoonoses and Public Health, 61 [Supplement]).<br><br>A meta-analysis should be preceded by a systematic review.<br><br>"Meta-analysis is the use of statistical methods to summarize the results of independent studies"<br>(Higgins JPT, Green S (editors). *Cochrane Handbook for Systematic Reviews of Interventions* Version 5.1.0 [updated March 2011]. The Cochrane Collaboration, 2011. Available from www.handbook.cochrane.org. | A meta-analysis uses a statistical approach to combine the findings of multiple similar studies to arrive at an overall numeric summary of the effectiveness of an intervention and to explore the factors that may modify that summary effect (e.g., age of animals).<br>A meta-analysis should be preceded by a systematic review. |
| 11. | Realist reviews | "A method of systematic review designed for complex policy or social interventions or programmes, and which is based on the emerging 'realist' approach to evaluation. It provides an explanatory analysis aimed at discerning what works for whom, in what circumstances, in what respects and how."<br>(Pawson R. et. al., 2005.Journal of Health | A realist review uses a systematic rigorous method to answer questions about the context of an intervention or program. |

| | | Services Research & Policy Vol 10 Suppl 1: 21–34). | |
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| 12. | Scoping reviews | Scoping reviews use rigorous methods to ensure transparency and replicability of findings.<br>"A scoping study/review tends to address broader topics where many different study designs might be applicable. Whereas, the systematic review aims to provide answers to questions from a relatively narrow range of quality assessed studies, a scoping study is less likely to seek to address very specific research questions nor, consequently, to assess the quality of included studies."<br>The purposes of a scoping review may include mapping (describing) the literature on the topic of interest, identifying areas where the available literature may support a systematic review / meta-analysis, and identifying gaps in the literature.<br>(Arksey, H. and O'Malley, L. (2005) Scoping studies: towards a methodological framework, *International Journal of Social Research Methodology, 8, 1, 19-32.)* | A scoping review uses a rigorous method to describe the nature of a body of research about a topic.<br>It may be done in advance of systematic reviews as 'reconnaissance' of the literature to determine if there is enough literature to answer a specific question through a systematic review or it can help identify research gaps. |

## Table of **study design terms**, definitions, and resources

|  | Term | Scientific definition and resources | Plain language definition |
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| 13. | Case Report/ Case Series | The study population is selected based on the presence of a disease or condition of interest. The analysis includes a description of disease condition, and may describe prognosis/survival time for individual study subjects. Inferential statements about the efficacy of treatment or statistical significance of potential risk factors are not appropriate as there are no control groups and no formal statistical analysis. (Sargeant, J., et al.,  J Vet Intern Med 2017;31:1035–1042) | Reports something novel about a condition (e.g., new disease, new manifestation of a familiar disease, example of a disease eradication protocol in a herd). There are no control/comparison groups and no statistics. |
| 14. | Challenge trials | A type of experimental trial in which the exposure of interest [e.g., infective agent, immune-stimulant, lameness, metabolic disease, stress, etc.] is deliberately administered to or induced in all study subjects. The challenge is given to the target species of interest. "Challenge trials may be used to evaluate both therapeutic and preventive interventions. (Sargeant et al., 2010. The REFLECT statement. *Zoonoses and Public Health* 57:105-136.) | A type of trial in which the disease, trauma, or illness is deliberately induced in order to 'challenge' the study animals. The 'challenged' animals are assigned to a group receiving the treatment [or prevention] of interest or a control group.  A vaccine challenge trial is a common use of these trial types. |
| 15. | Clinical Trial | A **clinical trial** is any experimental **study** that prospectively allocates human/animal subjects or groups of subjects to one or more interventions to evaluate the effects on outcomes [e.g., health and wellbeing, performance and animal production or welfare]. The exposure of interest [e.g., infective agent, immune-stimulant, lameness, metabolic disease, stress, etc.] is allowed to occur naturally. WHO http://www.who.int/topics/clinical trials/en/ The trial compares the outcome in the treated group versus the control group. | A type of trial in which the animals are assigned to the treatment that is being tested for effectiveness or they are assigned to a control group. The study animals are exposed naturally to the exposure of interest. |
| 16. | Randomized controlled | A clinical trial in which the subjects from the study population are allocated to the treatment and control groups though a formal random | A clinical trial that uses a formal random process to assign the animals to |

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| | trials (RCT) | process. The effectiveness of the intervention is compared between the treatment group(s) and the control group.<br>(Sargeant et al., (2014). Zoonoses and Public Health 61:18-27 [Supplement 1]) | the treatment and control groups. An example is the use of a random number generator. |
| 17. | Observational studies | Much like a 'natural experiment', "in an observational study, investigators assess associations between exposure and outcomes. Animals may receive interventions (which can include therapies such as drugs) or be exposed to management practices or risk factors as part of their routine care, but the animals are not allocated to specific interventions by the investigator (as in a clinical trial)."<br>https://ebusiness.avma.org/aahsd/more_info/veterinary_clinical_studies.aspx#trials | A study in which the animals are not assigned to the treatment or control group but are observed in their natural state. |
| 18. | Cross-sectional studies<br><br>(a type of observational study design) | Subjects are sampled without regard to exposure or outcome status then categorized into groups based on exposure and outcome. The analysis compares the prevalence of the outcome between exposure groups, and can calculate prevalence of outcome in the population and distribution of the exposure in the population.<br>(Sargeant, J. et al., J Vet Intern Med 2017;31:1035–1042). | These are studies that test a relationship (i.e. association) between a factor and an outcome in a study population. These studies measure the outcome and factors at one point in time. They evaluate what outcome the study subjects 'have' not what 'they get over time'. |
| 19. | Case-control studies<br><br>(a type of observational study design) | Subjects are sampled based on the presence/absence of an incident or prevalent outcome, then categorized into exposure groups. The analysis compares distribution of exposure between outcome groups.<br>(Sargeant, J. et al., (2017). *J Vet Intern Med* 31:1035–1042). | These studies compare a group with a certain outcome, such as a disease, with a group that does not have the outcome. Various factors that may have contributed to the outcome are identified. |
| 20. | Cohort studies<br><br>(a type of observational study design) | A cohort is a group of animals that share a common characteristic or experience within a defined period (e.g., were born in a specific year, are exposed to an occupational hazard or pollutant, or undergo a certain medical procedure).<br>Individuals free of the outcome at the outset are selected and categorized based on exposure status and then are followed over time to determine incidence of an outcome. Analysis compares incidence of outcome between | Cohort studies monitor groups over time to establish a before and after relationship between a factor and a certain outcome. The group(s) needs to be free of the outcome at the start of the study. These studies evaluate what outcome the study |

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| | | exposure groups.<br>Cohort studies can be <u>retrospective</u> (looking back in time, thus using existing data such as medical records or a claims database) or <u>prospective</u> (requiring the collection of new data).<br>(Dohoo, Martin, and Stryhn (2009), Veterinary Epidemiologic Research). | subjects 'get over time'. |

## Table of definitions and resources for **efficacy trials vs. effectiveness trials**

| | Term | Scientific definition and resources | Plain language definition |
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| 21. | **Efficacy** trials | **Efficacy** trials (explanatory trials) determine whether an intervention produces the expected result under ideal circumstances.<br>https://www.ncbi.nlm.nih.gov/books/NBK44024/ | These trials test the ability of an intervention such as a vaccine, medicine, or program to influence an outcome under ideal conditions (e.g., experimental conditions). |
| 22. | **Effectiveness** trials | **Effectiveness** trials (pragmatic trials) measure the degree of beneficial effect under "real world" clinical settings.<br>https://www.ncbi.nlm.nih.gov/books/NBK44024/ | These trials test the ability of an intervention such as a vaccine, medicine, or program to influence an outcome under **'real world'** natural conditions. |