

# Evaluating scientific literature and applying in the field

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## Abstract

Animal health and performance research trials are commonly performed to evaluate ways to improve production efficiency and well-being. The objective of these proceedings is to provide information on how to search for research articles, evaluate articles and what to do when no research is available. Open-source databases, such as Google Scholar, PubMed and AGRICOLA, are available to search for articles. Research articles are generally divided up into sections: abstract, introduction, materials and methods, results, discussion and conclusion. The null hypothesis is typically there is no difference between treatment groups. After evaluating the study, we need to consider the production system where the study was performed and study the population for potential external validity. Unfortunately, there will not be data to support every decision made in veterinary medicine. When no information is available, you can try to sort through other study types, work in different species, and/or in vitro to make the most informed decision possible. Identifying and evaluating scientific studies can take some time to sort through all the information; however, it is an important process to make sure appropriate application is performed in the field.

**Key words:** external validity, methods, research

## Introduction

Animal health and performance research trials are commonly performed to evaluate ways to improve production efficiency and well-being. Management strategies, product evaluation and food safety components related to animal health, performance and economics are a few of the types of trials able to be performed in animal production systems. There are multiple types of research trials including randomized control trials, prospective/retrospective cohort, cross-sectional, observational, challenge, systematic reviews, meta-analyses, simulation models, algorithm and survey.<sup>2,4</sup> Each one of these types of trials and analyses are able to answer different types of questions if performed appropriately. The objective of these proceedings is to provide information on how to search for research articles, evaluate articles and what to do when no research is available.

## Identifying research articles

Open-source databases, such as Google Scholar, PubMed, and AGRICOLA, are available to search for articles. Google Scholar will provide recommended articles based on your search history when you open website. PubMed has the ability to create search criteria and email you if any new articles are published which fall within the search criteria. This allows you to stay up to date on new information.

## Dissecting a research article

Research articles are generally divided up into sections: abstract, introduction, materials and methods, results, discussion and conclusion. The abstract provides a brief overview of the entire study and the outcome. Reading the abstract can

determine if the full article needs to be evaluated. The introduction provides an overview of previous research in the area and the reason for the study. Materials and methods describe what was done and more precisely how it was done. Information such as how treatment groups were applied, were personnel-blinded, study population used, and time points outcomes collected are included in the materials and methods. The statistical analysis section is generally within the materials and methods. Need to briefly glance to make sure appropriate models are used to the type of outcome evaluated, and the hierarchical structure is accounted.<sup>7</sup> Results are where the outcomes of the study are reported. Need to interpret the results in context of the materials and methods which were described. Discussion is where information is provided to explain the results. Supporting information from previous studies where the results agree or differ is provided as well in the discussion. The conclusion is the general take home and interpretation of the outcomes by the authors. I recommend reading information completely to see if you arrive at the same conclusions as the authors.

## Inferential research definitions

Table 1 provides an overview of important definitions for inferential research. The null hypothesis is the basis for most research projects and my initial basis for interpreting results. The null hypothesis is typically there is no difference between treatment groups. My basis for initially interpreting outcomes is there is no difference until I have been provided data to disprove the null hypothesis.

Internal and external validity are important to evaluate and interpret. If the internal validity is not achieved due to incorrect study design, outcomes aren't in agreement with materials and methods, you need to disregard the study or at least give it less credibility. External validity is interpretation of how the results can be applied to other populations. Study population is critical to evaluate external validity.

## Application of results in the field

After evaluating the study, the goal is to apply the results in the field to make a difference. Before applying, consider the production system where the study was performed and study the population to determine if results will apply in different production systems. You need to consider if the research study needs to be repeated in a different production setting or study population before applying outcomes to other systems for external validity. When evaluating data and results from different sources, evaluate the data to determine if you arrive at the same conclusions as reported.

Two BRD treatment trials were conducted by separate investigators comparing tulathromycin to tildipirosin and published in *The Bovine Practitioner* in 2018.<sup>3,6</sup> The authors well-described the methods used in the study and outcomes were within the scope described; therefore, internal validity of both studies seem to be achieved. Health outcomes of the 2 trials are shown in Table 2.

**Table 1:** Practical definitions of terms used in research studies.

Term	Practical definition
Null hypothesis	Beginning assumption for most research there is no difference between treatment groups.
P value	The probability of outcome difference as great as observed being incompatible with statistical model used.
Type I error	Concluding a difference between treatment groups exists when there truly is no difference.
Type II error	Failing to reject the null hypothesis of no difference when a difference truly exists.
Internal validity	Study design is appropriate for the hypothesis, and potential issues related to bias are controlled.
External validity	Ability for study results to be generalized and applied to other populations.

**Table 2:** Health outcomes of two bovine respiratory disease treatment studies comparing tulathromycin to tildipirosin.

Study	Outcome	Tulathromycin	Tildipirosin	P value
Dodd et al., 2018 <sup>3</sup>	No allocated, <i>n</i>	300	300	–
	Initial body weight, lb	502.52	504.37	0.52
	First treatment success, %	67.17	59.26	0.05
	BRD case fatality risk, %	4.95	10.25	0.02
Theurer et al., 2018 <sup>6</sup>	No allocated, <i>n</i>	298	295	–
	Initial body weight, lb	802.91	799.44	0.71
	First treatment success, %	80.59	80.72	0.97
	BRD case fatality risk, %	5.93	6.17	0.89

Both studies had 300 head per treatment group enrolled, but outcomes of the two studies were different. Dodd et al., 2018 found improved first treatment success and case fatality risk in cattle treated with tulathromycin compared to tildipirosin;<sup>3</sup> however, Theurer et al., 2018, found no differences between treatment groups.<sup>6</sup> Evaluating study populations used for the trials most likely explains the reason for the differences observed between the trials. Dodd et al., 2018, used the 600 BRD cases identified by pen rider from a total of 791 head resulting in a morbidity risk of 75.9% and pulled within the first 10 days on feed.<sup>3</sup> Treatment response is poorer with fewer days on feed when initially pulled.<sup>1</sup> Theurer et al., 2018, enrolled cattle at a commercial feedlot over a 133-day period to reach the 600 cases enrolled into the study.<sup>6</sup> Both of the studies are relevant; however, study populations result in different applications in the field. The Dodd et al., 2018, study is more applicable to high-risk cattle.<sup>3</sup> Theurer et al., 2018, results are more applicable to low-to moderate-risk cattle which are more common in commercial feedlots. Without evaluating the study populations of the 2 studies, incomplete conclusions may have been determined.

## What to do when there are no data available?

Unfortunately, there will not be data to support every decision made in veterinary medicine. The time and money required sometimes makes research a slow process when decisions need to be made rapidly. When no information is available, you can

try to sort through other study types, work in different species, and/or in vitro to make the most informed decision possible. Discuss with the client and outline the pros and cons of making the decision with the information (or lack of information) available. You can then conduct a research trial to generate the data to support the decision.<sup>5</sup>

## Conclusions

Identifying and evaluating scientific studies can take some time to sort through all of the information. However, it is an important process to make sure appropriate application is performed in the field. With some practice, you will be able to sort through these studies quickly.

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