

Focusing on the Fundamentals: Reading Quantitative Research with a Critical Eye

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This article in the Focus on the Fundamentals series of the Exploring the Evidence department offers nephrology nurses an opportunity to review the basics of examining a quantitative research study. Quantitative research is a method used to answer questions about or explain a phenomenon of interest by collecting and analyzing objective numerical data, as opposed to subjective narrative data contained in a qualitative study (Ingham-Broomfield, 2014). With a strong focus on evidence-based practice in healthcare, the need to be discerning in the evaluation of the evidence is critical. The purpose of this article is to review principles that nephrology nurses can use when reading and interpreting a quantitative research article, and to provide a methodical way of approaching a quantitative research article to determine its merits and limitations. A methodical approach is important in the evaluation of literature for identification of gaps in nursing knowledge and potential translation to nursing practice.

Critical Analysis

It is important for nurses to learn techniques for critically analyzing research. A critique is an analysis of the strengths and weaknesses of the study. Nurses must ask questions, such as are the methods appropriate, does the study explain the phenomenon of interest, and are the findings useful (Gray & Grove, 2017)? No study is perfect; thus, an analysis helps nurses decide the value of findings and applicability to practice, despite identified weaknesses. Weaknesses are generally referred to as limitations of the study and may include areas such as sampling technique and sample size. Sizable limitations will impact the

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Nephrology nurses must be able to critically analyze research to improve their practice. This article defines the components of a quantitative research article, reviews principles that nephrology nurses can use when reading and interpreting a quantitative research article, and provides a methodical way of approaching a quantitative research article to determine its merits and limitations.

Key Words: Research critique, quantitative research, framework.

ability of the nurse to generalize findings from the study (Gray & Grove, 2017).

Strength of the Evidence

Nurses need to consider the strength of the evidence presented in the research article during the review. Historically, the strength of the evidence was primarily evaluated based on study designs. For example, systematic reviews or meta-analyses are considered to provide highest levels of evidence because they are subject to the highest level of critical appraisal, followed by quantitative studies and qualitative studies (Ingham-Broomfield, 2016). In

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addition, among quantitative studies, randomized controlled trials (RCTs) are considered to provide stronger evidence than other quantitative design studies, such as cohort studies, case-control studies, or case reports that are quasi- or non-experimental for reasons that include reduced risk for bias (Watson, 2015).

More recently, researchers have suggested that numerous factors in addition to study design contribute to the strength of evidence; even if a study employed a rigorous design, the quality of the study may be poor. In particular, the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group developed a framework to include other factors independent from study design, such as methodological limitations of a study, inconsistency, indirectness, and imprecision, to grade the quality of the evidence as high, moderate, low, and very low (Guyatt et al., 2008). Another group of researchers created tools and guidelines to assist with critical appraisal of strength and quality of both research and non-research evidence; this allows the nurse to synthesize evidence for dissemination and application to practice (Johns Hopkins Center for Evidence-Based Practice, 2017). The different levels of evidence vary by study design; the quality of evidence is based on appraisal of the components of the research and rated as high, good, or low. For example, the grading of the quality of the evidence for experimental studies or systematic review of experimental studies (level 1: highest level) is based on generalizability, sufficient sample size, and consistent with findings in the literature (Johns Hopkins Center for Evidence-Based Practice, 2017). On the other hand, grading the quality of evidence for quasi-experimental studies or systematic reviews of those studies (level 2) and non-experimental studies or systematic reviews of those studies (level 3: lowest level) is based on the quality of the inquiry, including verification, self-reflection and scrutiny, and insightful interpretation (Johns Hopkins Center for Evidence-Based Practice, 2017).

Framework for Analysis

While there are several frameworks to use when evaluating research reports, the literature suggests areas to consider when critically reviewing reports of quantitative research (Caldwell, Henshaw, & Taylor, 2011; Gray & Grove, 2017). Key areas to critique include the title, abstract, introduction or background, review of the literature, theory or framework, purpose, methods, results/findings, discussion, and conclusion (see Table 1). The inclusion of these components may vary according to the journal in which the research article is published; for example, journals of disciplines outside of nursing may not require identification of a theoretical or conceptual framework, yet the research may have important findings and implications for practice.

Title. The title of an article should clearly and accurately depict the content of the study. Generally, the title includes information about the population, the problem,

and the design to allow the opportunity to determine if a paper is related to the identified topic of interest. Clever and ‘catchy’ titles often do not capture the necessary elements of a scholarly paper.

Authorship. Each author’s educational background and experience should be appropriate for the type of research done. Their experience should be relevant and convey the relevance of their expertise in the area being researched (Caldwell et al., 2011; Gray & Grove, 2017).

Abstract. The abstract of an article should be well written, concise, and provide an accurate overview of the study. It should briefly outline the background, identified gap in the knowledge, purpose of the study, methods used, study findings, and implications for future research and clinical practice. The abstract should be informative and allow for a decision to be made if the article presents the content sought.

Introduction or background. The introduction or background section of an article should allude to the scope and significance of the research problem or topic of interest. Statistics regarding the number of people influenced, cost involved in addressing the problem, and the severity of health outcomes (morbidity or mortality) provide objective means to indicate the scope and severity of the problem.

Review of the literature. The review of the literature section should give additional background information about the research problem; it should be relevant and current (Gray & Grove, 2017). One guideline is that reviewed literature should be no more than five years old unless citing classic studies. The review should identify what is known and unknown about the problem. The gap in the literature identified in this section needs to support the necessity of the proposed study.

Theory/conceptual framework. A theory or conceptual framework that supports the study should be clearly identified and explained. To support the study, the theory or conceptual framework needs to depict the relationships among the study variables; a diagram of the theory or framework is useful. Study variables are concepts including the topic of interest and possible influential factors. The use of a theory or conceptual framework is more common in nursing than in biomedical research.

Purpose. The study should include a clear purpose statement that identifies the focus of the research. The variables identified in the purpose should be clearly linked to the chosen theory or conceptual framework (Gray & Grove, 2017). Additionally, report of hypotheses being tested or research question(s) being asked to meet the purpose of the study is preferable. Hypotheses are more likely reported with studies using an experimental design.

Methods. The methods section of the study should contain a variety of elements, including the research design, sample, setting, and variables to be studied. It also explains the procedures for human subjects’ protection, recruitment of research participants, and data collection and analysis.

Table 1
Key Areas for Critical Review of Quantitative Research

Title	<ul style="list-style-type: none"> • Is the title clear, and does it accurately depict the content of the study?
Authorship	<ul style="list-style-type: none"> • Are the authors' credentials appropriate for the topic?
Abstract	<ul style="list-style-type: none"> • Is it well written and concise, and does it provide an accurate overview of the study?
Introduction or background	<ul style="list-style-type: none"> • Does this section allude to the scope and significance of the problem?
Review of the literature	<ul style="list-style-type: none"> • Does the review of the literature give additional background information about the problem? • Does the review identify what is known and unknown about the problem? Are gaps in the literature identified?
Theory or framework	<ul style="list-style-type: none"> • Is there a theory or underlying framework identified that underpins the study? • Does the theory or framework depict the relationships among the study variables?
Purpose	<ul style="list-style-type: none"> • Is there a statement of the purpose for the study? • Does the author include appropriately stated hypotheses and/or research questions that are appropriate to the identified research problem?
Methods	<ul style="list-style-type: none"> • Is the design of the study and setting clearly described? Does the design represent the best way to collect evidence to answer research questions or test the hypothesis? • Is the sample described and include justification for the number of participants, such as a power analysis? Does the sample represent the intended population? • Are the study variables clearly defined and measured? Is there sufficient information provided about any instruments, including what it measures, how it is scored, and reliability and validity information? • Is there evidence that human subjects' protection was secured through an Institutional Review Board (IRB) process? • Are procedures for participant recruitment and data collection described? Is it clear what the researchers did and in what order? • Are interventions clearly described, if applicable? Are data analysis procedures/tests described and sufficient to answer the research questions?
Results/findings	<ul style="list-style-type: none"> • Are results presented and interpreted correctly? • Do findings answer research questions and meet the purpose of the study? • Are both clinical and statistical significance reported? • Is the effectiveness of the intervention reported, if applicable?
Discussion	<ul style="list-style-type: none"> • Are results discussed and compared with those from other studies?
Conclusion	<ul style="list-style-type: none"> • Are conclusions in line with results presented? What are implications for future research and clinical practice?

Design. The design of the study should be clearly described and represent the best way to collect evidence to answer the research question or test the hypothesis. For example, causality is better supported by studies employing longitudinal design rather than cross-sectional design. A cross-sectional design observes the phenomena of interest at one point in time, while a longitudinal study will contain observations at several points over time.

Setting. The setting of the study may include sites of participant recruitment and data collection. The setting should be clearly described and appropriate for meeting the purpose of the study (Gray & Grove, 2017).

Sample. The sample includes a description of research participants who meet the eligibility criteria set by authors. The sampling technique should be adequate to reflect the population on which the research is focused and avoid selection bias (Caldwell et al., 2011). If the study is inter-

vention research, there should be adequate information to distinguish between the control and intervention groups. This section should contain justification for the number of participants, such as a power analysis, to ensure sample size is sufficient to detect the effect of a test at the desired level of significance.

Measurement. Study variables should be clearly defined and measured. The author should provide sufficient information about any instruments used, including variables measured, the method of scoring, and the meaning of instrument scores, as well as reliability and validity data. Reliability is an estimate of how often the measure produces the same results each time (Watson, 2015). Validity is related to an estimate of how accurately the instrument measures the variable being studied (Watson, 2015).

Procedures. Authors should indicate that human subjects' protection was secured through an Institutional

Review Board (IRB) process. Steps for participant recruitment and data collection should be clearly delineated. If interventions are a part of the study, they should be clearly explained. Data analysis procedures/tests should be sufficiently described and appropriate to answer research questions or test the hypothesis.

Results/findings. Study results should be clearly presented and interpreted according to research questions or hypotheses. Tables and graphs must be consistent with findings reported in the text. Statistical significance can be reported with a *p*-value or confidence interval based on a preset determination of what constitutes statistical significance. A lower *p*-value indicates the research hypothesis is more apt to be true, and 95% confidence interval is commonly used (Hoare & Hoe, 2013). The reader may also consider if there is clinical significance. Clinical significance relates to the importance of study findings to everyday practice. A finding that is statistically significant may not necessarily be significant in the clinical setting. If applicable, clinical significance may help determine the effectiveness of an intervention reported.

Discussion. In the discussion, results of the study should be compared with those from other studies. Authors should describe how study findings aligned with previous studies and provide an explanation for findings that are not. This discourse may suggest future areas for research. Authors should include a discussion of study limitations.

Conclusion. Conclusions should flow from results presented. The conclusion may summarize results and provide implications for future research and clinical practice.

Practice

The extensiveness of the critique may be affected by the education and training of the nurse reader. The baccalaureate-prepared nurse can identify the essential components of the research study, while the nurse prepared at the master's level should be able to also identify strengths and weaknesses of the study (Gray & Grove, 2017). The nurse prepared at the doctoral level may be more equipped to synthesize results from multiple studies to influence research for practice decisions (Gray & Grove, 2017).

The evaluation of research is a skill nurses can develop with practice. Evaluation of research studies may be overwhelming the first few times a nurse performs the skill, but it is also an activity that can be completed in a group with other more experienced nurses (Caldwell et al., 2011). Journal clubs are one avenue of support and guidance. Nursing journal clubs offer an opportunity for nurses to come together, face-to-face or virtually, to review articles of choice that may be relevant to their current clinical interest or problem. If the purpose of the review is to find evidence to support best practice, nurses may benefit from using grading guides, such as those from Johns Hopkins Nursing Evidence-Based Practice to help them identify, appraise, and summarize evidence from the scientific literature.

In a review of the literature, Lachance (2014) reported

journal clubs to be an effective teaching strategy for continuing education and evidence-based practice. Journal clubs allow nurses to develop and use not only research-related skills, such as in reading and critically appraising research, but also to remain abreast of the latest evidence, and incorporate best practice for patient care. A barrier to journal clubs was a lack of participation related to voluntary nature of this activity (Lachance, 2014). This can be overcome with a supportive organizational culture that includes journal clubs as a part of continuing education and offers online participation (Moore, Green, & Gallis, 2003).

Conclusion

A critical analysis of a research study is an important skill for nurses to develop and hone, as they strive to improve patient outcomes and the quality of care provided. Publication of a research study does not guarantee it is high-quality work. Critical appraisal of studies using the framework, tools, and guidelines suggested here to determine the strength and quality of evidence is essential for the nurse to determine if the research is methodologically sound. It becomes the judgment of the nurse reviewing the study to differentiate high-quality work that ultimately meets the need for discovery of evidence that will improve practice.

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Learning Outcome

After completing this learning activity, the learner will be able to define components of a quantitative research article and describe a format to use when reviewing a quantitative research article.

Learner Engagement Activity

For more information on this topic, refer to the following article: <https://www.apa.org/pubs/journals/releases/amp-amp0000151.pdf>

Evaluation Form (All questions must be answered to complete the learning activity. Longer answers to open-ended questions may be typed on a separate page.)

1. I verify I have completed this education activity. Yes No

SIGNATURE _____

- | | Strongly Disagree | (Circle one) | Strongly Agree |
|--|-------------------|--------------|--|
| 2. The learning outcome could be achieved using the content provided. | 1 | 2 3 | 4 5 |
| 3. The authors stimulated my desire to learn, and demonstrated knowledge and expertise in the content areas. | 1 | 2 3 | 4 5 |
| 4. I am more confident in my abilities since completing this education activity. | 1 | 2 3 | 4 5 |
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| 6. Did the learner engagement activity add value to this education activity? | | | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 7. Commitment to change practice (select one): | | | |
| a. I will make a change to my current practice as the result of this education activity. | | | |
| b. I am considering a change to my current practice. | | | |
| c. This education activity confirms my current practice. | | | |
| d. I am not yet convinced that any change in practice is warranted. | | | |
| e. I perceive there may be barriers to changing my current practice. | | | |
| 8. What do you plan to do differently in your practice as a result of completing this educational activity? (Required) _____ | | | |
| 9. What information from this education activity do you plan to share with a professional colleague? (Required) _____ | | | |
| 10. This education activity was free of bias, product promotion, and commercial interest influence. (Required) | | | <input type="checkbox"/> Yes <input type="checkbox"/> No |
| 11. If no, please explain: _____ | | | |

* Commercial interest – any entity either producing, marketing, reselling, or distributing healthcare goods or services consumed by or used on patients or an entity that is owned or controlled by an entity that produces, markets, resells, or distributes healthcare goods or services consumed by or used on patients. Exceptions are non-profits, government and non-healthcare related companies.

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