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Research Article

Survey of Audiologists' Clinical Practice Patterns and Perceptions of Electrophysiological Assessments

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ABSTRACT

Purpose: Electrophysiological assessments in audiology are used for neurodiagnostic evaluations, newborn hearing screenings, and estimating auditory thresholds when behavioral responses are unobtainable or unreliable. Nonetheless, evidence suggests that many electrophysiological tools remain underutilized. This study examined current practice patterns, perceptions, and barriers related to electrophysiological testing among audiologists in the United States.
Method: An online survey distributed between January and April 2025 yielded 220 eligible responses. Participants answered questions specific to their patient population (i.e., n = 178 regarding adult patients, n = 174 for pediatric patients) to examine potential differences in utilization and perspectives.
Results: Nearly 60% of audiologists working with pediatric populations reported using electrophysiological techniques at least monthly compared to approximately 40% of those working with adults. Across specific tests, auditory brainstem response testing was the most frequently used for both populations, followed by electrocochleography and vestibular evoked myogenic potentials. Most respondents rated electrophysiological assessments as very or quite useful and beneficial for at least some or most patient cases. Key barriers included lack of time, financial limitations related to equipment and reimbursement, and population-specific challenges (pediatric populations: setup or recording difficulties including patient cooperation, noise, etc.; adult populations: limited perceived clinical relevance of electrophysiological techniques).
Conclusions: These findings underscore both the recognized value of electrophysiological assessments as well as the practical, perceptual, and financial barriers restricting broader implementation. Addressing these challenges at individual, institutional, and national levels may support fuller scope-of-practice adoption and enhance patient care across the field.
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In the field of audiology, electrophysiological assessments provide a glimpse into neural functionality of the auditory system from the cochlea (e.g., electrocochleography [ECochG]) to the cortex (e.g., late latency response [LLR], mismatch negativity [MMN]) and everything in between (e.g., auditory brainstem response [ABR], middle latency response [MLR]). Within the scope of practice, electrophysiological procedures such as auditory evoked potentials (AEPs) play a specialized but important role in diagnostics, intervention planning, and counseling (American Speech-Language-Hearing Association [ASHA], 2006). Common clinical applications of electrophysiological assessments include objective threshold measurements and neurodiagnostic evaluations, as well as some vestibular assessments. Given their role in comprehensive audiologic examinations and patient care, the goal of the current study is to characterize the state of the field with regard to current practice patterns and perceptions of electrophysiological techniques among audiologists in the United States.

As an objective measure of neural pathway function, electrophysiological tests can differentiate central and peripheral processes beyond traditional measures, evaluate difficult-to-test patients (such as when behavioral responses

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are unobtainable or unreliable), and provide insights to guide clinical decision making. The ABR, for example, has become the gold standard for neural-based hearing assessments, particularly for early hearing loss detection among newborn infants (The Joint Committee on Infant Hearing, 2019). Cortical AEPs show promise to improve neurodiagnostic evaluations including better characterization of auditory processing disorders (Mattsson et al., 2019), neurodevelopmental delays (Riva et al., 2018), speech-language processing abilities (B. A. Martin et al., 2008), aided intervention outcomes (Mehta et al., 2020), and even prospective cochlear implant candidates (Hoth & Dziemba, 2017). Additionally, electrophysiological measures may offer greater sensitivity than traditional audiologic tests in detecting patient-reported speech perception difficulties (Anderson et al., 2013; Barbee et al., 2018; Le Prell & Brungart, 2016; Plack et al., 2014). It is perhaps no surprise therefore that most audiology students, clinicians, and educators rate AEPs as an important part of audiology educational training (Mondul et al., 2025).

Despite their potential to expand patient services, treatment, and care, clinical adoption of electrophysiological techniques is somewhat limited. Reported usage of electrophysiological tests among audiologists both in the United States and abroad generally range between 45% and 75% (Easwar et al., 2013; Goulios & Patuzzi, 2008; F. N. Martin et al., 1998), but the last survey of U.S. audiologists by F. N. Martin et al. (1998) reports < 10% usage of electrophysiology measures beyond the brainstem (e.g., MLR, LLR, MMN). Clinical implementation of such tests may be limited by several factors including time constraints, equipment and resource costs, nonexistent normative data, no standardized protocols, or lack of awareness, training, or competence in applying advanced electrophysiology methodologies. However, to our knowledge, no study has formally quantified perceptions, practice patterns, and barriers specific to audiologic electrophysiology testing across the United States (cf. Australia and cortical potentials: Mehta et al., 2020, or limited to otoacoustic emissions: Mertes & Marquess, 2023b). Identifying and eventually overcoming these barriers could enable audiologists to fully leverage electrophysiological testing as a powerful tool for enhancing patient care.

Three decades ago, F. N. Martin et al. (1994) predicted "future surveys will show a marked increase in the practice of measuring … a variety of AEPs," but the current status of these techniques is unknown. Thus, the goal of the current study was to survey the state of the field with regard to electrophysiological techniques in clinical audiology practice in the United States. The survey evaluated current practice patterns, barriers to clinical implementation, and perceptions on current and future use of electrophysiological assessments among currently licensed practicing audiologists. We believe these results will shed light on diagnostic advantages, limitations of current applications, and opportunities for advancement of electrophysiological techniques in the field of audiology.

Method

Focus Group Interviews and Survey Development

The study was divided into two phases. The first phase included qualitative focus group interviews conducted with six pairs of currently practicing U.S. audiologists (total n = 12, nine women and three men) to support survey development and validation (Gehlbach & Brinkworth, 2011; e.g., Phillips et al., 2022). During pilot testing, we found that paired interviews promoted an ideal balance of active participation, intersubject conversational interactions, and efficiency in an online video call format (Zoom Communications, Inc.). Focus group participants were recruited by listserv e-mails and word of mouth and paired for interviews according to schedule availability. The focus group participants were representative of a broad cross-section of audiologists, including in their years of experience (M = 9.31 years, range: 2.5–26 years), typical patient populations (n = 5 adults only, 3 mostly adults, 2 mostly pediatrics, and 2 pediatrics only), practice settings (n = 3 pediatric hospital; 2 general hospital; 2 veterans' hospital; 1 university hospital; 2 private practice; 1 ear, nose, and throat practice; and 1 other), workplace location setting (n = 9 city/urban, 2 suburban, and 1 rural), and geographic regions (n = 10 Southeast, 1 Midwest, and 1 Northeast). Frequency of electrophysiology usage also varied across participants, providing rich insight into how and why such techniques are utilized or not (n = 7 typically use electrophysiological techniques every day, 3 approximately weekly, and 2 never). The semistructured focus group interviews lasted approximately 1 hr and were recorded, transcribed, and coded, leading to the identification of key themes (i.e., background experiences and training, perceived clinical advantages, barriers to implementation, and strategies to overcome challenges).

Focus group participants were then asked to provide feedback on the survey developed directly from the focus group themes. Feedback from these audiologists ensured that survey questions were not only appropriate, clear, and concise but were also balanced across breadth and depth of field scope (Phillips et al., 2022). Survey item wordings were also honed based on this expert feedback to safeguard against bias, inconsistency, and ambiguity (Gehlbach & Artino, 2018; Gehlbach & Brinkworth, 2011). A similar feedback approach was recently undertaken in the development of a survey to measure U.S. audiologists' usage and attitudes toward otoacoustic emissions (Mertes & Marquess, 2023a, 2023b). Focus group participants were compensated both for their time during the interview and for completing the survey feedback process ($50 Amazon or Starbucks gift cards).

Once the survey was finalized, the second phase of the project included survey data collection and analysis. Given our study goals, eligible survey participants were (a) at least 18 years old, (b) clinically licensed audiologists or audiologist assistants/technicians (audiology students or externs excluded), (c) currently practicing (either part-time or full-time; retired or nonactive clinicians excluded), and (d) working in the United States. The entire study, including the final survey questionnaire, was approved by the University of Memphis Institutional Review Board (IRB; IRB Protocol No. PRO-FY2024-331). The focus group participants and survey respondents completed informed consent for study participation per the approved IRB protocol.

Survey Sections

The survey was designed within Qualtrics and has been included in Supplemental Material S1. After providing study information and obtaining consent for survey participation, the survey was divided into five major sections: (a) employment information, (b) clinical experience/background, (c) clinical practice, (d) educational background, and (e) respondent demographics. In the employment information section, participants reported their current employment status (i.e., employed full-time, part-time, pro re nata, retired, not currently employed), current occupation, and clinical credentials. Clinical experience/background included years of clinical experience, current and past practice type(s), U.S. region of workplace, current workplace location setting (e.g., urban, suburban, rural), and the relative proportion of adult versus pediatric populations seen in their clinical work (ASHA, 2022a, 2024a; Mertes & Marquess, 2023b). For the latter, participants reported whether they "only" see pediatric or adult populations, whether they see "some" of one but "mostly" the other, or whether their typical case load is approximately an equal mix of both. The clinical practice questions were then divided into adult and pediatric questions, depending on the clinician's typical patient population. For example, anyone who reported "some," "equal mix," "mostly," or "only" pediatrics saw the clinical practice questions on pediatrics and vice versa for adult clinical practice questions. Some respondents therefore only answered questions on pediatric populations (19.09%, n = 42), some answered for only adult populations (20.91%, n = 46), and many answered questions for both populations (60.00%, n = 132). The clinical practice section included questions on specific patient characteristics, general perceived benefit of electrophysiological assessments, equipment used, referral sources for electrophysiological testing, electrophysiological test purpose(s), greatest advantage(s) of electrophysiological testing, barrier(s) for using electrophysiological assessments, and the relative frequency, usefulness, and confidence in performing and/or interpreting individual electrophysiological measures.[1] The last two sections collected information about electrophysiology-related educational backgrounds and respondent demographics, respectively. Eighty percent of survey respondents completed the survey in 30 min or less, with more than half (52.73%) finishing the survey in 15 min or less.

In the present analyses, we focused on questions most relevant to clinical experience, practice patterns, and perceptions of electrophysiological testing (i.e., confidence, usefulness, and overall benefit to clinical practice). While certain questions pertaining to education, training, and equipment, for example, were beyond the scope of this article, we hope to include these details in future publications.

Survey Distribution

Responses were collected between January 30 and April 10, 2025. The survey was distributed via professional listservs (i.e., auditory.org, ASHA Special Interest Groups), local audiologist networking listservs, social media, word of mouth, and paid advertising campaigns with both Meta (Meta Platforms, Inc.) and LinkedIn (LinkedIn Corporation). Although widespread online distribution makes calculation of traditional response rates difficult (because it is nearly impossible to quantify the number of possible recipients or the potential cross-posting across individuals), the advertising campaigns significantly boosted survey outreach, which allowed us to better capture the diversity of practice patterns and perspectives across the profession. Participants who completed the survey were offered the opportunity to enter a drawing for one of ten $50 Amazon gift cards.

[1]As seen in the survey (see Supplemental Material S1), we included questions about otoacoustic emissions (OAEs) and electronically evoked stapedius reflex thresholds (eSRT) because these tests were mentioned by qualitative participants in the context of other electrophysiological tests. However, there is debate whether tests such as OAEs and eSRTs would be considered electrophysiological assessments (e.g., Bakhos et al., 2017; Brown & Johnson, 2016; F. N. Martin et al., 1998) or separate physiologic measurements (ASHA, 2006; Cain et al., 2020; Legatt, 2015). Our working definition more closely aligns with the latter, including professional organizations such as the American Academy of Audiology (Cain et al., 2020) and ASHA (2006). To accommodate these differing views, participants therefore had the opportunity to report on a variety of individual tests, including OAEs and eSRTs, but we excluded OAE and eSRT responses from the results in this report.

Analysis

Qualtrics data quality features were used for automatic detection and flagging of bots, duplicate respondents, high rates of unanswered questions, and straight-lined answers. These responses were reviewed carefully by the authors and were either included in the analysis, if the issue could be cleared based on the responses, or were excluded altogether. Any conflicting opinions on response inclusion were resolved by discussion among the authors. In most cases, the automatically flagged responses would have been excluded for other reasons, such as failure to complete the survey. Primary analyses were conducted using Qualtrics and Excel. Descriptive statistics included counts, percentages, means, and standard deviations. To compare the relationships between perceptions, practice patterns, and individual experience or workplace characteristics, we used a combination of nonparametric Spearman rank correlations, Kruskal–Wallis tests, and Fisher's exact tests conducted in SAS Studio (Version 3.82; SAS Institute Inc.). We used the Dwass–Steel–Critchlow–Fligner (DSCF) test to compute nonparametric post hoc pairwise comparisons while controlling family-wise error rate following a significant Kruskal–Wallis test (available in SAS as part of PROC NPAR1WAY: Critchlow & Fligner, 1991; Dwass, 1960; SAS Institute Inc., 2020; Steel, 1960). Unless otherwise stated (i.e., besides DSCF), post hoc comparisons were adjusted using the Holm–Bonferroni method to control family-wise error rate given evidence suggesting the sequential step-down procedure is as effective at controlling Type I error yet more powerful than traditional Bonferroni corrections (Abdi, 2010; Aickin & Gensler, 1996; Eichstaedt et al., 2013; Holm, 1979).

Results

Respondents

Three hundred fifty-one individuals interacted with the survey. The data were further cleaned according to a priori criteria (see the Focus Group Interviews and Survey Development section): 119 did not finish the survey, one response was flagged as a potential bot and did not consent, and seven did not meet the inclusion criteria (i.e., two indicated they were not currently employed, and five were retired audiologists). Additionally, two audiology assistants and two hearing aid specialists completed the survey. Since two submissions each are not sufficient to characterize practice patterns from each profession, we excluded these responses as well. The rate of unanswered questions reported by Qualtrics (M = 2.27% ± 3.47%, range: 0%–24.49%) was acceptable for this sample, so no further exclusions were needed. Thus, the total number of responses included in the analysis was 220.

Table 1 lists the demographic characteristics, while Table 2 highlights the work characteristics of the included respondents. Consistent with recent ASHA Audiology Survey respondent demographics (ASHA, 2022a, 2024a), the majority of our survey participants were women (86.36%), held a Doctor of Audiology degree (86.82%), were currently employed full-time (87.73%), and worked in a city/urban setting (55.91%). There were more respondents from the South and Midwest (38.18% and 26.36%, respectively) but also fair representation from the Northeast (22.73%) and some from the West (11.36%), indicating good coverage across the United States. The mean age was 40.60 ± 10.66 years, with more younger respondents than older, but there was a good spread of survey respondents between 25 and 55 years of age (range: 25–72 years). The younger skew was also reflected in years of practice where the mean total years of practice was 13.90 ± 10.93 years, with almost half of respondents between 0 and 10 years (46.82%).

Table 1. Respondent demographics.

Demographic characteristics	*n* (out of 220)	%
Gender		
Female	190	86.36
Male	23	10.45
Nonbinary	4	1.82
Prefer not to say	3	1.36
Geographic region		
Midwest	58	26.36
Northeast	50	22.73
South	84	38.18
West	25	11.36
Other	3	1.36
Age (years)		
25–34	74	33.64
35–44	56	25.45
45–54	45	20.45
55–64	14	6.36
65–74	7	3.18
Did not answer	24	10.91
Race		
American Indian/Alaska Native	1	0.45
Asian	5	2.27
Black/African American	5	2.27
Caucasian	198	90.00
Multiple selected	2	0.91
Other	1	0.45
Unknown/prefer not to say	8	3.64
Ethnicity		
Hispanic or Latino	12	5.45
Not Hispanic or Latino	199	90.45
Unknown/prefer not to say	9	4.09

Table 2. Respondent work characteristics.

Work characteristics	*n* (out of 220)	%
Years of practice		
0–10	103	46.82
10–20	55	25.00
20–30	37	16.82
30–40	20	9.09
40–50	4	1.82
Did not answer	1	0.45
Degree		
AuD	191	86.82
PhD	3	1.36
Dual doctorate (e.g., AuD-PhD, MD-PhD)	8	3.64
Master's degree (e.g., MA in Audiology)	16	7.27
Other	2	0.91
Employment status		
Employed full-time	193	87.73
Employed part-time	25	11.36
PRN—as situation demands	2	0.91
Practice location setting		
City/urban	123	55.91
Rural	27	12.27
Suburban	70	31.82

Note. AuD = Doctor of Audiology; PhD = Doctor of Philosophy; MD = Doctor of Medicine; MA = Master of Arts; PRN = pro re nata.

Figure 1 shows the distribution of practice types reported by the survey respondents. Most respondents worked at either a hospital or nonresidential health care facility (39.55% and 32.27%, respectively). Respondents were also asked to describe their typical patient population, whether pediatric or adult, and the relative proportion of each (i.e., only, mostly, some, or approximately equal split of pediatric and adult populations). Figure 2A indicates the relative splits across patient populations. Participants were asked follow-up questions on practice patterns and perceptions of electrophysiological assessments with regard to pediatric or adult populations if they at least saw "some" of that population in their current practice. This meant that 174 total respondents saw the pediatric questions and 178 saw the adult questions, respectively. Participants were also asked to report what audiologic conditions they typically see when providing services to pediatrics or adults, respectively (i.e., typical hearing loss types, disorders, or cases). Figure 2B further reflects the specific types of conditions commonly seen by our respondents across pediatric and adult populations.

Practice Patterns and Perceptions

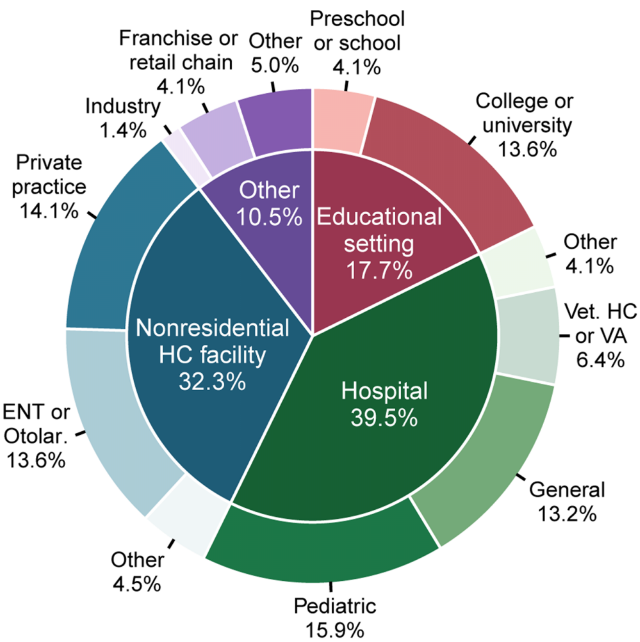
Purpose of Electrophysiological Testing

Participants classified as at least "rare users" of electrophysiological assessments (i.e., reported frequency of "rarely" or more frequent) for either patient population were asked to indicate the purpose of electrophysiology testing—specifically, how they utilized electrophysiological data in their current clinical practice (n = 149 for adults, n = 157 for pediatrics). The responses are summarized in Figure 3. A high proportion of our respondents indicated the use of electrophysiological data as a cross-check of other audiologic results (pediatrics: 91.08%, adults: 80.54%) and for differential diagnosis in both populations (pediatrics: 80.25%, adults: 77.18%). Most audiologists working with pediatric populations also reported using electrophysiological measures to estimate hearing sensitivity when behavioral results are unobtainable or unreliable (86.62%). This same purpose was also reported by 58.39% of respondents working with adult populations. Additionally, more than half of the respondents reported assessment of neural integrity as a common testing purpose for both populations (pediatrics: 59.24%, adults: 62.42%) as well as hearing screening in the pediatric population (57.32%; cf. 14.77% in adults). To a smaller degree, electrophysiological assessments are also utilized by our respondents as a counseling tool (pediatrics: 41.40%, adults: 38.26%), for intervention planning (pediatrics: 29.94%, adults: 22.15%), and to validate or assess amplification (pediatrics: 18.47%, adults: 12.08%).

Frequency of Usage

Participants who were at least "rare users" of electrophysiological assessments were also asked to report their relative frequency of usage across specific electrophysiological

Figure 1. Breakdown of current practice types across respondents. The outer ring reflects percentages of the total respondents corresponding to specific subcategories of the inner ring pie chart. *N* = 220 responses. HC = health care; ENT = ear, nose, and throat; Otolar. = otolaryngology; Vet. = veterans; VA = Veterans Affairs.



tests. The maximum frequency for performing any electrophysiological assessments was coded as the highest overall rating across the tests (e.g., "weekly" for ABR and "monthly" or less frequent for everything else would be scored as "weekly"). We coded frequency based on the highest rating across specific tests to ensure that the frequency of usage was not skewed by misinterpretations of electrophysiological assessments. Anyone who indicated they "never" used any electrophysiological assessments at all were not asked to report usage frequencies across specific electrophysiological tests; their maximum frequency responses were coded as "never." As expected, audiologists who see pediatric populations tended to use electrophysiological assessments more frequently than adults in general. More than three quarters of the pediatric respondents used at least one electrophysiological test "rarely" (76.44%) compared to 62.92% of adult respondents. For more regular users, however (i.e., at least "monthly"), the reported frequency drops to 58.05% versus 43.26%, respectively (see Figure 4A).

The relative usage of each specific test across pediatric and adult populations is shown in Figure 5A. Across both groups, ABRs were the most common test by far (at least "rarely": 79.62% for pediatric patients, 69.13% for adult patients; at least "monthly": 57.96% for pediatrics, 36.24% for adults, respectively). ECochG and vestibular evoked myogenic potentials (VEMPs) are the next most common tests (at least "rarely": 26.11% and 28.66% for pediatric patients, 46.31% and 37.58% for adult patients; at least "monthly": 9.55% and 3.82% for pediatrics, 26.85% and 22.82% for adults, respectively). Meanwhile, electrically evoked compound action potentials (eCAPs) followed by auditory steady-state response (ASSR) were the next most commonly used tests, particularly for pediatric patients (at least "rarely": 21.66% and 20.38% for pediatrics, 13.32% and 14.09% for adults; at least "monthly": 14.65% and 12.74% for pediatrics, 10.74% and 4.03% for adults, respectively).

To understand how individual test usage contributes to overall frequency of use, particularly for the most utilized ABR, we compared the overall frequency rating to the rating reported across specific tests. Of the 157 pediatric and 149 adult participants who were asked usage frequencies across specific tests, the overall frequency shown in Figure 4A was consistently driven by ABR usage: For 86.62% pediatric and 73.83% adult respondents, the ABR was one of their most frequently used tests (i.e., n = 136 and 110, respectively). Meanwhile, 12.74% pediatric and 26.17% adult respondents used some other test more frequently than ABRs in their practice, such as VEMPs, ECochG, ASSR, eCAP, or intraoperative monitoring (IOM; i.e., n = 20 and 39, respectively).

Perceived Usefulness

All participants were asked to rate how useful they perceived each individual test for their respective patient populations (see Figure 5B). Similar to the maximum frequency coding, the maximum usefulness was calculated as the highest usefulness rating across all the specific tests. In general, nearly all respondents indicated at least one electrophysiological test as moderately to very useful (98.85% for pediatrics, 93.82% for adults; see Figure 4B). Additionally, participants reported how beneficial they perceived electrophysiological testing in general was to their clinical practice overall, and most reported that they were beneficial in at least some cases (95.98% for pediatrics, 85.96% for adults; see Figure 4D). Responses suggest that electrophysiological assessments tend to benefit more pediatric cases compared to adults (i.e., beneficial for "most" or "all" cases: 73.56% vs. 31.46%, respectively).

The perceived usefulness of specific electrophysiological tests is shown in Figure 5B. ABRs were rated the highest for perceived usefulness across both populations. Indeed, of the 174 pediatric respondents who answered the question, the ABR was rated as one of the most useful individual tests by 97.13% (n = 169) and therefore the main contributor to overall usefulness ratings shown in Figure 4B. For adult respondents, however, this was only true for 66.85% (n = 119 out of 178). Other reportedly more useful tests for adult populations included VEMPs and IOM and, to a lesser extent, ECochG and eCAP assessments. Compared to their relative frequency of usage shown in Figure 5A, ASSR and

Figure 2. Patient populations seen by our respondents. (A) Respondents reported the relative proportion of pediatric versus adult patients served in their current practice. Follow-up questions were further divided by patient population. Audiologists who reported seeing "some pediatrics" through "pediatrics only" saw the pediatric-based questions and vice versa for those who saw at least "some adults" through "adults only" in their clinical practice. This resulted in n = 174 possible respondents on the pediatric questions and n = 178 respondents for the adult questions. (B) Specific patient types typically seen by our respondents. HL = hearing loss.

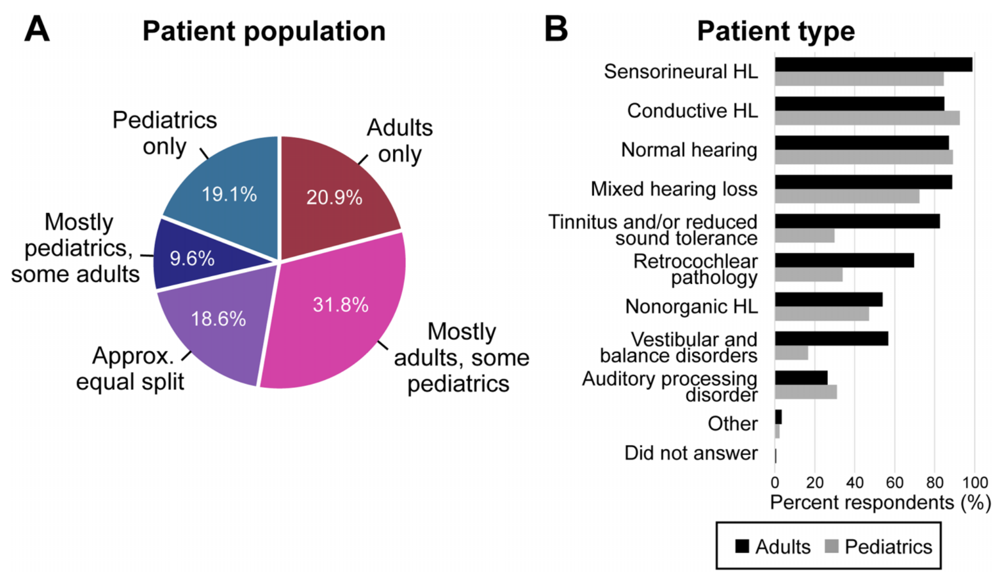
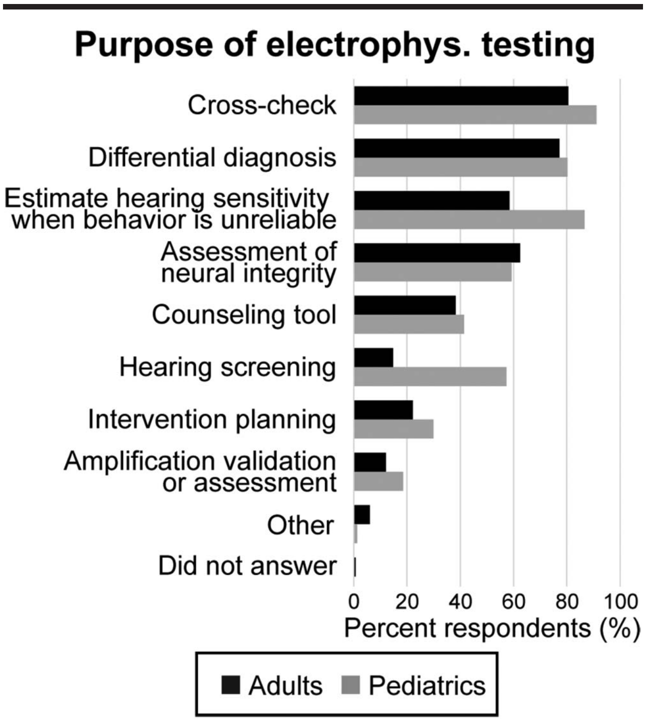


Figure 3. Audiologic applications of electrophysiology (electrophys.) testing by patient population reported by those who used electrophysiological assessments at least "rarely" (n = 149 for adults, n = 157 for pediatrics).

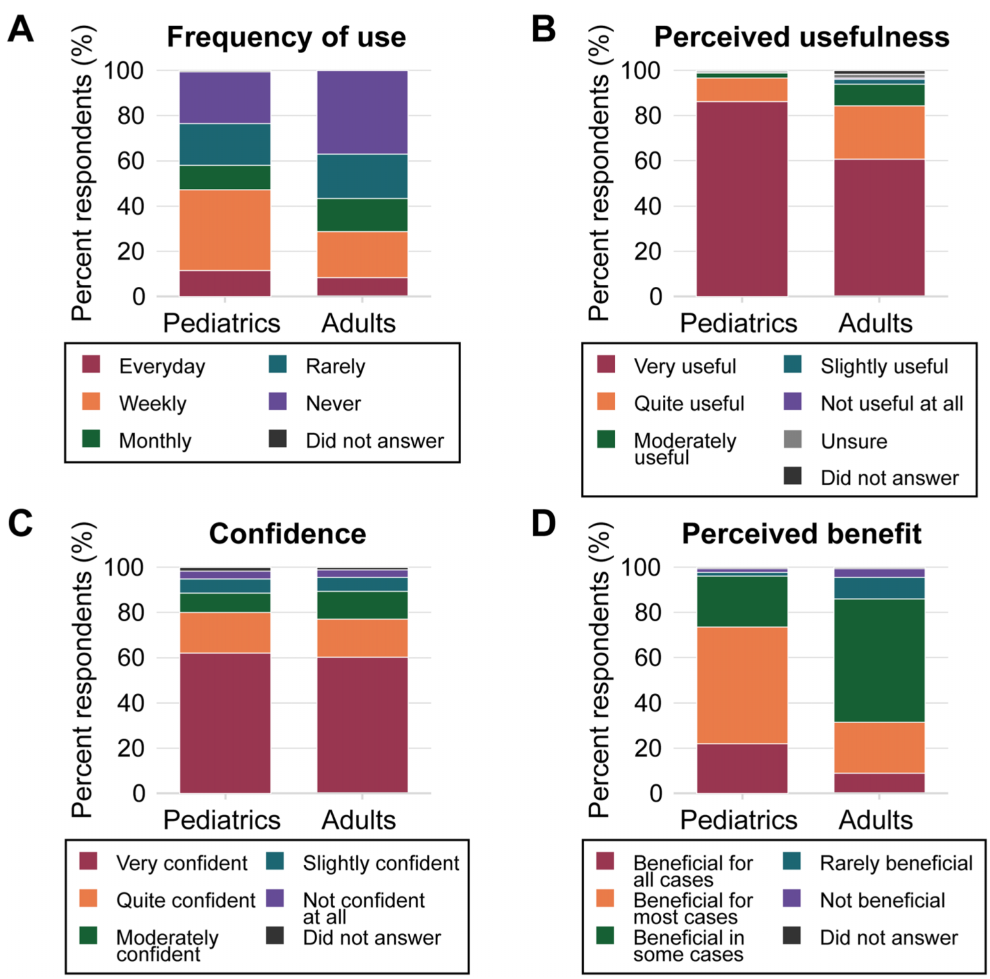


IOM achieved slightly higher ratings in perceived usefulness, especially ASSRs in pediatric populations. Interestingly, there is a higher proportion of "not useful at all" ratings for the ECochG and VEMPs in pediatric populations as well as cortical potentials, the MLR, and the FFR tests in both populations compared to other tests. We also observed a high rate of "unsure" responses for perceived usefulness of tests beyond the ABR, especially for the MLR, FFR, and cortical potentials (including ALR/LLR).

Confidence in Performing and Interpreting Electrophysiological Tests

In addition to frequency and usage, participants also rated their perceived confidence performing and interpreting the results of electrophysiological tests. In general, the majority of participants felt either "quite" or "very" confident performing and interpreting at least one test (79.89% for pediatrics, 76.97% for adults; 88.51% vs. 89.33% at least "moderately" confident, respectively; see Figure 4C). This was largely driven by high confidence in ABR testing, as shown in Figure 5C (at least "quite": 71.26% and 70.79%; at least "moderate": 83.33% and 85.96% for pediatrics and adults, respectively). Specifically, of the 174 pediatric and 178 adult respondents who saw the question, 84.48% and 89.89% reported their highest confidence rating at least for the ABR (n = 147 and 160, respectively), whereas 13.79% and 8.99% felt more confident performing and interpreting another test, such as VEMPs, ECochG, or eCAP. The confidence pattern (see Figure 5C) approximately

Figure 4. Reported overall (A) frequency, (B) perceived usefulness, (C) confidence, and (D) perceived benefit of electrophysiological assessments. Data for Figures A–C arise from the highest rating reported by participants across specific electrophysiological tests (see Figure 5), unless they previously reported "never" using any electrophysiological measures for their respective patient population(s). n = 174 pediatric population respondents, and n = 178 adult population respondents.



followed the frequency pattern shown in Figure 5A with a slight increase in confidence for ASSR testing across both populations. Similar to the perceived usefulness ratings, we also see a high proportion of "not confident at all" ratings for all of the tests except ABRs, especially for the eCAP, MLR, FFR, cortical potentials, and IOM.

Barriers to Implementation

All participants were asked to select challenges and barriers to implementation of electrophysiological techniques in their clinical practice for their adult and/or pediatric populations (i.e., barriers related to why they "never" or "rarely" use electrophysiological tests, if applicable, or else challenges and barriers that limit their use of electrophysiological testing in general). The barrier questions referred to electrophysiological assessments in general rather than specific to individual tests. Some write-in "other" responses overlapped with preexisting selections, so these options were combined (for more details, see Supplemental Material S2). The results are shown in Figure 6A. Across both adult and pediatric populations, more than 10% of respondents reported lack of time/scheduling challenges, setup/recording challenges (including patient compliance, noise/artifacts, sleep or sedation challenges, etc.), cost of equipment/resources, access to equipment (including they do not own equipment themselves or reported that the equipment was broken), lack of clinical relevance or applicability to their practice specialty (including few patients seen or little need for electrophysiological testing at their clinic), billing/reimbursement, and another professional typically performs electrophysiological measures (including the individual typically refers out for these tests) as key challenges to clinical implementation. Additionally, more than 10% of audiologist respondents working with adult populations claimed that electrophysiological tests provided limited diagnostic information.

Figure 5. Frequency of usage (A), perceived usefulness (B), and subjective confidence (C) in performing and interpreting specific electrophysiological assessments. Separate responses were collected for audiologists working with pediatric (top) and adult patients, respectively (bottom). Participants reported their frequency of usage for individual electrophysiological tests if they reported using any electrophysiological measures at least "rarely" for a given patient population (n = 157 pediatric population respondents, n = 149 adult population respondents). Otherwise, all participants were asked to rate perceived usefulness and confidence for each test as applicable to their typical patient population (n = 174 pediatric population respondents, n = 178 adult population respondents). ABR = auditory brainstem response; ECochG = electrocochleography; oVEMP/cVEMP = ocular and cervical vestibular myogenic potential; eCAP = electrically evoked compound action potential; ASSR = auditory steady-state response; ALR/LLR = auditory long/late latency response; MLR = auditory middle latency response; IOM = intraoperative monitoring; FFR = frequency-following response.

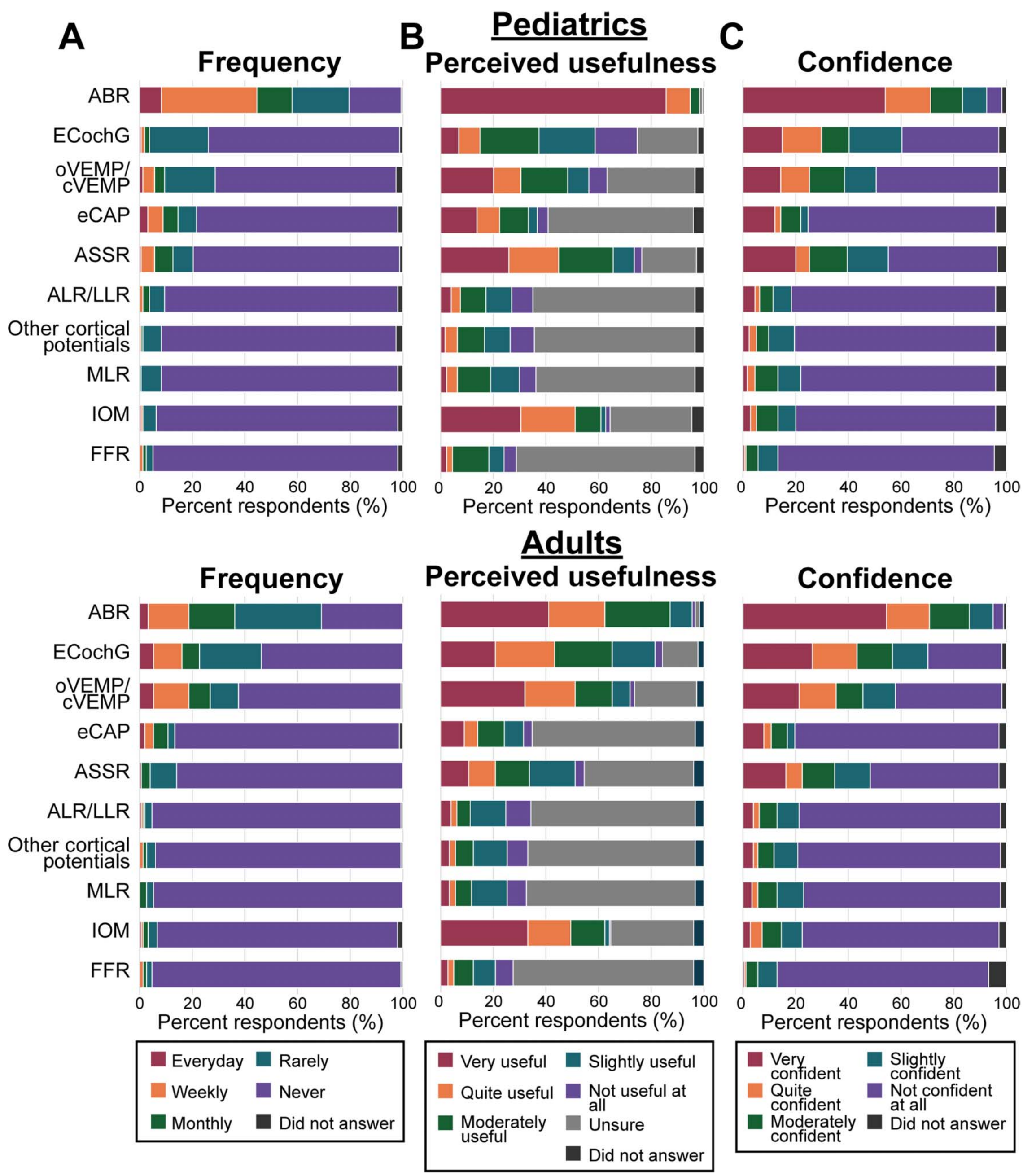
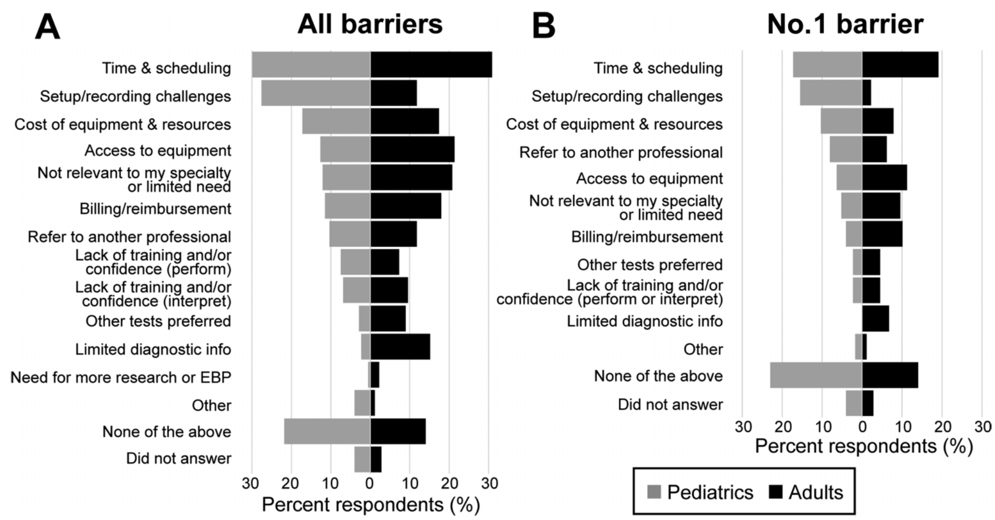


Figure 6. Barriers to clinical implementation of electrophysiological assessments. (A) The proportion of respondents reporting various potential barriers in their clinical practice. Participants were invited to select all barriers that applied (i.e., multiselect). (B) Participants who selected more than one barrier were asked to select one option as the top (No. 1) barrier to clinical implementation of electrophysiological techniques in their current practice (i.e., single choice only). Any responses with only one option selected on the previous question were carried over as the single, top barrier as well. Due to low respondent numbers, the categories for lack of training and/or confidence in performing electrophysiological tests were combined with lack of training and/or confidence in interpreting these tests. For both A and B, certain write-in "other" responses were combined with established categories where appropriate. See Supplemental Material S2 and S3 for more details. n = 174 pediatric population respondents, and n = 178 adult population respondents. EBP = evidence-based practice.

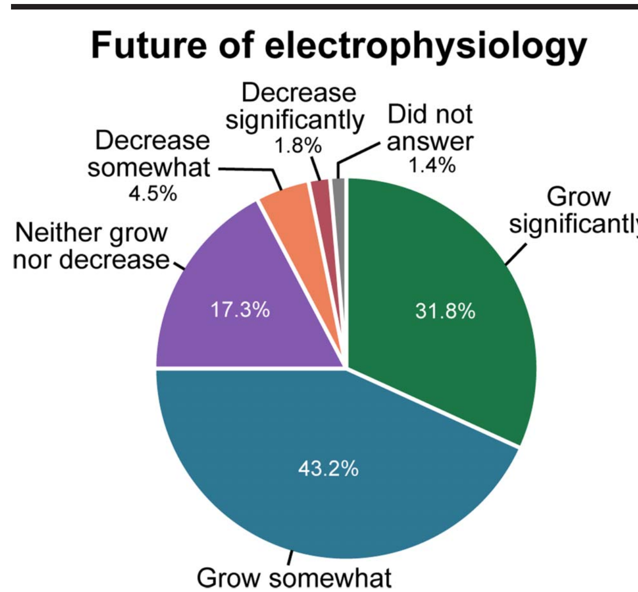


If more than one item was selected, respondents also were asked to indicate which item was the most significant barrier or challenge. The forced single-choice, most significant barrier responses highlighted in Figure 6B mirrored the results for all barriers described previously (see Figure 6A). Lack of time/scheduling challenges, cost of equipment/resources, access to equipment (i.e., they do not own equipment or reported that the equipment was broken), not clinically relevant or applicable to their practice specialty (including few patients seen or needing electrophysiological testing), and another professional typically performs these tests were among the top most common challenges limiting electrophysiology use for both populations (i.e., > 5%), but some key differences emerged as well. For example, the perceived limited diagnostic information as well as billing/reimbursement issues were also among the most significant challenges for those who see adult patients, whereas setup/recording challenges (including patient compliance, noise/artifacts, and sleep or sedation considerations) were top factors for those working with pediatric populations.

Future of Electrophysiology in Audiology

Regardless of how often they used electrophysiological tests, all participants were then asked to complete the following statement: "When thinking about the future of audiology clinical practice, the use of electrophysiological techniques will … " As shown in Figure 7, 75% of respondents felt that electrophysiology will either grow somewhat or significantly in the field of audiology. Only 6.37% thought that the use of electrophysiological techniques will decrease to some degree in the future.

Figure 7. Perceptions on the future of electrophysiological techniques in the field of audiology.



Relationships Between Electrophysiology Perceptions and Practice Patterns

We conducted additional analyses to explore possible relationships between individual perceptions and practice patterns. Spearman correlations between overall frequency of use, perceived usefulness, confidence, and perceived benefit ratings, reported separately for pediatric or adult patients (see Figure 4), indicated moderate to strong correlations between the variables (see Supplemental Material S4). Among those who answered all four survey questions, all correlations were significant except frequency–usefulness and confidence–benefit for those working with adults, though the Holm–Bonferroni-corrected p values indicated a trend similar to those working with pediatrics ($\rho = .1382$, $p = .0715$ and $\rho = .1643$, $p = .0636$, respectively; see Supplemental Material S4). That is, audiologists who used electrophysiological techniques more frequently in their clinical practice generally reported higher ratings of perceived usefulness, confidence performing and interpreting the tests, and perceived benefit overall.

Years of practice, practice location setting, and practice type were then compared to the four practice pattern and perception variables (frequency, perceived usefulness, confidence, and perceived benefit) to evaluate differences across experience and workplace characteristics. Analyses excluded the “unsure” usefulness ratings due to data sparseness and lack of clear ranking ($n = 1$ pediatric and $n = 3$ adult respondents). Neither years of practice nor location was significantly related to any of the four variables. A negative correlation trend was noted between years of practice and frequency of use among those working with adults ($\rho = -.1522$, raw $p = .0431$, $n = 177$) as well as perceived benefit among those working with pediatrics ($\rho = -.1563$, raw $p = .0406$, $n = 172$), but these effects were not significant after Holm–Bonferroni correction ($p = .1726$ and $p = .1625$, respectively). According to nonparametric Kruskal–Wallis tests, practice type was significantly related to all four practice pattern and perception variables, excluding perceived benefit among pediatric respondents and perceived usefulness among adult respondents (all other Holm-adjusted $p < .05$; see Supplemental Material S5). We then used the DSCF method to conduct nonparametric pairwise multiple comparisons. The observed effects were driven exclusively by those working in hospital settings who generally reported higher frequency of use, usefulness, confidence, and perceived benefit of electrophysiological assessments compared to the other practice types. Supplemental Material S6 lists the cross tabulations and significant post hoc DSCF pairwise results for each of the variables.

Finally, we evaluated differences in the reported most significant barrier (see Figure 6B) across the four practice pattern and perception variables (frequency, perceived usefulness, confidence, and perceived benefit) as well as workplace and experience characteristics. To aid interpretability, we collapsed the top barriers into five categories: financial (cost of equipment and resources, billing/reimbursement), operational (time and scheduling, setup/recording challenges), access (access to equipment, refer to another professional), clinical utility (not relevant to my specialty or limited need, other tests preferred, limited diagnostic info), and other (lack of training and/or confidence, other). The combined “other” category was excluded from analysis due to data sparseness ($n = 7$ pediatric and $n = 10$ adult respondents excluded, < 5% of the data) as well as any “none of the above” barriers and “unsure” usefulness responses due to lack of clear ranking. Reported barriers differed according to frequency of use for both populations, perceived usefulness and confidence for pediatric respondents, and perceived benefit for adult respondents ($p < .05$; see Supplemental Material S7 for omnibus Kruskal–Wallis test results). In general, respondents whose greatest barriers were financial or operational in origin tended to use electrophysiological assessments more frequently, rated such tests as more useful, reported higher confidence performing and interpreting the measures, and perceived greater benefit for more patient cases compared to those whose top barriers related to access or clinical utility. For cross tabulations and specific DSCF pairwise comparisons, see Supplemental Material S8.

Fisher exact test suggested that the top reported barriers differed by practice type for both pediatric and adult patient respondents ($p < .0001$ for both). This result was primarily driven by those working in hospital settings, specifically compared to nonresidential health care facilities in both groups (Holm–Bonferroni-corrected pediatric $p = .0012$, adult $p = .0126$) and educational settings among those working with pediatric patients ($p = .0460$; see Supplemental Material S9). We then ran 2 × 2 Fisher exact tests for these significant practice type pairs to clarify which specific barriers differed across the practice types (i.e., by comparing each individual barrier category versus all other barriers collapsed). For pediatrics, individuals working in hospital settings reported more operational-based top barriers compared to those in nonresidential health care facilities and educational settings (Holm–Bonferroni-corrected $p = .0001$ and $p = .0256$, respectively). Meanwhile, audiologists who see adults in hospital settings were more likely to report lack of clinical utility as a top barrier compared to those working in nonresidential health care facilities (Holm–Bonferroni-corrected $p = .0016$). Neither years of experience nor location setting was related to reported barriers ($p > .05$).

Discussion

Summary

The goal of this survey was to evaluate the current state of the field regarding practice patterns and perceptions of electrophysiological techniques among U.S. audiologists. Our results indicated relatively common electrophysiological assessment use across the field, at least with techniques such as the ABR, though regular, consistent use varied. Perceptions of usefulness, benefit across clinical cases, and confidence in performing and interpreting electrophysiological tests were also generally high, though characteristically higher for audiologists working with pediatric compared to adult populations. Our survey also highlighted common barriers that potentially limit clinical use of electrophysiological techniques, including time and scheduling challenges, financial cost, billing and reimbursement issues, setup and recording difficulties, perceived lack of relevance or diagnostic sensitivity to practice specialties, and preferences to refer out to other professionals for testing. Collectively, our results emphasize the importance of electrophysiological assessments within the current scope of audiologic practice, underscored by a high proportion of respondents indicating a potentially expanding relevance in the future. Such data lay the foundation to reduce clinical implementation barriers, improve access, and enhance patient care overall.

Frequency of Usage Varies but Perceived Benefits Are Generally High

Among our respondents, 76.44% of the pediatric respondents and 62.92% of adult respondents used at least one electrophysiological test "rarely." More frequent usage, however (i.e., at least "monthly"), dropped to 58.05% versus 43.26%. These results are consistent with one survey conducted in India that reported 15.56% of 193 surveyed audiologists working with children younger than 2 years of age used ABR and ASSR tests exclusively and 63.71% performed a combination of behavioral and objective tests (for children 2–5 years of age: 6.74% and 63.73%, respectively; Easwar et al., 2013). Our results also suggest a slight increase in the use of specific electrophysiological tests over the nearly 30 years since the last survey of U.S. audiologists conducted by F. N. Martin et al. (1998). Compared to the F. N. Martin et al. results, our frequency ratings of at least "rarely" included the following: ABR—79.62% pediatrics, 69.13% adults versus 65% F. N. Martin et al.; ECochG—26.11% pediatrics, 46.31% adults versus 25% F. N. Martin et al.; MLR—8.28% pediatrics, 5.37% adults versus 9% F. N. Martin et al.; LLR—9.55% pediatrics, 4.70% adults versus 2% F. N. Martin et al.; IOM—6.37% pediatrics, 6.71% adults versus 10% F. N. Martin et al. Although such results are indeed promising, regular usage particularly of the MLR and LLR is still nearly nonexistent across our respondents.

In general, ratings on the frequency of use, perceived usefulness, and perceived benefit to clinical cases were higher for audiologists working with pediatric compared to adult patients and for those working in hospital settings compared to other practice types. These rating differences are largely driven by the ABR, which may not be surprising given its crucial role in diagnostics, hearing sensitivity estimates, and hearing screenings particularly in the pediatric population (see Figure 3). In addition to the ABR, other AEP techniques including ECochG, VEMPs, IOM, and ASSRs were viewed as somewhat useful in the scope of audiologic practice despite their limited usage (see Figures 5A and 5B). Previous research has shown promise for techniques such as the LLR and other evoked potentials beyond the brainstem for applications such as hearing aid fittings (Mehta et al., 2020; Punch et al., 2016), cochlear implant provision (Hoth & Dziemba, 2017), auditory processing disorders, (Mattsson et al., 2019), neurodevelopmental delays (Riva et al., 2018), and auditory neuropathy (Campbell et al., 2011; Pearce et al., 2007). Additionally, some have argued for increased usage of AEPs such as the frequency-following response (Kraus et al., 2017) or ECochG (Barnes et al., 2021) to expand clinical capabilities. However, these tests were among the lowest usefulness ratings in our survey.

Nonetheless, our work indicates that perceptions of usefulness vary across audiologists and patient populations, and usage of tests beyond the ABR is quite limited across the field (excluding ECochG and VEMPs for adult patients). Some of these differences could be attributed to the distinct drop in confidence audiologists feel for performing and interpreting these tests compared to the ABR, for example (see Figure 5C). Indeed, audiologists who had higher overall frequency ratings also reported higher confidence performing and interpreting the measures as well as greater perceived usefulness and benefit—largely driven by the ABR results. Another explanation could be that barriers such as time needed to perform these tests, limited diagnostic sensitivity or applicability to practice specialties, limited billing codes and reimbursement, or even access to appropriate equipment for running more advanced protocols severely inhibit usage of these other techniques. That is, audiologists whose top barriers were related to access used electrophysiological assessments less frequently, whereas those reporting clinical utility-like barriers also tended to report lower ratings of usefulness, confidence, and perceived benefit of electrophysiological measures. Additionally, some key professional guidelines do not mention electrophysiological tests beyond the ABR and ASSR (e.g., Cain et al., 2020; The Joint Committee on Infant Hearing, 2019; cf. ASHA, 2006). It may therefore be unsurprising that other tests such as the eCAP, MLR, FFR, LLR, and other cortical potentials were associated with a relatively high proportion of “unsure” or “not confident at all” ratings. Addressing the underlying discrepancies between usefulness and frequency of usage or the specific obstacles to implementation may allow audiologists to take full advantage of all available techniques in the field (ASHA, 2006).

Common Barriers to Electrophysiology Applications

Our results revealed important insights into the barriers faced by audiologists in current clinical practice with regard to electrophysiological assessments. Chief among the barriers was, quite simply, a lack of time. Previous reports indicated delays up to 9 months for scheduling neurodiagnostic ABRs and a need for multiple ABR appointments, which can significantly delay diagnosis and intervention for children who did not pass their newborn hearing screenings (Holte et al., 2012). Practices such as teleaudiology are generally viewed to positively impact scheduling, provide flexibility in services, and improve patient access to services (D’Onofrio & Zeng, 2022; Eikelboom et al., 2022; Kim et al., 2021; Manchaiah et al., 2022). Nonetheless, opinions on telemedicine applicability to electrophysiological techniques seem mixed. Several studies indicate feasibility and improved patient access to diagnostic ABRs in rural communities via telehealth options (Hatton et al., 2019; Ramkumar et al., 2019; Towers et al., 2005), but a small-scale survey suggested either neutral or negative opinions among audiologists toward telehealth as an approach for diagnostic ABR testing (Prins et al., 2021). Additionally, neurodiagnostic evaluations are famously long appointments, often a half hour to an hour or more—with the completion time of traditional ABR tests reportedly eight to 10 times the duration of other objective measures such as tympanometry or otoacoustic emissions (Başar & Canbaz, 2019). Trimming down clinical electrophysiological testing time has motivated research on novel approaches such as multifrequency ASSRs (Luts & Wouters, 2004; Sininger et al., 2018; Vander Werff, 2020), simultaneous ECochG and ABR recordings (Ferraro & Ferguson, 1989; Lefler et al., 2021; Minaya & Atcherson, 2015), or even recent advances in “parallel” ABRs (Polonenko & Maddox, 2019), provided a reasonable level of specificity and sensitivity is maintained.

Setup and recording challenges were the second most common barrier reported by our respondents who worked with pediatric populations, which also included factors such as patient compliance, artifacts from patient noise or movements, or even the need for sedation to obtain clear interpretable responses. Patient cooperation is crucial for complete and efficient testing, and an asleep or sedated state is often ideal for pediatric cases who undergo neurodiagnostic testing (Reynolds et al., 2016). However, sedation may not be a viable option for patients with contraindications, as it can be associated with increased risks or potential complications, or it may simply not be an option for audiologists where access to a sedation nurse or other qualified medical professional is limited (Valenzuela et al., 2016). Other factors such as ambient environmental noise or electromagnetic artifacts can impede electrophysiological measurement, alter response waveforms, and impede evaluation or diagnosis (Dimitrijevic et al., 2002; Richmond et al., 1986). Furthermore, setup challenges (e.g., impedances, electrode placement) have also been cited as a significant cause of increased ABR test time (Başar & Canbaz, 2019), compounding on issues with time and scheduling if appointments run long or need to be rescheduled as a result of extended test time.

Financial constraints were also common across our respondents, including the cost of evoked potentials equipment and billing or reimbursement issues. Indeed, cost of equipment and resources was ranked among the top three barriers for audiologists who work with pediatric populations and among the top five barriers for those providing adult services. Additionally, billing/reimbursement was ranked third in No. 1 barriers and fourth overall for audiologists who worked with adults (sixth and seventh for those serving pediatric patients, respectively). Over the past couple of years, the national average payment amounts as reported by the Medicare Physician Fee Schedule have dropped for nearly all audiologic services (with only a few exceptions). Between 2023 and 2025, many of the largest nonfacility average payment amount drops—and the largest relative value unit (RVU) decreases—were for electrophysiology-related Current Procedural Terminology (CPT) codes[2] (ASHA, 2022b, 2024b, 2024c). While the payment value of a CPT code will fluctuate over time (and certain VEMPs codes are actually trending higher in 2025 than 2022; ASHA, 2017, 2022b, 2024c), a progressive downward trend of Medicare reimbursement for audiologic CPT codes—especially electrophysiology-based codes—will exacerbate an already challenging situation for many audiologists. Such reports highlight the need for increased professional

[2]Many of the largest average payment and RVU decreases between 2023 and 2025 were for electrophysiology-related codes, including \$16.14 drop for VEMPs (−0.31 RVU; CPT 92519), \$9.74 for electrocochleography (−0.14 RVU; CPT 92584), \$9.41 for AEPs to estimate thresholds (−0.13 RVU; CPT 92652), \$9.07 for AEPs to determine hearing status (−0.16 RVU; CPT 92651), \$7.24 for oVEMPS alone (−0.11 RVU; CPT 92518), and \$6.47 for neurodiagnostic evaluations (−0.08 RVU; CPT 92653). Among other top 10 average payment drops between 2023 and 2025 are a few codes related to diagnostic analysis and programming of cochlear implants, whether 7 years of age or younger (\$10.31, −0.09 RVU, CPT 92601) and subsequent reprogramming (\$7.27, −0.08 RVU, CPT 92602) or 7 years and older (\$9.20, −0.07 RVU, CPT 92603), and one for basic vestibular evaluations (\$8.22, −0.10 RVU, CPT 92540).

advocacy and reevaluation of billing practices to ensure that the benefits of electrophysiological assessments will outweigh the costs for these populations. When combined with the notion of high (and rising) equipment costs, audiologists are forced to compare the benefit electrophysiological assessment services offer to their clinical practice against both the upfront cost as well as the potential to recoup expenses through service payments, potentially sacrificing more costly services for their clinic to stay afloat. We do not claim that electrophysiological assessments are appropriate or necessary for all clinics. However, those audiologists who wish to take advantage of the fullest scope of practice may be prohibited from doing so because of such financial constraints.

Across the reported barriers and patient populations, one difference that emerged was a shared perception that electrophysiological assessments provide limited diagnostic information and/or were not clinically applicable for adult patients. In particular, individuals who worked with adult patients in hospital settings reported more top barriers related to clinical utility than those who work in nonresidential health care facilities (see Supplemental Material S9). Referring to other professionals, such as for structural magnetic resonance imaging in lieu of functional electrophysiological tests, was also reported by several of our respondents (see Supplemental Material S2). Recently, some states have modernized their audiology scope of practice to allow audiologists to order (but not interpret) imaging (American Academy of Audiology, 2025a, 2025b, 2026). Although the impacts of these changes remain somewhat unknown, more direct access to imaging may influence the use of electrophysiological tests in the future.

Optimistic Future for Growth of Electrophysiology in Audiology

Despite the reported barriers and limited use of electrophysiological assessments beyond the ABR, our respondents overwhelmingly indicated potential growth for electrophysiology within the audiologic field. Such perceptions align with previous reports of high perceived value for training in AEPs and general neuroscience concepts in audiology (Mondul et al., 2025). Educational programs, in large part, provide the knowledge and skills necessary to meet the future needs of patients and the field in general (Hunter et al., 2016; Windmill & Freeman, 2013). We hope this study will pave the way for advancing the audiology field by turning those challenges into action through future evidence-based practice, resources, and training. For example, future research could provide support for the expanded clinical use of electrophysiological measures, which might lead to better patient diagnoses and outcomes. Additionally, conference workshops, presentations, or educational resources could be constructed for clinicians who want to fill knowledge gaps or supplement their previous training. Training on standards and professional perceptions of electrophysiological techniques—including expectations for scope of practice, barriers to implementation, perceived feasibility, and relevance to various clinical populations—will likely influence clinical attitudes and utilization patterns for years to come (Hunter et al., 2016).

Although behavioral responses on other audiologic tests and imaging referrals can be sufficient for diagnosis and treatment planning of many patient cases (provided the behavioral responses are reliable; see Figure 3), electrophysiological measures may be able to fill current gaps in clinical care. For example, an estimated 10%–15% of adults who report speech-in-noise listening difficulties have normal or mild audiometric thresholds (Parthasarathy et al., 2020; Spankovich et al., 2018; Tremblay et al., 2015), and many patients in this category report some degree of dissatisfaction with their provided audiologic services (Mealings et al., 2020). Pure-tone average thresholds, speech recognition in quiet, and even speech-in-noise tests are at best only modestly correlated with self-reported hearing abilities (Fitzgerald et al., 2024; Wilson, 2011). Electrophysiological assessments that characterize how the brain encodes sound, particularly speech in noise, may improve sensitivity in diagnosing where and how this process is breaking down among listeners with otherwise "hidden" hearing loss (Anderson et al., 2013; Bharadwaj et al., 2019; Bramhall et al., 2020; Liberman et al., 2016; Parthasarathy et al., 2020). Of course, more research is needed to translate animal model findings to humans, validate and optimize clinical protocols, develop normative data, and ensure accessibility for clinicians interested in adopting new techniques. As evidence grows and more clinicians gain exposure, electrophysiology-based assessments and interventions are well positioned to expand within the field of audiology, helping to resolve current challenges, support innovation in practice, and improve patient care.

Limitations

While certain measures were taken to reduce survey bias (i.e., mixed-methods qualitative approach, expert review of the survey prior to distribution) and improve survey distribution and response rate (e.g., dissemination on professional listservs, targeted advertising), we recognize that some limitations of our survey could have impacted our results. For example, while the targeted advertising accounted for more than half of our respondents and led to broader reach than we otherwise achieved by listservs, social media posts, and word of mouth, reports from LinkedIn and Meta suggested that our advertising approach also reached ineligible individuals, such as speech-language pathologists, international respondents, or even bots. This may have inflated our number of participants who interacted with the survey, even if they were not able to complete the survey or were subsequently cleaned from the data set due to ineligibility or other reasons. The total number of eligible responses retained in the final data set is on par with previous audiology studies not affiliated with professional organizations (Mertes & Marquess, 2023b; Stoup et al., 2022), though ASHA-sponsored surveys have notably achieved many more respondents on their biannual Audiology Survey reports (ASHA, 2024a). Despite the difference in number of respondents, our respondent demographic characteristics align very well with recent ASHA reports, including relative proportions of practice types, geographic locations, practice location setting, and employment status, suggesting that our results provide a fair representation of the field as a whole (ASHA, 2024a). Additionally, although participants were encouraged to complete the survey even if they did not use electrophysiological assessments in their practice, our consent page did mention these terms, so it is possible that some participants may not have completed the survey due to misconceptions about the study purpose and their ability to contribute despite limited personal experience. Some of these limitations may be addressed in the future such as through sponsorship by professional organizations and membership surveys to boost targeted outreach (e.g., ASHA, 2024a; F. N. Martin et al., 1994, 1998), improved compensation for study participation (Abdelazeem et al., 2023), and/or broadened scope of the survey to seem more inclusive of all audiologic practices. We also noted that 21.84% pediatric and 14.04% adult respondents, respectively, selected “none of the above” from the list of possible barriers (22.99% pediatric and 14.04% adult respondents for No. 1 barriers, respectively; see Figure 6). However, we cannot infer with our data whether the individuals experience no barriers at all or simply did not identify with any of the listed survey options, so we cannot provide further interpretation at this time. Future studies could include alternative options to better capture the possible factors influencing clinical practice.

Conclusions

This study highlights both the recognized clinical value of electrophysiological assessments in audiology and the persistent challenges that limit their widespread routine use. Audiologists reported clear utility of electrophysiological measures across patient populations, particularly in pediatrics, yet barriers related to time, equipment costs, reimbursement, and perceived clinical relevance continue to restrict use in many settings. These findings underscore the need for targeted efforts to improve access to equipment and resources and increase awareness for the clinical utility of electrophysiological applications. Broader institutional support, advancements in evidence-based research, and professional advocacy are also essential to address workflow constraints, diagnostic precision, and financial limitations. Collectively, addressing these barriers has the potential to expand the integration of electrophysiological techniques in clinical practice, support audiologists in practicing at the top of their scope, and, ultimately, enhance patient care across the field.

Author Contributions

Kelsey Mankel: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Supervision, Visualization, Writing – original draft, Writing – review & editing. **Caitlin N. Price:** Conceptualization, Investigation, Methodology, Supervision, Writing – review & editing. **Allie Austin:** Conceptualization, Methodology, Writing – review & editing. **Mira Milman:** Formal analysis, Investigation, Writing – review & editing.

Data Availability Statement

The data sets generated and analyzed for the current study are available from the corresponding author on reasonable request.

Artificial Intelligence Statement

Artificial intelligence was used in a limited capacity for this article, primarily assisting with minor text editing and basic phrasing. All original ideas, significant drafting, analysis, and editing were completed by the authors.

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References

Abdelazeem, B., Hamdallah, A., Rizk, M. A., Abbas, K. S., El-Shahat, N. A., Manasrah, N., Mostafa, M. R., & Eltobgy, M. (2023). Does usage of monetary incentive impact the involvement in surveys? A systematic review and meta-analysis of 46 randomized controlled trials. *PLOS ONE, 18*(1), Article e0279128. https://doi.org/10.1371/journal.pone.0279128

Abdi, H. (2010). Holm's sequential Bonferroni procedure. In N. J. Salkind (Ed.), *Encyclopedia of research design*. Sage. https://www.utdallas.edu/~herve/abdi-Holm2010-pretty.pdf [PDF]

Aickin, M., & Gensler, H. (1996). Adjusting for multiple testing when reporting research results: The Bonferroni vs Holm methods. *American Journal of Public Health, 86*(5), 726–728. https://doi.org/10.2105/ajph.86.5.726

American Academy of Audiology. (2025a, March 12). *Academy backs HB 1298 to strengthen audiology care in Maryland*. https://www.audiology.org/academy-backs-hb-1298-to-strengthen-audiology-care-in-maryland/

American Academy of Audiology. (2025b, March 5). *AR SB 118: Expanding audiology scope of practice*. https://www.audiology.org/ar-sb-118-expanding-audiology-scope-of-practice/

American Academy of Audiology. (2026, January 14). *Wisconsin bill seeks to update audiology scope of practice*. https://www.audiology.org/wisconsin-bill-seeks-to-update-audiology-scope-of-practice/

American Speech-Language-Hearing Association. (2006). *Preferred practice patterns for the profession of audiology*. https://www.asha.org/policy/pp2006-00274/

American Speech-Language-Hearing Association. (2017). *How a CPT code becomes a code*. https://www.asha.org/siteassets/uploadedfiles/how-a-cpt-code-becomes-a-code.pdf [PDF]

American Speech-Language-Hearing Association. (2022a). *ASHA 2021 audiology survey: Survey methodology, respondent demographics, and glossary*. https://www.asha.org/siteassets/surveys/2021-audiology-survey-demographics-methodology-glossary.pdf [PDF]

American Speech-Language-Hearing Association. (2022b). *2023 Medicare fee schedule for audiologists*. https://www.asha.org/siteassets/reimbursement/2023-medicare-fee-schedule-for-audiologists.pdf [PDF]

American Speech-Language-Hearing Association. (2024a). *ASHA 2023 audiology survey: Survey methodology, respondent demographics, and glossary*. https://www.asha.org/siteassets/surveys/2023-audiology-survey-demographics-methodology-glossary.pdf [PDF]

American Speech-Language-Hearing Association. (2024b). *2024 Medicare fee schedule for audiologists*. https://www.asha.org/siteassets/reimbursement/2024-medicare-fee-schedule-for-audiologists.pdf?srsltid=AfmBOorviKVck6M9Nw8Y3QZHXCIFTGTHxMBTte1P4hqn8jurFbWjpTLR [PDF]

American Speech-Language-Hearing Association. (2024c). *2025 Medicare fee schedule for audiologists*. https://www.asha.org/siteassets/reimbursement/2025-medicare-fee-schedule-for-audiologists.pdf [PDF]

Anderson, S., Parbery-Clark, A., White-Schwoch, T., & Kraus, N. (2013). Auditory brainstem response to complex sounds predicts self-reported speech-in-noise performance. *Journal of Speech, Language, and Hearing Research, 56*(1), 31–43. https://doi.org/10.1044/1092-4388(2012/12-0043)

Bakhos, D., Marx, M., Villeneuve, A., Lescanne, E., Kim, S., & Robier, A. (2017). Electrophysiological exploration of hearing. *European Annals of Otorhinolaryngology, Head and Neck Diseases, 134*(5), 325–331. https://doi.org/10.1016/j.anorl.2017.02.011

Barbee, C. M., James, J. A., Park, J. H., Smith, E. M., Johnson, C. E., Clifton, S., & Danhauer, J. L. (2018). Effectiveness of auditory measures for detecting hidden hearing loss and/or cochlear synaptopathy: A systematic review. *Seminars in Hearing, 39*(2), 172–209. https://doi.org/10.1055/s-0038-1641743

Barnes, J. H., Yin, L. X., Saoji, A. A., & Carlson, M. L. (2021). Electrocochleography in cochlear implantation: Development, applications, and future directions. *World Journal of Otorhinolaryngology—Head and Neck Surgery, 7*(2), 94–100. https://doi.org/10.1016/j.wjorl.2020.04.006

Başar, F., & Canbaz, S. (2019). What is the audiological evaluation time for those aged 0–5 years and older? *The Journal of International Advanced Otology, 11*(1), 42–47. https://doi.org/10.5152/iao.2015.592

Bharadwaj, H. M., Mai, A. R., Simpson, J. M., Choi, I., Heinz, M. G., & Shinn-Cunningham, B. G. (2019). Non-invasive assays of cochlear synaptopathy—Candidates and considerations. *Neuroscience, 407,* 53–66. https://doi.org/10.1016/j.neuroscience.2019.02.031

Bramhall, N. F., Niemczak, C. E., Kampel, S. D., Billings, C. J., & McMillan, G. P. (2020). Evoked potentials reveal noise exposure–related central auditory changes despite normal audiograms. *American Journal of Audiology, 29*(2), 152–164. https://doi.org/10.1044/2019_AJA-19-00060

Brown, C. J., & Johnson, T. A. (2016, June 5). *Electrophysiologic assessment of hearing*. Ento Key. https://entokey.com/electrophysiologic-assessment-of-hearing/

Cain, S. E., Gomes, T., Leisner, D., Lenzen, N., Rall, E., Schicke, E., & Uhler, K. M. (2020). *Clinical guidance document: Assessment of hearing in infants and young children*. American Academy of Audiology. https://www.audiology.org/wp-content/uploads/2021/05/Clin-Guid-Doc_Assess_Hear_Infants_Children_1.23.20.pdf [PDF]

Campbell, J., Cardon, G., & Sharma, A. (2011). Clinical application of the P1 cortical auditory evoked potential biomarker in children with sensorineural hearing loss and auditory neuropathy spectrum disorder. *Seminars in Hearing, 32*(2), 147–155. https://doi.org/10.1055/s-0031-1277236

Critchlow, D. E., & Fligner, M. A. (1991). On distribution-free multiple comparisons in the one-way analysis of variance. *Communications in Statistics—Theory and Methods, 20*(1), 127–139. https://doi.org/10.1080/03610929108830487

D'Onofrio, K. L., & Zeng, F.-G. (2022). Tele-audiology: Current state and future directions. *Frontiers in Digital Health, 3,* Article 788103. https://doi.org/10.3389/fdgth.2021.788103

Dimitrijevic, A., John, S. M., Van Roon, P., Purcell, D. W., Adamonis, J., Ostroff, J., Nedzelski, J. M., & Picton, T. W. (2002). Estimating the audiogram using multiple auditory steady-state responses. *Journal of the American Academy of Audiology, 13*(4), 205–224. https://doi.org/10.1055/s-0040-1715964

Dwass, M. (1960). Some k-sample rank-order tests. In I. Olkin, S. G. Ghurye, W. Hoeffding, W. G. Madow, & H. B. Mann (Eds.), *Contributions to probability and statistics: Essays in honor of Harold Hotelling* (pp. 198–202). Stanford University Press.

Easwar, V., Boothalingam, S., Chundu, S., Manchaiah, V. K. C., & Ismail, S. M. (2013). Audiological practice in India: An internet-based survey of audiologists. *Indian Journal of Otolaryngology and Head & Neck Surgery, 65*(Suppl. 3), 636–644. https://doi.org/10.1007/s12070-013-0674-2

Eichstaedt, K. E., Kovatch, K., & Maroof, D. A. (2013). A less conservative method to adjust for familywise error rate in neuropsychological research: The Holm's sequential Bonferroni procedure. *NeuroRehabilitation, 32*(3), 693–696. https://doi.org/10.3233/NRE-130893

Eikelboom, R. H., Bennett, R. J., Manchaiah, V., Parmar, B., Beukes, E., Rajasingam, S. L., & Swanepoel, D. W. (2022). International survey of audiologists during the COVID-19 pandemic: Use of and attitudes to telehealth. *International Journal of Audiology, 61*(4), 283–292. https://doi.org/10.1080/14992027.2021.1957160

Ferraro, J. A., & Ferguson, R. (1989). Tympanic ECochG and conventional ABR: A combined approach for the identification of wave I and the I-V interwave interval. *Ear and Hearing, 10*(3), 161–166. https://doi.org/10.1097/00003446-198906000-00004

Fitzgerald, M. B., Ward, K. M., Gianakas, S. P., Smith, M. L., Blevins, N. H., & Swanson, A. P. (2024). Speech-in-noise assessment in the routine audiologic test battery: Relationship to perceived auditory disability. *Ear and Hearing, 45*(4), 816–826. https://doi.org/10.1097/AUD.0000000000001472

Gehlbach, H., & Artino, A. R., Jr. (2018). The survey checklist (manifesto). *Academic Medicine, 93*(3), 360–366. https://doi.org/10.1097/ACM.0000000000002083

Gehlbach, H., & Brinkworth, M. E. (2011). Measure twice, cut down error: A process for enhancing the validity of survey scales. *Review of General Psychology, 15*(4), 380–387. https://doi.org/10.1037/a0025704

Goulios, H., & Patuzzi, R. B. (2008). Audiology education and practice from an international perspective. *International Journal of Audiology, 47*(10), 647–664. https://doi.org/10.1080/14992020802203322

Hatton, J. L., Rowlandson, J., Beers, A., & Small, S. (2019). Telehealth-enabled auditory brainstem response testing for infants living in rural communities: The British Columbia Early Hearing Program experience. *International Journal of Audiology, 58*(7), 381–392. https://doi.org/10.1080/14992027.2019.1584681

Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics, 6*(2), 65–70. https://www.jstor.org/stable/4615733

Holte, L., Walker, E., Oleson, J., Spratford, M., Moeller, M. P., Roush, P., Ou, H., & Tomblin, J. B. (2012). Factors influencing follow-up to newborn hearing screening for infants who are hard of hearing. *American Journal of Audiology, 21*(2), 163–174. https://doi.org/10.1044/1059-0889(2012/12-0016)

Hoth, S., & Dziemba, O. C. (2017). The role of auditory evoked potentials in the context of cochlear implant provision. *Otology & Neurotology, 38*(10), e522–e530. https://doi.org/10.1097/MAO.0000000000001480

Hunter, L., Hall, J. W., III, & Gordon, D. (2016). Tomorrow's standards today. *Audiology Today, 28*(3), 68–69. https://acaeaccred.org/wp-content/uploads/2022/08/AT283_MayJun_16-Tomorrows-Standards.pdf [PDF]

Kim, J., Jeon, S., Kim, D., & Shin, Y. (2021). A review of contemporary teleaudiology: Literature review, technology, and considerations for practicing. *Journal of Audiology & Otology, 25*(1), 1–7. https://doi.org/10.7874/jao.2020.00500

Kraus, N., Anderson, S., & White-Schwoch, T. (2017). The frequency-following response: A window into human communication. In N. Kraus, S. Anderson, T. White-Schwoch, R. R. Fay, & A. N. Popper (Eds.), *The frequency-following response: A window into human communication* (pp. 1–15). Springer. https://doi.org/10.1007/978-3-319-47944-6_1

Le Prell, C. G., & Brungart, D. S. (2016). Speech-in-noise tests and supra-threshold auditory evoked potentials as metrics for noise damage and clinical trial outcome measures. *Otology & Neurotology, 37*(8), e295–e302. https://doi.org/10.1097/MAO.0000000000001069

Lefler, S. M., Kaf, W. A., & Ferraro, J. A. (2021). Comparing simultaneous electrocochleography and auditory brainstem response measurements using three different extratympanic electrodes. *Journal of the American Academy of Audiology, 32*(6), 339–346. https://doi.org/10.1055/s-0041-1727273

Legatt, A. D. (2015). Electrophysiologic auditory tests. In M. J. Aminoff, F. Boller, & D. F. Swaab (Eds.), *Handbook of clinical neurology* (Vol. 129, pp. 289–311). Elsevier. https://doi.org/10.1016/B978-0-444-62630-1.00017-2

Liberman, M. C., Epstein, M. J., Cleveland, S. S., Wang, H., & Maison, S. F. (2016). Toward a differential diagnosis of hidden hearing loss in humans. *PLOS ONE, 11*(9), Article e0162726. https://doi.org/10.1371/journal.pone.0162726

Luts, H., & Wouters, J. (2004). Hearing assessment by recording multiple auditory steady-state responses: The influence of test duration. *International Journal of Audiology, 43*(8), 471–478. https://doi.org/10.1080/14992020400050060

Manchaiah, V., Eikelboom, R. H., Bennett, R. J., & Swanepoel, D. W. (2022). International survey of audiologists during the COVID-19 pandemic: Effects on the workplace. *International Journal of Audiology, 61*(4), 265–272. https://doi.org/10.1080/14992027.2021.1937348

Martin, B. A., Tremblay, K. L., & Korczak, P. (2008). Speech evoked potentials: From the laboratory to the clinic. *Ear and Hearing, 29*(3), 285–313. https://doi.org/10.1097/AUD.0b013e3181662c0e

Martin, F. N., Armstrong, T. W., & Champlin, C. A. (1994). A survey of audiological practices in the United States. *American Journal of Audiology, 3*(2), 20–26. https://doi.org/10.1044/1059-0889.0302.20

Martin, F. N., Champlin, C. A., & Chambers, J. A. (1998). Seventh survey of audiometric practices in the United States. *Journal of the American Academy of Audiology, 9*(2), 95–104. https://openurl.ebsco.com/EPDB%3Agcd%3A12%3A24909740/detailv2?sid=ebsco%3Aplink%3Acrawler&id=ebsco%3Agcd%3A107295575&crl=f&link_origin=www.google.com

Mattsson, T. S., Lind, O., Follestad, T., Grøndahl, K., Wilson, W., Nicholas, J., Nordgård, S., & Andersson, S. (2019). Electrophysiological characteristics in children with listening difficulties, with or without auditory processing disorder. *International Journal of Audiology, 58*(11), 704–716. https://doi.org/10.1080/14992027.2019.1621396

Mealings, K., Yeend, I., Valderrama, J. T., Gilliver, M., Pang, J., Heeris, J., & Jackson, P. (2020). Discovering the unmet needs of people with difficulties understanding speech in noise and a normal or near-normal audiogram. *American Journal of Audiology, 29*(3), 329–355. https://doi.org/10.1044/2020_AJA-19-00093

Mehta, K., Mahon, M., Van Dun, B., Marriage, J., & Vickers, D. (2020). Clinicians' views of using cortical auditory evoked potentials (CAEP) in the permanent childhood hearing impairment patient pathway. *International Journal of Audiology, 59*(2), 81–89. https://doi.org/10.1080/14992027.2019.1654623

Mertes, I. B., & Marquess, A. (2023a). Erratum to "A survey of U.S. audiologists' usage of and attitudes toward otoacoustic emissions." *American Journal of Audiology, 32*(4), 1005–1005. https://doi.org/10.1044/2023_AJA-23-00138

Mertes, I. B., & Marquess, A. (2023b). A survey of U.S. audiologists' usage of and attitudes toward otoacoustic emissions. *American Journal of Audiology, 32*(2), 417–431. https://doi.org/10.1044/2023_AJA-22-00096

Minaya, C., & Atcherson, S. R. (2015). Simultaneous extratympanic electrocochleography and auditory brainstem responses revisited. *Audiology Research, 5*(1), Article 105. https://doi.org/10.4081/audiores.2015.105

Mondul, J. A., Hauser, S. N., & Racca, J. M. (2025). Perspectives on neuroscience education in doctor of audiology programs. *Perspectives of the ASHA Special Interest Groups, 10*(5), 1498–1514. https://doi.org/10.1044/2025_PERSP-25-00062

Parthasarathy, A., Hancock, K. E., Bennett, K., DeGruttola, V., & Polley, D. B. (2020). Bottom-up and top-down neural signatures of disordered multi-talker speech perception in adults with normal hearing. *eLife, 9*, Article e51419. https://doi.org/10.7554/eLife.51419

Pearce, W., Golding, M., & Dillon, H. (2007). Cortical auditory evoked potentials in the assessment of auditory neuropathy:

Two case studies. *Journal of the American Academy of Audiology, 18*(5), 380–390. https://doi.org/10.3766/jaaa.18.5.3
Phillips, A. W., Durning, S. J., & Artino, A.R., Jr. (2022). *Survey methods for medical and health professions education*. Elsevier.
Plack, C. J., Barker, D., & Prendergast, G. (2014). Perceptual consequences of "hidden" hearing loss. *Trends in Hearing, 18*. https://doi.org/10.1177/2331216514550621
Polonenko, M. J., & Maddox, R. K. (2019). The parallel auditory brainstem response. *Trends in Hearing, 23*. https://doi.org/10.1177/2331216519871395
Prins, H., Peters, K., & Sladen, D. (2021). Diagnostic infant ABR testing via telehealth: A survey of professional opinions and current barriers. *Journal of Early Hearing Detection and Intervention, 6*(1), 60–68. https://doi.org/10.26077/7ee7-068f
Punch, S., Van Dun, B., King, A., Carter, L., & Pearce, W. (2016). Clinical experience of using cortical auditory evoked potentials in the treatment of infant hearing loss in Australia. *Seminars in Hearing, 37*(1), 36–52. https://doi.org/10.1055/s-0035-1570331
Ramkumar, V., Nagarajan, R., Shankarnarayan, V. C., Kumaravelu, S., & Hall, J. W. (2019). Implementation and evaluation of a rural community-based pediatric hearing screening program integrating in-person and tele-diagnostic auditory brainstem response (ABR). *BMC Health Services Research, 19*(1), Article 1. https://doi.org/10.1186/s12913-018-3827-x
Reynolds, J., Rogers, A., Medellin, E., Guzman, J. A., & Watcha, M. F. (2016). A prospective, randomized, double-blind trial of intranasal dexmedetomidine and oral chloral hydrate for sedated auditory brainstem response (ABR) testing. *Pediatric Anesthesia, 26*(3), 286–293. https://doi.org/10.1111/pan.12854
Richmond, K. H., Konkle, D. F., & Potsic, W. P. (1986). ABR screening of high-risk infants: Effects of ambient noise in the neonatal nursery. *Otolaryngology—Head and Neck Surgery, 94*(5), 552–560. https://doi.org/10.1177/019459988609400604
Riva, V., Cantiani, C., Mornati, G., Gallo, M., Villa, L., Mani, E., Saviozzi, I., Marino, C., & Molteni, M. (2018). Distinct ERP profiles for auditory processing in infants at-risk for autism and language impairment. *Scientific Reports, 8*(1), Article 715. https://doi.org/10.1038/s41598-017-19009-y
SAS Institute Inc. (2020, October 28). *Multiple comparisons based on pairwise rankings*. SAS. https://documentation.sas.com/doc/en/statug/15.2/statug_npar1way_details23.htm
Sininger, Y. S., Hunter, L. L., Hayes, D., Roush, P. A., & Uhler, K. M. (2018). Evaluation of speed and accuracy of next-generation auditory steady state response and auditory brainstem response audiometry in children with normal hearing and hearing loss. *Ear and Hearing, 39*(6), 1207–1223. https://doi.org/10.1097/AUD.0000000000000580
Spankovich, C., Gonzalez, V. B., Su, D., & Bishop, C. E. (2018). Self reported hearing difficulty, tinnitus, and normal audiometric thresholds, the National Health and Nutrition Examination Survey 1999-2002. *Hearing Research, 358*, 30–36. https://doi.org/10.1016/j.heares.2017.12.001
Steel, R. G. D. (1960). A rank sum test for comparing all pairs of treatments. *Technometrics, 2*(2), 197–207. https://doi.org/10.1080/00401706.1960.10489894
Stoup, J., Emanuel, D. C., Kozlowski, A., & Peitsch, K. (2022). Audiology clinical practice patterns in acoustic reflex testing. *American Journal of Audiology, 31*(4), 1222–1231. https://doi.org/10.1044/2022_AJA-22-00070
The Joint Committee on Infant Hearing. (2019). Year 2019 position statement: Principles and guidelines for early hearing detection and intervention programs. *Journal of Early Hearing Detection and Intervention, 4*(2), 1–44. https://doi.org/10.15142/fptk-b748
Towers, A. D., Pisa, J., Froelich, T. M., & Krumm, M. (2005). The reliability of click-evoked and frequency-specific auditory brainstem response testing using telehealth technology. *Seminars in Hearing, 26*(1), 26–34. https://doi.org/10.1055/s-2005-863792
Tremblay, K. L., Pinto, A., Fischer, M. E., Klein, B. E. K., Klein, R., Levy, S., Tweed, T. S., & Cruickshanks, K. J. (2015). Self-reported hearing difficulties among adults with normal audiograms: The Beaver Dam Offspring Study. *Ear and Hearing, 36*(6), e290–e299. https://doi.org/10.1097/AUD.0000000000000195
Valenzuela, D. G., Kumar, D. S., Atkins, C. L., Beers, A., Kozak, F. K., & Chadha, N. K. (2016). Chloral hydrate sedation for auditory brainstem response (ABR) testing in children: Safety and effectiveness. *International Journal of Pediatric Otorhinolaryngology, 83*, 175–178. https://doi.org/10.1016/j.ijporl.2016.02.006
Vander Werff, K. R. (2020). Accuracy and time efficiency of two ASSR analysis methods using clinical test protocols. *Journal of the American Academy of Audiology, 20*(7), 433–452. https://doi.org/10.3766/jaaa.20.7.5
Wilson, R. H. (2011). Clinical experience with the words-in-noise test on 3430 veterans: Comparisons with pure-tone thresholds and word recognition in quiet. *Journal of the American Academy of Audiology, 22*(7), 405–423. https://doi.org/10.3766/jaaa.22.7.3
Windmill, I. M., & Freeman, B. A. (2013). Demand for audiology services: 30-Yr projections and impact on academic programs. *Journal of the American Academy of Audiology, 24*(5), 407–416. https://doi.org/10.3766/jaaa.24.5.7