



RESOURCE DOCUMENT

The evidence-based case report: a resource pack for chiropractors

Amanda R. Jones-Harris*

Active Chiropractic Clinic, The Orchard Surgery, Baldock Road, Buntingford, Hertfordshire SG9 9DL, UK

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Introduction

What is evidence-based medicine?

Evidence-based medicine (EBM) is described as "... 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 requires the integration of individual clinical expertise with the best available external clinical evidence from systematic research."¹ More recently, this definition has been updated to incorporate patient values in the decision process.^{2,3} These key elements of evidence-based clinical decisions are depicted in Fig. 1. The overall aim of EBM is to provide the best possible care for the individual patient.

The integration of best research evidence, clinical expertise and patient values, allows clinicians and patients to form a "diagnostic and therapeutic alliance" to optimise clinical outcomes and quality of life.² As professionals, we should constantly question clinical practice how and why we practice in the way we do and whether we are providing the most effective care for our patients. To do less is to practice as a technician and not as a professional.⁴

The need for evidence-based practice has arisen from the rapid advances in medical knowledge and the large number of clinical papers being published. Traditional sources of information such as textbooks rapidly become out of date. Consequently,

a disparity develops between diagnostic skills and clinical judgement that increases with experience and dating of academic knowledge resulting in a decline in clinical performance over time. EBM was developed to help bridge this gap between research and practice. Recent advances in database searching and secondary sources of evidence, as well as improved access to them, have made the practice of EBM a more viable option.²

Limitations of evidence-based medicine

Three limitations are universal to medicine and science: the shortage of coherent, consistent evidence; the difficulty of applying evidence to individual patients and external barriers to the practice of high quality medicine. In addition, EBM has some further specific limitations.

Practitioners often lack the required skills in identifying and formulating clinical questions⁵ and in finding, assessing, interpreting and applying current best evidence.^{5–7} Time limitations have also been reported as a major barrier that prohibits evidence-based practice.^{5,7–9}

Concern has also been expressed about the potential conflict between best evidence and perceived patients' wishes^{9,10} and fears that the way evidence is presented could unduly influence a patient's decision.¹⁰

The evidence in evidence-based practice has been criticised because it is produced by researchers not practising medics.¹¹ EBM is considered of greatest value when undertaken by practising clinicians as they are in the best position to balance research evidence with clinical evidence for a

*Tel.: +44-1763-274646.

E-mail address: chiropractic@dsl.pipex.com

(A.R. Jones-Harris).

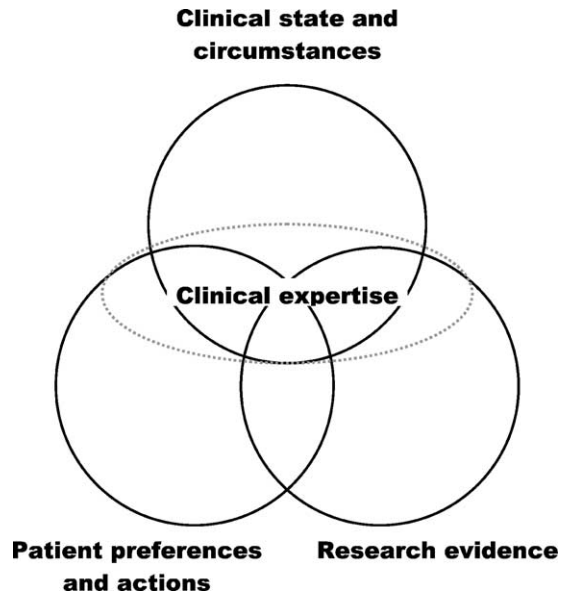


Figure 1 An updated model for evidence-based clinical decisions.³ Reproduced with permission from the American College of Physicians.

particular case.^{6,12} Therefore, this criticism could actually be viewed as a reason *why* practising physicians should become conversant in the relevant EBM skills, so that they can appraise the primary sources of evidence for themselves.

Through debate, many of the other suggested "limitations" of EBM have been clarified. Claims that EBM degrades clinical expertise, is limited to clinical research, ignores patients' values and preferences and promotes a 'cookbook' approach to medicine⁷ have been dismissed as they are contrary to the more recent definition of EBM.¹³ EBM has also been accused of being a cost cutting exercise instigated by economists.^{7,11} However, in reality, it would probably increase, rather than decrease, the cost of health care.¹⁴

What counts as "external" evidence

Until recently, sound evidence has been interpreted by many as being synonymous with randomised controlled trials (RCTs).¹⁵ Because the RCT is generally considered the gold standard of research design, the supposition has been that only evidence from RCTs should be considered in evidence-based medicine. However, this view is now being challenged.^{1,16,17} A more flexible approach to the hierarchy of evidence has been suggested whereby RCTs and observational studies have complementary roles. There are times when RCTs are unethical or impractical and a good quality observational study is more appropriate.¹⁸ There has also been a general

shift towards outcomes-based research^{19,20} and a growing acceptance of the importance of qualitative research.^{2,17,21,22} Yet, despite this, qualitative methods are still absent from hierarchies of evidence.² If the qualitative values, preferences and perspectives of patients are to be incorporated into the definition of evidence-based practice, then it can be argued that evidence-based approaches must be able to cope with such data.¹⁷ Ultimately, it should be the research question itself that should determine the most appropriate research methodology and methods.²³

Complementary and alternative medicine (CAM) and evidence-based practice

The call for complementary medicine to become research led and evidence-based has become increasingly voiced.²⁴ However, EBM has also been seen as a threat to complementary and alternative medicines (CAM). It has been suggested that CAM not supported by reliable scientific evidence should be viewed with suspicion²⁵ and complementary health care practitioners have been urged to embrace empiricism or risk extinction.²⁶

Others argue that EBM is more likely to empower rather than disadvantage CAM practitioners^{27,28} as, without it, the future of CAM would be decided by medical tradition, power and influence. Moreover, EBM should promote higher quality CAM research, which should translate into better patient care.²⁸ It has also been suggested that EBM could help bridge the gap between allopathic and CAM providers,^{28–31} but the difference in the philosophies of health care between allopathic medicine and CAM is a major barrier to realising EBM in the CAM community.^{31,32}

Evidence-based chiropractic practice

The chiropractic profession in the United Kingdom has already come a long way by gaining regulation and setting standards for practice through the General Chiropractic Council. The profession overall has greatly benefited from research³³ and has been held up as an example within CAM because of its research and guideline development.³⁴ The profession is being urged to embrace evidence-based practice.^{35–39} However, the lack of high-quality evidence about many therapies, diagnostic tests and procedures used in chiropractic practice,³⁷ and manual medicine generally,⁴⁰ is an impediment to further implementation of the evidence-based

approach. Therefore, to advance within the EBM ethos, the profession needs to increase the quality and quantity of research and researchers,^{39,41–43} as well as educate chiropractors in the skills and principles of evidence-based practice.^{38,39,44} Whilst not all clinicians need to be proficient in advanced appraisal, it is argued that all need some evidence-based practice skills to be able to understand secondary sources of preappraised evidence, as well as to use the original literature when no preappraised synopsis exists.⁴⁵

Teaching critical appraisal skills to practitioners does not, however, inevitably translate into their application in clinical practice and improved patient outcomes.^{29,46,47} Although aspects of evidence-based health care and critical appraisal are being incorporated into the curriculum at many chiropractic colleges,^{46,48} these skills are not being applied to any great extent by the student interns in the college clinics.⁴⁶

It is agreed that, in order for evidence-based practice to be implemented, the information needs to be useful, manageable and accessible³⁶ and be taught in a way which makes it relevant to real patient management.^{2,49} Electronic databases, systematic reviews, guidelines and journals that summarise evidence^{8,50,51} facilitate easier and quicker access to information in the practice setting. The transition to evidence-based practice can also assist effective continuing medical education⁵² through the integration of medical education with practice.⁵³

The evidence-based case report

The evidence-based case report was launched by the British Medical Journal (BMJ) in an attempt to encourage the use of research-based evidence in clinical practice and provide reliable updates on the management of common clinical conditions. It documents how research evidence has been applied to inform the management of a particular case and evaluates the clinical outcome.⁵⁴ It is also useful as a teaching tool and has been used as such in undergraduate medical studies.⁵⁵

It is important to differentiate it from the “traditional” case report, which is a retrospective account of a clinical case describing the presenting signs and symptoms of a disease, its progress or response to treatment and comparing it with the contemporary knowledge.⁵⁶ In addition, case reports should not be confused with a case *study*. The term “case study” is used for a variety of research approaches, both qualitative and quantitative, where the unit of study is a single case/patient or institution/group.⁵⁷

The EBM approach can be summarised in five steps:^{7,58} asking answerable clinical questions; searching for the evidence; critically appraising the evidence for its validity and relevance; making a decision, by integrating the evidence with your clinical expertise and the patients’ values and evaluating your performance. An evidence-based case report should illustrate each step of this process.⁵⁴

Asking the question

Clinical questions occur frequently through daily clinical practice. They may arise through cognitive dissonance, reflective practice and the desire to ensure maintenance of up to date knowledge. Asking the clinical question initially means defining the patient and determining the patient’s problem. There may be, at any one time, a number of cases that generate questions. To ensure that cases are considered in order of priority and of significance to practice, the following criteria can be considered: the frequency of the problem; the magnitude of its consequences; the availability of the research evidence addressing it and the likelihood that its management can be improved.⁵⁹ Furthermore, some cases may generate numerous questions, which then need to be prioritised. This can be helped by considering which question is most important to the patient’s well being, which are feasible to answer in the given timeframe, which question is most beneficial to your clinical practice and which question is of most interest.⁵⁸

A well-formulated clinical question forms the basis of the search for evidence and guides the assessment of the evidence for relevance.⁵⁸ There are four main elements to the question: the patient and/or problem; the intervention; comparison intervention (if appropriate); and the relevant outcome(s).^{60,61} This is illustrated by the example in [Table 1](#).

Searching the literature

A good starting place when searching for evidence is a search engine that concentrates on evidence-based sources. For example, the TRIP Database searches over 75 sites and gives direct, hyperlinked access to ‘evidence-based’ material on the web as well as to articles from premier on-line journals www.tripdatabase.com. Secondary sources of evidence, which provide a pre-existing quality and referenced-filtered summary of evidence, are also very useful. The Cochrane library contains a database of systematic reviews (CDSR) that are prepared

Table 1 The elements of a clinical question.

| Element | Guide | Example |
|-------------------------|---|---|
| Patient and/or problem | Define the patient group, and/or identify the relevant clinical characteristics of the problem | In a 25-year-old male with a grade 1 ankle sprain ... |
| Intervention | Ask what is the main intervention to be considered | ... is ultrasound therapy with cryotherapy ... |
| Comparison intervention | Ask (if relevant) what the alternative to the intervention would be. Evidence should be interpreted in the context of normal practice | ... more effective than cryotherapy alone ... |
| Outcome | Decide what outcome is important and pertinent to the patient group and practitioner. Ask what could realistically be accomplished | ... at enabling return to sport at 1 week |

using explicit criteria for searching the literature and for appraising and synthesising the retrieved evidence www.cochrane.org/cochrane/revabstr/mainindex.htm.

Other sources of preappraised evidence include critically appraised topics (CATs) and best evidence topics (BETs). CATs are a standardised, one-page summary of the critically appraised evidence from an article related to a given clinical topic.² A library of completed CATs can be accessed through the Centre for Evidence-based Medicine at <http://minerva.minervation.com/cebm/docs/catbank.html>. CATs do have some limitations though. They are often based on single investigations and not on systematic reviews and so may not be representative of the entire body of evidence. They become obsolete as soon as newer, better evidence becomes available and individual CATs can be inaccurate if they have been produced without peer review.⁶¹ BETs are a modification of CATs and were developed to allow emergency physicians rapid access to best current evidence on a wide range of clinical topics.⁶² Studies are retrieved through an explicit search, those that provide the highest available levels of evidence are critically appraised and a clinical bottom line determined. A library of clinical BETs can be found at the website <http://www.bestbets.org>.

Searching for primary sources of evidence can be done through relevant bibliographic databases and by cross-referencing germane papers. For chiropractors asking clinical questions, the most used databases are likely to be allied and complementary medicine database (AMED); index to chiropractic literature (ICL) www.chiroindex.org; manual, alternative and natural therapy database (MANTIS); and MEDLINE (PubMed) www.ncbi.nlm.nih.gov/PubMed. ICL and MEDLINE can be accessed freely through the provided web links. Internet access to AMED can be obtained through ‘SilverPlatter’ or ‘OVID’ (follow the links from www.bl.uk/services/information/amed.html)

and MANTIS at www.chiroaccess.com. Both require a subscription fee.

At this stage, it is worth considering what type of study would give the best quality evidence with which to answer the clinical question. As already discussed, there is some dissent over the issue of what constitutes best evidence, it is currently the author’s opinion that consideration of the *type* of question is paramount and that the best methodology to answer a particular question should be considered first (see [Table 2](#)). However, this does not mean that evidence from other suitable methodologies should be excluded. Detailed levels of evidence and grades of recommendations for the conventional ‘‘hierarchy of evidence’’ can be found at the Centre for Evidence-based Medicine website <http://minerva.minervation.com/cebm/docs/levels.html>, although these do not make any provision for qualitative research methods.

Care needs to be taken when using review articles. Whilst some are valuable resources, many do not consider all the relevant evidence or are biased. Systematic reviews and meta-analysis offer a more reliable alternative as they are produced to clear standards.⁶³

Database search strategies

There are two main ways of searching bibliographic databases: thesaurus and textword searching. A thesaurus search examines the subject headings by which the articles are indexed (i.e. medical subject headings (MeSH) terms), whilst a textword search examines the article’s bibliographic record for specific words. It is best to use both searches where possible, as searching by either alone may miss an important article.

Depending on which database is being used, there are different features that can vary the sensitivity and specificity of the search. They can be used alone

Table 2 The best evidence for different clinical questions.

| Type of question | Best-evidence research design | Basic criteria which help determine strength of evidence |
|--|---|--|
| Therapy | Randomised controlled trial (RCT) | Was there true randomisation? Were all patients followed to the end of the trial? |
| Prognosis | Individual inception cohort study | Was the patient sample at a well-defined point in the course of the disease initially? Was follow up sufficiently long and complete? |
| Aetiology/harm | RCT or cohort study or case-control (Dependent upon ethical issues and size of effect or rarity of phenomenon) | See above for RCT For cohort and case-control: Were all possible confounders accounted for in the initial design or through analysis? Could a dose–response gradient be established? NB: cohort and case-control studies allow for associations and direction of effect to be shown but do not <i>prove</i> a causal link. Only an RCT can prove causality |
| Diagnosis and screening | Cross-sectional studies | Was there an independent, blind comparison to “gold standard?” Were there enough patient numbers and did they represent the full spectrum of the disorder? |
| Perspectives/experiences/feelings/emotions | Qualitative studies: phenomenology, ethnography, or grounded theory | Was there rigor in the approach? Were there sufficient explanation of, and appropriate use of, data collection and analysis methods? Are the findings well presented and meaningful? |

or in combination with each other. Common examples of these, and how to use them, are given in [Table 3](#). It is best to start with a broad search and to then progressively narrow it to exclude irrelevant items. If the search is too specific at the outset, important articles may be missed. A detailed explanation of how to search PubMed MEDLINE on the National Library of Medicine (NLM) is given on their website www.ncbi.nlm.nih.gov/entrez/query/static/help/pmhelp.html. Use of select combinations of indexing terms and textwords and using limit variables and Boolean operators can improve retrieval of clinical studies in MEDLINE.⁶⁴

The way in which limit variables are applied depends on the database being used. The relevant field tags either follow the word being searched separated by a full stop or surrounded by square brackets. For example:

- **Clinical-trial.pt** or **clinical-trial [pt]** will restrict the search to clinical trials.
- **Chiropractic.ti** or **chiropractic [ti]** will search for articles with chiropractic in the title.

PubMed MEDLINE, through NLM, requires square brackets around the field tags. A list of their particular search field description and tags, as well as all

MeSH terms and publication types, is available on the website www.ncbi.nlm.nih.gov/entrez/query/static/help/pmhelp.html. A list of useful variables, together with examples of how to use them, is given in [Table 4](#).

Terms can also be combined using Boolean operators and commas in order to widen or narrow the search. For example:

- **guideline.pt AND chiropractic.ti,me** will search for guidelines which include the word chiropractic in the title or as a MeSH term.

The evidence-based case report should demonstrate to the reader how the search was undertaken, including details of search strings and which databases were searched. Enough detail should be given to allow the reader to replicate the search.

Critical review

Once a list of articles has been retrieved, a decision has to be made as to which should be reviewed. If there is a large number of articles, there are a number of factors that can be considered to reduce the articles to a manageable number.⁴⁸ The evidence-based case report should describe which

Table 3 Features for database searches.

| Feature | Key | Explanation |
|----------------|-----------------------------------|--|
| Truncation | * (or \$ or :) | Placed at the end of a word will include terms with all variable endings to the beginning of the word in the search, e.g. analy* will search for analytic, analytical, analyse, etc. |
| Focus | * | Placed at the beginning of a word searches for articles in which the word is a major focus of the paper, e.g. *migraine will search for papers with migraine as the major subject |
| Explode/expand | Explode or exp | Placed before a term will search for all possible related options, e.g. explode headache will search for different headache types such as cluster, vascular and so on NB: some indexers do not consider migraine a type of headache, therefore to include all headaches the Boolean operator "OR" needs to be added, i.e. explode headache OR migraine |
| Wildcards | ? | Placed within a word indicates that the letter it replaces is a variable or absent. The search will include all permutations of the word, e.g. gyn?ecology will search for gynaecology and gynecology |
| Boolean | AND OR NOT | Boolean operators are used between terms to link them Article must include both terms, e.g. chiropractic AND evidence-based Article can include either term Excludes articles, which include the term following NOT, e.g. ultrasound NOT diagnostic |
| Proximity | NEAR | Terms linked must occur close to each other, e.g. manipulative NEAR therapy |
| Limits | See Table 4 for specific examples | Can be used to restrict a search by publication type, year, language or other characteristics. Limits can also direct the search for terms to a particular part of the document. Many databases also have a limits option, which can be selected by clicking on it |
| Related | | Clicking on this hyperlink when you have found a useful reference will search for similar articles in the database |

articles were chosen for critical review and explain why this was so. If a journal is peer-reviewed and/or indexed, then there is a certain level of rigour to the journal and its articles should be of reasonable quality. However, just because an article is in a peer-reviewed journal, does not ensure that it will be high quality.⁶⁵ The title of the paper may reveal how pertinent it is to the clinical question and, if an author is a recognised expert in the field, the paper may be of more worth. The results of the study will be more relevant for evidence-based practice if its site, and the patients involved, are similar to yours and if the results are important to the clinical question asked.⁴⁸

There are two basic ways of critically appraising the selected literature. The first approach is by methodological checklist such as is used by the Critical Appraisal Skills Programme (CASP) www.phru.org.uk/~casp/resources/ and the Scottish Intercollegiate Guidelines Network (SIGN) www.sign.ac.uk/guidelines/fulltext/50/annexc.html. These websites include guidelines on how to critically appraise studies using their checklists. The second way is by type of study question; whether the study is looking at

diagnosis, prognosis, therapy or harm.² This is also described in some detail on the website of the Centre for Evidence-based Medicine www.med.ualberta.ca/ebm/ebm.htm. There are, however, certain appraisal questions that apply universally.

Were the aims clearly stated?

Regardless of the type of research approach or methodology used, the aims of a study and the need for the research must be clearly defined at the outset. Clearly stated and focused aims suggest a well-planned study.⁶⁶

Was the research relevant and original?

Studies should address an issue that is important in the light of current research and understanding. The research should be undertaken in an original manner and should add to the current body of knowledge and literature.⁶⁷

Table 4 Limit variables for database searches.

| Variable (search field tags) | Meaning | Example |
|------------------------------|--|--|
| ab | Abstract | manipulation.ab will search for the word manipulation in the abstract |
| all | All fields | Sacro occipital technique.all will search for the term sacro occipital technique in all fields. However, PubMed will only search all fields if it cannot match the word in one of its Translation tables or Indexes via the Automatic Term Mapping process |
| au | Author | Smith a.au will search for articles by the author A. Smith |
| dp | Date of publication | 1996.dp will search for articles from the year 1996. Dates must be entered using the format YYYY/MM/DD but month and day are optional. To enter a date range insert a colon between each date, e.g. 1995/01:1996/12 |
| jn | Journal | Spine.jn will search for articles in the Journal Spine |
| la | Language | English.la will only search for articles written in English |
| me or mh | Single word, wherever it may appear as a MeSH (medical subject heading) term | Brachialgia.me or Brachialgia.mh will search for articles with brachialgia listed as a MeSH term |
| Majr | MeSH major topic | Chiropractic.majr searches for articles where chiropractic is one of the main topics in the article |
| ps | Personal name as a subject | Limits retrieval to where the name is the subject of the article, e.g. Palmer dd.ps will search for articles about or that reference DD Palmer |
| pt | Publication type | Clinical trial.pt will search for clinical trials |
| px | Subheading preexplosion | Diagnosis.px will search for and include all MeSH subheadings that deal with diagnosis |
| sb | Subject subset | This search for articles on specialised topics. Subject subsets available are: AIDS, bioethics, complementary medicine, history of medicine, space life sciences, systematic reviews and toxicology. Asthma AND cam.sb will search for articles within complementary medicine concerning asthma |
| sh | Subheadings | Evidence-based.sh will search for the words evidence-based in the subheadings |
| ta | Journal title | Manual therapy.ta will only search the journal manual therapy |
| ti | Title | Chiropractic.ti will search for articles with the word chiropractic in the title |
| tiab | Title and abstract | Manipulation.tiab will search the title and abstract only for the term manipulation |
| tw | Text words | Kinesiology.tw will search for articles with the term in the title, abstract, MeSH terms and subheadings, chemical substance names, personal name as a subject, and MEDLINE secondary source field |
| vi | Volume | The number of a journal in which an article is published, e.g. chiropractic.ti AND (spine.jn AND 2002.da AND 27.vi) will search volume 27 of spine published in 2002 for articles with chiropractic in the title |
| yr | Year | 2002.yr will search for articles published during the year 2002 only |

Note: Examples are given with a full stop before the search field tag, however depending on the database the search tag may need to be in square brackets.

Was the research approach suited to the research question?

The research approach can be quantitative or qualitative. Quantitative research begins with a

specific question and usually a hypothesis that, through measurement, generates quantifiable data allowing statistical analysis and conclusions to be drawn.⁶⁸ The most appropriate study design depends on the question, but each also has parti-

Table 5 Quantitative research approaches.

| Type of study design | Description of design | Pros and cons |
|-----------------------------------|--|---|
| Case-control study | Patients who have developed a disorder are identified and their exposure to suspected causative factors is compared with controls who do not have the disease | Advantages are that they are quick, cheap and are the only way of studying very rare disorders or those with a long time lag between exposure and outcome. Disadvantages are in the reliance of records to determine exposure, difficulty in selecting control groups, and eliminating confounding variables |
| Cohort study | A group of patients, with or without a disorder, are followed over a period to see if they develop the disorder, allowing for comparison of risk | They are simpler and cheaper to do than RCTs, and can be more rigorous than case-control studies. They can establish the timing and sequence of events, and therefore show not only an association, but also the direction of the association. However, they cannot exclude unknown confounders, blinding is difficult and identifying a matched control group can be hard. They are difficult to use for rare events, large sample sizes or when long follow up is necessary |
| Crossover design | Subjects are randomly assigned to one of two treatment groups and followed to see if they develop the outcome of interest. After a suitable period, they are switched to the other group | Subjects act as their own controls so error variance is reduced and a smaller sample size is needed. Randomisation and blinding are often possible, facilitating powerful statistical analysis. Disadvantages are that the "washout" period (time required for the effects of the first treatment to wear off) may be long or unknown. In addition, crossover designs cannot be used where a treatment effect is permanent |
| Cross-sectional survey | Measures the point or period prevalence of a factor | They are cheap, simple and ethically safe but cannot establish causality and are susceptible to bias |
| Randomised controlled trial (RCT) | Similar subjects are assigned at random to a treatment or a control group to see if they develop the outcome of interest | Confounding factors are eliminated and powerful statistics can be used to show causality. However, RCTs are expensive, can be ethically challenging, and they can suffer from selection and observer biases |

cular pros and cons (see Table 5). Qualitative research is suited to questions with answers that are not quantifiable such as feeling, experiences, values and emotions.^{23,68}

The appropriateness of the study's methodology must then be considered. This should be determined by the research question.²³ The methodology chosen should be that which provides the highest level of evidence² but yet is still feasible and ethical to execute.⁶⁷

Were the ethical implications considered?

Irrespective of methodology, all studies should demonstrate consideration of ethical issues and, if necessary, obtain approval from an ethical committee.

Was the sample size justified, and were the participants assigned appropriately?

In quantitative studies, sample size calculation should be included. The power of the study at the design stage determines the appropriate number of participants by deciding the level of Type II error that is acceptable.⁶⁹ Good quality papers should also state the size of effect the study had the power to detect.⁵⁶ Using a random sample reduces bias in a study⁶⁹ and allows for generalisable results. If intervention and control groups are used, then there should be randomisation to the groups wherever possible. With a non-randomised study, the groups may be either matched at the beginning or confounding dealt with in the analysis.⁷⁰ Inclusion and exclusion criteria will determine the characteristics of the study population.

The need to obtain informed consent can introduce bias into a sample, since those who chose to take part may significantly differ from those that do not.⁶⁶

In qualitative research, the sample size is not predetermined, but is guided by the analysis of the data (theoretical sampling). Generally, this means data collection continues until the point of saturation.⁵⁷ Often, potentially deviant cases that challenge the emerging theory are selected; this is termed 'purposeful sampling'.

Were the data obtained in a way, that is valid and reliable?

Outcome measures should be adequately described and appropriate to the aims of the study. Studies should discuss potential measurement errors and the effect they may have on the validity and reliability of the measurement used. Quality studies should also discuss how validity and reliability were assessed.^{65,66} In a trial, blinding procedures should be used where possible.

Subjective measurements have different types of problems. If there is more than one observer or interviewer, efforts should be taken to standardise measurements. The way in which questions are asked in an interview can introduce bias by influencing replies.⁶⁶ Feedback of the interview transcript to the participant can help improve validity.

Did any untoward events occur during the study?

If problems occur during a study that lead to a change in design, this suggests a lack of preparation. Most such problems should be identified and dealt with in pilot studies. Some untoward events are unpredictable but, generally, they are a sign of a poor quality study.⁶⁶

Were the data adequately described?

The population should be clearly described, including the demographics and socio-economic features of the subjects, as well as any inclusion and exclusion criteria. This information is vital to determine how generalisable the results are and whether they are relevant to the reader's own patients.

All the outcomes data should be presented and complicated statistics should be used only after simple analysis has been presented. There should also be no discrepancy between the two.⁶⁶

Were there any missing data?

In quantitative studies, it is usually quite easy to account for all subjects by checking that the numbers tally throughout the paper. Any participants lost to follow up should be described and compared to those who completed the study to see if they differed significantly. If large amounts of data are missing, or there is a sizeable loss of participants to follow up, this can bias the results.⁶⁶ Furthermore, all of the outcome measures mentioned in the methods should be accounted for.

With qualitative studies, it is more difficult to tell if there are any missing data. Analysis by more than one researcher and presentation of data that contradict the themes are deemed evidence that all data have been included.⁶⁵

Were the data appropriately analysed?

The type of analysis used is dependent on the methodology and the sort of data collected. Analysis should be according to the original study protocol to prevent manipulation of the data to get a positive result, as well as the presentation of serendipitous findings.⁶⁵

Quantitative data can be nominal, ordinal, full ranking or interval.⁶⁹ The type of data collected and its distribution will determine the proper statistical tests. The use of multiple statistical tests, or more complicated statistics than necessary, should raise suspicions that the researchers are fishing for results. The statistical significance of the main findings should be assessed; a *P* value of less than 0.05 shows that the result is likely to be real rather than due to chance. As the *P* value becomes smaller, confidence increases that the result is not a chance event.⁶⁶

The analysis of qualitative data can be both systematic and rigorous. Data are usually coded and categorised, allowing concepts and constructs to be formed. Provisional hypotheses are conceived from the initial data and tested against further data. Through the emergence of major categories, theories can evolve.⁵⁷ The major challenge to researchers is to demonstrate the complexity of qualitative data and its analysis within the constraints of a medical journal article.²¹

Were the biases of the researchers considered?

A researcher should consider any potential biases they may have, as well as the biases of those collecting and analysing the data.

Were the findings properly interpreted?

The credibility of quantitative research results depends upon appropriate data collection methods and statistical analysis. Non-causal explanations for the findings should also be considered, in addition to the effects of any biases, confounding,⁷¹ study flaws or limitations.⁶⁶ The author's conclusions should be justified by the results and follow on logically from them. They should also be consistent with the study objectives.⁴⁸

A statistically significant result is not necessarily clinically significant.⁶⁹ Intervention trials should therefore express their results in terms of the likely benefit to the individual.⁶⁵ The use of confidence intervals demonstrates the true size of an effect and so helps evaluate the actual importance of the results. The findings of a study can also be supported if a dose–response gradient can be established.⁶⁶

In qualitative research, proper interpretation of the findings requires a common sense judgement on whether they are sensible and believable and whether they matter in practice.⁶⁵

How do the results compare with previous studies?

Authors should discuss their findings within a balanced, unbiased overview of previous studies and contemporaneous views, to show what new information their study brings to the current body of knowledge.

What are the implications for clinical practice?

If the study's methodology was sound and its findings properly interpreted, then it must be decided if the findings were significant and relevant enough to instil change in clinical practice.⁶⁶ For this to occur, the findings must also be relevant to your patients. Therefore, either the study's population must be similar to them or the findings must be generalisable.

It is the current author's experience that, although critical review can initially seem daunting and time consuming, with practice it becomes easier and quicker. Try using different assessment tools and attempt to evaluate articles from first principles, rather than using the same appraisal tool all the time. This should give an overall better feel for, and broader understanding of, critical review. Remember, there is no such thing as a perfect study; therefore each must be evaluated to see if the strengths outweigh the weaknesses.

Compiling the evidence

The significant and relevant findings from the papers appraised should be compiled according to the strength of their evidence to determine a clinical bottom line in answer to the original question. The information is then integrated with clinical experience of the condition and the patient's preferences to make a decision on the appropriate management.

The evidence-based case report should demonstrate what evidence was used from which studies and explain how and why it was compiled. The resulting decision on patient management should be discussed, followed by the outcome of the case.

Evaluating your performance

The process of evaluation is central to EBM. Evaluation of one's own performance should include some measure of how clinical questions were prioritised for a case and how the evidence was treated considering the needs and choices of the individual patient.⁷² Reflection upon this (reflection on action),⁷³ is fundamental to learning from the experience. Questionnaires have been developed to help the practitioner evaluate their own performance.²

It is also important to reflect on and evaluate the effect the process has had on clinical practice. Clinical audit has been suggested as a way of evaluating the application of evidence in practice.⁷⁴ However, it is important that this process is continuous.⁷⁵ Practitioners must constantly monitor the evidence for the best standard of care and change practice accordingly (i.e. double and not single loop learning) if evidence-based practice is to assist in maintaining the best possible care for patients.

Conclusion

Evidence-based practice is not an easy option; it takes time and effort to learn the requisite skills and to implement them. It is also not without its limitations, about which there is much debate. However, it is no longer acceptable to practice according to tradition and dogma and most people understand and accept the importance of the use of research evidence to inform practice when such evidence exists. Practice by best evidence alone, though, is also unacceptable. Evidence-based practice requires the integration of research evidence with individual practitioner's expertise and patient's choice; it is not a "cookbook" approach to practice.¹ There may be debate about the "hierarchy of evidence" and the specifics of how to implement

evidence-based medicine, but it is up to the responsible and intelligent practitioner to consider this and to make the most of the evidence-based approach to practice; not just dismiss it out of hand.

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