



How to critically appraise scientific literature?

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Aims and Objectives of the session

- Aims: Promote research by improving research writing skills
- Objectives:
 1. Evidence based practice & scientific literature
 2. What is Critical Appraisal(CA) , Why do CA, What to read, Where to find it?
 3. Components of a Primary research paper
 4. Steps of Critical Appraisal (Checklist)

Evidence based practice

- Evidence based practice is imperative
- Scientific literature
- Types of scientific literature
- Types of Primary research paper

What is critical appraisal?

Critical appraisal is the process of **carefully** and **systematically** examining research to judge its *trustworthiness*, and its *value* and *relevance* in a particular context.

Burls, A. (2009). *What is critical appraisal?*. Hayward Medical Communications

Why to critically appraise?

- Information overload
- Pseudoscience
- Conflict of interest
- Overstatement of benefits

Information overload

- There are about 20,000 worldwide biomedical journals, publishing about 6 million articles per annum!
- “It usually comes as a surprise to students to learn that some (the purists would say 99% of) published articles belong in the bin and should not be used to inform practice.”

Greenhalgh, T. (2010). *How to read a paper: The basics of evidence-based medicine*. BMJ books.

Poor science

- Studies which don't report their methods fully overstate the benefits of treatments by around 25%

(Khan et al. Arch Intern med, 1996; Maher et al, Lancet 1998.)

- “What should we think about researchers who use the wrong techniques (either wilfully or in ignorance), use the right techniques wrongly, misinterpret their results, report their results selectively, cite the literature selectively, and draw unjustified conclusions?”

Altman, D. G. (1994). The scandal of poor medical research. *BMJ: British Medical Journal*, 308(6924), 283.

Conflict of interest

“Studies funded by a pharmaceutical company were found to be 4 times as likely to give results that were favourable to the company than independent studies.”

Lexchin, J., Bero, L. A., Djulbegovic, B., & Clark, O. (2003). Pharmaceutical industry sponsorship and research outcome and quality: systematic review. *Bmj*, 326(7400), 1167-1170.

- Do not believe all what you read – be critical
- Appraisal is a technique which increases the effectiveness of your reading, by enabling you to quickly exclude papers that are of too poor a quality
- Not just a fault finding exercise
- Balanced assessment of benefits and strengths of research against its flaws and weaknesses

What to read and
where to find it?



What to read and where to find it?

- Database
- Impact factor
- Journal indexation
- Literature search techniques
- Different types of papers

International database

- www.ncbi.nlm.nih.gov/pubmed
- <http://www.ncbi.nlm.nih.gov/pmc>
- <http://www.biomedcentral.com/>
- <http://www.doaj.org/>

Regional Resources

- Pakmedinet.com
- Medind.nic.in
- Medknow.com
- Emrmedex.com
- Bioline.org.br

Critical Appraisal



Components of Critical Appraisal

- Evaluation of the appropriateness of the study design for the research question
- Careful assessment of the key methodological features of this design
- Suitability of statistical methods, and its interpretation
- Potential conflict of interest
- Relevance of the research to one's own practice

Young, J. M., & Solomon, M. J. (2009). How to critically appraise an article. *Nature Clinical Practice Gastroenterology & Hepatology*, 6(2), 82-91.

Science of trashing a paper

- Getting your bearings
- 3 preliminary questions to ask before getting started

Greenhalgh, T. (2010). *How to read a paper: The basics of evidence-based medicine*. BMJ books

1. Why was the study done and what hypothesis were the authors testing?
2. Was this design appropriate to the broad field of research addressed?
3. What type of study was done?

Greenhalgh, T. (2010). *How to read a paper: The basics of evidence-based medicine*. BMJ books.

Reading and critically appraising a scientific paper



What does a paper comprise?

- Title
- Abstract/Summary
- Introduction
- Materials and Methods
- Results
- Discussion
- References

Checklists

Checklists for particular types of literature are a quick and easy way of learning critical appraisal.



Checklists

- CONSORT – Consolidated Standards of Reporting Trials
- MOOSE – Meta-analysis of Observational Studies in Epidemiology
- QUORUM – Quality of Reporting for Meta-analysis
- STROBE – Strengthening the Reporting of Observations Studies in Epidemiology
- PRISMA
- CASP

Ten questions to ask when critically appraising a research article

1. **Is the study question relevant?**
2. **Does the study add anything new?**
3. **What type of research question is being asked?**
4. **Was the study design appropriate for the research question?**
5. **Did the study methods address the most important potential sources of bias?**
6. **Was the study performed according to the original protocol?**
7. **Does the study test a stated hypothesis?**
8. **Were the statistical analyses performed correctly?**
9. **Do the data justify the conclusions?**
10. **Are there any conflicts of interest?**

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01. Is the study question relevant?

- Addresses an important topic (subjective opinion)
- Relevance to ones' own field

02. Does the study add anything new?

- Substantive new contribution to knowledge
- Research should make an incremental advance (increase confidence in validity of previous research, enhance generalizability)

03. What type of research question is being asked?

- Identify the specific research question that an article addresses
- Major categories of clinical research questions: Question about effectiveness of a treatment; frequency of events etc.
- Well developed research question usually identifies three components:
 1. Population studied
 2. Parameter studied
 3. Outcomes of interest

04. Was the study design appropriate for the research question?

- Based on research question, parameter studied
- Effectiveness
- Reporting events

05. Did the study methods address the most important potential sources of bias?

- The presence of bias means that the results of a study have deviated from the truth.
- Results in the overestimation or underestimation of the 'truth'.
- Systematic biases and random errors

Key methodological considerations for RCTs

- Was treatment allocation truly random
- Would participants have been able to know/guess their allocation
- Blinding

Key methodological considerations for Case control study

- Clearly defined Case definition
- Case representative of defined population
- Selection of controls
- Recall bias

Key methodological considerations for Cross sectional studies

- Study sample clearly defined
- Sufficient response rate
- All relevant exposures, confounders and outcomes measured accurately
- Were patients with a wide range of disease severity assessed

Key methodological considerations for Case study

- Retrospective or prospective
- Are the cases a representative sample
- All relevant exposures, confounders and outcomes measured accurately

Key methodological considerations for Cohort studies

- Retrospective/Prospective
- Is the cohort representative of defined population
- Were all confounding factors identified
- Were all important exposures and outcomes measured accurately
- Sufficient length of follow up

06. Was the study performed according to the original protocol?

- Failure to recruit the planned number of participants
- Changes to the inclusion and exclusion criteria
- Variation in the provided treatments or interventions
- Changes to the employed techniques or technologies
- Changes to the duration of follow-up.

07. Does the study test a stated hypothesis?

- “Hypothesis is a clear statement of what the investigators expect the study to find out and is central to any research question in a form that can be tested and refuted.”
- Identified *a priori* based on theory or previous knowledge
- Would help determine sample size and appropriate analyses

Last JE (Ed.; 2001) *A Dictionary of Epidemiology (4th Edn)*. New York: Oxford University Press

08. Were the statistical analyses performed correctly?

- Assessing the appropriateness of statistical analyses can be difficult for nonstatisticians.
- However, all quantitative research articles should include a segment within their 'Method' section that explains the tools used in the statistical analysis and the rationale for this approach

09. Do the data justify the conclusions?

- Whether the conclusions that the authors present are reasonable on the basis of the accumulated data
- Over emphasis
- Dismissal of important findings

10. Are there any conflicts of interest?

- When personal factors have the potential to influence professional roles or responsibilities.
- Important: recognition; how they are dealt with.

Conclusion

- Encourage research writing culture
- Academicians: Promote Journal Clubs

“I am writing a book... I’ve got the
page numbers done!”
(Steven Wright)



Questions?



References

1. Greenhalgh, T. (2010). *How to read a paper: The basics of evidence-based medicine*. BMJ books
2. Young, J. M., & Solomon, M. J. (2009). How to critically appraise an article. *Nature Clinical Practice Gastroenterology & Hepatology*, 6(2), 82-91
3. Critical appraisal of the literature: Michael Ferenzi. National Heart and Lung Institute
4. (Cover JA, Curd M (Eds, 1998) *Philosophy of Science: The Central Issues*, 1-82.)

The ability to critically appraise an article is part art and part science. This systematic process is used to identify the strengths and weaknesses of a research article in order to determine the usefulness and validity of research findings for clinical use. When reading an article, you should ask yourself a number of questions about the appropriateness of the study design and its key methodological features. Although the exact criteria by which the validity of a study should be assessed will vary slightly according to the design, some general principles are at the heart of every good critique (2000). How to review the evidence: systematic identification and review of the scientific literature. Canberra: NHMRC. 3. Guyatt GH, Sackett DL, Cook DJ. Selection and Critical Appraisal of Research Literature. Ten key questions () can be used to assess the validity and relevance of a research article. These questions can assist clinicians to identify the most relevant, high-quality studies that are available to guide their clinical practice. Box 1. Ten Questions to Ask when Critically Appraising a Research Article. Is the study question relevant? Does the study add anything new? Scientific-research endeavor is often likened to 'standing on the shoulders of giants', because new ideas and knowledge are developed on the basis of previous work.[18] Seminal research papers that make a substantive new contribution to knowledge are a relative rarity, but research that makes an incremental advance can also be of value. Clinicians, appraisal are an evaluation of the appropriateness of the study design for therefore, must be able to select and appraise the research question and a careful assessment of the key methodological scientific literature that is relevant to their field, features of this design. literature are not static; they must evolve with Box 1 Ten questions to ask when critically improvements in understanding of the important appraising a research article. sources of bias inherent in different study designs, Is the study question relevant? and increased awareness of the potential influ- Does the study add anything new? ence of other nonmethodological factors, such as What type of research.