A CASE STUDY APPROACH FOR ASSESSMENT AND TREATMENT OF CHILDREN WITH HIGHLY UNINTELLIGIBLE SPEECH
Part 1

PRESENTED BY
MARGARET (DEE) FISH, MS, CCC-SLP
GLENVIEW, ILLINOIS, USA
FOR
NORTH SUBURBAN SPEECH-LANGUAGE ASSOCIATION

DECEMBER 3, 2022

1

DISCLOSURES

Financial:
- honorarium for this presentation
- royalties from Plural Publishing from sales of the book, "Here's How to Treat Childhood Apraxia of Speech: Third Edition"

Nonfinancial:
- no nonfinancial relationships to disclose

2

AGENDA

9:30-10:00: Discussion of the **characteristics and features** most associated with childhood apraxia of speech (CAS), phonological disorder (PD), and dysarthria
10:00-10:15: Description of **how to develop and test your hypothesis** regarding the diagnosis of a child with a severe speech sound disorder during the evaluation process
10:15-11:00: **Case studies of the evaluation process and hypothesis testing** of 4 children with severe speech sound disorders
11:00-11:15: Break
11:15-12:00: **Case studies for use of evidence-informed decision** making in choosing appropriate treatment options **for children with CAS** or suspected CAS (sCAS)
12:00-12:30: **Case studies for use of evidence-informed decision making** in choosing appropriate treatment options **for children with PD**
12:30-12:45: **Questions and answers**

3

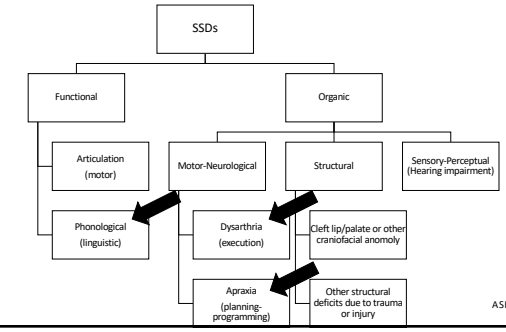
LEARNER OBJECTIVES

FOLLOWING THIS PRESENTATION, PARTICIPANTS WILL BE ABLE TO:

1. **Describe features** most commonly associated with CAS, phonological disorder, and dysarthria.
2. **List steps in the evaluation process** of children with severe speech sound disorders that allow the clinician to develop and test their hypothesis(es).
3. **Determine which of 5 evidence-based treatment approaches for CAS would be most appropriate** for children with various communication profiles.
4. **Identify and describe 3 approaches** to treatment of children with **phonological disorders**.

4

CATEGORIES OF SPEECH SOUND DISORDERS



ASHA (n.d.)

5

DEFINITION OF CHILDHOOD APRAXIA OF SPEECH (CAS)

Childhood apraxia of speech (CAS) is a neurological childhood (pediatric) speech sound disorder in which the precision and consistency of movements underlying speech are impaired in the *absence of neuromuscular deficits (e.g., abnormal reflexes, abnormal tone).

* Murray et al. 2015 – 32 children with CAS – 4 also had dysarthria

6

DEFINITION OF CHILDHOOD APRAXIA OF SPEECH (CAS)

CAS may occur as a result of *known neurological impairment, in association with **complex neurobehavioral disorders of known or unknown origin, or as an ***idiopathic neurogenic speech sound disorder.

**Fish & Skinder-Meredith (2022)* - neuroimaging tools are helping identify more children with CAS who have neurological impairments

***Shriberg et al. (2019)* – Prevalence of CAS in children with complex neurodevelopmental disorders – 4%, CAS + dysarthria – 5%

****Shriberg et al. (2019)* – Prevalence of CAS in children with idiopathic speech delay – 2%

7

DEFINITION OF CHILDHOOD APRAXIA OF SPEECH (CAS)

The core impairment in planning and/or programming spatiotemporal parameters of movement sequences results in errors in speech sound production and prosody (ASHA Position Statement, 2007, para. 3).

8

DEFINITION OF PHONOLOGICAL DISORDER

A Phonological Disorder (PD) is a speech sound disorder characterized by consistent phonological processes or pattern-based errors, often resulting in a restricted sound system. Children with PD my exhibit homonymy (producing one sound for several different target sounds).

PD is considered a linguistic disorder, with underlying difficulties in sorting out the sound system of the native language.

9

DEFINITION OF DEVELOPMENTAL DYARTHRIA

Developmental Dysarthria refers to a group of motor speech disorders that are caused by central or peripheral nervous system damage that results in weakness, paralysis, or incoordination of the speech muscles. Dysarthria impacts the *execution* of speech in some or each of the speech subsystems, including respiration, phonation, articulation, resonance, and prosody to varying degrees.

10

FEATURES OF CAS

11

ASHA's 3 PRIMARY FEATURES OF CAS

FEATURE	DESCRIPTION
INCONSISTENCY	Phoneme inconsistency across words/positions
	Token-to-token inconsistency
PROSODIC DISTURBANCES	Difficulty marking the suprasegmental aspects of speech (syllable/sentential stress, rate, pitch, inflection, and/or loudness)
CHALLENGES WITH ARTICULATORY TRANSITIONS	Difficulty making smooth coarticulatory transitions by prolonging sounds
	Adding sounds

12

MAYO 10 CHARACTERISTICS OF CAS

SEGMENTAL CHARACTERISTICS		
Characteristic	**Description**	**Examples**
Vowel errors	Nondialectal vowel distortions and substitutions	/kɑt/ for "cat" /mɪ/ for "me"
Consonant distortion	Consonant not produced accurately, but recognizable as that consonant	/ˈsɑk/ for "sock" /fɪ!ʃ/ for "fish"
**Intrusive schwa*	An addition of a schwa at the end of words or between consonants	/kætə/ for "cat" /səlip/ for "sleep" /bækəpæk/ for "backpack"
Voicing errors	A phoneme produced as its voiced cognate	/bobo/ for "papa"

*Differentiating characteristic for CAS

13

MAYO 10 CHARACTERISTICS

SEGMENTAL CHARACTERISTICS		
Characteristic	**Description**	**Examples**
**Difficulty achieving initial articulatory configurations or transitional movement gestures*	The child may have difficulty initiating the initial sound of a word or making smooth coarticulatory transitions within a word/phrase	/…haɪ: …mɑm/ for "hi mom"
**Groping*	Visible trial-and-error movements of the articulators prior to speaking	When producing "more" the child opens mouth, retracts lips, then finally closes and rounds lips
**Increased difficulty with multisyllabic words*	Errors increase as length of word or utterance increases	Child can say "prince" and "pull" but says, /pɪndəpo/ for "principle"
Resonance or nasality disturbance	Nasal sounds may sound hyponasal and oral sounds may sound hypernasal – generally *inconsistently* in CAS	

14

MAYO 10 CHARACTERISTICS

SUPRASEGMENTAL CHARACTERISTICS		
Characteristic	**Description**	**Examples**
**Syllable segregation*	Short or long pauses between syllables when not linguistically appropriate	/bə..næ..nə/ for "banana"
Slow rate and/or slow DDK rates	Decreased rate when speaking or performing DDK tasks – may be more prevalent in challenging or unfamiliar words	/pʌ:..tʌ:..kʌ:/ for "/pʌtʌkʌ/" /aɪ lɔst maɪ dɪ:k..ʃ:ə:..n:e:..ri:/ for "I lost my dictionary."
Stress errors	Equal stress *Incorrect stress assignment Sentential stress difficulties	/ˈbəˌnæˌnə/ /bəˌ næˌnə/ /ˈletˌmiˈduˌɪt/ for "Let **ME** do it."

15

HOW MANY CHARACTERISTICS TO CONFIDENTLY DIAGNOSE CAS

- Varies
- 4 of 10 Mayo 10 characteristics (+inconsistency) across 3 tasks (Murray et al., 2015)
- 5-3-3 rule - 5 characteristics, 3 times each, across 3 contexts (Iuzzini-Seigel, 2021)

16

WHAT SPEECH TESTS OR TASKS HELP IDENTIFY FEATURES OF CAS?

- Tests of CAS (some identify more features than others)
- Articulation Tests (*with additional analysis*: age ranges vary, but as young as 2 years)
- DDK task (4+ years)
- Repetition of phrases of increasing length (when child is able)
- Connected speech sample (all ages)
- *Multisyllabic word repetition (4+ years)

** Multisyllabic word repetitions should not be used to measure inconsistency*

17

MULTISYLLABIC WORD REPETITION TASK

FEATURES MEASURED

- ❑vowel errors
- ❑consonant distortion
- ❑intrusive schwa
- ❑voicing errors
- ❑difficulty achieving initial articulatory configurations or transitional movement gestures
- ❑groping
- ❑increased difficulty with multisyllabic words
- ❑resonance or nasality disturbance
- ❑syllable segregation
- ❑slow rate
- ❑stress errors

18

MEASURING ASHA'S
CORE CHARACTERISTICS OF CAS

- Inconsistency
- Prosody
- Difficulties with articulatory transitions

19

INCONSISTENCY

20

INCONSISTENCY IN SCHOOL-AGE CHILDREN

"Buy Bobby a puppy."

Produced 5 times
Note ANY inconsistency across 5 repetitions (token-to-token inconsistency)

70% sensitive and 80% specific
in determine if child is at risk for CAS

*Better than multisyllabic word inconsistency measure

21

BUY BOBBY A PUPPY

CHILD A	CHILD B
/baɪː bɑbi ə pʌ..pi/	/baɪ bɑbi ə pʌpi/
/baɪː bɑbi ə pʌ..pi/	/baɪ bɑbi ə pʌpi/
/baɪː bɑbi ə bʌpi/	/baɪ bɑbi ə pʌpi/
/baɪː bɑbi ə bʌpi/	/baɪ bɑbi ə pʌpi/
/bɑ bɑji ə bʌpi/	/baɪ bɑbi ə pʌpi/

22

INCONSISTENCY IN PRESCHOOL CHILDREN

Inconsistency Severity Percentage (ISP)

Examines # of different error types (S/O/D/A) relative to total # of consonant opportunities

What words do I use?
- Custom word list *OR*
- Standard articulation test (e.g., GFTA-3)

23

DYNAMIC ASSESSMENT OF
MOTOR SPEECH SKILL (DEMSS)

SAMPLE TEST ITEMS AND SCORING

TARGET	INITIAL ATTEMPT		AFTER CUEING	
	Vowel accuracy (score 2, 1, or 0)	Articulatory accuracy (score 4, 3, or 2)	Articulatory accuracy (score 2, 1, or 0)	Consistency (score 1 or 0)
Me				
Pow				
Bye				

Note

Inconsistent voicing errors		Trial or error		Difficulty with multisyllabic words	
Groping		Vowel or consonant distortion		Awkward movement transition	
Intrusive schwa		Lexical stress errors			
Slow rate		Segmentation			

24

Inconsistency Calculation Sheet - CML-Lab

Participant:________ Date:________ Clinician:________ Phase:________ PreTx/PostTx/Maintenance

m	n	ŋ	p	b	t/ r	d	k	g	θ	ð	f	v	s	z	ʃ	h	tʃ	dʒ	l	r	w	j

Nasal Clusters	/l/ Clusters	/r/ Clusters	/s/ Clusters	Phonetic Inventory	P.V.M. Error Patterns

CSIP= # Inconsistent productions/total # of erred productions*100=	ISP= # Inconsistent productions/ total # of targets* 100=
% Error= # Erred productions/total # of targets*100=	***Total number of targets in GFTA-3= 123 (do not include clusters), unless the child did not complete the probe

Let us know if you have questions or enjoy using this tool: cml-lab@marquette.edu or on Insta @marquette_cml_lab

25

ISP ≥ 18%
is

A RED FLAG

for CAS
in preschool children

26

Inconsistency Calculation Sheet CML-Lab

GFTA-3
house [hɔ]
door [do]
pig [biyə]
cup [dʌ]
girl [daʊ]
boy [bo]
apple [bɑpo]
go [go]

Participant:________ Date:________ Clinician:________ Phase:________ PreTx/PostTx/Maintenance

m	n	ŋ	p	b	t/ r	d	k	g	θ	ð	f	v	s	z	ʃ	h	tʃ	dʒ	l	r	w	j

Nasal Clusters	/l/ Clusters	/r/ Clusters	/s/ Clusters	Phonetic Inventory	P.V.M. Error Patterns

CSIP= # Inconsistent productions/total # of erred productions*100=	ISP= # Inconsistent productions/ total # of targets* 100=
% Error= # Erred productions/total # of targets*100=	***Total number of targets in GFTA-3= 123 (do not include clusters), unless the child did not complete the probe

Let us know if you have questions or enjoy using this tool: cml-lab@marquette.edu or on Insta @marquette_cml_lab

27

PROSODY

28

WAYS TO ASSESS PROSODY

Dynamic Assessment Of Motor Speech Skill (DEMSS)
- Many of the test items with 2+ syllables are given a lexical stress match score
- Section in scoring to note if the child exhibited:
  - segmentation
  - equal stress
  - incorrect stress assignment

29

DYNAMIC ASSESSMENT OF MOTOR SPEECH SKILL (DEMSS)

SAMPLE TEST ITEMS AND SCORING

TARGET	INITIAL ATTEMPT			AFTER CUEING
	Vowel accuracy (score 2, 1, or 0)	Prosodic accuracy (score 1 or 0)	Articulatory accuracy (score 4, 3, or 2)	Articulatory accuracy (score 2, 1, or 0)
Bunny				
Open				
To**day**				

30

ASSESSING PROSODY

Language Sample

- Note difficulty with syllable stress or sentence-level stress, segmented syllables, lack of intonation or unusual intonation, etc.

31

INFORMAL PROSODY ASSESSMENT TASK

EXAMPLES from Here's How to Treat Childhood Apraxia of Speech, Third Edition (Fish & Skinder Meredith, 2022)

- Lexical stress contrasts (e.g., **ob**ject/ob**ject**; **per**mit/per**mit**)
- Lexical stress match in increasingly complex words (e.g., a**gain**, **tri**angle, **te**levision, invi**ta**tion)
- Contrastive stress (e.g., **Baby** ate the apple. Baby **ate** the apple. Baby ate the **apple**.)
- Intonation (e.g., Bobby ate 10 cookies.↘ Bobby ate 10 cookies? ↗)
- Vocal control of tone of voice, loudness, pitch (e.g., I came in 2nd place. *excited* I came in 2nd place. *sad/disappointed*)

32

PROSODY OBSERVATION IN YOUNGER CHILDREN

During play – can child make vocal contrasts (pitch/loudness) and prolong vowels in words with high emotional content

wow

whee

hoo**ray**

I **did** it

oh **no**

Mo:mmy where **are:** you?

33

DIFFICULTIES WITH ARTICULATORY TRANSITIONS

34

WAYS TO ASSESS DIFFICULTIES WITH ARTICULATORY TRANSITIONS

Observations on any formal or informal assessment:

- slow productions
- gaps between syllables
- groping
- insertion of schwa
- prolonged vowels or consonants

Observations can be made during:

- spontaneous speech sample
- DDK
- test of articulation or CAS
- multisyllabic word repetition
- phrase repetition

35

PHONOLOGICAL DISORDER

36

CHARACTERISTICS OF PD

- Rule-based errors that affect more than one sound
- Limited phoneme inventories
- Reduced speech intelligibility
- Restricted distribution of phonemes across word positions
- Collapse of contrasts between phonemes (resulting in one sound replacing many sounds)
  - Results in homonymy (e.g., /ti/ for *tea, key, she, see)*
- Phonological simplifications observed in younger children do not resolve over time
- May also demonstrate idiosyncratic error patterns (e.g., initial consonant deletion; backing of alveolars; replacing stops with fricatives; stopping of glides)

37

DIFFERENTIATING CAS FROM PD

- Compared to children with CAS, children with PD tend to:
  - be more consistent in their errors
  - have more natural sounding prosody
  - have more normal/smoother articulatory transitions
  - have fewer vowel and voicing errors
  - use a more normal habitual rate of speech
- Various assessment tasks (e.g., formal articulation/phonology test; speech sample; phrase repetition; multisyllabic word repetition) will help reveal these differences.
- *Caveat* – children with CAS will typically use some phonological patterns

38

DYSARTHRIA

39

CHARACTERISTICS OF DYSARTHRIA

- Imprecise articulation – *Always*
- Other features vary by subtype and which neural substrate is affected, including:
  - disordered prosody
  - poor respiratory-phonatory coordination
  - scanning speech
  - decreased range of motion, speed, coordination
  - difficulty controlling rate, rhythm, prosody
  - hypernasality
  - voice quality differences (strained, breathy, harsh)
  - inconsistency*

40

DIFFERENTIATING CAS FROM DYSARTHRIA

New tool from
Iuzzini-Seigel, Allison, and Stoeckel (2022)

Pro-CAD
Profile of Childhood Apraxia of speech and Dysarthria

Free online tool
to help differentiate CAS from Dysarthria

41

ProCAD – *Free online tool*

Supplemental material, Iuzzini-Seigel et al., "A Tool for Differential Diagnosis of Childhood Apraxia of Speech and Dysarthria in Children: A Tutorial," *LSHSS*. https://doi.org/10.1044/2022_LSHSS-21-00164

Child's Name _____ Clinician's Name _____ Date of Evaluation _____

ProCAD (Profile of Childhood Apraxia of speech and Dysarthria) Auditory-Perceptual Feature Rating Checklist

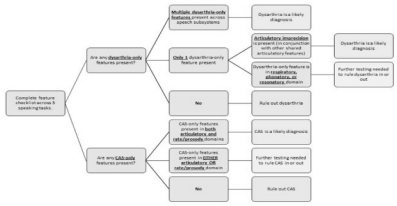
Speech Subsystem	Speech Feature		Dysarthria/ CAS/ Both	Speech Task 1	Speech Task 2	Speech Task 3
Respiration/ Phonation (R/P)	Volume	Low volume or loudness decay	Dysarthria*,***			
		Excessive loudness	Dysarthria*,**,***			
		Excess loudness variation	Dysarthria*,***			
	Speech breathing	Effortful/ Audible inspiration	Dysarthria*,***			
		Short breath groups	Dysarthria*,***			
	Atypical voice quality		Dysarthria*,**,***			
Resonance (Res)	Fluctuating resonance/intermittent hyper/hyponasality		Both*,***,†			
	Consistent hypernasality (with or without nasal emission)		Dysarthria*,**,***			
Rate/ Prosody (Pros)	Slow rate		Both*,***,†††			
	Atypical stress/reduced stress		Both*,***,†††			
	Lexical stress errors		CAS†,††			
	Syllable segregation		CAS†,††			
Articulation (Artic)	Imprecise articulatory contacts		Dysarthria*			
	Consonant distortions		Both*,***,†††			
	Vowel errors		Both*,***,†††			
	Voicing errors		Both*,***,†††			
	Intrusive schwa		CAS†,††			
	Groping (articulatory searching)		CAS†,††			
	Increased difficulty with multisyll. words		CAS†,††			
	Difficulty with initial artic configs/ transitionary movement gestures		CAS†,††			
# Dys-only features						
# CAS-only features						
# Total features						
Subsystems involved				☐ R/P ☐ Res ☐ Pros ☐ Artic	☐ R/P ☐ Res ☐ Pros ☐ Artic	☐ R/P ☐ Res ☐ Pros ☐ Artic
Diagnosis						
Severity						

*Duffy 2019, **Workinger & Kent, 1992, *** Scholderle et al, 2020
†Iuzzini-Seigel, Hogan & Green, 2017, ††Shriberg, Potter & Strand, 2011 (Iuzzini-Seigel, Allison, & Stoeckel, 2022)

Supplemental Material S2. Auditory-perceptual feature list template and decision-making flowchart to support clinical application.

42

ProCAD Flowchart



(Iuzzini-Seigel, Allison, & Stoeckel, 2022)

43

PURPOSE OF ASSESSMENT

Gathering
specific types of information
TO TEST A HYPOTHESIS
and using the findings to
GUIDE TREATMENT DECISIONS

44

ASSESSMENT FOR CHILDREN WITH HIGHLY UNINTELLIGIBLE SPEECH

*Area of Assessment	Purpose
*Hearing screening	Rule out hearing loss as a factor
*Case history	Note: family history of S/L disorder; early vocal and feeding behavior; parent/teacher concerns re: play and language skills; social challenges
*Oral mechanism examination of structure and function	Rule out any structural deficits (e.g., cleft, ankyloglossia, etc. or functional deficits in strength, speed, range of motion, coordination)
Maximum performance tasks (MPTs)	If dysarthria is suspected (e.g., Maximum exhalation duration (MED); Maximum phonation duration (MPD))
*Nonverbal praxis examination	Observe imitation of single/combined oral movements; DDK

45

ASSESSMENT FOR CHILDREN WITH HIGHLY UNINTELLIGIBLE SPEECH

Area of Assessment	Purpose
Speech sound assessment in single words	Determine types and consistency of error types (S/O/D/A)
Phonological assessment	Determine types and consistency of phonological patterns
Motor speech assessment	Tax the motor speech system - produce words with increasing length and complexity
Vowel production	Determine which vowels are in the child's inventories and the types/frequency of vowel errors
Prosody observations	Note differences in syllable/sentential stress; intonation; rhythm. Note segmentation of sounds/syllables/words
Dynamic assessment; *Stimulability	Determine how the child responds to cueing to improve accuracy of production (e.g., modeling, simultaneous production, tactile cueing)?

46

YOU CAN ALSO MEASURE/DESCRIBE…

- Child's speech severity
  - Articulation/phonology/motor speech assessment score
  - Percent consonants correct (PCC)
  - Percent vowels correct (PVC)
  - Percent phonemes correct (PPC)
    - 85-100% mild
    - 65-85% mild/moderate
    - 50-65% moderate
    - below 50% severe
- Intelligibility
  - Intelligibility in Context Scale (ICS) - McLeod, Harrison, McCormack (2012)
  - Informal rating scales – (e.g., 1-7)
- Comprehensibility – note any additional means the child uses to make themselves understood

47

YOU CAN ALSO MEASURE/DESCRIBE…

- Speech perception
  - identification of correct/incorrect productions
  - choose the picture they heard
- Receptive/expressive language
- Social-pragmatic language (conversational reciprocity, variety of language functions, engagement and interaction
- Phonological awareness
- Gross and fine motor skills (based on observation of gait and use of writing/drawing tools) or other reports
- Sensory processing (based on parent reports or reports from other providers)
- Social-emotional well-being (based on parent reports or reports from other providers)

48

DEVELOPING AND TESTING A HYPOTHESIS

When do we begin **developing a hypothesis** about the nature of the child's communication challenges?

How do we test our hypothesis?

- **Observe –** play/conversation
- **Examine –** oral structure and function (MPTs-if dysarthria is suspected)
- **Assess** - speech (and language if warranted)
- **Choose** – assessments that help us test our hypothesis
  - formal
  - informal

49

BE OPEN TO A RANGE OF POSSIBILITIES

This child may be having difficulty with communication because of…

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

50

USE THE ASSESSMENT...

To begin ruling out these possibilities
and
determining the true diagnosis
or diagnoses

51

STEPS IN THE EVALUATION PROCESS

1. Case history; audiological findings; current concerns
2. Observe child during play/conversation – note any obvious neurological soft signs; obvious motor challenges; obvious social communication and/or receptive language challenges; play skills; overall intelligibility; expressive language
3. Structural-Functional Assessment (SFA - including DDK if child is 4+ years); include Maximum Performance Tasks (MPTs) if dysarthria is suspected
4. Formal and/or informal assessments of speech, phonology, and/or motor speech
5. Other formal/informal assessment measures to gather additional information (e.g., phonological awareness, receptive/expressive language)

52

CASE STUDIES for EVALUATION

53

ELI

INITIAL PHONE CONVERSATION WITH MOTHER

- Age: 4 years, 2 months
- Recent audiological exam – normal findings
- Significant History- Frequent **ear infections**; recent big leap of **progress** in speech therapy

❖Current **SLP suspects CAS**

❖Mother reported most **people have trouble understanding him;** gets easily frustrated when misunderstood and will throw toys and hit

54

ELI

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

55

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

56

ELI

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

57

ELI

OBSERVATIONS DURING PLAY

- **Strong** cognitive, social engagement, play, gross/fine motor skills, receptive language
- **Highly verbal –** Spoke a LOT, but primarily in **single words and 2- to 4-word phrases** spontaneously
- **Soft neurological signs** – None
- Speech was **difficult to understand**

58

ELI

Is there anything from list of possible reasons for speech/language impairment that can be **ruled out** or **ruled in**?

59

ELI

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

60

ELI

ORAL EXAMINATION OF STRUCTURE AND FUNCTION

- Oral exam/structure – **Normal strength, tone, symmetry**
- Oral exam/function – Was able to **imitate all tongue and lip movements** and movement sequences requested with ease
- **No drooling**
- Good **range of motion**

61

ELI

Is there anything from list of possible reasons for speech/language impairment that can be **ruled out** or **ruled in**?

62

ELI

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

63

Some words/phrases transcribed during play

Target Word	Eli's Production
daddy	"daddy"
blue dinosaur	"boo di.nu.hau"
sun, shoe, funny	"un" "oo" "unny"
bus	"bus"
pajamas	"pa.da.mas"
cookie	"too.tie"
pepperoni	"pep.puh.wo.ni"
alligator	"a.wi.da.do"
spoon	"poon"
Baby eat ice cream	"baby ea ice weam"
I not see it.	"I nah ee ih."

64

WHAT FORMAL OR INFORMAL ASSESSMENT(S) WOULD PROVIDE THE MOST INFORMATION?

65

FORMAL ASSESSMENTS Speech Praxis

TEST – AGE RANGE	AREA(S) ASSESSED
Dynamic Evaluation of Motor Speech Skill (DEMSS) – 3:0 and older	Children with severe speech sound disorders
Kaufman Speech Praxis Test for Children (KSPT) – 2:0 – 5:11	Young children with suspected CAS
Verbal Motor Production Assessment for Children (VMPAC-R) – 3:0 – 12:0	Children with suspected motor speech involvement (CAS or dysarthria)

66

FORMAL ASSESSMENTS
Articulation and Phonology

TEST; AGE RANGE	AREA(S) ASSESSED
Arizona Articulation and Phonology Scale – 4th Revision (**Arizona 4**) 18 months to 21;11	Assesses articulation and phonology in toddlers through young adults
Diagnostic Evaluation of Articulation and Phonology (**DEAP**) – U.S. version 3;0 – 8;11	Assesses articulation and phonology in preschool and early elementary school children
Goldman-Fristoe Test of Articulation-Third Edition (**GFTA-3**) 2;0 to 21;11	Assesses articulation in toddlers through young adults
Hodson Assessment of Phonological Patterns, Third Edition (**HAPP-3e**) 2;0 to adult	Assesses children to adults with highly unintelligible speech
Glaspey Dynamic Assessment of Phonology 3-10 years	Dynamic assessment of speech production and stimulability

67

ELI

- Administered the DEAP
- Phoneme repertoire Consonants /p, b, t, d, m, n, h, w, j, f, v, s, z, tʃ, l/
- Phoneme repertoire Vowels – all except rhotics
- Syllables shape Repertoire

CV	/pɪ/ for pig	**VC**	/ip/ for sheep
VCCV	/ibwə/ for zebra	**CVC**	/wɑtʃ/ for watch
CVCV	/bætɪ/ for basket	**CVC**	/win/ for queen
CVCVCV	/wɔbɛwi/ for strawberry	**CVCCVC**	/laɪthaʊs/ for lighthouse
CVCCCVC	/tufbwəs/ for toothbrush	**CVCVCVCV**	/hɛlətətʊ/

68

ELI

- **Percentage of Consonants Correct** - **63%**
- **Percentage of Vowels Correct** - **100%** (excludes rhotic vowels)
- **Inconsistency Severity Percentage** - **7%**
- **Patterns observed** – ICD (many fricatives and affricates; cluster reduction; fronting; FCD; liquid gliding & vowelization)
- **Prosody** – **good** stress, rhythm, and intonation; smooth articulatory transitions
- **Other observations**
  - **Consistent** and predictable **error patterns**
  - **Single word** and **phrase-level** errors were **similar**
- **Beneficial cues** - direct models at reduced rate; hand gestures

69

ELI

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

70

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

71

ELI: Diagnoses and Relative Contributions

- Upon completion of evaluation, **what diagnosis/diagnoses** would fit Eli's profile?

  _____
  _____
  _____

- At this point in time, **which diagnosis(es) is/are contributing most** to communication challenges?

72

GREG

INITIAL PHONE CONVERSATION WITH MOTHER

- Age: 2 years, 10 months
- Recent audiological exam – normal findings
- Significant History- No significant medical history; all milestones good except speech; limited babbling in infancy; began speech tx at 2;0 but has made minimal progress
- Has fewer than 10 words in spontaneous expressive vocabulary; but does imitate more words
- Mom suspects CAS

73

GREG

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

74

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

75

GREG

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

76

GREG

OBSERVATIONS DURING PLAY

- Excellent social engagement, creative play, good gross/fine motor skills, good receptive language
- Good gestural system and facial expressions
- Used a few manual signs spontaneously
- Imitated a few words

Word	Production	Word	Production
Mama	/mɑmɑ/, /bɑbɑ/	Daddy	/dɑdɑ/
More	/mɑ/	No	/dʌ/, /nʌ/
Go	/dʌ/	One	/ɑ/
Two	/du/	Three	/dɪ/
Ball	/bɑ/	In	/ɪ/
Hole	/o/, /u/	Me	/bɪ/, /mɪ/

77

GREG

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

78

GREG

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

79

GREG

ORAL EXAMINATION OF STRUCTURE AND FUNCTION

- Oral exam/structure – Normal strength, tone, symmetry, no other findings
- Oral exam/function – Reluctant to imitate oral-facial movements
- No drooling

80

GREG

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

81

GREG

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

82

GREG

- Dynamic testing and analysis of:
  - Consistency
  - Groping
  - Awkward movement transitions
  - Segmentation
  - Rate
  - Vowels
  - Cueing required to achieve accuracy

83

GREG

- Dynamic testing and analysis of:
  - Consistency (ISP) - 21%
  - Groping - observed
  - Awkward movement transitions - observed
  - Segmentation – gaps between syllables
  - Rate - slow
  - Vowels – PVC-34%
  - Cueing required to achieve accuracy - substantial
  - Stress/prosody – equal stress

84

GREG

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

85

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

86

GREG : Diagnoses and Relative Contributions

- Upon completion of evaluation, **what diagnosis/diagnoses** would fit Greg's profile?

  _____
  _____
  _____

- At this point in time, **which diagnosis(es) is/are contributing most** to communication challenges?

87

LISA

INITIAL PHONE CONVERSATION WITH MOTHER

- Age: 5 years, 10 months
- Recent audiological exam – normal findings
- Significant History- No significant birth or other medical history; delayed attainment of all milestones; PT initiated at 8 months to help with motor skills; Speech therapy since 18 months (some progress, but slow)
- Limited expressive vocabulary
- Uses some signs and picture boards to communicate
- Parents and SLP suspect CAS

88

LISA

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

89

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

90

LISA

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

91

LISA

OBSERVATIONS DURING PLAY

- Enjoyed toys, but became frustrated and cried easily when asked to request verbally or gesturally
- Played with adults, but preferred to play on her own
- Limited variety in play
- Substantial drooling
- Difficulty holding herself upright when seated
- Attempted words periodically, but often achieved an approximation of the initial phoneme
- Receptive language higher than expressive, but quite delayed

92

LISA

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

93

LISA

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

94

LISA

ORAL EXAMINATION OF STRUCTURE AND FUNCTION

- Oral exam/structure – No overt structural deficits, reduced strength, low tone, open-mouth posture, asymmetry of eyes, lips, cheeks during movement, ROM-
- Oral exam/function – Difficulty imitating oral-facial movements
- Drooling observed
- Strained vocal quality at times

95

LISA

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

96

LISA

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

97

LISA

- Testing and analysis of:
  - Phoneme repertoire (vowels and consonants)
  - Syllable shape repertoire
  - Any phonetically consistent forms?
  - Response to cueing
  - Any features of CAS

98

LISA

- Phoneme repertoire (vowels and consonants)
  - /b, p, k, m, ɑ, ʌ, ɪ/
- Syllable shape repertoire
  - V, C, CV, CVCV reduplicated (trouble stopping at 2 syllables, so often produced multiple syllables)
- Any phonetically consistent forms? - No
- Response to cueing – Better with models, simultaneous productions, tactile cues
- Any features of CAS – not enough reliable verbal communicative attempts to assess for CAS

99

LISA

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

100

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

101

LISA : Diagnoses and Relative Contributions

- Upon completion of evaluation, **what diagnosis/diagnoses** would fit Lisa's profile?

  _____
  _____
  _____

- At this point in time, **which diagnosis(es) is/are contributing most** to communication challenges?

102

CASE STUDY - CALEB

Age: 9 years, 4 months

Birth history: Delivered via c-section 37 weeks due to preeclampsia; jaundice

Developmental history: Achieved milestones at or slightly later than age expectancies – first word – 12 months, but slow to add new words

Speech and OT – initiated at 15 months

Incoming diagnoses: ADHD, Learning disabilities, Sensory modulation disorder, and Childhood apraxia of speech (CAS).

Audiological: Normal hearing

103

CALEB

Is there anything from list of possible reasons for speech/language impairment that can be **ruled out** or **ruled in**?

104

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

105

CALEB

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

106

CALEB

OBSERVATIONS DURING CONVERSATION

- Highly verbal – spoke in long sentences; many stops and restarts; many grammatical errors
- Good social engagement – friendly and eager to share personal information and knowledge
- Intelligibility – good in context; when I could not understand, he simply repeated himself without using any strategies to increase intelligibility
- Pulled lip toward the right when producing certain sounds

107

CALEB

Is there anything from list of possible reasons for speech/language impairment that can be **ruled out** or **ruled in**?

108

CALEB

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

109

CALEB

Examination of oral structure and function

Structure: No structural abnormalities; normal tone and symmetry at rest

Function: Good ROM; Good MPTs, asymmetry of cheek/lip (pulling toward right) during production of certain phonemes; DDK - could produce /puh/ and /kuh/ at appropriate rate; /tuh/ was much slower; could not produce /puh tuh kuh/ correctly even after multiple attempts; /puh kuh/ and /tuh kuh/ were accurate, but slow; able to imitate single oral movements, but combined oral movements were clumsy

110

CALEB

Is there anything from list of possible reasons for speech/language impairment that can be **ruled out** or **ruled in**?

111

CALEB

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

112

CALEB

- GFTA-3
  - liquid gliding and vowelization (l and r)
  - /f/ for /θ/ and /d/ for /ð/
  - cluster reduction (more in medial position and complex words)
  - difficulty with all 3-syllable words
  - mild lateral release /ˡ/of /s, z, ʃ, tʃ/
- "Buy Bobby a puppy" – Consistent across 5 trials, but halting speech and segmentation of syllables
- Multisyllabic Word Repetition

vacation	/və.ke.ˈtʃən/	subtraction	/ˈtʃwæ.ˈtʃən/
experiment	/ɛ.ˈspi.mət/	congratulations	/gwæ.dʒu.we.ˈʃənˈz/
enthusiasm	/ɹ.fu. ˈzi.æm/	evaporation	/vɪ.væ.pə.we.ˈʃən/
television	/tɛ.wɪ.ˈʒən/	unbelievable	/ən.bwi.bə.bo/

113

CALEB

Build-Upon Words

Ann /æn/	Anna /æ.nə/	Animal /æ.mo/
Bass /bæˈs/	Basket /bæ.ˈsɪt/	Basketball /bæ.ˈsɪt.bɔ/
Me /Mi/	Meaty /mi.ji/	Medium /mi.jəm/
Soup /ˈsup/	Scoop /ˈskup/	Scoops /ˈsupˈs/
Cap /kæp/	Camp /kæmp/	Scamp /stæmp/
Wish /wɪʃ/	Swish /ˈswɪʃ/	Swished /ˈswitʃt/

114

CALEB – Mayo 10

- ❑vowel errors
- ✓consonant distortion (mild)
- ❑intrusive schwa
- ❑voicing errors
- ✓difficulty achieving initial articulatory configurations or transitional movement gestures (for complex words)
- ❑groping
- ✓increased difficulty with multisyllabic words
- ❑resonance or nasality disturbance
- ✓syllable segregation
- ✓slow rate (DDK, some multisyllabic words)
- ❑stress errors
- ✓inconsistency (when motor speech system was taxed)

115

CALEB – Phonological Patterns

Phonological Patterns observed – *more prevalent in conversational speech, sentence repetition, and multisyllabic word repetition*:

- Cluster reduction
- Weak syllable deletion
- Epenthesis
- Assimilation
- Final consonant deletion
- Medial consonant deletion
- Liquid gliding and liquid vowelization

116

CALEB

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

117

CALEB

What can we **rule in or out** next?

AND

What **type of testing/observations** would we do?

118

LANGUAGE ASSESSMENT

Difficulties observed in the areas of:

- Grammar
- Auditory memory
- Problem solving
- Inferencing
- Narrative language organization

- Low scores in both receptive and expressive language

119

CALEB

Is there anything from list of possible reasons for speech/language impairment that can be **ruled in or out**?

120

POSSIBLE REASONS FOR LIMITED LANGUAGE AND/OR SPEECH INTELLIGIBILITY

- ❑Cognitive impairment
- ❑Receptive language impairment
- ❑Expressive language impairment
- ❑Social language impairment (Including but not limited to Autism)
- ❑Hearing impairment
- ❑Other physiological impairment (e.g., cleft palate)
- ❑Phonological disorder
- ❑Dysarthria
- ❑CAS

121

CALEB: Diagnoses and Relative Contributions

- Upon completion of evaluation, **what diagnosis/diagnoses** would fit Caleb's profile?

_____
_____
_____

- At this point in time, **which diagnosis(es) is/are contributing most** to communication challenges?

122

Questions and Answers

123