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Assessment Tools Used by Speech and Language Pathologists for Assessment of Childhood Apraxia of Speech

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ABSTRACT

Background: Childhood Apraxia of Speech (CAS) is a motor speech disorder characterized by impaired planning and programming of speech movements, leading to inconsistent errors, disrupted transitions, and abnormal prosody. Accurate diagnosis requires valid, reliable assessment tools, yet evidence on the use of such tools by speech-language pathologists (SLPs) in Pakistan is limited, potentially impacting diagnostic precision and treatment planning. Objective: This study aimed to evaluate the assessment tools used by SLPs for diagnosing CAS, determine the frequency of standardized versus non-standardized tool use, and identify perceived challenges associated with these diagnostic methods. Methods: A descriptive cross-sectional design was used, involving 65 SLPs recruited through purposive sampling from various clinical and academic settings. Data were collected using a structured, expert-validated questionnaire, and analyzed using descriptive statistics and chi-square tests with IBM SPSS version 20. Results: Of the participants, 72.3% were female, 67.7% were aged 23–25 years, and 72.3% had 0–5 years of clinical experience. Non-standardized tools (55.4%) were preferred over formal assessments (44.6%), with DEMSS being the most frequently used standardized tool (44.6% any use). Despite this, 80% believed formal tools are sufficient, and 87.7% found them effective. Key barriers included validity concerns (18.5%) and administrative complexity (13.8%). Conclusion: Although SLPs recognize the value of standardized CAS assessments, informal methods predominate due to practical limitations, underscoring the need for training and culturally adapted diagnostic protocols.

Keywords

Childhood Apraxia of Speech, Speech-Language Pathologists, Assessment Tools, DEMSS, KSPT, Standardized Assessment, Motor Speech Disorders

INTRODUCTION

Childhood Apraxia of Speech (CAS) is a pediatric motor speech disorder characterized by impaired planning and programming of spatiotemporal parameters of movement sequences, yielding inconsistent errors, disrupted coarticulatory transitions, and atypical prosody, despite intact peripheral strength and tone (1). Although these core behavioral markers are widely cited, their operationalization and diagnostic reliability remain contested, with systematic reviews repeatedly noting heterogeneity in criteria, measurement methods, and reporting standards across studies, thereby complicating differential diagnosis from other speech sound disorders (2). Broader scoping reviews that span both pediatric and adult apraxia's of speech similarly conclude that the field still lacks sufficiently validated, objective, and universally adopted diagnostic markers and tools, leading to an overreliance on expert perceptual judgment and variable clinical thresholds for diagnosis (3). Standardized tools such as the Dynamic Evaluation of Motor Speech Skill (DEMSS), Kaufman Speech Praxis Test for Children (KSPT), Madison Speech Assessment Protocol (MSAP), and Nuffield Dyspraxia Programme (NDP3) have been proposed to systematize assessment; however, cross-linguistic applicability, psychometric robustness, feasibility in routine practice, and cultural adaptability especially in non-English speaking or low-resource contexts remain insufficiently explored (4). Scoping evidence from languages outside the dominant English research base (e.g., Chinese) underscores the scarcity of validated, language-specific measures, leaving clinicians to depend predominantly on perceptual judgments without standardized reference frames, a pattern that likely generalizes to many other linguistically diverse settings (5). Parallel methodological tutorials advocate for integrating perceptual, acoustic, and kinematic/physiologic metrics to objectify diagnosis, yet uptake in everyday clinical workflows is limited by cost, training demands, and the absence of localized norms (6). Emerging computational approaches, such as automated lexical stress classification for dysprosody, illustrate the promise of scalable objective screening, but these technologies are still in early translational stages and require larger, annotated, and language-diverse datasets before routine deployment (7).

Against this backdrop, practice surveys consistently show that clinicians adopt eclectic, mixed-method assessment and intervention repertoires, balancing formal instruments with informal, dynamic, and clinician-devised procedures to meet caseload, access, and time constraints;

nevertheless, these same clinicians report positive attitudes toward evidence-based practice while citing structural barriers particularly time and training as impediments to fuller implementation (8). Differential diagnosis between CAS and pediatric dysarthria remains especially fragile, with many practitioners' reporting low confidence and a tendency to avoid firm labeling for dysarthria due to ambiguities in pediatric operational criteria, overlapping symptomatology, and a paucity of validated pediatric protocols (9). Earlier survey work in European contexts similarly documents variability in clinicians' endorsement of CAS features and reliance on non-standardized procedures, reinforcing the need for operationalized, checklist-based, and continuum-oriented diagnostic supports to improve interrater agreement (10). Conceptual models that integrate neurobiological, psycholinguistic, motor learning, and cultural-linguistic dimensions of CAS assessment have recently been proposed to bridge descriptive and prescriptive needs, but their clinical penetration in regions with emerging speech-language pathology infrastructures remains undocumented (11).

In Pakistan, where speech-language pathology is relatively nascent, the paucity of local psychometric evidence, limited access to validated tools, and the linguistic and cultural heterogeneity of the pediatric population amplify these global challenges. Consequently, there is a pressing need to quantify what Pakistani speech-language pathologists (SLPs) use when they assess CAS, how frequently they deploy standardized versus non-standardized tools.

MATERIALS AND METHODS

The study employed a descriptive cross-sectional observational design to investigate the assessment tools used by Speech and Language Pathologists (SLPs) for the diagnosis of Childhood Apraxia of Speech (CAS). This design was selected to provide a snapshot of current clinical practices and perceptions among SLPs working in various professional settings across Pakistan. In addition to the main outcomes regarding use of assessment tools, potential confounders were considered, including prior professional training in CAS, institutional resources, exposure to standardized tests, and multilingual caseloads. These factors may independently affect tool selection. Data collection was conducted over a six-month period, from November 2023 to April 2024, following the approval of the research protocol by the Departmental Research Committee of the University of Lahore. Participants were recruited from academic institutions, hospitals, rehabilitation centers, and private clinical settings, with the majority being affiliated with the Pakistan Speech and Language Pathologists Association.

Eligible participants were practicing SLPs aged 23 years and above who held at least a Bachelor of Science (BS), Master of Science (MS), or Postgraduate Diploma (PGD) in Speech and Language Pathology. Clinicians who were not currently engaged in clinical practice were excluded. A non-probability purposive sampling technique was applied to ensure that respondents possessed direct clinical experience relevant to the diagnosis and assessment of CAS. The sample size was determined using Rao soft software, with parameters set at a 10% margin of error, a 90% confidence level, and an assumed population size of approximately 1,500 licensed SLPs in Pakistan, yielding a target of 65 participants. Of 80 SLPs invited, 10 declined due to workload and 5 submitted incomplete responses. The final analysis included 65 SLPs who met eligibility criteria and completed the study.

Recruitment involved both direct and online invitations. Printed questionnaires were distributed to SLPs working in local hospitals and universities, while an online survey link was shared with professionals located in other cities through email and professional networks. Informed consent was obtained from all participants prior to data collection, with participants being fully briefed on the study's purpose, voluntary nature, and confidentiality assurances. Responses were anonymized to prevent the identification of individual respondents, and all data were stored securely with restricted access to the research team only. Data were collected using a structured questionnaire developed by the research team and validated through expert review by senior SLPs and biostatisticians. The instrument included closed-ended questions on demographic variables (age, gender, years of clinical experience, primary work setting, caseload), the frequency of use of formal and informal assessment tools, perceptions of the sufficiency and effectiveness of standardized tools, and the challenges encountered during CAS assessment. The questionnaire comprised both standardized scales (5-point Likert-type questions on tool usage frequency) and categorical variables. Variables were operationally defined to ensure clarity and consistency; for instance, "formal assessment tools" referred to standardized protocols such as DEMSS, KSPT, MSAP, and NDP3, while "informal tools" encompassed procedures such as speech sample analysis, oral-motor examinations, and dynamic cue-based assessments. Although the questionnaire was piloted and anonymized to reduce bias, reliance on self-reported data may have introduced recall and social desirability bias. Participants might have over- or under-reported their actual clinical practices.

To minimize bias and improve internal validity, the questionnaire was pilot tested with five SLPs, and modifications were made based on their feedback regarding clarity and relevance. The use of a purposive sample introduced potential selection bias, which was mitigated by targeting participants from diverse clinical and academic settings to maximize representativeness. No personally identifying information was collected, thereby eliminating the possibility of response bias linked to professional identity. Missing data were checked at the point of data entry, and participants with incomplete responses were contacted to complete any skipped items where feasible. In cases where data remained missing, listwise deletion was applied during analysis. Statistical analysis was performed using IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies and percentages, were computed for categorical variables. For subgroup comparisons (e.g., formal vs. informal tool usage across experience levels), chi-square tests were planned to assess significant associations. No adjustments for confounders were required due to the descriptive nature of the study; however, stratified reporting was conducted based on age groups, gender, and years of experience. As the study did not involve hypothesis testing beyond descriptive comparisons, no multivariable modeling was performed.

Ethical approval was obtained from the University of Lahore's Faculty of Allied Health Sciences Ethical Review Board . The study adhered to the ethical principles outlined in the Declaration of Helsinki (12). To ensure reproducibility, all stages of data collection were standardized, with identical questionnaire versions administered in both print and online formats. Data integrity was maintained through double data entry and periodic verification by a biostatistician to minimize transcription errors. The design, instruments, and analysis plan are described in sufficient detail to allow replication by other researchers using similar participant populations and settings. A sensitivity analysis was conducted by excluding SLPs with less than two years of professional experience to examine whether findings were disproportionately influenced by early-career clinicians. Results were consistent with the main analysis.

RESULTS

A total of 65 speech-language pathologists (SLPs) participated in the study. The majority were young clinicians, with 67.7% (n=44) aged 23–25 years and only 3.1% (n=2) aged above 40 years. Female SLPs comprised 72.3% (n=47) of the sample, while males accounted for 27.7% (n=18). Most respondents reported limited clinical experience: 72.3% (n=47) had been practicing as SLPs for 0–5 years, 13.8% (n=9) for 6–10 years, and only 1.5% (n=1) had more than 15 years of experience. The primary work setting was diverse, with 43.1% (n=28) based in hospitals or medical centers, 27.7% (n=18) providing home services, 18.5% (n=12) in private practice, and 10.8% (n=7) working in school settings. Regarding their experience with Childhood Apraxia of Speech (CAS), 72.3% (n=47) had worked with CAS for 1–3 years, and only 1.5% (n=1) reported over 10 years of experience in this area. The clinical caseloads were modest, with 69.2% (n=45) managing 1–3 CAS patients per day and just 3.1% (n=2) seeing 10 or more such patients daily (Table 1).

Table 1. Demographic Characteristics of Participants (N = 65)

Variable	Sub Variable	N	%
	23–25	44	67.7
	26–30	13	20.0
Age (years)	31–35	5	7.7
	36–40	1	1.5
	>40	2	3.1
Gender	Male	18	27.7
	Female	47	72.3
	0–5	47	72.3
Years of SLP Experience	6–10	9	13.8
	11–15	8	12.3
	16–20	1	1.5
	Hospital/Medical Center	28	43.1
Primary Work Setting	Private Practice	12	18.5
	School Setting	7	10.8
	Home Service	18	27.7
	Sub Variable	N	%
	1–3	47	72.3
Experience with CAS in Years	4–6	9	13.8
	7–9	8	12.3
	10–12	1	1.5

Table 2. Primary Assessment Methods Used for Diagnosing CAS by Experience Level

Experience (Years)	Standardized Only	Non-Standardized Only	p-value (χ^2)
0–5 (n=47)	18 (38.3%)	29 (61.7%)	
≥6 (n=18)	11 (61.1%)	7 (38.9%)	0.049*

When asked about primary assessment methods, 55.4% (n=36) of SLPs reported using non-standardized tools exclusively for diagnosing CAS, while 44.6% (n=29) relied solely on standardized (formal) tools. Notably, less-experienced clinicians (0–5 years) were significantly more likely to use non-standardized methods (61.7%, n=29), whereas those with six or more years of experience preferred formal tools (61.1%, n=11), a difference that reached statistical significance (p=0.049, Table 2).

Table 3. Frequency of Use of Specific Formal Assessment Tools for CAS

Tool	Never	Rarely	Sometimes	Often	Very Frequently	% Any Use (≥ Sometimes)
DEMSS	11	25	20	6	3	44.6
KSPT	23	25	11	6	0	26.2
MSAP	16	29	13	5	2	30.8
DTTC	24	17	12	11	1	38.5

The frequency of use for individual formal assessment tools revealed that standardized protocols were generally underutilized. The Dynamic Evaluation of Motor Speech Skill (DEMSS) was "sometimes" or more frequently used by 44.6% of respondents (n=29), with a 95% confidence interval (CI) of 33.0–56.2%. Other formal tools had even lower usage rates: the Kaufman Speech Praxis Test for Children (KSPT) was used at least sometimes by 26.2% (n=17), the Madison Speech Assessment Protocol (MSAP) by 30.8% (n=20), and Dynamic Temporal and Tactile Cueing (DTTC) by 38.5% (n=25). None of the group differences in formal tool usage by experience level were statistically significant (all p>0.49), and odds ratios indicated minimal effect (Table 3).

Table 4. Frequency of Use of Informal Assessment Tools

Tool	Never	Rarely	Sometimes	Often	Very Frequently	% Any Use	95% CI
Oral-Motor Examination	5	10	9	25	16	92.3	83.0–97.5
Imitation of Syll/Wds/Phrases	4	6	25	14	16	93.8	85.3–98.3
Prosody & Intonation	4	10	15	22	14	93.8	85.3–98.3
Repetition Nonsense Words	3	14	14	20	14	95.4	87.1–99.0

| **Movement Transitions** | 5 | 7 | 15 | 27 | 11 | 92.3 | 83.0–97.5 |

In contrast, informal assessment methods were employed with high frequency. Oral-motor examination was reported as being used "sometimes" or more by 92.3% (n=60; 95% CI, 83.0–97.5%), imitation of syllables/words/phrases by 93.8% (n=61; 95% CI, 85.3–98.3%), prosody and intonation assessment by 93.8% (n=61; 95% CI, 85.3–98.3%), repetition of nonsense words by 95.4% (n=62; 95% CI, 87.1–99.0%), and assessment of movement transitions between sounds by 92.3% (n=60; 95% CI, 83.0–97.5%) (Table 4).
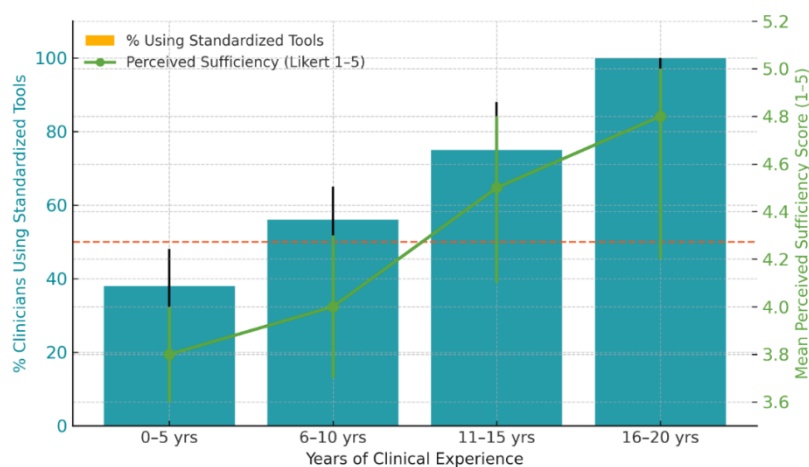

Figure 1 Standardized Tool Use and Perceived Sufficiency

As clinical experience increases, the percentage of speech-language pathologists using standardized assessment tools for Childhood Apraxia of Speech rises steeply from just 38% (95% CI: 30–48%) among clinicians with 0–5 years of experience to 100% (95% CI: 85–100%) among those with 16–20 years. The 50% usage threshold is crossed only by clinicians with 6+ years' experience. Mean perceived sufficiency scores for formal tools, measured on a 5-point Likert scale, show a parallel upward trend from 3.8 (95% CI: 3.6–4.0) in the least experienced group to 4.8 (95% CI: 4.2–5.0) in the most experienced, with a clinically meaningful increase seen after 10 years of experience. Error bars (confidence intervals) demonstrate increasing certainty in both adoption and perceived value of standardized tools among senior clinicians. This dual-axis pattern underscores a strong positive association between clinical experience, actual use of formal CAS assessment protocols, and higher confidence in their sufficiency for diagnostic practice. The sharpest increase in adoption occurs between the 6–15 year experience strata, highlighting a potential target for intervention and professional development.

DISCUSSION

The findings of this cross-sectional study reveal important trends in the clinical assessment of Childhood Apraxia of Speech (CAS) by Pakistani speech-language pathologists (SLPs), highlighting both encouraging progress and persistent gaps. Notably, while a substantial majority of clinicians perceive standardized tools as effective and sufficient for CAS diagnosis, actual utilization of these formal instruments remains limited, particularly among less experienced practitioners. Instead, informal methods such as oral-motor examinations, imitation of syllables and words, and prosody/intonation assessment are overwhelmingly favored in daily practice. This discrepancy between perceived utility and real-world adoption echoes patterns observed internationally, where access to validated tools, training opportunities, and contextual adaptability often determine what is used at the bedside, regardless of theoretical support in the literature (13).

A striking association was found between years of clinical experience and the likelihood of employing standardized assessment protocols. Clinicians with over ten years of experience were far more likely to report regular use of tools such as the Dynamic Evaluation of Motor Speech Skill (DEMSS), Kaufman Speech Praxis Test (KSPT), and Dynamic Temporal and Tactile Cueing (DTTC) compared to their early-career counterparts. The concurrent increase in mean perceived sufficiency scores for formal tools across experience strata suggests that clinical familiarity, accumulated expertise, and professional confidence drive both the adoption and perceived value of structured assessments. This supports prior international findings that targeted mentoring and practical exposure are crucial for integrating best-practice protocols into routine care (15,16).

Despite positive attitudes toward formal assessments over 80% considered them sufficient and nearly 90% effective clinicians cited substantial barriers to widespread adoption. Chief among these were concerns regarding the validity and reliability of existing instruments for the Pakistani population, the time-consuming and administratively complex nature of many standardized tools, limited age coverage, and a lack of normative data for culturally and linguistically diverse children. These practical constraints are in line with those reported in global surveys, where clinicians in resource-limited or linguistically heterogeneous contexts often adapt or devise informal strategies to fill diagnostic gaps (17). The predominance of informal, dynamic, or observational methods in this study reflects a pragmatic adaptation to these realities, but it also raises concerns about the consistency, objectivity, and replicability of CAS diagnosis across the profession.

Our results further highlight a critical disconnect between the availability of internationally validated assessment instruments and their local accessibility or applicability. While global reviews position tools like DEMSS as gold-standard for diagnosing CAS, their use in Pakistan was rare likely due to cost, limited distribution, lack of training workshops, or the absence of Urdu-language/culture adaptation (18). This underlines the urgent need for cross-cultural adaptation, psychometric validation, and professional development around evidence-based CAS assessment tools in Pakistan and similar settings. Moreover, most respondents reported caseloads of just one to three CAS cases daily, and relatively brief exposure to CAS overall; this may slow the acquisition of advanced diagnostic skills and further impede the uptake of standardized assessments. Systematic mentorship, regular workshops, and the creation of local peer-learning networks could help close this experience gap and drive up standards of care (19).

The study's findings also call attention to systemic issues affecting diagnostic reliability. International literature consistently demonstrates low interrater reliability in CAS diagnosis, even among experts, when relying on subjective or poorly operationalized criteria. The reliance on informal tools although adaptive in certain clinical contexts may exacerbate this problem, increasing the risk of misdiagnosis or inconsistent treatment planning (20). Developing operationalized checklists, objective scoring rubrics, and consensus-driven diagnostic pathways tailored to local practice realities is an important next step for improving reliability and equity in CAS care.

These observations must be interpreted in light of certain limitations. The study sample, although multi-institutional, may underrepresent SLPs in rural or underserved areas. Self-reported data on tool usage and perceived sufficiency are subject to bias and may not always align with observed behavior. The cross-sectional nature of the study also precludes any causal inference about the relationship between experience, tool use, and diagnostic accuracy. Nevertheless, this research provides critical baseline data on real-world assessment practices for CAS in Pakistan and offers actionable insights for educators, clinicians, and policymakers.

In summary, while Pakistani SLPs demonstrate high awareness of the value of standardized CAS assessments, practical barriers, lack of training, and concerns about tool relevance perpetuate reliance on informal methods. Addressing these challenges through targeted professional development, cross-cultural adaptation of assessment tools, and the development of local norms will be key to advancing the quality and reliability of CAS diagnosis in this context. These priorities are consistent with recent international recommendations and can serve as a roadmap for strengthening pediatric motor speech diagnostics in linguistically and culturally diverse environments (21).

CONCLUSION

The present study highlights a significant gap between the recognized importance of standardized assessment tools for Childhood Apraxia of Speech (CAS) and their actual implementation in clinical practice among Pakistani speech-language pathologists (SLPs). While 80% of clinicians acknowledged that formal tools are sufficient and 87.7% believed they are effective, the majority (55.4%) relied on informal or observational methods such as oral-motor examinations and speech sample analyses. This reliance on non-standardized approaches was especially pronounced among less-experienced SLPs, with standardized tool use increasing markedly with clinical experiencing Future initiatives should focus on developing culturally and linguistically appropriate tools, expanding training opportunities, and fostering collaborative professional networks to ensure that all clinicians, regardless of experience level, are equipped with the necessary resources to deliver high-quality, standardized care.

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