WHAT IS EVIDENCE-BASED PRACTICE IN SPEECH-LANGUAGE PATHOLOGY?

Definition of Evidence-Based Practice

What it is:

- Integrating craft and theory with science and data
- "Scientific thinking" by clinical professionals

What it is not:

- Ignoring everything but the data

What it allows us to do:

- Allocate resources carefully
- Provide more effective interventions
- Limit exposure to ineffective interventions

Where Does EBP Come From?

"Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients… This practice means integrating individual clinical experience with the best available external clinical evidence from systematic research"

(Sackett et al., 1996)

Importance

- To efficiently assess and treat cases confronted in everyday practice.
  - Weigh pros and cons of applying treatment
- To provide the most effective therapy given the state of accredited research available to us.
  - Expand upon training given in professional school

EBP Is a Process…

Engaging in EBP involves four steps

Don't worry, we'll walk you through each one!

- Step 1: Frame the question
- Step 2: Search for evidence that answer the question
- Step 3: Assess validity and quality of the evidence
- Step 4: Apply the evidence

Step 1:

Frame the question

Step 1: Frame the question

- EBP involves continually posing clinical questions that are of direct practical importance to clients.
- The first step in asking a question is to determine the type of question: **background** or **foreground**.
  - The type of question helps to determine the resource to access to answer the question.

Background

- **Background questions** ask for general knowledge
- The background question is usually asked because of the need for basic information
  - Ask for general knowledge about a condition
  - Two essential components:
    - A question root (who, what, when, etc.) with a verb
    - Identification of a disorder, test, treatment, etc.
- Example: *What is fetal alcohol syndrome? Is it usually associated with communication disorders?*

Evidence-Based Practice Asking the Clinical Question. Retrieved August 18, 2009, from Evidence Based Practice Asking the Clinical Question Web site: http://www.med.yale.edu/library/nursing/education/clinquest.html

Foreground

- **Foreground questions** seek to find evidence on a very specific clinical problem
- These have 4 essential components **(PICO)**
  - **P**atient and/or problem
  - **I**ntervention
  - **C**omparative intervention (optional, include if relevant)
  - **O**utcome
- Example: *In a 6-year-old child with a severe speech production impairment, would the use of a cycles approach to ordering targets as compared to a hierarchical approach be a better therapy in promoting speech intelligibility?*

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PICO: How To Write Questions for EBP

- Patient/Problem
  - Describe student/classroom as accurately as possible
- Intervention
  - What is the main intervention/therapy you wish to consider? (Including exposure to disease, a diagnostic tests, prognostic factors, treatment, patient perception, risk factors, etc).
- Comparative Intervention
  - Is there an alternative treatment to compare?
- Outcome
  - What is the clinical outcome?

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PICO

Element of the clinical question	Patient	Intervention (or cause, prognosis)	Comparison (optional)	Outcome
Example	6-year-old child with a severe speech production impairment	Maximal opposition approach	No treatment	Improvement in intelligibility
Example	70-year-old stroke patient	Test that will accurately diagnose aphasia	Alternative test	Sensitive differential diagnosis
Example	10 year-old girl with serious dysphonia	Vocal rest	No treatment	Improved voice quality

Step 2:
Search for evidence to answer the question

Step 2: Search for evidence that answer the question

- ***General Resources*- Textbooks, encyclopedia articles, and guidebooks or handbooks.** Provides an overview of key research findings and an introduction to principles within the discipline. It's a good resource for students who are learning about a new field.
- ***Filtered Resource*-** Professionals synthesize available studies. Examples include review articles (specifically **meta-analysis and systematic reviews**).
- ***Unfiltered Resource*-** Authored by the researchers, contains original research data. Includes **peer-reviewed journals, conference papers, pre-prints, or preliminary reports.**

Gathering Evidence: Where to Start

1. General resources:

   Seeking general background information

2. Filtered resources: syntheses of evidence

   Seeking a specific course of action

3. Unfiltered resources: primary research articles

   Use when filtered resources were not helpful

Reliable Research Designs

- Some research designs provide a stronger level of evidence than others.

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Refine Your Search

- Some databases provide filters to help searchers find the appropriate study types:

Clinical Question	Research Design
Therapy	Randomized experiment preferred Otherwise: cohort study, case-control study, case series
Diagnosis	Prospective, blind comparison to a reference standard
Etiology or Harm	Cohort study, case-control study, case series
Prognosis	Cohort study preferred otherwise: case-control study, case series

Potentially Unreliable Literature

- **Grey literature** is fleeting, non-conventional and sometimes short term publications:
  - reports
  - theses
  - conference proceedings
  - technical specifications and standards
  - non-commercial translations
  - bibliographies
  - technical and commercial documentation
  - official documents not published commercially (primarily government reports and documents)

Step 3: Assess validity and quality of the evidence

Step 3: Assess validity and quality of the evidence

- Below are steps you will use to assess your evidence:
  - ***(i) External validity and eligibility criteria***
  - ***(ii) Temporal, ethnical, socio-economic and geographical aspects***
  - ***(iii) External validity <u>beyond</u> eligibility criteria***
  - ***(iv) Applicability of study results***

Dekkers, O M, Elm, E v., Algra, A, Romijn, J A, Vandenbroucke, J P (2009). How to assess the external validity of therapeutic trials: a conceptual approach. *Int J Epidemiol* 0: dyp174v1-dyp174

Step 3: Assess validity and quality of the evidence

- ***(i) External validity and eligibility criteria***
  - Is the criteria for people to take part in the study a proper reflection of the study population? If this is not the case, the external validity might be limited.
  - <u>Selection of study population-</u> Patients who give consent to participate differ from non-consenters in characteristics that can determine outcome.
    - *Example: A study asked for parents to consent to reading to their child every night and to keep a log about each time they read with their child. The researchers may have to take into account that parents who consent to the study and read to their child have more time and less stress than parents who don't consent. Perhaps parents who don't consent are more concerned with putting food on the table than reading to their child on a regular basis.*

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Step 3: Assess validity and quality of the evidence

- Participating centres
  - *Example: Only one school consents to letting researchers study a population of children. If researchers are trying to generalize the study to represent all children in the U.S. population it will not be an accurate representation of all children in the United States.*

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Step 3: Assess validity and quality of the evidence

- ***(ii) Temporal, ethnical, socio-economic and geographical aspects***
  - Do temporal, ethnical and geographical differences between study populations and target populations translate into a limited generalizability?
  - Temporal aspects- The time elapsed since the original study was performed may translate into important changes in SLP practice that influence treatment effects.

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Step 3: Assess validity and quality of the evidence

- Ethnical aspects
  - Example: An SLP video tapes and analyzes the language capabilities of a classroom of children. One child is Hispanic and uses Spanish and English interchangeably. It is important to take his ethnicity into account when interpreting the results of the study.
- Geographical and socio-economic aspects
  - Example: Researchers asked preschools all over Columbus if they would participate in a study in which lessons between children and teachers would be video taped, coded and analyzed to see how well children's language is developing. Researchers must take into account that more affluent areas may have better teachers and concerned parents than poorer areas with under paid teachers and parents struggling to make a living.

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Step 3: Assess validity and quality of the evidence

- ***(iii) External validity <u>beyond</u> eligibility criteria***
  - Can study results be generalized beyond the eligibility criteria?
  - <u>Age</u>- Generalizability beyond age should be based on prior knowledge and biological plausibility.
    - *Example: If an SLP is conducting a study to measure language development of early childhood language development they should include children aging from birth to 3rd grade.*

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Step 3: Assess validity and quality of the evidence

- Co-morbidities- The presence of one or more disorders in addition to a primary disorder and/or the effect of these additional disorders.
  - Random Control Trials often exclude student with co-morbidity. Generalizability to students with co-morbidities should only be done with caution, and can only be based on external evidence.
  - *Example: An SLP videotapes a classroom of students to assess their language development. One of the children is deaf. The SLP may want to exclude the child from the study because he has a co-morbidity (he is deaf and in addition he has slower language development).*

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Step 3: Assess validity and quality of the evidence

- ***(iv) Applicability of study results***
  - Do differences in treatment setting account for differences in treatment effects?
  - Treating SLPs- Treatment effects can depend on skills of treating SLPs.
  - Treatment setting- Treatment effects can depend on setting (i.e. in classroom, pulled out of classroom, in clinicians office)

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Step 4:

Apply the evidence

- The final step of the EBP process is integrating research evidence (found in Steps 2-3) with internal evidence:
  - **Internal evidence**: your preferences, habits, institutional norms, availability of resources, theoretical knowledge of what's good and what's not
  - **External evidence**: evidence from scientific research

Internal Evidence

How To Evaluate Internal Evidence

- **Determine your treatment's clinical significance**
  - **<u>Clinical significance</u>**
    - Are the results of the research applicable to your student or setting scenario?
    - Is the experimental treatment or test available in your setting?
    - Is it cost effective?

External Evidence

How To Evaluate External Evidence

- The following measurements are used to evaluate external evidence. Examples and the formulas provided in subsequent slides will lead you through the process.
- **Measuring the benefit of the treatment**
  - *Absolute Risk Reduction(ARR)*- % of students that benefit from the treatment-
  - *Number Needed to Treat*- number of patients it will take for one of those patients to benefit from the treatment
- **Measuring the benefit of the diagnostic tool** (presence of symptoms, a screening tool, other means of measuring target disorders).
  - Calculate the number of people from the sample that have a positive test result.
  - Calculate the number of people from the sample that have a negative test result.
  - Calculate the likelihood that a result would be expected in a patient with the target disorder compared to a patient without that disorder.

Measuring The Benefits of a Treatment

Application of Measuring the Benefit of a Treatment: Scenario

- An SLP has a population of 100 second grade students who have reading disabilities and receive standard treatment. She administers a computer-based treatment to 50 of her students.15 students who were given the computer-based treatment showed no change but 35 students showed a significant improvement after they were given the computer-based treatment. **How can she measure the effects of her treatment?**

Application of Measuring the Benefit of a Treatment

First generate a table for your results

Study groups	No change/negative outcome	Desired change/favorable outcome	Total
Standard Treatment	A: 50	B: 0	A+B= 50
Standard Treatment and Computer-Based Treatment	C: 15	D: 35	C+D= 50

How to Calculate the Benefit of The Treatment

- **Absolute Risk Reduction (ARR)** measures the benefit of the new treatment.

$$ARR = CER - EER$$

  - **Control Event Rate (CER)** =% of students who received standard treatment (control group) that experienced no change/negative outcome.
  - **Experimental Event Rate (EER)** =% of students who received standard treatment and computer-based treatment (experimental group) that experienced no change/negative outcome
  - **The greater the ARR the greater the benefit of the treatment**

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Application of Measuring the Benefit of A Treatment

Study groups	No change/negative outcome	Desired change/favorable outcome	Total
Standard Treatment	A: 50	B: 0	A+B= 50
Standard Treatment and Computer-Based Treatment	C: 15	D: 35	C+D= 50

- **Control Event Rate (CER)**: students who received standard treatment with no change/total student receiving standard treatment. $A/A+B=50/50= 1$ (100%)
- **Experimental Event Rate (EER)**: students who received standard treatment and computer-based with experienced no change/total students receiving stand and computer-based treatment. $C/C+D=15/50= 0.3$ (30%)
- **Absolute Risk Reduction** (**ARR=CER - EER**):1–0.3 = 0.7 (70%)

70% OF THE STUDENTS BENEFIT FROM THE TREATMENT

How to Determine The Significance of The Treatment

- **Number Needed to Treat (NNT)** is the number of students a clinician needs to treat in order for one of those students to benefit from the treatment.

$$NNT = 1/ARR$$

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Application of Measuring the Benefit of A Treatment

- **Number Needed to Treat (NNT):** 1/measured benefit of a treatment. 1/AAR= 1/0.7 = 1

A SLP NEEDS TO TREAT 1 STUDENT FOR 1 OF THOSE STUDENTS TO BENEFIT FROM THE TREATMENT.

The following will help you measure the efficacy of a diagnostic tool…

How to Calculate the Benefit of The Diagnostic Tool

- How do we measure the efficacy of a diagnostic tool (presence of symptoms, a screening tool, other means of measuring disorders)?
  - **Sensitivity** is the proportion of students with a disorder who have a positive test result.
  - **Specificity** is the proportion of students without the disorder who have a negative test result.

Sensitivity and Specificity

- Two commonly used mnemonics for sensitivity and specificity are:
  - **SnNout-** When a test has a **high sensitivity** a **negative result** rules out the diagnosis.
  - **SpPin-** When a test has a **high specificity** a **positive result** rules in the diagnosis.

Example of Calculating The Benefit of Using A Diagnostic Tool

- To calculate the sensitivity and specificity of a diagnostic tool, you need the test results for both the index tool and the reference standard.

Index test result	Really sick	Really well	Total
Positive Test	A:95	B:100	A+B= 195
Negative Test	C:5	D:800	C+D= 805
Total	A+C=100	B+D=900	A+B+C+D= 1000

Sensitivity = A/(A+C) = 95/100= 95
Specificity = D/(B+D) = 800/900 = 89

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Example of Calculating The Benefit of Using A Diagnostic Tool

- **Likelihood Ratio (LR)** - the likelihood that a test result would be expected in a student with the disorder compared to a student without that disorder.
- LR can be used during initial assessment to determine the likelihood of a disorder ("**pre-test probability**"), then SLPs can administer a test to shift their suspicion one way or the other.
- Then they can determine a final assessment of the likelihood of disorder ("**post-test probability**").

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The Likelihood Ratio

- Likelihood ratios tell us how <u>much</u> we should shift our suspicion for a particular test result.
- The "positive likelihood ratio" (LR+) tells us how much to increase the probability of a disorder if the test is positive.
  - **LR+** corresponds to the concept of **"ruling-in disorder"**
- The "negative likelihood ratio" (LR-) tells us how much to decrease the probability it if the test is negative.
  - **LR-** corresponds to the concept of **"ruling-out disorder"**

Likelihood Ratios. Mark H. Ebell MD, MS, 15 July 1998. Web. 1 Oct. 2009. <www.poems.msu.edu/InfoMastery/Diagnosis/likelihood_ratios.htm>.

Calculating the Likelihood Ratio

- LR+ calculations are used to determine how much to increase the probability of disorder if the test is positive.
  - LR+=probability of a student **w**/ the condition having a + test / probability of a student **w**/**o** the condition having a + test
  - **LR+ = Sensitivity/(1-Specificity)**
- The "negative likelihood ratio" (LR-) tells us how much to decrease it if the test is negative.
- LR-= probability of a student **w**/ the condition having a - test / probability of a student **w**/**o** the condition having a - test
- LR- = (1-Sensitivity)/Specificity)

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Interpreting Likelihood Ratios: General Guidelines

LR	Interpretation
> 10	Large and often conclusive increase in the likelihood of disease
5 - 10	Moderate increase in the likelihood of disease
2 - 5	Small increase in the likelihood of disease
1 - 2	Minimal increase in the likelihood of disease
1	No change in the likelihood of disease
0.5 - 1.0	Minimal decrease in the likelihood of disease
0.2 - 0.5	Small decrease in the likelihood of disease
0.1 - 0.2	Moderate decrease in the likelihood of disease
< 0.1	Large and often conclusive decrease in the likelihood of disease

- LR > 1 indicates an increased probability that the target disorder is present
- LR < 1 indicates a decreased probability that the target disorder is present.

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Application of Calculating the Benefit of the Diagnostic Tool

- A random sample of 100 first graders from Columbus City Schools are tested for childhood apraxia of speech using STDAS 2. **10** have childhood apraxia and **90** do not.
  - 9 children who have childhood apraxia test positive while 10 children who do not have childhood apraxia test positive.
  - **How can we measure the benefit of STDAS 2?**

Application of Calculating the Benefit of the Diagnostic Tool

A wide range of scores was noticed in children who took STDAS 2.

Index test result	Students w/ Childhood Apraxia	Students w/o Childhood Apraxia	Total
Positive Test	A: 9	B: 10	A+B= 19
Negative Test	C: 1	D: 80	C+D= 81
Total	A+C= 10	B+D= 90	A+B+C+D= 100

Sensitivity = A/(A+C) = 9/10 = 90%
Specificity = D/(B+D) = 80/90 = 89%

90% of children tested who have apraxia displayed a positive test result
89% of children tested who do not have apraxia display a negative test result

Application of Calculating the Benefit of the Diagnostic Tool

LR	Interpretation
> 10	Large and often conclusive increase in the likelihood of disease
5 - 10	Moderate increase in the likelihood of disease
2 - 5	Small increase in the likelihood of disease
1 - 2	Minimal increase in the likelihood of disease
1	No change in the likelihood of disease
0.5 - 1.0	Minimal decrease in the likelihood of disease
0.2 - 0.5	Small decrease in the likelihood of disease
0.1 - 0.2	Moderate decrease in the likelihood of disease
< 0.1	Large and often conclusive decrease in the likelihood of disease

- Positive LR = Sensitivity/(1-Specificity) = 90%/11% = ***8.2***
  - LR > 1: There is an increased probability that childhood apraxia is present
  - 5-10: Moderate increase in the likelihood of disorder
- Negative LR = (1-Sensitivity)/Specificity) = 10%/89% = ***0.112***
  - LR < 1: There is a decreased probability that childhood apraxia is present.
  - 0.1-0.2: Moderate decrease in the likelihood of disorder

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Application of Calculating the Benefit of the Diagnostic Tool

- Based on LR + there is an increased probability that students with childhood apraxia display positive test results when using STDAS 2.
- Based on LR – there is a decreased probability that students with childhood apraxia display negative test results when using STDAS 2.
- **STDAS 2 is a reliable diagnostic tool because it shows primarily positive test results for students who have childhood apraxia and negative test results for students without the disorder.**

INTEGRATE YOUR INTERNAL AND EXTERNAL EVIDENCE

- **INTERNAL:** What is the clinical significance of the research?
- **EXTERNAL:** What is the benefit of using the treatment/diagnostic tool?

INTERNAL + EXTERNAL = <u>YOUR DECISION</u>

Case Study

The following case is based on McGinty and Justice (2007), available for download at http://www.speechandlanguage.com/ebp/

Case Study

- **You work in a school in which 80% of children quality for F/R lunch**
- **You serve 15% of children in grades K-3 for speech and language difficulties**
- **Your caseload is high – 92 children**
- **You have 7 new referrals this week, all of whom appear to have serious language difficulties**
- **You want to know if it is effective to begin to serve children within their classrooms rather than using a pull-out model…**

Step 1:

Frame the question

Step 1: Frame the question

- **P**- Patient/Problem
- **I**- Intervention
- **C**- Comparative Intervention
- **O**- Outcome

Step 1: Frame the question

- Would a preschool or early elementary child with language impairment (P) show greater improvement with classroom-based language intervention (individual or group) (I) or pull-out intervention (individual or group) (C), as shown by improvements in language skills in the areas of phonology, morphology/syntax, pragmatics, and/or vocabulary (O)?

Step 2:

Search for evidence to answer the question

Step 2: Search for evidence that answer the question

- General Background Information
- Filtered Resources
- Unfiltered Resources

Step 2: Search for evidence that answer the question

- General background information
  - read a variety of texts on service delivery models and language disorders
- Filtered resources
  - found report in *EBP Briefs* that offered a review of three studies
- Unfiltered resources
  - did not look due to success with filtered resources

Step 2: Search for evidence that answer the question

Overview of EBP Brief (Filtered Resource):

Inclusionary/exclusionary criteria specified

- Peer reviewed journals
- Explicit comparison (pull-out, push-in)
- Participants: Child language outcome, child age 2-8 years, child presence of LI

Search procedures

- 7 search engines
- Review of prior meta-analyses
- 783 papers screened

Step 3: Assess validity and quality of the evidence

Step 3: Assess validity and quality of the evidence

- Did the articles I used as evidence account for
  - ***External validity and eligibility criteria***
  - ***Temporal, ethnical, socio-economic and geographical aspects***
  - ***External validity beyond eligibility criteria*** *(Age, co-morbidity)*
  - ***Applicability of study results***

Step 4:

Apply the evidence

Step 4: Apply the evidence

- INTERNAL: Integrate scientific conclusions with:
  - Theoretical knowledge
  - Experience
  - Preferences
- EXTERNAL: Two of three studies converge in showing benefit to collaborative push-in model over pull-out model
- YOUR DECISION:

Results of the Actual Case Study

- **Systematic review of the outcomes showed an advantage for team-taught language lessons between the classroom teacher and the SLP.**
  - EBP does not only involve research. The clinician must integrate child/family preference their own experiences and the culture in which they work to make the best decision concerning the models they use to meet the needs of the children.

References

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