

Diagnostic markers for child speech-sound disorders: introductory comments

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Abstract

The four papers in this issue report findings from a research programme on the etiological origins of child speech-sound disorders of currently unknown origin. Overviews elsewhere describe an evolving classificatory framework that posits six putative subtypes within this general domain of communicative disorders (cf. Shriberg, 2002). The following introductory comments provide brief historical and clinical perspectives on the primary objective of this research: the availability of a suite of computer-assisted diagnostic markers that clinicians and clinical researchers can use to classify six etiological subtypes of child speech-sound disorders.

Historical perspectives

Over a quarter of a century ago, Ingram's (1976) synthesis of typical and atypical speech acquisition motivated a change in the cover term used to classify childhood speech-sound disorders of unknown origin. The former classificatory term, *functional articulation disorder*, which reflected poor understanding of the origin of the disorder, was replaced by *developmental phonological disorder*, which claimed explanatory ties to universal grammar.

The theoretical shift from *articulation* to *phonology* during the past 25 years has yielded a number of useful *descriptive linguistic* typologies that have been widely used by clinicians to select and sequence linguistic targets for treatment (cf. Gierut, 1998). During the past decade, several *psycholinguistic* typologies have also been developed to classify proposed *proximal causes* of speech disorders of unknown origin (e.g. Stackhouse and Wells, 1993; Dodd, 1995; Edwards and Lahey, 1998; Edwards, Fourakis, Beckman and Fox, 1999). Such proposals continue to provide

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alternative explanatory frameworks for the acquisition and persistence of speech-sound errors, including deficits at proposed stages of auditory-perceptual, cognitive-memorial and articulatory-motor processing.

To date, the paradigmatic shift from articulation to linguistic and psycholinguistic research has not been accompanied by comprehensive explanatory accounts of the *distal causes* or *etiologies* of child speech-sound disorders. We view the identification of such origins as essential for research goals that include the eventual prevention of child speech-sound disorders. There has been, however, a trend since the mid-1990s toward certain claims about the neurodevelopmental substrates of speech-sound disorders. Notably in the USA, for example, some speech treatment has been based on the hypothesis that some children have significant deficits in variables such as 'oral sensation', 'oral-motor development', 'sensory-motor integration' and other currently unsupported explanatory constructs (see evaluative reviews by Moore and Ruark, 1996; Weismer, 1997; Forrest, 2002; Strand, Hodge and Forrest, 2002). We, too, suggest that such etiological claims lack the research support needed to recommend oral-motor therapy as a necessary or sufficient treatment component for children with common speech delay.

Evidence-based medicine

There is notable impetus within communicative disorders and other health professions for the development and validation of *diagnostic markers* to aid in clinical decision making (cf. Yorkston, Spencer, Duffy, Beukelman, Golper and Miller, 2001; Dollaghan, 2002). The continual development of philosophical views and assessment procedures consistent with this perspective is termed *Evidence-Based Medicine* (EBM) (Sackett, Straus, Richardson, Rosenberg and Haynes, 2000), or more generically, *evidence-based practice*. The goals and methods of each of the four papers in this issue reflect two interrelated tenets of EBM.

First, as in EBM, we submit that accurate differential diagnosis of a patient's disorder, including information on both original and maintaining causes, is *necessary* to determine the optimum form and content of treatment. EBM describes other factors that should be included in treatment decisions, especially the importance of patient perceptions and needs. We suggest that among such factors, accurate differential diagnosis is the core goal for a clinical science and that it can be achieved only with the availability of one or more well-validated diagnostic markers for a disorder or disorder subtype.

The second characteristic of EBM central to the present context is that EBM has a prescriptive literature on the types and ways that quantitative evidence should be used to develop diagnostic markers. For example, EBM stresses the need for metrics such as positive and negative likelihood ratios to guide clinical decision making. Many of these mathematically straightforward metrics of diagnostic accuracy are new to researchers and clinicians in clinical speech pathology. Fortunately, their development and use is increasingly evident across a wide spectrum of disciplines (cf. Sackett *et al.*, 2000). These metrics will likely become increasingly familiar in communicative disorders as they are included in instructional materials in clinical diagnoses. The four studies reported in this issue focus on the identification and development of perceptual markers, and in particular, acoustic markers that have high rates of documented diagnostic accuracy.

Definitions and research aims

The present research defines a paediatric speech-sound disorder of unknown origin as ‘a clinically notable difference in speech-sound acquisition that cannot be explained by significant impairment in cognitive, sensory, motor, structural, or affective functioning’ (Shriberg, 1980). The criterion used for significant speech-sound disorder, termed *Speech Delay* in our studies, is the presence of consonant deletions and substitutions characteristic of Ingram’s (1976) *Phonological Stage III* that persist in a child’s conversational speech past 4 years of age (cf. Shriberg, Gruber and Kwiatkowski, 1994). *Speech Delay* is a highly prevalent communicative disorder that requires significant public health resources for assessment and treatment. A recent epidemiological study estimated that 3.8% of 6-year-old children in the USA meet inclusionary criteria for this classification (Shriberg, Tomblin and McSweeney, 1999).

Relevant background issues for each of the two subtypes of *Speech Delay* addressed in this issue—those posited to be consequent to early recurrent otitis media with effusion and those posited to reflect a deficit in speech praxis—are reviewed in the introductory sections of each of the four papers. The Reference section of this introduction also includes citations for four papers that report acoustic reference data and diagnostic marker findings for two additional subtypes of child speech-sound disorders that do not involve an across-the-board speech delay—dentalized fricative distortions (Flipsen, Shriberg, Weismer, Karlsson and McSweeney, 1999; Karlsson, Shriberg, Flipsen and McSweeney, 2002) and derhotacized rhotics (Flipsen, Shriberg, Weismer, Karlsson and McSweeney, 2001; Shriberg, Flipsen, Karlsson and McSweeney, 2001). The development of acoustic markers for these two disorders is especially motivated by the need to distinguish children with these subtypes from children and family members with a subtype of speech delay posited to be genetically transmitted (cf. Shriberg, 2002). As with other complex behavioural traits, methodological constraints on the genetics of speech disorders include challenging heterogeneities in etiologies, genotypes, endophenotypes and phenotypes (cf. Shriberg, 2003). Associated papers, technical reports and slide presentations concerning this program of research in assessment and etiological classification of children with speech-sound disorders of currently unknown origin are available at <http://www.waisman.wisc.edu/phonology/index.htm>.

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References

- DODD, B., 1995, *The Differential Diagnosis and Treatment of Children with Speech Disorder* (London: Whurr Publishers Ltd).
- DOLLAGHAN, C., 2002, *Evidence-based practice in communication disorders*. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Atlanta, GA, November.
- EDWARDS, J. and LAHEY, M., 1998, Nonword repetitions of children with specific language impairment: exploration of some explanations for their inaccuracies. *Applied Psycholinguistics*, **19**, 279–309.
- EDWARDS, J., FOURAKIS, M., BECKMAN, M. E. and FOX, R. A., 1999, Characterizing knowledge deficits in phonological disorders. *Journal of Speech, Language, and Hearing Research*, **42**, 169–186.
- FLIPSEN, P., JR., SHRIBERG, L. D., WEISMER, G., KARLSSON, H. B. and MCSWEENEY, J. L., 1999, Acoustic characteristics of /s/ in adolescents. *Journal of Speech, Language, and Hearing Research*, **42**, 663–677.
- FLIPSEN, P., JR., SHRIBERG, L. D., WEISMER, G., KARLSSON, H. B. and MCSWEENEY, J. L., 2001, Acoustic phenotypes for speech-genetics studies: reference data for residual /s/ distortions. *Clinical Linguistics and Phonetics*, **15**, 603–630.
- FORREST, K., 2002, Are oral-motor exercises useful in the treatment of phonological/articulatory disorders? *Seminars in Speech and Language*, **23**, 15–26.
- GIERUT, J. A., 1998, Treatment efficacy: functional phonological disorders in children. *Journal of Speech, Language, and Hearing Research*, **41**, S85–S100.
- INGRAM, D., 1976, *Phonological Disability in Children: Studies in language disability and remediation*, second edition (New York: Elsevier Publishing Company, Inc.).
- KARLSSON, H. B., SHRIBERG, L. D., FLIPSEN, P., JR. and MCSWEENEY, J. L., 2002, Acoustic phenotypes for speech-genetics studies: toward an acoustic marker for residual /s/ distortions. *Clinical Linguistics and Phonetics*, **16**, 403–424.
- MOORE, C. A. and RUARK, J. L., 1996, Does speech emerge from earlier appearing motor behaviors? *Journal of Speech and Hearing Research*, **39**, 1034–1047.
- SACKETT, D. L., STRAUS, S. E., RICHARDSON, W. S., ROSENBERG, W. and HAYNES, R. B., 2000, *Evidence-Based Medicine: How to practice and teach EBM*, second edition (Edinburgh: Churchill Livingstone).
- SHRIBERG, L. D., 1980, Developmental phonological disorders. In T. J. Hixon, L. D. Shriberg and J. S. Saxman (Eds), *Introduction to Communicative Disorders* (Englewood Cliffs, NJ: Prentice Hall), pp. 262–309.
- SHRIBERG, L. D., 2002, *Classification and misclassification of child speech sound disorders*. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Atlanta, GA, November.
- SHRIBERG, L. D., 2003, *Toward a phenotype marker for genetically-transmitted speech delay*. Paper presented at the 15th International Congress of Phonetic Sciences, Barcelona, August.
- SHRIBERG, L. D., FLIPSEN, P., JR., KARLSSON, H. B. and MCSWEENEY, J. L., 2001, Acoustic phenotypes for speech-genetics studies: an acoustic marker for residual /s/ distortions. *Clinical Linguistics and Phonetics*, **15**, 631–650.
- SHRIBERG, L. D., GRUBER, F. A. and KWIATKOWSKI, J., 1994, Developmental phonological disorders III: long-term speech-sound normalization. *Journal of Speech and Hearing Research*, **37**, 1151–1177.
- SHRIBERG, L. D., TOMBLIN, J. B. and MCSWEENEY, J. L., 1999, Prevalence of speech delay in 6-year-old children and comorbidity with language impairment. *Journal of Speech, Language, and Hearing Research*, **42**, 1461–1481.
- STACKHOUSE, J. and WELLS, B., 1993, *Psycholinguistic Investigation of Children with Speech and Literacy Difficulties* (London: Whurr).
- STRAND, E. A., HODGE, M. M. and FORREST, K., 2002, *Use of oral-motor treatment in*

articulation and phonological disorders. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Atlanta, GA, November.

WEISMER, G., 1997, *Assessment of oromotor, nonspeech gestures in speech-language pathology: a critical review*. National Center for Neurogenic Communication Disorders Telerounds no. 35.

YORKSTON, K. M., SPENCER, K., DUFFY, J., BEUKELMAN, D., GOLPER, L. and MILLER, R., 2001, Evidence-based medicine and practice guidelines: application to the field of speech-language pathology. *Journal of Medical Speech-Language Pathology*, **9**, 243–256.

