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 η w h p b t d
   b. Some knowledge (mid accuracy): l k ɡ v s z tʃ dʒ
   c. Least knowledge (low accuracy): r f θ δ 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): η l r ɡ δ 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, Morissette, Hughes, & Rowland, 1996; Morissette & Gierut, 2003; but see Rvachew & Nowak, 2001)

12. Clinical application child A: 5;0 female, least knowledge sounds: r f θ δ ʃ
    a. Early acquired: f δ
    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: η l r ɡ δ ʃ tʃ dʒ
    a. Early acquired: k ɡ
    b. Late acquired: η l r ɡ δ 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 /ʃ/ or /ts/ in some cases
      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, Morrise) 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
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   Lawrence, KS 66045-7555

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


