MEDICAL EDUCATION SERIES

Evidence-Based Medicine

A practical framework for asking better clinical questions, appraising the literature, and making sound decisions at the bedside

A guide for medical students and clinical trainees

What Is Evidence-Based Medicine?

The conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients.

— Sackett et al., 1996

Best Research Evidence

Valid, clinically relevant findings drawn from systematic, well-designed research

Clinical Expertise

The clinician's accumulated experience, skill, and diagnostic judgment

Patient Values & Circumstances

The individual patient's preferences, concerns, and unique circumstances

EBM sits at the intersection of these three elements — not research evidence alone.

Why Evidence-Based Practice Matters

Clinical practice built on tradition, authority, or anecdote alone can drift far from what actually helps patients.

~2.5M

New articles published in biomedical journals each year — far more than any clinician can read

Years

The well-documented lag between a research discovery and its routine use in practice

Wide

Variation in practice patterns across regions and providers for the same condition

EBM gives clinicians a structured way to filter the flood of information and keep decisions grounded in what the evidence actually supports.

The Five Steps of Evidence-Based Practice

Often remembered as the "5 A's" — a repeatable cycle for every clinical question

1

Ask

Convert a clinical problem into an answerable question (PICO)

2

Acquire

Search the literature efficiently for the best available evidence

3

Appraise

Critically evaluate validity, results, and relevance

4

Apply

Integrate the evidence with expertise and patient values

5

Assess

Evaluate the outcome and your own performance

Framing the Question: PICO

A well-built clinical question is the foundation of an efficient search

P

Population

Who is the patient or problem?

I

Intervention

What is being considered — a drug, test, or approach?

C

Comparison

What is the alternative — placebo, standard care, no treatment?

O

Outcome

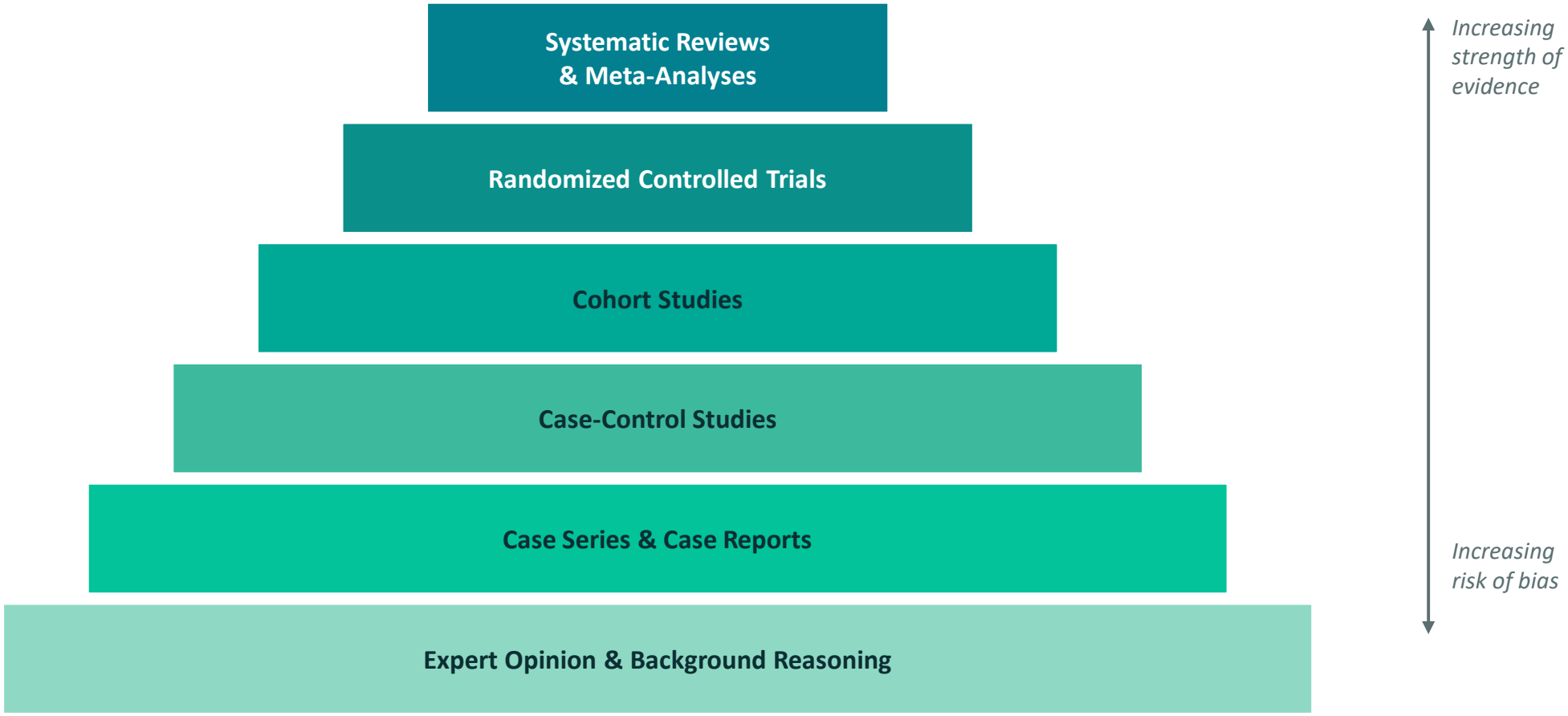
What result matters — symptom relief, survival, complication?

EXAMPLE

In adults with type 2 diabetes **(P)**, does adding an SGLT2 inhibitor **(I)** compared with standard therapy alone **(C)** reduce cardiovascular events **(O)**?

The Hierarchy of Evidence

Not all evidence carries the same weight — study design shapes how much we can trust the result



Hierarchy reflects typical risk of bias, not a guarantee — a poorly conducted RCT can be weaker than a well-conducted cohort study.

Common Study Designs

Randomized Controlled Trial

Participants randomly assigned to intervention or control — best for establishing causation

Best for: treatment effect

Cohort Study

Groups followed over time, exposed vs. unexposed, to compare outcomes

Best for: prognosis, harm

Case-Control Study

Compares patients with an outcome to those without, looking backward at exposures

Best for: rare outcomes

Systematic Review & Meta-Analysis

Synthesizes results across multiple studies using explicit, reproducible methods

Best for: the big picture

Critical Appraisal: Three Key Questions

Ask these of every paper before letting it change your practice

Are the results valid?

- Was allocation randomized and concealed?
- Were groups similar at baseline?
- Was follow-up complete?
- Was analysis by intention-to-treat?

What are the results?

- How large was the treatment effect?
- How precise is the estimate (confidence interval)?

Will they help my patient?

- Does my patient resemble those studied?
- Were all clinically important outcomes considered?
- Do benefits outweigh harms and costs?

Statistics Every Clinician Should Know

The vocabulary needed to interpret results, not just read the abstract

Term	Meaning
Relative Risk (RR)	Ratio of event risk in the exposed vs. unexposed group
Odds Ratio (OR)	Ratio of the odds of an outcome between two groups; approximates RR when the outcome is rare
Number Needed to Treat (NNT)	Patients who must be treated for one additional person to benefit
Number Needed to Harm (NNH)	Patients treated for one additional person to be harmed
Confidence Interval (CI)	Range likely to contain the true effect; a 95% CI crossing 1 (for RR/OR) suggests no significant effect
P-value	Probability of seeing this result (or more extreme) if there were truly no effect

Common Biases & Pitfalls to Watch For

Recognizing these helps you judge whether a study's conclusions can be trusted

Selection Bias

Study participants differ systematically from the population of interest

Confounding

A third variable influences both exposure and outcome, distorting the apparent association

Publication Bias

Positive or striking results are more likely to be published than null findings

Funding / Sponsorship Bias

Study design or reporting favors the interests of the funding source

Limitations of Evidence-Based Medicine

EBM is a tool, not a substitute for clinical reasoning — it has real constraints

Evidence gaps

High-quality trials don't exist for every clinical scenario, especially in rare diseases or special populations

Trial populations differ from real patients

Strict inclusion/exclusion criteria may not reflect the multimorbid patient in front of you

Time and resource constraints

Searching and appraising literature for every decision is not always feasible in busy practice

Risk of over-standardization

Rigid guideline-following can crowd out individualized judgment and patient preference

Putting It Into Practice

A short worked scenario

THE SCENARIO

A 68-year-old with atrial fibrillation asks whether a direct oral anticoagulant (DOAC) is safer than warfarin for stroke prevention.

- Ask: In patients with AF, does a DOAC vs. warfarin reduce stroke and major bleeding?
- Acquire: Search for recent systematic reviews and major RCTs
- Appraise: Check randomization, follow-up, and confidence intervals
- Apply: Weigh renal function, bleeding risk, and the patient's preference for monitoring
- Assess: Reassess after starting therapy and follow outcomes

THE TAKEAWAY

The evidence points to comparable or better outcomes with DOACs for many patients — but the right answer for this patient depends on kidney function, fall risk, cost, and what matters most to them.

EBM doesn't hand you the answer — it structures how you find, weigh, and apply the best available evidence to the person in front of you.

Key Takeaways

- EBM blends best research evidence, clinical expertise, and patient values — no single element is sufficient alone
- The 5 steps (Ask, Acquire, Appraise, Apply, Assess) give you a repeatable process for any clinical question
- Not all evidence is equal — understand the hierarchy and the biases that can distort results
- Statistics like NNT, RR, and confidence intervals turn a p-value into something clinically meaningful
- EBM supports clinical judgment; it does not replace it

Further Reading

Foundational texts and resources to go deeper

- **Sackett DL, Rosenberg WM, Gray JA, et al.** *Evidence based medicine: what it is and what it isn't. BMJ, 1996.*
- **Guyatt G, Rennie D, Meade MO, Cook DJ.** *Users' Guides to the Medical Literature (JAMA Evidence).*
- **Straus SE, Glasziou P, Richardson WS, Haynes RB.** *Evidence-Based Medicine: How to Practice and Teach EBM.*
- **GRADE Working Group** *Guidelines for grading the quality of evidence and strength of recommendations.*
- **Cochrane Library** *A leading source of systematic reviews across clinical topics.*

Thank you