



# An infection preventionist's guide to evaluating research studies

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**E**valuating research studies and incorporating the results of research findings into the practice of infection prevention and control are core competencies for the infection preventionist (IP).<sup>1</sup> Understanding how research is conducted and identifying the key components of how the results of a study are presented can help IPs ground their daily work in evidence-based practice and apply the most current findings to the prevention of infection.

In this article, we review the main components of a research paper and some key questions that are useful when evaluating such a paper. Understanding the basic structure of a research article is a first step in the critical review process.

**IMRAD: INTRODUCTION, METHODS, RESULTS, AND DISCUSSION**

The results of research studies are presented in a standard format including an introduction, a description of the methods, the results, and a discussion (IMRAD).

The introduction to a research paper provides an overview of the topic and the importance of the problem to be studied. A well-done introduction addresses what is known in the field, gaps in current knowledge, and then describes the purpose of the study. The methods section includes information on how the study was designed and conducted, and how data was collected, measured, and compared. The results section presents the specific data collected and provides the results of statistical comparisons. The discussion and conclusion summarize the main results in order to provide an overview of how the findings are similar or different from other studies, discuss any study limitations, and provide applications of the findings in terms of practice and future research. The discussion compares results of the study to observations made from previous studies including similarities of the results to other studies as well as important differences of the results to previous findings. The discussion section also addresses the purpose and outcome of the study and any implications for practice.

**AFTER IMRAD: EVALUATE AND ASSESS**

*3 key concepts*

The standardized IMRAD format allows readers to become oriented quickly to a research paper. In addition, the abstract of the paper, included in the published article, briefly summarizes the methods, main findings, and conclusions of the study.

Once the reader is oriented to the research paper, it becomes easier to keep in mind three important concepts that help to evaluate and assess the relative importance of the research results: validity, reliability, and applicability (see Table 1).

**“Another key element to consider when evaluating the validity and reliability of a research paper is the types of measures used, and their appropriateness for the underlying variables.”**

**HOW TO EVALUATE FOR VALIDITY, RELIABILITY, APPLICABILITY**

*Study design and methods*

In broad terms, data from a research study can be qualitative or quantitative. Qualitative data includes narrative descriptions of phenomena and themes or summaries of experiences collected from groups of people through focus groups, observations, or interviews. Quantitative data is collected through precise measurement of different variables and is presented as numbers, counts, and statistics.

Understanding the study design, or how the data was collected, is important to evaluating the validity and reliability of a study. Research studies can be prospective or retrospective. Prospective studies present an idea or hypothesis to be tested looking forward. Retrospective studies use previously collected data looking backward to identify trends and make comparisons between groups. The topic of the research, access to the patient population, frequency of the outcome, and other factors impact whether a prospective or retrospective study is most appropriate.

*Variables and measures*

Variables are observations made or data collected. Independent variables are risk factors or other descriptors of the study participants. Dependent variables are the outcomes associated with the independent variables. In essence, the outcome depends on the independent variables; thus, it is called the dependent variable.

For a study to be valid, it is important that the dependent variables actually relate to the outcome of interest. Dependent variables can be process measures or outcome measures. For example, a process measure might be the number of patient-days of urinary catheter utilization while an outcome measure might be the number of catheter-associated infections.

Another key element to consider when evaluating the validity and reliability of a research paper is the types of measures used and their appropriateness for the underlying variables. Data may be collected on several scales and this can impact the validity and reliability of the study. Nominal, ordinal, interval, and ratio data describe the scale of the data, and variables can be collected

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|----------------------|---|
| <b>Validity</b>      | <ul style="list-style-type: none"> <li>• Were the results of the study obtained using sound scientific methods?</li> <li>• What factors impact the accuracy of the study?</li> <li>• Some study characteristics to consider when evaluating the validity of a quantitative study include: random selection/assignment of study participants, inclusion/exclusion criteria used, appropriateness of statistical tests.</li> <li>• Control for other extraneous factors that can affect the variables of interest (confounding).</li> </ul> |
| <b>Reliability</b>   | <ul style="list-style-type: none"> <li>• Are the findings repeatable? If the study were repeated using the same methods in a similar patient population, is it likely that it would yield the same results?</li> </ul>  |
| <b>Applicability</b> | <ul style="list-style-type: none"> <li>• Are the results of the study appropriate to your particular setting/practice?</li> <li>• Does the study address an important topic in infection prevention practice?</li> </ul>  |

**TABLE 1. KEY CONCEPTS IN EVALUATING RESEARCH PAPERS.**

**“The goal of statistical analysis is to determine whether differences observed between groups are due to random variation or a true difference.”**

using different scales. For example, temperature may be collected as a nominal measure (“normal” or “abnormal”), as an ordinal measure in which different categories can be ranked (“hypothermia,” “normal,” “elevated,” and “high”), in an interval scale (less than 35.6°C, 35.6–38.0°C, greater than 38.0°C), or as an absolute number (degrees C).

A consideration of how the research study analyzed the data collected is another important component of evaluating the validity and reliability of the study being presented. Different statistical methods are used depending on the scale of the dependent and independent variables. The statistical methods selected should be appropriate to the type of data collected. Quantitative, statistical comparisons measure the differences in dependent variables between groups.

The goal of statistical analysis is to determine whether differences observed between groups are due to random variation or a true difference. To identify this, look for measures of precision such as a p-value or

### ADDITIONAL RESOURCES

- Herzig CT (2014). Research Study Design in Grota, P (Ed.) *APIC Text of Infection Control and Epidemiology*. Available at <http://text.apic.org>.
- Pogorzelska-Maziarz M (2014). Qualitative Research Methods in Grota, P (Ed.) *APIC Text of Infection Control and Epidemiology*. Available at <http://text.apic.org>.
- Manning ML, Davis J (2012). Journal club: A venue to advance evidence-based infection prevention practice. *American Journal of Infection Control*, 40 (7), 667-669.
- *American Journal of Infection Control* Journal Club series. Available at [www.ajicjournal.org](http://www.ajicjournal.org).
- *British Medical Journal* How to read a paper series. Available at [www.bmj.com/about-bmj/resources-readers/publications/how-read-paper](http://www.bmj.com/about-bmj/resources-readers/publications/how-read-paper).

confidence intervals that are reported in the paper.

### HOW CAN THE STUDY CHANGE PRACTICE?

A commonly missed aspect of critiquing research studies is understanding how the results of this study can impact practice and the relevance of the findings to a particular setting. After evaluating validity and reliability, an important next step is to consider how the results of the research study could be used to change practice.

In order to assess the applicability of a study, the outcomes of interest should be considered in relationship to the desired clinical outcome. This requires thoughtful comparisons and an understanding of the

context of the study. For example, a study on the use of an educational intervention to improve hand hygiene might measure hand hygiene compliance in a group receiving the intervention (experimental) compared to a group that did not receive the intervention (control). Evaluating the applicability of this study requires background knowledge of the efficacy of hand hygiene and the impact of hand hygiene on overall infection rates.

The relevance of the study population should be compared to a specific setting and institution. For example, the intervention and design of a study on universal contact isolation conducted in an intensive care setting may not be practical or relevant in a long-term care setting.

Being able to evaluate and critique research studies in order to inform practice is an important competency for the IP. The best way to become better at reading and critiquing research studies is to practice and share thoughts with colleagues. **R3**

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### Reference

1. Murphy D, Hanchett M, Olmsted RN, et al. Competency in infection prevention: A conceptual approach to guide current and future practice. *American Journal of Infection Control* 2012, 40(4), 296–303. doi:10.1016/j.ajic.2012.03.002.

