

Evidence-Based Practice: What's the Deal? What are the Ethics?

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This Presentation is Approved for
1 CRCE Credit Hour

Learning Objectives

- Explain the rational & ethical-legal implications of medical research & evidence-based practice
- Describe research methods & the fundamentals of evaluating research & applying research findings to clinical practice

Introduction

Evidence-Based Medicine (EBM)

- Definition: "the conscientious, explicit & judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research." (Sackett D, 1996)

Rationale of EBM for RCPs

- Applications to clinical practice
 - ❖ Generating clinical practice guidelines
 - ❖ Implementing therapeutics & medications that are effective & safe
 - ❖ Implementing diagnostic procedures that are accurate & reliable
 - ❖ Influencing change to more effective therapeutics & diagnostic tests

Rationale of EBM for RCPs

- Ethical implications - what are ethics of continuing with practices that have no evidence for effectiveness?
 - ❖ Any research?
 - ❖ Risks to patient?
 - ❖ Costs?

Rationale of EBM for RCPs

- Examples of RC practices without evidence of effectiveness
 - ❖ Incentive spirometry
 - ❖ Nebulized n-acetylcysteine
 - ❖ Cool mist therapy

Rationale of EBM for RCPs

- Legal implications
 - ❖ Patient injured because of failure to use evidence-based practice: professional liability
 - ❖ Professional ought to know

Rationale of EBM for RCPs

- Example of RC practice with negative evidence
 - ❖ Large tidal volume for ALI/ARDS

Barriers to Evidence-Based Practice

- Lack of evidence
 - ❖ Unethical to do the research, e.g. resuscitation efforts
 - ❖ Uncommon circumstances
 - Disease conditions
 - Therapeutic applications
- Changing evidence: accumulation of research, often with conflicting results

Barriers to Evidence-Based Practice

- Tradition (habit) - resistance to change
- Failure to read research literature
 - ❖ Lack of instruction on research
 - ❖ Lack of motivation

Barriers to Evidence-Based Practice

- Failure to believe research literature
- Arrogance - I'll do what I want!
- It's not my job!

FYI see links below for introductory article on EBM

Research Concepts

Research Concepts

- > Causality
 - ❖ Rationale for experimentation
 - ❖ Doing 'a' (independent variable) causes 'b' (dependent variable)
- > Spurious relationship
 - ❖ 'c' (confounding variable) affects relationship between 'a' & 'b'
 - ❖ Commonly operational, especially in correlations

FYI see links below for explanation of spurious relationship

Research Concepts

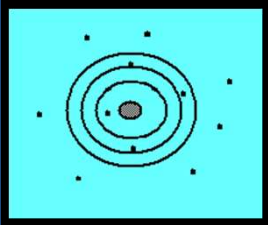
- > Validity (accuracy): measures what it purports to measure
 - ❖ Internal validity of a study: within the confines of the study, the treatment produced the effect
 - ❖ External validity: the treatment will produce the same effect within other contexts (generalizability)

Research Concepts

- > Reliability (precision): measures consistently
 - ❖ If replicated the study produces same results
 - ❖ Unreliability → random error
 - ❖ Reliability of study depends on amount of data, e.g. number of subjects

Research Concepts

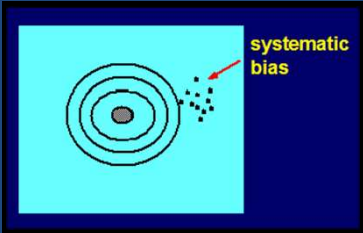
- > Invalid & unreliable



A target diagram with three concentric circles and a central bullseye. Ten small black dots representing shots are scattered randomly across the target area, with none near the center, illustrating a lack of both accuracy and precision.

Research Concepts

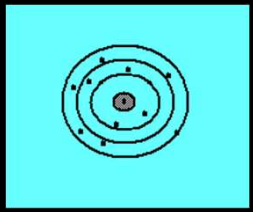
- > Invalid & reliable



A target diagram with three concentric circles and a central bullseye. Ten small black dots representing shots are clustered together in a small area on the right side of the target, away from the center. A red arrow points from the text 'systematic bias' to this cluster, illustrating high precision but low accuracy.

Research Concepts

- > Valid & unreliable



Research Concepts

- > Valid & reliable



Research Concepts

- > Preventing bias
 - ❖ Randomizing subjects: treatment assigned in manner to prevent bias
 - ❖ Control groups: subjects receiving different or placebo treatment
 - ❖ Blinding: researchers do not know which subject receives which treatment

FYI see links below for Placebo Television (medical humor)

Research Concepts

- > Preventing bias
 - ❖ Multiple testing sites: increases likelihood that treatment works in more than one context - increases generalizability
 - ❖ Statistical analysis: probability that effects did not occur accidentally

Research Ethics

- > All studies involving human subjects must receive approval from institutional review boards (IRB)
 - ❖ Expedited reviews for minimal risk
 - ❖ Exemptions for observations
- > Human subjects of experiments must give informed consent
- > Anonymity of subjects for all research must be enforced

Research Ethics

- > At predetermined intervals, effects of interventions are measured & experiment is stopped, if
 - ❖ Hazard of intervention is likely
 - ❖ Benefit of intervention is too great to continue patients in control group

FYI see links below for Bioethics resources on the web

Examples

- > Tidal volumes for ALI/ARDS: it was considered unethical to continue large tidal volumes
- > Aspirin for MI: it was considered unethical to deny aspirin to patients with history of MI

Evidence Sources

Information Sources

- > Personal experience - biased
- > Textbooks - old information
- > Magazines - biased
- > Commercial news - biased
- > Colleagues - their source?

Information Sources

- > Internet
 - ❖ Reliability depends on specific source
 - ❖ Some studies published on Internet before hard copy
- > Original research reports
 - ❖ If you are serious about an issue, read these
 - ❖ Time lag from completion to publication
 - ❖ Multiple imperfections

Information Sources

- > Scientific meetings
 - ❖ Often first dissemination method
 - ❖ Most recent findings

Strength of Cause-Effect Evidence

- Multi-center randomized controlled trial (RCT)
- Meta-analysis of RCT's
- Randomized controlled trial
- Systematic review of non-RCTs
- Observational studies
- Anecdotal information

Multi-Center RCT

- Definition: clinical trial, conducted at several institutions, where subjects are randomized to comparison groups

Multi-Center RCT

- Strengths
 - ❖ Randomized: prevents several sources of bias
 - ❖ Controlled: comparison groups
 - ❖ Multi-center
 - Increased generalizability
 - Can recruit more subjects
 - ❖ Blinding adds strength

Multi-Center RCT

- Weaknesses
 - ❖ Very expensive
 - ❖ Time consuming

Example

- Mercat A, et al. Positive End-Expiratory Pressure Setting in Adults With Acute Lung Injury & Acute Respiratory Distress Syndrome: A Randomized Controlled Trial. JAMA. 2008;299(6):646-655.
 - ❖ In France; 37 intensive care units; 767 subjects. A strategy for setting PEEP did not significantly reduce mortality. It did improve lung function & reduced the duration of mechanical ventilation.

Meta-Analysis of RCTs

- Definition: statistical combination of the results from all RCTs that address the same question
- Systematic methods developed by Cochrane Collaboration

FYI see links below for Cochrane Collaboration

Meta-Analysis of RCTs

- Strengths
 - ❖ Increased statistical power
 - ❖ Increased generalizability: trials conducted in different contexts
 - ❖ Inexpensive, compared to trials
 - ❖ Exempt from IRB review

Meta-Analysis of RCTs

- Weaknesses
 - ❖ Heterogeneity (differences) among trials make them not combinable
 - ❖ Post-hoc analysis: data gathered before research proceeds (source of bias)
 - ❖ Publication bias: not all trials are published
 - ❖ Poor quality of primary trials: garbage in - garbage out

Example

- Rodrigo G, Pollack C, Rodrigo C, Rowe BH. Heliox for nonintubated acute asthma patients. Cochrane database of systematic reviews 2006.
 - ❖ 10 RCTs; 544 patients. The existing evidence does not support the administration of helium-oxygen mixtures to all ED patients with acute asthma

FYI see links below for article on meta-analysis

Randomized Controlled Trial (RCT)

- Definition: clinical trial with subjects randomized to comparison groups
- Strengths
 - ❖ Randomized: prevents several sources of bias
 - ❖ Controlled: comparison groups
 - ❖ Blinding increases strength

Randomized Controlled Trial (RCT)

- Weaknesses
 - ❖ May be small - statistical power concern
 - ❖ Expensive
 - ❖ Time-consuming
 - ❖ Generalizability

Example

- Scolnik D, et al. Controlled delivery of high vs. low humidity vs. mist therapy for croup in emergency departments: a randomized controlled trial. JAMA 2006.
 - ❖ Canada. 140 pediatric patients with croup. This study does not support the use of humidity for moderate croup for patients treated in the emergency department

Systematic Review of Non-RCTs

- Definition: a synthesis of research literature that follows strict guidelines to prevent bias
- Methods developed by Cochrane Collaboration
- Strengths
 - ❖ Control over bias
 - ❖ Inexpensive
 - ❖ Increased generalizability

Systematic Review of Non-RCTs

- > Weaknesses
 - ❖ Quality of primary trials
 - ❖ Absence of primary trials
 - ❖ Publication bias

FYI see links below for article on systematic reviews

Examples

- > Bronchopulmonary hygiene physical therapy in bronchiectasis & chronic obstructive pulmonary disease: a systematic review. *Heart & Lung*. 2000 Mar-Apr;29(2): 125-35. Review.
 - ❖ 7 trials, poor quality, 126 subjects. Research is inconclusive

Observational Studies

- > Definition: research wherein subjects are observed & variables of interest are measured
- > No manipulation of interventions
- > Data are gathered
- > Types
 - ❖ Case-control
 - ❖ Survey

Observational Studies

- > Strengths
 - ❖ Ethical to do when experimental research would not be ethical
 - ❖ Less expensive - much data are already available
 - ❖ Expedited IRB review, because there is no experimental manipulation - anonymity of subjects remains critical

Observational Studies

- > Weakness
 - ❖ Less power than experiment for establishing cause-effect relationship

Examples

- > Dongelmans DA, et al. Determinants of Tidal Volumes with Adaptive Support Ventilation: A Multi-center Observational Study. *Anesth Analg* 2008; 107:932-937
 - ❖ Observation in 3 Dutch intensive care units, 346 subjects. Tidal volume with adaptive support ventilation are dependent on the correctness of set body weight.

Anecdotes, Case Studies

- > Definition: informal observational studies that report incidents, cases
- > Purposes
 - ❖ Communicating rare conditions, infrequently used interventions
 - ❖ Instruction
 - ❖ May provide basis for formal studies

Examples

- > Vihad B, Salerno DA, Marik PE. Lymphomatoid Granulomatosis: A Rare Cause of Multiple Pulmonary Nodules. Respir Care 2008.
 - ❖ Teaching case about rare occurrence

Implications of Research

- > Statistical significance: relationships did not occur by chance
 - ❖ No significant differences → interventional group did the same as control on post-measurement

Implications of Research

- > Clinical importance
 - ❖ Physiologic variables for clinical interventions
 - ❖ Sensitivity, specificity for diagnostic tests
 - ❖ Outcomes
 - Mortality
 - Morbidity
 - Adversity
 - Cost benefits

Evaluating Research

Bias in Literature

- > Funding, e.g. by drug companies, equipment manufacturers
- > Researchers: desire for intervention to work
- > Publication bias: positive research more likely published

Things to Look For

- > Animal studies: useful, but require human studies for validation to medicine
- > Physiological variables: can be transient & noncontributory to outcomes
- > Small studies: difficult to generalize from a few patients
- > Crossover studies: each subject is counted more than once

Things to Look For

- > Effects of interventions may be tied to specific equipment, e.g. PCIRV, PR-2 & 900C
- > Control treatment may not be appropriate for comparison

Application to Practice

Application to Practice

- > Formulate the question
- > Search the literature to locate evidence
 - ❖ On-line resources
 - ❖ Learn to search
 - ❖ Try various terms
 - ❖ Search for strongest evidence

Application to Practice

- > Obtain research reports - medical librarian is your best friend
- > Read all components
 - ❖ Abstract: summary of components
 - ❖ Introduction
 - Background
 - Purpose of study
 - Research question

Application to Practice

- > Read all components
 - ❖ Methods
 - Context of study
 - Subjects, number, description
 - Procedures

Application to Practice

- Read all components
 - ❖ Results
 - ❖ Discussion (of results)
 - ❖ Conclusion
 - Implications for practice
 - Implications for research

Application to Practice

- Appraise the report(s)
 - ❖ Quality of research methods
 - ❖ Do they apply to your context (situation)?

Application to Practice

- Generate conclusion for your own setting
 - ❖ Institution
 - ❖ Patients
 - ❖ Disease conditions
 - ❖ Current practices
 - ❖ Available resources

Application to Practice

- Generate protocol for implementation of intervention/ diagnostic procedure, including evaluation procedures
- Present evidence & protocol to influential parties
- Implement protocol
- Evaluate the outcomes
- Adjust, in accordance with evaluation

Conducting Clinical Research

- Formulate question
- Search the literature
- Identify resources
- Generate research protocol - varies with sponsoring institution
- Approvals
 - ❖ Administration
 - ❖ Institutional review board

FYI see links below for guide to writing research protocol

Conducting Clinical Research

- Recruit research team
 - ❖ Assistants
 - ❖ Statistician
- Train research team
- Implement protocol - gather data
- Analyze data

Conducting Clinical Research

- Generate report - Index Medicus format
- Submit for publication

FYI see links below for Respiratory
Care manuscript instructions

On-Line Reference Resources

- AARC Clinical Practice Guidelines
<http://www.rcjournal.com/cpgs/index.cfm>
- NIH Library of Medicine
<http://www.nlm.nih.gov/portals/healthcare.html>
- Agency for Healthcare Research and Quality
<http://www.ahrq.gov/clinic/>
- Cochrane Reviews
<http://www.cochrane.org/reviews/index.htm>
- Evidence-based medicine
<http://ebm.bmj.com/>
- Evidence-based practice resources (awesome)
<http://guides.lib.uw.edu/hsl/ebptools>

Additional Reference Sources

- Hulley SB, Cummings SR (eds.). *Designing clinical research: an epidemiologic approach* 2000. Williams & Wilkins; Baltimore.
- Phillips JL. *How to think about statistics* 1999. WH Freeman; New York.
- Donald A, Greenhaigh T. *Evidence-based healthcare workbook* 2000. Blackwell BMJ Books
- Greenhaigh T. *How to Read a Paper: The Basics of Evidence-based Medicine* 3rd Ed. 2005. Blackwell BMJ Books
- Gibson P. *Evidence-based respiratory medicine* 2005. BMJ Books

Summary & Review

- Introduction
 - ❖ Rationale for EBM
 - ❖ Ethical implications for EBM
 - ❖ Barriers to EBM
- Research concepts
 - ❖ Validity
 - ❖ Reliability
 - ❖ Bias
 - ❖ Research ethics

Summary & Review

- Evidence sources
 - ❖ Cause-effect strength of research types
 - ❖ Implications of research - clinical importance
- Evaluating research
 - ❖ Sources of bias
 - ❖ Things to look for

Summary & Review

- Application to practice
 - ❖ DIY literature review
 - ❖ Conducting clinical research