

# Evidence-Based Medicine:

  

## mini-manual

Based in part on the Evidence-Based Medicine Toolkit, <http://www.med.ualberta.ca/ebm>

"... a collection of tools for identifying, assessing and applying relevant evidence for better health care decision-making. The appraisal tools are adapted from the Users' Guides series prepared by the Evidence Based Medicine Working Group and originally published in JAMA"

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## ***What is Evidence-Based Medicine?***

Evidence-based medicine is the conscientious, explicit, and judicious use of the best current evidence in making decisions about the care of individual patients.

(David L. Sackett, et al., BMJ 1996; 312:71)

Evidence-based practice is “a process of care that takes the patient and his or her preferences and actions, the clinical setting including the resources available, and current and applicable scientific evidence, and knits the three together using the clinical expertise and training of the health-care providers.” (Haynes et al., 2002)

## ***What are the steps of practicing Evidence Based Medicine?***

Analyze the clinical situation.

Ask a focused clinical question

Access the clinical research literature (i.e., the evidence)

Appraise the best evidence you have found

Apply the evidence to care of your patient

Assess the effectiveness of care based on this evidence

## ***Looking for the evidence***

### **What kind of study?**

**Descriptive:** documents and communicates experience—begins the search for explanations -- e.g., case reports, case series, population studies, general review articles

**Explanatory:** makes comparisons

**\*\*Observational--investigator observes nature**

Cohort studies—usually prospective

Case-Control studies—usually retrospective

Cross-sectional studies

**\*\*Experimental--investigator introduces an intervention**

controlled trial

randomized controlled trial

randomized placebo-controlled trial

double-blind randomized controlled trial

(bench studies—in vitro, animal, etc.)

**\*\* Systematic Reviews—reviews in which rigorous scientific strategies have been followed in search, selection, critical appraisal and synthesis of all relevant studies addressing a question.**

**\*\*Meta-analysis—analysis of data from multiple sources to determine overall trends or significance. Systematic reviews with meta-analysis of the results of homogeneous studies are considered among the highest levels of evidence. (Sometimes “systematic review” and “meta-analysis” are used interchangeably. However, systematic reviews often do not include meta-analyses; and meta-**

analyses of data can be conducted without systematic reviews.)

## ***Levels of Evidence (for interventions mainly)***

Systematic review with meta-analysis of high quality randomized controlled trials with low heterogeneity.

Well-designed Randomized Controlled Trial (preferably double-blind)

Systematic review of observational studies with low heterogeneity.

Well-designed observational studies (prospective studies are considered to be stronger or less potentially biased than retrospective studies)

Unsystematic clinical reports: case study, case series

Authority, population studies, bench studies

See also the levels of evidence from the Oxford Centre for Evidence-based Medicine at [http://www.cebm.net/levels\\_of\\_evidence.asp#levels](http://www.cebm.net/levels_of_evidence.asp#levels)

### **What's the best evidence for each domain?**

#### **Therapy/Prevention**

\*\* The best evidence for a study of therapy or prevention is a double blind randomized controlled trial or a systematic review of such studies, with meta-analysis; if these are not possible, because of the nature of the question, or are not available, the next best level is a prospective controlled trial.

#### **Etiology/Cause/Harm**

\*\* Some etiology studies (such as adverse drug reactions) are combined with therapy studies—for these RCTs or systematic reviews are the best study designs; for other causation questions, retrospective case-control studies are usually the best available, although prospective cohort studies may be possible; but frequently case studies constitute the only evidence there is.

#### **Diagnosis**

\*\* Systematic review of prospective cohort studies or cross sectional studies, with blind comparison to the diagnostic gold standard, preferably with consecutive patients with appropriate characteristics, or an individual study with these characteristics.

#### **Prognosis**

\*\* Systematic review of homogeneous inception cohort studies or a strong inception cohort study

## ***Well-Built Clinical Question: Therapy***

PICOS	Ask yourself:	Example:
Population (patient)	How would I describe a group of patients similar to mine? (condition, age, gender, etc.)	
Intervention (drug, procedure, etc.)	Which main /new intervention am I considering?	
Comparison	What is the alternative to compare with the intervention? (placebo, standard of care, etc.)	
Outcome	What can I hope to accomplish, measure, improve, or affect?	
Study design	What study design would provide the best level of evidence for this question?	

## ***Well-Built Clinical Question: Diagnosis***

PICOS

Ask yourself:

Example:

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Population (patient)

What are the characteristics of the patients? What is the condition that may be present?

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Intervention  
(diagnostic test)

Which diagnostic test am I considering?

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Comparison

What is the diagnostic gold standard?

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Outcome

How likely is the test to predict/rule out this condition?

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Study design

What study design would provide the best level of evidence for this question?

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## **Well-Built Clinical Question: Prognosis**

PICOS	Ask yourself:	Example:
Population (patient)	How would I describe a cohort of patients similar to mine?	
Intervention (prognostic factor)	Which main prognostic factor am I considering?	
Comparison (optional)	What is the comparison group, if any?	
Outcome	What disease progression can be expected?	
Study Design	What study design would provide the best level of evidence for this question?	

## ***Well-Built Clinical Question: Harm/Causation/Etiology***

PICO	Ask yourself:	Example:
Population (patient)	How would I describe a group of patients similar to mine?	
Intervention (exposure)	Which main exposure am I considering?	
Comparison	What is the main alternative to compare with the exposure?	
Outcome	How is the incidence or prevalence of the condition in this group affected by this exposure?	
Study design	What study design would provide the best level of evidence for this question?	

## ***Answers to clinical questions:***

**Where do I look first?**

**What do I look for?**

### **First principles:**

Go for quality-filtered (pre-appraised) if possible

Go for the best evidence you can

If you find a good answer, it's o.k. to stop looking

### **For Background information (secondary literature):**

Look for evidence-based sources (i.e., sources that cite credible references from published clinical research). Clinical Evidence gives good background information explicitly evidence-based.

Look for clinical practice guidelines or clinical decision rules with explicit levels of evidence (NHS Clinical Knowledge summaries, National Guideline Clearinghouse)

Look for current standard clinical textbooks, paper or electronic format, with references (ACP Medicine, ACP PIER, e-Medicine, UpToDate, other e-textbooks available in MDConsult, StatRef, Access Medicine, Books@OVID, etc.)

Look for current review articles based in research literature, systematic reviews if possible

### **For Foreground information (primary literature=original clinical research)**

Look in “filtered” or “pre-appraised” sources first (e.g., Cochrane Library, ACP Journal Club or other Evidence-based ... digests, Clinical Evidence, BestBETS)

If you don't find an answer to suit your question (i.e., evidence that is applicable to your patient, important, and valid), use an appropriate database to search the journal literature (e.g., Medline, PubMed, EMBASE, Web of Science, SCOPUS)

Always use a “quality filter” when searching for evidence in a bibliographic database—quality filters are search statements usually indicating study design; these statements are then combined with the subject search

## **Therapy**

What kind of study?

Ideally, look for randomized controlled trials or systematic reviews of randomized controlled trials

### **Look first in:**

1. Cochrane Library: Cochrane reviews, DARE reviews (other systematic reviews), Cochrane Central Register of Controlled Trials
2. ACP PIER (via StatRef) shows specific evidence sources for its recommendations
3. Clinical Evidence or BestBETS (synthesized evidence—check references)
4. ACP Journal Club (or a relevant Evidence-based digest, such as Evidence-based Child Health, Evidence-based Eye Care, etc.)
5. Clinical Practice Guideline—but only if it is current, from a reputable source, and has explicitly stated and appropriate levels of evidence

### **Then look in**

MEDLINE/PubMed

Limit to RCT's or meta-analysis (Ovid MEDLINE)

For surgical questions or questions where randomization is not practicable, combine subject search with "cohort studies" or "cohort\$.mp." or "comparative studies".

**\*\*or\*\***

In PubMed, search in the Clinical Queries mode for Systematic Reviews or under "Therapy" and "Specificity" (do not use the "Clinical Queries" mode for surgical questions. Instead, combine your PubMed search with the subject heading "cohort studies") (OVID Medline has a "Clinical Queries" limit found under "More Limits"—do your subject search first, then limit to "Therapy" and "Specific".)

## Questions you should ask a Therapy study

### Are the results valid?

- Was the assignment of patients to treatment randomized?
- Were all patients who entered the trial properly accounted for and attributed at its conclusion?
  - Was follow-up complete?
  - Were patients analyzed in the groups to which they were randomized ?
  - Intention to Treat analysis?
- Were patients, their clinicians and study personnel 'blind' to the treatment allocation?
- Were the groups similar at the start of the trial?
  - Baseline prognostic factors (demographics, co-morbidity, disease severity, other known confounders) balanced?
  - If different, were these adjusted for?
- Aside from the experimental intervention, were the groups treated equally? What about
  - Cointerventions?
  - Contamination?
  - Compliance?

### What are the results?

- How large is the treatment effect?
  - Absolute risk reduction?
  - Relative risk reduction?
- Did the study have a sufficiently large [sample size](#)?
- How precise is the estimate of the treatment effect?
  - Confidence intervals?

### Will the results help me care for my patient?

- Can the results be applied to my patients?
  - Patients similar for demographics, severity, co-morbidity and other prognostic factors?
  - Compelling reason why they should not be applied?
- Were all clinically relevant outcomes considered?
- Are substitute endpoints valid?
- Are the benefits worth the harms and costs?
  - NNT (Number Needed to Treat) for different outcomes?

## ***Therapy—statistical terms and concepts***

Absolute Risk (AR) = Incidence = the observed or calculated probability of an event in the population under study.

Absolute Risk Difference (ARD= CER-EER): the difference in the risk for disease or death between an exposed population and an unexposed population.

	Yes	No
Exposed	a	b
Not Exposed	c	d

Control event rate (CER) =  $c/c+d$

Experimental event rate (EER) =  $a/a+b$

Relative Risk (RR) =  $EER/CER=(a/a+b)/(c/c+d)$  = the ratio of the probability of developing, in a specified period of time, an outcome among those receiving the treatment of interest or exposed to a risk factor, compared with the probability of developing the outcome if the risk factor or intervention is not present.

Relative Risk Reduction (RRR) =  $CER-EER/CER$  = the extent to which a treatment reduces a risk, in comparison with patients not receiving the treatment of interest.

Absolute Risk Reduction (ARR) =  $CER-EER$  = the difference in the absolute risk (rates of adverse events) between study and control populations.

Number Needed to Treat (NNT) =  $1/ARR$  = the number of patients who must be exposed to an intervention before the clinical outcome of interest occurred; for example, the number of patients needed to treat to prevent one adverse outcome.

Confidence Interval (CI) = The range of numerical values in which we can be confident (to a computed probability, such as 90 or 95%) that the population value being estimated will be found. Confidence intervals indicate the strength of evidence; where confidence intervals are wide, they indicate less precise estimates of effect. The larger the trial's sample size, the larger the number of outcome events and the greater becomes the confidence that the true relative risk reduction is close to the value stated. Thus the confidence intervals narrow and "precision" is increased. In a "positive finding" study the lower boundary of the confidence interval, or lower confidence limit, should still remain important or clinically significant if the results are to be accepted. In a "negative finding" study, the upper boundary of the confidence interval should not be clinically significant if

you are to confidently accept this result. The estimate of where the true value of a result lies is usually expressed in terms of a 95% confidence interval (CI), or confidence limits. These define the range that includes the true relative risk reduction 95% of the time.

p Value = the probability that any particular outcome would have occurred by chance. Statistical significance is usually  $p < 0.05$ ;  $p < 0.01$  would be considered highly statistically significant. Considered to be inferior to Confidence Intervals in determining significance of studies.

## ***Diagnosis***

### **What kind of study?**

Ideally, look for a prospective study, in which all patients receive both the test under investigation and the gold standard test; the individual examining the results of the gold standard test should not be aware of the results of the investigational test, and vice-versa.

### **Look first in:**

1. Cochrane Library (mainly therapeutic—use “diagnos\*”, restrict to title): Cochrane Systematic reviews, DARE reviews, Cochrane Central Register of Controlled Trials
2. BestBETS
3. A general evidence-based textbook, such as ACP PIER or ACP Medicine, then
4. Speciality/Sub-speciality textbooks—current edition only (e-textbooks are available in sets, including MDConsult, StatRef, and [Books@OVID](#))
5. ACP Journal Club (or a relevant Evidence-based review, such as Evidence-based Dentistry, Evidence-based Eye Care, etc.)
6. Clinical Decision Rule or Clinical Practice Guideline—but only if it is current, from a reputable source, and has explicitly stated and appropriate levels of evidence

### **Then look in:**

Medline/PubMed

Combine your subject search with “EXP Sensitivity and Specificity”

**\*\*or\*\***

In PubMed, search under Diagnosis in the Clinical Queries mode (choose “specificity”); in OVID Medline, limit your search under “More Limits” > “Clinical Queries” > “Diagnosis (specific)”

### **Questions you should ask a Diagnostic study**

#### **Are the results valid?**

- Was there an independent blind comparison with a reference standard?
- Is reference standard used acceptable?
- Were both reference standard and test applied to all patients?
- Did the patient sample include an appropriate spectrum of patients to whom the test will be applied?
- Did the results of the test being evaluated influence the decision to perform the reference standard (“verification” or “work-up” bias)?
- Were the test's methods described clearly enough to permit replication?
  - Preparation of patient?
  - Performance of test?
  - Analysis and interpretation of results?

## **What are the results?**

- What are the likelihood ratios for the test results?

## **Will the results help me care for my patients?**

- Will the test be reproducible and well interpreted in my practice setting?
- Are the results applicable to my patients?
  - Similar distribution of disease severity?
  - Similar distribution of competing diseases?
  - Compelling reasons why the results should not be applied?
- Will the test results change my management?
  - Test and treatment thresholds?
  - High or low likelihood ratios?
- Will my patients be better off because of the test?
  - Is target disorder dangerous if left undiagnosed?
  - Is test risk acceptable?
  - Does effective treatment exist?
- Will information from test lead to change of management beneficial to patient?

## ***Diagnosis—statistical terms and concepts***

	Gold standard Positive (condition present)	Gold standard Negative (condition not present)
Test result Positive	True Positive	False Positive
Test result Negative	False Negative	True Negative

Stable Properties:

**Sensitivity** = True Positives / (True Positives + False Negatives) = the proportion of truly diseased persons, as measured by the gold standard, who are identified as diseased by the test under study

**Specificity** = True Negatives / (False Positive + True Negative) = the proportion of persons who truly do not have the disease, as measured by the gold standard, who are so identified by the diagnostic test under study

Frequency Dependent Properties:

**Predictive value:** In screening and diagnostic tests, the probability that a person with a positive test is a true positive (i.e., does have the disease), or that a person with a negative test truly does not have the disease. The predictive value of a screening test is determined by the **sensitivity** and **specificity** of the test, and by the prevalence of the condition for which the test is used.

**Positive Predictive Value** = True Positive / (True Positive + False Positive) = probability that a person with a positive test is a true positive (i.e., does have the disease)

**Negative Predictive Value** = True Negative / (True Negative + False Negative) = the probability that a person with a negative test truly does not have the disease.

Likelihood Ratios (LR)

The likelihood ratio for a test result compares the likelihood of that result in patients with disease to the likelihood of that result in patients without disease:

	Condition present)	Condition not present
Test result Positive	a	b
Test result Negative	c	d

Positive LR =  $(a/a+c)/(b/b+d)$

Negative LR =  $(c/a+c)/(d/b+d)$

How much do Likelihood Ratios change disease likelihood?

LRs >10 or <0.1 cause large changes in likelihood.

LRs 5-10 or 0.1-0.2 cause moderate changes.

LRs 2-5 or 0.2-0.5 cause small changes.

LRs between <2 and 0.5 cause little or no change.

## ***Prognosis***

### **What kind of study?**

Look for prospective inception cohort studies with at least 80% follow-up.

### **Look first in:**

Evidence based textbook: A general textbook(e.g., ACP Medicine, ACP PIER, e-Medicine)

Speciality/Sub-speciality textbooks—current edition only

Sources of e-textbooks: MDConsult, StatRef, [Books@OVID](#)

### **Then look in:**

Medline/PubMed

Combine your subject search with “EXP cohort studies” or “survival analysis”

**\*\*or\*\***

In PubMed, search under Prognosis in the Clinical Queries mode (choose “specificity”); in OVID Medline, limit your search under “More Limits” to “Clinical Queries” > “Prognosis (specific)”

### **Questions you should ask a study of Prognosis**

#### **Are the results valid?**

- Was there a representative and well-defined sample of patients at a similar point in the course of disease?
  - Inclusion and exclusion criteria?
  - Selection bias?
  - Stage of disease?
- Was follow-up sufficiently long and complete?
  - Reasons for incomplete follow-up?
  - Prognostic factors similar for patients lost- and not lost-to-follow-up?
- Were objective and unbiased outcome criteria used?
  - Outcomes defined at start of study?
  - Investigators 'blind' to prognostic factors?
- Was there adjustment for important prognostic factors?

#### **What are the results?**

- How likely are the outcomes over time? Survival curves (Kaplan-Meier)?
- How precise are the estimates of likelihood?
  - Confidence intervals?

## Will the results help me care for my patients?

- Were the study patients similar to my own?
  - Patients similar for demographics, severity, co-morbidity, and other prognostic factors?
- Compelling reason why the results should not be applied?
- Will the results lead directly to selecting therapy?
- Are the results useful for reassuring patients?

## Notes on Understanding an Article on Prognosis

The **prognosis** of a disease refers to its possible outcomes and the likelihood that each one will occur.

A **prognostic factor** is a patient characteristic that can predict that patient's eventual outcome:

- demographic: e.g. age
- disease-specific: e.g. tumor stage
- comorbid: other conditions present

Prognostic results are the number of events that occur over time, expressed in:

- absolute terms: e.g. 5 year survival rate
- relative terms: e.g. risk from prognostic factor
- survival curves: cumulative events over time

## ***Etiology/Causation/Harm***

### **What kind of study?**

You may find randomized controlled trials, systematic reviews with meta-analysis, or multi-centre studies, especially if you are looking for adverse effects of a therapeutic agent or comparative risks and benefits of a therapeutic agent. If you are looking for other kinds of causation studies, such as environmental exposures, look for case-control studies.

### **Look here first:**

1. **\*\*If an adverse drug reaction (ADR), look in the same sources as for a Therapy study (Cochrane Library, Clinical Evidence, BestBETS, ACP Journal Club) plus an evidence-based drug handbook such as**

MedicinesComplete (choose Martindale)

2. If not an ADR, Evidence based textbook, such as

ACP Medicine or ACP PIER

Speciality/Sub-speciality textbooks—current edition only

Sources of e-textbooks: MDConsult, StatRef, Books@OVID

Consider a toxicology, environmental or occupational health encyclopedia or handbook (e.g., Casarett and Doull's toxicology, available online)

### **Then look in:**

3. Medline

Search for articles indexed as “case control studies” or “cohort studies” (for an ADR, limit your subject search to Randomized Controlled Trials or Meta-analysis as a publication type)

**\*\*or\*\***

In PubMed, search under Etiology in the Clinical Queries mode (choose “specificity” first); in OVID Medline, limit your search under “More Limits” to “Clinical Queries” > “Etiology (Specific)”

### **Questions you should ask an etiology study**

#### **Are the results valid?**

- Except for the exposure under study, were the compared groups similar to each other?

- RCT, cohort, case-control?
- Other known prognosis factors similar or adjusted for?
- Were the outcomes and exposures measured in the same way in the compared groups?
  - Recall bias? Interviewer bias?
  - Exposure opportunity similar?
- Was follow-up sufficiently long and complete?
  - Reasons for incomplete follow-up?
  - Risk factors similar in those lost and not lost to follow-up?
- Is the temporal relationship correct?
  - Exposure preceded outcome?
- Is there a dose-response gradient?
  - Risk of outcome increases with quantity or duration of exposure?

### **What are the results?**

- How strong is the association between exposure and outcome?
  - Relative Risk or Odds Ratio
- How precise is the estimate of risk?
  - Confidence intervals?

### **Will the results help me care for my patients**

- Are the results applicable to my patients?
  - Patients similar for demographics, morbidity and other prognostic factors?
  - Are treatments and exposures similar?
- What is the magnitude of the risk?
  - Absolute risk increase (and its reciprocal)?
- Should I attempt to stop the exposure?
  - Strength of evidence?
  - Magnitude of risk?
  - Adverse effects of reducing exposure?

## ***Etiology—statistical terms and concepts***

Attributable Risk= Absolute risk difference (ARD): the difference in the risk for disease or death between an exposed population and an unexposed population.

Attributable Risk Percentage = The percentage of risk among those with the risk factor that is associated with the risk factor itself. If a cause and effect relationship exists, attributable risk is the percentage of a disease that can be expected to be eliminated among those with the risk factor, if the effect of the risk factor can be eliminated

Odds: a proportion in which the numerator contains the number of times an event occurs and the denominator includes the number of times the event does not occur.

Odds Ratio (OR): a measure of the degree of association; for example, the odds of exposure among the cases compared with the odds of exposure among the controls.

Odds Ratios and Relative Risk

	Condition present	Condition not present
Exposure	a	b
No Exposure	c	d

	Appropriate use	Formulae
Relative Risk	Randomized controlled trials Cohort studies	RR= $(a/a+b)/(c/c+d)$  RR= $(a/a+b)/(c/c+d)$
Odds Ratio	Randomized controlled trials Cohort studies  Case-control studies	OR= $(a/b)/(c/d)=ad/bc$  OR= $(a/b)/(c/d)=ad/bc$  OR= $(a/c)/(b/d)=ad/bc$

When outcomes or events are rare, the estimates of RR are similar to those of OR. As the outcomes become more common, this approximation no longer holds.

## **Systematic Reviews**

A systematic review is as good as the quality of studies included in the review and as applicable as the applicability of these individual studies. A systematic review comprised of weak studies is a weak systematic review; pooling data from studies of different populations with different treatment protocols or at different stages of a disease provides results that are statistically invalid.

### **Sources of Systematic Reviews:**

Pre-appraised sources

Cochrane Database of Systematic Reviews

Database of Abstracts of Reviews of Effect (DARE)

CCOHTA or other databases of Health Technology Assessments

ACP Journal Club (and other Evidence-based... digests); Bandolier

Unappraised bibliographic databases

Medline—limit subject search to “meta-analysis” as a publication type **\*\*or\*\***

PubMed-- under “Clinical Queries” search for Systematic Reviews

### **Questions to ask a Systematic Review**

#### **Are the results valid?**

- Did the overview address a focused clinical question?
  - Patients? Exposures? Outcomes?
  - Were the criteria used to select articles for inclusion appropriate? Patients? Exposures? Outcomes? Methodological standards?
- Is it unlikely that important, relevant studies were missed?
  - Bibliographic databases searched? Detailed search strategy?
  - Reference lists?
  - Personal contacts?
- Was the validity of the included studies appraised? By what criteria?
- Were assessments of studies reproducible?
  - Blinded reviewers?
  - Inter-observer agreement?
- Were the results similar from study to study?
  - Tests of homogeneity?

#### **What are the results?**

- What are the overall results of the review?
  - Overall odds ratios?
  - Weighting of studies?

- How precise were the results? Confidence intervals?

### **Will the results help me care for my patients?**

- Can the results be applied to my patients?
  - Patients similar for demographics, severity, comorbidity, and other prognostic factors?
- Compelling reason why they should not be applied?
- Were all clinically relevant outcomes considered?
  - Are substitute endpoints valid?
- Are the benefits worth the harms and costs?
  - NNT for different outcomes?

## ***Other Evidence-Based Practice Resources***

### **To Learn More about EBM:**

- CATWalk: <http://www.library.ualberta.ca/subject/healthsciences/catwalk/index.cfm> (walks you through the evidence-based practice protocol)
- Evidence-based Medicine Toolkit: <http://www.med.ualberta.ca/ebm/ebm.htm> (helps you evaluate what you found, search strategies, etc.)
- Bandolier--A highly readable monthly evidence-based medicine newsletter from the Oxford Centre for Evidence-Based Medicine—mini-systematic reviews + good info on concepts used in EBM <http://www.jr2.ox.ac.uk/bandolier/>
- Centre for Evidence Based Medicine <http://www.cebm.utoronto.ca/> Excellent resources for EBM--see especially the calculator for PDA's <http://www.cebm.utoronto.ca/palm/ebmcalc/>
- Other excellent resources are listed at the Resource Guide for Evidence Based Practice: <http://www.library.ualberta.ca/subject/evidence/guide/index.cfm>

### **Useful Resources for Evidence-based Practice**

- Users Guides to the Medical Literature— Complete revised set of Users' Guides originally published as a series in the Journal of the American Medical Association (JAMA). [http://ugi.usersguides.org/usersguides/hg/hh\\_start.asp](http://ugi.usersguides.org/usersguides/hg/hh_start.asp)
- How to Read a Paper—a very readable series of BMJ articles by Trisha Greenhalgh on how to critically appraise clinical journal articles. <http://www.bmj.com/cgi/search?fulltext=how+to+read+a+paper&x=17&y=12>
- TRIP Database—from the Centre for Research Support, Wales; one-stop shopping for evidence <http://www.tripdatabase.com/>
- A good home base:
  - University of Alberta Libraries <http://www.library.ualberta.ca/subject/healthsciences/index.cfm>

### **Further Reading**

- Greenhalgh, Trisha. How to read a paper: the basics of evidence based medicine. 3rd ed. London: BMJ, 2006. R 118.6 G74 2006
- McKibbin, Ann. PDQ Evidence-Based Principles and Practice. Hamilton: B.C.Decker, 1999 R 850.7 D42 M158 1999

- Moore, R. Andrew. Bandolier's little book of making sense of the medical evidence. Oxford: Oxford University Press, 2006. R 723.7 M66 2006
- Straus, Sharon E., et al. Evidence-based Medicine: How to Practice and Teach EBM. 3rd ed. Edinburgh: Churchill-Livingstone, 2005. R 118.6 E95 2005 Reserve
- Users' guides to the medical literature: a manual for evidence-based clinical practice. Evidence-Based Medicine Working Group; edited by Gordon Guyatt, Drummond Rennie. Chicago: AMA Press, c2002. RA 427 U84 2002 Ref
  - Also on-line as Users Guides Interactive at [http://ugi.usersguides.org/usersguides/hg/hh\\_start.asp](http://ugi.usersguides.org/usersguides/hg/hh_start.asp)
- Surgical Clinics of North America, February, 2006—Special issue devoted to EBM for Surgery (Available via MDConsult)