

INTERVENTIONS for
**Speech
Sound
Disorders**
in CHILDREN

2ND
EDITION

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Foreword by Caroline Bowen



INTERVENTIONS for Speech Sound Disorders in CHILDREN SECOND EDITION

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Introduction

A. Lynn Williams, Sharynne McLeod, and Rebecca J. McCauley



Speech sound disorders (SSD) in children are a widespread, high-prevalence disability (Eadie et al., 2015; Law, Boyle, Harris, Harkness, & Nye, 2000; McLeod, Harrison, McAllister, & McCormack, 2013) that comprises 40% to 70% of the caseload of speech-language pathologists (SLPs) who work in pediatric settings (Furlong, Serry, Erickson, & Morris, 2018; Joffe & Pring, 2008; McLeod & Baker, 2014). SSD are diverse and vary in both severity and type and often co-occur with other disabilities, such as language and literacy impairments. Following is a comprehensive definition of SSD that is used throughout this book:

Children with speech sound disorders can have any combination of difficulties with *perception*, *articulation/motor production*, and/or *phonological representation* of speech segments (consonants and vowels), *phonotactics* (syllable and word shapes), and *prosody* (lexical and grammatical tones, rhythm, stress, and intonation) that may impact speech *intelligibility* and *acceptability* . . . speech sound disorders is used as an umbrella term for the full range of speech sound difficulties of both known (e.g., Down syndrome, cleft lip and palate) and presently unknown origin. (International Expert Panel on Multilingual Children's Speech, 2012, p. 1, emphasis added)

This definition of SSD aligns closely with definitions of SSD from the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5; American Psychiatric Association, 2013) and the *International Classification of Diseases, 11th Revision* (ICD-11; World Health Organization [WHO], 2018) except that, in this book, we also include children with known causes for their SSD (e.g., cerebral palsy). A number of the authors have used the following classification from McLeod and Baker (2017) to describe the breadth of SSDs: phonology (phonological impairment and inconsistent speech disorder) and motor speech (articulation impairment, childhood apraxia of speech, and childhood dysarthria).

The breadth and complexity of SSD present a considerable challenge for SLPs to differentially diagnose the type of SSD and determine the most appropriate intervention approach for a given child, especially when there are a number of published approaches from which to select. Similar to the first edition, this book uses a prescribed template to describe a number of intervention approaches that were developed for the range of SSD that SLPs may encounter in their practice. This template facilitates critical comparisons across interventions in terms of client populations and key elements as well as levels of evidence. As in the first edition, this organization may be useful for different groups of readers who will likely read the book with different goals in mind. In particular, we expect this book will be of interest to four different groups: 1) students of speech-language pathology;

2) clinical practitioners who work with children with SSD; 3) faculty and clinical educators who teach students about SSD in children; and 4) parents of children with SSD. The chapter begins with a description of the purpose of the book followed by an overview of the template and organization of each intervention chapter, with recommended sections for different readers. Next, a structural framework for intervention is described to aid in the understanding of the components of each intervention. Finally, the chapter ends with a list of references for several core components that are foundational to working with children with SSD.

THE PURPOSE OF THIS BOOK

Clinical decision making is defined as choosing among available alternatives and involves collection, interpretation, and evaluation of data in order to make an evidence-based decision (Tiffen, Corbridge, & Slimmer, 2014). A growing body of literature demonstrates that explicit training in clinical decision-making skills is required for novice clinicians (Dudding & Pfeiffer, 2018; Finn, 2011; Furlong, et al., 2018; Ginsberg, Friberg, & Visconti, 2016; Hill, Davidson, & Theodoros, 2012). This is a critically important skill for students and practitioners to develop in making evidence-based clinical decisions in selecting intervention approaches, especially when there are a number of published approaches from which to select. Baker and McLeod (2011) identified 42 different intervention approaches for children with SSD. While there is empirical evidence that most studied interventions are effective, no single approach has proven to be the most effective. This adds to the overwhelming nature of the decision that both novice and experienced clinicians face in determining which approach to select from an array of approaches. The variety poses a challenge for SLPs: knowing which approaches best suit the children with SSD on their caseloads and understanding how to implement the approaches with fidelity. Further, different approaches may be better suited to specific degrees and types of impairments (see Table 1.1) or at different points within the continuum of intervention for a given child (Baker, McCauley, Williams, & McLeod, 2020). So, the question is, How do clinicians determine which intervention approach is the best one to use with their client? That is where this book comes in.

A primary purpose of this book is to describe and critically analyze a range of intervention approaches used for children with SSD. A second, equally important, or even *more* important, purpose is to help readers learn skills that will enable them to examine and critically evaluate these and other approaches *for themselves*. Thus, in response to the previous question, our goal with this book is to provide SLPs with sufficient information about each intervention approach so that they can align the clinical characteristics of their client's SSD to the intervention approach that best addresses those needs. Furthermore, we do not believe that a single intervention approach will be the sole intervention for any child with SSD. As readers will learn through reading about the various approaches in this book, several interventions are designed as transitional methods to help children progress from emerging sound systems to elaborating their sound systems.

Both of these purposes provide compelling rationales for a book because of the complexity of SSD and because children with SSD comprise a heterogeneous population. SSD are diverse, varying in both severity and type (articulation, phonological, and motor speech).

To introduce readers to an extensive range of interventions for SSD, we invited 20 groups of authors from around the world to write chapters about interventions they have developed and/or tested. Consequently, the book contains chapters by the world's foremost SLP researcher-clinicians from the United States, Canada, Scotland, Ireland, England, Australia, New Zealand, and South Africa. The interventions were selected on the basis of

Table 1.1. Breadth of speech sound disorders included in this book

Primary populations	Children with: Articulation delay/disorder Phonological delay/disorder Inconsistent speech disorder Speech impairment Phonological/morphological disorder Phonological/language disorder Phonological/phonological awareness/literacy impairment Repaired cleft lip and palate Childhood apraxia of speech Motor speech disorders, including childhood apraxia of speech and developmental dysarthria
Secondary populations	Children with: Craniofacial anomalies Hearing loss Sensorimotor impairments Cerebral palsy Tongue thrust Intellectual impairment, including children with Down syndrome Congenital conditions associated with developmental dysarthria, such as conditions affecting the cranial nerves, and early onset muscular dystrophy

their empirical evidence, or potential efficacy, as well as their widespread use across ages, severity levels, and populations. Included are approaches encompassing interventions that focus on sound production accuracy, systemwide restructuring of the child's phonology, coexisting speech and language or speech and literacy impairments, articulation, motor speech, and perceptual training, as well as biofeedback and digitally based interventions.

THE BOOK'S OVERALL ORGANIZATION

We begin this edition of the book with a chapter by Baker and Williams (Chapter 2) with a guide for readers on how to learn about the various interventions discussed in the book and how to implement those interventions with fidelity. The framework from the Phonological Intervention Taxonomy (Baker, Williams, McLeod, & McCauley, 2018) is used to help both novice and experienced clinicians gain a deeper, richer understanding of the elements that comprise each intervention by considering four broad domains: Goals, Teaching Moment, Context, and Procedural Issues. The remainder of the book is devoted to the description of 21 intervention approaches. Given the diversity and complexity of these interventions, we have not attempted a categorization. An imposed classification of individual approaches would not be based on a definitive or agreed-upon set of categories, and classifications would differ among readers as well as among the developers of the approaches. Instead, the interventions are independent of each other and can be taught and learned in the sequence that matches readers' goals and needs. However, as in the first edition, we have synthesized the information across all 21 approaches in a grid format both to help you identify approaches you want to explore further and to provide a snapshot comparison of the approaches. The appendix to Chapter 1, available online, synthesizes and summarizes many of the

most salient features of each intervention approach in terms of the *developmental level* of the child's sound system (emerging, developing, and elaborating), the *targeted stage of production* of the intervention (planning, programming, and/or execution), and the *targeted outcomes* of the intervention (speech production, speech perception, phonological awareness, other oral language, and/or literacy). This strategy gives you the big picture of all 20 approaches so that you can then move to more focused reading of specific intervention approaches.

Three key features of the intervention chapters will be of special interest to readers:

1. Organization of each chapter using standard headings, which increases the ease of reading and learning about the interventions and enables comparisons among approaches. These headings, particularly Practical Requirements and Key Components, should also facilitate implementation of interventions once they are chosen as appropriate for a given child.
2. Evaluation of each approach within an evidence-based practice (EBP) framework that examines the levels of evidence—and the quality of evidence—for each approach. This information helps readers gauge the strength of an intervention's empirical base, thus allowing them to determine an intervention's likely benefit for appropriate children.
3. Inclusion of demonstration videos for almost all of the intervention approaches. The use of intertitle text slides in each video provides a guide for viewers to understand what is occurring in segments of the demonstration, which can be related back to the text in the Practical Requirements and Key Component sections.

THE ORGANIZATION OF INDIVIDUAL INTERVENTION CHAPTERS

To provide uniformity across approaches, authors of individual intervention chapters were invited to use the same template, with its prescribed specific headings and expected content. The standardization of headings across chapters promotes easy access to and evaluation of important information about each approach, thus facilitating decisions concerning treatment efficacy, clinician expertise, and clients' preferences—the triad of considerations within EBP (Dollaghan, 2007; Sackett, Rosenberg, Gray, Hayes, & Richardson, 1996). The current template was modified slightly from the one used in the first edition on the basis of reviews and feedback we received from readers. Table 1.2 describes the current template in terms of the headings and content.

Target Populations

Following an abstract and brief introduction, each chapter describes the primary populations for which the intervention is designed as well as any secondary populations—especially those for which there is empirical support or theoretical support for its use. Client populations are described in terms of age or developmental range and prerequisite skills required for use of the approach or program. Other considerations, such as child's attention span, ability to imitate, and ability to follow complex directions, are described.

Assessment and Analysis Methods

In this section of their chapter, authors describe any assessment methods used to establish the appropriateness of the intervention for the individual child, including what analyses are completed. When assessment methods associated with determining the appropriateness of

Table 1.2. The template: Components of each chapter

Section heading	Content
Target Populations	Description of population(s) for which empirical and/or theoretical support of the intervention is available (e.g., in terms of age, major disability, prerequisite skills)
Assessment and Analysis Methods	Standardized and/or informal measures used and the type of analysis completed Assessment linked to ICF-CY model to address other aspects assessed beyond Body Structure and Body Function (e.g., Activities and Participation)
Theoretical Basis	The dominant rationale for the intervention Assumptions made about the deficits, compensatory strategies, or strengths that are targeted Nature of outcomes targeted (e.g., positive effect on social roles, decreased functional limitation) Area of functioning being targeted (e.g., intelligibility, movement for speech), including the nature of the outcomes targeted within the ICF-CY framework
Empirical Basis	Summary and interpretation of studies Study descriptions that provide information about participants and the study design, including an evaluation of the quality of the experimental designs using PEDro (group designs) and RoBiNT scales (single-subject designs) Level of evidence table providing a quick reference to the strength of the designs included in this section, tabled according to whether or not the studies support the intervention
Practical Requirements	Time demands Personnel demands, including training, for both professionals and family members Type of sessions (e.g., group, individual) Frequency and duration of sessions (dosage)
Key Components	Target selection approach, including impairment-based and social-based goals Types of goals targeted (e.g., production of a specific sound, improved phonological awareness) Goal attack strategy for addressing multiple goals (sequential, cyclic, simultaneous) Procedures (therapeutic actions of the primary clinician, who may be a professional or family member depending on the approach) Activities in which procedures are embedded (e.g., storybook reading, play, conversation, structured repetition) Materials used in the intervention List of general therapy steps, often including a flowchart to convey this information Roles of secondary personnel (e.g., teachers, family members, the clinician for family-based interventions)
Monitoring Progress and Generalization	Recommendations for data collection and for how decisions are made regarding the alteration of goals, methods, stimuli, termination of therapy, and so forth Include ICF or ICF-CY framework in measuring outcomes to include changes in participation

(continued)

Table 1.2. (continued)

Section heading	Content
Considerations for Children from Culturally and Linguistically Diverse Backgrounds	Applicability of approach to children of different linguistic and cultural backgrounds Recommended ways in which the intervention can be adapted to better meet child and caregiver needs
Case Study	Description of one or more children for whom the intervention was helpful (used to illustrate children's responses to the intervention and ongoing decision making) Inclusion of first-hand accounts from parents/families/children regarding the impact of intervention
Learning Activities	Two to three activities that help readers apply information about the intervention approach
Future Directions	Recommendations for areas of further study regarding the intervention; these may include additional populations for which it may be useful
Summary	Main takeaway points of the intervention approach
Suggested Readings	Three to five readings providing additional information about the intervention's theoretical or empirical basis or its procedures
References	Bibliographic references of in-text citations

Key: ICF, *International Classification of Functioning, Disability, and Health* (World Health Organization [WHO], 2001); ICF-CY, *International Classification of Functioning, Disability, and Health – Children and Youth Version* (WHO, 2007); PEDro, Physiotherapy Evidence Database (Verhagen et al., 1998); RoBiNT, Risk of Bias of N-of-1 Trials (Tate et al., 2013)

the approach to the child are particularly detailed, authors use citations to supplement a brief overview of the methods.

Finally, authors address whether assessment also focused on the impact of the SSD on the child's activities and participation. Interest in this expansion beyond the level of the speech impairment arises from work by WHO (2007) in the form of the *International Classification of Functioning, Disability and Health—Children and Youth Version* (ICF-CY). The ICF-CY is a framework that provides an international interdisciplinary language of health and health-related issues for children that allows for the holistic consideration of the biopsychosocial issues facing children. Over the past 40 years, WHO has been working to create a holistic approach for all people, of all ages, across all nations, from a perspective of health and wellness providing a common language for comparison of data across countries, health-care disciplines, services, and time; to provide a systematic coding scheme for health information systems; and to provide a scientific basis for consequences of health conditions. The *International Classification of Functioning, Disability and Health* (ICF; WHO, 2001) and ICF-CY have been endorsed by many professional associations throughout the world, including the American Speech-Language-Hearing Association in the *Scope of Practice in Speech-Language Pathology* (ASHA, 2016) and the *Scope of Practice in Audiology* (ASHA, 2018), the Royal College of Speech and Language Therapists (RCSLT), the Speech-Language and Audiology Canada (SAC), and Speech Pathology Australia (SPA), and have broad relevance to these professions (Blake & McLeod, 2018). The ICF and ICF-CY comprise the following interrelated components: Body Functions, Body Structures, Activities and Participation, Environmental Factors, and Personal Factors. Each of these factors relates to children with SSD, who are the focus of this book. An example of the application of the ICF-CY to a 7-year-old boy with

unintelligible speech is found in McLeod (2006), and other applications to children with SSD are available (McLeod & McCormack, 2007).

A merger between the ICF and ICF-CY was proposed by WHO in 2012 (<https://www.who.int/classifications/icf/whoficresolution2012icfcy.pdf?ua=1>) and is scheduled to occur in 2020. When this book was finalized, WHO still provided separate searchable websites for the ICF (WHO, 2001) (<http://apps.who.int/classifications/icfbrowser/>) and the ICF-CY (WHO, 2007) (<https://apps.who.int/iris/handle/10665/43737>). Therefore, in this book authors were able to select whether they referred to the ICF or ICF-CY. Table 1.3 describes the components of the ICF (WHO, 2001) and the ICF-CY (2007).

Theoretical Basis

In this section, authors discuss the dominant theoretical explanation or rationale for the intervention approach or program, including the underlying assumptions regarding the nature of 1) the impairment being addressed or 2) compensatory strategies being

Table 1.3. Components of the *International Classification of Functioning, Disability, and Health* (ICF) and the *International Classification of Functioning, Disability, and Health – Children and Youth Version* (WHO, 2001, 2007)

Component	Definition	Difficulty
Body Functions	Physiological functions of body systems (including psychological functions) Eight chapters describe Body Functions, including <ul style="list-style-type: none"> Chapter 1: Mental functions (e.g., Memory functions, Intellectual functions) Chapter 3: Voice and speech functions (e.g., Articulation functions) 	Impairment: Problems in Body Functions such as significant deviation or loss
Body Structures	Anatomical parts of the body such as organs, limbs, and their components Eight chapters describe Body Structures, including <ul style="list-style-type: none"> Chapter 2: The eye, ear, and related structures (e.g., Structure of inner ear) Chapter 3: Structures involved in voice and speech (e.g. Structure of mouth) 	Impairment: Problems in Body Structures such as significant deviation or loss
Activities and Participation	Activity: The execution of a task or action by an individual Participation: Involvement in a life situation Nine chapters describe Activities and Participation, including <ul style="list-style-type: none"> Chapter 3: Communication (e.g., Speaking, Conversation) Chapter 12: Interpersonal interactions and relationships (e.g., Relating with strangers) 	Activity limitation: Difficulties an individual may have in executing activities Participation restriction: Difficulties an individual may experience in involvement in life situations
Environmental Factors	The physical, social, and attitudinal environment in which people live and conduct their lives Five chapters describe Environmental Factors, including <ul style="list-style-type: none"> Chapter 3: Support and relationships (e.g., Support from siblings) Chapter 4: Attitudes (e.g., Attitude of friends) 	Environmental Factors are either barriers to or facilitators of the person's functioning
Personal Factors	These are not specified in the ICF; however, factors may include age, sex, and indigenous status	

Source: World Health Organization (2001, 2007).

developed via the intervention. Authors provide information about whether the intervention approach focuses solely on speech output and/or on other domains (e.g., perception, literacy, morphosyntax). Typically, the authors also provide information about the level of consequences being addressed within the ICF-CY framework—for example, whether the intervention is targeting a functional limitation directly or the social skill, activity, or social role restrictions that result from it.

Empirical Basis

This section of each chapter presents the empirical basis for the intervention through summaries and interpretation of studies that provide evidence to support the use of the intervention. Study descriptions include information about the participants and the study design. The Empirical Basis section of each chapter is considered of utmost importance because of its relevance to EBP. Although EBP was initially developed within medicine, it has become shorthand for the assumption that clinical services are improved when practitioners become “data seekers, data integrators, and critical evaluators of the application of new knowledge to clinical cases” (Bernstein Ratner, 2006, pp. 257–258). Furthermore, EBP encompasses specific steps by which professionals not only seek and evaluate research evidence in support of their practice but also actively integrate such evidence with their own expertise (including clinical data gathering) and client preferences (e.g., Dollaghan, 2007).

In this section, authors analyze the research conducted for their approach and describe this research in terms of levels of evidence—a summary of evidence quality to facilitate readers’ effective and appropriate implementation of the interventions in clinical practice. A table is included in each intervention chapter that indicates the level of evidence for the journal articles and other sources cited by the authors and whether the evidence supports or refutes the effectiveness of the intervention approach. The levels-of-evidence system used here was adapted from the Scottish Intercollegiate Guideline Network system and has been used by ASHA; see Table 1.4. Authors were encouraged to evaluate the quality of the evidence using two systems: the Physiotherapy Evidence Database (PEDro) scale (Verhagen et al., 1998) to evaluate the quality of experimental group designs, and the Risk of Bias of N-of-1 Trials (RoBiNT) scale (Tate et al., 2013) to evaluate the quality of single case experimental designs.

Practical Requirements

In this section, authors describe the nature, frequency, and length of sessions as well as whether the sessions are individual, group, school-based, or home-based. In addition, authors describe the personnel demands by identifying the primary clinician and other

Table 1.4. Levels of evidence for intervention studies

Level	Description
1	Meta-analysis, systematic review, randomized controlled trial (RCT)
2	Controlled study without randomization (single case experimental design [SCED], case control study, cohort study, quasi-experimental study)
3	Nonexperimental/nonanalytic studies (correlational study, case report, case study)
4	Expert opinion (expert committee report, consensus conference, clinical experience of respected authorities)

Adapted from the Scottish Intercollegiate Guideline Network (<http://www.sign.ac.uk>).

participants, the training required of those involved, and typically the dosage of the intervention (e.g., frequency and length of sessions). Where appropriate, the authors have included the nature of involvement of participants beyond the clinician and child (e.g., parents, peers, siblings, teachers). In the case of parent-administered interventions, the clinician's role is specified.

Key Components

This section is the how-to portion of the intervention chapters. Authors typically describe the target selection approach, the nature of goals or targeted outcome of the intervention approach (e.g., production of a specific sound, improved phonological awareness), and goal attack strategies (e.g., sequential, simultaneous, cyclical). Authors were encouraged to address the inclusion of social-based goals linked to the ICF framework, which address activities and participation. In addition, there is a description of the activities undertaken during the intervention approach, procedures implemented by the clinician, a list of general therapy steps (often including a therapy flowchart), and what materials and equipment are required.

Monitoring Progress and Generalization

In each chapter, authors provide recommended assessment techniques and data collection used for decision-making in each intervention approach. This includes discussion regarding techniques for determining whether progress is being made, when changes should be made to the intervention plan, and when treatment should be terminated. For some interventions, this section may be relatively brief, usually because it is assumed that these methods are independent of the specific approach and may differ by setting or clinician. Authors were also encouraged to address any outcome measures linked to the ICF-CY framework that include changes in participation.

Considerations for Children from Culturally and Linguistically Diverse Backgrounds

This section highlights the applicability of each intervention approach to children who are from linguistically and culturally diverse backgrounds. Authors provide ways their intervention approach might be modified to be more appropriate for children across the world. This section can be relatively brief when authors believe that their approach poses few challenges associated with cultural and linguistic differences. When appropriate, the authors also document countries where their approach has been adopted and languages in which their approach has been translated. This searching was facilitated with reference to *The International Guide to Speech Acquisition* (McLeod, 2007), a resource documenting speech acquisition, assessment, and intervention practices across 24 languages and 12 English dialects.

Case Study

Each chapter includes a case study or studies to illustrate how an individual child responds to the intervention, challenges that require decision-making over the course of the intervention period, and the kinds of data collection that may be used to provide input to those decisions. Authors were also invited to include firsthand accounts from parents, families, or children regarding the impact of the intervention.

Learning Activities

Each chapter includes a list of two to three learning activities to help readers apply information about the intervention approach, such as identify intervention targets given a brief description of a child's sound system, develop a list of intervention exemplars, or develop a lesson plan. When this text is being read as part of a course, professors may choose to use these learning activities to facilitate class discussion or to structure in-class writing assignments.

Future Directions

This section provides authors with the opportunity to draw on their current research and clinical experiences with their approach and point the way toward further, productive development of that approach. Readers can use this section to confirm their impressions about current gaps in the research evidence and the theoretical underpinnings of a given approach. Furthermore, readers can consider how they themselves might address those gaps—through data collection designed to provide local evidence that the intervention is useful to a specific client or group of clients, if they decide to adopt the intervention despite its limitations, or through their own research efforts, if they are interested in and able to conduct more formal research.

Summary

Each chapter ends with a summary of the main takeaway points of the intervention approach. This will help readers determine if they understood the key points or possibly what sections of the chapter will require additional reading.

Suggested Readings

Because book chapters are necessarily limited in space and some of the interventions are quite complex, we include this section so that authors can direct readers to additional readings. Whereas many of these readings will provide further information about intervention procedures, stimuli, and materials, others represent the primary scholarly sources in which important studies were first reported. Readers who become particularly intrigued by a given approach should consider these sources as their next logical step in learning about the intervention.

HOW TO USE THIS BOOK: COMMENTS TO SPECIFIC AUDIENCES

This book may be useful for diverse groups of readers who would probably be reading it for different reasons and with different goals in mind. As noted earlier in this chapter, we anticipate four primary categories of readers who may be especially interested in this book:

- Students of speech-language pathology (speech and language therapy)
- Clinical practitioners who work with children with SSD
- Academics and clinical educators who teach students about SSD in children
- Parents of children with SSD

Because each audience will probably approach the book from different needs and perspectives, Table 1.5 lists suggested strategies, as well as specific chapters and sections within chapters that may address each group's special needs and interests.

Table 1.5. Suggested sections for specific audiences

Audience	Recommended sections	Comments
Students	<ul style="list-style-type: none"> • Chapter 1, Introduction • Chapter 2, Implementing Interventions 	<ul style="list-style-type: none"> • Chapter 1 gives you an overview of how the chapters are organized, which is a valuable map to guide your reading. • Chapter 2 gives you a more specific framework to help you understand the components and elements of a given intervention approach. <ul style="list-style-type: none"> – As you read individual intervention chapters, you may want to pay close attention to the Introduction and Summary, along with key terms (boldfaced in the text and defined in the Glossary, available online), before you complete a thoughtful reading of the chapter. – The chapter template in Table 1.2 can also guide your reading. • This appendix guides your identification of approaches appropriate to the children in your caseload. • Chapter 2 gives you a framework for considering the complex and dynamic components that comprise an intervention approach so you can implement it with fidelity. <ul style="list-style-type: none"> – The theoretical and empirical bases of intervention approaches may help you identify possible advantages of an intervention over one you currently use. – These sections provide the nuts and bolts of an intervention and how well it can fit the needs and situations of children in your caseload. • The summary tables give you a quick sense of the types of problems addressed by the interventions and the information provided for each approach. • Chapter 2 gives you a framework for teaching the complex and dynamic components that comprise an intervention approach. <ul style="list-style-type: none"> – In the intervention chapters, you may choose to focus on these sections to identify topics for class discussion or test question preparation. – The video demonstrations help students identify the key components of an approach that they read in the chapter. • The summary tables in Chapter 1 give you a map for the layout of all intervention chapters. <ul style="list-style-type: none"> – The Chapter 1 appendix gives you a snapshot of all 21 approaches. • Once you have selected an intervention or interventions to read about, reading the Introduction and Case Study sections and watching the video will help you decide if you want to read further or ask your child's SLP questions about what you have read or seen. • These sections give you an understanding of the strategies and activities that will be implemented in therapy sessions with your child. • After an intervention has been adopted for your child, you may want to read further to increase your understanding of the intervention's methods or rationale.
Clinical practitioners	<ul style="list-style-type: none"> • The Chapter 1 appendix provides an excellent overview of all 21 intervention approaches. • Chapter 2, Implementing Interventions • As you begin reading individual intervention chapters, sections that may be most valuable may include <ul style="list-style-type: none"> – Theoretical Basis and Empirical Basis – Key Components, Practical Requirements, Case Study, Considerations for Children from Culturally and Linguistically Diverse Backgrounds, and video demonstrations (in select chapters) • Scan the summary tables in Chapter 1 • Chapter 2, Implementing Interventions • Most, if not all, intervention chapters with special attention to <ul style="list-style-type: none"> – Introduction, key terms, Learning Activities – Video demonstrations 	
Professors, academics, and clinical educators	<ul style="list-style-type: none"> • Scan the summary tables in Chapter 1 • Chapter 2, Implementing Interventions • Most, if not all, intervention chapters with special attention to <ul style="list-style-type: none"> – Introduction, key terms, Learning Activities – Video demonstrations 	
Parents	<ul style="list-style-type: none"> • Chapter 1, Introduction <ul style="list-style-type: none"> – Especially the appendix • Of selected intervention approaches, read Introduction and Case Study sections; watch video demonstration • Practical Requirements and Key Components are important sections for approaches that engage family members directly • Suggested Readings 	

A STRUCTURAL FRAMEWORK FOR INTERVENTION

Intervention approaches are implemented within a framework that encompasses a number of components that comprise an intervention package, so to speak. To better understand the individual components of the package, it is helpful to separate the parts to determine how they fit within a structural framework of intervention. One framework that has been described and commonly referenced is a model with roots in Fey (1986) and outlined in McCauley and Fey (2006). This framework provides a broad-based structure for conceptualizing intervention and therefore is not tied to a specific theoretical perspective or intervention approach. We present it here in Figure 1.1 as a structural framework for readers to understand the various components of the intervention package as well as to provide a scheme for comparisons across the 20 intervention approaches presented in this book.

As shown in Figure 1.1, this model includes the following components: 1) *goals* (hierarchy of specificity that advances from broad to specific goals in terms of basic, intermediate, specific, and subgoals), 2) *intervention context* (clinic, classroom, or home), 3) *intervention agent* (clinician, teacher, or parent), 4) *dosage of intervention* (frequency and intensity of sessions), 5) *procedures* (the various intervention components that comprise a specific intervention approach), 6) *goal attack strategies* (plan for addressing multiple goals), 7) *activities* (the specific activities and materials used to address a goal within a session),

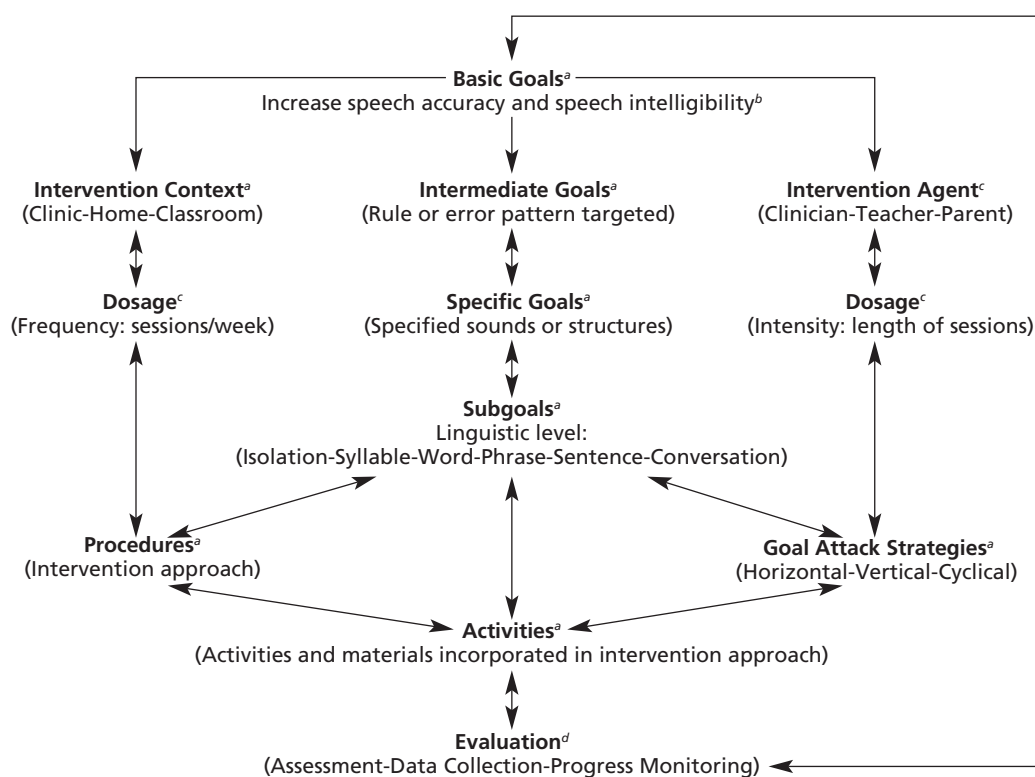


Figure 1.1. Structure of intervention focused on speech sound disorders. (Source: McCauley & Fey, 2006.) ^aKey Components (Goals-Goal Attack Strategy-Procedures-Activities-Materials). ^bIncluding interrelated goals of language and/or literacy. ^cPractical Requirements (Personnel-Dosage). ^dAssessment and Progress Monitoring (Evaluation-Data Collection).

and 8) *evaluation* (data collection procedures and methods for progress monitoring and decision-making relevant to alteration of goals, methods, stimuli, activities, and so forth). This figure links each intervention component represented in the diagram to the chapter section that addresses those components. This will facilitate readers' connection of the intervention components to the chapter template sections for each intervention approach as well as allow comparisons to be easily made between and among the approaches.

FOUNDATIONAL CORE KNOWLEDGE

Working effectively with children who have SSD requires strong foundational, or core, knowledge. Baker and Williams note in Chapter 2 that intervention approaches for children with SSD are complex and dynamic. Interventions are interactional, and SLPs need to make a number of decisions quickly in order to provide nuanced intervention tailoring that is still within acceptable fidelity in implementing an intervention. This requires foundational knowledge in typical acquisition as well as phonetic transcription. Finally, information on the prevalence of SSD is important to use to advocate for this population and for justifying expenditure of resources for materials and funding for professional development. Each of these topics is briefly addressed in the following sections with a list of resources that readers can access.

Speech Acquisition

Typical speech acquisition is often described in terms of four periods of development:

- Prelinguistic (birth–12 months)
- First words (12–18 months)
- Phonemic development (18 months–4 years)
- Stabilization (4–8 years)

A brief description of each of these periods is summarized in Table 1.6. These developmental periods are important to consider with regard to the developmental levels of the intervention approaches included in this book (see “Developmental level” column in the chapter appendix available online). Specifically, the *emerging* developmental level corresponds with the first-words period; the *developing* level corresponds with the phonemic-development period; and the *elaborating* level aligns with the stabilization period.

Children's speech acquisition requires development of many interrelated skills in order to conduct successful mutually intelligible conversations in the relevant languages. Some of these skills that need to be refined include the perception, storage, and production of speech (consonants, vowels, tones, prosody, phonotactics) with the appropriate motor coordination for the oral (lips, teeth, tongue, palate), aural (ear), laryngeal, pharyngeal, neurological, and respiratory structures. To this end, extensive research has been undertaken to describe children's acquisition of skills enabling oromotor function, perception, intelligibility, phonetic inventory, syllable and word shape inventory, mastery of consonants and vowels, percentage of consonants/vowels/phonemes correct, common mismatches, phonological processes (patterns), syllable structure, prosody, and metalinguistic and phonological awareness skills (for an extensive international review, see McLeod and Baker, 2017, Chapter 6). Additionally, McLeod (2009, 2012) developed a freely downloadable year-by-year handout titled “A summary of English studies of speech acquisition,” including phonetic inventory by consonants, vowels, clusters; intelligibility; percentage

Table 1.6. Periods of typical speech acquisition (Stark, 1980; Stoel-Gammon & Dunn, 1985; McLeod & Crowe, 2018; McLeod, 2020)

Developmental period	Description
Prelinguistic (birth–1 year)	This period of development prior to the first words includes five stages in which the infant moves from reflexive vocalizations to adult-like syllables: <ul style="list-style-type: none"> • Phonation (0–1 month) • Cooing (2–4 months) • Vocal expansion or experimentation (4–6 months) • Canonical babbling (6–8 months) • Variegated babbling (9–12 months)
First words (1–1;6)	This period is characterized by the lexical and phonological development occurring in tandem. Specifically, the child appears to learn new vocabulary as unanalyzed wholes rather than as a sequence of sound segments. Therefore, a stable one-to-one correspondence occurs within and across lexical items. This has been referred to as a <i>whole-word strategy</i> , and the acquisition of vocabulary is largely driven by the child within the phonetic inventory.
Phonemic development (1;6–4 years)	A rapid increase in vocabulary occurs after the 50-word stage around 18 months, which forces the child to move to a <i>rule-based strategy</i> . The child changes to rule-governed forms that result in a more stable, segmental correspondence with the adult words. Perceptual skills and intelligibility increases.
Stabilization (4–8 years)	The child stabilizes production of inconsistently produced phonemes and acquires the later developing phonemes (for English this includes liquids, fricatives, and affricates) and consonant clusters. By 5 years, the child is intelligible and most consonants are produced correctly. Phonological awareness and literacy skills increase.

Sources: Stark (1980); Stoel-Gammon & Dunn (1985).

of consonants correct (PCC); phonological processes; diadochokinetic rate; maximum phonation time; phonological awareness; and prosody (<https://www.csu.edu.au/research/multilingual-speech/speech-acquisition>).

One key area that has received extensive consideration is the mastery of consonants. McLeod and Crowe (2018) analyzed developmental norms from 64 studies across 27 languages for more than 26,000 children from 31 countries and found that most children around the world can produce most consonants in their first language correctly by 5 years of age (90% criterion) (see Table 1.7). Next, Crowe and McLeod (2020) analyzed developmental norms from 15 studies of English consonant acquisition for more than 18,000 children in the United States. Again, they found that most children in the United States can produce most consonants correctly by 5 years of age (90% criterion). The results of both studies were remarkably similar (Table 1.7). These authors have produced speech sound acquisition posters for English, which can be downloaded for free from <https://www.csu.edu.au/research/multilingual-speech/speech-acquisition>. Similarly, Shriberg (1993), by analyzing speech data from 63 children with SSD, suggested a developmental sequence of consonant acquisition known as the early 8, middle 8, and late 8 (Table 1.7). Data from the aforementioned studies of typically developing children have many similarities in terms of the general order of acquisition; however, children with SSD have fewer consonants in the early category and more consonants in the late category.

Important factors must be considered when using developmental norms, including the consonant acquisition norms described previously (cf. Farquharson & Tambyraja, 2019; Storkel, 2019). Among the numerous studies of speech sound acquisition, there are differences in the ages at which speech skills are reported to be acquired. This discrepancy can be

Table 1.7 Comparison of the age of acquisition (90% criterion) for consonants across three studies of English-speaking children

Average age (years;months)	McLeod & Crowe (2018)	Crowe & McLeod (2020)	Shriberg (1993)
Sample	Eight studies of typically developing English-speaking children from 6 countries*	Thirteen studies of 18,187 typically developing English-speaking children from United States	One study of 64 children with speech sound disorder from United States
2;0–2;11	/p/	/b, n, m, p, h, w, d/	
3;0–3;11	/b, m, d, n, h, t, k, g, w, ŋ, f, j/	/g, k, f, t, ŋ, j/	Early 8: /m, b, j, n, w, d, p, h/
4;0–4;11	/l, dʒ, tʃ, s, v, ʃ, z/	/v, dʒ, s, tʃ, l, ʃ, z/	Middle 8: /t, ŋ, k, g, f, v, tʃ, dʒ/
5;0–5;11	/ɹ, ʒ, ð/	/ɹ, ð, ʒ/	Late 8: /ʃ, θ, s, z, ð, l, ɹ, ʒ/
6;0–6;11	/θ/	/θ/	

*This is a subset of the complete sample of 64 studies of children from 31 countries speaking 27 languages.

Sources: Crowe & McLeod (2020); McLeod & Crowe (2018); Shriberg (1993).

related to methodological differences across studies in which even a small difference, such as imitative versus spontaneous naming, can result in large differences in reported age of acquisition. Further, differences in criterion levels also lead to differences in reported ages of acquisition. For example, use of 50% (customary production) versus 90% (mastery) criteria results in different decision making. Given these differences, there is no agreed-upon set of norms that has been adopted as the gold standard by all SLPs. The important point to consider is that speech acquisition does not occur at a single age or a definitive cut-off point and requires a development of a range of skills.

Phonetic Transcription

Phonetic transcription is a basic clinical skill and an essential component of a speech sound assessment. Ramsdell and Stuart (2012) conducted a survey of more than 2,600 U.S. SLPs and reported that while they believe transcription is important to their clinical practice, the majority of SLPs rarely transcribe. A similar survey of U.S. SLPs by Munson, Johnson, and Edwards (2012) reported that only 52% regularly transcribe. This percentage is somewhat lower than that of speech and language therapists surveyed in the United Kingdom, where the authors found that 61% regularly transcribe speech (Knight, Bandali, Woodhead, & Vansadia, 2018). Furthermore, a study of 175 SLPs revealed limited knowledge of the place of tongue/palate contact for English consonants (McLeod, 2011). SLPs were most accurate for /p, f, h/ (where there is no tongue/palate contact) and the velar consonants /k, g, ŋ/, but most did not demonstrate knowledge about lateral bracing (tongue contact along the lateral margins of the teeth) for alveolar consonants such as /t, d, s, z, n/ or the groove (so that air can move through the midline) for consonants such as /s, z, ʃ, ʒ/ (McLeod, 2011).

The importance of phonetic transcription is growing as SLPs are increasingly working with multilingual children. Many analyses are based on phonetic transcriptions, so if our transcriptions do not accurately reflect the child's productions, our analyses will be faulty and, consequently, our intervention plan will be flawed. Our analyses and interventions are as sound as our transcriptions are accurate. A major snag for both students and practitioners in the United States is that phonetics coursework is typically completed as one of the first courses in the undergraduate communicative disorders curriculum. Then it can be years before those skills are actually used to transcribe disordered speech in the clinic.

Phonetic transcription is a tool skill—and as the saying goes, “If you don’t use it, you lose it.” This section provides a broad review with some suggested resources to refresh and sharpen your transcription skills.

Phonetic Transcription for Disordered Speech Basic phonetic transcription uses the symbols in the International Phonetic Alphabet (IPA) chart (see the final pages of this book following the index). The IPA symbols can be used to provide broad transcription of consonants and vowels that are part of the standard phonetic repertoire of the adult sound system in any language (including English). It is not uncommon, however, for English-speaking children with SSD to produce sounds that are outside the typical English phonetic inventory. SLPs therefore must be familiar with the full IPA. Powell (2001) summarized several non-English IPA symbols that are often used in transcribing disordered speech. These include bilabial fricatives ([ɸ, β]), velar fricatives ([x, ɣ]), lateral fricatives ([ɬ, ɮ]), alveolar affricates ([tʃ, dʒ]), and interdental affricates ([t̪θ, d̪ð]) (see Table 1.8). To elaborate on Table 1.8, Figure 1.2 provides a coronal image of tongue/palate contact for different productions of /s/: typical, interdental, lateral, and stopped. The images are a stylized image of a person’s hard palate, with the top of each image indicating the area of the palate immediately behind the top teeth and the bottom of each image indicating the junction between the hard and soft palates. The black boxes indicate where the tongue touches the palate. The boxes represent electrodes used in electropalatography (EPG; see Chapter 22 for more information).

Often, more detail is needed to capture what the child does for the adult target. Diacritic markings are added to IPA symbols to capture variations in the production of the consonant or vowel. Transcription with diacritics is frequently referred to as *narrow phonetic transcription*. Diacritics, found on the IPA chart, can be categorized by the type of production change as *place diacritics*, *manner diacritics*, and *voicing diacritics*. Common diacritics used with children with SSD include “voiceless [̥], voiced [̬], aspirated [ʰ], labialized [ʷ], dental [̪], nasalized [̃], and no audible release [̚]” (McLeod & Baker, 2017, p. 98) (see Table 1.8). For example, a child may indicate knowledge of the final nasal in the word *soon* /sun/ by lengthening and adding nasalization to the vowel /u/ so that the word is produced as [sũː]. Ball and colleagues provided a useful three-part tutorial on the transcription of disordered speech: consonants (Ball, Müller, Rutter, & Klopfenstein, 2009), vowels and diacritics (Ball, Müller, Klopfenstein, & Rutter, 2010), and prosody and unattested sounds (Rutter, Klopfenstein, Ball, & Müller, 2010).

IPA Extensions The International Clinical Phonetics and Linguistics Association in 1994 adopted the Extensions to the IPA for the Transcription of Disordered Speech (extIPA) to include a set of specialized symbols for clinical phonetics in order to describe disordered speech (ICPLA Executive Committee, 1994). It was revised in 2015 (Ball, Howard, & Miller, 2018). The extIPA chart is included on the final page of this book following the index (https://www.internationalphoneticassociation.org/sites/default/files/extIPA_2016.pdf). As can be seen, it is organized similarly to the IPA chart in terms of place, manner, and voicing. However, it includes symbols for consonants that do not occur in natural languages but may be produced by someone with a speech disorder. The *places of production* include dentolabial, labioalveolar, linguolabial, and bidental. The *manners of production* include three types of fricatives (median, lateral + median, and nareal) as well as a percussive manner. *Voicing* is represented with the voiceless sound listed first in the cognate pairs, as in the IPA chart. The extIPA also includes 15 diacritic marks to document place modifications, force of production (strong and weak articulation), dynamic features (as in dysfluency), manner

Table 1.8. Common clinical transcriptions using IPA and extIPA symbols and diacritics

Target	Sound class	Common disordered realizations in English	Description	Example word	Adult target	Child's production
/s, z/	Voiceless and voiced alveolar fricatives	[ʃ, ʒ]	Dentalized fricatives	<i>seat</i> <i>zoo</i>	/sit/ /zu/	[ʃit] [zu]
		[θ, ð]	Interdental fricatives	<i>seat</i> <i>zoo</i>	/sit/ /zu/	[θit] [ðu]
		[ɬ, ɮ]	Lateral fricatives	<i>seat</i> <i>zoo</i>	/sit/ /zu/	[ɬit] [ɮu]
		[sː, zː]	Lengthened fricatives	<i>seat</i> <i>zoo</i>	/sit/ /zu/	[sːit] [zːu]
/ɹ/	Alveolar approximant ("r")	[w], [ɹʷ]	Labialized	<i>read</i>	/ɹid/	[wid], [ɹʷid]
/ɹ/, /ə-/	Voiceless and voiced interdental fricatives	[ʋ, ə]	Derhoticized	<i>reader</i>	/ɹidə-/	[vidə]
/θ, ð/		[ɸ, β]	Bilabial fricatives	<i>thick</i> <i>this</i>	/θɪk/ /ðɪs/	[ɸɪk] [βɪk]
		[x, ɣ]	Velar fricatives	<i>thick</i> <i>this</i>	/θɪk/ /ðɪs/	[xɪk] [ɣɪs]
/tʃ, dʒ/		Voiceless and voiced affricates	[ts, dz]	Alveolar affricates	<i>jeans</i>	/dʒɪnz/
		[tθ, dð]	Interdental affricates	<i>jeans</i>	/dʒɪnz/	[dðɪnð]
/p, b, t, d, k, g/	Voiceless and voiced stops	[ʔ]	Glottal stop	<i>goo</i>	/gu/	[ʔu]
		[pʰ, tʰ, kʰ]	Aspirated (allophones in word-initial English words)	<i>team</i> <i>key</i>	/tim/ /ki/	[tʰim] [kʰi]
		[p̚, t̚, k̚]	Deaspirated/no audible release (allophones in word-final English words)	<i>heat</i> <i>peak</i>	/hit/ /pik/	[hit̚] [pik̚]
		[p, t, k]	Voiced	<i>team</i>	/tim/	[t̚im]
		[b, d, g]	Voiceless	<i>do</i>	/du/	[d̚u]

Sources: Ball, Müller, Rutter, & Klopfenstein (2009); McLeod & Baker (2017); Powell (2001).

differences (e.g., whistled articulation), and direction of airflow (ingressive vs. egressive). Lastly, the extIPA includes a system for indicating uncertainty in transcribing a particular aspect of a speaker's production. The extIPA also allows you to indicate, by circling either C or V, that a consonant (C) or vowel (V) was unable to be determined.

Remember that phonetic transcription is a skill, so you will become more proficient the more you use it—although only if you periodically gauge your reliability. Whether working in a monolingual or multilingual setting, every student and clinician needs to know how to brush up their skills. To increase your confidence in your transcription skills,

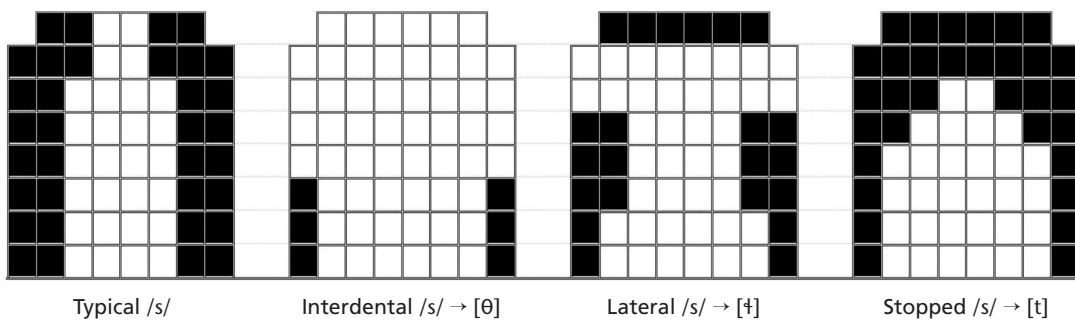


Figure 1.2. Comparison between stylized transverse images of four productions of /s/: typical, interdental, lateral, and stopped. Images represent the hard palate. Dark boxes indicate tongue/palate contact. (Used by permission from Sharynne McLeod.)

transcribe live, but it is important to also get a quality video-recording of your speech samples because visual cues are helpful for placement, as well as for transcribing some fricatives. If available, find a transcription partner so you can compare transcriptions. This will give you an idea of your transcription reliability as well as feedback to help you improve your transcription skills. A number of transcription and IPA resources are available on the Internet, and many are listed in Table 1.9. This chart, also available on the Brookes website with the other online resources accompanying this book, includes links to IPA charts to

Table 1.9. Resources regarding transcription and the International Phonetic Alphabet (IPA)

Official IPA charts from the International Phonetic Association

- <https://www.internationalphoneticassociation.org/content/ipa-chart>
- https://www.internationalphoneticassociation.org/sites/default/files/extIPA_2016.pdf

Journal of the International Phonetic Association

- <https://www.cambridge.org/core/journals/journal-of-the-international-phonetic-association>

Online IPA keyboards (so you can type in phonetics)

- <https://ipa.typeit.org/full/>
- <https://www.blugs.com/IPA/index.html>

Downloadable IPA fonts (free) for your computer

- <https://software.sil.org/doulos/>
- <https://software.sil.org/charis/>

Sites that allow you to listen to pronunciation of IPA symbols

- <https://www.internationalphoneticalphabet.org/ipa-sounds/ipa-chart-with-sounds/>
- <http://phonetics.ucla.edu/course/chapter1/chapter1.html>
- <https://www.ipachart.com/>
- <https://enunciate.arts.ubc.ca/linguistics/world-sounds/>
- <http://web.uvic.ca/ling/resources/ipa/charts/IPA-lab/>
- <http://www.yorku.ca/earmstro/ipa/index.html>

Sites that allow you to see and listen to pronunciation of IPA symbols

- <https://www.seeingspeech.ac.uk/>
- <https://soundsofspeech.uiowa.edu/home/>

Transcription self-study programs

- <http://phonetics.ucla.edu/course/contents.html>
- <http://elearning.marjon.ac.uk/ptsp/>
- <https://libguides.northwestern.edu/phonetics/>
- <http://billcprice.com/futureimperfect/2013/06/three-types-of-web-resources-for-teaching-phonetics/>
- <https://enunciate.arts.ubc.ca/linguistics/world-sounds/>

the International Phonetic Association, to the *Journal of the International Phonetic Association*, and to sites that allow you to type, see, and listen to the pronunciation of the IPA symbols. If you are working with a child who has a cleft palate, additional resources will be valuable (e.g., Harding & Grunwell, 1998; Howard, 2011).

Prevalence of SSD in Children Children, especially between the ages of 3 and 6 years, with SSD comprise a significant portion of the caseloads of SLPs. A 2012 survey from the National Center for Health Statistics (Black, Vahratian, & Hoffman, 2015) estimated that among children with a communication disorder, 48% of 3- to 10-year-old children had an SSD only, a proportion that dropped to 24% of 11- to 17-year-old children. Residual or persistent speech errors are estimated to occur in 3.8% of 8-year-old children (Wren, Miller, Peters, Emond, & Roulstone, 2016) and 1% to 2% of older children and adults (Flipsen, 2015). Adding to the complexity of SSD is that 11% to 40% of children with SSD have co-occurring language impairment (Eadie et al., 2015; Shriberg, Tomblin, & McSweeney, 1999). SSD in kindergarten children have been associated with lower literacy outcomes (Overby, Trainin, Smit, Bernthal, & Nelson, 2012) and poorer overall academic performance with long term consequences for their educational experiences and employment outcomes (McCormack, McLeod, McAllister, & Harrison, 2009; McLeod, Harrison & Wang, 2019). Consequently, SSD are not confined solely to speech or to early childhood.

CONCLUDING COMMENTS

We believe this book can have a positive impact on speech-language pathology through the advancement of effective practices for the intervention of SSD with individual children in the present day as well as with children who will be served by future generations of clinical practitioners. By making EBP and interventions for which evidence is being sought accessible to practicing clinicians, we hope to facilitate increased intervention effectiveness, as well as increased efficiency, by significantly decreasing the amount of time these children require services.

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