

## Critical Appraisal of a Research Paper

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### ABSTRACT

Whether studying for your professional examinations or planning the care of your patients, critical appraisal is a vital skill for healthcare professionals. Evidence based healthcare involves the integration of the best available evidence, clinical experience and patient preference when making decisions related to patient care. Research papers provide information on current practice and new developments in the diagnosis, prevention and treatment of disease. It is a fundamental skill to be able to identify and appraise the best available evidence in order to integrate it with your own clinical experience and patients values. In this article we hope to provide you with a robust and simple process for assessing the trustworthiness of articles and assessing their value to your clinical practice.

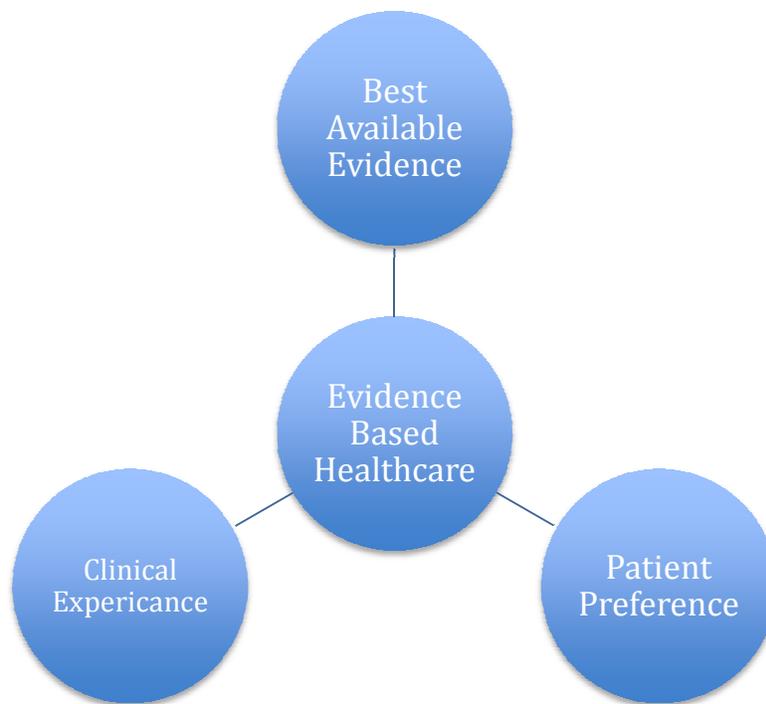
**Key Words:** Evidence-Based Medicine, Critical Appraisal and Research Design

### Introduction

Whether studying for your professional examinations or planning the care of your patients, critical appraisal is a vital skill for healthcare professionals. Evidence based healthcare involves the integration of the best available evidence, clinical experience and patient preference when making decisions related to patient care. Research papers provide information on current practice and new developments in the diagnosis, prevention and treatment of disease. It is a fundamental skill to be able to identify and appraise the best available evidence in order to integrate it with your own clinical experience and patients values. During the final years of Dental school and early years as a graduate part of our roles has been to discuss with patients their diagnoses and treatment options in an evidence-based manner. This requires up to date and accurate knowledge of the available evidence. Critical Appraisal is a method of carefully and systematically examining articles to assess their value and their place in the literature. In this article we hope to provide you with a robust and simple process for assessing the trustworthiness of articles and assessing their value to your clinical practice.

## Background

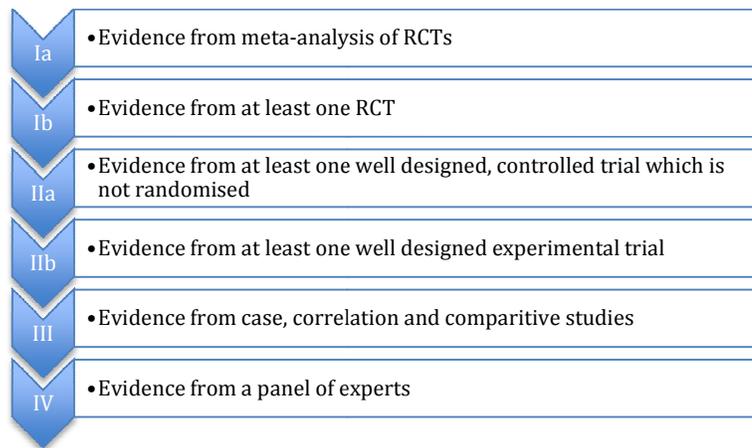
Once an article is identified, critical appraisal involves a structured approach to examining evidence to assess its value and clinical relevance to modern practice. This allows practitioners to recognise studies which are biased or poorly designed and therefore ensure only the most reliable information is incorporated into clinical practice. As the medical profession evolves, undergraduate and junior practitioners are increasingly expected to be aware of current developments in patient care. Figure 1 outlines the three important components in providing evidence based healthcare.



**Figure 1:**  
Providing evidenced based healthcare – three important components

An important part of the process is an understanding of the differing levels of the evidence hierarchy. Figure 2, below, highlights the differing study designs and their relative robustness and reliability. Evidence from meta-analysis of randomised control trials, such as systematic reviews carried out by the Cochrane Collaboration, are considered to be the gold standard in evidence. These involve the aggregation of the highest quality studies available with careful appraisal and statistical analysis of the findings. These, in turn, may form the

basis for evidence based clinical practice guidelines that serve to aid the translation of best available evidence into clinical practice<sup>2</sup>. Due to the nature of these studies and the prerequisite body of evidence needed, in many areas of healthcare these are not available and alternate study designs are utilised.



**Figure 2:**  
Levels of Evidence

Although assessment of the level of evidence is a significant aspect of critical appraisal, it is essential to note that studies utilising designs recognised as one of the lower levels of evidence may still have a value to the profession and increase the body of evidence available, e.g. case, correlation or comparative studies may be a precursor to assess a hypothesis before a randomised control trial can be designed. Therefore, different critical appraisal tools may be utilised to assess the varying study designs available. Additionally, some study questions may preclude themselves to a particular study design<sup>2</sup>, i.e. a double blind, randomised control trial of parachutes may not be appropriate! Figure 3 demonstrates the most appropriate study design to answer the different type of questions being asked.

Therapy	•Randomised controlled trial
Prevention	•Randomised controlled trial
Aetiology	•Randomised controlled trial
Harm	•Randomised controlled trial
Prognosis	•Cohort Study with $\geq 80\%$ follow-up
Diagnosis	•Validating cohort study with good reference standards
Differential Diagnosis	•Prospective cohort study with adequate follow-up
Symptom Prevalence Study	•Prospective cohort study with adequate follow-up

**Figure 3:**  
Research design for different clinical questions

## Carrying out Critical Appraisal

Critical appraisal may be carried out utilising various assessment tools. These involve the evaluation of different aspects of the paper and, in turn, highlight important characteristics of the paper and study design used. A useful resource to aid the assessment of the multiple study designs employed is the critical skills assessment programme (CASP)

### *Critical Skills Appraisal Programme (CASP)*

Founded in 1993 the CASP program is a non-profit entity that provides resources, learning and development opportunities to support critical appraisal skills development in the UK<sup>1</sup>. It provides critical appraisal checklists for different types of study designs to enable comprehensive and robust protocols for critically appraising a research paper. This section breaks critical appraisal down to assess 7 main points of a research paper. Similar to the CASP methodology we will assess the important features of any research paper and highlight key points that should be evaluated.

### *Initial Assessment*

The initial assessment of a research paper involves a generalised look at the details of the article and the publication it is appearing in. It may be of value to look at the year the article was published in and ascertain if new evidence has been added to the literature since this publication. Conversely, it is also important to note that seminal papers may have been published a significant time ago and, although the studies are old, these may still be of significance to modern practice.

The presence of a peer review process in journal acceptance protocols also adds robustness to the assessment criteria for research papers and hence would indicate a reduced likelihood of publication of poor quality research. Other areas to consider may include authors' declarations of interest and potential market bias.

### *Problem*

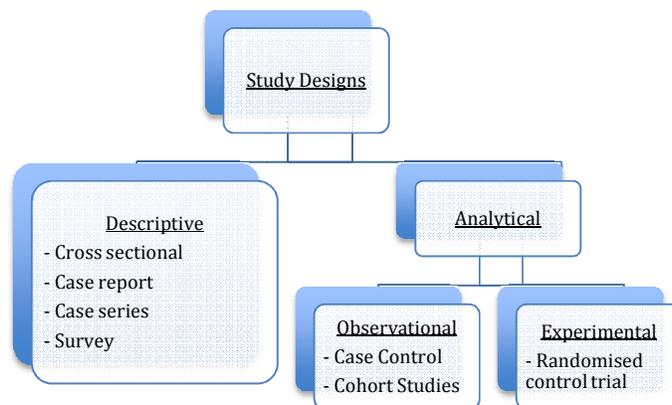
Appraisal of the paper hypothesis and problem addressed by the study is a crucial facet of critical appraisal. For a study to have value it must address a significant or relevant problem within healthcare and usually provide new or meaningful results. A useful structure for assessing the problem addressed in the article is the Problem Intervention Comparison Outcome (PICO) method. This involves identifying if the research has a focused question (problem), appropriate and clearly stated management strategy (intervention), a suitable control or alternative (comparison) and that the desired results or patient related consequences have been identified (outcomes). The current literature should have been reviewed and commonly will support the hypothesis, which should be clearly stated.

### *Methodology*

The study design of the research is fundamental to the usefulness of the study. Several types of study design, noted in Figure 4, are available and each has their advantages and disadvantages. Suboptimal study design can incorporate bias into the study and subsequently skew results.

Assessment of the data collection tool and its relevance to the problem is important, i.e. if the problem involved assessment or measurement of a disease is the method of doing this appropriately specific and sensitive. The data collection of a study should be objective and the results reproducible. Additionally, it is important to consider if the amount of time

allocated for data collection was appropriate and reliable to the clinical course of the disease or intervention being studied.



**Figure 4:**  
Different Study Designs

#### *Participants/Sample Population*

Analysis of the sample population utilised in the research will give an indication as to the relevance of the study results to individual clinical practice. To minimise any bias within a study the sample population should be representative of the population being studied as a whole and, ideally, participants should be allocated randomly within the study. It is also imperative to consider the sample size in the study and identify if the study is adequately powered to produce statistically significant results, i.e. p values quoted are  $<0.05$ .

#### *Data Analysis and Results*

The results of the study should be presented in a suitable manner with the main result, whether it supports or opposes the paper hypothesis, clearly demonstrated. The use of charts and graphs should highlight the data collected and facilitate analysis of the outcomes.

Correct statistical analysis of results is crucial to the reliability of the conclusions drawn from the research paper. Depending on the study design and sample selection method employed, observational or inferential statistical analysis may be carried out on the results of the study. It is important to identify if this is appropriate for the study.

#### *Conclusion of Paper*

Analysis of the conclusions drawn from the study involves assessment of the author's interpretation of the results and an overall general assessment of study outcome. When

critically appraising the conclusions of a study it is vital to consider if the results are precise enough to infer a conclusion and also whether the data was shown to be statistically significant, i.e.  $p$  value  $<0.05$ .

Appraisal of the conclusions should also ensure recommendations stated were appropriate for the results achieved and also within the scope of the study. The authors should also address shortcomings in the study and discuss how this may have affected the results and recommendations proposed.

### *Overall Assessment*

After careful analysis of the different aspects of the research paper the final stage of critically appraising a research paper is assessing the relevance of its findings to the profession. The reported outcomes of the diagnostic, preventative or treatment intervention should be assessed focusing on the balance of potential benefits and drawbacks when compared to accepted alternatives.

## **Summary**

In conclusion, critical appraisal is a fundamental skill in modern practice for assessing the value of research papers and providing an indication of their relevance to the profession. As the medical profession evolves and studies providing information on the diagnosis, prevention and treatment of diseases are published it is crucial to be able to discern the best available evidence. Practitioners are then able to, through systematic reviews or guidelines, synthesise the available evidence in order to identify if a change in practice is indicated. Critical appraisal is a skills-set developed throughout a professional career that facilitates this and, through integration with clinical experience and patient preference, permits the practice of evidence based medicine and dentistry.

## References

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