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Introduction: Speech Sound Disorders

Below please find the assessment and intervention module for Speech Sound Disorders. It is the author's hope that this document will assist North Carolina Speech-Language Pathologists in identifying and providing interventions for students who exhibit any type of speech sound disorder. For additional information the reader may wish to visit the two links below.

[http://www.asha.org/public/speech/disorders/SpeechSoundDisorders.htm]

[http://www.asha.org/public/speech/disorders/SSDcauses.htm]

Over 90% of speech-language pathologists in schools serve individuals with speech sound disorders (ASHA 2006). Early phonological disorders are associated with subsequent reading, writing, spelling, and mathematical difficulties. Children with phonological disorders may exhibit general academic difficulty through grade 12 (Gierut 1998).

Speech sound errors are commonly observed in typically developing young children. Children acquire simple unmarked sounds (maximally closed and maximally open sounds such as stops, nasals, glides and vowels) before they acquire more marked sounds requiring complex constrictions. Shriberg (1993) categorized 24 speech sounds into early, middle and late acquisition groups. These have been confirmed in subsequent studies (Goldstein and Fabiano 2010).

Early 8: /m, b, j, n, w, d, p, h/

Middle 8: /t, ŋ, k, g, f, v, tʃ, dʒ /

Late 8: /ʃ, ʒ, s, z, θ, ð, l, r/

English speaking children should have a complete phonemic inventory of English sounds by the age of 8. Speech errors that persist beyond age 8 are considered residual articulation errors. These persistent articulation errors typically involve the "late 8" sounds.

Some speech sound errors can be secondary to structural or neurological problems, such as:

- developmental disorders (e.g.,autism)
- genetic syndromes (e.g., Down syndrome)
- neurological disorders (e.g., cerebral palsy)
- hearing loss (including hear loss secondary to otitis media)

Speech sound disorders include *articulation disorders* (difficulty producing the motor movements of speech sounds) and *phonological disorders* (difficulties acquiring the underlying linguistic representations of speech sounds).

Articulation disorders

Chidlren with speech articulation disorders have difficulties with the motor production of speech sounds. Articulation errors can be classified as *substitutions* (e.g., [w] for /r/, “th” for /s/), *omissions*, *distortions* (e.g., dental or lateral lisp, derhoticized r) or *additions*.

An oral mechanism examination must be performed to identify or rule out an underlying structural (anatomical) or functional (physiological) reason for the motor production difficulty. Articulation disorders may have an identifiable origin, such as a brain injury or genetic syndrome, or they may be of unknown origin. Residual articulation errors result when the wrong motor program for the production of specific speech sounds has been learned (Fey, 1992).

Childhood apraxia of speech (CAS) is a **motor speech disorder**. Children with CAS have problems saying sounds, syllables, and words. This is not because of muscle weakness or paralysis. The brain has problems planning to move the body parts (e.g., lips, jaw, tongue) needed for speech. The child knows what he or she wants to say, but the brain has difficulty coordinating the muscle movements necessary to say those words.

Dysarthria is a **motor speech disorder**. The muscles of the mouth, face, and respiratory system may become weak, move slowly, or not move at all after a stroke or other brain injury. The type and severity of dysarthria depend on which area of the nervous system is affected. Some causes of dysarthria include stroke, head injury, cerebral palsy, and muscular dystrophy.

Oromyofunctional Disorder (OMD) causes the tongue to move forward in an exaggerated way during swallowing and/or speech. The tongue may lie too far forward during rest or may protrude between the upper and lower teeth during speech and swallowing. Some children with OMD produce sounds incorrectly, while in others speech may not be affected at all. OMD most often causes sounds produced with the tongue tip to sound differently. For example, the child may say "thumb" instead of *some* because the tongue tip is too far forward.

Phonological disorders

Children with phonological disorders have difficulty with development of the speech sound system. This difficulty results in errors affecting entire classes of sounds, in identifiable patterns. For example, the sound system may not allow production of any sounds that are classified as “fricatives.” The child may substitute fricative sounds with “stops” (such as “t” for “s”). This pattern is called *stopping of fricatives*. Substituting a velar sound such as "k" with

alveolar sound “t” is called *velar fronting*. In both examples, the child is substituting “t” for another sound, but for different reasons.

Some children have difficulty producing certain syllable shapes or sound sequences. For example, they may delete final consonants or omit one element of a consonant cluster.

Phonological disorders affect 10% of preschool and school age children with communication impairments. Children with phonological disorders are also at risk for reading and writing difficulties. Unremediated phonological disorders may interfere with social, academic, and vocational development, as a result of the impact of reduced speech intelligibility. Functional outcome measures have demonstrated that children with phonological disorders benefit from treatment provided by speech-language pathologists. (Gierut, ASHA Treatment efficacy summary: Phonological disorders in children).

Accented speech

Some speech sound omissions and substitutions may be features of an individual’s dialect or accent. For example, in African American Vernacular English (AAVE) a "d" sound may replace a voiced "th" sound (e.g., "dat" for "that"), or the “f” sound may be used in place of voiceless “th” (e.g., “wif” for “with.”). These are linguistic features of AAVE, not speech sound errors.

English language learners may produce accented English speech that is influenced by the native language. Typically, English sounds that are absent in the child’s native language are more difficult to acquire. For example, in Spanish the letter “z” is voiceless, so a native Spanish-speaker may produce English words containing the “z” sound with “s” (i.e., “zoo” may sound like “Sue.”)

Treatment of Speech Sound Disorders

Speech-language services for remediation of speech sound disorders may target individual sounds or classes of sounds. Treatment may involve learning to discriminate between correct and incorrect sound productions. Articulation treatment may teach correct production of speech sounds in a variety of contexts. Phonological treatment may focus on teaching certain rules of speech, with the expectation of generalization to untreated sounds and sound classes (e.g., eliminating the phonological error pattern of final consonant deletion by targeting a few specific sounds in syllable-final positions.)

Directions into Velocities of Articulators (DIVA) is a neural network model of the brain processes that underlie speech acquisition and production. Using this model, speech production involves the integration of auditory, somatosensory, and motor information in the brain. Its hypothesized neural correlates have been demonstrated in functional magnetic resonance imaging studies (Guenther 2006). According to DIVA, new speech sounds are learned by:

1. Storing an auditory target for the sound

2. Using the auditory feedback control system to control production of the sound in early repetitions
3. Repeated production of the sound, leading to tuning of feed forward commands
4. Eventual suppression of the feedback-based control signals.

The link below provides some general guidelines suggesting that a referral in the area of speech sound disorders may be appropriate.

I. Speech Referral Guidelines [http://www.asha.org/public/speech/speech-referral.htm]

I.a. Common Etiologies

- Difficulty in hearing and/or inability to differentiate between sounds can inhibit a child's ability to detect and correct error sounds
- Neurological disorders, such as cerebral palsy, can result in dysarthria (muscle weakness) which can affect any of the speech subsystems (respiration, phonation, articulation, resonance)
- Structural disorders, such as craniofacial anomalies (e.g., cleft lip/palate) can result in compensatory articulations
- Phonological disorders can cause error patterns affecting syllable structure and sound classes
- Apraxia of speech can cause decreased intelligibility as utterance length and complexity increase

I.b. Potential Consequences and Impact of Speech Impairment on Activities and Participation

- Difficulty expressing basic wants, needs, or routine information intelligibly
- Difficulty communicating intelligibly at level of function and independence expected for age
- Difficulty expressing feelings intelligibly, possibly resulting in frustration
- Difficulty engaging successfully in social and/or classroom situations
- Difficulty reaching educational potential
- Risk of personal injury due to difficulty communicating intelligibly about a dangerous situation

I.c. Major Milestones for Speech Development

By age 3 years:

- Familiar conversation partners (family, caregivers) understand the child.
- The child correctly produces vowels and the sounds p, b, m, w in words.

By age 4 years:

- Individuals the child associates with regularly understand the child's speech.
- The child correctly produces t, d, k, g, f in words.

By age 5 years:

- The child is understood by familiar and unfamiliar listeners.
- The child correctly produces most speech sounds in words.

I.d. Behaviors that Should Trigger an SLP Referral

Disturbance in neuromuscular control causes difficulty learning to produce sounds appropriately

- Speech is usually slurred; difficulty controlling respiration for speech; abnormal loudness, rhythm, or vocal quality
- Child exhibits difficulty learning sounds to form words; may sound nasal, strangled and/or breathy
- Child exhibits frustration and/or avoidance of speech due to extreme difficulty forming sounds or difficulty being understood

Disturbance in programming, positioning, and sequencing of muscular movements

- Speech sound errors are prevalent but variable (i.e., "dog" could be produced "dog," "tog," "gog," "god" by same child)
- Child varies from rarely being able to produce sounds to ongoing speech that is rarely understood, or speech that is usually understood with frequent sound errors
- Child is unaware of sound variations or exhibits varying degrees of frustration and/or anxiety regarding inability to "control speech"

Disturbance in performing voluntary movements with mouth and vocal mechanism

- Child cannot produce movements for sound production or sounds are produced without voice (whispered speech)
- Child varies from inability to produce any words to extreme difficulty being understood
- Child exhibits frustration and/or avoidance of speech due to difficulties

Deafness/severe hearing loss causes severe prosodic disturbances in intonation, duration, and rhythm in addition to sound errors

- Child produces no meaningful words or sounds understood only by family
- Child speaks loudly in high pitched voice with frequent distortion, omission, and substitution of sounds

Autism, emotional disturbance, and/or mental retardation may cause very unusual prosodic variations

- Child's intonation and/or rhythm of connected speech may sound abnormal
- Child's speech volume may be consistently or intermittently too loud or too soft

Deviation in structure of speech mechanism

- Child has difficulty producing specific sounds and intelligible speech
- Child exhibits frustration and/or avoidance of speech
- Child's speech has excessive nasality

Exhibits sudden decrease in speech intelligibility

- Chidl's speech ranges from slurred, generally intelligible speech to total absence of speech, or totally unintelligible speech
- Child's awareness ranges from extremely aware to totally unaware of sound errors

Exhibits decline in ability to be understood by family, friends, and/or caregivers in the expression of basic needs, preferences, and feelings

I.e. World Health Organization Model (WHO) International Classification of Functioning, Disability and Health (ICF)

McLeod, Sharynne and Bleile, Ken (2004). A framework for setting goals for children with speech impairment. *Child Language Teaching and Therapy,* 20(3), pp 199-219.

The ICF incorporates characteristics of impairment and social factors to consider when selecting appropriate goals to bring about change in the lives of children with speech impairment.

Difficulty producing sounds may have influence on subsequent educational, occupational and social opportunities.

Traditionally, SLPs have relied on an impairment based model for decision making. The previous WHO model (1980) used the terms impairment, disability and handicap. The more recent WHO model (ICF, 2001) describes a "universe of wellbeing" including the components of:

Function and Disability:

- **Body Structures –** anatomical parts, such as nose, mouth, larynx
- **Body Functions –** such as articulation of phonemes, expression of spoken language
- **Activities –** conversation, learning to read and write
- **Participation –** interpersonal interactions and relationships

Contextual Factors:

Environmental Factors

- Products and technology
- Support and relationships
- Services, systems, and policies

Personal Factors

- Attributes of person (e.g., "resilience")
- Internal influences on functioning and disability

Every child is unique, requiring a different approach to best meet individual needs. The World Health Organization's International Classification of Functions (ICF) emphasizes considering the impact of functional impairments on the individual's **activities and participation**. When setting goals, it is very important to consider how the intervention will improve the client's communication activities of daily living in specific settings, such as academic communication in the classroom, and social communication in peer interaction.

Ultimate goals of speech intervention:

- Intelligible conversational speech within a child's milieu
- Enhancement of child's participation in social interaction

Goals: Body Structures

Note: The majority of children who are seen by SLPs have communication impairments of unknown origin (body structure is considered to be intact).

Surgical repair of a cleft palate, frenectomy, cochlear implant, etc. would be interventions related to body structures.

Goals: Body Functions

Most speech-language goals for children with speech sound disorders are written to address body functions of speech perception and production. Here are some examples:

Child will improve speech intelligibility by suppressing phonological error patterns of final consonant deletion, velar fronting, gliding, and consonant cluster reduction in at least 60% of opportunities in words.

Child will improve speech intelligibility by producing two maximally opposite sounds (one obstruent and one sonorant, such as “ch” and “l”) that are currently absent from the phonemic inventory, in initial and final word positions with 75% accuracy.

Child will reduce audible nasal emissions during the production of high pressure consonants (stops, fricatives, and affricates).

When focusing on functional intelligibility, it is important to prioritize phonemes that have a high frequency of occurrence. If the child has speech patterns that are unusual (e.g., initial consonant deletion, backing of alveolars), these will have a greater impact on intelligibility, so they should be targeted as a priority.

Goals: Activities

Speech-language services should support academic success, especially with respect to reading and spelling. Intervention targeting phonological awareness should accompany speech intervention.

Goals: Participation

Unintelligible speech affects interpersonal interactions and relationships. There may be a mismatch between a child’s performance within their daily lives and their communicative capacity on standardized speech assessment tools.

The Speech Participation and Activity of Children (SPAA-C) (McLeod 2003) questionnaire is designed to elicit information from the child, friends, siblings, parents, teachers and others. This information helps to increase understanding of the individual child and context in which they live, using the categories of Activity and Participation, Environmental and Personal Factors from the International Classification of Functioning, Disability and Health (ICF). The SPAA-C can be downloaded from: http://athene.riv.csu.edu.au/~smcleod/SPAAC2.pdf

II. Screening

II.a ASHA Practice Policy

American Speech-Language-Hearing Association. (2004). *Preferred Practice Patterns for the Profession of Speech-Language Pathology* [Preferred Practice Patterns]. Available from www.asha.org/policy.

[http://www.asha.org/docs/pdf/PP2004-00191.pdf]

#1. Speech-Language Screening—Children

Speech-language screening in the pediatric population is a pass/fail procedure to identify infants, toddlers, children, or adolescents who require further speech-language/communication assessment or referral to other professional and/or medical services.

Pediatric speech-language screening is conducted according to the *Fundamental Components and Guiding Principles*.

Individuals Who Provide the Service(s)

Pediatric speech-language screening is conducted by appropriately credentialed and trained speech-language pathologists, possibly supported by speech-language pathology assistants under appropriate supervision.

Expected Outcome(s)

Pediatric speech-language screening identifies infants, toddlers, children, or adolescents likely to have speech-language and communication impairments that may interfere with body structure/function and/or activity/participation as defined by the World Health Organization (WHO) (see *Fundamental Components and Guiding Principles*).

Screening services result in pass/fail decisions and may result in —

- recommendations for supporting normal development and preventing speech language impairment;
- referral for comprehensive speech-language assessment or other assessments or services;
- plans to monitor development.

Clinical Indications

Pediatric speech-language screening services are provided to infants, toddlers, children, adolescents, and their families as needed, requested, or mandated, or when other evidence

suggests that they have risks for speech-language disorders associated with their body structure/function and/or activities/participation.

Clinical Process

Pediatric speech-language screening services are provided with parental consent as mandated by federal, state, and or local regulations.

Screening services are sensitive to cultural and linguistic diversity. Screening includes a range of age-appropriate, speech-language and other communication functions and activities.

Standardized (e.g., normed screening tests) or nonstandardized methods (e.g., criterion-referenced assessments, parent interviews, classroom observations) are used to screen oral motor function, communication and social interaction skills, speech production skills, comprehension and production of spoken and written language (as age-appropriate), and cognitive aspects of communication.

Screening typically focuses on body structures/functions but may also address activities/participation, and contextual factors affecting communication.

Individuals who fail the screening are referred to a speech-language pathologist for further assessment.

Setting, Equipment Specifications, Safety and Health Precautions

Setting: Pediatric speech-language screening is conducted in a clinical or educational setting or other natural environment conducive to valid screening results. Settings for screening may include hospitals, clinics, schools, or homes.

Equipment Specifications: All equipment used for pediatric speech-language screening is used and maintained in accordance with the manufacturer's specifications.

Safety and Health Precautions: All screening services ensure the safety of the patient/client and clinician and adhere to universal health precautions (e.g., prevention of bodily injury and transmission of infectious disease). Decontamination, cleaning, disinfection, and sterilization of multiple-use equipment before reuse are carried out according to facility-specific infection control policies and services and according to manufacturer's instructions.

Documentation

Documentation includes a statement of identifying information, screening results, and recommendations, indicating the need for rescreening, assessment, or for a referral.

The privacy and security of documentation are maintained in compliance with the regulations of the Health Insurance Portability and Accountability Act (HIPAA), the Family Educational Rights and Privacy Act (FERPA), and other state and federal laws.

Results of screening are reported to child's family/caregivers, as appropriate. Reports are distributed to referral source and other professionals when appropriate and with written consent.

II.b Screening Tools for Speech Sound Disorders

Diagnostic Evaluation of Language Variance (DELV)–Screening Test

Author(s): Harry N. Seymour, Thomas W. Roeper, and Jill de Villiers

Publisher: Pearson

Year: 2003

Age Range: 4–12 years

Administration Time: (entire screening) 15–20 minutes

Description: Identifies children who are speaking a variation from Mainstream American English (MAE). Identifies children who are at risk for a language disorder. Includes Phonology subtest.

Hodson Assessment of Phonological Patterns-Third Edition (HAPP-3)

Author(s): Barbara Williams Hodson

Publisher: PRO-ED

Year: 2004

Age Range: 2 years and up

Administration Time: 5 minutes

Language(s): English

Description: Includes two quick screening components with 12 stimulus words each.

Preschool Language Scale, Fifth Edition (PLS-5) – Articulation Screener

Author(s): Irla Lee Zimmerman, Violette G. Steiner, and Roberta Evatt Pond

Publisher: Pearson

Year: 2011

Age Range: Birth–6;11 (years; months)

Administration Time: 5 minutes

Language(s): English, Spanish

Description: Criterion-based articulation screener targets multiple phonemes within words using picture stimuli.

III. Assessment

III.a ASHA Practice Policy

American Speech-Language-Hearing Association. (2004). *Preferred Practice Patterns for the Profession of Speech-Language Pathology* [Preferred Practice Patterns]. Available from www.asha.org/policy.

[http://www.asha.org/docs/pdf/PP2004-00191.pdf]

#15. Speech Sound Assessment

Speech-language assessment is a complex process. Assessing, describing, and interpreting an individual's communication ability requires the integration of a variety of information gathered in the evaluation process. ASHA's Preferred Practice Patterns for the Professions of Speech-Language Pathology (2004) indicates that comprehensive speech-language pathology assessment includes these components:

- Case history, including medical status, education, vocation, socioeconomic, cultural, and linguistic backgrounds
- Patient/client
- Review of auditory, visual, motor, and cognitive status
- Standardized and/or nonstandardized measures of specific aspects of speech, spoken and nonspoken language, cognitive-communication, and swallowing function
- Identification of potential for effective intervention strategies and compensations
- Selection of standardized measures for speech, language, cognitive-communication, and/or swallowing assessment with consideration for documented ecological validity
- Follow-up services to monitor communication and swallowing status and ensure appropriate intervention and support for individuals with identified speech, language, cognitive-communication, and/or swallowing disorders
- Results of standardized tests provide the speech-language pathologist with valuable information regarding the communication abilities in specific areas. However, ASHA recognizes that standardized tests are only one component of a comprehensive

assessment process. Nonstandardized or informal assessment procedures, including behavioral and pragmatic observations in natural contexts and spontaneous and structured language sampling, provide valuable information that standardized tests alone may not.
- Sampling communication in a variety of situations gives speech-language pathologists a more accurate profile of an individual's functional communication ability.
- Assessment of articulation and phonology is provided to evaluate articulatory and phonological functioning (strengths and weaknesses in speech sound discrimination and production), including identification of impairments, associated activity and participation limitations, and context barriers and facilitators.
- Articulation and phonology assessment is conducted according to the *Fundamental Components and Guiding Principles*.

Individuals Who Provide the Service(s)

Speech sound assessments are conducted by appropriately credentialed and trained speech-language pathologists.

Speech-language pathologists may perform these assessments individually or as members of collaborative teams that may include the individual, family/caregivers, and other relevant persons.

Expected Outcome(s)

Consistent with the World Health Organization (WHO) framework, assessment is conducted to identify and describe —

- underlying structural/functional strengths and deficits related to articulatory and phonological factors that affect communication performance;
- effects of articulation and phonology impairments on the individual's activities (capacity and performance in everyday communication contexts) and participation;
- contextual factors that serve as barriers to or facilitators of successful communication and participation for individuals with speech sound disorders.

Assessment may result in the following:

- Diagnosis of a speech sound disorder, including childhood apraxia of speech.
- Clinical description of the characteristics of articulation and phonology (e.g., speech sound discrimination, developmental phonological processes, production of phonemes in multiple contexts, intelligibility, phonemic awareness).
- Identification of a communication difference, possibly co-occurring with a speech sound disorder.

- Prognosis for change (in the individual or relevant environmental contexts).
- Recommendations for intervention and support.
- Identification of the effectiveness of intervention and supports.
- Referral for other assessments or services.

Clinical Indications

Speech sound assessments are provided to individuals as needed, requested, or mandated or when other evidence suggests that individuals have articulation and phonology impairments associated with their body structure/function and/or communication activities/participation.

Assessment is prompted by referral, by the individual's medical status, or by failing a speech-language screening that is sensitive to cultural and linguistic diversity.

Clinical Process

Comprehensive assessment is sensitive to cultural and linguistic diversity and addresses the components within the WHO's *International Classification of Functioning, Disability and Health* (2001) framework including body structures/functions, activities/participation, and contextual factors.

Assessment may be static (i.e., using procedures designed to describe current levels of functioning within relevant domains) or dynamic (i.e., using hypothesis testing procedures to identify potentially successful intervention and support procedures) and includes the following:

- Relevant case history, including medical status, education, vocation and socioeconomic, cultural, and linguistic backgrounds.
- Review of auditory, visual, motor, and cognitive status.
- Standardized and/or nonstandardized assessments including —
- articulation tests;
- spontaneous speech samples;
- error analysis to determine whether the individual displays primarily speech production deficits and/or deficits associated with phonological constraints;
- independent analysis such as a phonetic inventory;
- relational analysis such as assessment of simplification processes;
- observation of intelligibility in communication environments.

- Standardized measures for articulation and/or phonological assessment selected with consideration for documented ecological validity.
- Follow-up services to monitor status and ensure appropriate intervention and support for individuals with identified speech sound disorders.

Setting, Equipment Specifications, Safety Precautions

Setting: Assessment is conducted in a clinical or educational setting or other natural environments conducive to eliciting a representative sample of the patient's/client's speech production. The goals of the assessment and the WHO framework are considered in selecting assessment settings. Identifying the influence of contextual factors on functioning (activity and participation) requires assessment data from multiple settings.

Equipment Specifications: All equipment will be used and maintained in accordance with the manufacturer's specifications.

Safety and Health Precautions: All services ensure the safety of the patient/client and clinician and adhere to universal health precautions (e.g., prevention of bodily injury and transmission of infectious disease). Decontamination, cleaning, disinfection, and sterilization of multiple-use equipment before reuse are carried out according to facility-specific infection control policies and services and according to manufacturer's instructions.

Documentation

Documentation includes pertinent background information, results and interpretation, prognosis, and recommendations. Recommendations may include the need for further assessment, follow-up, or referral. When intervention is recommended, information is provided concerning frequency, estimated duration, and type of service delivery.

Documentation addresses the type and severity of the speech sound disorder or difference and associated conditions (e.g., educational or medical diagnoses).

Documentation includes summaries of previous services in accordance with all relevant legal and agency guidelines.

The privacy and security of documentation are maintained in compliance with the regulations of the Health Insurance Portability and Accountability Act (HIPAA), the Family Educational Rights and Privacy Act (FERPA), and other state and federal laws.

Results of assessment are reported to the individual and family/caregivers, as appropriate. Reports are distributed to referral source and other professionals when appropriate and with written consent.

III.b. Published Tests for Assessment of Speech Sound Disorders

The American Speech-Language-Hearing Association (ASHA) is provides a Directory of Speech-Language Pathology Assessment Instruments. The purpose of this directory is to provide speech-language pathologists with a comprehensive reference of assessment tools used to evaluate the speech, language, cognitive-communication, and swallowing abilities of individuals across the life span. Following are brief descriptions of selected published tests for assessment of speech sound disorders that are included in the ASHA Directory [http://www.asha.org/assessments.aspx].

III.b.1 English Speech Sound Assessment Tools

The Apraxia Profile

Author(s): Lori A. Hickman

Publisher: Harcourt Assessment

Year: 1997

Age Range: 3-13 years

Administration Time: 25-35 minutes

Description: Helps identify the presence of oral apraxia, diagnose developmental verbal apraxia, and determine oral-motor movement and sequence disorders.

Arizona Articulation Proficiency Scale, Third Revision (Arizona-3)

Author(s): Janet Barker Fudala

Publisher: Western Psychological Services

Year: 2000

Age Range: 1;5-18;0 (years; months)

Administration Time: 3-5 minutes

Description: Identifies misarticulations and total articulatory proficiency. Covers all major speech sounds in the English language, including initial and final consonants and blends, vowels, and diphthongs.

Children's Speech Intelligibility Measure (CSIM)

Author(s): Kim Wilcox and Sherrill Morris

Publisher: Pearson

Year: 1999

Age Range: 3–10 years

Administration Time: 20 minutes

Description: Establishes baseline information about intelligibility and monitors progress during the course of articulation/phonological treatment. Meets IDEA regulations for progress reports to parents on the same schedule as report cards for regular education.

Description: The DEAP is a comprehensive, individually administered, norm-referenced battery designed to provide a differential diagnosis of speech disorders

Clinical Assessment of Articulation and Phonology (CAAP)

Author(s): Wayne Secord, JoAnn Donohue, and Clint Johnson

Publisher: Super Duper Publications

Year: 2002

Age Range: 2;6-8;11 (years; months)

Administration Time: 15-20 minutes

Description: Assesses articulation and phonology of preschool and school-age children.

Computerized Articulation and Phonology Evaluation System (CAPES)

Author(s): Julie Masterson and Barbara Bernhardt

Publisher: Pearson

Year: 2001

Age Range: 2 years–adult

Administration Time: Phonemic Profile: 5-10 minutes Individual Phonological Evaluation and Connected Speech Sample: Varies

Computerized Scoring: Yes

Description: Analyzes articulation and phonology on a PC. Consists of a Phonemic Profile and an Indivualized Phonological Evaluation. The Phonemic Profile is a primary analysis of the production of 46 words, and results automatically determine the appropriate Individualized Phonological Evaluation. The Individualized Phonological Evaluation consists of 20-100 words that enable an in-depth analysis of the client's productions.

Diagnostic Evaluation of Articulation and Phonology (DEAP)

Author(s): Barbara Dodd, Zhu Huo, Sharon Crosbie, Alison Holm, and Anne Ozanne

Publisher: Pearson

Year: 2006

Age Range: 3;0–8;11 (years; months)

Administration Time: Diagnostic Screen and Oral Motor Screen are 5 minutes each; Articulation Assessment, Phonology Assessment, and Word Inconsistency Assessment each take approximately 15 minutes.

Diagnostic Evaluation of Language Variation (DELV)

Author(s): Harry N. Seymour, Thomas W. Roeper, and Jill de Villiers

Publisher: Pearson

Year: 2005

Age Range: 4–9 years

Administration Time: 45–50 minutes

Description: Used to diagnose a child's speech and language disorders accurately. DELV includes a phonology subtest specifically designed to neutralize the effects that variations from Mainstream American English (MAE) may have on a child's test performance.

Goldman-Fristoe Test of Articulation-Second Edition (G-FTA-2)

Author(s): Ronald Goldman and Macalyne Fristoe

Publisher: Pearson

Year: 2000

Age Range: 2;0–21;11 (years; months)

Administration Time: 5–15 minutes

Computerized Scoring: Yes (Optional)

Description: Provides information about a child's articulation ability by sampling both spontaneous and imitative sounds. Measures articulation of consonant sounds and determines types of misarticulation. The Sounds-in-Words section is norm-referenced. The Sounds-in-Sentences and Stimulability sections are not norm-referenced.

Hodson Assessment of Phonological Patterns-Third Edition (HAPP-3)

Author(s): Barbara Williams Hodson

Publisher: PRO-ED

Year: 2004

Age Range: 2 years and up

Administration Time: 15-20 minutes

Computerized Scoring: No

Description: Designed for children with highly unintelligible speech. Gives a standardized comprehensive measure of phonology and two quick screening components with 12 stimulus words each. Alternative English words are included to increase flexibility of use in other English-speaking countries.

Kaufman Speech Praxis Test for Children (KSPT)

Author(s): Nancy Kaufman

Publisher: Wayne State University Press

Year: 1995

Age Range: 2;0-5;11 (years; months)

Administration Time: 5-15 minutes

Computerized Scoring: No

Description: Assists in the diagnosis and treatment of developmental apraxia (dyspraxia) of speech in preschool children. Identifies the level of breakdown in a child's ability to speak. Measures a child's imitative responses, locates where the child's speech system is breaking down, and points to a systematic course of treatment. Measures and quantifies gains in motor-speech proficiency in several ways. Individual sections of the test can be used to establish treatment goals and measure progress.

Khan-Lewis Phonological Analysis-Second Edition (KLPA-2)

Author(s): Linda Khan and Nancy Lewis

Publisher: Pearson

Year: 2002

Age Range: 2;0–21;11 (years; months)

Administration Time: 10–30 minutes

Computerized Scoring: Yes (Optional)

Description: Assesses phonological processes in the speech of individuals. Includes a phonological summary and progress report for parents. Use with G-FTA-2 for a comprehensive analysis of articulation and phonology.

Photo Articulation Test, Third Edition (PAT-3)

Author(s): Kathleen Pendergast, Stanley Dickey, John Selmar, and Anton Soder

Publisher: PRO-ED

Year: 1997

Age Range: 3;0-8;11 (years; months)

Administration Time: 5 minutes

Description: Uses color photographs of common objects to assess and interpret articulation errors rapidly and accurately.

Secord Contextual Articulation Test (S-CAT)

Author(s): Wayne A. Secord and Richard E. Shine

Publisher: Super Duper Publications

Year: 1997

Age Range: 4;0–adult

Administration Time: Varies with client

Description: Secord Contextual Articulation Test (S-CAT) helps to determine the exact pretreatment status for any phoneme or phonological process, evaluate progress during treatment, and target where it is most needed. In addition, the S-CAT helps to link practice materials to the assessment processes, document the overall effectiveness of intervention, and decide when to dismiss a patient from treatment.

Test of Articulation in Context (TAC)

Author(s): Teresa Lanphere, art by Rick Menard

Publisher: PRO-ED

Year: 1998

Age Range: Pre-K-elementary

Administration Time: 20-30 minutes

Language(s): English

Description: Based on the premise that articulation skills are most accurately represented in spontaneous speech; uses pictures to elicit all common consonants, consonant clusters, and vowels.

Verbal Motor Production Assessment for Children (VMPAC)

Author(s): Deborah Hayden and Paula Square

Publisher: Harcourt Assessment

Year: 1999

Age Range: 3-12 years

Administration Time: 30 minutes (low estimate)

Language(s): English

Description: Assesses the neuromotor integrity of the motor- speech system. Assesses global motor control, focal oromotor control, sequencing, connected speech and language control and speech characteristics.

III.b.2 Spanish Speech Sound Assessment Tools

Contextual Probes of Articulation Competence - Spanish (CPAC-S)

Author(s): Brian Goldstein, PhD & Aquiles Iglesias, PhD

Publisher: Super Duper Publications

Year: 2009

Age Range: 3;0–8;11

Administration Time: 20–25 minutes

Language(s): Spanish

Computerized Scoring: Yes

Description: The Contextual Probes of Articulation Competence-Spanish is an assessment and therapy tool kit for working on Spanish articulation and phonology. It is based on the "Contextual Probes of Articulation," found in the Secord Contextual Articulation Tests (S-CAT). The CPAC-S contains a Quick Screen that assesses all Spanish phonemes and many frequently occurring phonological patterns. In addition, it contains a Full Assessment that provides a comprehensive analysis of a client's articulation and phonological skills.

Spanish Articulation Measures, Revised Edition (SAM)

Author(s): Larry J. Mattes

Publisher: Academic Communication Associates

Year: 1994

Age Range: 3 years and up

Administration Time: Varies

Language(s): Spanish

Description: A criterion-referenced test that assesses Spanish-speaking children's production of individual phonemes and use of phonological processes.

III.b.3 Bilingual Speech Sound Assessment Tools

Each language has a unique phonemic system. When learning English as a second language, it is common for the phonemic system of the native first language to influence the production of sounds in English. Therefore, SLPs must consider the sound systems of all the languages used by a client in order to provide appropriate assessment and treatment services. To assist with this, ASHA's Office of Multicultural Affairs has compiled information on the phonemic systems for several languages commonly spoken by English language learners [http://www.asha.org/practice/multicultural/Phono.htm]:

Arabic Phonemic Inventory [PDF]
Cantonese Phonemic Inventory [PDF]
English Phonemic Inventory [PDF]
Korean Phonemic Inventory [PDF]
Mandarin Phonemic Inventory [PDF]
Spanish Phonemic Inventory [PDF]
Vietnamese Phonemic Inventory [PDF]

Using this information, SLPs can determine phonemic influences of a client's native language on English, identify sounds from the client's first language that may not exist in English, and identify sounds in English that do not exist in the native language. In addition, sounds that occur in both languages may have constraints in whether they can be used at the beginning or ending of words or whether they occur in clusters.

Brian Goldstein and Leah Fabiano wrote a step-by-step tutorial, *Assessment and Intervention for Bilingual Children with Phonological Disorders*, for the ASHA Leader (February 13, 2007) [http://www.asha.org/Publications/leader/2007/070213/f070213a/]. The following is a brief summary of the 5 steps to authentic assessment of bilingual children with speech sound disorders. It is based on the Dual Interactional Systems Model, the theoretical rationale that bilingual children maintain separation for some phonological elements while demonstrating interaction on others.

Step 1: Perform a detailed case history. Obtain the following information: language history (when the child was exposed to and began to use each language); percent input in each language (hours per week the child hears each language); and percent output in each language (hours per week the child uses each language).

Step 2: Obtain speech samples. Single-word and connected speech (conversation or narrative) samples should be obtained in both of the bilingual child's languages. The order of acquisition and phonological patterns will differ for each language; phonological development in bilinguals is similar, but not identical, to monolinguals.

Step 3: Perform an independent analysis. Determine the phonetic inventory of the child in both languages (all sounds produced by the child, regardless of the targeted sounds). This will help to determine whether to take a phonetic or phonological approach to intervention.

Step 4: Perform a relational analysis. Examine overall consonant and vowel accuracy in each language, and accuracy of shared elements (i.e., common to both languages, such as /p/ between Spanish and English) and unshared elements (i.e., unique to each language, such as the Spanish trill). Studies examining bilingual phonological representation have found significantly higher accuracy on shared elements compared with unshared elements, demonstrating interaction between the two languages (Fabiano, 2006).

Step 5: Perform an error analysis. Examine targets and substitutes, then account for cross-linguistic effects (using a phonological element specific to one language in the production of the other; for example, the Spanish trill /r/ found in an English production). Neither cross-linguistic effects nor dialect features should be scored as errors.

III.b.4 Assessment of Intelligibility

Percentage of Consonants Correct

The percentage of consonants correct (PCC) measure originally described by Shriberg & Kwiatkowski (1982) has provided instructors, researchers, and speech-language pathologists working in different settings a means to specify descriptions of intelligibility and gauge the effects of intervention programs. It is derived by dividing the total number of correct consonants by the total number of consonants in the targeted words.

PCC values correspond to an ordinal severity scale that is useful for describing intelligibility and impairment. PCC values can be assigned four levels of severity of involvement using the severity adjectives *mild, mild-moderate, moderate-severe* and *severe*. PCC has consistently been shown to correlate with listeners' subjective impressions of intelligibility. For example, if a child's PCC was 36%, it is likely that most listeners understand about 1/3 of the child's speech, and that the child would be perceived as "severely unintelligible."

Percentage of Consonants Correct (PCC) Consonants Correct / Total Consonants in Target Words	
Mild	**>85%**
Mild-moderate	**67-84%**
Moderate-severe	**50-66%**
Severe	**<50%**

ASHA's **Functional Communication Measure for Articulation and** Phonology (FCMAP) used 7 levels of severity. The FCMAP demonstrated the functional outcome of treatment for speech sound disorders; intelligible speech.

ASHA Functional Communication Measure: Articulation/Phonology (FCMAP)		
0	Unable to rate	Reason:
1	Profound	Unintelligible in all contexts with all people. No self-monitoring.
2	Severe	10-20% intelligibility at the word level in restricted contexts.
3	Mod-severe	30-40% intelligibility at the word/phrase level in restricted contexts.
4	Moderate	50% intelligibility at the phrase/sentence level in familiar contexts.
5	Mild-moderate	60-70% intelligibility at the sentence and conversation level in familiar contexts.
6	Mild	80-90% intelligibility at the conversational level in broad contexts.
7	Normal	Normal production of speech sounds in conversation in all contexts.

Example of Long-Term goal related to functional intelligibility:

- Child's speech will be 85% intelligible at the conversational level in broad contexts as measured by percentage of consonants correct in a spontaneous speech sample.

Short-term objectives explain how you will achieve the goal. For example:

- Child will consistently produce 50 functional core vocabulary words in appropriate contexts in 4/5 trials.
- Child will suppress phonological error patterns of cluster reduction, stopping of fricatives, velar fronting, and gliding of liquids to <40% of opportunities in multisyllabic words.
- Child will produce palatal sounds / ʃ, tʃ, dʒ, ɹ/ with 80% accuracy in syllable onsets and codas in words from the English language arts, social studies, science and math curriculum.
- Child will improve precision of articulation by placing stress on content words at the sentence level using materials from the core curriculum in 80% of sentences.

IV. Differential Diagnosis

Speech sound disorders encompass two broad categories:

- Articulation Disorders, which are motor based
  - Articulation is a speech domain (surface representation of sounds)
- Phonological Disorders, which are linguistically based
  - Phonology is a language domain (underlying representation of phonemes)

Articulation disorders can be further subdivided into disorders of:

- Organic/Structural origin (examples)
  - Hearing loss
  - Cleft palate or high vaulted palate

    - Dental malocclusion
    - Enlarged tongue
- Neurological origin
    - Childhood apraxia of speech (CAS)
    - Dysarthria, often secondary to brain damage or genetic syndrome
- Functional origin
    - Residual errors, sometimes called "persistent speech sound disorder"
        - Any articulation errors persisting beyond age 8 are generally considered residual
        - Residual errors persist when a motor pattern has been created for a sound or when a structural problem modifies the target place or manner of production

Phonological disorders can be further subdivided into:

- Phonological delay (child's error patterns are developmental in nature; i.e., seen in typically developing younger children)
- Phonological disorder (child's patterns of errors are not all developmental in nature)
    - Consistent errors
    - Inconsistent errors

IV.a Phonological Disorder

Barbara Dodd (1995) observed three types of phonological disorders in monolingual and bilingual children across many languages.

Delayed phonological development:

- Child's phonological system is similar to younger, typically developing children
- There is a discrepancy between the phonological processes (error patterns) observed and the child's chronological age
- Reasons for delayed phonological development may include an impoverished language learning environment, slower neurological maturation, or general cognitive delay (Powers, 1971)

Consistent phonological disorder:

- Systematic use of error patterns that are atypical of normal phonological development (e.g. deleting initial consonants; backing alveolars), along with typical error patterns like consonant cluster simplification, gliding of liquids, etc.
- Phonological disorder is thought to be caused by an impaired organization of the phonological system (Dodd and McCormack, 1995; Bradford and Dodd, 1996; Leitao *et al*., 1997)

Inconsistent speech disorder:

- Variable production of the same words or phonological features in the same contexts
  - A word is classified as "inconsistent" if it is produced differently across three trials
- Children who make inconsistent errors have intact knowledge of the phonological system but find it difficult to plan motor sequences (Bradford and Dodd, 1996)

Note: The Developmental Evaluation of Articulation and Phonology (DEAP) is designed to determine which subgroup classifies the child's speech disorder.

IV.b. Dysarthria

See http://www.asha.org/public/speech/disorders/dysarthria/

Dysarthria is a motor speech (articulation) disorder caused by weakness or low muscle tone in the lips, jaw, and tongue. Some causes of dysarthria include traumatic brain injury, cerebral palsy, and muscular dystrophy. Dysarthria can be secondary to a genetic syndrome.

The type and severity of dysarthria depend on which area of the nervous system is affected. Dysarthria can affect respiration, phonation, articulation, and/or resonance. Depending on the extent and location of damage to the nervous system, any of the following symptoms may occur:

- "Slurred" speech due to limited tongue, lip and jaw movement
- Speaking very quietly or with inconsistent vocal volume
- Rate of speech noticeably slow or rapid
- Abnormal stress or intonation
- Changes in vocal quality ("nasal" speech, hoarseness, breathiness)
- Drooling or poor control of saliva
- Difficulty chewing and swallowing

Treatment depends on the cause, type, and severity of the symptoms. Possible goals of treatment include:

- Improving the breath support so the person can speak more loudly
- Slowing the rate of speech
- Increasing mouth, tongue, and lip movement
- Improving articulation or teaching compensatory articulations
- Teaching caregivers, family members, and teachers strategies to better communicate with the person with dysarthria

- Learning to use augmentative or alternative means of communication (e.g., gestures, communication symbol boards, or electronic or computer-based equipment)

The following speech dimensions have been used to describe the characteristics of dysarthric speech. These terms were originally described by Darley, Aronson and Brown (1969).

Perceptual Speech Dimensions

Present	Dimension Number	Dimension Name	Dimension Description
	1	*Pitch level*	Pitch of voice sounds consistently too low or too high for age and sex.
	2	*Pitch breaks*	Pitch of voice shows sudden and uncontrolled variation (falsetto breaks).
	3	*Monopitch*	Voice is characterized by a monopitch or monotone. Voice lacks normal pitch and inflectional changes. It tends to stay at one pitch level.
	4	*Voice tremor*	Voice shows shakiness or tremulousness.
	5	*Monoloudness*	Voice shows monotony of loudness. It lacks normal variations in loudness.
	6	*Excess loudness variations*	Voice shows sudden, uncontrolled alterations in loudness, sometimes becoming too loud, sometimes too weak.
	7	*Loudness decay*	There is progressive diminution or decay of loudness.
	8	*Alternating loudness*	There are alternating changes in loudness.
	9	*Loudness (overall)*	Voice is insufficiently or excessively

			loud.
	10	*Harsh voice*	Voice is harsh, rough, and raspy.
	11	*Hoarse (wet) voice*	There is wet, “liquid sounding” hoarseness.
	12	*Breathy voice (continuous)*	Voice is continuously breathy, weak, thin.
	13	*Breathy voice (transient)*	Breathiness is transient, periodic, and intermittent.
	14	*Strained-strangled voice*	Voice (phonation) sounds strained (an apparently effortful squeezing of voice through glottis).
	15	*Voice Stoppages*	There are sudden stoppages of voiced air stream (as if some obstacle along vocal tract momentarily impedes flow of air).
	16	*Hypernasality*	Voice sounds excessively nasal. Excessive amount of air is resonated by nasal cavities.
	17	*Hyponasality*	Voice is denasal.
	18	*Nasal emission*	There is nasal emission of airstream.
	19	*Forced inspiration-expiration*	Speech is interrupted by sudden, forced inspiration and expiration sighs.
	20	*Audible inspiration*	There is audible, breathy inspiration.

	21	*Grunt at end of expiration*	There is a grunt at the end of expiration.
	22	*Rate*	Rate of actual speech is abnormally slow or rapid.
	23	*Phrases short*	Phrases are short (possibly because inspirations occur more often than normal). Speaker may sound as if running out of air and may produce a gasp at the end of a phrase.
	24	*Increase of rate in segments*	Rate increases progressively within given segments of connected speech.
	25	*Increase of rate overall*	Rate increases progressively from beginning to end of sample.
	26	*Reduced stress*	Speech shows reduction of proper stress or emphasis patterns.
	27	*Variable rate*	Rate alternately changes from slow to fast.
	28	*Intervals prolonged*	There is prolongation of interword or intersyllable intervals.
	29	*Inappropriate silences*	There are inappropriate silent intervals.
	30	*Short rushes of speech*	There are short rushes of speech separated by pauses.
	31	*Excess and equal stress*	There is excess stress on usually unstressed parts of speech, e.g. (1) monosyllabic words and (2) unstressed syllables of polysyllabic words.
	32	*Imprecise consonants*	Consonant sounds lack precision. They show slurring, inadequate sharpness, distortions, and lack of

			crispness. There is clumsiness in going from one consonant sound to another.
	33	*Phonemes prolonged*	There are prolongations of phonemes.
	34	*Phonemes repeated*	There are repetitions of phonemes.
	35	*Irregular articulatory breakdown*	There is intermittent nonsystematic breakdown in accuracy of articulation.
	36	*Vowels distorted*	Vowel sounds are distorted throughout their total duration.
0 1 2 3 4 *	37	*Intelligibility (overall)**	Rating of overall intelligibility or understandability of speech.*
0 1 2 3 4 *	38	*Bizarreness (overall)**	Rating of degree to which overall speech calls attention to itself, because of its unusual, peculiar, or bizarre characteristics.*

*** Qualifier used to indicate the extent or magnitude of an impairment**

Darley, F.L., Aronson, A.E. and Brown, J.R. (1969). Differential diagnostic patterns of dysarthria. *Journal of Speech and Hearing Research.* 12 (2), 246–269.

World Health Organization (2007). *International Classification of Functioning, Disability and Health, Children & Youth Version*.

0	NO impairment/difficulty	(none, absent, negligible,…)
1	MILD impairment/difficulty	(slight, low,…)

2	MODERATE impairment/difficulty	(medium, fair,…)
3	SEVERE impairment/difficulty	(high, extreme,…)
4	COMPLETE impairment/difficulty	(total,…)

IV.c. Childhood Apraxia of Speech

See http://www.asha.org/public/speech/disorders/ChildhoodApraxia/

Childhood apraxia of speech (CAS) is a motor speech (articulation) disorder. Children with CAS have difficulty planning and sequencing the necessary movements for speech. They have difficulty coordinating muscle movements of the lips, jaw and tongue in order to formulate words, phrases and sentences. This difficulty is not due to muscle weakness or paralysis.

Like all speech sound disorders, CAS can range from mild to severe. It is important to assess the child's oral-motor abilities, speech sound development, and speech prosody (rate, rhythm, stress and intonation).

The following signs and symptoms have been associated with CAS. All of the possible signs and symptoms associated with CAS may not be present.

Prelinguistic stages of speech development

- Lack of cooing or babbling as an infant
- Late developing first word
- Limited inventory of consonant and vowel sounds
- Difficulty sequencing sounds; may pause between sounds
- May have eating difficulties due to oral apraxia

Emerging stages of speech development

- Inconsistent sound errors that are not developmental phonological patterns
- Receptive language abilities greater than expressive skills
- Difficulty imitating speech
- Lips and tongue may appear to be groping when attempting to produce sounds or words
- Increased difficulty as length and complexity of utterances increases
- Difficult to understand, even with familiar listeners
- Incorrect syllable or word stress; incorrect “melody” of speech

Associated Difficulties

- Delayed language development, especially expressive spoken language
- Difficulty sequencing word order; apparent difficulty recalling words
- Difficulties with other fine motor movements
- Oral sensitivity (hypersensitive) or lack of oral sensitivity (hyposensitive); e.g., may avoid certain textures
- Difficulties with literacy development (reading, writing, spelling)

An oral-motor assessment is conducted to rule out signs of weakness or low muscle tone in the lips, jaw, and tongue, which would be associated with dysarthria. Children with CAS do not usually have weakness, but they may have difficulty coordinating imitation of nonspeech movements such as elevating and lateralizing the tongue, smiling and puckering the lips. They typically have difficulty sequencing muscle movements for speech during a diadochokinesis task (repeating front-mid-back sounds such as puh-tuh-kuh as fast as possible).

Assessing speech prosody involves listening to stress and intonation patterns. The child may have difficulty stressing syllables in words or stressing appropriate words in sentences. The child may not use pitch correctly to indicate questions, or may pause at inappropriate junctures.

Since children with CAS typically have inconsistent vowel productions and difficulty sequencing diphthongs, it is important to evaluate both vowel and consonant sounds. It is also important to assess whether the child has limited syllable and word shapes.

Top Ten Things to Remember
about Childhood Apraxia of Speech

1. CAS is overdiagnosed. When making this diagnosis, identify Strand's "essential" characteristics: difficulty achieving and maintaining articulatory configurations, vowel distortions, increased difficulty as utterance length expands.

2. Considering the WHO "universe of well-being," assess the functional, structural, environmental, and participation factors for the child.

3. Schedule sessions as frequently as possible. Four 15 minute sessions are better than two 30 minute sessions.

4. Use a session structure of drill (to determine necessary cuing strategies) and drill play activities. Aim for the highest number of productions possible, at least 50 in a 15 minute block.

5. When introducing a new, more difficult phoneme, use a simpler word shape. When introducing a new, more difficult word shape, use simpler phonemes. Don't mix these two difficulty levels. This helps the child to focus on the target and the motor plan.

6. Always work toward improving functional expressive communication. Begin with words and add carrier phrases, negatives, pronouns.

7. Don't use oral motor exercises with children with CAS. Use auditory, visual, and tactile cues in the context of speech.

8. Children with CAS are at high risk for later reading and (especially) spelling problems. Focus on phonological awareness, especially with the preK-3 age group.

9. Emphasize natural prosody (stress and intonation). Model slowed rate and exaggerated (but natural) stress and intonation contours.

10. Teach parents how to provide effective modeling and recasting.

IV.d. Comparison of Childhood Apraxia of Speech, Dysarthria and Phonological Disorder

The following comparison chart was developed by the advisory committee of the Childhood Apraxia of Speech Association (CASANA, 2004). The chart lists and contrasts key characteristics of apraxia of speech, dysarthria and phonological disorder. It is important to note that all characteristics may not be present in an individual child. In addition, it is possible for a child to have both a motor speech disorder and a phonological disorder. For example, a child with cerebral palsy may have dysarthria along with delayed phonological development. A chart such as this one may be helpful in ruling out one diagnosis while identifying which diagnosis is predominant.

Comparison of Childhood Apraxia of Speech, Dysarthria and Phonological Disorder

Childhood Apraxia of Speech	Dysarthria	Phonological Disorder
No weakness, incoordination or paralysis of speech musculature	Decreased strength and coordination of speech musculature that leads to imprecise speech production, slurring and distortions	No weakness, incoordination or paralysis of speech musculature
No difficulty with involuntary motor control for chewing, swallowing, etc. unless there is also an oral apraxia	Difficulty with involuntary motor control for chewing, swallowing, etc. due to muscle weakness and incoordination	No difficulty with involuntary motor control for chewing and swallowing
Inconsistencies in articulation performance--the same word may be produced several different ways	Articulation may be noticeably "different" due to imprecision, but errors generally consistent	Consistent errors that can usually be grouped into categories (fronting, stopping, etc.), even if the patterns are nondevelopmental/idiosyncratic, such as gliding of fricatives
Errors include substitutions, omissions, additions and repetitions, frequently includes simplification of word forms. Tendency for omissions in initial position. Tendency to centralize vowels to a "schwa." Vowel distortions are an “essential diagnostic marker.”	Errors are generally distortions	Errors may include substitutions, omissions, distortions, etc. Omissions in final position more likely than initial position. Vowel distortions not as common.
Number of errors increases as length of word/phrase increases	May be less precise in connected speech than in single words	Errors are generally consistent as length of words/phrases increases

Well rehearsed, "automatic" speech is easiest to produce, "on demand" speech most difficult	No difference in how easily speech is produced based on situation	No difference in how easily speech is produced based on situation
Receptive language skills are usually significantly better than expressive skills	Typically no significant discrepancy between receptive and expressive language skills	Sometimes differences between receptive and expressive language skills
Rate, rhythm and stress of speech are disrupted, some groping for placement may be noted	Rate, rhythm and stress are disrupted in ways specifically related to the type of dysarthria (spastic, flaccid, etc.)	Typically no disruption of rate, rhythm or stress
Generally good control of pitch and loudness, may have limited inflectional range for speaking	Monotone voice, difficulty controlling pitch and loudness	Good control of pitch and loudness, not limited in inflectional range for speaking
Age-appropriate voice quality	Voice quality may be hoarse, harsh, hypernasal, etc. depending on type of dysarthria	Age-appropriate voice quality

V. Severity

Severity of speech sound disorders is based on the impact on speech intelligibility.

- It is important to specify whether intelligibility is being judged at the whole word level or at the phoneme level, and whether it is based on known or unknown contexts with familiar or unfamiliar listeners. Intelligibility can be highly subjective and is influenced by many factors, including the predictability of the individual's error patterns.
- Percent consonants correct (PCC) is a more objective measure that tends to correlate with listeners' overall impression of intelligibility. For example, if a client's PCC is 35%, approximately 1/3 of their speech is understandable by an unfamiliar listener. It is

computed by dividing the number of correct consonants by the number of targeted consonants. (correct consonants/total consonants x 100 = PCC)

- Shriberg and Kwiatkowski (1984) described an intelligibility severity rating for use with PCC.

Good/Mild	>85 PCC
Mild-moderately unintelligible	66-85 PCC
Moderately-severely unintelligible	50-65 PCC
Severely unintelligible	<50 PCC

VI. Intervention

VI.a ASHA Practice Policy

American Speech-Language-Hearing Association. (2004). *Preferred Practice Patterns for the Profession of Speech-Language Pathology* [Preferred Practice Patterns]. Available from www.asha.org/policy.

[http://www.asha.org/docs/pdf/PP2004-00191.pdf]

#16. Speech Sound Intervention

Intervention in speech sound disorders addresses articulatory and phonological impairments, associated activity and participation limitations, and context barriers and facilitators by optimizing speech discrimination, speech sound production, and intelligibility in multiple communication contexts.

Intervention is conducted according to the *Fundamental Components and Guiding Principles*.

Individuals Who Provide the Services

Interventions in speech sound disorders are conducted by appropriately credentialed and rained speech-language pathologists, possibly supported by speech-language pathology assistants under appropriate supervision.

Speech-language pathologists may provide these services individually or as members of collaborative teams that may include the individual, family/caregivers, and other relevant persons (e.g., educators, medical personnel).

Expected Outcome(s)

Consistent with the World Health Organization (WHO) framework, intervention is designed to—

- capitalize on strengths and address weaknesses related to underlying structures and functions that affect articulation and phonology;

- facilitate the individual's activities and participation by assisting the person to acquire new speech production skills and strategies;
- modify contextual factors to reduce barriers and enhance facilitators of successful communication and participation and to provide appropriate accommodations and other supports, as well as training in how to use them.

Intervention is expected to result in improved abilities, functioning, participation, and contextual factors. Intervention also may result in recommendations for reassessment or follow-up, or in a referral for other services.

Clinical Indications

Intervention for speech sound disorders is prompted by referral, mandates, and/or by the results of an assessment that includes measures of articulation and phonology. Individuals receive treatment and/or consultation services when their ability to communicate effectively is impaired because of a speech sound disorder and when there is a reasonable expectation of benefit to the individual in body structure/function and/or activity/participation. Interventions that enhance activity and participation through modification of contextual factors may be warranted even if the prognosis for improved body structure/function is limited.

Clinical Process

Intervention involves providing information and guidance to patients/clients, families, and other significant persons about articulation and phonology, the course of intervention, an estimate of intervention duration, and prognosis for improvement.

Depending on assessment results and age of the client/patient, intervention addresses the following:

- Selection of intervention targets based on the results of an assessment of the client/patient's articulation and phonology.
- Improvement of speech sound discrimination and production.
- General facilitation of newly acquired articulation and/or phonological abilities to a variety of speaking, listening, and literacy-learning contexts.
- Increased phonological awareness of sounds and sound sequences in words and relating them to print orthography (when age-appropriate).

Intervention extends long enough to accomplish stated objectives/predicted outcomes. The intervention period ends when there is no longer any expectation for further benefit.

Setting, Equipment Specifications, Safety and Health Precautions

Setting: Intervention may be conducted in a variety of settings, selected on the basis of intervention goals and in consideration of the social, educational, and/or vocational activities that are relevant to or desired by the individual. In any setting, intervention addresses the personal and environmental factors that are barriers to or facilitators of the patient's/client's articulatory and phonological abilities. There is a plan to generalize and maintain intervention gains and to increase participation in relevant settings and activities.

Equipment Specifications: All equipment is used and maintained in accordance with the manufacturer's specifications.

Safety and Health Precautions: All services ensure the safety of the patient/client and clinician and adhere to universal health precautions (e.g., prevention of bodily injury and transmission of infectious disease). Decontamination, cleaning, disinfection, and sterilization of multiple-use equipment before reuse are carried out according to facility-specific infection control policies and services and according to manufacturer's instructions.

Documentation

Documentation includes the following:

- Written record of the dates, length, and type of interventions that were provided.
- Progress toward stated goals, updated prognosis, and specific recommendations.
- Evaluation of intervention outcomes and effectiveness within the WHO framework of body structures/functions, activities/participation, and contextual factors.

The privacy and security of documentation are maintained in compliance with the regulations of the Health Insurance Portability and Accountability Act (HIPAA), the Family Educational Rights and Privacy Act (FERPA), and other state and federal laws.

VI.b Evidence Based Practice

Baker and McLeod (2011) proposed a 7-step evidence-based practice (EBP) decision-making process for managing speech sound disorders (SSD) in children (adapted from Gillam & Gillam, 2006).

1. Generate a PICO (patient, intervention, comparison, outcome) clinical question.
   The goal of this step is to identify the benefits and risks of using a specific intervention approach relative to another intervention approach (or no intervention) to achieve a specific outcome for a specific patient or client population.

2. Find external evidence that pertains to the question.

   The Appendix in Baker and McLeod (2011) could serve as a useful starting point for gathering evidence relevant to a specific intervention approach. This article reviewed 134 different studies.

3. Critically evaluate the external evidence.

   ASHA (2004) proposed a system for ranking evidence in levels according to credibility and quality.

Level	Description
Ia	Well-designed meta-analysis of >1 randomized controlled trial
Ib	Well-designed randomized controlled study
IIa	Well-designed controlled study without randomization
IIb	Well-designed quasi-experimental study
III	Well-designed nonexperimental studies, i.e., correlational and case studies
IV	Expert committee report, consensus conference, clinical experience of respected authorities

4. Evaluate the internal evidence from clinical practice.

   Evidence could include treatment data, phonological generalization data, changes in PCC, ASHA's National Outcome Measure Systems' (NOMS) Functional Communication Measures (FCM) of articulation/intelligibility (ASHA, 2003), and measures of the impact of intervention on children's activities and participation using the World Health Organization's (WHO's, 2007) International Classification of Functioning, Disability and Health: Children and Youth Version (ICF-CY), measures of the impact of intervention on children's activities and participation.

5. Evaluate the internal evidence with respect to client factors, values and preferences.

   It is important to incorporate activities and participation factors as well as environmental and personal factors associated with individual children and their families in the decision-making process.

6. Integrate the three sources of evidence to generate a clinical decision.

   There does not seem to be one intervention approach or target selection strategy that is superior to others. Clinical expertise is required to integrate sources of evidence in the decision-making process. Clinical expertise draws on:

   i. external evidence (knowledge of the literature)
   ii. internal clinical evidence (experience applying knowledge within the constraints of clinical practice)
   iii. internal client-related evidence (interpersonal skills and attitudes to understand, connect, and relate with the children and families they work with).

7. Evaluate the outcome of the decision.

   Goals must be identified from the outset of intervention, and a plan or schedule for evaluating progress must be implemented.

Research indicates that different deficits underlie the different surface error patterns of the four subgroups of speech disorder (Dodd, 1995). Therefore, intervention targeting the primary area of deficit is likely to be most effective.

VI.b.1. Articulation Impairment (residual errors; e.g., lateral lisp, vocalized r)

- Treating in English will generalize to other languages (Holm and Dodd 1999)
  - Articulation therapy targets motor skills that are not specific to one language
- Use principles of motor learning (Dodd 2004)
  - shorter, more frequent sessions
  - large number of practice trials per session and in home practice
  - mass practice for success along with distributed practice for generalization
- Non-speech oral motor exercises are not indicated as a treatment for articulation disorders (McCauley et al. 2009)

VI.b.2. Phonological Disorder

The benefits of effective phonological treatments have been widely documented in clinical and experimental studies dating from the 1960s. There are a number of acceptable treatment approaches. A single treatment approach is not endorsed over others. Each clinically accepted method has been shown to result in improved accuracy and use of speech sounds. See Baker and McLeod (2011) for a review of 134 studies.

According to data collected from ASHA's National Outcomes Measurement System (NOMS), 70% of preschool-aged children who received phonological treatment exhibited improved intelligibility and communication functioning. Approximately one half of the children who were unintelligible to familiar and/or unfamiliar people at the beginning of treatment progressed to a level where they were understandable to all listeners. The amount of treatment had a significant impact on outcome. The preschoolers who achieved intelligible speech received roughly twice as much treatment as those children who remained unintelligible (ASHA).

The speech-language pathologist assesses the phonological disorder and develops a treatment plan to correct speech sound production. The goal of treatment is to improve accuracy and use of speech sounds to achieve maximum intelligibility in both single words and connected speech, as well as across all settings in which children communicate (Geirut 1998).

VI.b.2.i *Delayed phonological development*:

(Example: 5 year old with developmental phonological patterns of final consonant deletion, gliding of liquids, cluster reduction, fronting)

- Children with delayed phonological development benefit from an approach targeting their developmental simplification patterns, such as final consonant deletion, velar fronting, cluster simplification, and gliding of liquids
- Build vocabulary by targeting words related to basic concepts
    - Target high frequency words which are phonologically different from other words
- Include phonemic awareness activities in treatment
- Auditory bombardment helps children with delayed phonological development to learn that it is important to be "faithful" to the adult target than to produce less "marked" (easier) sounds
- Treatment in English may not generalize to the other language because the simplification patterns in each language may be different; it is important to reassess after each treatment cycle

"Cycles" therapy (Hodson 2007) focuses on suppression of speech sound error patterns (phonological processes). A "cycle" of treatment typically lasts 12-15 weeks, depending on the child's specific error patterns.

A different phoneme is targeted each week for a total of 60 minutes. This can be separated into two 30 minute sessions, three 20 minute sessions, or five 10 minute sessions.

It is possible to include group work, as long as the child receives auditory bombardment, drill, and drill play activities geared to the child's specific target.

Drill play is particularly suitable for groups, because this is a turn taking activity. Participants can produce their target words when it is their turn.

The clinician provides appropriate cuing as needed. Group participants do not all need to be addressing the same target words. Each child needs some weekly individual instruction (auditory bombardment and drill) on the target sound.

A typical "cycle" for an unintelligible child would target:

Word-final consonant deletion:

Week 1: Final p hop, top, nap, mop

Week 2: Final t bat, dot, hat, boat

Week 3: Final k bike, book, pack, hook

Posterior/Anterior Contrasts (velar fronting)

Week 4: Initial k key, cow, cap, cup

Week 5: Initial g go, gum, game, gate

(Note: if the child has difficulty producing /h/, this can also be added. If the child is *backing* alveolars rather than fronting velars, the targets would be initial /t/ and initial /d/.)

/s/-Clusters (targets cluster reduction, stopping of fricatives, stridency deletion)

Week 6: Final -ts hats, dots, bats,

Week 7: Final -ps cups, lips, hops

Week 8: Final -ks box, fox, axe

Week 9: Initial sp- spy, spoon, spin, spot

Week 10: Initial st- stop, star, store step

Week 11: Initial sm- small, smoke, smell

Week 12: Initial sn- snake, snail, snow, sneeze

Week 13: Initial sk- school, ski, scale, skunk

Liquids

Week 14: Initial l- light, lock, look, leg

Week 15: Initial r- row, run, rock, red

(goal is to *suppress* gliding rather than to produce perfect [r])

After “Cycle 1” is completed, a re-evaluation would be conducted and any remaining error patterns would be “re-cycled” in Cycle 2. Again, following Cycle 2, a re-evaluation would indicate which error patterns should be “re-cycled.” Typically, at least 3-4 cycles are necessary to correct a severe phonological disorder.

In Cycle 2, the complexity can be increased by using more complex syllable shapes and/or multi-syllabic words (example: cookie, candle to address initial /k/ sound) and/or phrases.

A typical therapy session using the Cycles approach includes:

No more than 3-5 carefully chosen target words. The words should not contain difficult sounds or word shapes that would distract from the target sound. High frequency, low density words are best.

Auditory Bombardment using light amplification (this can be done with a digital recorder and headphones, or a personal listening device such as Pocket Talker, or an FM system). The child colors or cuts the target words while the clinician repeats a list of 10-12 words containing the session's target sound.

Drill: Child repeats each target word at least 3 times and/or until a successful production is elicited. Various elicitation metaphors and cues (verbal, visual, tactile) can be provided to help the child achieve the target.

Drill play: Child gets to advance in game or activity after producing target word correctly. Cuing is provided as needed. This should be a very fast-moving activity, such as making dots using a bingo marker.

In a turn-taking game, child produces target each time it is her turn, with higher level cuing given, such as question cues (“did you close that word?”). The child can also be given the opportunity to "be the teacher" and judge the accuracy of the clinician's productions - and provide cuing to the clinician.

Auditory bombardment repeated 1-2 minutes.

Home practice consists of the caregiver reading the auditory bombardment list and the child naming the target words. The caregiver is not expected to provide any cuing.

VI.b.2.ii. *Consistent phonological disorder:*

(example: 3 year old with initial consonant deletion, backing of alveolars)

- Children with **consistent** speech disorder make the most change in PCC when their **error patterns** are targeted (Dodd 2006).
- Therapy targeting contrastive use of phonemes has been most successful with children with consistent non-developmental phonological errors
- To promote generalization across both languages in bilingual children:
    - Treatment in English may generalize to the other language under certain conditions
    - Start with sounds that are shared by both languages (compare phonemic inventories of both languages)
    - Target two sounds that are maximally contrastive (that have the greatest number of different features; e.g., /l/ and /tS/)
    - Use nonwords to promote greater, rapid, system-wide generalization
        - (use as names of pet animals, cartoon characters, aliens, etc.)

VI.b.2.iii *Inconsistent speech disorder*:

Core Vocabulary Therapy was developed for children with Inconsistent Speech Disorders. Children with **inconsistent** speech disorder benefitted most from **core vocabulary** therapy in terms of increased consistency and PCC (Dodd 2006). It begins with an assessment of the consistency of the child's word productions.

INCONSISTENCY ASSESSMENT

I. Picture Naming

25 pictures are named 3 times in 1 session

dinosaur	thank you	elephant
slippery slide	jump	witch
shark	birthday cake	tongue
Bert	fish	chips

girl	five	kangaroo
teeth	vacuum cleaner	helicopter
scissors	rain	ladybug
zebra	parrot	
umbrella	bridge	

II. Comparison of productions:

Compare the 3 productions for each word to determine consistency. Note: Do not rate production accuracy, just the consistency of the child's three productions.

Examples of consistency ratings for 3 productions of the target word *dinosaur*:
1. di-no-saur / 2. dye-doh-saur / 3. dye-doh-saur

- inconsistent (variable production)

1. die-su-sor / 2. die-su-sor / 3. die-su-sor

- consistent (NOT variable production)

1. die-su-sor / 2. dye-doh-saur 3. / die-uh-sor

- inconsistent (variable production)

1. dye-oh-saur / 2. dinosaur / 3. dinosaur

- inconsistent (variable production)

1. die-sor / 2. die-sor / 3. die-sor
- consistent (NOT variable production)

Tally the WORDS that are variably produced (inconsistent) and multiply the sum by 4. (Since there are 25 words, this will give you a percentage of inconsistent word productions.)

III. Classification

INCONSISTENT SPEECH DISORDER: at least 40% of words produced variably
CONSISTENT SPEECH DISORDER: at least two atypical patterns and an inconsistency score below 40%

Example: If 11 words are produced variably, 11 x 4 = 44, giving you an Inconsistency Score of 44%, suggesting Inconsistent Speech Disorder.

CORE VOCABULARY THERAPY

1. Clients: Children with inconsistent speech disorder (usually in the severe range)

2. Stimuli: Words that are powerful for (mean something to) the child

3. Rationale: Different parts of the speech processing chain respond differently to therapy targeting different processing skills.

4. Hypothesis: The underlying deficit of inconsistent speech disorder is hypothesized to be a phonological planning deficit, and not a cognitive-linguistic deficit

5. Therapeutic Mechanism: Treatment that targets the speech-processing deficit underlying the child's speech disorder will result in system wide change.

CORE VOCABULARY THERAPY PROCEDURE

I. Begin the treatment block by selecting a core vocabulary of 50 words.

Dodd et al. (2004) suggest a block of 8 weeks intervention for 50 words. The child, parents & teacher select 50 words that are functionally 'powerful' for the child. These may include:

- Names: family, friends, teacher, pets;
- Places: school, library, swimming, McDonalds;
- Functional words: please, thank you, toilet;
- Favorite things: sport, the Simpsons, Pokemon, Batman, Star Wars, Legos

II. Principles and structure of sessions (typically 2 sessions per week)

Session A

Randomly select target words (5-10, depending on session length)

Establish best production: The words are broken down into syllables. The clinician elicits the child's best production on each syllable, providing feedback and modeling after the child's attempts. Phonemic awareness is incorporated so the child learns how to link sounds to letters. Monitor consistency of production of target words

Session B

Drill play: Drill best production of target words. The child practices the target words in a fast moving game that requires repetition (aim for 50 responses per 15 minute block).

Demystification: To assist the client's understanding of the reason for attending therapy, the clinician explains the client's error to him/her and compares it to the correct version.

Monitor consistent production: The client produces the set of target words three times each at the end of the session. If the client produces a word consistently using his/her best production it is removed from the list. Words that are inconsistently produced remain on the list from which the next week's 10 words are randomly chosen.

Home practice: The child will continue to practice the consistent target words at home.

VII. Helpful Websites

Bowen, Caroline. Speech-Language-Therapy dot com [http://speech-language-therapy.com/].

Founded in 1998 as one of the first Speech-Language Pathology related websites, this is a vast resource of information about speech sound disorders for parents and professionals. Especially useful resources from this site include:

- Consumer slide shows for Speech-Language Pathologists to share with families, teachers and others, including an explanation of modeling and recasting. [http://www.speech-language-therapy.com/shows.html]
- Phonology and articulation resources for speech-language pathologists: Worksheets, handouts, pictures and words. [http://www.speech-language-therapy.com/txresources.html]
- The "fixed up one routine" for teaching children how to self-correct. [http://www.speech-language-therapy.com/tx-self-corrections.html]

Taps, Jennifer. SLPath dot com [http://slpath.com/].

Includes resources developed through collaboration between the San Diego Unified School District and San Diego State University. The goal is to support best practices in phonological and articulation treatment. The web site includes assessment tools, treatment ideas, homework sheets, research summaries and links to other online resources. You must register to access the resources. Registration is free and requires only an email address.

VIII. ASHA Policy Documents and Selected References

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