

Management of speech impairment in children: The journey so far and the road ahead

ELISE BAKER

School of Communication Sciences and Disorders, The University of Sydney, Australia

Abstract

The management of speech impairment of unknown origin in children requires speech-language pathologists (SLPs) to make a number of important clinical decisions. These decisions revolve around assessment, analysis, diagnosis and intervention. Ideally, clinicians should be guided in their clinical decision making by the best available published evidence. Over 30 years ago, this was a relatively straightforward task. Most children's speech problems were assessed and analysed from an articulation perspective, and children were provided with articulation-based intervention. Since the paradigm shift from articulation to phonology, it could be argued that clinical decision making has become challenging. This challenge is not due to a limitation of options for children with unintelligible speech, but due to a plethora of knowledge and approaches for assessment, analysis, diagnosis and intervention. This paper summarizes the current state of knowledge in the management of speech impairment in children. The benefits as well as the difficulties associated with having such a plethora of knowledge are explored, followed by a discussion of possible pathways for both clinicians and researchers. It is proposed that more comparative research is needed to make sense of the increasing diversity in the field.

Keywords: *Speech impairment, phonology, assessment, intervention.*

Introduction

Children with speech impairment of unknown origin have a fascinating problem. Despite the fact that they can detect speech sounds and have no obvious physical problem with their articulators, their speech is often difficult to understand. Take Jarrod, a 7 year old boy with an intriguing phonological system. He pronounces car as [p^ha\], pig as [beɪ\] and [beə\] and girl as [dʒu\ /] and [gʒu\ /]. Children like Jarrod present speech-language pathologists with two challenges. One is to understand the nature of the problem, and the other is to successfully treat the problem.

Prior to the 1970s, children with unintelligible speech were routinely diagnosed as having an articulation impairment, and as such were provided with intervention targeting articulation skills (e.g. Scripture & Jackson, 1927; Van Riper, 1939; Young & Stinchfield-Hawk, 1938). Clinical decision making was relatively straightforward. Then, in a major paradigm shift, Ingram's (1976) seminal work *Phonological Disability in Children* changed the focus of the problem to the phonological system. Children were no longer viewed as having a difficulty with the articulation of individual speech sounds. Rather, they were viewed as having a linguistic problem with the

organization and use of phonemes to signal meaning (Howell & Dean, 1994). That is, the shift changed the focus from the mouth to the mind (Grunwell, 1983).

Thirty years after Ingram's (1976) seminal work on child phonology, the challenge to understand and treat speech-sound problems in children has become more complex. It is not that we have no way forward with children like Jarrod, but rather we have a smorgasbord of approaches to choose from. The purpose of this paper is to consider the current state of knowledge in the area of speech impairments in children. The benefits as well as the difficulties associated with having such a plethora of knowledge are explored, followed by a discussion of possible ways forward for both clinicians and researchers.

Management of speech impairments in children: The journey so far

Management of speech impairment of unknown origin in children has an interesting history. As highlighted earlier, the most revolutionary moment in the journey so far, has been the paradigm shift from articulation to phonology. According to K. Bleile (personal communication, 2 February 2006), this shift to phonology was preceded by a

shift in the clinical population. During the 1960s and 1970s clinicians began to treat younger children. They began to see preschoolers with more severe and unintelligible speech compared with the children they saw on school-age caseloads. Although the articulation perspective offered an approach for diagnosis and intervention with the preschool population, it was inefficient. The work by Ingram and other early phonologists offered clinicians an appealing and sensible alternative to articulation. Phonology opened the door to a new way of thinking about children with unintelligible speech. As a consequence, children once diagnosed with an articulation impairment were diagnosed as having a phonological impairment (Elbert, 1997). According to Grunwell (1997), this change in diagnostic terminology reflected a strong clinical motivation to dissociate phonetics (aligned with articulation-based problems) from phonology (aligned with linguistically-based problems).

In addition to this change in diagnosis, assessment practices changed and order was found in the disorder (Grunwell, 1997). The change was primarily reflected in the way that speech samples were analysed. Prior to the shift, speech samples were analysed phoneme by phoneme. Errors were described as substitutions, omissions, distortions or additions of phonemes. Children's speech-sound problems were described on the basis of the number of errors they exhibited (e.g. multiple articulation errors). Phonology offered a different perspective. Phonologically-based analysis identified patterns of difficulty. Although distinctive features and generative phonological rules were used to identify and describe these patterns, Stampe's (1979) notion of the phonological process became the most widely accepted and applied analysis approach (Edwards, 1997). Phonological processes served to group error patterns into categories of difficulty such as the deletion of final consonants or the use of stops for fricatives. The labels used to represent these error patterns provided a user-friendly way of applying the comparatively more complex perspective offered by phonology (Elbert, 1997).

Principles of intervention also changed, in that the overall goal was not that children learned how to articulate individual phonemes but that children's phonological systems changed through a process of phonological generalization. This concept of phonological generalization emerged from a small collection of studies conducted during the late-1960s and early-1970s which indicated that untreated sounds sharing features similar to treated sounds changed without direct treatment (e.g. Elbert & McReynolds, 1978; 1979; Elbert, Shelton, & Arndt, 1967; McReynolds & Bennet, 1972; McReynolds & Huston, 1971). The findings from this research suggested that patterns of generalization were indicative of a change in children's phonological systems rather than an improvement in their ability to articulate. Generalization

probes of untrained but related phonemes became a standard feature of clinical and research practice (Elbert & Gierut, 1986). The occurrence of phonological generalization became the hallmark of an effective phonologically-based intervention (Elbert, 1997). The ultimate outcome of this shift from articulation to phonology during the 1970s and early-80s was an improvement in the efficiency of intervention. Preschool children with a phonological impairment of unknown origin characterized by highly unintelligible speech were reported to become intelligible in less than 2 years given phonologically-oriented intervention as opposed to 5 or 6 years given more traditional phonetic-oriented intervention (Hodson, 1998).

Since the 1990s, the field has witnessed an explosion of approaches for managing speech impairments of unknown origin in children. It would seem that all areas of management from assessment, analysis, diagnosis and target selection through to intervention have been ardently investigated. One issue that continues to attract controversy is the differential diagnosis of speech impairment (Kamhi, 2005). What exactly is a speech impairment of unknown origin? Is it primarily a linguistic problem warranting the label of a phonological impairment? Is it primarily a motor-based problem warranting the label of an articulation impairment? During the 1980s and 90s the theoretical divide and diagnostic application of the terms articulation and phonology was keenly debated by researchers in discussion papers, clinical forums and texts (e.g. Bleile, Folkins, Fey & Locke, 1996; Edwards, 1992; Elbert, 1992; 1993; Fey, 1985; 1992; Folkins & Bleile, 1990; Grundy, 1989; Hodson, 1992; 1997; 1998; Hoffman, 1992; Kamhi, 1992; McCauley, 1993; Schwartz, 1992; Shelton, 1993; Shriberg, 1994a).

Over the past decade, research on the diagnosis of speech impairment would seem to have moved beyond this dichotic notion of the problem being either articulatory or phonological, to one of multiple diagnostic subgroups. Mounting research indicates that subgroups exist (e.g. Broomfield & Dodd, 2004; Crosbie, Holm, & Dodd, 2005; Fox & Dodd, 2001; Goldstein, 1996; Hauner, Shriberg, Kwiatkowski, & Allen, 2005; Raitano, Pennington, Tunick, Boada, & Shriberg, 2004; So & Dodd, 1994; Shriberg, 2004; Shriberg, Lewis, Tomblin, McSweeney, Karlsson, & Scheer, 2005; Zhu & Dodd, 2000). However, there is yet to be consensus on what the subgroups are and how they are best differentially diagnosed. For example, Dodd (1995) proposed a symptomatic classification system with psycholinguistic underpinnings. It includes four subgroups of speech impairment: phonological delay, consistent deviant phonological disorder, inconsistent deviant phonological disorder, and articulation disorder. In a more recent publication exploring these four subtypes, Broomfield and Dodd (2004) expanded the

classification system to include a fifth subgroup, childhood apraxia of speech (CAS). Shriberg (1994b) proposed an aetiologically-based classification system of five subgroups of speech impairment: speech delay–genetic origin (SD–gen), speech delay–otitis media with effusion (SD–OME), speech delay–apraxia of speech (+/– dysathria) (SD–AOS), speech delay–developmental psychosocial involvement (SD–DPI), and speech errors (“residual errors”) (SE). These two different approaches to classification and differential diagnosis along side the variety of diagnostic labels used in published intervention studies on children with unintelligible speech highlight the ongoing debate and need for further diagnostic research. Jarrod’s case, in this special issue (Holm & Crosbie, 2006), provides a fine example of the diagnostic challenge facing researchers and practising speech-language pathologists. Jarrod presents with phonological and motoric difficulties. He occasionally has different realizations of the same word (e.g. thumb as [θλ̩n̩^dʌ] and [bλ̩m ʌ]) suggesting an element of inconsistency. Jarrod also has an interesting constellation of possible aetiologies—with a positive family history, alongside a positive history of glue ear. Whatever the diagnostic label, whatever the symptoms and whatever the underlying cause, a wealth of approaches are available to assess, analyse and treat unintelligible speech.

In terms of assessment and analysis, since the 1990s there has been an upsurge in theoretical applications to unintelligible speech. Not only have an array of phonological theories been applied to child phonology by different researchers, such as Bernhardt and Stemberger’s (1998; 2000) application of constraint-based nonlinear phonology, Gierut and Morrisette’s (2005) application of optimality theory, and Ball’s (1997, 2002) applications of dependency phonology, government phonology and gestural phonology, but the pendulum would also seem to have swung back to re-embrace the motor side of speech (Kamhi, 2005). The application of more sophisticated phonological theories has resulted in greater understanding of children’s phonological systems, and as such the identification of more carefully targeted goals (e.g. Baker & Bernhardt, 2004; Bernhardt, 1992). In addition, the once dichotomous platform of articulation and phonology has been expanded with the application of diverse theoretical orientations. For instance, Norris and Hoffman’s (2005) neuro-networking constellation model attempts to account for the inseparable role of phonology within the broader context of language learning. Stackhouse and Wells’ (1997, 2001) application of psycholinguistics to speech and literacy difficulties is another example. A psycholinguistic perspective not only considers speech production, but attempts to account for the underlying processes involved in the perception, storage and production of spoken and written language (Baker, Croot, McLeod, & Paul, 2001). Stackhouse

and Wells’s approach to psycholinguistic assessment uses a theoretical model ‘from which hypotheses about the level of breakdown leading to the speech difficulties can be generated and systematically tested’ (Pascoe, Stackhouse, & Wells, 2005, p. 190). Intervention then strategically targets the identified levels of breakdown, bearing in mind the individual’s processing strengths and weaknesses. The outcome of much of this research has been increased sophistication in the way that children’s speech problems are assessed and speech samples are analysed.

One other area of research from the past decade that has posed a challenge to traditional clinical practice has been the identification and prioritization of intervention targets. Traditionally, stimutable and early developing phonemes have been prioritized for intervention. Gierut and colleagues’ work on the Learnability Project has shown that intervention targeting more complex aspects of a child’s phonological system, such as non-stimutable, later developing phonemes associated with least productive phonological knowledge may result in greater system-wide phonological generalization, and as such more efficient gains over the course of intervention (Gierut, 2001; 2004a, 2004b, 2005). Despite these research findings, it would seem that speech-language pathologists (SLPs) continue to select intervention targets in line with traditional methods of practice (McLeod & Baker, 2004; Murray, Baker, & McCabe, in preparation). This may in part be due to conflicting research findings (e.g. Rvachew & Nowak, 2001) alongside the existence of other approaches to goal selection and prioritization (e.g. Bernhardt & Stemberger, 2000; Hodson & Paden, 1991). An interesting extension of this work by Gierut and colleagues has been the impact of word type, in terms of frequency and neighbourhood density, on treatment progress. In particular, Morrisette and Gierut (2002, p. 153) reported that “if the ultimate goal is to promote system-wide change in the phonology, then the best targets are likely to be high-frequency words”.

Paralleling the research on the assessment and analysis of children with speech impairments has been growth in the number of approaches to intervention. In the 1980s, speech-language pathologists typically chose between articulation therapy, minimal opposition contrast (Weiner, 1981) or the cycles approach (Hodson & Paden, 1983). Since the 1990s, this range has expanded with at least 22 different published approaches to choose from (see Table I).¹ Of the approaches listed in Table I, each consists of a unique combination of procedures—some of which are common to other approaches and some which are unique to the particular approach. Most approaches primarily have a linguistic basis. For instance, PACT therapy (Bowen & Cupples, 1999; 2006) consists of procedures common to minimal oppositions contrast, cycles and Metaphon,

Table I. A selection of approaches for treating speech impairment of unknown origin in children.

Phonologically-based Interventions

- Constraint-based nonlinear phonological intervention (e.g. Bernhardt, 1992; 1994; Bernhardt & Stemberger, 2000)
- Core vocabulary (e.g. Dodd & Bradford, 2000)
- Cycles (e.g. Hodson & Paden, 1983; Tyler, Edwards, & Saxman, 1987)
- Empty set (e.g. Gierut, 1991)
- Imagery therapy (e.g. Klein, 1996)
- Maximal oppositions contrast (e.g. Gierut, 1990)
- Metaphon (e.g. Howell & Dean, 1984)
- Metaphonological intervention (e.g. Hesketh, Adams, Nightingale, & Hall, 2000; Major & Bernhardt, 1998)
- Minimal opposition contrast (minimal pairs) (e.g. Weiner, 1981)
- Mnemonic approach for targeting polysyllables (e.g. Young, 1987; 1995)
- Multiple opposition contrast (e.g. Williams, 2000a; b; 2005a; b)
- Natural speech intelligibility training (e.g. Camarata, 1993; 1995)
- Parents and children together (PACT) (e.g. Bowen & Cupples, 1999)
- Phonotactic therapy (e.g. Velleman, 2003b)
- Pressure points phonological intervention (Smit, 2004)
- Psycholinguistically-based intervention (Pascoe, Stackhouse, & Wells, 2005; Stackhouse & Wells, 1997; 2001)
- SAILS Program (e.g. Rvachew, 1994; 2005)
- Treatment program for enhancing stimulability (e.g. Miccio, 2005)
- Whole language therapy (e.g. Hoffman, Norris & Monjure, 1990; 1996)

Motorically-based interventions

- Traditional articulation therapy (e.g. van Riper, 1939)
- PROMPT (e.g. Chumpelik, 1984; Dodd & Bradford, 2000)

within a family-centred focus. A relatively smaller number of approaches have a motoric basis. For instance, PROMPT (Prompts for Restructuring Oral Muscular Phonetic Targets) is a multisensory approach involving tactile-kinaesthetic stimulation in addition to auditory and visual modelling (Chumpelik, 1984; Dodd & Bradford, 2000; Hayden, 2006). Furthermore, some intervention approaches adhere to a particular theoretical orientation for analysis and identification of intervention targets, while others do not. For instance, Williams's (2005b) systemic approach to target selection is used in conjunction with the multiple opposition intervention approach (Williams, 2005a, 2006).

Management of speech impairments in children: The road ahead

As we look down the road ahead, is this diversity a good thing? On the one hand yes. Without ongoing research the field would still be considering all children with unintelligible speech from an articulation perspective. Improvements in the efficiency of intervention would not have been made, and we would not have discovered the role of phonology in unintelligible speech. Diversity is also necessary given the fact that children with unintelligible speech are heterogeneous. The small body of clinical research that has compared intervention approaches has indicated that some approaches are better suited to some child over other approaches. For example, Gierut (1991) reported that non-homonymous word pairs containing two unknown sounds to a child (i.e. empty set) facilitated more widespread phonological change compared with homonymous word pairs consistent with traditional minimal opposition

contrast therapy. Tyler, Edwards and Saxman (1987) reported that children who exhibit multiple phonological processes may be better suited to the cycles approach whereas children who exhibit one particular pervasive process may be better suited to minimal pairs therapy. Tyler and Sandoval (1994) demonstrated that for children with concomitant phonological and language impairment, a modified cycles approach using minimal pairs combined with indirect narrative intervention was more effective and efficient compared with one approach targeting one domain. Dodd and Bradford (2000) and Crosbie et al. (2005) both reported that the core vocabulary approach was more effective for children with inconsistent deviant phonological disorder compared with phonological contrast (minimal pairs) therapy; whereas, phonological contrast therapy was more effective for children with consistent deviant phonological disorder. Interestingly, Masterson and Daniels (1991) reported that in the one child, a motoric approach was more effective for one particular speech error while minimal pairs therapy was more effective for another speech error. Williams' (2000b) research also indicates that different approaches may be needed at different points in time over the course of intervention for some children. To suggest that one approach fits all, and have all researchers follow one line of inquiry would be remiss of a relatively young field. It would quash the ingenuity and benefit of new investigations. It would also neglect the mounting body of evidence that children with speech impairment each have a unique combination of symptoms that requires consideration in the development of individualized management plans. Baker and Bernhardt (2004) and Baker and McLeod (2004) provide helpful case

examples of the need to consider the individual when managing children with a speech impairment of unknown origin.

On the other hand, one could argue that the current diversity of approaches for managing speech impairments in children is overwhelming. For the practising clinician, the wealth of knowledge readily available on assessment, analysis and intervention could be seen as a smorgasbord from which one can pick and chose. Whether clinicians return to the smorgasbord to select a familiar dish, or try out something new is the challenge. The gap between research and practice suggests that speech-language pathologists tend to select the familiar (McLeod & Baker, 2004; Murray et al., in preparation). Ideally, published research should guide clinicians in their decision making as they face the smorgasbord. It should provide insight into how clinicians can most effectively *and* efficiently help children with unintelligible speech become intelligible.

In the current climate of accountability where words like “efficacy”, “outcomes” and “evidence-based practice” (EBP) echo down to the corridors of speech-language pathology departments, clinicians need to maintain a steady momentum in reading and critiquing published research in order to make clinical decisions that meet the gold standard of best practice. However, for the busy clinician, the momentum required to maintain an up-to-date knowledge based can be difficult to sustain. Vallino-Napoli and Reilly (2004) conducted a survey of 378 speech pathologists in Victoria, Australia regarding their perceived barriers to EBP. The greatest barrier was insufficient time to read and learn how to utilize research, with at least 88% of participants agreeing this was a problem. It would seem that the time required to read *and* critique published treatment research tends to be sacrificed by the pressure and immediate need to treat clients.

In an active and evolving field like speech impairment in children, a drop in the momentum required to maintain an up-to-date knowledge-based may result in patchy knowledge. This in-turn could jeopardize evidence-based decision-making, and overtime, result in clinical practice that is out-of-date. When faced with a particularly intriguing client like Jarrod (Holm & Crosbie, 2006), the challenge is even greater. One way busy SLPs could overcome such difficulties is to consider expert opinion. This issue of *Advances in Speech-Language Pathology* provides a unique opportunity for clinicians to canvas an array of perspectives for managing speech impairment in children from key researchers in the field.

What does this diversity mean for the researcher? Should researchers continue to follow their own lines of inquiry? Absolutely. Although non-randomized experimental and non-experimental studies have been published attesting to the efficacy of many intervention approaches (Gierut, 1998), higher levels of evidence are needed such as randomized

controlled trials and systematic reviews (Baker & McLeod, 2004). Researchers also need to identify the relative contribution or importance of individual procedures within approaches. As Olswang (1998) points out, we have relatively little knowledge as to what it is within various intervention approaches that makes them work. We need to conduct systematic and controlled investigations on the necessity of procedures within approaches.

In addition to pursuing their own lines of inquiry, researchers need to consider their own approach in light of others’ research. We already have evidence that an approach that considers a child’s phonological system is more efficient compared with articulation therapy (Klein, 1996). As highlighted previously, we also have evidence to suggest that some approaches are better suited to some children than others. To help make sense of the diversity, more comparative research is needed. We need to sift through the explosion of diverse theoretical orientations to better understand which approaches are suited to which particular children, as well as which approaches if any are actually superior in terms of efficacy. Could it be that intervention goals identified via constraint-based nonlinear analysis lead to more efficient outcomes compared with traditional phonological process analysis (see Baker & Bernhardt, 2004, for a case study example)? Could it be that multiple oppositions along side a systematic approach for target selection leads to more efficient gains compared with another approach? Given the emerging findings about diagnostic subgroups, could it be that more in-depth assessment and differential diagnosis is needed to select an intervention that addresses an individual child’s need for intervention with a phonological and/or motoric-basis? Perhaps children of different ages have different needs as their articulatory and phonological skills mature. Toddlers may have different intervention needs compared with preschoolers, compared with school-age children. Moreover, given what we know about the short and longer term outcomes for children with phonological impairment (e.g. Dodd & Gillon, 2001; Felsenfeld, Broen, & McGue, 1992; 1994) could it be that the theoretically broader perspective offered by psycholinguistics is needed to identify and treat underlying phonological processing deficits known to contribute to future literacy difficulties for some children? Conversely, research may indicate that a number of approaches are equally effective.

The conduct of comparative research is a relatively daunting task, given the range of approaches for assessing, analysing, diagnosing and treating speech impairments in children. However, until different research teams can come together and compare approaches, the diversity may remain intriguing but somewhat confusing to practising SLPs. The smorgasbord needs to be better organized, and the newer more efficient approaches need to be appealing and accessible for clinicians, so that changes to

everyday clinical practice are made. In Kamhi's (2005) reflection on the different perspectives for managing phonological impairments in children, he commented that "there are too many ways to improve speech, and these approaches are often theoretically incompatible with one another" (p. 221). This may well be the case, however, until we can sort through these different ways, we will not know what best suits particular children and what are the gold standards of best practice. This issue of *Advances in Speech-Language Pathology* embraces this challenge by considering how diverse approaches would manage a speech impairment in the same child.

Note

1 This does not include the range of approaches for treating childhood apraxia of speech (CAS). Readers are referred to Caruso and Strand (1999) and Velleman (2003a) for information on assessment, diagnosis and treatment of CAS.

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