

1 Evaluating scientific literature and applying in the field

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6 **Abstract**

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

21 **Keywords:** external validity, methods, research,

## 22 **Introduction**

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

## 34 **Identifying Research Articles**

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

## 41 **Dissecting a Research Article**

42 Research articles are generally divided up into sections: abstract, introduction, materials and  
43 methods, results, discussion, and conclusion. The abstract provides a brief overview of the entire  
44 study and the outcome. Reading the abstract can determine if the full article needs to be

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

58

### 59 **Inferential Research Definitions**

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

65

66 Internal and external validity are important to evaluate and interpret. If the internal validity is  
67 not achieved due to incorrect study design, outcomes aren't in agreement with materials and

68 methods, need to disregard the study or at least give it less credibility. External validity is  
69 interpretation of how the results can be applied to other populations. Study population is critical  
70 to evaluate external validity.

71

## 72 **Application of Results in the Field**

73 After evaluating the study, the goal is to apply the results in the field to make a difference.

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

80

81 Two BRD treatment trials were conducted by separate investigators comparing tulathromycin to  
82 tildipirosin and published in *The Bovine Practitioner* in 2018.<sup>3,6</sup> The authors well-described the  
83 methods used in the study and outcomes were within the scope described; therefore, internal  
84 validity of both studies seem to be achieved. Health outcomes of the 2 trials are shown in Table  
85 2. Both studies had 300 head per treatment group enrolled, but outcomes of the two studies were  
86 different. Dodd et al., 2018 found improved first treatment success and case fatality risk in cattle  
87 treated with tulathromycin compared to tildipirosin;<sup>3</sup> however, Theurer et al., 2018 found no  
88 differences between treatment groups.<sup>6</sup> Evaluating study populations used for the trials most  
89 likely explains the reason for the differences observed between the trials. Dodd et al., 2018 used  
90 the 600 BRD cases identified by pen rider from a total of 791 head resulting in a morbidity risk

91 of 75.9% and pulled within the first 10 days on feed.<sup>3</sup> Treatment response is poorer with fewer  
92 days on feed when initially pulled.<sup>1</sup> Theurer et al., 2018 enrolled cattle at a commercial feedlot  
93 over 133-day period to reach the 600 cases enrolled into the study.<sup>6</sup> Both of the studies are  
94 relevant, however study populations result in different applications in the field. Dodd et al., 2018  
95 study is more applicable to high-risk cattle.<sup>3</sup> Theurer et al., 2018 results are more applicable to  
96 low- to moderate-risk cattle which are more common in commercial feedlots. Without evaluating  
97 the study populations of the two studies, incomplete conclusions may have been determined.

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

100 Unfortunately, there will not be data to support every decision made in veterinary medicine. The  
101 time and money required sometimes makes research a slow process when decisions need to be  
102 made rapidly. When no information is available, you can try to sort through other study types,  
103 work in different species, and/or in vitro to make the most informed decision possible. Discuss  
104 with the client and outline the pros and cons of making the decision with the information (or lack  
105 of information) available. Can then conduct a research trial to generate the data to support the  
106 decision.<sup>5</sup>

### 108 **Conclusions**

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

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