

Column: Tips on Research and Publication

WRITING LIMITATIONS IN RESEARCH MANUSCRIPT: RECOGNIZING THE STUDY'S CONSTRAINTS AND THEIR IMPLICATIONS

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ABSTRACT

All research has certain limitations. Acknowledging these limitations, explaining how they were minimized, and discussing their impact on the findings are important for enhancing transparency in research. However, many papers either omit limitations altogether or address them only superficially. Researchers should clearly identify all major limitations, explain how they may affect the interpretation of the findings, describe the measures taken to mitigate their impact, and provide recommendations for future research. This will help readers, reviewers, and editors evaluate the research within the context of its constraints. All reporting guidelines emphasize inclusion of relevant study limitations in publications.

Keywords: Limitations, Constraints, Research, Manuscripts

INTRODUCTION

No research study is without limitations. These are typically described in the Discussion section of a manuscript, usually just before the Conclusions, either as a separate paragraph or under a dedicated subheading.¹ Authors should acknowledge all important limitations, particularly those that may influence the interpretation of the findings. Failure to do so may result in editors, reviewers, or readers identifying overlooked limitations, leading to substantial revisions during peer review or post-publication critiques. This can be embarrassing for the authors and potentially undermine the credibility of the study.

Evidence suggests that many published manuscripts do not report study limitations adequately.^{2,3} This may reflect limited understanding of methodological issues or reluctance to disclose weaknesses. Novice authors, in particular, may fear that discussing

limitations will reduce the chances of publication. However, transparent reporting of limitations enhances the credibility of the research and is generally valued by editors, reviewers, and readers.

Major methodological limitations that threaten internal validity can undermine the reliability of its findings and even lead to rejection. However, other important but nonfatal limitations should be clearly acknowledged. Beyond listing limitations, authors should explain how they may affect the interpretation of the results. This demonstrates scientific rigor, helps readers interpret the findings appropriately, and identifies directions for future research.

Limitation vs Delimitation

A *limitation* is a source of potential bias or constraint that cannot be fully controlled by the researcher. For example, the use of a non-



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Table 1: Typology of limitations

	Threats to validity	Explanation	Examples
1	Internal validity	These limitations affect the accuracy and credibility of study findings because of methodological problems.	Selection bias, measurement error (e.g. incorrect use of tools), missing data, confounding, researcher bias, inadequate randomization (e.g., alternate allocation), poor allocation concealment (e.g., use of opaque envelopes without proper safeguards), lack of anonymizing (e.g., failure to anonymize outcome assessors), participant attrition (dropouts in longitudinal studies), weaknesses in intervention or control group design.
2	External validity	These limitations affect the generalizability of findings beyond the study setting.	Restricted or non-representative samples, single-site studies, limited geographic coverage, strict experimental conditions, or time-bound findings.
3	Construct validity	These limitations result from inadequate measurement of the constructs under study.	Use of non-standardized instruments, poorly designed questionnaires, surrogate outcomes, or assessment tools that have not been culturally adapted and validated for the target population.
4	Statistical conclusion validity	These limitations arise from weaknesses in statistical inference.	Small sample size, low statistical power, violations of model assumptions, multiple testing, and measurement error.

standard or inadequately validated instrument to measure a condition may constitute a limitation if no better alternative is available. In contrast, a *delimitation* refers to a boundary or restriction that is intentionally imposed by the researcher as part of the study design.⁴ For example, restricting a study on alcohol dependence to male participants because of feasibility, resource, or logistical considerations is a delimitation. Although delimitations may limit the generalizability of findings, they differ from limitations in that they result from deliberate methodological decisions rather than unavoidable constraints.

Typology of limitations

Limitations can arise at all stages of research, from the formulation of the research question and objectives to the choice of study methodology, participant attrition, and statistical analysis. Based on Donald T. Campbell's framework,⁵ study limitations can be categorized according to The following is a modified and expanded version of this framework:

threats to internal validity, external validity, construct validity, and statistical conclusion validity (see **Table 1**). Using the PICO framework can also help identify limitations related to each study component, including the population (diagnosis, sampling, sample size, and study setting), intervention or exposure (type, dose, duration, and mode of delivery), comparison (type of comparator), and outcomes (type, measurement tools, and assessment methods).

Components of the limitations section

The four-step framework proposed by Ross and Bibler Zaidi can be used to describe study limitations.⁶ It consists of the following elements: 1) Describe the limitations; 2) Explain the implications of each limitation; 3) Provide potential alternative approaches and explanations; and 4) Describe steps taken to minimize each limitation.

1. *Declare*: Acknowledge that the study has limitations. A common opening statement is, “This study has several limitations.”
2. *Describe*: List all the relevant limitations. Mention only those limitations that might reasonably be expected to change the results to an important extent. The limitations should be presented in decreasing order of their importance, beginning with those most likely to affect the validity, generalizability, or interpretation of the findings. Trivial limitations need not be included. Authors may introduce them using statements such as “The major limitations of this study include...” followed by “Other limitations are...”. Alternatively, limitations may be presented sequentially using terms such as “First,” “Second,” and so on.
3. *Detail*: Explain each limitation in sufficient detail. Authors should describe the nature of each limitation and why it arose.
4. *Discuss*: Elaborate on the effect of the limitations on the study findings. The potential influence of each limitation on the results, interpretation, and conclusions should be clearly explained. Also, describe why you think the effects of each limitation do not substantially change your main results (e.g., About 12% of our sample was aged above 60, and the cognitive decline related to ageing may have been attributed to depression. However, a sensitivity analysis that excluded those aged >60 also significant correlation between duration of depression and impaired verbal memory). Use appropriate citations to justify your arguments. State the likely *direction and magnitude* of bias. Best practice is to say whether a limitation probably over- or under-estimates the effect.
5. *Mitigate*: Describe the steps taken to minimize each limitation. Authors should not only discuss any measures taken to minimize or mitigate the limitation but also assess the extent to which these efforts were successful.

6. *Suggest*: Provide recommendations for future research. Authors should suggest ways in which future studies can minimize, address, or overcome the identified limitations.

Presenting limitations in this structured manner enhances transparency and enables readers, reviewers, and editors to evaluate the findings within the appropriate context. The following paragraph illustrates how a single limitation can be carried through all six steps. (1) Declare — “This study has several limitations.” (2) Describe — “The most important is that participants were recruited by convenience sampling from a single tertiary-care hospital.” (3) Detail — “Nurses were approached during day-shift handovers, and those who were unavailable or declined to take part were not replaced, so the final sample consisted predominantly of day-shift staff.” (4) Discuss — “Because participation was voluntary and confined to one site, the sample may over-represent nurses with a personal interest in mental health, probably inflating the observed prevalence of depressive symptoms and limiting the generalisability of our estimates to nurses in other settings.” (5) Mitigate — “To reduce this bias, we collected information on age and sex across all three shifts, hospital personnel records, over a six-week period, and compared it with the age and sex distribution of the participants.” (6) Suggest — “Future studies should use probability-based, multi-centre sampling to obtain more representative prevalence estimates.”

Suggestions on reporting limitations in manuscripts

1. Do not omit *important limitations*. This could happen if there are word constraints in the manuscripts. All major limitations that may affect the interpretation or validity of the findings should be clearly stated.
2. Avoid *overly generic* or *vague descriptions* of limitations. For example, do not simply say

cross-sectional study, small sample size, or hospital-based sample. Each limitation should be described in a specific and meaningful way that reflects its actual impact on the study.

3. Do not *selectively report* limitations. Avoid acknowledging only minor limitations while omitting more serious ones that could affect validity or interpretation. Do not list all possible limitations, including trivial ones. Mention only those limitations that might reasonably be expected to change the results to an important extent.
4. Do not cite a *small sample size* as a limitation if the study was adequately powered based on an *a priori* sample size calculation. Because sample size is typically estimated for the primary outcome, this limitation may still apply to secondary outcomes. However, if the final sample is lower than planned because of recruitment or other constraints, this should be clearly reported, along with its implications for the findings.
5. Do not overlook potential *confounding factors* in observational studies. These should be described in the Methods section, including how they were addressed. Failure to acknowledge residual or unmeasured confounding is a common reporting error. If recognized only during peer review, it should be transparently reported as a study limitation.
6. Do not merely list study limitations *without explanation*. Authors should describe how each limitation may affect the interpretation
3. Ter Riet G, Chesley P, Gross AG, Siebeling L, Muggensturm P, Heller N, et al. All that glitters isn't gold: a survey on acknowledgment of limitations in biomedical studies. PLoS One. 2013;8(11): e73623.
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of the findings, as simply naming a limitation adds little value to the manuscript.

7. Pay attention to how limitations are *phrased*. The language should be balanced—tentative but not apologetic. The researcher should understand that acknowledging limitations does not excuse a weak design.

CONCLUSION

All research studies have limitations. Authors should clearly report the major limitations of their study and explain how they may affect the interpretation of the findings. Acknowledging limitations enhances, rather than diminishes, the credibility of the research. Reviewers and editors should also encourage comprehensive reporting of important limitations, as recommended by reporting guidelines.

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AI Declaration: "The author(s) attest that there was no use of generative artificial intelligence (AI) technology in the generation of text, figures, or other informational content of this manuscript."

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