Auditory Processing Disorder Diagnosis: Science or Pseudoscience?

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Overview

- This presentation reviews current controversies pertaining to the validity of assessment and treatment of auditory processing disorder (APD). It also discusses how the APD label results in professionals discounting true language and literacy deficits in students who require appropriate language and literacy assessment and targeted language and literacy intervention services.

Learning Objectives

- At the end of this presentation learners will be able to

1. List ‘APD’-related symptoms and describe their overlap with other disorders as per APD testing results
2. Describe the current controversy pertaining to ‘APD’ diagnosis
3. Discuss how speech-language pathologists can assist students with “processing deficits” with respect to language and literacy assessment and intervention

‘APD’ Symptomology as per AuD, Parent Reports and Notable APD Models

- **A.** Student presents with difficulty processing information efficiently
  - Requires increased processing time to respond to questions
  - Presents like s/he are ignoring the speaker
  - May request frequent repetition of presented information from speakers
  - Difficulty following long sentences
  - Difficulty keeping up with class discussions in group settings
  - Poor listening abilities under noisy conditions may be interpreted as “distractibility”
- **B.** Student has difficulty maintaining attention on presented tasks
  - Frequent loss of focus
  - Difficulty completing assignments on their own

‘APD’ Symptomology (cont.)

- **C.** Student has poor short-term memory
  - Difficulty remembering instructions and directions or verbally presented information
- **D.** Student has difficulty with phonemic awareness, reading and spelling
  - Poor ability to recognize and produce rhyming words
  - Poor segmentation abilities (separation of sentences, syllables and sounds)
  - Poor sound manipulation abilities (isolation, deletion, substitution, blending, etc.)
  - Poor sound letter identification abilities
  - Poor vowel recognition abilities
  - Poor decoding
  - Poor comprehension
  - Spelling errors
  - Limited/disorganized writing

‘APD’ Symptomology (cont.)

- **E.** The combination of above factors may result in generalized deficits across the board, affecting the child’s social and academic performance:
  - Poor reading comprehension
  - Poor oral and written expression
  - Disorganized thinking (e.g., disjointed narrative production)
  - Sequencing errors (recalling/retelling information in order, following recipes, etc)
  - Poor message interpretation
  - Difficulty making inferences
  - Misinterpreting the meaning of abstract information

Interpreting 'APD' Symptomology

- **What are we really looking at?**
- **Classical signs of a language impairment which turned into a learning disability masking under the ambiguous label of 'APD' (Sun and Wallach, 2014)**
- **Dawes & Bishop, stated in 2009**, when they asserted that "**a child who is regarded as having a specific learning disability by one group of experts may be given an APD diagnosis by another.**"
- They concluded that: "**APD, as currently diagnosed, is not a coherent category, but that rather than abandoning the construct, we need to develop improved methods for assessment and diagnosis, with a focus on interdisciplinary evaluation".**

Major 'APD' Model Analysis

The Buffalo Model (Katz) contains 4 major categories:

1. ***The Decoding Category –*** refers to the ability to quickly and accurately process speech, most importantly at the phonemic level
   - **Since this involves <u>speech sounds</u> then this has nothing to do with the processing of auditory stimuli.**
   - **In other words, deficits in this area are of a linguistic nature and are highly correlated with reading deficits characterized by weak/deficient phonemic awareness abilities and poor emergent reading abilities.**

Deficits Interpretation

- Difficulty with processing what is heard accurately and quickly; tends to respond more slowly
  - **Indicative of weak language abilities**
- Problems keeping up with the flow of communication and running discourse
  - **Indicative of weak language abilities**
- Problems processing at a phonemic level (e.g., can't blend 't,' 'u' and 'b' together to make the word 'tub')
  - **Indicative of phonemic awareness deficits**
- Trouble reading and spelling
  - **Reading and writing disability**
- Receptive language problems and impairments in discrimination, closure abilities and temporal resolution
  - **Listening comprehension deficits**

The Buffalo Model (Katz) cont.

2. Tolerance-Fading Memory (TFM) Category – refers to two skills that are often found together: "tolerance" – understanding speech in noise **(processing of language)** and "fading memory" – auditory short-term or working memory

- **Memory is a higher level cognitive skill rather than a pure auditory entity**

- Difficulty blocking out background noise so child's performance suffers in a noisy classroom environment as a result the child may be labeled as distractible
  - **Describes the child with poor language comprehension**
- Linked to poor reading comprehension, oral and written expression, poor short-term memory
  - **Describes a learning disability**

The Buffalo Model (Katz) cont.

Integration category

- Difficulty bringing in information from different modalities, such as receiving auditory and visual information at the same time; these children are often **labeled as learning disabled or even dyslexic**
- They may be poor readers, have trouble with spelling, and exhibit difficulty with multimodal tasks
    - **Indicative of reading and writing deficits or students which will often get classified in the schools with specific learning disability)**

4. Organization –disorganized thinking; sequencing errors

- **This appears to be indicative of the social communication and executive function deficits, as well as word-retrieval deficits**

Major 'APD' Models Analysis (cont.)

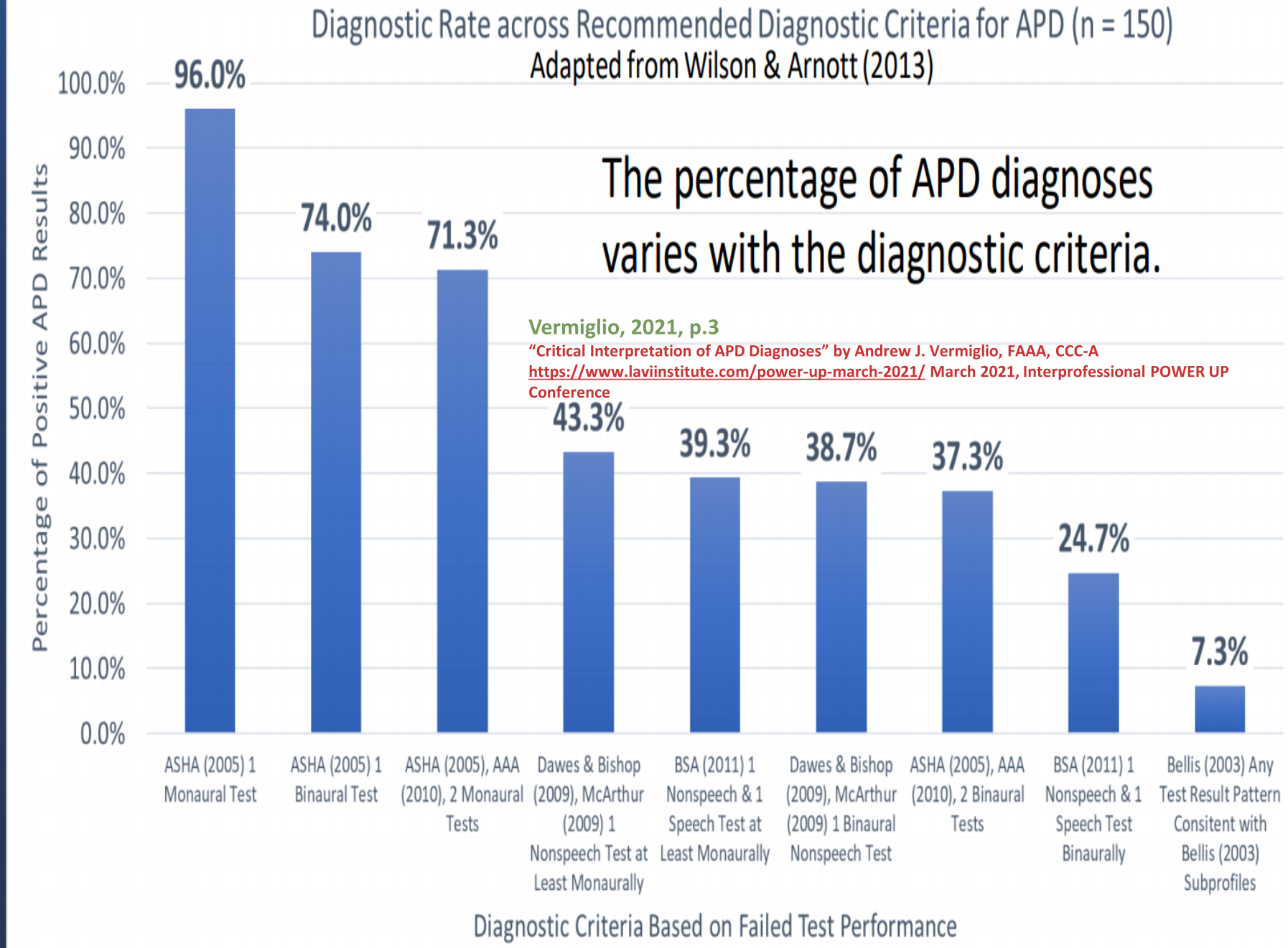
- **Bellis/Ferre Model** divides the Katz's four categories into the following subtypes:
- ***Primary subtype***
  - Auditory decoding – listening difficulties in noisy environments
  - Integration deficit – problems with tasks requiring both cerebral hemispheres to cooperate
  - Prosodic deficits- difficulty understanding the intent of verbal messages
- ***Secondary subtype***
  - Associative deficits- receptive language disorder
  - Output organization deficits- attention and/or executive function disorder- might also be caused by an auditory efferent dysfunction
- **Similar to the Buffalo model, the Bellis/Ferre Model, describes deficits of linguistic vs. auditory nature, many of which are characteristic of a learning disability characterized by language and learning needs**

At-Risk Populations Who Display "APD" Symptomology

- Any child whose typical prenatal, perinatal or postnatal development was disrupted by toxins, illnesses, injuries, or any form of life adversity
  - Genetic Disorders
  - Medical Conditions
  - Brain Injury
    - Acquired (TBI)
    - Surgical Intervention (Tumor removal)
  - Psychiatric Conditions
  - Parental Substance Abuse (Causes Acquired Syndromes)
    - Fetal Alcohol Spectrum, Static Encephalopathy, etc
  - Institutionalization
    - Orphanage, Foster care
  - Maltreatment
    - Sexual, physical abuse, neglect, etc.
  - Poverty

Audiological Assessment Problems

- There's **no clear performance criteria** to make the 'APD' diagnosis
- "Despite lofty claims to the contrary, there is no clear consensus concerning the battery of tests that lead to a diagnosis of APD." (Burkard, 2009, p. vii)
- **"Presently, neither the American Academy of Audiology nor the American Speech Language Hearing Association have a clear criteria on what testing to administer, how many standard deviations the client has to be in order to qualify, as well as even who is a good candidate for 'APD' testing."** (DeBonis, 2015 pg. 125)
- Children diagnosed with 'APD' **are diagnosed purely arbitrary rather than based on a specific widely accepted standard**
  - **W. J. Wilson and Arnott (2013)** found that "in a sample of records of 150 school-aged children who had completed at least four 'APD' tests, rates of diagnosis ranged from **7.3% to 96%** depending on the criteria used" (DeBonis, 2015 pg. 125)


Diagnostic Rate across Recommended Diagnostic Criteria for APD (n = 150)
Adapted from Wilson & Arnott (2013)
The percentage of APD diagnoses varies with the diagnostic criteria.
Vermiglio, 2021, p.3
"Critical Interpretation of APD Diagnoses" by Andrew J. Vermiglio, FAAA, CCC-A
https://www.laviinstitute.com/power-up-march-2021/ March 2021, Interprofessional POWER UP Conference
Percentage of Positive APD Results
100.0%
90.0%
80.0%
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
96.0%
74.0%
71.3%
43.3%
39.3%
38.7%
37.3%
24.7%
7.3%
ASHA (2005) 1 Monaural Test
ASHA (2005) 1 Binaural Test
ASHA (2005), AAA (2010), 2 Monaural Tests
Dawes & Bishop (2009), McArthur (2009) 1 Nonspeech Test at Least Monaurally
BSA (2011) 1 Nonspeech & 1 Speech Test at Least Monaurally
Dawes & Bishop (2009), McArthur (2009) 1 Binaural Nonspeech Test
ASHA (2005), AAA (2010), 2 Binaural Tests
BSA (2011) 1 Nonspeech & 1 Speech Test Binaurally
Bellis (2003) Any Test Result Pattern Consitent with Bellis (2003) Subprofiles
Diagnostic Criteria Based on Failed Test Performance

ASHA 2005 Recommended 7 Assessment Areas

- Auditory pattern/temporal tests
- Monaural low-redundancy tests
- Binaural/dichotic speech tests
- Binaural interaction tests
- Auditory discrimination tests
- Electroacoustic tests
- Electrophysiologic tests

Types of APD Assessments: Auditory Temporal Processing and Patterning Tests (ASHA, 2005) from Erickson 2008

Auditory Temporal Processing and Patterning Tests		
Test	Reference	Description
Pitch Pattern Sequence test (PPS)	Pinheiro, (1976) ; Pinheiro & Musiek, (1985) , (1987)	A high frequency and a lower frequency are presented in a set of 3 tones. The listener must describe the pattern they hear (e.g., "high, low, high" or "low, low, high"). They may also imitate (e.g., hum) the pattern.
Duration Pattern Sequence (DPS)	Musiek, Baran & Pinheiro, (1990)	A long tone and a short tone are presented in a set of 3 tones. The listener must describe the pattern they hear (e.g., "long, long, short" or "short, long, short"). They may also imitate it.
Gaps in Noise (GIN)	Musiek, Shinn, Jirsa, Bamiou, Baran & Zaidan, (2005)	Embedded in a 6 second segment of white noise are 0-3 silent intervals, ranging from 2-20 ms. The listener pushes a button when they hear silence, or, a gap.
Random Gap Detection Test (RGDT)	Keith, (2000)	Tone pairs with varying interstimulus intervals of 0-40 ms for 500, 1000, 2000 & 4000 Hz. Listener must say if he heard one or two tones.

Types of APD Assessments: Dichotic Speech Tests (ASHA, 2005) from Erickson 2008

Dichotic Speech Tests		
Test	Reference	Description
Staggered Spondaic Word test (SSW)	Katz, (1986); Katz, (1962)	Two spondees are presented (one in each ear at the same time), with an overlapping of the 2nd syllable of the 1st spondee, and the 1st syllable of the 2nd spondee. The listener is to repeat both spondees.
Competing Sentences (CS) test	Willeford, (1977)	One sentence is presented to one ear at a softer intensity level than a different sentence presented to the opposite ear. The listener is to repeat the target sentence (lower dB) and ignore the competing message (higher dB), first for the right ear, then for the left ear.
Dichotic Digits (DD) test	Musiek, (1983); Guenette, 2006	Two different numbers are presented to each ear at the same time. The listener is to repeat all the numbers heard.
Dichotic Rhyme Test (DRT)	Musiek et al., (1989); Wexler & Halwes, (1983)	Pairs of nearly-perfectly fused CVC's, rhyming words that differ only in 1st consonant are presented to each ear at the same time. The listener typically hears only 1 word & repeats it.
Dichotic consonant vowel (CV) tests	Berlin et al., (1972)	2 syllables, differing in initial consonant, are presented to each ear at the same time (e.g., "ta" & "da"). Can be run with equal and/or lagging onset. Listener repeats what heard.

Monaural Low Redundancy Tests (ASHA, 2005) from Erickson 2008

Monaural Low Redundancy tests		
Test	Reference	Description
Low-Pass Filtered Speech (LPFS)	Bocca et al., (1954); Rintelmann, (1985)	Monosyllabic words are low-pass filtered (various cut-offs & slopes) & presented to one ear at a time. Listener repeats.
Time Compressed Speech (TCS) test	Fairbanks et al., (1954); Baran et al., 1985	Temporal characteristics of speech (e.g., monosyllabic words) are altered to reduce duration. Listener repeats.
Time Compressed Speech test with Reverberation (TCS w/Reverb)	Wilson et al., 1994	The time-compressed word with 0.3-second reverberation added.
Speech in Noise testing	None	"lack of standardization and high degree of variability" (Bellis, 2003)

SCAN-3:A/SCAN-3:C (Keith 2009 a, 2009 b) Tests

- Past studies of previous versions have found that SCAN tests assess limited recommended areas (ASHA, 2005), have unstable test-retest reliability (Amos & Humes, 1998), are highly dependent upon verbal knowledge (Chermak & Musiek, 1997), and had poor sensitivity of less than 50% (Domitz & Schow, 2000).
- **Scan-3:A**
  - Marginal psychometrics characterized by weak content and construct validity, and lower than acceptable reliability for most of the tests (Salvia, Ysseldyke, & Bolt, 2007)
  - "Evidence for reliability falls short of accepted standards, and without adequate construct validity, it cannot be recommended as a diagnostic tool." (Canivez, 2010, p, 500)
  - Validity of the assumption that there exists a relationship between APDs and learning problems has not been established in the research, and the test author has not provided any significant support or evidence that the skills assessed in the SCAN-3:A are, **in fact, related to learning difficulties.**
    - "Though the belief persists that auditory processing deficits related to learning difficulties can be identified and remediated, research supporting this position has not been established (Cacace & McFarland, 1998)."
- **SCAN-3:C**
  - Very serious psychometric limitations …including questionable reliability for all but the composite score and very limited evidence for validity
  - no empirical studies were published in peer-reviewed journals
  - Should not be used in diagnostic decision making (Canivez, 2010, p. 504)

APD Testing Controversy (cont.)

- 'APD' testing battery does not simply consists of pure tone audiometry
- **It is heavily comprised of higher order linguistic and cognitive tasks**
- Listeners need to attend to given directions, remember and label the presented auditory sequences, and participate in tasks **aimed to task their linguistic system and executive functions** (DeBonis, 2015)
- **Wallach (2011)** has indicated that 'APD' 'symptomology' "reflects broader underlying problems in language comprehension and metalinguistic awareness.
- **Dawes and Bishop (2009)** compared children with a 'APD' to children diagnosed with dyslexia and found similar attention, reading, and language deficits in both groups.
- **Kelly et al. (2009)** found that 76% of a sample of 68 children with suspected auditory processing disorder also had language impairment with 53% demonstrating decreased auditory attention and 59% demonstrated decreased auditory memory.
- **Ferguson et al. (2011)** concluded that "the current labels of 'APD' and SLI [specific language impairment] may, for all practical purposes, be indistinguishable" (p. 225).
- Source: DeBonis, 2015 pgs. 126-127)
- Aetna (2019) Policy on APD "The reported frequent co-occurrence of APD with other disorders affecting listening and/or spoken language comprehension suggests that APD is not, in fact, a distinct clinical entity."

APD Testing Controversy (cont.)

- Presently 'APD' assessment batteries are highly subjective and significantly limited in utility with respect to both APD diagnosis and subsequent treatment recommendations by Aud's.
- In his 2017 article entitled: "**AAA (2010) APD clinical practice guidelines: need for an update** **DeBonis reviewed the current guidelines and concluded that:**
- **"The AAA document … does not reflect the current literature, fails to help clinicians understand for whom auditory processing testing and intervention would be most useful, includes contradictory suggestions which reduce clarity and appears to avoid conclusions that might cast the APD construct in a negative light. It also does not include input from diverse affected groups. All of these reduce the document's credibility."**
- As such it is recommended that SLPs "***Do not assume that a child who has been diagnosed with APD needs to be treated any differently than children who have been diagnosed with language and learning disabilities***" (Kamhi, 2011, p. 270).

Differential diagnosis of APD (Disorder Sampling)

Numerous medical, psychiatric neurological, psychological, linguistic and cognitive conditions can be misdiagnosed as 'APD' including (but not limited):

Genetic Disorders

- Fragile X Syndrome

Toxin Exposure

- Lead, Mercury, Drug Exposure

Sleep Disorders

- Sleep Apnea

Mental Health Disorders

- Trauma, anxiety, mood disorders, adjustment disorders

"Sensory Processing Disorders"*

- Vision, hearing, etc.

Acquired Disorders

- FASD

What are SLPs to Do?

- When a student with confirmed or suspected 'APD', SLPs should administer a comprehensive battery of testing to determine the scope of the student's **language** deficits.
- **Comprehensive Test**:
  - **Test of Integrated Language & Literacy Skills (TILLS)**
- **Examples of Specific Tests:**
  - **CELF-5:M**
    - **Comprehension of Ambiguous/Figurative Language** (idioms, ambiguous expressions, etc.)
  - **WORD Tests**
    - **Semantic Flexibility Skills** (can the student easily generate definitions, synonyms, antonyms, multiple meaning words, etc.)
  - **Clinical Narrative Assessment**
    - **C**an the student coherently and cohesively summarize books or movies
  - **TOPS-2/3:**
    - **Critical Thinking and Problem Solving**
  - **CAPS:**
    - **Pragmatic Skills**

Why Should SLPs Assess Students with 'APD'?

- SLPs MUST understand that without a comprehensive language and literacy assessment of deficit areas **it is very difficult to adequately address the student's linguistically-based deficits**!
- Without the assessment it is also impossible to determine which language goals need to be prioritized and targeted in therapy
- Goals NEED to be based on formal/clinical **language** assessment findings

Common APD Treatment Recommendations

- Popular Programs
  - Dichotic listening (CAPDOTS)
  - Auditory Integration Training (AIT)
  - Fast ForWord® (FFW)
  - The Listening Program (LP)
  - Earobics
- Fey et al 2011 conducted a systematic review of 25 journal articles on the efficacy of interventions for school-age children with auditory processing disorder (C)APD.
- It found no compelling evidence that **auditory interventions provided any unique benefit to auditory, language, or academic outcomes for children with diagnoses of (C)APD or language disorder**
- Presently there is no valid evidence that targeting specific processing skills such as auditory discrimination, auditory sequencing, phonological memory, working memory, or rapid serial naming **actually improves children's** 'auditory processing', language or reading abilities (Fey et al., 2011)
  - To illustrate **systematic reviews found no sign of a reliable effect of Fast ForWord® on reading or on expressive or receptive spoken language**

Are Auditory Interventions Functional

- Bellis et al (2012) in a response to Fey et al (2011) wrote "…auditory interventions are intended to improve auditory deficits that have been identified by valid tests of auditory function in a targeted, deficit-specific manner."
- "The goal of auditory training is not to improve spoken or written language abilities (AAA, 2010; ASHA 2005a, 2005b)."
- What is the functionality of improving something that has no bearing on academic abilities?
- What is the cost of both time and money wasted in improving something which will not result in any improvements of oral language abilities, reading, spelling or writing skills?

What about FM Systems?

Lemos et, al, 2009 did a systematic literature review of articles recommending the use of FM systems for APD. They concluded that: "**Strong scientific evidence supporting the use of personal FM systems for APD intervention was not found.**

Since such device is frequently recommended for the treatment of APD, it becomes essential to carry out studies with high scientific evidence that could safely guide clinical decision making on this subject."

Formulating Targeted Goals for Students with "APD"

- Focus on the **linguistic underpinnings of processing skills** like auditory discrimination, auditory sequencing, working memory **and turn them into measurable and productive language goals.**
- Child presents with phonemic awareness deficits?
  - Determine where in the **hierarchy of phonemic awareness** the breakdown is and formulate goals based areas of need
- Received a description of the child's deficits from the audiologist in an accompanying report?
  - Turn "prosodic deficits" or difficulty understanding the intent of verbal messages into "listening for details and main ideas in stories" goals.
- **Ascertain the linguistic correlates of the 'auditory processing' deficits and replace them**

Gold Standard and APD: Is APD a legitimate Clinical Entity (Vermiglio, 2021, 181)

1. The legitimacy of APD is in question.
2. The presence of APD cannot be verified in the absence of a lesion of the central auditory nervous system due to the absence of a "gold" or reference standard test.
3. Therefore, the diagnostic accuracy of the APD test protocols are unknown.
4. The meaning of an APD diagnosis is unclear.
5. This means that the benefit of intervention cannot be determined.
6. Therefore, the best type of intervention for APD is unknown.
7. The APD construct is perpetuated by the **logical fallacy of equivocation**
   - Occurs when a key term or phrase (APD) in an argument is used in an ambiguous way, constantly shifting meaning in different portions of arguments
   - "The ambiguity of the APD construct forces audiologists, speech-language pathologists, and researchers into the logical fallacy of equivocation. • This causes a great deal of confusion when discussing APD with colleagues, patients, and family members." (Vermiglio, 2021, 179)
   - **Critical Interpretation of APD Diagnoses by Andrew J. Vermiglio, FAAA, CCC-A https://www.laviinstitute.com/power-up-march-2021/ March 2021, Interprofessional POWER UP Conference**

SLP Treatment Options

- SLPs have to use psychometrically sound assessments and supplement them with strong clinical tasks in order to **appropriately** uncover deficit areas
  - Administration of tests such as CASL-2, OWLS-II, RESCA-E, CELF-5, etc. IS NOT ADEQUATE
    - Test Selection for Comprehensive Assessment Purposes https://www.laviinstitute.com/power-up-march-2021/
- SLPs create functional treatment goals (with a focus on improving academic outcomes) based on **SLP assessment findings only** to meaningfully address language and literacy abilities of children with suspected/confirmed "APD"
- SLPs must integrate both language and literacy goals in order to effectively address student needs
  - Oral language goals are SIMPLY NOT ENOUGH
  - Best outcomes involve contextualized therapy interventions which integrate both language and literacy (reading, spelling, and writing)
    - By fourth grade the instructional focus significantly shifts from gaining language through oral means to gaining information from text *(*Annie E. Casey Foundation Report, 2010*).* In fourth grade, students begin encountering a wider variety of texts. By then, able readers have learned to extract and analyze new information and expand their vocabularies by reading (O'Brien, 2008). But struggling readers rarely catch up with their peers academically and are four times more likely to drop out of high school, lowering their earning power as adults and possibly costing society in welfare and other supports (Hernandez, 2011)
    - *Students who are unable to read or read poorly by 4th grade are at risk of having poorer therapeutic outcomes if they receive oral language therapy only vs. integrated language and literacy interventions*

On the Success of Memes (Kamhi, 2004)

- **Why do some terms, labels, ideas, and constructs prevail whereas others fail to gain acceptance?**
- "In order to explain why misinformation wins and scientific information loses, it is necessary to find something that explains situations in which **the truth value of an idea is not the primary determinant of its use**."
- "Memes are especially attractive to parents looking for a "straightforward explanation for their child's language learning problem".
- The common held belief is "the professional who knows the cause of the problem will also know the most effective way to treat it".

APD MEME (Kamhi, 2014)

- Provides a simple solution (which is not necessarily a correct one) that "*the learning problem is the result of difficulty processing auditory information…*"
- The assumption is "*improving auditory processing abilities*" will improve learning difficulties
- Has *only one cause*", so "*finding an appropriate treatment ...seems more feasible because there is only one problem to eliminate*"
- Gives parents "*a sense of relief*" that they finally have an "*understandable explanation for what is wrong with their child*"
- Gives parents hope that the "*diagnosis will lead to successful remediation of the learning problem*"

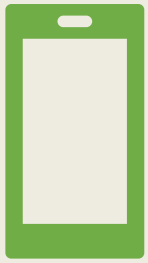
On the Appeal of APD Memplex (Kamhi, 2014)

- MEMEPLEXES (Blackmore, 1999) occur when “nonprofessionals think they know how children learn language and the factors that affect language learning“ (Kamhi, 2004, p.108).
- A memplex is a group of memes, which become much more memorable to individuals (can replicate more efficiently) as a team vs. in isolation
- If one believes that
- ‘a) sounds are the building blocks of speech and language and
- (b) children learn to talk by stringing together sounds and constructing meanings out of strings of sounds’ (both wrong assumptions) then its quite a simple leap to make with respect to the following fallacies:
  - Auditory processing is not influenced by language knowledge
  - You can reliably discriminate between APD and language deficits
  - You can validly and reliably assess “uncontaminated” auditory processing abilities and thus diagnose stand-alone APD
  - You can target auditory abilities in isolation without targeting language
  - Improvements in discrimination and identification of ‘*speech sounds will lead to improvements in speech and language abilities*‘
- “The way to resolve the meme wars in favor of science and logic is **to provide people with the scientific knowledge necessary to become independent evaluators of evidence-based research claims**” (Stanovich, 2000)

CEUs and Handouts

Available via Lavi Institute in July 2021

https://www.laviinstitute.com/



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