



# EBM Guidebook

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[Read the Guidebook online](#)

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## I. Introduction to EBM

Much has been written about evidence-based medicine (EBM) and the steps in the EBM process. The purpose of this EBM guidebook is to provide a pocket reference that can structure your approach to EBM in searching for answers in clinical situations and in journal clubs. It is not intended to serve as a primary or comprehensive text on EBM.

### What is EBM/EBP?

EBM aka EBP (Evidence-Based Practice) "is the integration of best research evidence with clinical expertise and patient values" (Sackett D, et.al. 2000).

EBM combines information obtained from a patient encounter with the best evidence available from the medical literature and your clinical experience and applies this knowledge to the prevention, diagnosis or management of disease in that patient (figure 1).

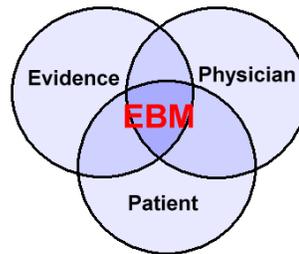


Figure 1: EBM diagram

### Why practice EBM?

Medical knowledge is constantly changing and increasing in complexity. New diagnostic and therapeutic procedures are constantly being recommended. Such recommendations range from changes in care practices to prevent physiologic derangements to new therapies for life-threatening or disabling conditions.

The evidence, by itself, does not make a decision for you, but it can help support the patient care process. The full integration of EBM components into clinical decisions enhances the opportunity for optimal clinical outcomes and quality of life. The practice of EBM is usually triggered by patient encounters which generate questions about the effects of therapy, the utility of diagnostic tests, the prognosis of diseases, or the etiology of disorders.

The EBM approach improves your ability to evaluate clinical literature and enhances life-long learning skills in day-to-day medical practice. It is also about keeping up to date.

## II. EBM Process

*EBM always begins and ends with the patient.* The process can be broken down into six steps:

1. **ASSESS the Patient:** Start with the patient -- a clinical problem or question arises from the care of the patient.
2. **ASK the question:** Construct a relevant, answerable question derived from the case (use the PICO model).
3. **ACQUIRE the evidence:** Select the appropriate resource(s) and conduct a search
4. **APPRAISE the evidence:** Appraise the evidence for its validity (closeness to the truth) and applicability (usefulness in clinical practice).
5. **APPLY-- talk with the patient:** Return to the patient -- integrate that evidence with your clinical expertise, patient preferences and apply it to practice.
6. **SELF-EVALUATION:** Evaluate your performance with this patient.

**III. Ask a Clinical Question – (Step 1 & 2):** Assess the Patient and Ask a Well-Built, Patient-Oriented Clinical Question

Asking a well-built, patient-oriented clinical question is the first step in getting to an evidence-based answer quickly. To begin this process, consider the following case example:

*As a medical student doing your clerkship rotation in Family Medicine, you are seeing a middle aged obese Japanese man at the clinic for his annual physical exam. He brings in a bottle of Chitosan, an OTC dietary supplement. He has family history of cardiovascular disease and colon cancer. He wants to lose weight to reduce his risk. His daily diet is high in carbohydrates including rice and noodle.*

The next step in this process is to take the identified problem and construct a question that is relevant to the case. There are two general types of clinical questions: background and foreground questions.

**Background questions** usually ask general questions about a disease, diagnostic test, or treatment. As a medical student, your clinical knowledge and experience are limited. For example, in the case scenario above, we might ask background questions such as:

- *What are the early signs and symptoms of metabolic syndrome?*
- *What is Chitosan?*
- *Is obesity a risk factor for cardiovascular disease?*

Answers for background questions may be found in resources such as medical textbooks, review articles, and point-of-care databases such as Up-To-Date.

As you gain clinical experience, you master the background knowledge you need and shift toward asking more complex questions (foreground questions).

**Foreground questions** often compare two things: two drugs or treatments, the prognosis of two groups, two diagnostic tests, or the harms or benefits of two interventions. To format foreground questions clearly, use the “**PICO**” format as shown in Table 1.

**Table 1:** The Clinical Question Worksheet -- PICO

Question Components	Your Question
<b>P – Patient or Population</b> Describe the most important characteristics of the patient. (e.g., age, disease/condition, gender)	
<b>I – Intervention; Prognostic Factor; Exposure</b> Describe the main intervention. (e.g., drug or other treatment, diagnostic/screening test)	
<b>C – Comparison</b> (if appropriate) Describe the main alternative being considered. (e.g., placebo, standard therapy, no treatment, the gold standard)	
<b>O – Outcome</b> Describe what you’re trying to accomplish, measure, improve, affect. (e.g., reduced mortality or morbidity, improved memory, accurate and timely diagnosis)	
<b>The well-built clinical question:</b>	

In our case scenario, you know that obesity is a risk factor for many chronic diseases. You wonder what the safety and efficacy of Chitosan is for weight loss. Table 2 shows the structure of a well-built clinical question in a PICO format:

**Table 2:** Example of a well-built clinical question in PICO format

<b>Patient / Problem</b>	<i>Middle aged obese Japanese male</i>
<b>Intervention</b>	<i>Chitosan</i>
<b>Comparison</b>	<i>No treatment (placebo)</i>
<b>Outcome</b>	<i>Weight loss</i>
The well-built clinical question: <i>In a middle aged, obese Japanese male, what is the safety and efficacy of Chitosan vs. no treatment for weight loss?"</i>	

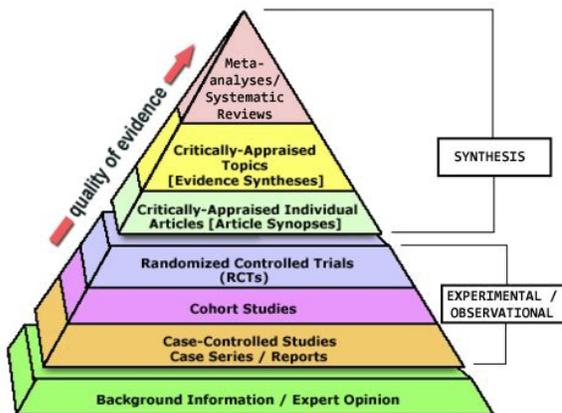
There are two additional elements of a well-built clinical question: **type of clinical question** and **type of study**. This information can be helpful in focusing the question and determining the most appropriate type of evidence or study to answer the clinical question.

**Table 3:** Type of Clinical Questions for the Ideal Type of Study

Type of Question	Ideal Type of Study
<input type="checkbox"/> <b>Therapy</b>	RCT > Cohort Study > Case Control
<input type="checkbox"/> <b>Diagnosis:</b>	Prospective, blind controlled trial comparison to gold standard
<input type="checkbox"/> <b>Prognosis</b>	Cohort Study > Case Control > Case Series/Case Report
<input type="checkbox"/> <b>Etiology/Harm</b>	RCT > Cohort Study > Case Control
<b>Note: Meta-analyses and systematic reviews, when available, often provide the best answers to clinical questions.</b>	

Adapted from the Dartmouth Biomedical Libraries: Evidence-Based Medicine Worksheets: [http://www.dartmouth.edu/~biomed/services.html#EBP\\_docs/clin\\_question\\_worksheet\\_EXAMPLE.pdf](http://www.dartmouth.edu/~biomed/services.html#EBP_docs/clin_question_worksheet_EXAMPLE.pdf)

**Figure 2: Levels of Evidence: Study Type / Evidence Hierarchy**



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**Note:** It is often impractical or infeasible to review "all the evidence" that might help to answer your clinical question. The levels of evidence serve as a framework or a short-cut for you to find the best available information.

**IV. Acquire the Evidence (Literature Search) -- (Step 3): Finding the Best Evidence:**

It is important when searching for evidence that search terms are derived from your original PICO question. The process of finding evidence therefore follows three key steps:

a. Identify terms to fit your PICO question. See Table 4 below.

**Table 4:** Search Strategy Development

	Primary search terms	Synonym 1	Synonym2
<b>P</b>	<i>Obesity</i>	<i>obese</i>	<i>overweight</i>
<b>I</b>	<i>Chitosan</i>	<i>Poliglusam</i>	
<b>C</b>	<i>No treatment / placebo (Terms not included in the search strategy)</i>		
<b>O</b>	<i>Weight loss</i>		

Final Search Strategy:

**"(Obesity OR Obese OR Overweight) AND (Chitosan OR Poliglusam) AND weight loss"**

[Alternate search strategy]

**"Obesity OR Obese OR Overweight) AND (Chitosan OR Poliglusam)"**

[Note: Authors often use various terminologies to describe the likely outcome. Including this concept can be redundant and may dramatically reduce the search result. Therefore, we often exclude the outcome search terms in our search strategy.]

b. Look for secondary sources (Systematic reviews, book chapters, etc.)

- Guidelines: [National Guidelines Clearinghouse](#)
- Evidence-Based / Expert Opinion Summaries: ACP Journal Club and UpToDate
- Systematic Reviews: The Cochrane Library
- e-Books, Book Chapters.

**The Grunigen Medical Library Website** (<http://grunigen.lib.uci.edu/>) provides access to key information resources in medicine for current UCI faculty, staff and students. These resources include PubMed (with access to thousands of full-text articles), the Cochrane Collaboration (systematic reviews/meta-analyses), AccessMedicine (e-books, case studies, images, videos), UpToDate (expert synopses of current medical knowledge), MDConsult (e-books, e-journals, patient materials, medical news), and much more.

c. Search for primary sources (clinical trials, case studies)

PubMed search results by "Study Type" for **"(Obesity OR Obese OR Overweight) AND (Chitosan OR Poliglusam)"**

**Table 5:** PubMed search results (as of 04/14/2011)

Type	PubMed Limits	# articles
All articles	(no filter)	46
Systematic Review	Systematic [Subset]	6
RCT	Randomized Controlled Trial[Publication Type]	8
Case report	Case Reports [Publication Type]	2

You can also use [PubMed Clinical Queries](http://www.ncbi.nlm.nih.gov/pubmed/clinical) (<http://www.ncbi.nlm.nih.gov/pubmed/clinical>) methodological filters to target the following categories of clinical questions: Therapy, Diagnosis, Prognosis, and Etiology. PubMed Clinical Queries automatically creates a search filter based on the search terms that you enter and the "Clinical Study Categories" you choose.

An example of a Therapy question and the PubMed Clinical Queries search strategy:

**"In a middle aged, obese Japanese male, what is the safety and efficacy of Chitosan vs. no treatment for weight loss?"**

Select “**Therapy**” as the question category and “**Narrow**” for the scope. (The Narrow Therapy Filter limits the search results to “*Randomized Controlled Trials*”):

Search (**Therapy/Narrow[filter]**) AND ((**obesity OR obese OR overweight**) AND (**Chitosan OR Poliglusam**)) Limits: **Humans, English, Middle Aged + Aged: 45+ years**

An example of a Diagnosis question and the PubMed Clinical Queries Search Strategy:

*“In a middle aged, obese Japanese male, what is the sensitivity and specificity of waist circumference and body-mass index in predicting cardiovascular disease?”*

Select “**Diagnosis**” as the question category and “**Narrow**” for the scope. (The Narrow Diagnosis Filter limits the search results to the term, “*Specificity*” in the Title/Abstract):

Search (**Diagnosis/Narrow[filter]**) AND (**waist circumference AND body-mass index AND cardiovascular disease**) Limits: **Humans, English, Middle Aged + Aged: 45+ years**

An example of a Prognosis question and the PubMed Clinical Queries Search Strategy:

*“In a middle aged, obese Japanese male, does metabolic syndrome increase the risk of cardiovascular events?”*

Select “**Prognosis**” as the question category and “**Narrow**” for the scope. (The Narrow Prognosis Filter limits the search results to the terms such as prognosis and cohort in the Title/Abstract):

Search (**Prognosis/Narrow[filter]**) AND (**obesity OR obese OR overweight**) AND **metabolic syndrome AND cardiovascular disease** Limits: **Humans, English, Middle Aged + Aged: 45+ years**

An example of an Etiology/Harm question and the PubMed Clinical Queries Search Strategy:

*“In Asian or Japanese males, does a diet high in carbohydrates, including rice, increase the risk of colon cancer?”*

Select “**Etiology/Harm**” as the question category and “**Narrow**” for the scope. (The Narrow Etiology/Harm Filter limits the search results to terms such as relative risk and cohort studies in Title/Abstract):

Search (**etiology/Narrow[filter]**) AND (**Asian OR Japanese**) and (**carbohydrates OR rice**) AND (**colon cancer or colonic neoplasms**) Limits: **Humans, English, Middle Aged + Aged: 45+ years**

**V. Critical Appraisal – (Step 4): Appraise the Evidence**

Appraise the evidence for its validity (closeness to the truth) and applicability (usefulness in clinical practice). Once the evidence is identified which may answer the clinical question, the next step is to read the article(s) and evaluate the study (or studies). There are three basic questions that need to be answered for every type of study:

- Are the results of the study valid?
- What are the results?
- Will the results help in caring for my patient?

When evaluating a study, there are standard questions which are used to test the validity of the evidence. The questions asked depend on the type of clinical question and the study methodology. See the worksheets below for examples of these questions.

**Worksheet 1: Critical Appraisal for a Therapy Study**

<b>Citation:</b>
<b>SCREENING</b>
<ul style="list-style-type: none"> <li>• Why was the study done (what was the research question)?</li> <li>• Was the study design appropriate?</li> <li>• Does the study PICO match your question PICO?</li> <li>• Are there potential conflict of interest issues?</li> </ul>
<b>VALIDITY</b>

<p><b>F: Patient Follow-Up</b></p> <ul style="list-style-type: none"> <li>• Were all patients who entered the trial properly accounted for and attributed at its conclusion (losses to follow-up should be less than 20%)?</li> <li>• Was follow-up complete?</li> </ul>
<p><b>R: Randomization</b></p> <ul style="list-style-type: none"> <li>• Were the recruited patients representative of the target population?</li> <li>• Was the allocation (assignment) of patients to treatment randomized?</li> <li>• Was the allocation concealed?</li> </ul>
<p><b>I: Intention to treat analysis</b></p> <ul style="list-style-type: none"> <li>• Were patients analyzed in the groups to which they were randomized?</li> <li>• Were all randomized patient data analyzed? If not, was a sensitivity or “worst case scenario” analysis done?</li> </ul>
<p><b>S: Similar Baseline Characteristics of Patients</b></p> <ul style="list-style-type: none"> <li>• Were groups similar at the start of the trial?</li> </ul>
<p><b>B: Blinding</b></p> <ul style="list-style-type: none"> <li>• Were patients, health workers, and study personnel “blind” to treatment?</li> <li>• If blinding was impossible, were blinded raters and/or objective outcome measures used?</li> </ul>
<p><b>E: Equal Treatment</b></p> <ul style="list-style-type: none"> <li>• Aside from the experimental intervention, were the groups treated equally?</li> </ul>
<p><b>Summary of article’s validity</b></p> <ul style="list-style-type: none"> <li>• Notable study strengths or weaknesses or concerns?</li> <li>• How serious are the threats to validity and in what direction could they bias the study outcomes?</li> </ul>
<p><b>CLINICAL IMPORTANCE</b></p> <ul style="list-style-type: none"> <li>• How large was the treatment effect? (see below)</li> <li>• How precise was the treatment effect? (confidence interval; in its absence p-value tells statistical significance)</li> </ul>

	Outcome Present	Outcome Absent	
Treated/ exposed	a =	b =	EER (Experimental Event Rate) $\frac{a}{a+b}$
Control/ not exposed	c =	d =	CER (Control Event Rate) $\frac{c}{c+d}$

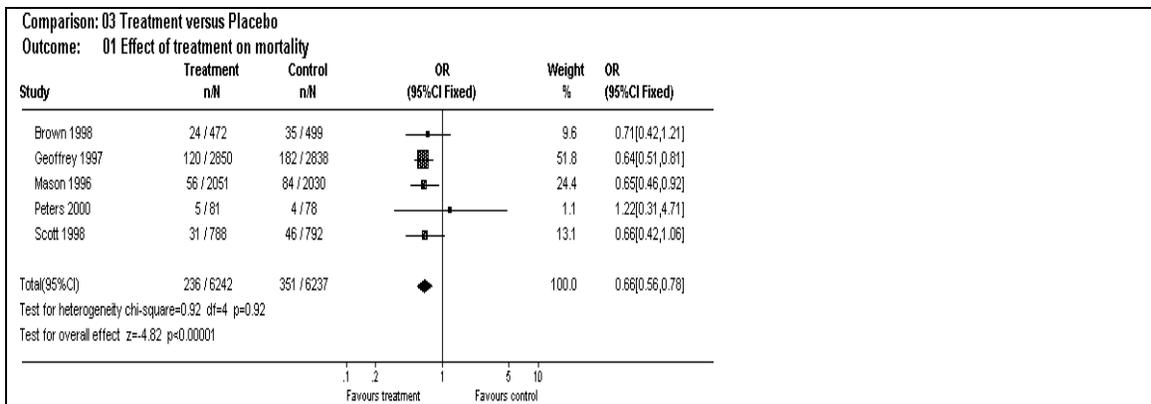
		RRR [RRI]	ARR [ARI]	NNT [NNH]
CER	EER	$\frac{(CER-EER)}{CER}$	CER-EER	$\frac{1}{ARR}$
<p><b>EER</b> (experimental event rate). The proportion of patients in the experimental treatment group who are observed to experience the outcome of interest.</p> <p><b>CER</b> (control event rate). The proportion of patients in the control group who are observed to experience the outcome of interest.</p> <p><b>ARR</b> (absolute risk reduction). The absolute arithmetic difference in rates of bad outcomes between experimental and control participants in a trial. (This is sometimes called the risk difference.)</p> <p><b>RRR</b> (relative risk reduction). The proportional reduction in rates of bad outcomes between experimental</p>				

and control participants in a trial.  
**NNT** (number needed to treat). The number of patients who need to be treated with the specified intervention to prevent one bad outcome or produce one good outcome over the period of time specified in the study.

Source: Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for a Therapy study: [ [http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/clin\\_question\\_worksheet.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/clin_question_worksheet.pdf) ]

**Worksheet 2: Critical Appraisal for a Systematic Review/Meta-analysis**

<b>1. What question did the systematic review address?</b>
The main question being addressed should be clearly stated. The exposure, such as therapy or diagnostic test, and the outcome(s) of interest will often be expressed in terms of a simple relationship.
<b>2. Is it likely that important, relevant studies were identified?</b>
The starting point for comprehensive search for all relevant studies is the major bibliographic databases (e.g. MEDLINE, Cochrane, EMBASE, etc). It should also include a search of reference lists from relevant studies, and contact with experts, particularly to inquire about unpublished studies. The search should not be limited to English language only. The search strategy should include both MeSH terms and text words.
<b>3. Were the criteria used to select articles for inclusion predetermined, clearly stated and appropriate?</b>
The inclusion or exclusion of studies in systematic reviews should be a clearly defined a priori. The eligibility criteria used should specify the patients, interventions or exposures and outcomes of interest. In many cases the type of study design will also be a key component of the eligibility criteria.
<b>4. Were the included studies sufficiently valid for the type of question asked?</b>
The article should describe how the quality of each study was assessed using predetermined quality criteria appropriate to the type of clinical question (e.g. randomization, blinding and completeness of follow-up)
<b>5. Were the results similar from study to study?</b>
Ideally, the results of the different studies should be similar or homogeneous. If heterogeneity exists the authors may estimate whether the differences are significant (chi-square test). Possible reasons for the heterogeneity should be explored.
<b>6. Clinical Importance</b>
6a. What were the results of the review? <i>(Are the results of all included studies clearly displayed? Are the results similar from study to study? Is there a clinical bottom line? If the study results combined, was it appropriate to do so?)</i>
6b. How precise are the results? <i>(What is the confidence interval? p-value?)</i>
6c. Did the interpretation of the review's results accurately reflect the results themselves? Are the results generalizable?
<b>7. How are the results presented?</b>
The systematic review provides a summary of the data from the results of a number of individual studies. If the results of the individual studies are similar, a statistical method (called meta-analysis) is used to combine the results from the individual studies and an overall summary estimate is calculation. The meta-analysis gives weighted values to each of the individual studies according to their size. The individual results of the studies need to be expressed in a standard way, such as relative risk, odds ratio or mean difference between the groups. Results are traditionally displayed in a figure, like the one below, called a <b>forest plot</b> .



The forest plot depicted above represents a meta-analysis of 5 trials that assessed the effects of a hypothetical treatment on mortality. Individual studies are represented by a black square and a horizontal line, which corresponds to the point estimate and 95% confidence interval of the odds ratio. The size of the black square reflects the weight of the study in the meta-analysis. The solid vertical line corresponds to ‘no effect’ of treatment - an odds ratio of 1.0. When the confidence interval includes 1 it indicates that the result is not significant at conventional levels ( $P>0.05$ ).

The diamond at the bottom represents the combined or pooled odds ratio of all 5 trials with its 95% confidence interval. In this case, it shows that the treatment reduces mortality by 34% (OR 0.66 95% CI 0.56 to 0.78). Notice that the diamond does not overlap the ‘no effect’ line (the confidence interval doesn’t include 1) so we can be assured that the pooled OR is statistically significant. The test for overall effect also indicates statistical significance ( $p<0.0001$ ).

### Exploring heterogeneity

Heterogeneity can be assessed using the “eyeball” test or more formally with

statistical tests, such as the Cochran  $Q$  test. With the “eyeball” test one looks for overlap of the confidence intervals of the trials with the summary estimate. In the example above note that the dotted line running vertically through the combined odds ratio crosses the horizontal lines of all the individual studies indicating that the studies are homogenous. Heterogeneity can also be assessed using the Cochran chi-square (Cochran  $Q$ ). If Cochran  $Q$  is statistically significant there is definite heterogeneity. If Cochran  $Q$  is not statistically significant but the ratio of Cochran  $Q$  and the degrees of freedom ( $Q/df$ ) is  $> 1$  there is possible heterogeneity. If Cochran  $Q$  is not statistically significant and  $Q/df$  is  $< 1$  then heterogeneity is very unlikely. In the example above  $Q/df$  is  $< 1$  ( $0.92/4 = 0.23$ ) and the  $p$ -value is not significant (0.92) indicating no heterogeneity.

**Note:** The level of significance for Cochran  $Q$  is often set at 0.1 due to the low power of the test to detect heterogeneity.

Source: Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for Systematic Review/Meta-analysis: [http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/CriticalAppraisalWorksheetSys-Review.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/CriticalAppraisalWorksheetSys-Review.pdf)

### Worksheet 3: Critical Appraisal for a Practice Guideline

Citation:
1. Does the guideline address a clear issue?
2. Are the target users clearly defined?
3. Was there a comprehensive search for the evidence?
4. Are the criteria for selecting and combining the evidence clearly described?
5. Are the methods used for formulating the recommendations clearly described?
6. Are the health benefits, side effects, and risks of the interventions considered in formulating recommendations?
7. Are different options for diagnosis and/or treatment of the condition clearly presented?
8. Are the key recommendations identifiable?
9. Is the guideline editorially independent from the funding body?

10. Are the conflicts of interest of the developing members recorded?
<b>11. Is the guideline current and up-to-date?</b>
<b>12. Is there an explicit link between the recommendations and the supporting evidence?</b>
<b>13. Has the guideline been externally reviewed by independent experts prior to its publication?</b>

Source: Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for Practice Guidelines  
[http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/CriticalAppraisalWorksheetGuidelines.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/CriticalAppraisalWorksheetGuidelines.pdf)

#### Worksheet 4: Critical Appraisal for a Diagnosis Study

<b>Citation:</b>			
<b>SCREENING</b>			
<ul style="list-style-type: none"> <li>Why was the study done (what was the research question)?</li> <li>Was the study design appropriate?</li> <li>P – I – C – O the study</li> </ul>			
<b>VALIDITY</b>			
<ul style="list-style-type: none"> <li>Was there a clearly defined question?</li> <li>Was the presence or absence of the target disorder confirmed with a reference standard?</li> <li>Was the comparison to the reference standard independent from and blind to the study test results?</li> <li>Was the test evaluated on an appropriate spectrum of patients?</li> <li>Was the reference standard applied to all patients?</li> </ul>			
<b>CLINICAL IMPORTANCE</b>			
		Target Disorder	
		Present	Absent
Test Result	Positive	A	B
	Negative	C	D
Sensitivity = $\frac{A}{A + C}$		Specificity = $\frac{D}{B + D}$	
Likelihood ratio + = $\frac{\text{Sensitivity}}{1 - \text{specificity}}$			
Likelihood ratio - = $\frac{1 - \text{sensitivity}}{\text{specificity}}$			

Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for Diagnostic test study  
[\[http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/CriticalAppraisalWorksheetDiagnosis.pdf\]](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/CriticalAppraisalWorksheetDiagnosis.pdf)

#### Worksheet 5: Critical Appraisal for a Prognosis Study

<b>Citation:</b>			
<b>SCREENING</b>			
<ul style="list-style-type: none"> <li>Why was the study done (what was the research question)?</li> <li>Was the study design appropriate?</li> <li>P – I – C – O the study</li> </ul>			
<b>VALIDITY</b>			
<ul style="list-style-type: none"> <li>Was a defined, representative sample of patients assembled at a common (usually early) point in their illness?</li> <li>Was patient follow-up long enough for the clinical outcome?</li> <li>Was patient follow-up complete?</li> <li>Were outcomes of interest defined in advance? Were there clear criteria to determine whether the outcomes had occurred?</li> <li>Were outcomes measured “blind” (i.e., without knowing the patient’s clinical characteristics and prognostic factors)?</li> </ul>			
<b>CLINICAL IMPORTANCE</b>			

- What is the risk of the outcome over time?
- How precise are the estimates?

Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for a Prognosis Study  
[http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/CriticalAppraisalWorksheetPrognosis.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/CriticalAppraisalWorksheetPrognosis.pdf)

### Worksheet 6: Critical Appraisal for a Harm/Etiology Study

<b>Citation:</b>			
<b>SCREENING</b>			
<ul style="list-style-type: none"> <li>• Why was the study done (what was the research question)?</li> <li>• Was the study design appropriate?</li> <li>• P – I – C – O the study</li> </ul>			
<b>VALIDITY</b>			
<ul style="list-style-type: none"> <li>• Was there a clearly defined question?</li> <li>• Were there clearly-defined, similar groups of patients?</li> <li>• Were exposures and clinical outcomes measured the same way in both groups?</li> <li>• Was the follow-up complete and long enough?</li> <li>• Does the suggested causative link make sense?</li> </ul>			
<b>CLINICAL IMPORTANCE</b>			
		Adverse Outcome	
		Present (case)	Absent (control)
Exposure	Yes	A	B
	No	C	D
In a cohort study:		Relative risk =	$\frac{A/(A+B)}{C/(C+D)}$
In a case-control study:		Odds ratio =	$\frac{A \times D}{B \times C}$

Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for a Etiology /Harm Study  
[http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/CriticalAppraisalWorksheetHarm-Etiology.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/CriticalAppraisalWorksheetHarm-Etiology.pdf)

## VI. Applying the Evidence – (Step 5): Applying the results (evidence) to patient care

### Similar Patients

- Are your patients similar to those in the study?
- Are they so different that the results are not applicable?
- How much of the study effect can you expect for your patients?

### Realistic Interventions

- Is the intervention realistic in your setting?
- Does the comparison intervention reflect your current Practice?
- What alternatives are available?

### Right Outcomes

- Have all the right outcomes been considered?
- Are the outcomes appropriate to your patient?
- Does the intervention meet their values and preferences?

[Dartmouth Biomedical Libraries: Evidence-Based Medicine Critical Appraisal Worksheet for Applying the Evidence  
[http://www.dartmouth.edu/~biomed/services.html/EBP\\_docs/ApplyingWorksheet.pdf](http://www.dartmouth.edu/~biomed/services.html/EBP_docs/ApplyingWorksheet.pdf) ]

## VII. Evidence-Based Practice (EBP): Improving Patient Care -- An Online Tutorial <http://www.lib.uci.edu/how/tutorials/EvidenceBasedPractice/>

## VIII. Glossary of Terms

**Absolute Risk Reduction (ARR):** The absolute arithmetic difference in rates of bad outcomes between experimental and control participants in a trial, calculated as  $|EER-CER|$ , and accompanied by a 95% CI.

**Case-Control Study:** A study which 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, e.g., looking at patients with leukemia and comparing their exposure to power cables to those who do not have leukemia. The Case-Control Study design can also be applied to prospective studies.

**Clinical Practice Guideline:** A systematically developed statement designed to assist clinician and patient decisions about appropriate health care for specific clinical circumstances.

**Cohort Study:** Involves identification of two groups (cohorts) of patients, one that received the exposure of interest (e.g., smokers), and one that did not (non-smokers), and following these cohorts forward for the outcome of interest. The Cohort Study design can also be applied retrospectively (a retrospective or historical cohort study).

**Confidence Interval (CI):** Quantifies the uncertainty in measurement. It is usually reported as 95% CI, which is the range of values within which we can be 95% sure that the true value for the whole population lies. For example, for an NNT of 10 with a 95% CI of 5 to 15, we would have 95% confidence that the true NNT value lies between 5 and 15.

**Control Event Rate (CER) = Event rate in control group =  $c/(c+d)$ :** The rate at which events occur in a control group. It may be represented by a percentage (say 10%) or as a proportion (when it is 0.1).

**Experimental Event Rate (EER) = Event rate in treated group =  $a/(a+b)$ :** The rate at which events occur in an experimental group. It may be represented by a percentage (say 50%) or as a proportion (when it is 0.5)

**Gold Standard:** Any standardized clinical assessment, method, procedure, intervention or measurement of known validity and reliability which is generally taken to be the best available, against which new tests or results and protocols are compared

**Inception Cohort:** A group of patients who are assembled near the onset of the target disorder, e.g., patients who appear in an Emergency Room with Myocardial Infarctions followed forward in time for morbidity.

**Meta-analysis:** A systematic review that uses quantitative methods to synthesize and summarize the results.

**Number Needed to Treat (NNT):** Is the inverse of the absolute risk reduction. The number of patients to be treated to achieve one additional good outcome, calculated as  $1/ARR$  and accompanied by a 95% CI. The ideal NNT is 1, where everyone improves with treatment and no-one improves with control. The higher the NNT, the less effective is the treatment.

**Randomized Controlled Trial (RCT):** Participants are randomly allocated into an experimental group or a control group and followed over time for the variables/outcomes of interest.

**Relative Risk Reduction (RRR):** The proportional reduction in rates of bad outcomes between experimental and control participants in a trial, calculated as  $|EER-CER|/CER$ , and accompanied by a 95% CI.

**Review (Narrative Review):** Conducted by experts in the field using informal methods to collect and interpret data.

**Systematic Review:** A summary of the medical literature that uses explicit methods to perform a comprehensive literature search and critical appraisal of individual studies, and that uses appropriate statistical techniques to combine these valid studies.

**Sensitivity:** Proportion of people with the target disorder who have a positive test result. It is used to assist in assessing and selecting a diagnostic test/sign/symptom.

**Sensitivity =  $a / (a + c)$ .**

**Specificity:** Proportion of people without the target disorder who have a negative test result. It is used to assist in assessing and selecting a diagnostic test/sign/symptom. **Specificity =  $d / (b + d)$**

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