Evidence-Based Medicine
Course Goals

Goals

1. Understand basic concepts of evidence-based medicine (EBM) and how EBM facilitates optimal patient care.

2. Develop a basic understanding of how clinical research studies are designed and analyzed, and how this can influence whether a study’s conclusions are valid.

3. Develop competence in the critical appraisal of common types of clinical research papers and the determination of whether the papers have drawn valid and applicable conclusions.

4. Develop competence in communicating scientific evidence to colleagues.

5. Develop competence in communicating risk and benefit of health interventions to patients.

6. Recognize the role played by physicians in population health.
Evidence-Based Medicine
Session Learning Objectives

Delivered In: Digestive, Endocrine and Metabolic Systems

Evidence Based Medicine- Review of Concepts
1. Distinguish between narrative review articles, systematic reviews, and meta-analysis and understand issues in using them such as publication bias, forest plots, and heterogeneity.
2. Describe characteristics of a good clinical practice guideline, including a focus on clinical outcomes, use of best available evidence, and involvement of multi-professional groups and consumers in development.

EBM Resources: a quick overview and how to
1. Create a basic MEDLINE search using MESH and limits appropriately.
2. Efficiently search the medical literature in order to locate the best evidence and answer clinical questions. Identify, locate and use: summary sources, e.g. UpToDate and DynaMed; practice guidelines, e.g., National Guidelines Clearinghouse; pre-appraised sources, e.g., Cochrane Library Database of Systematic Reviews, ACP Journal Club; and sources of individual studies, e.g., PubMed.

Delivered In: Evidence-Based Medicine: Online Journal Club 1

Online Journal Club 1 - Case 1 Observational Study
1. Evaluate a case-control study.
2. Apply concepts used in case control studies including odds ratio, selection bias, confounding and recall bias.
3. Recognize appropriate methods to account for confounding.
4. Explain the study’s relevance to patient care and clinical decision-making.

Online Journal Club Case 3 - Screening Trial
1. Evaluate a study about diagnosis or screening.
2. Apply concepts that relate to the validity of diagnosis or screening studies including blinding, use of a gold standard, sensitivity, specificity, and negative and positive predictive value.
3. Apply concepts of pre-test and post-test probability to diagnosis or screening studies.
4. Explain a diagnosis or screening study’s relevance to patient care and clinical decision-making.

Online Journal Club 1 - Case 2 Observational Study
1. Evaluate a cohort study.
2. Apply concepts that relate to validity of cohort studies, including selection bias, confounding, and follow-up.
3. Explain a cohort study's relevance to patient care and clinical decision-making.
Online Journal Club Case 4 - Therapy Trial

1. Evaluate a study about therapy.
2. Apply concepts that relate to validity of randomized control trial studies (RCTs) including randomization, concealed allocation, intention-to-treat, blinding, significance, and power.
3. Explain its relevance to patient care and clinical decision-making.

Delivered In: Evidence-Based Medicine: Online Journal Club 2

Online Journal Club 2 - Case 1 Observational Study

1. Evaluate a case-control study.
2. Apply concepts used in case control studies including odds ratio, selection bias, confounding and recall bias.
3. Describe appropriate methods to account for confounding.
4. Explain a case-control study’s relevance to patient care and clinical decision-making.

Online Journal Club 2 - Case 2 Observational Study

1. Evaluate a study about therapy.
2. Apply concepts that relate to validity of randomized control trial studies (RCTs) including randomization, concealed allocation, intention-to-treat, blinding, significance, and power.
3. Explain a therapy study’s relevance to patient care and clinical decision-making.

Online Journal Club 2 - Case 3 Screening Trial

1. Evaluate a meta-analysis and apply concepts that relate to its validity, including asking a focused clinical question, specifying inclusion criteria, comprehensiveness of literature search, quality assessment of included studies, and assessment of heterogeneity.
2. Explain a meta-analysis study’s relevance to patient care and clinical decision-making.

Online Journal Club 2 - Case 4 Therapy Trial

1. Evaluate a cohort study.
2. Apply concepts that relate to validity of cohort studies, including selection bias, selection of comparison group, exposure measurement, confounding, and loss to follow-up.
3. Explain a cohort study’s relevance to patient care and clinical decision-making.
Delivered In: Life Cycle

**LC - Breast Cancer Screening: A Primary Care Perspective**

1. Describe desirable attributes of screening tests.
2. Review the perils of screening tests including issues related to lead time and overdiagnosis bias.
3. Identify commonly used screening tests for breast cancer and how to optimize their use by quantifying the benefits and harms as applied to an individual patient.
4. Clarify and apply biostatistics commonly used to describe screening tests including sensitivity, specificity, predictive values, likelihood ratios, relative risk, absolute risk, risk difference, number needed to screen and number needed to harm.
5. Assess an individual patient’s risk of developing breast cancer and implement an appropriate preventive regimen including screening and chemoprevention.
6. Assess an individual patient’s risk of being a BRCA mutation carrier and when to refer for additional testing and counseling.
7. Summarize differences in breast cancer screening guidelines from professional societies and recognize the origins of those differences.
8. Discuss the potential impact of public health messaging on how patients and clinicians perceive benefits and harms of breast cancer screening.

Delivered In: Molecules to Medicine

**Introduction to EBM - Lecture**

1. Explain the value of evidence over opinion in making medical decisions.
2. Define evidence-based medicine (EBM).
3. Describe the evidence hierarchy. Recognize differences in study design for both observational and experimental studies.

**Answering Clinical Questions, Understanding Risk, Optimizing Care - Case Study (EBM)**

1. Apply the EBM cycle of asking clinical questions using the PICO format, using appropriate resources to select high quality evidence, and applying evidence to individual patients.
2. Calculate number needed to treat/harm (NNT/H), absolute risk reduction (ARR) and relative risk reduction (RRR); explain how these can be used to communicate risk to patients.
3. Differentiate between disease-oriented outcomes and patient-oriented outcomes.

**EBM and Population Health - Lecture**

1. Recognize a population health perspective, including social determinants of health.
Understanding Evidence-Based Healthcare - Independent Study (EBM)

1. Explain the value of evidence over opinion in making medical decisions and in the practice of life-long learning.

2. Define evidence-based medicine (EBM).

3. Define epidemiologic concepts of incidence and prevalence.

4. Describe the evidence hierarchy.

5. Describe bias and how it can be minimized.

6. Describe characteristics of randomized controlled trials (RCTs) such as randomization, blinding, allocation concealment, intention-to-treat analysis (as compared with per-protocol or as-treated analyses), and follow up, and explain how these characteristics reduce bias.

7. Explain the difference between risk and odds.

8. Calculate NNT/H, ARR and RRR, and explain how these can be used to communicate risk to patients.

9. Describe barriers to understanding evidence and explain appropriate techniques for communicating numeric and other information to colleagues and patients.

10. Calculate and apply common diagnostic/screening test information including sensitivity, specificity, predictive values.

11. Describe characteristics of a good screening test and features of diseases amenable to screening.

12. Apply the evidence-based medicine (EBM) cycle of asking clinical questions using the PICO format, using appropriate resources to select high quality evidence, and applying evidence to individual patients.

13. Recognize differences in study design for both observational and experimental studies including ecologic studies; case reports; case series; cohort, case-control, and cross-sectional studies; randomized controlled trials; systematic reviews; and meta-analyses, and discuss the strengths and limitations of each and the clinical questions best answered by each study type.

14. Critically appraise a randomized controlled trial (RCT).

15. Define selection bias and information (measurement) bias.

16. Calculate and apply common measures of effect including absolute risk, risk ratio (also known as relative risk), odds ratio and explain the circumstances in which each is appropriate to use and how each is interpreted.

17. Differentiate between disease-oriented outcomes and patient-oriented outcomes.

18. Explain over-diagnosis.

Introduction to Observational Studies – Independent Study (EBM)

1. Apply the EBM cycle of asking clinical questions using the PICO format, using appropriate resources to select high quality evidence, and applying evidence to individual patients.

2. Recognize differences in study design for both observational and experimental studies including ecologic studies; case reports; case series; cohort, case-control, and cross-sectional studies; and RCTs, and discuss the strengths and limitations of each and the clinical questions best answered by each study type.

3. Describe the difference between random error and bias and how these can be minimized.

4. Describe characteristics of RCTs such as randomization, blinding, allocation concealment, intention-to-treat analysis (as compared with per-protocol or as-treated analyses), and follow up, and explain how these characteristics reduce bias.

5. Describe characteristics of cohort, case-control and cross-sectional studies, explain how these characteristics may result in bias, and recognize appropriate methods for minimizing these biases.

6. Recognize a population health perspective, including use of epidemiologic methods for outbreak investigation

7. Define validity, selection bias and information (measurement) bias.
Introduction to Screening and Diagnostic Studies - Case Study (EBM)  
1. Calculate and apply common diagnostic/screening test information including sensitivity, specificity, predictive values, and likelihood ratios.
2. Describe characteristics of a good screening test and features of diseases amenable to screening.
3. Explain concepts of pre- and post-test probability and testing & treatment thresholds.
4. Interpret a Receiver Operating Characteristic (ROC) curve.
5. Explain common biases that occur in screening trials including lead and length time bias and over-diagnosis.
6. Describe how predictive values are influenced by disease prevalence.

Introduction to Screening & Diagnostic Studies – Independent Study (EBM)  
1. Calculate and apply common diagnostic/screening test information including sensitivity, specificity, predictive values, and likelihood ratios.
2. Describe characteristics of a good screening test and features of diseases amenable to screening.
3. Explain the concepts of pre- and post-test probability and testing & treatment thresholds.
4. Interpret a Receiver Operating Characteristic (ROC) curve.
5. Describe how predictive values are influenced by disease prevalence.
6. Explain common biases that occur in screening trials including lead and length time bias and over-diagnosis.

Screening and Diagnostic Testing - Case Study (EBM)  
1. Calculate and apply common diagnostic/screening test information including sensitivity, specificity, predictive values, and likelihood ratios.
2. Describe characteristics of a good screening test and features of diseases amenable to screening.
3. Explain concepts of pre- and post-test probability and testing & treatment thresholds.
4. Interpret an ROC curve.
5. Describe how predictive values are influenced by disease prevalence.
6. Explain common biases that occur in screening trials including lead and length time bias and over-diagnosis.

Descriptive Statistics and Hypothesis Testing - Lecture (EBM)  
1. Define statistical measures commonly used in the medical literature, including sampling, normal distribution, mean, median, mode, variance, standard deviation, and range.
2. Explain the difference between statistical significance and clinical significance.
3. Recognize statistical methods commonly used in the medical literature, including t-tests and chi-square tests, correlation, ANOVA, logistic regression, linear regression, survival analysis/Cox proportional hazards model, Kaplan-Meier curve, and forest plot, and describe how to interpret their results.
4. Define type I and type II errors, null hypotheses, alpha level, power, p-values and confidence intervals.
5. Accurately interpret p-values and confidence intervals in a clinical context.
Understanding Evidence-Based Healthcare: Critical Appraisal - Independent Study (EBM)

1. Explain the value of evidence over opinion in making medical decisions and in the practice of life-long learning.

2. Define evidence-based medicine (EBM).

3. Recognize differences in study design for both observational and experimental studies, and discuss the strengths and limitations of each and the clinical questions best-answered by each study type.

4. Examine the difference between random error and bias and how these can be minimized.

5. Describe characteristics of randomized controlled trials (RCTs) such as randomization, blinding, allocation concealment, intention-to-treat analysis (as compared with per-protocol or as-treated analyses), and follow up, and explain how these characteristics reduce bias.

6. Define criteria for inferring causality from statistical associations including Hill criteria and apply to an example.

7. Describe characteristics of cohort, case-control and cross-sectional studies, explain how these characteristics may result in bias, and recognize appropriate methods for minimizing these biases.

8. Explain the difference between statistical significance and clinical significance.

9. Apply the EBM cycle of asking clinical questions using the PICO format, using appropriate resources to select high quality evidence, and applying evidence to individual patients.

10. Define validity, selection bias and information (measurement) bias.

11. Critically appraise a randomized controlled trials (RCT).

12. Critically appraise an observational study.

13. Describe type I and type II errors, null hypotheses, alpha level, power, p-values, and confidence intervals.

14. Accurately interpret p-values and confidence intervals in a clinical context.

Population Health (EBM)

1. Define epidemiologic concept of case-fatality rate, attributable risk and population attributable risk.

2. Recognize a population health perspective, including use of epidemiologic methods for disease prevention and health promotion (e.g., disease surveillance), and public health and population health systems.
EBM Small Groups Exercise

1. Explain the value of evidence over opinion in making medical decisions and in the practice of life-long learning.

2. Define evidence-based medicine (EBM). Apply the EBM cycle of asking clinical questions using the PICO format, using appropriate resources to select high quality evidence, and applying evidence to individual patients.

3. Define epidemiologic concepts of incidence.

4. Recognize differences in study design for both observational and experimental studies including cohort studies; randomized controlled trials; and meta-analyses, and discuss the strengths and limitations of each and the clinical questions best answered by each study type.

5. Describe the difference between random error and bias and discuss how these can be minimized.

6. Critically appraise an RCT.

7. Define criteria for inferring causality from statistical associations including Hill criteria and apply to an example.

8. Critically appraise an observational study.

9. Calculate number needed to treat/harm (NNT/H).

10. Explain the difference between statistical significance and clinical significance.

11. Describe p-values and confidence intervals.

12. Accurately interpret p-values and confidence intervals in a clinical context.