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An Update on Professional Education and Clinical Practices in Central Auditory Processing

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Abstract

Results of an online questionnaire probing audiologists' professional education and clinical practices in central auditory processing and its disorders are reported. Respondents demonstrated scant knowledge of the efficiency of central auditory tests and procedures; however, they were rather consistent in reporting more frequent use of tests and procedures they rated as more efficient. Many of the tests and procedures (including electrophysiologic measures) reported as most frequently used are among those cited in the literature as having good sensitivity and specificity. Respondents recognized the audiologist's treatment responsibilities in the areas of environmental accommodations and assistive listening devices; however, less than half of the respondents judged auditory training to fall within the audiologist's purview. Comparison with a similar study published in 1998 revealed an increase in respondents' academic preparation in (C)APD, with little change in clinical preparation, and use of a more efficient central auditory test battery.

Key Words: Assessment, (central) auditory processing disorder, clinical practices, diagnostics, intervention, management, professional education, screening, treatment

Abbreviations: ABR = auditory brainstem response; ARD = acoustic reflex decay; ART = acoustic reflex threshold; CANS = central auditory nervous system; CAP = central auditory processing; (C)APD = (central) auditory processing disorder; CFY = clinical fellowship year; CS = competing sentences; DD = dichotic digits; DP = duration patterns; GIN = gaps-in-noise; LPFS = low-pass filtered speech; MLD = masking level difference; MLR = middle latency response; PI-PB = performance intensity for phonetically balanced words; PP = pitch (frequency) patterns; SCAN = screening test for auditory processing disorders; SLP = speech-language pathologist; SRN = speech recognition in noise; SSW = Staggered Spondaic Word Test

Sumario

Se reportan los resultados de un cuestionario en línea indagando sobre la educación profesional y las prácticas clínicas de los audiólogos en cuanto al procesamiento auditivo (central) y sus trastornos. Aquellos que respondieron demostraron un débil conocimiento sobre la eficiencia de las pruebas y procedimientos auditivos centrales; sin embargo, fueron bastante consistentes

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en reportar un uso más frecuente de las pruebas y procedimientos que consideraban más eficientes. Muchas de las pruebas y procedimientos (incluyendo las mediciones electrofisiológicas) que se reportaron como más frecuentemente utilizadas, están entre las que se citan en la literatura como de mejor sensibibilidad y especificidad. Los que responsieron reconocieron las responsabilidades en cuanto a tratamiento por parte del audiólogo, en las áreas de adecuación ambiental y en el uso de dispositivos auditivos de apoyo. Sin embargo, menos de la mitad de los que respondieron consideraron que el entrenamiento auditivo estaba dentro de las ámbito del audiólogo. La comparación con un estudio similar publicado en 1998 reveló una mejoría en la preparación académica de los audiológos en (C)APD, con poco cambios en la preparación clínica, y en el uso de una batería mas eficiente de pruebas para audición central.

Palabras Clave: Evaluación, trastorno de procesamiento auditivo (central), prácticas clínicas, diagnóstico, intervención, manejo, educación profesional, tamizaje, tratamiento

Abreviaturas: ABR = respuesta auditiva del tallo cerebral; ARD = fatiga del reflejo acústico; ART = umbral de reflejo acústico; CANS = sistema nervioso auditivo central; CAP = procesamiento auditivo central; (C)APD = trastorno de procesamiento auditivo (central); CFY = año de rotación clínica; CS = frases de competencia; DD = dígitos dicóticos; DP = patrones de duración; GIN = brechas en ruido; LPFS = lenguaje filtrado en pasa-bajo; MLD = diferencia en nivel de enmascaramiento; MLR = respuesta de latencia media; PI-PB = desempeño en la intensidad para palabras fonéticamente balanceadas; PP = patrones tonales (de frecuencia); SCAN = prueba de tamizaje para trastornos de procesamiento auditivo; SLP = patólogo de lenguaje; SRN = reconocimiento del lenguaje en ruido; SSW = prueba de palabras espondaicas escalonadas

A number of reports have identified current audiologic practices in the United States during the last 35 years (Martin and Pennington, 1971; Pennington and Martin, 1972; Martin and Forbis, 1978; Martin and Sides, 1985; Martin et al, 1994; Chermak et al, 1998; Martin et al, 1998; Emanuel, 2002). Only a few of these reports have focused specifically on current audiologic practices in (central) auditory processing disorder ([C]APD; Chermak et al, 1998; Martin et al, 1998; Emanuel, 2002). Those studies that did examine (C)APD practices have revealed a need for improvement in professional preparation in diagnosis and assessment of (C)APD.

Chermak et al (1998) identified deficiencies in the graduate academic and clinical preparation in the areas of central auditory function and assessment. Martin et al (1998) reported a decrease in the number of audiologists assessing (C)APD from 1992 to 1997. Emanuel (2002) observed that none of the Maryland audiologists responding to her survey reported using a protocol that met the (C)APD consensus statement guidelines (American Speech-Language-Hearing Association, 1996) for assessment of (C)APD.

Scientists and clinicians have made considerable progress over the last decade understanding the nature of (C)APD, developing efficient diagnostic tests and procedures, and designing promising interventions, many of which currently are under study for effectiveness and efficacy (American Speech-Language-Hearing Association, 1996; Chermak and Musiek 1997; Bellis, 2003; American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005; Musiek et al, 2005; Chermak and Musiek, 2006; Musiek and Chermak, 2006). Given the transition to doctoral audiology education as the entry-level requirement for practicing audiologists, one might anticipate some improvement in professional preparation in this area, including additional courses dedicated to the study of the central auditory nervous system (CANS) and (C)APD. Therefore, the primary purposes of the present survey were to update and examine in greater detail current audiologic practices in the diagnosis and assessment of and intervention for (C)APD in the United States and to describe audiologists' professional preparation and continuing education in this clinical area.

METHOD

Participants

Three hundred and seventy audiologists, randomly selected from the 2005 American Academy of Audiology (AAA) online membership directory, received an e-mail explaining the purpose of the survey and inviting their participation in the study. The e-mail provided a link to the survey for their responses.

Questionnaire

SurveyMonkey™ online survey software, which can be downloaded at http://www.surveymonkey.com, was used to construct a 41-item questionnaire. The questionnaire examined a number of different categories of information as follows:

1. Demographics and Education: Seven items requested demographic information; six items probed graduate and continuing education course work and clinical training; two items examined the number of hours spent weekly in the respondent's clinical practice dedicated to diagnosis and treatment of (C)APD.

2. Evaluation and Diagnostic Procedures: Three questions asked whether respondents diagnosed (C)APD, screened for (C)APD, and treated (C)APD in their current clinical setting; one question asked respondents who indicated that they diagnosed (C)APD the number of years they have tested for (C)APD; one question asked respondents who indicated they did not diagnose (C)APD to state their reasons for not doing so; one question probed contraindications for (C)APD testing.

3. Screening Procedures: Three questions probed the percentage of caseload screened for (C)APD, the type of screening tools used, and the percentage of those screened who ultimately were diagnosed with (C)APD.

4. Test Instruments and Guiding Model: Two items queried types of diagnostic tests used; one item asked respondents to rate the efficiency (i.e., sensitivity and specificity) of central auditory tests and procedures; one item asked respondents which model guided their diagnostic approach.

5. Team Involvement: One item inquired about the respondents' involvement as a member of a team in the diagnosis and intervention for (C)APD, and a second item asked which other professionals were involved in the team.

6. Intervention and Management: Eight questions probed respondents' involvement in treatment and management of (C)APD: one item asked respondents to identify the professional responsible for a range of intervention options, one item asked respondents whether they provided treatment/management for patients identified with (C)APD; another item asked those respondents whether they customized therapy, and another asked them to indicate how frequently they used various approaches; one item questioned the model underlying their intervention approach; and four additional questions probed respondents' involvement in establishing the effectiveness of their interventions; one item asked respondents whether they tested other modalities (e.g., vision) or supramodal function; a follow-up question queried which visual tests they might use; and another question asked to whom the respondent referred for testing of other modalities.

Procedure

Consistent with Dillman's Total Design method (Dillman, 2000), follow-up e-mails were sent one and two weeks following the initial invitation. The survey remained on the Web site for one additional week following the second follow-up email. The survey software provided by SurveyMonkey included a program that allowed the investigator to send notification only to respondents who had not yet participated.

RESULTS

Of the 370 e-mail invitations to participate, 95 responses were received. Four respondents declined to take the survey, and one was excluded from statistical analysis, as the survey was incomplete. Analysis was performed on 90 completed questionnaires, representing a 24% response rate. A summary of the most pertinent findings is presented here. Due to the construction of the survey, which directed respondents to particular follow-up questions based on preceding responses, the number of respondents varies across questions. A more detailed presentation of raw data is found in Appendix A.

Demographic Information

Respondents were queried about their educational background, years in practice, work setting, American Speech-Language-Hearing Association (ASHA) and AAA membership, and state licensure. Forty-seven percent (N = 42) were educated at the master's level; 34% (N = 31) held an AuD degree; 18% (N = 16) held a PhD degree; and less than 1% (N = 1) was currently enrolled in a doctoral (PhD) program. Respondents reported a mean of 19.4 years in practice, with a minimum of 1 year and a maximum of 42 years. The mean date respondents earned their highest degree was 1992, ranging from 1965 to 2005. The largest percentage of respondents (32%, N = 29) were employed in private practice, with 18% (N = 16) in ENT practices, and 16% (N = 14) employed in hospitals. Eighty-seven percent (N = 78) held ASHA certification (CCC-A), and all respondents were members of AAA. Almost all respondents (97%, N = 87) were licensed to practice audiology in their state.

Professional Preparation

Sixty-nine percent (N = 62) of respondents reported taking at least one graduate course specifically devoted to either the assessment of the CANS or diagnosis of (C)APD. Ninety-two percent of respondents (N = 83) reported taking at least one basic science course (i.e., psychoacoustics and related hearing science). Respondents reported little clinical experience devoted to the assessment of central auditory processing (CAP) during their graduate program. The mean number of total clock hours reported in assessing CAP in the campus clinic setting during participants' entire graduate program was 8.3 hours and for the off-site practicum setting was 4.6 hours. Experience during the internship/externship setting also was limited, with a mean of 2.6 hours. For the clinical residency year setting (reported by respondents with the AuD degree), the mean number of clock hours reported was less than 1. For the clinical fellowship year (CFY) setting, the mean number of clock hours reported was 7.6. Similarly, respondents reported few clock hours earned in treatment/management of (C)APD during graduate studies in various settings, ranging from a mean total of 1.9 hr in the campus clinic setting, less than 1 hr in the off-site practicum setting, the internship/externship setting, or the clinical residency setting, and 2.5 hr in the CFY. Sixty-six percent (N = 59) of respondents reported taking at least one continuing education course specifically devoted to either the assessment of the CANS or diagnosis of (C)APD, while 46 percent (N = 41) reported taking at least one continuing education basic science course (i.e., psychoacoustics and related hearing science).

Assessment Practices

Twenty-seven percent (N = 24) of respondents diagnosed (C)APD by examining CANS function. The primary reasons respondents offered for not evaluating CAP were time required to test, inadequate educational background, inadequate reimbursement, and difficulty finding professionals to whom to refer patients diagnosed with (C)APD for treatment. As contraindications for CAP testing, respondents identified low-level intelligence, cognitive deficit, language delay, or attention deficit hyperactivity disorder, as well as being a non–native English language speaker. Seventy-seven percent of respondents (N = 13) who tested for (C)APD reported that they did not differentially diagnose with a team of professionals. Of the four respondents who stated they did differentially diagnose with a professional team, all involved speech-language pathologists (SLPs) on their team, three included an educator, two involved a psychologist, and one involved physicians. None of the respondents who diagnose (C)APD tested visual processing to explore multimodal/pansensory components that might coexist with (C)APD. Most (40%) referred to a psychologist or an SLP (40%) for other modality testing.

Respondents reported dedicating, on average, less than one hour weekly to the diagnosis of (C)APD in their clinical practices. Respondents' aggregated ratings, computed as the total of each rating (ranging from 0–4) multiplied by the respective number of respondents assigning that rating, were used to determine the most frequently used tests and procedures. The 12 most frequently used tests and procedures identified by respondents active in (C)APD diagnosis are shown in Figure 1. The most used diagnostic tests and procedures were the acoustic reflex threshold (ART) (aggregated rating = 20), speech recognition in noise (SRN) (aggregated rating = 15), competing sentences (CS) (aggregated rating = 12), and pitch (frequency) patterns (PP) (aggregated rating = 11), followed by acoustic reflex decay (ARD), dichotic digits (DD), and Staggered Spondaic Word (SSW) Test, with aggregated ratings of 10, and the auditory brainstem response (ABR) and duration patterns (DP), with aggregated ratings of 9. Low-pass filtered speech (LPFS), middle latency response (MLR), and Fisher's Checklist were given aggregated ratings of 8. Respondents' aggregated ratings of test and procedure efficiency were computed as the total of each rating (ranging from 0–2) multiplied by the respective number of respondents assigning that rating. Respondents active in (C)APD diagnosis rated the most utilized procedure, the ART, as having the highest aggregated efficiency (11), followed by the ARD and the ABR, each of which earned aggregated efficiency ratings of 10, SRN with an aggregated efficiency of 9, PP with aggregated efficiency of 8, PI-PB (performance intensity for phonetically balanced words) function with aggregated efficiency of 7, DD and DP with aggregated efficiencies of 6, and LPFS and SSW with aggregated

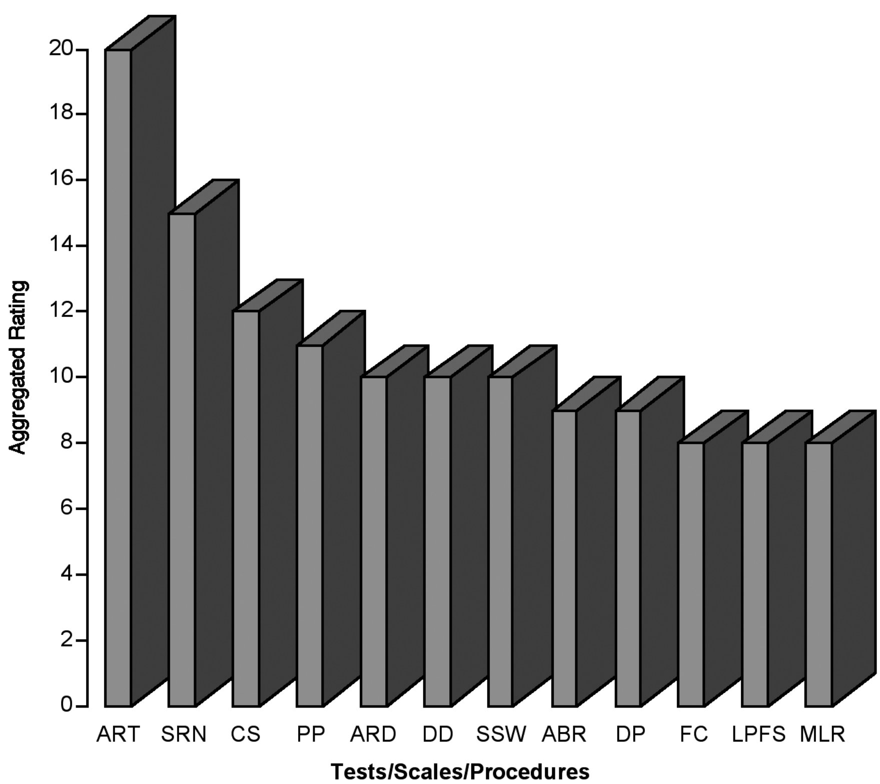

Figure 1. Twelve most frequently used tests, scales, and procedures for diagnosis of (central) auditory processing disorder. ART = acoustic reflex threshold; SRN = speech recognition in noise; CS = competing sentences; PP = pitch (frequency) patterns; ARD = acoustic reflex decay; DD = dichotic digits; SSW = Staggered Spondaic Word Test; ABR = auditory brainstem response; DP = duration patterns; FC = Fisher's checklist; LPFS = low-pass filtered speech; MLR = middle latency response.

efficiencies of 5 (all from a possible 34) (see Figure 2). Six of the measures identified by respondents as used most often (i.e., CS, SSW, DP, LPFS, MLR, and Fisher's Checklist) were not listed among the most efficient tools. Conversely, the PI-PB function, which was identified as one of the ten most efficient tools, was not identified as a more frequently used procedure. Of those respondents diagnosing (C)APD who graduated more than ten years ago, 67% reported that they did not know the efficiency of at least 50% of the tests/procedures/scales listed. Somewhat surprisingly, 100% of those respondents who graduated most recently (within the last ten years) indicated that they did not know the efficiency of at least 50% of the tests/procedures.[1]

Forty-six percent of respondents (N = 31) who screened for (C)APD cited the acoustic reflex, questionnaires, and the SCAN (screening test for auditory processing disorders) as most frequently used screening tools. Respondents screened on average less than one percent of their caseload for (C)APD; however, the mean percentage of the screened caseload ultimately diagnosed with (C)APD was 4.3%.

Chi-square analysis was conducted in cases where cell size permitted. Categories were collapsed to permit statistical analysis in cases where cells were small or empty. Chi-square analysis was used to examine whether graduate preparation may have affected current professional decisions to engage in CAP/CANS diagnosis/assessment. No significant difference in current involvement in CAP/CANS diagnosis/assessment was seen relative to the number of graduate courses taken dedicated to CAP/CANS assessment ($X^2 = 0.41$, df = 1, $p > 0.05$) or to auditory perception/psychoacoustics and related hearing science ($X^2 = 4.59$, df = 2, $p > 0.05$).

Similarly, no significant difference in current involvement in CAP/CANS diagnosis/assessment was seen relative to the number of continuing education courses taken dedicated to CAP/CANS assessment ($X^2 = 4.66$, df = 2, $p > 0.05$) or to auditory perception/psychoacoustics and related hearing science ($X^2 = 2.15$, df = 2, $p > 0.05$). Involvement in CAP/CANS diagnosis/assessment did not differ as a function of the number of clock hours accrued in CAP assessment during graduate training ($X^2 = 2.34$, df = 1, $p > 0.05$) nor the number of hours devoted to CAP assessment during the CFY ($X^2 = .23$, df = 1, $p > 0.05$). No significant difference was found in current involvement in CAP/CANS assessment as a function of the number of years respondents have been in practice ($X^2 = 1.94$, df = 2, $p > 0.05$) or work setting ($X^2 = 0.63$, df = 2, $p > 0.05$).

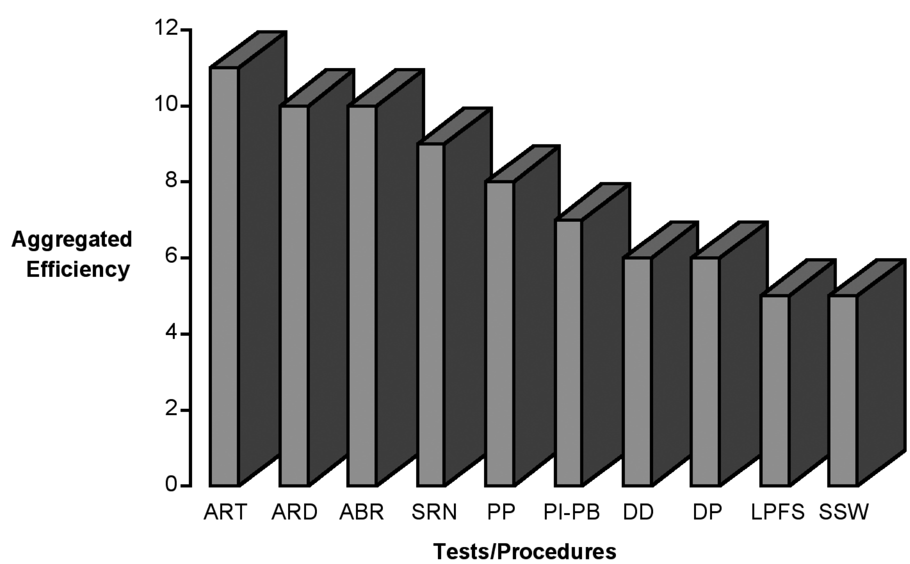

Figure 2. Ten tests and procedures rated as most efficient for the diagnosis of (central) auditory processing disorder. ART = acoustic reflex threshold; ARD = acoustic reflex decay; ABR = auditory brainstem response; SRN = speech recognition in noise; PP = pitch (frequency) pattern; PI-PB = PI-PB function; DD = dichotic digits; DP = duration patterns; LPFS = low-pass filtered speech; SSW = Staggered Spondaic Word Test.

Intervention

Fifty-five percent of respondents (N = 12) indicated that the speech-language pathologist (SLP) should provide a range of interventions for (C)APD, including metalinguistic strategies (77%, N = 17), metacognitive strategies (79%, N = 15), computer-assisted therapy (60%, N = 15), and cognitive strategies (67%, N = 14). By contrast, 94% (N = 16) of respondents indicated that audiologists should be responsible for assistive listening devices, and 71% (N = 15) stated that environmental modifications were the purview of audiologists. Only 45 percent (N = 10) of respondents identified the audiologist as the provider of auditory training, while 55% (N = 12) identified the SLP as the provider of auditory training. Moreover, respondents reported dedicating on average less than one hour per week to the treatment or management of (C)APD in their clinical practices, and only one respondent reported direct provision of treatment/management. Thirty-eight percent (N = 6) of respondents did not refer for treatment; the remaining respondents refer primarily to SLPs and hospitals.

DISCUSSION

Results of this survey indicate that (1) a small number of respondents are active in the diagnosis and treatment of (C)APD; (2) professional education in this practice area, primarily course work, has improved over the last decade, although significant shortcomings persist, especially in clinical training; (3) most respondents indicated that they could not assess the efficiency of most of the 51 tests, procedures, and scales probed; (4) respondents' efficiency ratings of a broad range of behavioral and electrophysiological central auditory tests and procedures were low; (5) respondents were rather consistent in reporting more frequent use of tests and procedures they rated as more efficient; (6) many of the tests and procedures reported as most frequently used in CAP assessments are among those cited in the literature as having good sensitivity and specificity; (7) electrophysiologic measures are being used in conjunction with behavioral tests in CAP test batteries; (8) SLPs are the predominant professional to whom patients are referred for treatment; (9) despite the respondents' recognition of the audiologist's treatment responsibilities in the areas of environmental accommodations and assistive listening devices, less than half of the respondents indicated auditory training to fall within the audiologist's purview, and only one respondent was active in any treatment area; and (10) many of the tests and procedures reported as most frequently used in CAP assessments are among those cited in the literature as having good sensitivity and specificity. These findings are discussed below and compared with the findings of a similar survey by Chermak et al (1998) where possible.[2]

Reasons cited for lack of involvement in this practice area included the perceived amount of time required to complete a diagnostic battery, lack of educational background, inadequate reimbursement, and difficulty finding professionals to whom to refer patients diagnosed with (C)APD. Compared to Chermak et al (1998), a smaller percentage of respondents are diagnosing (C)APD today than eight years ago. Chermak and colleagues reported that 41% of respondents assessed CAP/CANS function, while, in the present study, only 27% responded that they diagnose (C)APD. The small percentage of respondents involved in CAP/CANS assessment might be a function of the high percentage employed in private practice, a work setting that typically emphasizes peripheral testing and hearing aid fittings.

While Chermak et al found audiologists' involvement in assessment of (C)APD differed as a function of the number of hours accrued in the assessment of CAP/CANS during the CFY, as well as with the number of basic science courses taken in graduate school, no significant differences in the respondents' involvement in CAP assessment were seen in the present study as a function of any academic, clinical, or continuing education variables. Differences may exist; however, chi-square analyses were limited due to small cell sizes.

In the years since the Chermak et al (1998) study, graduate audiology education has undergone a transformation from the master's degree to three- to four-year doctoral education. Although more than half (52%) of the respondents held a doctoral degree, primarily the AuD, results of this survey revealed that audiologists still lack adequate graduate education and clinical experience in the area of CAP/CANS. Given the report by Sykes et al (1997) that audiology faculty identified CAP evaluation as the most frequently offered service provided by on-campus audiology clinics, it is surprising to find that 31% of current respondents reported having taken no graduate course work specifically devoted to CAP/CANS, with fewer than ten clock hours earned on average in the campus clinic setting in the assessment of (C)APD and fewer than two clock hours earned on average in treatment/management of (C)APD in any of the clinical practice settings queried (i.e., campus clinic setting, off-campus practicum, internship/externship, clinical residency, clinical fellowship year [CFY]). This is not a sufficient amount of time to master the assessment of CAP/CANS, which may explain why so few respondents diagnose or manage (C)APD in their current work setting.

No treatment clock hour comparisons can be made to the 1998 survey, which queried only graduate preparation and professional practices in assessment; however, comparisons of respondents' academic and clinical experiences in assessment of CAP are illuminating. While the 31% of respondents reporting no graduate course work devoted to CAP/CANS is smaller than the 80% of respondents reported in the Chermak et al (1998) study, that significant percentage, coupled with only a negligible increase in the average number of assessment clock hours earned, suggests a continuing shortcoming in university training programs. Perhaps, as discussed by Chermak et al (1998), the Sykes et al finding that (ironically) audiology faculty consider (C)APD as the least important of five areas (including hearing aids, tinnitus, cochlear implants, and dizziness) continues to prevail to the detriment of audiology education and professional preparation. Audiology students may adopt the faculty's priorities leading them to avoid (C)APD evaluations in practice. Lack of clinical experience (combined with limited course work) surely helps explain why so few respondents diagnose (C)APD and why the majority of respondents reported that they did not know the efficiency for the majority of the 51 (C)APD tests, scales, and procedures listed in this survey. It is clear that a higher percentage of audiologists must develop the competencies and skills necessary to diagnose (C)APD to meet the strong demand for services in this area.

Encouraging trends were seen in basic science preparation and continuing education. Ninety-two percent of current respondents compared to 83% in the Chermak et al survey completed at least one basic hearing science course (i.e., psychoacoustics and related hearing science). The majority of respondents (66%) completed at least one continuing education course in the area of CAP/CANS, and 46% completed at least one continuing education course in hearing science following graduation. These findings suggest that graduate curricula are expanding coverage of the science foundations of clinical practice and that audiologists recognize the value of education beyond graduate course work in order to be well prepared to serve patients suspected of (C)APD.

Of those respondents involved in the diagnosis of (C)APD, the most utilized diagnostic tool was the acoustic reflex threshold (ART). Respondents also rated the ART the most efficient tool in the CAP battery; however, the ART and ARD only measure the lower brainstem and, hence, have not been considered as particularly efficient tools for diagnosis of (C)APD, which often involves compromise of higher levels of the CANS (Chermak and Musiek, 1997). Given the respondents' report that the amount of time required to test was the number one reason for not assessing (C)APD, the acoustic reflex procedures may be more attractive and highly valued relative to other tests because they are relatively easily administered and interpretation is rather straightforward. Nonetheless, the respondents' rating of the ART as the most efficient tool in the CAP battery suggests some limitation in their anatomical knowledge and that they may be inappropriately using acoustic reflex procedures, given the low incidence of brainstem lesions and the limited scope of these procedures (Chermak et al, 1998).

A high percentage of respondents reported that they did not know the efficiency of CAP tests. Overall, aggregated efficiency ratings were alarmingly low; however, despite respondents' difficulty in assessing the efficiency of the 51 tests, procedures, and scales, it is encouraging that many of the tests and procedures they reported as most frequently used in CAP assessments are cited in the literature as having good sensitivity and specificity (e.g., PP, DD, ABR, DP, MLR) (Musiek and Chermak, 2006). Furthermore, respondents were rather consistent in reporting more frequent use of tests and procedures they rated as more efficient; however, some of the more frequently used tools (e.g., SRN, CS, LPFS) are not among the most efficient tests of CANS function (Musiek and Chermak, 2006). At least one efficient measure of the brainstem (i.e., masking level differences [MLD]) and one recently developed test (i.e., gaps-in-noise [GIN]) were not among those tests used most frequently or considered more efficient. The omission of the GIN is not surprising given the limited published information on the GIN at the time of this survey. The omission of MLD may reflect respondents' preference for other measures that reveal the integrity of the brainstem (i.e., ABR). Compared to the Chermak et al (1998) study in which the ART, ABR, SCAN, LPFS, CS, and the SSW were seen to be the most frequently used tools, the present results reveal positive developments in the audiologist's CAP test battery.

Results indicated that audiologists are beginning to include electrophysiologic measures (i.e., ABR and MLR) in their CAP test batteries, as recommended in several recent reports (Jerger and Musiek, 2000; American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005). While ABR has not been considered to be a primary electrophysiologic tool for diagnosis of (C)APD (Jerger and Musiek, 2000), recent research suggests the potential of ABR as a marker of (C)APD and associated language and learning issues (Banai et al, 2005). It would appear that the additional graduate course work and continuing education in (C)APD and hearing science may be in part responsible for these developments. The current findings substantiate a positive change as audiologists begin to adopt more efficient tools and a test battery more capable of assessing across the CANS.

Chermak et al (1998) did not ask respondents to evaluate the efficiency of specific tests; however, they were asked about overall satisfaction with their chosen (C)APD test battery. Chermak et al reported that 48% of respondents gave a satisfaction rating no greater than 50%. The results of the present study suggest that satisfaction with the CAP test battery may still be limited and might have contributed to the low participation rate in (C)APD diagnoses.

While respondents' test batteries are increasingly aligned with published recommendations, their approach to (C)APD screening is not. Of the less than 50% who screen, the ART and various questionnaires were identified as the preferred tool. Apparently, recommendations to expand screening beyond questionnaires to include gap detection or DD (Jerger and Musiek, 2000; American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005) have not been adopted.

Also, perhaps reflecting shortcomings in educational preparation, few respondents identified a theoretical model that guides their approach to diagnosis or treatment. Alternatively, respondents may be conversant with published models and may have concluded that all available models are inadequate. Validation of central auditory processing models is needed to improve differential diagnosis and customize intervention by delineating the relationships among central auditory processing and learning, language, and related functions.

Regarding intervention, SLPs remain the number one professional to whom audiologists refer patients diagnosed with (C)APD, a finding consistent with the Chermak et al survey and recent professional reports (American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005). SLPs should be involved in the treatment/management process, as they provide valuable perspective on the cognitive-communicative and language-related factors that are associated with (C)APD (American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005). SLPs provide differential diagnosis for individuals with compounding language disorders, and typically they will provide a more comprehensive range of therapies for (C)APD, including metalinguistic, metacognitive, and cognitive approaches (American Speech-Language-Hearing Association Working Group on Auditory Processing

Disorders, 2005; Chermak and Musiek, 2006). Of concern is the number of respondents answering this question who indicated that they do not refer their patients with (C)APD for treatment and the number who are not taking an active role in the treatment process. Only one respondent reported providing treatment/management services, despite the fact that signal enhancement, environmental accommodations, and auditory training are considered within the purview of the audiologist (Chermak and Musiek, 1997; American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005). Respondents recognized the audiologist's role in environmental accommodations and assistive listening devices, although auditory training was relegated by almost half of the respondents answering this question to the SLP.

Despite the frequent referral to speech-language pathologists for intervention, only 24% of respondents providing (C)APD diagnosis reported that they differentially diagnose with a team of professionals. This is a major concern as (C)APD often is associated with language, cognitive-communicative, and learning deficits, and it is imperative that these other factors are identified to ensure that the most effective and efficient intervention is implemented (Chermak et al, 1999; Jerger and Musiek, 2000; American Speech-Language-Hearing Association on Auditory Processing Disorders, 2005; Musiek et al, 2005; Chermak et al, 2007).

Not surprisingly, none of the respondents reported examining visual processing to differentiate multimodal and supramodal factors that some claim must be explored to accurately diagnose (C)APD (Cacace and McFarland, 2005). Given educational limitations, scope of practice issues, and lack of clinical tests for use by audiologists to examine other modalities, such a recommendation seems inappropriate and unrealistic. (See Musiek et al, 2005, for discussion of clinical and theoretical issues related to multimodality assessment.)

Limitation of the Study

Given the low response rate (24%), one must question whether the respondents represent audiologists active in the diagnosis and treatment of (C)APD. The current sample, however, reflects the primary work settings reported for audiologists (i.e., private practice, ENT clinics, and hospitals) (American Speech-Language-Hearing Association, 2004), yet only 24 of 90 respondents (27%) reported testing for (C)APD. Furthermore, only 17 of 90 respondents (19%) actually rated the frequency of use and efficiency of the (C)APD tests/scales/procedures. The responses given by this small number of audiologists, particularly to those questions asked only of those who actually assess (C)APD, might misrepresent the perspective of a larger sample (Babbie, 1973).

CONCLUSIONS

The results of this survey reveal some positive changes in the academic preparation (but not the clinical preparation) of audiologists in the area of (C)APD. Improved professional preparation, new current procedure terminology (CPT) codes to facilitate reimbursement for evaluation of central auditory function (e.g., 92620 and 92621), and published reports and position papers delineating the responsibilities of the multidisciplinary team (e.g., American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005) and the efficacy of specific treatment (see chapters in Chermak and Musiek, 2007, for a review) should enable and encourage a larger number of audiologists to competently engage in diagnosis and treatment of (C)APD. Doctoral curricula in audiology must include course work devoted to the assessment of the CANS and the diagnosis of (C)APD, as well as course work in the basic hearing sciences. Such course work coupled with significantly more clinical practice in this area will provide students the scientific and theoretical foundations and experience needed to diagnose and treat (C)APD in their professional practices. Given the scope and evolution of knowledge needed to competently assess, diagnose, and treat complex disorders including (C)APD, it is essential that clinicians participate in continuing education and ongoing training in addition to those obtained during the educational preparation process (American Speech-Language-Hearing Association Working Group on Auditory Processing Disorders, 2005; Bellis, 2006).

NOTES

1. Percentages calculated from the sum of "do not know" responses per respondent across all 51 tests/scales/procedures.

2. Areas not queried in the present study included satisfaction with the graduate education received in the area of (C)APD; types of courses completed in continuing education; reasons for not treating/managing (C)APD; and reasons for not differentially diagnosing/treating/managing (C)APD. Areas not queried in the Chermak et al (1998) study included contraindications for administration of a diagnostic (C)APD evaluation; opinions regarding which professional should treat/manage (C)APD; types of treatment/management approaches; consideration of the AuD level of graduate education of respondents; and practice trends regarding evaluation of other modalities.

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Appendix A. Questionnaire and Raw Data

Survey questions, number and percentage of responses, and descriptive statistics. Note that rounding errors may result in percentage totals less than or greater than 100%. Not all respondents answered all questions. Number of respondents was 90, unless otherwise indicated.

Q1. What is the highest degree you currently hold?

	%	N
Master's degree	47%	42
AuD	34%	31
PhD	18%	16
Enrolled/Doctoral program	1%	1

Q2. What year did you earn your highest degree?

Mean	1992
SD	11.84
Range	1965–2005
Mode	2002

Q3. Do you hold ASHA certification in audiology?

	%	N
Yes	87	78
No	13	12

Q4. Are you licensed to practice audiology in your state?

	%	N
Yes	97	87
No	3	3

Q5. Are you a member of the American Academy of Audiology?

	%	N
Yes	100	90
No	0	0

Q6. How many years have you practiced audiology?

Mean	19.37
SD	10.47
Range	1–42
Mode	25

Q7. Please indicate the type of setting at which you are currently employed.*

	%	N
Private Practice	32	29
Hospital	16	14
Ear, Nose, and Throat Clinic	18	16
School District	4	4
University Clinic	8	7
Hearing Aid Industry	2	2
Government Facility	6	5
Veteran's Facility	6	5
Community-Based Clinic	1	1
Cochlear Implant Company	2	2
Audiologic Equipment Manufacturer	0	0
Other	16	14

Total number of respondents = 90

* Respondents selected all settings that applied.

Q8. How many courses addressing either the assessment of the integrity/function of the central auditory nervous system (CANS) or diagnosis of (central) auditory processing disorder ([C]APD) did you complete DURING YOUR GRADUATE STUDIES?

Mean	1.07
SD	1.02
Mode	1
Range	0–6

Courses	N	%
0	28	31
1	40	69*
2	16	
3	4	
4	1	
6	1	

* Percentage of respondents completing one or more courses.

Q9. How many auditory perception, psychoacoustics, and related hearing science courses did you complete DURING YOUR GRADUATE STUDIES?

Mean	2.47
SD	1.80
Mode	0
Range	0–6

Courses	N	%
0	7	8
1	22	92*
2	25	
3	12	
4	14	
5	5	
6	4	
11	1	

* Percentage of respondents completing one or more courses.

Q10. How many courses addressing either the assessment of the integrity/function of the central auditory nervous system (CANS) or diagnosis of (C)APD did you complete through CONTINUING EDUCATION since earning your highest degree?

Mean	2.64	
SD	3.27	
Mode	0	
Range	0–12	
Courses	N	%
0	31	34
1	16	66*
2	9	
3	9	
4	8	
5	5	
9	2	
10+	10	

* Percentage of respondents completing one or more courses.

Q11. How many auditory perception, psychoacoustics, and related hearing science courses did you complete through CONTINUING EDUCATION since earning your highest degree?

Mean	1.84	
SD	2.97	
Mode	0	
Range	0–10	
Courses	N	%
0	49	54
1	8	46*
2	12	
3	4	
4	6	
5	2	
9	2	
10+	7	

* Percentage of respondents completing one or more courses.

Q12. In each of the settings below, please indicate the approximate number of total hours you spent on the assessment of (C)APD during your entire graduate program.

	Campus Clinic	Off-Site Practicum	Internship/ Externship	Clinical Residency	CFY
Mean	8.29	4.55	2.61	0.08	7.58
SD	10.75	14.04	7.08	0.51	16.87
Range	0–48	0–100	0–50	0–4	0–100
Mode	0	0	0	0	0
N	84	85	76	76	83

Q13. In each of the settings below, please indicate the approximate number of total hours you spent on the treatment/ management of (C)APD during your entire graduate program.

	Campus Clinic	Off-Site Practicum	Internship/ Externship	Clinical Residency	CFY
Mean	1.94	0.76	0.94	0.00	2.50
SD	5.71	4.51	4.85	0.00	8.00
Range	0–40	0–40	0–40	0	0–40
Mode	0	0	0	0	0
N	83	82	80	76	83

Q14. Please indicate the average number of hours per week you dedicate to the diagnosis of (C)APD in your clinical practice.

Mean	0.84
SD	1.62
Range	0–6
Mode	0

Total number of respondents = 87

Q15. Please indicate the average number of hours per week you dedicate to the treatment/management of (C)APD in your clinical practice.

Mean	0.49
SD	1.84
Range	0–15
Mode	0

Total number of respondents = 87

Q16. Do you currently diagnose (C)APD by examining central auditory nervous system (CANS) function at your facility?

	%	N
Yes	27	24
No	73	66

Q17. If you do not currently evaluate (C)APD, please state why (Check all that apply).

	%	N
Inadequate reimbursement	24	16
Questionable validity of diagnosis	17	11
Limited number of diagnostic tests and procedures	8	5
Limited normative data	8	5
Poor test efficiency (sensitivity/specificity)	12	8
Lack of test instrumentation	17	11
Too much time required to test	35	23
Caseload issues (too many referrals)	6	4
Question efficacy of treatment options	15	10
Difficulty finding professionals to whom to refer patients diagnosed with (C)APD for treatment	21	14
Lack the educational background required	29	19
Other	58	38

Total number of respondents = 66

Q18. How many years have you spent testing for (C)APD?

Mean	5.17
SD	8.21
Range	0–25
Mode	0

Total number of respondents = 66

Q19. Do you screen for (C)APD?

	%	N
Yes	46	31
No	54	37

Total number of respondents = 68

Q20. Which of the following do you utilize in your screening protocol for (C)APD? (Check all that apply)

	%	N
Acoustic Reflex	13	4
Dichotic Digits	0	0
Gap Detection	0	0
Questionnaires	10	3
SCAN	6	2
None	71	22

Total number of respondents = 31

Q21. Approximately what percentage of your total patient caseload is screened for (C)APD as part of your routine test battery?

Mean	0.26
SD	0.95
Range	0–5
Mode	0

Total number of respondents = 27

Q22. Approximately what percentage of screened patients is ULTIMATELY diagnosed as having (C)APD?

Mean	4.30
SD	15.62
Range	0–75
Mode	0

Total number of respondents = 20

Q23. Which conditions would contraindicate administering a diagnostic evaluation of (central) auditory processing/function? (Check all that apply)

	%	N
ADHD	18	3
Low IQ	29	5
Cognitive deficit	29	5
Speech delay	12	2
Poor vision	0	0
Language delay	24	4
Non-native speaker	35	6
Bilingual speaker	12	2
Other	59	10

Total number of respondents = 17

Q24. Please rate, on a scale of zero to four (0 = never, 1 = rarely, 2 = sometimes, 3 = often, 4 = always), how often you currently utilize the following tests to evaluate (C)APD.

Total number of respondents = 17

Acoustic Reflex Threshold

Value	Number of Respondents
0	10
1	1
2	2
3	1
4	3

Aggregated Rating = 20*

*Aggregated rating computed as total of all values x respective number of respondents.

Acoustic Reflex Decay

Value	Number of Respondents
0	12
1	1
2	3
3	1
4	0

Aggregated Rating = 10

Auditory Brainstem Response

Value	Number of Respondents
0	12
1	1
2	4
3	0
4	0

Aggregated Rating = 9

Auditory Continuous Performance Test

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Auditory Fusion Test-Revised

Value	Number of Respondents
0	16
1	0
2	0
3	0
4	1

Aggregated Rating = 4

Binaural Fusion

Value	Number of Respondents
0	15
1	1
2	0
3	0
4	1

Aggregated Rating = 5

Children's Auditory Processing Performance Scale (CHAPPS)

Value	Number of Respondents
0	16
1	0
2	0
3	0
4	1

Aggregated Rating = 4

Children's Auditory Processing Skills Profiles: Checklist of Classroom Observations for Children with Possible Auditory Processing Problems

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Listening Inventory for Education (LIFE)

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Children's Home Inventory for Listening Difficulties (CHILD)

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Competing Environmental Sounds

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Competing Sentences

Value	Number of Respondents
0	13
1	0
2	2
3	0
4	2

Aggregated Rating = 12

Dichotic Digits

Value	Number of Respondents
0	14
1	0
2	1
3	0
4	2

Aggregated Rating = 10

Dichotic CVs

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Dichotic Rhyme

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Dichotic Sentence Identification (DSI)

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Duration Patterns

Value	Number of Respondents
0	13
1	1
2	2
3	0
4	1

Aggregated Rating = 9

Filtered Speech (Low Pass)

Value	Number of Respondents
0	15
1	0
2	0
3	0
4	2

Aggregated Rating = 8

Filtered Speech (High Pass)

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Fisher's Checklist

Value	Number of Respondents
0	15
1	0
2	0
3	0
4	2

Aggregated Rating = 8

Gaps-in-Noise

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Goldman-Fristoe-Woodcock Test of Auditory Discrimination

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Interaural Timing Tasks

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Late Latency Response

Value	Number of Respondents
0	15
1	2
2	0
3	0
4	0

Aggregated Rating = 2

Localization

Value	Number of Respondents
0	16
1	1
2	0
3	0
4	0

Aggregated Rating = 1

Masking Level Difference (Tones)

Value	Number of Respondents
0	14
1	2
2	1
3	0
4	0

Aggregated Rating = 4

Masking Level Difference (Spondees)

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Middle Latency Response (MLR)

Value	Number of Respondents
0	14
1	2
2	1
3	0
4	0

Aggregated Rating = 8

Mismatched Negativity Potential (MMN)

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Pediatric Speech Intelligibility (PSI)

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Phonemic Synthesis

Value	Number of Respondents
0	15
1	0
2	0
3	1
4	1

Aggregated Rating = 7

PI-PB Function

Value	Number of Respondents
0	13
1	2
2	1
3	1
4	0

Aggregated Rating = 7

P300

Value	Number of Respondents
0	14
1	2
2	1
3	0
4	0

Aggregated Rating = 4

Pitch (Frequency) Patterns

Value	Number of Respondents
0	13
1	1
2	1
3	0
4	2

Aggregated Rating = 11

Rapidly Alternating Speech Perception (RASP)

Value	Number of Respondents
0	16
1	0
2	0
3	0
4	1

Aggregated Rating = 4

Random Gap Detection Test (RGDT)

Value	Number of Respondents
0	15
1	1
2	0
3	0
4	1

Aggregated Rating = 5

Rush Hughes Difference Score

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Test for Auditory Processing Disorders in Children-Revised (SCAN-C)

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Test for Auditory Processing Disorders in Adolescents and Adults (SCAN-A)

Value	Number of Respondents
0	15
1	0
2	2
3	0
4	0

Aggregated Rating = 4

Selective Auditory Attention Test

Value	Number of Respondents
0	16
1	1
2	0
3	0
4	0

Aggregated Rating = 1

Self-Assessment Scale

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Speech Perception in Noise Test (SPIN)

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Speech Recognition in Noise

Value	Number of Respondents
0	12
1	1
2	1
3	0
4	3

Aggregated Rating = 15

Staggered Spondaic Word (SSW)

Value	Number of Respondents
0	14
1	0
2	1
3	0
4	2

Aggregated Rating = 10

Synthetic Sentence Identification with Contralateral Competing Message (SSI-CCM)

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Synthetic Sentence Identification with Ipsilateral Competing Message (SSI-ICM)

Value	Number of Respondents
0	15
1	1
2	1
3	0
4	0

Aggregated Rating = 3

Tallal's Tests

Value	Number of Respondents
0	16
1	0
2	0
3	1
4	0

Aggregated Rating = 3

Test for Auditory Perceptual Skills (TAPS)

Value	Number of Respondents
0	16
1	1
2	0
3	0
4	0

Aggregated Rating = 1

Time Compressed Speech

Value	Number of Respondents
0	16
1	0
2	1
3	0
4	0

Aggregated Rating = 2

Time Compressed Speech with Reverberation

Value	Number of Respondents
0	15
1	0
2	1
3	0
4	1

Aggregated Rating = 6

Wichita Auditory Fusion Test (WAFT)

Value	Number of Respondents
0	17
1	0
2	0
3	0
4	0

Aggregated Rating = 0

Q25. If you utilize other tests, please specify which ones you use.

No other tests specified.

Q26. Please indicate on a scale of zero to three (0 = not efficient, 1 = efficient, 2 = highly efficient, 3 = do not know) your impression of the efficiency (i.e., sensitivity and specificity) of each of the following tests.

Total number of respondents = 17

Acoustic Reflex Threshold

Value	Number of Respondents
0	2
1	5
2	3
3	7

Aggregated Efficiency = 11*

*Aggregated efficiency computed as total of all values x respective number of respondents (excluding value 3, "do not know").

Acoustic Reflex Decay

Value	Number of Respondents
0	1
1	6
2	2
3	8

Aggregated Efficiency = 10

Auditory Brainstem Response

Value	Number of Respondents
0	2
1	4
2	3
3	8

Aggregated Efficiency = 10

Auditory Continuous Performance Test

Value	Number of Respondents
0	1
1	1
2	1
3	14

Aggregated Efficiency = 3

Auditory Fusion Test-Revised

Value	Number of Respondents
0	2
1	0
2	0
3	15

Aggregated Efficiency = 3

Binaural Fusion

Value	Number of Respondents
0	1
1	3
2	0
3	13

Aggregated Efficiency = 3

Children's Auditory Processing Performance Scale (CHAPPS)

Value	Number of Respondents
0	1
1	2
2	0
3	14

Aggregated Efficiency = 2

Children's Auditory Processing Skills Profiles: Checklist of Classroom Observations for Children with Possible Auditory Processing Problems

Value	Number of Respondents
0	1
1	1
2	0
3	15

Aggregated Efficiency = 1

Listening Inventory for Education (LIFE)

Value	Number of Respondents
0	1
1	1
2	0
3	15

Aggregated Efficiency = 1

Children's Home Inventory for Listening Difficulties (CHILD)

Value	Number of Respondents
0	1
1	1
2	0
3	15

Aggregated Efficiency = 1

Competing Environmental Sounds

Value	Number of Respondents
0	2
1	1
2	0
3	15

Aggregated Efficiency = 1

Competing Sentences

Value	Number of Respondents
0	3
1	2
2	0
3	12

Aggregated Efficiency = 2

Dichotic Digits

Value	Number of Respondents
0	0
1	2
2	2
3	13

Aggregated Efficiency = 6

Dichotic CVs

Value	Number of Respondents
0	0
1	3
2	0
3	14

Aggregated Efficiency = 3

Dichotic Rhyme

Value	Number of Respondents
0	1
1	0
2	1
3	15

Aggregated Efficiency = 2

Dichotic Sentence Identification (DSI)

Value	Number of Respondents
0	1
1	0
2	1
3	15

Aggregated Efficiency = 2

Duration Patterns

Value	Number of Respondents
0	1
1	2
2	2
3	12

Aggregated Efficiency = 6

Filtered Speech (Low Pass)

Value	Number of Respondents
0	1
1	3
2	1
3	12

Aggregated Efficiency = 5

Filtered Speech (High Pass)

Value	Number of Respondents
0	2
1	1
2	0
3	14

Aggregated Efficiency = 1

Fisher's Checklist

Value	Number of Respondents
0	3
1	1
2	0
3	13

Aggregated Efficiency = 1

Gaps-in-Noise

Value	Number of Respondents
0	0
1	2
2	1
3	14

Aggregated Efficiency = 4

Goldman-Fristoe-Woodcock Test of Auditory Discrimination

Value	Number of Respondents
0	1
1	2
2	0
3	14

Aggregated Efficiency = 2

Interaural Timing Tasks

Value	Number of Respondents
0	1
1	0
2	1
3	15

Aggregated Efficiency = 2

Late Latency Response

Value	Number of Respondents
0	0
1	4
2	0
3	13

Aggregated Efficiency = 4

Localization

Value	Number of Respondents
0	1
1	3
2	0
3	13

Aggregated Efficiency = 3

Masking Level Difference (Tones)

Value	Number of Respondents
0	1
1	4
2	0
3	12

Aggregated Efficiency = 4

Masking Level Difference (Spondees)

Value	Number of Respondents
0	1
1	1
2	1
3	14

Aggregated Efficiency = 3

Middle Latency Response (MLR)

Value	Number of Respondents
0	1
1	4
2	0
3	12

Aggregated Efficiency = 4

Mismatched Negativity Potential (MMN)

Value	Number of Respondents
0	1
1	1
2	1
3	14

Aggregated Efficiency = 3

Pediatric Speech Intelligibility (PSI)

Value	Number of Respondents
0	2
1	0
2	0
3	15

Aggregated Efficiency = 0

Phonemic Synthesis

Value	Number of Respondents
0	0
1	1
2	1
3	15

Aggregated Efficiency = 3

PI-PB Function

Value	Number of Respondents
0	0
1	5
2	1
3	11

Aggregated Efficiency = 7

P300

Value	Number of Respondents
0	0
1	2
2	1
3	14

Aggregated Efficiency = 4

Pitch (Frequency) Patterns

Value	Number of Respondents
0	0
1	2
2	3
3	12

Aggregated Efficiency = 8

Rapidly Alternating Speech Perception (RASP)

Value	Number of Respondents
0	2
1	2
2	0
3	13

Aggregated Efficiency = 2

Random Gap Detection Test (RGDT)

Value	Number of Respondents
0	1
1	3
2	0
3	13

Aggregated Efficiency = 3

Rush Hughes Difference Score

Value	Number of Respondents
0	1
1	0
2	0
3	16

Aggregated Efficiency = 0

Test for Auditory Processing Disorders in Children (SCAN-C)

Value	Number of Respondents
0	16
1	0
2	1
3	0

Aggregated Efficiency = 2

Test for Auditory Processing Disorders in Adolescents and Adults (SCAN-A)

Value	Number of Respondents
0	2
1	4
2	0
3	11

Aggregated Efficiency = 4

Selective Auditory Attention Test

Value	Number of Respondents
0	2
1	1
2	0
3	14

Aggregated Efficiency = 1

Self-Assessment Scale

Value	Number of Respondents
0	0
1	0
2	0
3	17

Aggregated Efficiency = 0

Speech Perception in Noise Test (SPIN)

Value	Number of Respondents
0	1
1	2
2	1
3	13

Aggregated Efficiency = 4

Speech Recognition in Noise

Value	Number of Respondents
0	1
1	5
2	2
3	9

Aggregated Efficiency = 9

Staggered Spondaic Word (SSW) Test

Value	Number of Respondents
0	1
1	3
2	1
3	12

Aggregated Efficiency = 5

Synthetic Sentence Identification with Contralateral Competing Message (SSI-CCM)

Value	Number of Respondents
0	1
1	3
2	0
3	13

Aggregated Efficiency = 3

Synthetic Sentence Identification with Ipsilateral Competing Message (SSI-ICM)

Value	Number of Respondents
0	0
1	4
2	0
3	13

Aggregated Efficiency = 4

Tallal's Tests

Value	Number of Respondents
0	1
1	0
2	0
3	16

Aggregated Efficiency = 0

Test for Auditory Perceptual Skills (TAPS)

Value	Number of Respondents
0	1
1	2
2	0
3	14

Aggregated Efficiency = 2

Time Compressed Speech

Value	Number of Respondents
0	1
1	4
2	0
3	12

Aggregated Efficiency = 4

Time Compressed Speech with Reverberation

Value	Number of Respondents
0	1
1	4
2	0
3	12

Aggregated Efficiency = 4

Wichita Auditory Fusion Test (WAFT)

Value	Number of Respondents
0	1
1	0
2	0
3	16

Aggregated Efficiency = 0

Q27. In your opinion, please indicate whether the audiologist, the speech-language pathologist or another professional should conduct the following treatment/management techniques.

	Audiologist	Speech/Lang. Pathologist	Other Professional	Total Respondents
Auditory Training	45% N=10	55% N=12	0% N=0	22
Metalinguistic Strategies	18% N=4	77% N=17	5% N=1	22
Metacognitive Strategies	11% N=2	79% N=15	11% N=2	19
Cognitive Strategies	10% N=2	67% N=14	24% N=5	21
Assistive Listening Devices	94% N=16	6% N=1	0% N=0	17
Environmental Modifications	71% N=15	24% N=5	5% N=1	21
Computer-Assisted Therapy Tools	32% N=8	60% N=15	8% N=2	25

Q28. Do you provide treatment/management to your patients identified with (C)APD? If "no" please specify to whom you refer.

Total number of respondents = 17

	%	N
Yes	6	1
No	94	16
Do not refer	38	6
Hospital	13	2
Speech-language pathologist	38	6
Other audiologist	13	2

Q29. Please indicate on a scale of zero (never) to four (always), how often you use the following intervention approaches.

	Never	Rarely	Sometimes	Often	Always
Auditory Training	0	0	100%	0	0
Metalinguistic Strategies	0	0	100%	0	0
Cognitive Strategies	0	0	100%	0	0
Environmental Modifications	0	0	100%	0	0
Assistive Listening Devices	0	0	0	100%	0
Metacognitive Strategies	0	100%	0	0	0
Computer-Assisted Therapy Tools	100%	0	0	0	0

Total number of respondents = 1

Q30. Do you customize treatment/management for every (C)APD identified patient?

	%	N
Yes	100	1

Total number of respondents = 1

Q31. Do you assess the effectiveness of the treatment/management you provide?

	%	N
Yes	100	1

Total number of respondents = 1

Q32. When do you assess the effectiveness of your treatment/management strategies (i.e., immediately following intervention, two months following, etc.)?

6 months following

Total number of respondents = 1

Q33. Do you utilize electrophysiologic tools to assess the effectiveness of treatment/management?

	%	N
No	100	1

Total number of respondents = 1

Q34. Do you utilize behavioral tools to assess the effectiveness of treatment/management?

	%	N
No	100	1

Total number of respondents = 1

Q35. Which (C)APD models guide your treatment/ management approach?

	%	N
Bellis/Ferre	0	0
Buffalo	0	0
None	100	1
Other	0	0

Total number of respondents = 1

Q36. Which (C)APD models guide your diagnostic approach?

	%	N
Bellis/Ferre	13	2
Buffalo	7	1
None	80	12
Other	0	0

Total number of respondents = 15

Q37. Do you differentially diagnose and manage your patients with (C)APD with a team of professionals?

	%	N
Yes	24	4
No	76	13

Total number of respondents = 17

Q38. Please indicate which members are a part of your diagnostic/management (C)APD team.

	%	N
Speech-language pathologist	100	4
Educator	75	3
Psychologist	50	2
Social worker	0	0
Parents	75	3
Physicians	25	1

Total number of respondents = 4*

*Total number of responses exceeds number of respondents because some selected more than one category.

Q39. Do you test visual processing to explore multi-modal and supramodal/pansensory components that may coexist with or to rule out (C)APD?

	%	N
Yes	0	0
No	100	17

Total number of respondents = 17

Q40. Please check all the visual tests you include in your assessment of (C)APD.

No visual tests specified.

Q41. To whom do you refer for other modality testing?

	%	N
Another audiologist	7	1
Psychologist	40	6
Educator	13	2
Speech-language pathologist	40	6
Optometrist	7	1
Physician	7	1
Do not refer	20	3

Total number of respondents = 15*

*Total number of responses exceeds number of respondents because some selected more than one category.