

CRITIQUING SCIENTIFIC RESEARCH PAPERS

Adolfo Correa, MD, MPH, PhD
Jackson Heart Study

GTEC
Jackson State University
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Research Camp to provide an overview on how to

- Read and critique the scientific literature
- Enhance skills in scientific writing
- Enhance skills in research evaluation, statistics, and design of epidemiological studies
- Provide guidance on career navigation

Learning Objective

- Appreciate the range questions to consider in critical reading of a manuscript

Reading and writing

Various guides and books on critically reading
epidemiologic studies

Better reader ↔ better writer

Organization of a journal article

- Abstract – all that most people will read
- Introduction – why read this article
- Methods – what was done
- Results – what was found
- Discussion – what it means
- References – the foundation for the study
- Tables and figures – ideally stand on own

Background

- How well does the introduction to the paper synthesize and summarize what is currently known in the field with respect to research question?
- Does the description of the background define a critical area of knowledge that is currently lacking and does it lead naturally into the research question under study?

Hypothesis

- Is the research question clearly stated in the form of a measurable testable hypothesis?
- **What is the hypothesis?**

Methods: Study design

- Is a clear study design explicitly stated?
- **What is the study design?**
- Is a clear explanation for the choice of study design detailed in the methods?
- Is the chosen study design appropriate given the stated hypothesis and the nature of the population under study?

Methods: Variables and analysis

- **What are the measures of occurrence used in the study? Are they appropriate for the study design?**
- **What are the measures of association used in the study?**
 - What are the key variables and their roles?
 - How are the variables defined & measured?
 - How suited are the variables, their definitions, their measurement methods, and the data collection modes for the objectives and rationale of this study?
- Are the statistical procedures employed appropriate?

Methods: Study conduct & quality control

- How was the study population recruited?
- What steps were taken to minimize non-participation and selective factors in recruitment and retention?
- How successful, overall, was the data collection?
- What steps were taken to improve and document accuracy of data collected?

Data analysis

- Primary data analysis strategies used?
- How were the primary variables coded?
- How were primary statistical parameters estimated?
- How well suited is the choice of these parameters?
- How many participants in the primary analyses?
- How well do the authors deal with issues of multiple causation?

Results

- What are the main findings?
- Which are most important?
- How well have the authors presented them?
- Should additional results or analyses been reported or data shown?
- Are extraneous results presented?

Results

- ▶ Are the results appropriately represented by tables and figures, and does the text appropriately highlight the salient features of these data representations?
- ▶ Are tables and figures given adequate description such that they can be read and interpreted independently of the text of the paper?
- ▶ Are point estimates presented with their appropriate measures of variance?
- ▶ Do the authors report all of their findings? What, if anything, have they excluded and why?
- ▶ Are the results internally coherent?
- ▶ Are the results plausible?

Discussion

- Do the authors succinctly summarize their results?
- Do the authors interpret each of the important findings that are reported in the results?
- Do the authors ground each of their interpretations in the existing literature?
- Do the authors honestly discuss the strengths and limitations of their study?
- **What are the strengths and limitations?**
- **Are the overall conclusions of the study appropriate?**
- Do the authors suggest avenues for future research?

Potential concerns

- Are all prospective members of the study population accounted for?
- Does study population reflect the target population well?
- Major threats to validity important for interpreting the findings?
- How well did the authors discuss these threats to validity?

Strengths and weaknesses

- Key strengths in regard to study objective(s)?
- Do these advance the field? How?
- Key limitations in regard to objective(s)?
- Are limitations shared by other studies?
- What would be needed to overcome limitations?

Linkage with previous knowledge

- Comparisons to findings from other relevant studies and discussion of reasons for differences?
- Evaluate the evidence concerning the study objective, possible biological mechanisms and other criteria for causal inference
- How relevant and responsive to the study rationale was this discussion?
- In what ways, if any, have the authors advanced previous knowledge?

Conclusions, implications, recommendations

- What are the primary conclusions? Clear?
- How well supported by findings & discussion?
- How directly do they relate to the objective and rationale?
- How well did authors address implications and/or give insightful recommendations for next steps.

Summary Assessment

- Did the authors accomplish what they set out to accomplish with this study?
- Is this study an appropriate addition to the scientific literature?

Summary Assessment

- Organize and summarize comments
- Prioritize comments
 - Major
 - Minor
- Recommendations
 - Comments to editor

Steps in reading

- ✓ Expect to read article more than once (quickly, slowly)
- ✓ Read for big picture, read for details
- ✓ Look up references
- ✓ Try calculations
- ✓ Be prepared for irregularities
- ✓ Obtain consultation

Questions?

Next Steps

- Select a paper for review
- Review and prepare a brief critique
- Present critique on Thursday
- Get in the habit of reading samples of good writing on a regular basis, e.g.,
 - New York Times
 - Wall Street Journal
 - Financial Times
 - JAMA
 - NEJM
 - BMJ
- Start a journal

References

- Zaccai HC. How to Assess Epidemiologic Studies. *Postgraduate Med.* 2004; 80:140-147.
- Alexander GA. A Guide to Reviewing Manuscripts. *Maternal and Child Health J.* 2005; 9(1): 113-117.
- Young JM, Solomon MJ. How to Critically Appraise an Article. *Nat Clin Pract Gastroenterol Hepatol.* 2009;6(2):82-91.