Evidence-Based Practice: Introduction

Stephen C. Allison, PT, Ph.D.

Course Outline

- Definition & Scope of EBP
- Rationale for EBP
- Fundamental principles of EBP
- Hierarchies of evidence
- Answerable foreground questions
- Searching for evidence
- Critical appraisal of evidence
- EBP resources

Definition of Evidence-Based Medicine

"the integration of best research evidence with clinical expertise and patient values"1

"the conscientious, explicit, and judicious use of the current best evidence in making decisions about the care of individual patients."2

Definition of Evidence-Based Medicine

Integration of:
- best research evidence
- clinical expertise
- patient values

NOT Integration of:
- best research evidence

Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select “best available evidence”
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?

Why EBP?

My practice is fine just the way it is.
APTA 2020 Vision Statement

"…physical therapists and physical therapist assistants will render evidence-based services throughout the continuum of care and improve quality of life for society."
Testimonials from Evidence-Based PTs & OTs

- "I have increased my practice largely due to using this EBM approach. My referral sources have been impressed."
  Don Barney, DPT, Athens, TX

- "This course has changed the way I look at the world of patient care."
  Matt Armentano, DPT, Chinle, AZ

- "I am very excited about putting EBP in my practice and ... am already doing that in some areas of my practice. I am thrilled to see the changes in my professional perspective."
  Kitsum Li, OTD, Pacifica, CA

Communications reproduced with permission

Testimonials from Evidence-Based PTs & OTs

- "I am definitely convinced that the EBP approach is critical to the PT profession and I am now one of its biggest supporters. I now feel confident that I can find research, critically appraise it and decide if it is relevant to my practice."
  Jerry Amash, DPT, Elon, NC

- "My evidence based methodology has been inspirational to many therapists here in NJ. I specialize in Pediatric Neurology and Sensory Integration in the Early Intervention program and the EBP approach has been yielding spectacular results with my patient population (birth to 3). The news has spread Statewide in the EI corridors and local community wide; the waiting list for my services is long and growing and its all due to the highly effective EBP approach."
  Jyoti Dashore, OTD, New Jersey

Communications reproduced with permission

Information Sources for Clinical Decisions

- Tradition & Authority
  - "That is the way it has always been done."
  - "That’s the way ________ does it."

- Trial and Error
  - Intuition and creativity in selecting options

- Logical Reasoning

- The Scientific Method

The Scientific Method

Defined as a systematic, empirical, controlled, and critical examination of hypothetical propositions about the associations among natural phenomena.*

Primary advantage is reduction of bias (compared to other approaches to clinical decision making)


Where are we as practitioners?

• Study of 321 PTs in England & Australia
  • “The basis of over 90% of each group’s choice of treatment interventions reflected what was taught during their initial training.”
  • “Research literature ranked least in importance as a basis for choosing techniques, and review articles fared little better.”


Where are we as practitioners?

• Survey results from 488 American PTs:
  • 90% agree EBP is necessary
  • 79% agree EBP improves the quality of patient care
  • However, primary barriers to implementing EBP:
    1) Lack of time
    2) Lack of skills

Where is our body of literature?

- Survey of 2,297 physical therapy RCTs indexed in PEDro*:
  - 16% reported using concealed allocation
  - 5% reported using blinded outcome assessors
  - 9% reported blinding of patients
- "The typical randomized trial in physical therapy is potentially seriously biased."**


Explosion of RCTs in Therapy

- 1929: 1
- 1972: 100
- 1986: 1,000
- 2005: 10,000
- 2009: 12,000

Maher C. PRISMA: helping to deliver information that physical therapists need. Phys Ther. 2004 Sep;84(9):870-2.

Best Available External Clinical Evidence

- Clinically relevant research
- Patient centered research into the:
  - Diagnosis: Accuracy & precision of diagnostic tests including the history and physical examination
  - Prognosis: Power of prognostic markers
  - Therapy: Efficacy of therapeutic, rehabilitative, and preventive regimens
  - Harm: Potential for harm with our treatments
Theory & Evidence

What does the clinician need most??

**Theory**
Justifications for treatment based on basic or applied work designed to answer the question why something should work.

**Evidence**
Justifications for treatment based on applied work (on patients) designed to answer the question if something works.

---

Biological Plausibility
(Which do you prefer?)

**THIS**
- Devoid of muscle the spine is unstable.
- Strengthening key muscles can lead to a stable spine.
- A more stable spine should decrease the risk of recurrence of LBP.

**Level 5 Evidence**

**OR THIS**
- A randomized clinical trial demonstrates that pain and function improve initially and at 1- and 3-year follow-up in patients with LBP undergoing specific stabilization exercises.

**Level 1b Evidence**

---

On the Other Hand.....
In the absence of higher-order evidence.... (Which do you prefer?)

**THIS**
- We use ultrasound, hot packs, and WFEs for LBP in my clinic.
- Therefore, Ms. Smith gets ultrasound, hot packs and WFEs.

**Tradition**

**OR THIS**
- Devoid of muscle the spine is unstable.
- Strengthening key muscles can lead to a stable spine.
- A more stable spine should decrease the risk of recurrence of LBP.

**Level 5 Evidence**
Two Fundamental Principles

1. The evidence is never enough
   a. Patient values and expectations
   b. Your own clinical expertise
   c. Benefits and risk
   d. Inconvenience
   e. Costs

Integration of:
1. Best research evidence
2. Clinical expertise
3. Patient values

2. There is a Hierarchy of Evidence

Hierarchy of Evidence (Therapy)

- N-of-1 randomized controlled trial (RCT)
- Systematic review of RCT
- Single RCT
- Systematic review of observational studies
- Single observational study
- Physiologic or other laboratory studies
- Unsystematic clinical observations (expert opinion)

Hierarchy of Evidence (for Therapy)

Higher levels of study design allow you to have increased confidence in the conclusions drawn from the study.

- N=1 RCT
- Systematic Reviews of RCTs
- Multiple RCTs
- Randomized Controlled Trial (RCT)
- Systematic Review of the studies below
- Observational Cohort or Case Control Studies, Large Case Series
- Case Reports, Small Case Series
- Unsystematic Clinical Observations (Expert Opinion)
Hierarchies: Levels and Grades

Levels
(Individual study)

- 1a
- 1b
- 1c
- 2a
- 2b
- ...
- 5

Higher: Stronger evidence

Grades
(Summarizing multiple studies)

- A
- B
- C
- D

Higher: Stronger evidence

Lower: Weaker evidence


Hierarchies: Levels and Grades

- Oxford taxonomy for categorizing at http://www.cebm.net (Centre for Evidence-Based Medicine)
- Separate hierarchies for separate domains of practice

What is “Best Research Evidence?”

Taking therapy as an example, it’s

NOT

RCTs vs. nothing

Rather,

Summary of Systematic Reviews
Multiple RCTs
RCTs
Observational Cohort or Case Control Studies, Large Case Series
Case Reports, Small Case Series
Systematic Clinical Observations (Expert Opinion)
A Quote from Jules Rothstein
Former editor of Physical Therapy

“Because RCTs are so difficult, we will always have areas that lack evidence, and we will need to find other credible research approaches to supply evidence. Keep in mind that an absence of evidence is different from negative evidence. An absence of evidence is not an excuse to ignore the growing body of data available to guide practice.”


Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select “best available evidence”
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?

Forming Answerable Clinical Questions

Elements of Answerable Questions
(Foreground Questions)

- **P** Patient population
- **I** Interventions or exposures
- **C** Comparison intervention(s)
- **O** Outcome(s)

Online question-building tips from cebm.net

---

Example Foreground Question

- **P** For a 68 year old woman with general deconditioning
- **I** is Tai-chi exercise training
- **C** more effective than no intervention
- **O** for reducing fall risk?

- For a 68 year old woman with general deconditioning, is Tai-chi exercise training more effective than no intervention for reducing fall risk?

---

4 Basic Types of Clinical Questions
-- and where to look for evidence

- **Diagnosis**
  - PubMed Clinical Queries (Diagnosis, Systematic Reviews, & Clinical Prediction Guides)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)

- **Prognosis**
  - PubMed Clinical Queries (Prognosis, Systematic Reviews, & Clinical Prediction Guides)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)

- **Intervention**
  - PubMed Clinical Queries (Therapy & Systematic Reviews)
  - Cochrane CDSR
  - PEDro
  - OT Seeker
  - APTA's Hosted on Evidence
  - National Guideline Clearinghouse (NGC)

- **Harm**
  - PubMed Clinical Queries (Etiology & Systematic Reviews)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)
Example:
Searching for Best Available Evidence

- For a 68 year old woman with general deconditioning, is Tai-chi exercise training more effective than no intervention for reducing fall risk?

First, is this a foreground question of intervention (prevention or therapy), prognosis, diagnosis, or harm?

- Intervention
  - PubMed Clinical Queries (Therapy & Systematic Reviews)
  - Cochrane CDSR
  - PEDro
  - CINAHL
  - APTA's Hooked on Evidence
  - National Guideline Clearinghouse (NGC)

Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select “best available evidence”
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?

Example: PubMed search
(Poor strategy; generic search engine)
Example: PubMed search
(Even better– PMCQ: Therapy, Narrow)

Example: CDSR Search

Example: PEDro Search
Example: OTSeeker search

Example: APTA’s Hooked on Evidence search

Example: National Guideline Clearinghouse search
Finding Evidence

- Literature searching is a skill
- We get better with practice
- Quick and easy searching:
  - PubMed Clinical Queries
  - Cochrane Library
    - http://www.thecochranelibrary.com/
  - National Guideline Clearinghouse
    - http://www.guideline.gov/
  - PEDro
  - OT Seeker
    - http://www.otseeker.com
  - APTA’s Hooked on Evidence
    - http://www.hookedonevidence.com/
  - APTA’s Open Door: Full-text Journals
    - http://www.apta.org (click on Evidence & Research, then Open Door)

Improving Searching Skills

- Database Tutorials
  - PubMed Tutorial
  - MeSH Tutorials
  - MEDLINE/OVID Tutorial
    - http://www.medlib.bu.edu/tutorials/ovid/

Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select “best available evidence”
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?
Critical Appraisal

Judgments made by the individual clinician
- Validity of evidence
- Level of evidence
- Protections against validity threats
- Strength of evidence
- Statistical significance
- Clinical meaningfulness of effect sizes
- Relevance of evidence
  - Intervention relevant to clinical setting
  - Intervention acceptable to the patient
  - Outcomes measurable in clinical setting
  - Outcomes important to the patient

Critical Appraisal

Judgments made by the individual clinician
- Validity of evidence
  - Level of evidence
  - Protections against validity threats
- Strength of evidence
  - Statistical significance
  - Clinical meaningfulness of effect sizes
- Relevance of evidence
  - Intervention relevant to clinical setting
  - Intervention acceptable to the patient
  - Outcomes measurable in clinical setting
  - Outcomes important to the patient

Are the results valid?

What are the results?

How can I apply the results to patient care?

Critical Appraisal

Judgments made by the individual clinician
- Validity of evidence
  - Level of evidence
  - Protections against validity threats
- Strength of evidence
  - Statistical significance
  - Clinical meaningfulness of effect sizes
- Relevance of evidence
  - Intervention relevant to clinical setting
  - Intervention acceptable to the patient
  - Outcomes measurable in clinical setting
  - Outcomes important to the patient

Conducting Critical Appraisal

Multiple choices for “level of involvement” by individual clinicians
- Trust judgments of others
  - Authors of individual studies
  - Extractors of original evidence
    - PEDro, OT Seeker, APTA’s Hooked on Evidence
  - Authors of critical appraisals
  - Authors of “pre-processed” evidence
    - Systematic reviews
  - Clinical Practice Guidelines
- Make your own judgments: Critical appraisal
Sources for “Judgments of others”

- PEDro: Physiotherapy Evidence Database
- OT Seeker
  - http://www.otseeker.com/
- TRIP (Turning Research Into Practice) Database
- Cochrane Library
  - http://www.thecochranelibrary.com/
- National Guideline Clearinghouse
  - http://www.guideline.gov/
- APTA’s Hooked on Evidence
  - http://www.hookedonevidence.com/ - need membership logon
- CAT Banks

Making Your Own Judgments

- Critical Appraisal of Topic (CAT) Concept
  - Formulate PICO question
  - Locate what you consider “best available evidence”
  - Read critically for content to answer 3 questions
    - Are the results valid?
    - What are the results?
    - How can I apply the results to patient care?
  - Document your judgments in a report (CAT)
    - Concise: Usually 2-3 pages
    - Not a “book report” – conclusions often different from those reported by authors

Key Elements in a CAT

- Title
- Bottom Line Statement
- Citation
- Three-part Clinical Question
- Search Terms & Databases Searched
- Concise description of the Study
- Judgments: Key validity issues
- The Evidence: Results -- usually in Table format
- Comments: Discussion and rationale for judgments on --
  - Are the results valid?
  - What are the results?
  - How can I apply the results to patient care?
CATmaker Software

- Available from CEBM Website
- Concept also described at CEBM Website

CATmaker’s Critical Appraisal Guides

CAT documents from CATmaker

Prognosis for Independent Ambulation among Children and Adolescents at Discharge from Inpatient Rehabilitation for Traumatic Brain Injury

A Critical Appraisal of Topic

This evidence suggests that 50% (95% CI 40% to 60%) of children and adolescents admitted to inpatient rehabilitation for TBI will be able to ambulate 50% without assistance at discharge. Patients in this study with no lower extremity hypotrophy, no lower extremity injury, and < 24 hours unconscious at time of injury had a better prognosis for independent ambulation. This is Level 2 evidence without secondary validation. There are several unprotected factors to validate which may reduce a child’s confidence in using these 3 identified prognostic factors to influence a prognosis for independent ambulation.

Citation:
Judgments: Key Validity Issues
-- Evidence for Diagnosis

- Did clinicians face diagnostic uncertainty?
- Was there a blind comparison with an independent gold standard?
- Did the results of the test being evaluated influence the decision to perform the reference standard?

Judgments: Key Validity Issues
-- Evidence for Prognosis

- Was the sample of patients representative?
- Were the patients sufficiently homogeneous with respect to prognostic risk?
- Was follow-up sufficiently complete?
- Were objective and unbiased outcome criteria used?

Judgments: Key Validity Issues
-- Evidence for Therapy

- Were patients randomized?
- Was randomization concealed?
- Were patients in the treatment and control groups similar with respect to known prognostic factors?
- Blinding: Patients? Treaters? Assessors?
- Was follow-up complete?
- Were all patients analyzed in groups to which initially assigned?
Judgments: Key Validity Issues
-- Evidence for Harm

- Did the investigators demonstrate similarity in all known determinants of outcome; Did they adjust for differences in the analysis?
- Were exposed patients equally likely to be identified in the two groups?
- Were the outcomes measured in the same way in the groups being compared?
- Was follow-up sufficiently complete?

Required Quantitative Skills –
General: For all Practice Domains

- Traditional hypothesis testing; concepts of statistical inference
- Statistical power
- Confidence interval analysis
- Minimal clinically important difference

Required Quantitative Skills –
Specific to Evidence for Diagnosis

- Sensitivity
- Specificity
- Likelihood ratios
- Likelihood ratio nomogram
- Receiver-operator characteristic (ROC) curve analysis
Required Quantitative Skills – Specific to Evidence for Prognosis

- Logistic regression analysis
- Odds ratio
- Relative Risk ratio
- Hazard ratio
- Cox-model regression
- Survival analyses (Kaplan-Meier graphs)

Required Quantitative Skills – Specific to Evidence for Therapy

- For continuous scale outcomes:
  - t-tests, ANOVA, ANCOVA
  - Non-parametric analogs
  - Effect size vs. MCID
- For dichotomous outcomes:
  - Control event rate (CER)
  - Experimental event rate (EER)
  - Absolute risk reduction (ARR)
  - Relative risk reduction (RRR)
  - Number needed to treat (NNT)

Required Quantitative Skills – Specific to Evidence for Harm

- Same as for therapy, plus
  - Number needed to harm (NNH)
Quantitative Tools for Critical Appraisal

- CEBM’s All-purpose 4-fold calculator
- CEBM’s Interactive LR Nomogram
- PEDro’s Confidence Interval Calculator
  - [MS Excel Spreadsheet](http://www.pedro.org.au/english/downloads/)
  - [Downloadable from](http://www.pedro.org.au/english/downloads/)

Limitations of CATs

- Individual CATs can be wrong
- Individual CATs usually address a single element of the relevant literature
- Individual CATs may have a short shelf life

CAT Banks

- Critically Appraised Topics for OTs
- Evidence in Motion: CAT Bank for PTs
- TRIP (Turning Research Into Practice) Database
- University of Michigan Dept. of Pediatrics
  - [www.med.umich.edu/pediatrics/ebm/](http://www.med.umich.edu/pediatrics/ebm/)
- Evidence-based Nursing Online -- journal publishes CATs
  - [http://ebn.bmj.com/](http://ebn.bmj.com/)
- Journal of Sport Rehabilitation – journal publishes CATs
  - [http://journals.humankinetics.com/](http://journals.humankinetics.com/)
Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select “best available evidence”
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?

Integration & Clinical Decision

- Similarity of my patient to patients in the study?
- Outcomes in the study important to my patient?
- Treatments or tests used in the study feasible in my clinical setting?
- Do I have necessary skills & equipment?
- Cost worth the benefit?
- Preferences, values, expectations of my patient?
Skills & Sequence for Using the EBP Method

- Acknowledge there’s something I don’t know
- Formulate a foreground question (PICO)
- Efficiently search online databases
- Select "best available evidence"
- Critically appraise evidence
- Integrate evidence with clinical practice & patient values
- Periodically evaluate myself: How am I doing as an evidence-based practitioner?

Self-evaluation: How am I doing as an evidence-based practitioner?

- Periodic self-assessment: Questions* –
  - Asking answerable questions?
  - Finding the best external evidence?
  - Critically appraising the evidence?
  - Integrating evidence & applying in clinical practice?
  - Changing practice behavior?
- Monitoring my outcomes vs. evidence
  - Concept of a Minimal Data Set

Summary & Review: Critical Appraisals

- Judgments made by the individual clinician
  - Are the results valid?
  - What are the results?
  - How can I apply the results to patient care?
- A CAT is not simply a summary of an article
  - It’s more (independent judgments)
  - It’s less (concise extraction of relevant information only – to answer the PICO question)
- A CAT should not be confused with evidence
  - Can be wrong
  - Contains a single element of the relevant literature
  - May have a short shelf life

*For specific self-assessment questions, see Chapter 9 of Straus et al, 2011 (Book References slide)
Summary & Review: What is EBP?

- Definition of EBM/EBP:
  - “the integration of best research evidence with clinical expertise and patient values”

- Two Fundamental Principles:
  - The evidence is never enough
  - There is a hierarchy of evidence

- Evidence falls into four general domains of practice
  - Diagnosis, prognosis, intervention, harm

- General Steps:
  - Acknowledge there’s something I don’t know
  - Formulate a foreground (PICO) question
  - Efficiently search online databases
  - Select “best available evidence”
  - Critically appraise evidence
  - Integrate evidence with clinical practice
  - Self-evaluation: How am I doing as an evidence-based practitioner?

Journal Article References


- Maher C. Examining the evidence that physical therapists need. Phys Ther. 2009 Sep;


Book References


Great EBP Websites

- http://www.cebm.net/ Centre for Evidence-Based Medicine – perhaps the most useful EBP site with fantastic tools, downloads, etc.
- http://cebp.nl/ Dutch Centre for Evidence-based Physiotherapy
- http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat The Health Services Technology/Assessment Texts (H51AT) is a free, Web-based resource of full-text documents that provide health information and support health care decision making. Includes AHRQ Evidence Reports, AHCPR Clinical Practice Guidelines, Consumer Guides, and many other resources.

Great EBP Websites (cont.)

- http://www.freemedicaljournals.com List of free online journals
- www.med.umich.edu/pediatrics/ebp Great Pediatrics EBP site with many CATs, links to online courses etc.
- http://www.uic.edu/depts/lib/hlsp/resources/publ.shtml University of Illinois at Chicago EBM Resources
- http://www.ebm.med.ualberta.ca/ University of Alberta Evidence Based Medicine Toolkit
- http://pubs.ama-assn.org/misc/usersguides.dtl Users’ Guides Interactive – accompanies the Guyatt & Rennie textbook Still under development, but the evolving EBP Teaching Tips Online are wonderfully interactive and resource-rich.

Questions