PUBMED and the EVIDENCE-BASED UNIVERSE

Midwest Chapter MLA
October 4, 2013

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OBJECTIVES

- By the end of this class, attendees will be able to:
  - Define evidence based research, identify process steps and know where the library services fit
  - Recognize types of studies and understand how they relate to levels of evidence
  - Formulate literature searches to find such evidence
  - Know where to go for additional information
AGENDA

- Introductions
- Just What IS Evidence Based?
- Asking the Right Question: PICO
- Searching and Search Strategies
- Studies, Studies, Studies: Study design
- Critical Appraisal
- Taking it to the Next Level
- Evidence-Based MeSH
JUST WHAT IS EVIDENCE BASED?
TERMINOLOGY

- Evidence-Based Medicine (EBM)
- Evidence-Based Practice (EBP)
- Evidence-Based Practice in xxx (EBPx)
- Evidence-Based Health Care (EBHC)
- Evidence-Based Nursing (EBN)
- Evidence-Based Public Health (EBPH)
- Evidence Based Library and Information Practice (EBLIP)
- Research Based Evidence (RBE)
DEFINITIONS - EBM

Evidence-based medicine requires the integration of the best research evidence with our clinical expertise and our patient’s unique values and circumstances.

Definitions - EBPH

Evidence-Based Public Health (EBPH): The process of systematically finding, appraising and using contemporaneous clinical and community research findings as the basis for decisions in public health.

Definitions - EBP

Evidence-Based Practice: A way of providing health care that is guided by a thoughtful integration of the best available scientific knowledge with clinical expertise. This approach allows the practitioner to critically assess research data, clinical guidelines, and other information resources in order to correctly identify the clinical problem, apply the most high-quality intervention, and re-evaluate the outcome for future improvement.

NLM MeSH 2009
Evidence-Based research begins and ends with a single patient in the clinical setting.
Steps in Evidence Based Practice

1. Ask an answerable clinical question (ACQ)
2. Apply the PICO format
3. Find and appraise the best evidence
4. Use that evidence in the clinical situation
5. Critically review the clinical results

**SCENARIO**

Your physician/patron (a first year resident) comes to you with the following case: a six year old male with asthma. The physician needs information regarding therapy.
Step 1 – ACQ

- Ask an answerable question – focused, searchable, clinical

Scenario

How do you treat an asthmatic child?
**Step 2 – Apply PICO**

- Patient, Problem, Population
- Intervention or therapy
- Comparison, Control, Context
- Outcome
SCENARIO: PICO

- P: child with asthma
- I: Commonly prescribed asthma medication
- C: Placebo
- O: Reduction in crises
Step 3 – Evidence

- Find the best evidence with which to answer the question through structured searches and understanding the literature

- Critically appraise the evidence for its validity (closeness to the truth), impact (size of the effect) and applicability (usefulness in clinical practice)
  - Is it valid?
  - Is it important?
  - Can it help?
EVIDENCE PYRAMID

- Meta-Analysis
- Systematic Review
- Randomized Controlled Trial
- Cohort studies
- Case Control studies
- Case Series/Case Reports
- Animal research

Clark N. *IT applications of EBM principles*. 2003.
SCENARIO: SEARCH STRATEGY

- PubMed ➔
- Clinical Queries ➔
- Asthma ➔
- Therapy, narrow
- Add limits
  - Child
  - Language
  - Recent (5 years)

STRUCTURED ABSTRACT

- **Background**: The purpose or hypothesis of the study
- **Methods**: A description of the population studied (size, important eligibility criteria, selection process) and the methods used to conduct the research (including study design and measures employed)
- **Results**: A statement of the primary results of the study with the types of analyses indicated and appropriate levels of statistical significance and confidence intervals
- **Conclusion**: A statement of the conclusions answering the hypotheses or research question posed at the beginning of the study.
**Step 4 - Application**

- Use that evidence in the clinical situation
- Applying a decision - Combining findings to make a recommendation, placing the evidence into context, incorporating recommendation into a specific patient situation, clinical setting or organization
  - How much will it help a patient or population?
  - Does it meet their values and goals?
  - Is it cost-effective?
STEP 5 - EVALUATION

- Evaluation - Determining and measuring the effectiveness of the practice change over time
  - What is the outcome of using (or not using) particular information and its impact on clinical practice?

**Steps in Evidence Based Practice**

1. Ask an answerable clinical question (ACQ)
2. Apply the PICO format
3. Find and appraise the best evidence
4. Use that evidence in the clinical situation
5. Critically review the clinical results
ASKING THE RIGHT QUESTION
MY BROTHER DIED OF STROKE, WILL I?

PICO QUESTIONS

- PICO
  - Patient, Problem, Population (subjects)
  - Intervention or therapy – may include coalition-building and/or collaborative programs (study groups)
  - Comparison, Control, Context
  - Outcome (results)
PICO Practice Suggestions

- What therapy is recommended for a preemie who is experiencing seizures?
- What is the prognosis for gastroischisis?
- What is the therapy for Coagulase-negative staphylococci (CoNS)?
- What is the therapy for omphalitis?
- Something personal to you
PICO Practice

- Small Groups
- Develop a PICO Question
- Share with the class
- Guidelines:
  - Develop an ACQ
  - Apply the PICO format
SEARCHING AND SEARCH STRATEGIES
SEARCHING FOR STUDIES – CREDIT NOTICE

This section has been adapted from

SEARCHING FOR STUDIES
Karianne Hammerstrøm
Information Retrieval Specialist
The Campbell Collaboration
**Boolean Searching**

- **cat AND dog**
  - Both words must be present in the document.

- **cat OR dog**
  - Either one (or both) of the words must be present in the document.

- **cat NOT dog**
  - You want to find documents which contain the first word, but NOT the second word.

*Remember: “Or is More”*
CREATE A SEARCH LOG

<table>
<thead>
<tr>
<th>Database</th>
<th>Date</th>
<th>Terms</th>
<th>#Relevant</th>
<th>#Irrelevant</th>
<th>Notes</th>
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STUDIES, STUDIES, STUDIES
## Identifying the Best Study

<table>
<thead>
<tr>
<th>Type of Question</th>
<th>Suggested best type of Study</th>
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<tbody>
<tr>
<td>Therapy</td>
<td>RCT &gt; cohort &gt; case control &gt; case series</td>
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<td>Diagnosis</td>
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*Introduction to Evidence Based Medicine. UNC-Chapel Hill. 2004.*
Levels of Evidence (Studies)

STUDIES INTRODUCTION

- You can think of studies using two very broad categories:
  - Interventional
  - Observational

- Ethical issues sometimes determine what investigators can use
STUDIES
RESEARCH DESIGN

Research

Descriptive
- Correlational
  - Qualitative Study Interview
    - Case Studies/Reports

Analytical
- Observational
  - Cohort
  - Case-Control
  - Cross Sectional
- Experimental
  - Randomized Clinical Trial
  - Non-Randomized Clinical Trial
  - Community Trial

Cambron JA. Study design. 2008.
STUDIES
RESEARCH DESIGN – DESCRIPTIVE

- Investigator studies people and exposures in nature, observational
- No control or comparison group
- Studies
  - Correlational – statistical association between variables
  - Case studies – new diseases & treatments, etc.
  - Case report – documenting research’s experience
  - Case series – following a group over time
  - Cross sectional study – survey
    - Community Survey
  - Qualitative study– interview w/open-ended question
  - Migrant studies
STUDIES
RESEARCH DESIGN – ANALYTICAL OBSERVATIONAL

- Investigator collects data without making changes to patient’s life or introducing treatments
- Control/Comparison group, not randomized
- Studies
  - **Case Control** – etiology; examine associations between disease/disorder/health issue and one or more risk factors
  - **Cohort Study** – measurement of one characteristic, outcome, or issues across two groups
    - Prospective Cohort
    - Retrospective Cohort
    - Time Series Study
  - **Cross sectional** – to determine prevalence
STUDIES
RESEARCH DESIGN – ANALYTICAL EXPERIMENTAL

- Investigator chooses and tests intervention, treatment or exposure
- Decision as to group allocation can be by either random or non-random methods
- Control and/or comparison group used
- Note: Random allocation of subjects to is used to reduce selection bias by investigator and evenly allocate subjects on basis of known and unknown characteristics
STUDIES
RESEARCH DESIGN – EXPERIMENTAL STUDIES

• Studies
  • Clinical trials
    • Non-randomized trials (quasi-experiment)
      • Interrupted time series
    • Randomized Controlled Trials (RCT)
      • Double-blind randomized trial
      • Single-blind randomized trial
      • Non-blind trial
      • Crossover trial (may also be observational)
  • Community trials – conducted directly through doctors and clinics
  • Laboratory trials
BROTHER DIED OF STROKE, WILL I?
Glasziou P. 2010.

Risk Factors → Frequency

Cause(s) → Past

Symptoms Signs, Tests

Current

Treatment Effect

Future
BROTHER DIED OF STROKE, WILL I?
Glasziou P. 2010.
BROTHER DIED OF STROKE, WILL I?
Glasziou P. 2010.
BROTHER DIED OF STROKE, WILL I?
Glasziou P. 2010.
BROther Died of Stroke, Will I?
Glasziou P. 2010.

Risk Factors

Frequency

Prognosis

Causes(s)

Past

Current

Future

Treatment Effect

Randomised Trial

Treatments

Symptoms, Tests
STUDIES - RCT
RANDOMIZED CONTROL TRIAL

- Gold standard – especially for therapy studies
- Participants are randomly allocated into intervention (treatment) and control (placebo)
  - Phase I Clinical Trials – Healthy subjects
  - Phase II Clinical Trials – Small group
  - Phase III Clinical Trials – Large group prior to marketing
  - Phases IV Clinical Trials – Post-marketing study
- Rigorous evaluation of a single variable
- Seeks to falsify (rather than confirm) it’s own hypotheses
ELEMENTS TO EXAMINE IN AN RCT

- Validity
- Reliability
- Intention to Treat
- Sample Size
- Control Group
- Randomization
- Blinding, Double Blinding, Triple Blinding
- Bias
- Confounding
VALIDITY

- Internal Validity
  - Does the study answer the question it purports to answer?

- External Validity
  - Can the study be generalized or extrapolated to the entire population from which the sample was drawn?
ELEMENTS OF INTERNAL VALIDITY

- **Temporal**: the result occurs *AFTER* the intervention
- **Selection**: biases resulting from method used to select participants and to assign them to experimental or control group
- **Intention to Treat**: Individuals are analyzed in the group to which they are initially assigned regardless of their participation
- **Dose Response Gradient**: the effect increases with an increase in the intervention
BIAS NOTED/AVOIDED/CORRECTED

- Randomization: method of randomization should be reported
- Blinding: single, double, triple
- Intention to treat: “Analyze where you randomize”
- Intention to treat: Replicates the reality of clinical situations where participants do not do what they are told or do not report accurately
EXAMINE RANDOMIZED CONTROL TRIALS

In small groups, select one of these RCTs and examine it in light of these elements

- PMID: 17088514
- PMID: 23380178 (use abstract only)
- PMID: 22909281

What issues have you uncovered?

What questions did you ask?
CRITICAL APPRAISAL
CRITICAL APPRAISAL - FOCUS

- Analysis of the article you chose to answer your PICO question
CRITICAL APPRAISAL QUESTIONS

- Is the study appropriate for my patient?
- What were the results?
- Are the results important?
  - Statistical significance
  - Clinical significance
- Will the results help me in caring for my patients

Heneghan C, Badenoch D. 2007
CRITICAL APPRAISAL TOPIC (CAT)

- Look up article
- In groups complete the Critically Appraised Topic (CAT) checklist
  - PMID: 21311842
**REPORTING STANDARDS**

- CONSORT – Consolidated Standards of Reporting Trials (http://www.consort-statement.org/)
- MOOSE – Meta-analysis of Observational Studies in Epidemiology
- QUORUM – Quality of Reporting for Meta-analysis
- STROBE – Strengthening the Reporting of Observations Studies in Epidemiology (http://www.strobe-statement.org/)

Brand RA. Standards of reporting. 2009.
IN DEPTH ANALYSIS

- Use the CONSORT Checklist to analyze the following article
  - PMID: 15383514
- Identify the PICO question
TAKING IT TO THE NEXT LEVEL
SECONDARY SOURCES

- Narrative Reviews
- Systematic Reviews
- Meta-Analyses

More convincing summaries of evidence
Evidence Pyramid

1. Meta-Analysis
2. Systematic Review
3. Randomized Controlled Trial
4. Cohort studies
5. Case Control studies
6. Case Series/Case Reports
7. Animal research

Clark N. 2003
HOWEVER:

- The types of studies that give the best evidence are different for the different types of questions.

- In every case, the best evidence comes from studies where the methods used maximize the chance of eliminating bias.

# Identifying the Best Study

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*Introduction to Evidence Based Medicine. 2004.*
Levels of Peer Reviewed Information

- **Primary**: original research
- **Secondary**: review articles
- **Tertiary**: textbooks, summaries

Clark N. 2003
**Review**

- Review of a body of data that uses explicit methods to locate primary studies and explicit criteria to assess their quality
- PubMed: Review [PT]
**SYSTEMATIC REVIEW**

- Review of a body of data that uses explicit methods to locate primary studies and explicit criteria to assess their quality
- PubMed: No separate MeSH heading; use the Systematic Review option in Clinical Queries
**Meta-Analysis**

- Works consisting of studies using a quantitative method of combining the results of independent studies (usually drawn from the published literature) and synthesizing summaries and conclusions which may be used to evaluate therapeutic effectiveness, plan new studies, etc.

- A statistical analysis combining or integrating the results of several independent clinical trials considered by the analyst to be “combinable” usually to the level of re-analysing the original data. Pooling, quantitative synthesis.

- PubMed MeSH: Meta-Analysis [PT]
EVIDENCE BASED MESH
Clinical Queries

- Search by Clinical Study Category
  - Category
    - Etiology
    - Diagnosis
    - Therapy (default)
    - Prognosis
    - Clinical prediction guides
  - Scope
    - Narrow specific search
    - Broad sensitive search (default)
- Systematic Reviews
- Medical Genetics Searches
# Filters Used in Clinical Queries

<table>
<thead>
<tr>
<th>Category</th>
<th>Optimized For</th>
<th>Sensitive/Specific</th>
<th>PubMed Equivalent</th>
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<tr>
<td>therapy</td>
<td>sensitive/broad</td>
<td>99%/70%</td>
<td>((clinical[Title/Abstract] AND trial[Title/Abstract]) OR clinical trials[MeSH Terms] OR clinical trial[Publication Type] OR random*[Title/Abstract] OR random allocation[MeSH Terms] OR therapeutic use[MeSH Subheading])</td>
</tr>
<tr>
<td>therapy</td>
<td>specific/narrow</td>
<td>93%/97%</td>
<td>(randomized controlled trial[Publication Type] OR (randomized[Title/Abstract] AND controlled[Title/Abstract] AND trial[Title/Abstract]))</td>
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</tbody>
</table>

TOPIC SPECIFIC (SPECIAL) QUERIES

- Comparative Effectiveness Research
- Health Services Research (HSR) Queries
- Research Reporting Guidelines and Initiatives
- Veterinary Medicine/Animal Health

MeSH Terms

- Evidence Based Practice [MH] (under Health Occupations)
  - Evidence-Based Dentistry
  - Evidence-Based Medicine (also listed under Clinical Medicine)
  - Evidence-Based Emergency Medicine
  - Evidence-Based Nursing
Mental disorders

- Psychiatry and Psychology (Non MeSH)
  - Behavior and Behavior Mechanisms
  - Psychological Phenomena and Processes
  - Mental Disorders
    - Adjustment Disorders
    - Anxiety Disorders
    - Delirium, Dementia, Amnestic, Cognitive Disorders
    - Dissociative Disorders
    - Eating Disorders
      - Anorexia Nervosa
      - Binge-Eating Disorder
      - Bulimia Nervosa
      - Coprophagia
      - Female Athlete Triad Syndrome
      - Pica

Mental disorders exploded
MeSH Terms – Publication Type [PT]

Study Characteristics [PT]

- Case Reports
- Clinical Conference
- Clinical Trial +
- Comparative Study
- Census Development Conference (CDC)
  - CDC, NIH
- Evaluation Studies
- In Vitro
- Meta-Analysis
- Multicenter Study
- Scientific Integrity Review
- Twin Study
- Validation Studies
**Mesh Terms – Clinical Trial**

- **Clinical Trial [PT]** (under *Study Characteristics*)
  - Clinical Trial, Phase I
  - Clinical Trial, Phase II
  - Clinical Trial, Phase III
  - Clinical Trial, Phase IV
  - Controlled Clinical Trial
  - Multicenter Study
  - Randomized Controlled Trial
MeSH Terms – TW/TIAB

- Useful text words – use [TW] or [TIAB]
  - Blind
  - Mask
  - Random
  - Efficacy
  - Effective (use sparingly)
MeSH Terms – Other terms

- Use [mh] for these
  - Crossover Studies
  - Cohort Studies
  - Random Allocation
  - Placebos
  - Treatment Outcome
FOR MORE INFORMATION

- CEMB (Centre for Evidence-Based Medicine): http://www.cebm.net/
- EMB Tools (Centre for Health Evidence): http://www.cche.net/usersguides/ebm_tips.asp

This project has been funded in whole or in part with Federal funds from the National Library of Medicine, National Institutes of Health, Department of Health and Human Services, under Contract No. HHS-N-276-2011-00005-C with the University of Illinois at Chicago.
PUBMED and the EVIDENCE-BASED UNIVERSE

http://nnlm.gov/training/pubmedebm/

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