

Health Library




# An Introduction To Critical Appraisal

## Training Notes

Health Library
Clinical Education Centre
City General Hospital
Newcastle Road
Stoke-on-Trent
ST4 6QG

Tel: 01782 556565
Fax: 01782 556582
Email: health.library@keele.ac.uk

http://www.keele.ac.uk/depts/li/hl

# Learning Outcomes

By the end of this session you should:

- understand the principles of critical appraisal and why you should undertake it
- be able to appraise published research and judge its reliability
- be able to assess the relevance of published research to your own work.

# What is critical appraisal?

Critical appraisal is the assessment of evidence by systematically reviewing its relevance, validity and results to specific situations.
Chambers, R. (1998).

| Critical appraisal is **not**: | Critical appraisal is: |
|---|---|
| × Negative dismissal of any piece of research | ✓ Balanced assessment of benefits and strengths of research against its flaws and weaknesses |
| × Assessment of results alone | ✓ Assessment of research process and results |
| × Based entirely on detailed statistical analysis | ✓ Consideration of quantitative and qualitative aspects of research |
| × To be undertaken by expert researchers/statisticians only | ✓ To be undertaken by all health professionals as part of their work |

## Why Should we Critically Appraise?

- Published research is not always reliable – we cannot take conclusions for granted, even if the article is published in a peer-reviewed journal.
- Published research is not always relevant – the abstract may indicate relevance but you will need to read the complete article to judge its applicability to your own practice/circumstances.
- To improve clinical effectiveness, we need a systematic framework to interpret research, rather than relying on a haphazard or casual approach.

## Key Steps To Effective Critical Appraisal

When critically appraising a piece of research, you are addressing 3 broad questions:

1. **Are the Results valid?**
2. **What are the results?**
3. **How will these results help me work with my patients?**

The following series of specific questions should help you to answer these broad questions. Although the questions are most applicable to a randomised controlled trial, most can be used in appraising all types of research. (see further sources at the end of this guide for details of other appraisal checklists)

# 1. Are the Results valid?

- Did the study address a clearly focused issue?
  **Is there a clearly stated aim and research question?**
  **Is there a clear explanation of the population being studied (inclusion and exclusion criteria)?**
  **Is there a clear overview of which interventions are being compared?**
  **Is there a clear overview of which outcomes are being measured and why?**

- Was the assignment of participants to treatments randomised?
  **If it is described as a randomised controlled trial and the participants were not randomised, the quality of the study should be questioned. Randomisation should ensure bias is eliminated in allocating the patients to each group.**

- Were all the participants who entered the study properly accounted for at its conclusion?
  **It is inevitable that some patients who entered the study will drop out (through death, moving away from the area or other changing circumstances). If the research does not account for all patients who entered the trial, the results could be biased.**
  **As a rule of thumb, if more than 15% of the participants dropout, then the results could be invalidated. Ideally, intention to treat anaysis should be performed whereby all participants are analysed (even if they did not complete the follow up) in the groups to which they were randomised.**

These first 3 questions are screening questions to help you decide if it is worth continuing with the article. If the answer to one of these is "no", then you would need to question whether it is worth continuing.

# Further Validity Questions

- Is the literature review appropriate?
  **It should be clear, comprehensive and provide an up to date background to the research. Check the references for currency and relevance.**

- Were the participants, health workers and study personnel "blind" to the treatment?
  **Blinding means being unaware of which research group you belong to. If patients are aware that they are in the intervention group, this may influence their self-reported health status. If possible, researchers and health professionals should also be blind, although this is not always possible**.

- Were the groups similar at the start of the trial?
  **The randomisation of participants should ensure that variables would be equally distributed between the two groups. All participants should be similar in terms of age, gender, social class, ethnicity, length of stay in hospital etc. If not, the differences could affect the results.**

- Apart from the experimental intervention, were the groups treated equally?
  **How many people delivered the intervention? If more than 1, the intervention should be standardised in some way. How was the control group treated? All participants would need to be treated equally to avoid bias.**

- Were ethical issues considered?
  **The authors should explain how they dealt with: Informed consent, confidentiality, risk factors, denial or withholding treatment, distress caused to participants.**

## 2. What are the results?

- Was there an adequate description of the data collection methods used?

  **These should be clearly described and justified. All outcome measures should be referenced and their validity reviewed. If data was self-reported by patients, it would need to be verified in some way for maximum credibility.**

- Were the methods of analysis appropriate, clearly described and justified?

  **Analysis should relate to the original aims and research questions. Choice of statistical analysis should be explained with a clear rationale. Any unconventional tests should be justified with references to validation studies.**

- What are the key findings?

  **The findings should answer the research question(s). Each outcome measure should be analysed and its results presented with comparisons between the groups.**

- How significant and precise were the results?

  **The significance of any differences between the groups should be discussed, with p-values given to indicate statistical significance (<0.05 being the common threshold for significance). The confidence intervals should be presented to demonstrate the degree of precision of the results.**

## 3. How will the results help me work with my patients/clients?

- Can the results be applied to the local population of my practice and clients?
  **How similar is the study sample to your own clients? Are there any key differences that you would need to consider for your own practice? Do you have the necessary skills to deliver the intervention or will you require additional training?**

- Were all the important outcomes considered?
  **Has the research covered the most important outcomes for your patients/clients? If key outcomes were overlooked, do you need further evidence before changing your practice?**

- Are the benefits of the intervention worth the harms and the costs?
  **If the study does not answer this question, you will need to use your own judgement, taking into account your clients, fund holders and yourself and your colleagues.**

**Notes:**

# Glossary of Critical Appraisal Terms

**Absolute Risk Reduction (ARR)** is the difference in the event rate between control group (CER) and treated group (EER): ARR = CER - EER.

**Bias** is the deviation of results from the truth, due to the way in which a study is conducted.

**Case-control Study**. Involves identifying patients who have the outcome of interest (cases) and control patients without the same outcome, and looking back to see if they had the exposure of interest.

**Case-series** is a report on a series of patients with an outcome of interest. No control group is involved.

**Clinical Effectiveness** The extent to which an intervention improves the outcome for patients in practice. The randomised controlled trial is a key measurement tool for this.

**Clinical Practice Guideline** is a systematically developed statement designed to assist practitioner and patient make decisions about appropriate health care for specific clinical circumstances.

**Cohort Study** involves identification of two groups (cohorts) of patients, one which did receive the exposure of interest, and one which did not, and following these cohorts forward for the outcome of interest.

**Confidence Interval** is a range within which the true size of effect lies with a given degree of assurance. A 95% confidence interval is within which it is 95% certain to contain the true value.

**Controls** in a RCT are people in a comparison group. They receive the usual treatment (or a placebo which has no effect) while the experimental group receive the treatment being tested.

**Cost-Benefit Analysis** converts effects into the same monetary terms as the costs and compares them.

**Cross-Sectional Study** is the observation of a defined population at a single point in time or time interval. Exposure and outcome are determined simultaneously.

**Event Rate** is the proportion of patients in a group in whom the event is observed. Thus, if out of 100 patients, the event is observed in 27, the event rate is 0.27. Control Event Rate (CER) and Experimental Event Rate (EER) are used to refer to this in control and experimental groups of patients respectively.

**Evidence-Based Health Care** extends the application of the principles of Evidence-Based Medicine (see below) to all professions associated with health care, including purchasing and management.

**Evidence-Based Medicine** is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research.

**Meta-analysis** is an overview that uses quantitative methods to summarise the results.

**Number Needed to Treat (NNT)** is the number of patients who need to be treated to prevent one bad outcome.

**Odds** are a ratio of events to non-events. If the event rate for a disease is 0.1 (10 per cent), its non-event rate is 0.9 and therefore its odds are 1:9, or 0.111.

**Odds Ratio** describes the odds of an experimental patient suffering an adverse event relative to a control patient. The Odds Ratio is the ratio of the odds of the outcome for the experimental group relative to the odds of the outcome in the control group. Odds ratio of 1 means there is no effect.

**P-value** shows the likelihood of an outcome occurring by chance. A widely accepted threshold p value is .05 i.e. If the p value is less than .05, the observed result is said to be *statistically significant,* and there is 95% certainty that the outcome did not occur by chance.

**Randomised Controlled Clinical Trial (RCT)** is a trial involving a number of patients randomised into an experimental group and a control group. These groups are followed up for the variables / outcomes of interest.

**Relative Risk Reduction (RRR)** is the percent reduction in events in the treated group event rate (EER) compared to the control group event rate (CER):

$$RRR = (CER - EER) / CER * 100$$

**Risk Ratio** is the ratio of risk in the treated group (EER) to the risk in the control group (CER): RR = EER/CER. RR is used in randomised trials and cohort studies.

**Systematic Review** is a review that strives comprehensively to identify and synthesise all the literature on a given topic (sometimes called an overview). The unit of analysis is the primary study and the same scientific principles and rigour apply as for any study. If a review does not state clearly whether and how all relevant studies were identified and synthesised it is not a systematic review.

## Sources of Reference/Further Reading


**Chambers R, Boath E, Rogers D. Clinical effectiveness and clinical governance made easy. Oxford; Radcliffe Medical Press, 2004.**

**Greenhalgh, T. and Donald, A. Evidence based healthcare workbook: understanding research. London; BMJ Publishing, 2000.**

**Light, K. The Cochrane Library Self-Training Guide and notes. NHS Centre for Reviews and Dissemination University of York, 2000. Available at: http://www.york.ac.uk/inst/crd/clibsec1.doc**

**Centre For Evidence Based Medicine Critical Appraisal Guide. Available at: http://www.cebm.net/critical_appraisal.asp**

**Centre for Evidence-Based Physiotherapy Confidence Interval Calculator. Available at: http://www.pedro.fhs.usyd.edu.au/Utilities/CIcalculator.xls**

**Critical Appraisal Skills Programme**
**CASP appraisal tool for Qualitative Research, 2002. Avaialable at:**
**http://www.phru.nhs.uk/casp/qualitative.pdf**

**CASP Appraisal Tools for other study designs, 2002. Available at:**
**http://www.phru.nhs.uk/casp/appraisa.htm**