Five Steps to Practice EBM

Step 1 – asking a question
Step 2 – searching for the best evidence
Step 3 – critically appraising
Step 4 – applying
Step 5 – evaluating

Step 1: Ask an answerable clinical question—P. I. C. O.

_Patient / Problem: Male Smokers
_Intervention / Exposure: Vitamin E, Beta-carotene
_Comparison: None
_Outcome: Coronary heart disease

Ex: In high cardiovascular risk male smokers, do vitamin E and carotene prevent clinical events or death?

Step 2: Effective searches for the best Evidence

Sources:
- Textbook
- Primary journal
- Secondary journal
- Internet
- E-mail
- Medline
- Best evidence
- Cochrane Library
- Expert / Colleagues

Websites recommended:
- Evidence Based Medicine Reviews (OVID)
- Cochrane Library Systematic Reviews (OVID)
- National Guideline Clearinghouse
- PubMed
- PubMed Clinical Queries
- ACP Journal Club
- Bandolier
- National Guideline Clearinghouse
- Evidence Based Nursing
- Evidence Based Mental Health

Step 3: Critically appraise that evidence for its validity and importance

- Diagnosis and Screening
- Prognosis
- Therapy
- Systematic Review
- Decision Analysis
- Harm / Etiology
- Guideline

Step 4: Apply to your patient: Integrate with patients’ values and preferences

Are these valid, important results applicable to our patient?
- Is our patient so different from those in the study that its results cannot apply?
- Is the treatment feasible in our setting?
- What are our patient’s potential benefits and harms from the therapy?
- What are our patient’s values and expectations for both the outcome we are trying to prevent and the treatment we are offering?
Objectives of the workshop:
you should be able to:

1. Recognize and formulate your own answerable clinical questions.
2. Identify the type of research that best answers the different classes of clinical questions.
3. Appraise and apply the results of different types of research studies to help in the management of individual patients (therapy studies and other types—diagnosis, prognostic, etc.).
4. Express the results of clinical trials in terms of both relative and absolute risk reductions, and be able to explain the numerical results to a patient.
5. Know which of several research databases (MEDLINE, EMBASE, Embase, and secondary sources (Clinical Evidence, Guidelines)) are most likely to be helpful in answering different types of clinical questions.
6. Search using multiple text words and MeSH headings connected by Boolean (AND, OR, NOT) and truncations (* and $).

Session ONE: Step 1: Asking Questions

PART A. Exercise: study designs

This first session aims to familiarize you with the PICO structure of questions, and being able to recognize these in research articles.

**PART A. Exercise: study designs**

Read the abstracts from published studies on the following pages and answer the following questions for each study:

1. What is the question (PICO) of the study?
2. What is the purpose of the study?
   a. Intervention
   b. Frequency (incidence or prevalence)
   c. Diagnostic accuracy
   d. Prognosis (or natural history)
   e. Etiology and risk factors
3. Which study type would give the highest quality evidence to answer the question? (Use Levels of evidence table)
4. Which is the best study type that is also feasible? (You can use the Table below as a guide)
5. What is the study type used?

PART B. Formulate the questions for the scenarios provided and for one or more of your own scenarios.

**Abstract 1**

Yoontsui S, Rosnami TH, Yoritna Z, Lekki TA, Yorovia JT, Kaspar Iscaim: Heart Disease Risk Factor Study. Low density lipoprotein is associated with increased risk of coronary heart disease (CHD); the findings are controversial.

**BACKGROUND:** Although several prospective studies have shown that low density lipoprotein and low concentrating factors are associated with increased risk of coronary heart disease (CHD), the findings are controversial.

**METHODS AND RESULTS:** We studied the association of density factors of vitamin B6, and vitamin B12 with the risk of acute coronary events in a prospective cohort study of 1980 Finnish men 47 to 69 years old, examined in 1984 and 1985 in the Kaapet Iscaim Heart Disease Risk Factor Study. Nomaat samples were assessed by 4 hours after receiving an average follow-up time of 10 years. A post-operative survival rate of 0.996 was observed. The Cox proportional hazards model adjusted for 21 non-medical and non-metabolic risk factors that the highest fifth of factors had a relative risk of acute coronary events of 0.49 (95% CI 0.25 to 0.98, P=0.04) compared with men in the lowest fifth. This association was stronger in non-smokers and light alcohol users than in smokers and alcohol users. A high-density factor of vitamin B6 had no significant association and that of vitamin B12 had a weak association with a reduced risk of acute coronary events.

**CONCLUSION:** The presence of CHD-free male-aged men in the first prospective cohort study to observe a significant inverse association between quantitative non-smokers and low density lipoprotein and incidence of acute coronary events is new. Our findings provide further support in favor of a role of factors in the prevention of good cardiovascular health.

**Question**

1. What is the question (PICO) of the study?
2. What is the purpose of the study?
3. Which study type would give the highest quality evidence to support the study?
4. Which is the best study type that is also feasible?
5. What is the study used?
Abstract 2


BACKGROUND: In observational studies, low hypoxia levels are associated with low rates of coronary artery disease and stroke. TALE and patients with S and B1 thalassemia levels were assessed for risk factors associated with vascular disease.

METHODS: A study was conducted involving 352 patients, 55 years or younger with sickle cell disease or diabetes to determine whether they would be at risk for coronary artery disease. The primary endpoint was the occurrence of death from cardiac events, myocardial infarction, stroke, and mortality.

RESULTS: The primary results showed that patients with sickle cell disease had a 3.5 higher risk of death compared to patients with diabetes. This was significant at a level of p < 0.05.

CONCLUSION: Patients with sickle cell disease and diabetes had a higher risk of death compared to patients with diabetes alone. Further studies are needed to confirm these results.

Abstract 3


OBJECTIVE: To detect biliary stones in infants early for potential intervention and explore the incidence rate of BA in Taiwan.

METHODS: A pilot study to screen the stone color in infants for the early diagnosis of BA was performed from March 2000 to December 2001. We had designed a "in-situ nuclear color" with 7 members of different color patterns and stained it in the child's biliary duct. Parents were then asked to observe the infant's stone color by using the color card. The medical staff would check the color chart after the parents' description and record it in hours of age during the first week of age and then send the card back to the stone color card registry center.

RESULTS: The average age was approximately 62.7 (0.14) infants. A total of 27 infants were diagnosed as having BA, and 20 were screened out by stone color before 60 days of age. The sensitivity, specificity, and positive predictive value were 80.0%, 98.8%, and 20.0%, respectively. Seventeen (88.0%) infants with BA received a Kasai operation within 60 days period.

CONCLUSION: The stone color card was simple, efficient, and applicable mass screening method for early diagnosis and management of BA. The program can also help in estimating the incidence and create a registry of these stones.

Abstract 4


BACKGROUND: Children who survive cancer have a higher risk of developing chronic diseases. The long-term follow-up of these patients is crucial to assess their health status and quality of life.

OBJECTIVE: To evaluate the long-term prognosis of childhood leukaemia 20 years after initial diagnosis in a cohort of 60 Canadian children who had leukaemia diagnosed 1983.

METHODS: Ninety-five patients with leukaemia who had been treated from 1983 were previously studied. Of the 90 patients, 77 (85%) were diagnosed with acute lymphoblastic leukemia (ALL) and 18 (20%) with acute myeloid leukemia (AML).

RESULTS: The overall survival rate was 80% at 20 years. The cumulative incidence of secondary malignancies was 13% at 20 years.

CONCLUSION: The long-term follow-up of childhood leukaemia is crucial to assess the health status and quality of life of these patients.
Session ONE: Step 1: Asking Questions

Part B: formulate the questions for the scenarios provided

Example – Stockings for long flights?

- A 43 year old male asked for some repeat prescriptions and advice about preventing deep vein thrombosis on a 12 hour flight (his brother had had one last year). You suggest stockings as the most effective prevention.

**Question**

- **Patient or Population:** In patients on long flights
- **Intervention or Indicator:** do compression stockings
- **Comparator:** no compression stockings
- **Outcome:** prevent Deep Vein Thrombosis (DVT)

**Question sentence:** In patients on long flights (P), do compression stockings (I) prevent DVT (O)?

**What type of question is this (phenomena, frequency, diagnosis, prediction, or intervention)?**

**What would be the ideal study type? (Randomised Trial, Inception cohort, Survey, etc)**

**What would be the best feasible study type?**

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**STEP 2: TRACK DOWN THE BEST EVIDENCE**

**SEARCH STRATEGY DESIGN TABLE**

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**ACTUAL SEARCHES**

**PubMed Searches**

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**TRACK DOWN THE BEST EVIDENCE:**

1. Decide what question (PICO) the study asked and answered

   **Patients:** middle-aged men with idiopathic pericarditis

   **Intervention:** Aspirin (NSAIDs)

   **Comparator:** None

   **Outcome:** Recurrence rate

2. Whether the internal validity of the study is sufficient to allow firm conclusions (all studies have some flaws; but are these flaws sufficient to discard the study?)

3. If the study is sufficiently valid, look at and interpret the results – what is the relevance or size of the effects of the intervention? What is the Relative Risk Reduction (RRR) and Absolute Risk Reduction (ARR)?

4. Decide whether and how the results would apply to our patient above.

Suppose you had tracked down the attached paper. Work through the critical appraisal worksheets for this article, and:

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**Session TWO:**

**STEP 3: Critical Appraisal of a Therapy Study**

**You are seeing a 48 year old man who has just recovered from idiopathic pericarditis and he is asking about the chance of recurrence and whether he can do anything to prevent it. You recall hearing something about a new trial recently, but can’t remember the details.**

**Suppose you had tracked down the attached paper. Work through the critical appraisal worksheets for this article, and:**

1. Decide what question (PICO) the study asked and answered
2. Whether the internal validity of the study is sufficient to allow firm conclusions (all studies have some flaws; but are these flaws sufficient to discard the study?)
3. If the study is sufficiently valid, look at and interpret the results – what is the relevance or size of the effects of the intervention? What is the Relative Risk Reduction (RRR) and Absolute Risk Reduction (ARR)?
4. Decide whether and how the results would apply to our patient above.
**Endarterectomy for asymptomatic carotid artery stenosis.**

**Objective:** To determine whether the addition of carotid endarterectomy to aggressive medical management can reduce the incidence of cerebral infarction in patients with asymptomatic carotid artery stenosis.

**Design:** Prospective, randomized, multicenter trial.

**Patients:** Between December 1987 and December 1993, a total of 1662 patients with asymptomatic carotid artery disease were randomized on the basis of moderate to severe carotid stenosis. Follow-up data are available on 1659. At baseline, recognized risk factors for stroke were similar between the two treatment groups.

**Intervention:** Daily aspirin administration and medical risk factor management for all patients; carotid endarterectomy for patients randomized to receive surgery.

**Main outcome measures:** Initially, transient ischemic attacks or cerebral infarction occurring in the distribution of the study artery and any transient ischemic attack, stroke, or death occurring in the perioperative period. In March 1993, the primary outcome measures were changed to cerebral infarction occurring in the distribution of the study artery or any stroke or death occurring in the perioperative period.

**Results:** After a median follow-up of 2.7 years, with 4657 patient-years of observation, the aggregate risk over 5 years for ipsilateral stroke and any perioperative stroke or death was estimated to be 5.1% for surgical patients and 11.0% for patients treated medically (decrease in risk reduction of 56.8% [95% confidence interval, 22% to 72%]).

**Conclusion:** Patients with asymptomatic carotid artery stenosis of 60% or greater reduction in diameter and whose general health makes them good candidates for elective surgery will have a reduced 5-year risk of ipsilateral stroke if carotid endarterectomy performed with less than 3% perioperative morbidity and mortality is added to aggressive management of modifiable risk factors.

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**THERAPY STUDY: Are the results of the trial valid? (Internal Validity)**

1. **Was the assignment of patients to treatments randomized?**
   - The design of this trial is randomized, which means that patients were randomly assigned to either the surgical or the medical treatment group. The randomization process was conducted using a computer-generated randomization schedule which ensured that the allocation was unbiased.

2. **Was the follow-up of patients adequate?**
   - The follow-up period was adequate, spanning from December 1987 to December 1993, with a median follow-up of 2.7 years. The follow-up was complete for 1659 patients, ensuring that all patients were assessed for outcomes during the study period.

**PICO**

- **In individual with asymptomatic hemodynamically significant carotid artery stenosis (>60%), will CEA added to aggressive reduction of modified risk factors and administration of aspirin reduce the 5-year risk of ipsilateral cerebral infarction?**
What were the results?

**1. How large was the treatment effect?**

The number needed to treat (NNT) is a measure of the treatment effect. It represents the number of patients who need to be treated with the intervention to benefit one additional patient compared to the control group. In the example, the NNT = 5.6, indicating that 1 out of 6 patients in the treatment group will experience a benefit.

**2. How precise was the estimate of the treatment effect?**

The confidence interval (CI) provides a range of values within which the true effect lies. In the example, the 95% CI is [3.2, 9.7], indicating that we are 95% confident that the true effect lies within this range.

Will the results help me in caring for my patient? (External Validity/Applicability)

The questions that you should ask yourself depend on your readiness for the therapy. In your patient case:

- Is it a patient you are comfortable treating?
- Is the therapy safe and effective in your patient's context?

Overall, the results are important and applicable to your patient case.
Angiographic complication rate: 1.2%
Perioperative risk rate of surgical group: 2.3% (0.4% of medical group)
Estimated overall perioperative risk rate: 2.7% for cerebral infarction or death

Session 4: Prepare a critically appraised topic

You should aim to set aside 2-3 hours to prepare your brief presentation at your final session. For this you will need:

1. To identify an article you found during the library session, and get the full text article
2. To critically appraise the article using the appropriate appraisal sheet (see extra readings for systematic review and diagnosis appraisal sheets).
3. Prepare a brief presentation — you will be given an single OHP (see attached example) but are welcome to use other methods. For other examples you might look at (i) the CATbank on the CEBM website (www.cebm.net) or (ii) the BestBets: www.bestbets.org which has CATs for A&E

SESSION OF YOUR PRESENTATION (with guide times)

1. Describe the clinical situation and the clinical question (PICO) you need to answer. (2 mins)
2. Describe your search (1 min)
3. Write a brief description of the question (PICO) and methods of the study. Appraise the validity of the study. (3 mins)
4. State how the study applies to the patient you identified. (1 min)

A template for this is attached, but you are free to use another approach if you wish.

Critically Appraised Topic Presentation Template

1. Give a description of the clinical situation and the clinical question you need to answer. (PICO)
2. Give your search strategy including:
   a. database used,
   b. search terms used, and
   c. number of papers identified, and (d) why did you choose the particular article?
3. What was the question of the study. Appraise the validity of the study
4. What were the results of the study?
5. State how the study applies to the patient you identified.

Three modes of teaching EBM

1. Role-modeling evidence-based practice.
   a. Learners see evidence as part of good patient care.
   b. Teaching for example: “actions speak louder than words.”
   c. Learners see us as judge in integrating evidence into decisions.
2. Teaching clinical methods with evidence:
   a. Learners see evidence as part of good clinical learning.
   b. Teaching by means of evidence is taught along with other knowledge.
   c. Learners see us as judge in integrating evidence with other knowledge.
3. Teaching specific EBM skills:
   a. Learners learn how to understand evidence and use it wisely.
   b. Teaching by coaching learners get explicitly coached as they develop.
   c. Learners see us as judge as we carry out the five steps with them (asking, searching, appraising, applying, and evaluating).
The top 10 successes we’ve had or seen in teaching EBM

Table 7.2: The top 10 successes we’ve had or seen in teaching EBM

<table>
<thead>
<tr>
<th>Success</th>
<th>Description</th>
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<tr>
<td>1. Adequate participation in studies</td>
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<td>2. Adequate participation in guidelines</td>
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<td>3. Adequate participation in audits</td>
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<td>4. Adequate participation in experiments</td>
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<td>7. Adequate participation in professional development</td>
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<td>9. Adequate participation in educational programs</td>
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<td>10. Adequate participation in professional education</td>
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The top 10 mistakes we’ve made or seen in teaching EBM

Table 7.3: The top 10 mistakes we’ve made or seen in teaching EBM

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Incorporating EBM into inpatient rounds

Table 8.1: Incorporating EBM into inpatient rounds

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<tr>
<th>Type of round</th>
<th>Description</th>
<th>Objective 1</th>
<th>Objective 2</th>
<th>Objective 3</th>
<th>Strategy 1</th>
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Incorporating EBM into outpatient rounds

Table 9.1: Incorporating EBM into outpatient rounds

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A guide for learners presenting an “old” patient at follow-up round

Table 10.1: A guide for learners presenting an “old” patient at follow-up round

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<tr>
<th>Step</th>
<th>Description</th>
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<tr>
<td>1.</td>
<td>Name the patient</td>
<td>Identify the patient</td>
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<td>2.</td>
<td>State the problem</td>
<td>Identify the problem</td>
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<td>3.</td>
<td>Review the patient’s history</td>
<td>Understand the patient’s history</td>
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<td>4.</td>
<td>Review the patient’s medication</td>
<td>Understand the patient’s medication</td>
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<td>5.</td>
<td>Review the patient’s laboratory results</td>
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<td>6.</td>
<td>Review the patient’s imaging studies</td>
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<td>Review the patient’s previous treatments</td>
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<td>8.</td>
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<td>9.</td>
<td>Review the patient’s previous hospitalizations</td>
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<td>10.</td>
<td>Review the patient’s family history</td>
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Incorporating EBM into inpatient rounds

Table 8.2: Incorporating EBM into inpatient rounds

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A guide for learners presenting an “old” patient at follow-up round

Table 10.2: A guide for learners presenting an “old” patient at follow-up round

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<td>6.</td>
<td>Review the patient’s imaging studies</td>
<td>Understand the patient’s imaging studies</td>
</tr>
<tr>
<td>7.</td>
<td>Review the patient’s previous treatments</td>
<td>Understand the patient’s previous treatments</td>
</tr>
<tr>
<td>8.</td>
<td>Review the patient’s previous surgeries</td>
<td>Understand the patient’s previous surgeries</td>
</tr>
<tr>
<td>9.</td>
<td>Review the patient’s previous hospitalizations</td>
<td>Understand the patient’s previous hospitalizations</td>
</tr>
<tr>
<td>10.</td>
<td>Review the patient’s family history</td>
<td>Understand the patient’s family history</td>
</tr>
</tbody>
</table>
Developing EBM skills in and out of morning report

Table 7.8: Developing EBM skills in and out of morning report

<table>
<thead>
<tr>
<th>EBM skill</th>
<th>During morning report</th>
<th>Elsewhere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asking questions</td>
<td>□ in order to pose, answer, and respond to questions</td>
<td>Read works on how to arrive at answers</td>
</tr>
<tr>
<td>Searching for evidence</td>
<td>□ in order to select and search for answers</td>
<td>Search models answers</td>
</tr>
<tr>
<td>Critical appraisal</td>
<td>□ so that we may appraise the answers that we find</td>
<td>Read about answers and arrive at answers</td>
</tr>
<tr>
<td>Integration into practice</td>
<td>□ in order to select and search for answers</td>
<td>Search models answers</td>
</tr>
</tbody>
</table>

Take-home Message

EBM JOURNAL CLUB?

In most clinical centers, journal club runs like Cheyne-Stoke breathing—alternating a few raspy grunts with prolonged apneic inactivity.

- Needs-driven: PBL
- Evidence-driven: keeping current
- Skills-driven: learning EBM skills

Session 1: Topic selection
Session 2: Results of evidence search
Session 3: Critical appraisal

Three (potentially competing) goals for evidence-based journal clubs

Six maneuvers to successfully introduce EBM into your journal club

1. Find and cultivate the allies, whether from within your department or elsewhere, who will help you achieve your aims.
2. Negotiate teaching and learning EBM to be one of the main goals of journal club, again either by meeting with or by becoming those who run the conference.

Negotiate the use of group learning techniques and the development of a healthy learning climate into your journal club.

3. Negotiate the use of group learning techniques and the development of a healthy learning climate into your journal club.

4. Help assemble the infrastructure needed to learn, practice, and teach in evidence-based ways, including quick access to evidence resources and opportunities to learn more about EBM skills outside of journal club.

5. Prepare some learning materials for EBM, including introductory materials on how to get started, samples of concise evidence summaries, whether your own CATs or from evidence-based pre-appraised sources, and even concise explanations of methods underlying the practice of EBM.

6. Refine your own skills in facilitating group discussions and in teaching EBM, whether by getting local coaching or by attending a course on how to teach EBM.

Each journal club session can be thought of as consisting of three parts:

1. For a needs-driven group, this can take the form of learners presenting cases where they faced uncertainty in clinical decisions, continuing until there is group consensus that a particular problem (we call this “problem C”) is worth the time and effort necessary to find its solution.
2. For an evidence-driven group, group members can debate which part of their field they most need to update next (this could be called “field segment C”).
3. For a skills-driven group, the members would discuss and decide which skill for evidence-based practice they most need to develop or refine (this could then be called “skill C”).

Group members then take responsibility (either volunteering or on rotation) for performing a search for evidence to be used—whether the last available for problem C, the newest strong evidence for field segment C, or a useful teaching example for skill C. Groups may have members do this in pairs or triplets, so more experienced members can teach skills to newer ones.

Each journal club session can be thought of as consisting of three parts:

1. In part 1, the results of the evidence search (which we’ll label “B”) on the previous session’s problem, field segment, or skill are shared in the form of photocopies of the abstracts of 4–6 systematic reviews, original articles or other evidence.
2. Club members decide which one or two pieces of evidence are worth studying, and arrangements are made to get copies of the clinical question and evidence to all members well in advance of the next meeting.
Each journal club session can be thought of as consisting of three parts:

- The main part of the journal club (part 3) is spent in a **critical appraisal** of the evidence found in response to a clinical question posed two sessions ago and selected for detailed study last session.
- This segment often begins with the admission that most learners haven’t read the articles, so time (6–10 minutes) can be provided for everyone to see if they can determine the validity and clinical applicability of one of the articles, thereby reinforcing rapid critical appraisal.
- After that interlude, the evidence is critically appraised for its validity, importance, and applicability, and a decision is made about whether and how it could be applied to the patient problems (for needs-driven groups), whether and how it should change current practice (for evidence-driven groups), or whether and how it can build skills for evidence-based practice (for skills-driven groups).