

Clinical Forum

What Speech-Language Pathologists Need to Know About Auditory Processing Disorder

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Purpose: To consider whether auditory processing disorder (APD) is truly a distinct clinical entity or whether auditory problems are more appropriately viewed as a processing deficit that may occur with various developmental disorders.

Method: Theoretical and clinical factors associated with APD are critically evaluated.

Results: There are compelling theoretical and clinical reasons to question whether APD is in fact a distinct clinical entity. Not only is there little evidence that auditory perceptual impairments are a significant risk factor for language and academic performance (e.g., Hazan, Messaoud-Galusi, Rosan, Nouwens, & Shakespeare, 2009; Watson & Kidd, 2009), there is also no evidence that auditory interventions provide any unique benefit to auditory, language, or academic outcomes (Fey et al., 2011).

Conclusion: Because there is no evidence that auditory interventions provide any unique therapeutic benefit (Fey et al., 2011), clinicians should treat children who have been diagnosed with APD the same way they treat children who have been diagnosed with language and learning disabilities. The theoretical and clinical problems associated with APD should encourage clinicians to consider viewing auditory deficits as a processing deficit that may occur with common developmental language and reading disabilities rather than as a distinct clinical entity.

Key Words: auditory processing disorder, assessment, intervention

Acquiring the language, conceptual knowledge, and reasoning skills necessary to talk, understand, read, write, and reason well is challenging even for typical learners. For students with language and learning disabilities, acquiring these skills may often appear insurmountable to families, teachers, and the particular student. Given these challenges, it is not surprising that families and teachers may be attracted to simple solutions to language and learning problems. Interventions that target language processing skills are particularly appealing because they offer the promise of improving language and learning deficits without having to directly target the specific knowledge and skills required to be a proficient speaker, listener, reader, and writer.

The Appeal of and Controversy Surrounding Auditory Processing Disorder (APD)

One of the most appealing processing explanations for language and learning disabilities is an impairment in the ability to process auditory information. Despite the considerable controversy about the definition and diagnostic criteria for APD (cf. Cacace & McFarland, 2009; DeBonis & Moncrieff, 2008), many clinicians believe that a comprehensive management plan for children with this impairment should include interventions that specifically target auditory perceptual skills (e.g., Bellis, 1996; Geffner & Ross-Swain, 2007). The systematic review (Fey et al., 2011) conducted by the 2007 American Speech-Language-Hearing Association (ASHA) Ad Hoc Committee on the Role of the Speech-Language Pathologist in Identifying and Treating Children With Auditory Processing Disorders, however, found no compelling evidence that auditory interventions provided any unique benefit to auditory, language, or academic outcomes for children with diagnoses of APD or language disorder.

Although the findings from the systematic review were straightforward, several members of the committee felt

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strongly that drawing any conclusions would be premature because of the following limitations:

- Studies were not excluded based on how APD was defined, so the population of children with APD may be too heterogeneous.
- Objective instruments (e.g., electrophysiological procedures) were not used to differentiate subgroups of APD.
- There were a limited number of efficacy studies with large samples.
- Most of the studies used Fast ForWord (Scientific Learning Corporation, 1998) or Fast ForWord-like acoustic modifications.
- Few studies included measures of long-term outcomes.
- The effect of auditory interventions on children with learning disabilities was not considered.

To address these limitations and fill the gaps in our understanding, the committee recommended that programs of thematically coherent research are needed. These programs should begin with small-scaled rigorous studies involving participants who are carefully evaluated using a comprehensive battery of conventional tests of APD as well as neurophysiological indices. A critical component of these studies is the adequate identification of individuals with APD and APD subgroups using rigorous test batteries that evaluate a child's auditory skills as well as his or her language abilities. Specific hypotheses developed from these studies should then be tested in high-quality efficacy and effectiveness studies.

The suggestions for future research may seem to be a logical and sensible way to address the limitations in the current body of evidence, but any optimism that future research will lead to consensus about the efficacy of auditory interventions needs to be seriously tempered by the lack of agreement among audiologists concerning the definition and diagnostic criteria of APD. As Burkard wrote in his foreword to Cacace and McFarland's (2009, p. vii) recent book on APD,

There is currently great divisiveness in the field of audiology concerning CAPD. There is no broadly accepted definition of CAPD. No one really knows what causes CAPD. Despite lofty claims to the contrary, there is no clear consensus concerning the battery of tests that lead to a diagnosis of CAPD. Similarly, there is no widely accepted auditory (re)habilitation program that has been conclusively shown to help those with CAPD. The strength and value of this book is that it clearly points out that "the emperor has no clothes." We are hamstrung by the lack of agreement and test batteries in the area of CAPD.

The contributors to the Cacace and McFarland (2009) book expressed very different opinions about how these fundamental issues can be addressed. Reading these diverse views leaves one with little hope that there will ever be consensus concerning the definition and diagnostic criteria of APD. Jerger and Musiek (2000), for example, recommended that behavioral measures should be supplemented

with electrophysiological and electroacoustic measures, whereas Katz and colleagues (Katz et al., 2002) argued that there is no evidence that these additional measures are useful in identifying APD. Even if there were a consensus among the audiology research community about an APD test protocol, it is unlikely that clinical audiologists would uniformly use it. A survey of audiologists' APD diagnostic practices (Emmanuel, 2002) found that none was using a protocol that met even the minimum guidelines recommended in the Consensus Conference Report (Jerger & Musiek, 2000). Without consensus about the diagnostic criteria for APD, it is not possible to adequately identify APD and APD subgroups using more rigorous test batteries. Adequate identification requires consensus.

If audiologists cannot agree about APD, where does that leave speech-language pathologists (SLPs)? How are we supposed to make informed clinical decisions about the treatment of children with suspected APD? Knowing the history of APD may help. There are, in fact, three distinct views of APD that have jockeyed for prominence among audiologists and SLPs. Knowledge of these discrepant views explains the current controversies surrounding the definition and diagnostic criteria of APD. After reviewing this history and the controversies surrounding the definition and diagnosis of APD, I argue that it is more appropriate to view auditory perceptual deficits as a processing problem that may occur with common developmental language and reading disabilities rather than as a distinct clinical entity. The article concludes with a list of suggestions to provide services for children referred to SLPs with the diagnosis of APD.

A Brief History of APD

The link between auditory processing impairments and speech, language, and learning has a long history in our profession. Myklebust (1954) was one of the first researchers to note that some "young children have disturbances of auditory perception without symbolic language disorders" (p. 157). It took more than 10 years for Myklebust's ideas to become formalized in the widely popular Illinois Test of Psycholinguistic Abilities (ITPA; Kirk, McCarthy, & Kirk, 1968). In the perceptual-motor domain, the ITPA had five auditory subtests: Auditory Reception, Auditory Association, Auditory Sequential Memory, Auditory Closure, and Sound Blending. Poor performance on one or more of these subtests was taken as evidence that the child had an auditory perceptual problem. These perceptual "problems" formed the foundation of the discrete-skill, psychoeducational view of language development that influenced the assessment and treatment of many children with APD as well as those who had been diagnosed with language impairments through the 1960s and 1970s.

It was not until the mid-1980s that a distinct audiologic approach to APD gained momentum. The audiologic approach grew out of observations by early 20th-century

neurologists like Jackson and Head (cited in Jerger, 2009) that soldiers with known brain injury to the auditory central nervous system exhibited certain auditory perceptual problems. This led to the development of tests to assess auditory perception. If these tests revealed perceptual problems, the patient was viewed as having a brain injury. Although some investigators noted the circular reasoning in this diagnosis, others were not bothered by the tautology and set out to create auditory perceptual tests that could be administered to children (Jerger, 2009). The most popular tests developed were the SCAN: Screening Test for Auditory Processing Disorders in Children (Keith, 1986), the SCAN-Revised (SCAN-C; Keith, 2000), the Staggered Spondaic Word Test (SSW; Arnst & Katz, 1982), and the Pediatric Speech Intelligibility Test (Jerger, Jerger, & Abrams, 1983). Not coincidentally, these tests represent the core assessment battery used to diagnose APD.

As the audiologic approach gained momentum, the discrete-skill, psychoeducational approach fell out of favor in speech-language pathology. It was replaced by linguistic, cognitive, and social interaction perspectives that focused attention on language form, content, and use (e.g., Bloom & Lahey, 1978). Assessments and interventions were developed to target each of these areas. The growing popularity of the audiologic approach inevitably led to renewed interest in the psychoeducational model. Bellis (1996) uniquely combined the audiologic approach with the ITPA's five discrete dimensions of auditory processing. The appeal of this combined approach persists today, as exemplified by Geffner and Ross-Swain's (2007) recent book on the assessment, management, and treatment of APD.

The third path in the history of APD, or fourth if the combined approach is viewed as a distinct path, is the language processing approach (Jerger, 2009). Researchers and clinicians who study and treat children with language disorders view auditory processing as only one component in the overall processing of language. Conceptual and language knowledge obviously have an important role in language processing. Jerger (2009) cited Medwetsky's (2006) spoken language processing model as an example of how to consider the intertwining effects of auditory processing, cognition, and language. In his most recent work, Medwetsky (2009) presented a comprehensive assessment battery that can be used to identify where breakdowns occur in the processing of spoken language. Consistent with his model, Medwetsky prefers the term *spoken language processing disorder* to characterize children who have deficits in spoken language processing.

The significant differences in these views of APD help explain why there is no broadly accepted definition for the disorder or clear consensus concerning diagnostic criteria for APD. In the next section, I discuss some of the controversies surrounding the definition and diagnosis of the disorder.

The Difficulty Defining and Diagnosing APD

The ASHA Working Group on Auditory Processing Disorders (2005) defined auditory processing as the perceptual processing of auditory information in the central nervous system that includes the following abilities or skills: sound localization and lateralization, auditory discrimination, auditory pattern recognition, temporal aspects of audition, and auditory performance with degraded acoustic signals. Importantly, the working group recognized that although abilities such as phonological awareness, attention to and memory for auditory information, and auditory comprehension may be associated with intact central auditory function, these abilities are higher order cognitive-communicative and/or language-related functions that should not be included in the definition of APD (ASHA, 2005, p. 2). Our ASHA committee was in general agreement with this definition because of this distinction.

Unfortunately, definitions of disorders do not always coincide with the way they are diagnosed. This is clearly the case for APD because the tests used to diagnose the disorder are not pure measures of auditory abilities. To make auditory measures more effective in identifying disorders in the central auditory system, they had to be "sensitized" in some way. This was usually accomplished by increasing the complexity or reducing the redundancy of the test stimuli. The consequence of sensitization, however, made the measures susceptible to the influence of higher level language and cognitive abilities as well as memory and attentional factors (Cacace & McFarland, 1998; Lum & Zarafa, 2010). One cannot assume, then, that poor performance on an APD test battery is caused by poor auditory abilities rather than some non-auditory factor. As a case in point, a recent study by Lum and Zarafa (2010) found that when verbal working memory was controlled, significant differences on the SCAN-C between children with specific language impairment and age-matched controls disappeared completely. This finding suggests that it is more appropriate to view difficulties on the SCAN-C as a problem with verbal working memory than with auditory processing. The same could probably be said for other tests that are commonly used to diagnose APD.

To address the inconsistency between the definition and diagnosis of APD, Cacace and McFarland (1998) and others (e.g., Cowan, Rosen, & Moore, 2009) have argued that the diagnosis of APD should be applied only when a processing deficit is demonstrated using a battery of auditory tasks. In their view, a deficit in auditory processing only makes sense if one can rule out the influence of language knowledge; basic cognitive processes like attention and memory; and other possibilities for poor performance, such as fatigue, anxiety, or lack of motivation (McFarland & Cacace, 2009). At minimum, the diagnosis of an APD would require that children perform poorly on a battery of auditory tasks but demonstrate

age-appropriate performance on comparable visual tasks (McFarland & Cacace, 2009). Poor performance on both auditory and visual tasks would indicate a nonmodality-specific deficit.

Not surprisingly, McFarland and Cacace's (2009) views are quite controversial in the audiology community. The Working Group on Auditory Processing Disorders (ASHA, 2005), for example, argued that the modality-specific view was implausible because "basic cognitive neuroscience has shown that there are few, if any, entirely compartmentalized areas in the brain that are solely responsible for a single modality" (p. 3). This reasoning seems puzzling. If basic neuroscience indicates that single-modality processes cannot be identified, why did the working group define APD as perceptual processing of only auditory information?

Dawes and Bishop (2009) have a different view of the controversy concerning modality specificity. They suggest that it stems from the lack of recognition of the different purposes associated with defining and diagnosing a disorder. They note that a narrow definition that restricts APD to auditory deficits is necessary to understand causal mechanisms. If one wants to understand the effect that auditory deficits have on language or reading, auditory measures cannot be confounded by non-auditory factors. In a clinical setting, however, it makes little sense for audiologists to restrict the diagnosis of APD to pure cases of an auditory deficit because most children who are referred for an APD evaluation will have some associated listening and learning problem. If they did not have listening or learning problems, they would not have been referred for APD testing. The diagnosis of APD remains problematic, however, because it is often interpreted to mean that auditory deficits are the primary cause of a child's listening and learning problems.

One way to reconcile the conflicting views about modality specificity and the different purposes of defining and diagnosing APD is to recognize that both researchers and clinicians would benefit from the development of reliable and well-standardized auditory measures that are not confounded by non-auditory factors. Researchers would be better able to investigate causal mechanisms, and clinicians would be able to determine the relative impact of auditory and non-auditory factors on children's language and academic performance. Moore and his colleagues have been developing such measures in England (Moore, 2006). In their most recent study, they found that poor performance on auditory tasks is due primarily to the attentional and memory demands of the tasks rather than to sensory challenges (Moore, Ferguson, Edmondson-Jones, Ratib, & Riley, 2010).

Is APD a Distinct Clinical Entity?

As mentioned previously, there is still no consensus among the audiology community about how to diagnosis APD. Even the so-called "Consensus Conference Report" (Jerger

& Musiek, 2000) lacks consensus, as evidenced by this comment from Burkard in his review of the initial draft of this article: "I take umbrage at the use of the term 'consensus,' unless they specifically mean a consensus of those who were invited and ultimately attended this meeting. The title of this conference and the resulting publication overstates their case by the inclusion of the term 'consensus'" (R. Burkard, personal communication, n.d.). Given the lack of consensus about how to diagnose APD, it should not be surprising that there is still some question about whether APD is truly a distinct clinical entity (e.g., Cacace & McFarland, 2009; Dawes & Bishop, 2009). The alternative is to view auditory processing problems as one of a number of deficits that are commonly found in developmental disorders (Dawes & Bishop, 2009). For example, many children with language and learning difficulties have working memory deficits (Leonard et al., 2007). The significant theoretical and clinical problems with APD should at least make one consider the viability of the alternative view rather than simply assume that APD is truly a distinct clinical entity. I briefly discuss some of these problems in the following paragraphs. (For more comprehensive reviews, see recent articles by Dawes and Bishop, 2009, Moore, 2006, and various chapters in Cacace and McFarland, 2009).

The clinical entity of APD is based in large part on the assumption that auditory deficits are a primary cause of speech, language, and academic learning difficulties. There is, however, a growing body of evidence showing that auditory perceptual deficits are not a significant risk factor for speech and language development or later academic achievement (Hazan et al., 2009; Ramus, White, & Frith, 2006; Rosen, 2003; Watson et al., 2003; Watson & Kidd, 2009). In a large sample of children representative of national norms in intelligence and socioeconomic status, for example, Watson et al. (2003) found that measures of auditory processing had no impact on children's reading or language abilities in Grades 1 through 4. More recently, Sharma, Purdy, and Kelly (2009) found that having auditory processing difficulties did not increase the likelihood that a child would have a language or reading disorder. There is also now considerable evidence that despite poor phonological processing abilities, individuals with dyslexia perform within normal limits on measures of speech perception (Hazan et al., 2009; Ramus et al., 2006). Even researchers who believe in the possible existence of APD acknowledge that the importance of auditory processing is undermined by these recent studies (e.g., Cowan et al., 2009).

The lack of consensus in diagnosing APD is, of course, a significant theoretical and clinical problem. McFarland and Cacace (2006) argue that a disorder should not be defined in terms of whatever a test measures. A disorder or distinct clinical category should be defined by a deficit in a particular perceptual or cognitive mechanism or function. Auditory deficits can occur at several different levels (Medwetsky, 2009; Moore, 2006), so it is not sufficient simply to say that

auditory deficits cause APD. A strong genetic influence on the etiology of APD would provide strong evidence that it is in fact a distinct clinical category. To date, however, the only study that addressed this question found that auditory problems appeared to be caused entirely by environmental factors (Bishop et al., 1999).

Concerns about the reliability and validity of APD tests are the most significant clinical problem with APD (Cacace & McFarland, 2009; Dawes & Bishop, 2009). Even if a test is reliable and well standardized, the test is often not a valid measure of auditory abilities because of the influence of non-auditory factors on test performance. Another significant clinical problem with APD is the lack of evidence that auditory interventions provide any unique benefit to auditory, language, or academic outcomes (Fey et al., 2011). The high comorbidity of APD with other developmental disorders (e.g., attention deficit disorder, specific language impairment, and dyslexia) is also problematic (Cacace & McFarland, 2006; Sharma et al., 2009). High comorbidity likely reflects the influence of attention, memory, and language abilities on APD tests and thus would be predicted by the view that auditory deficits are a common characteristic of developmental disorders. Importantly, the high comorbidity of APD with other developmental disorders cannot be taken as evidence that auditory deficits are the primary cause of these disorders.

It should be clear that there are compelling theoretical and clinical reasons to question whether APD is in fact a distinct clinical entity. At the present time, it seems more appropriate to view auditory deficits as a processing deficit that may occur with common developmental language and reading disabilities rather than as a distinct clinical entity. Interestingly, Dawes and Bishop (2009) also suggest this possibility, but do so after concluding that “there is both clinical and theoretical support for the category of APD” (p. 459). On the following page, they suggest “that it may be more helpful to clinicians and researchers as well as the children and families concerned to consider auditory processing problems as one of several dimensions of impairment associated with a range of developmental conditions, rather than being a categorical disorder in its own right” (p. 460). The fact that they raise this possibility after concluding that there is support for the distinct category of APD is telling: Even researchers who want to believe that APD is a distinct clinical category recognize that the current evidence for APD is not convincing.

Why Only Three Processing Limitations Became Distinct Clinical Entities

With all of the possible candidates for processing disorders, it seems appropriate to question why only three processing deficits became distinct clinical entities: APD, attention deficit-hyperactivity disorder (ADHD), and sensory integration disorder (SID). Processing limitations that directly influence language and reading would seem to be the most

likely candidates to become distinct clinical entities, but this is not the case. The processing abilities that affect language the most are working memory and speed of processing. Limitations in these abilities have been found to account for 62% of the variance in composite language scores of children with language impairments (Leonard et al., 2007). The processing abilities with the greatest influence on learning to read are phonological memory, phonological awareness, and rapid serial naming. Deficits in these phonological processes account for a large proportion of the variance in a child’s word recognition ability (Wagner & Torgesen, 1987; Wagner, Torgesen, & Rashotte, 1994).

Despite the significant impact that working memory, processing speed, and phonological processing have on children’s language and reading, there has never been any attempt to turn them into distinct clinical categories. It is a good thing, too. If all processing deficits were distinct clinical categories, the list of disorders would be interminable. In addition to a working memory disorder, processing speed disorders, and phonological processing disorder, we also could have a phonological memory disorder; rapid serial naming disorder; word retrieval disorder; and all of the possible language processing disorders such as a syntactic processing disorder, morphological processing disorder, semantic processing disorder, and pragmatic processing disorder.

So, why did auditory, attentional, and sensory integration problems become distinct clinical entities? A number of factors contributed to the creation of these distinct clinical entities, but the following three factors were particularly important: (a) Each disorder is associated with a distinct profession and practitioner (audiologist, psychologist, occupational therapist); (b) a certified, licensed professional in the discipline is the only one qualified to administer the assessment battery and make the diagnosis; and (c) the label for the disorder is not stigmatizing and is easy to understand, remember, and communicate to others (i.e., a good meme; cf. Kamhi, 2004). APD, ADHD, and SID meet all of these criteria, whereas none of the other processing limitations do. A working memory disorder and phonological processing disorder fall short on all three criteria. For example, although working memory and phonological processing abilities can be assessed by a variety of practitioners with tests that anyone can purchase (e.g., Comprehensive Test of Phonological Processing; Wagner, Torgesen, & Rashotte 1999), the constructs they represent are difficult to understand and communicate to others. Working memory and phonological processing will thus never become distinct clinical entities that compete with existing disorders like specific language impairment and dyslexia.

Conclusion

Simply put, enough is enough already! We have already expended far too much time, energy, and resources trying to understand and treat a disorder that has not only defied

definition, but lacks clear diagnostic criteria. Even if there were a consensus about the definition of APD and the specific diagnostic criteria that characterize the disorder, there is no compelling evidence that auditory deficits are a significant risk factor for language or academic performance (e.g., Hazan et al., 2009; Watson & Kidd, 2009). There is also no evidence that auditory interventions provide any unique benefit to auditory, language, or academic outcomes (Fey et al., 2011). These theoretical and clinical problems with APD suggest that it may be more appropriate to view auditory deficits as a processing deficit that may occur with common developmental disorders (e.g., specific language impairment, dyslexia, ADHD) rather than as a distinct clinical entity. This does not change the fact that SLPs will continue to have children on their caseloads who have been diagnosed with APD, so here are some suggestions for providing services to these children.

- 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.
- Do not provide auditory intervention for a child who has been diagnosed with APD. Our systematic review found no evidence that auditory interventions provided any unique benefit to auditory, language, or academic outcomes (Fey et al., 2011). Language interventions are just as effective as auditory interventions in improving a child's auditory abilities (Gillam et al., 2008).
- Perform a comprehensive assessment of the child's speech, language, and literacy abilities just as you would do with any other student who was referred for an evaluation.
- Consider non-auditory reasons for listening and comprehension difficulties, such as limitations in working memory, attention, motivation, language and conceptual knowledge, and inferencing abilities.
- Target speech, language, literacy, and knowledge-based goals in therapy.
- Avoid goals that target processing skills like auditory discrimination, auditory sequencing, phonological memory, working memory, or rapid serial naming. There is no compelling evidence that targeting these skills significantly improves a child's language or reading ability (Fey et al., 2011; Fletcher, 2007).
- Recognize that acquiring the language, conceptual knowledge, and reasoning skills necessary to talk, understand, read, write, and reason well is challenging even for typical learners. Learning these skills will, therefore, be particularly challenging for students with language and learning disabilities.
- Keep searching for more effective and efficient ways to improve children's language and reading abilities, but be wary of interventions that promise quick fixes.

- Most important of all: Devote most of your time and effort teaching students the knowledge and skills that will help them talk, understand, read, write, and reason better.

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