

# **Evidence-Based Practice in Treatment of Preschool Children with Speech Delays:**

## **What is the Evidence?**

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### **Overview (*Holly L. Storkel*)**

1. Evidence-Based Practice: Application of current best evidence to clinical decision making for individual clients (Apel, 2001; Dollaghan, 2004)
2. Children with functional phonological disorders: Significant delays in sound production with no obvious cause (Gierut, 1998)

### **Child Variables (*Jill R. Hoover*)**

3. Generalization: learning beyond what is taught
  - a. Treated sound: change in the treated sound in untreated words
  - b. Untreated within class: change in untreated sounds that are similar to the treated sound (e.g., sounds that are the same manner as the treated sound)
  - c. Untreated across class: change in untreated sounds that are dissimilar to the treated sound (e.g., sounds that differ in manner from the treated sound)
4. Stimulability: ability to imitate a correct production of an error sound
  - a. Research evidence shows that stimulable sounds tend to improve without treatment
  - b. Research evidence shows that nonstimulable sounds require treatment
  - c. Recommendation: treat nonstimulable sounds
  - d. Readings: (Miccio & Elbert, 1996; Miccio, 1999; Powell, Elbert, & Dinnsen, 1991)
5. Consistency of substitutes: the stability of the production of a substitute across word positions and across words
  - a. Research evidence shows that treatment of a sounds with a consistent substitute leads to generalization of the treated sound across word positions
  - b. Research evidence shows that treatment of a sound with an inconsistent substitute leads to change in the treated sound in only the treated word position
  - c. Recommendation: treatment of sounds with inconsistent substitutes may require a specialized treatment approach
  - d. Readings: (Forrest, Dinnsen, & Elbert, 1997; Forrest & Elbert, 2001; Forrest, Elbert, & Dinnsen, 2000)
6. Productive phonological knowledge: accuracy of child's sound production
  - a. Knowledge continuum:
    - i. Least knowledge: sound always produced incorrectly or produced correctly in only a few words
    - ii. Some knowledge: sound produced correctly in only some word positions or sound produced correctly in all word positions but variability across words (i.e., inter-word variability)
    - iii. Most knowledge: sound produced correctly in all words or sound produced correctly in all words but variability across productions of the same word (i.e., intra-word variability)
  - b. Research evidence shows that treatment of most knowledge sounds leads to change in treated sounds only
  - c. Research evidence shows that treatment of least knowledge sounds leads to change in treated and untreated sounds
  - d. Recommendation: Treat least knowledge sounds to promote global sound change
  - e. Readings: (Gierut, Elbert, & Dinnsen, 1987)

7. Clinical Application Child A: 5;0 female 1st percentile
  - a. Most knowledge (high accuracy): m n ŋ w h p b t d
  - b. Some knowledge (mid accuracy): l k g v s z tʃ dʒ
  - c. Least knowledge (low accuracy): r f θ ð ʃ
  - d. Recommendation: select 1 least knowledge sound
8. Clinical Application Child B: 4;9 male 2nd percentile
  - a. Most knowledge (high accuracy): m n w j h p b t d
  - b. Some knowledge (mid accuracy): θ s z
  - c. Least knowledge (low accuracy): ŋ l r k g ð ʃ tʃ dʒ
  - d. Recommendation: select 1 least knowledge sound

**Phonological Variables (*Junko M. Young*)**

9. Phonetic complexity: based on cross-linguistic and developmental patterns with certain sets of sounds being viewed as less complex (e.g., nasals, stops, & glides) and other sets of sounds being viewed as more complex (e.g., nasals, stops, glides, fricatives, & 1 liquid)
  - a. Research evidence suggests treating less complex sounds (e.g., fricatives) leads to limited change
  - b. Research evidence suggests treating more complex sounds (e.g., liquids) leads to global change
  - c. Recommendation: treat complex sounds
  - d. Readings: (Tyler & Figurski, 1994)
10. Markedness: based on frequency of occurrence of sounds across languages as well as developmental patterns
  - a. Marked sounds: voiced, fricatives, affricates, clusters, liquids
  - b. Unmarked sounds: voiceless, stops, singletons, nasals
  - c. Research evidence suggests treating unmarked sounds leads to change in only unmarked sounds
  - d. Research evidence suggests treating marked sounds leads to change in unmarked and marked sounds
  - e. Recommendation: treat marked sounds
  - f. Readings: (Gierut, 1999, 2001; Gierut & Champion, 2001)
11. Developmental age norms: age when sounds are typically acquired (Smit, Hand, Freilinger, Bernthal, & Bird, 1990)
  - a. Research evidence suggests treating early acquired sounds leads to change in the treated sound and untreated within class sounds
  - b. Research evidence suggests treating late acquired sounds leads to change in treated, untreated within class, and untreated across class sounds
  - c. Recommendation: treat late acquired sounds
  - d. Readings: (Gierut, Morrisette, Hughes, & Rowland, 1996; Morrisette & Gierut, 2003; but see Rvachew & Nowak, 2001)
12. Clinical application child A: 5;0 female, least knowledge sounds: r f θ ð ʃ
  - a. Early acquired: f ð
  - b. Late acquired: r θ ʃ
  - c. Recommendation: select one least knowledge late acquired sound (e.g., /r/)
13. Clinical application child B: 4;9 male, least knowledge sounds: ŋ l r k g ð ʃ tʃ dʒ
  - a. Early acquired: k g
  - b. Late acquired: ŋ l r ð ʃ tʃ dʒ
  - c. Recommendation: select one least knowledge late acquired sound (e.g., /dʒ/)

## Lexical Variables (*Holly L. Storkel*)

14. Many phonological treatment programs treat sounds in real words. Does word selection matter in promoting sound change?
15. Review lexical characteristics (Storkel & Morrisette, 2002)
  - a. Word frequency: how often a word occurs in a language
    - i. High frequency advantage for word recognition, production, and learning
  - b. Neighborhood density: number of words phonologically similar to a given word based on a 1 phoneme difference (i.e., minimal pairs)
    - i. Neighbors of "sit" = "hit, sat, sip, spit, it" + many others
    - ii. High density disadvantage in word recognition
    - iii. High density advantage in production, learning, and phonological awareness
  - c. Additional readings: (De Cara & Goswami, 2003; Garlock, Walley, & Metsala, 2001; German & Newman, 2004; Metsala, 1997; Rice, Oetting, Marquis, Bode, & Pae, 1994; Storkel, 2004)
16. Effect of lexical characteristics on phonological treatment
  - a. Research evidence suggests that treatment of a sound in low density words leads to change in the treated sound only
  - b. Research evidence suggests that treatment of a sound in low frequency words leads to change in untreated sounds only
  - c. Research evidence suggests that treatment of a sound in high frequency words leads to change in the treated sound and untreated sounds
  - d. Recommendation: Treat sounds in high frequency words
  - e. Readings: (Gierut, Morrisette, & Champion, 1999; Morrisette & Gierut, 2002)
17. Clinical application child A: Treatment of /r/ in high frequency words (balanced in density)
  - a. Dr. Mitchell Sommers' website (Washington University in St. Louis)  
<http://128.252.27.56/neighborhood/Home.asp>  
Select Item search
  - b. High frequency = 100+ (low frequency = 99-)
  - c. Low density = 9- & High density = 10+
  - d. Searching
    - i. Target box: r% phonology use wildcards
    - ii. Filter options: low frequency 100
    - iii. Variables for output: orthography frequency density B
  - e. Selected words: run (high density), radio (low density), read (high density), river (low density)
18. Clinical application child B: Treatment of /dʒ/ in high frequency words (balanced in density)
  - a. Searching
    - i. Target box: J% phonology use wildcards
    - ii. Filter options: low frequency 100
    - iii. Variables for output: orthography frequency density B
  - b. Selected words: job (high density), justice (low density), j (high density), general (low density)
19. Additional information:
  - a. Klatt -- IPA symbol conversion
    - i. G for /ŋ/
    - ii. y for /j/
    - iii. T for /θ/
    - iv. D for /ð/
    - v. S for /ʃ/
    - vi. Z for /ʒ/
    - vii. C for /tʃ/
    - viii. J for /dʒ/

- b. Varying word position
  - i. Sound% = initial only
  - ii. %sound% = initial, medial, final
  - iii. %sound = final only
- c. Additional filter options
  - i. High frequency: set frequency low filter to 100
  - ii. Low frequency: set frequency high filter to 99
  - iii. High density: set density B low filter to 10
  - iv. Low density: set density B high filter to 9

### Summary (*Holly L. Storkel*)

#### 20. Resources for evidence

- a. ASHA journals on-line <http://www.asha.org/default.htm>
- b. Cochrane collaboration <http://www.cochrane.org/index0.htm>
- c. Word & Sound Learning lab (Storkel, Hoover, Young) <http://www.ku.edu/~wrdlrng/>
- d. Learnability Lab (Gierut, Morrisette) <http://www.indiana.edu/%7Esndlrng/>

#### 21. Conclusion: Evidence from clinical research can enhance clinical practice

#### 22. Word & Sound Learning Lab (Storkel, Hoover, Young) Contact Information

<http://www.ku.edu/~wrdlrng/>  
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### References

*(Many are available on the ASHA website to ASHA-members)*

- Apel, K. (2001). Prologue: developing evidence-based practices and research collaborations in school settings. *Language, Speech, and Hearing Services in Schools, 32*, 149-152.
- De Cara, B., & Goswami, U. (2003). Phonological neighbourhood density: Effects in a rhyme awareness task in five-year-old children. *Journal of Child Language, 30*(3), 695-710.
- Dollaghan, C. (2004). Evidence-based practice myths and realities. *ASHA Leader, April*.
- Forrest, K., Dinnsen, D. A., & Elbert, M. (1997). The impact of substitution patterns on phonological learning by misarticulating children. *Clinical Linguistics & Phonetics, 11*, 63-76.
- Forrest, K., & Elbert, M. (2001). Treatment for phonologically disordered children with variable substitution patterns. *Clinical Linguistics & Phonetics, 15*, 41-45.
- Forrest, K., Elbert, M., & Dinnsen, D. A. (2000). The effect of substitution patterns on phonological treatment outcomes. *Clinical Linguistics & Phonetics, 14*, 519-531.
- Garlock, V. M., Walley, A. C., & Metsala, J. L. (2001). Age-of-acquisition, word frequency, and neighborhood density effects on spoken word recognition by children and adults. *Journal of Memory and Language, 45*, 468-492.
- German, D. J., & Newman, R. S. (2004). The impact of lexical factors on children's word-finding errors. *Journal of Speech, Language, and Hearing Research, 47*(3), 624-636.
- Gierut, J. A. (1998). Treatment efficacy: functional phonological disorders in children. *Journal of Speech, Language, and Hearing Research, 41*, S85-S100.
- Gierut, J. A. (1999). Syllable onsets: clusters and adjuncts in acquisition. *Journal of Speech, Language, and Hearing Research, 42*, 708-726.
- Gierut, J. A. (2001). Complexity in phonological treatment: clinical factors. *Language, Speech, and Hearing Services in Schools, 32*, 229-241.

- Gierut, J. A., & Champion, A. (2001). Syllable onsets II: three-element clusters in phonological treatment. *Journal of Speech, Language, and Hearing Research, 44*, 886-904.
- Gierut, J. A., Elbert, M., & Dinnsen, D. A. (1987). A functional analysis of phonological knowledge and generalization learning in misarticulating children. *Journal of Speech and Hearing Research, 30*, 462-479.
- Gierut, J. A., Morrisette, M. L., & Champion, A. H. (1999). Lexical constraints in phonological acquisition. *Journal of Child Language, 26*, 261-294.
- Gierut, J. A., Morrisette, M. L., Hughes, M. T., & Rowland, S. (1996). Phonological treatment efficacy and developmental norms. *Language, Speech and Hearing Services in Schools, 27*, 215-230.
- Metsala, J. L. (1997). An examination of word frequency and neighborhood density in the development of spoken-word recognition. *Memory and Cognition, 25*, 47-56.
- Miccio, A. W., & Elbert, M. (1996). Enhancing stimulability: A treatment program. *Journal of Communication Disorders: Clinics Issue, 29*, 335-351.
- Miccio, A. W., Elbert, M., Forrest, K. (1999). The relationship between stimulability and phonological acquisition in children with normally developing and disordered phonologies. *American Journal of Speech-Language Pathology, 8*, 347-363.
- Morrisette, M. L., & Gierut, J. A. (2002). Lexical organization and phonological change in treatment. *Journal of Speech, Language, and Hearing Research, 45*, 143-159.
- Morrisette, M. L., & Gierut, J. A. (2003). Unified treatment recommendations on phonological knowledge and normative age-of-acquisition: A response to Rvachew & Nowak (2001). *Journal of Speech, Language and Hearing Research, 46*(2), 382-384.
- Powell, T. W., Elbert, M., & Dinnsen, D. A. (1991). Stimulability as a factor in the phonological generalization of misarticulating preschool children. *Journal of Speech and Hearing Research, 34*, 1318-1328.
- Rice, M. L., Oetting, J. B., Marquis, J., Bode, J., & Pae, S. (1994). Frequency of input effects on word comprehension of children with specific language impairment. *Journal of Speech and Hearing Research, 37*, 106-122.
- Rvachew, S., & Nowak, M. (2001). The Effect of Target-Selection Strategy on Phonological Learning. *Journal of Speech, Language, and Hearing Research, 44*, 610-623.
- Smit, A. B., Hand, L., Freilinger, J. J., Bernthal, J. E., & Bird, A. (1990). The Iowa Articulation Norms Project and its Nebraska replication. *Journal of Speech and Hearing Disorders, 55*, 779-798.
- Storkel, H. L. (2004). Do children acquire dense neighbourhoods? An investigation of similarity neighbourhoods in lexical acquisition. *Journal of Applied Psycholinguistics, 25*, 201-221.
- Storkel, H. L., & Morrisette, M. L. (2002). The lexicon and phonology: Interactions in language acquisition. *Language, Speech, and Hearing Services in Schools, 33*, 22-35.
- Tyler, A. A., & Figurski, G. R. (1994). Phonetic inventory changes after treating distinctions along an implicational hierarchy. *Clinical Linguistics & Phonetics, 8*, 91-108.