

Evidence Summary - Childhood Apraxia of Speech – August 2026

McCabe, P., Murray, E. & Thomas, D.*

This document is a free summary of the current evidence on assessment, diagnosis and treatment of Childhood Apraxia of Speech (CAS). Please seek advice from your speech pathologist.

This evidence summary is only valid until December 2027.

Background

Childhood Apraxia of Speech (ICD code R48.2) is a relatively rare, severe and lifelong neurodevelopmental disorder of speech motor programming and planning. It is present from birth and does not naturally resolve. In recent years, substantial progress has been made in improving speech pathology treatment for CAS but there remains many older children, adolescents and adults who have severe limitations to all aspects of their lives due to ineffective and/or insufficient treatment in earlier years. Recent advances in treatment efficacy should improve the rate functional spoken communication is achieved however there is emerging evidence that a significant burden of psychosocial, educational, economic and communication deficits that remains across the lifespan with resultant restrictions on many aspects of daily life.

Many people with CAS have an unknown cause, however CAS can co-occur with all other developmental conditions including other communication disorders. Up to 1 in 3 children have a genetic cause for their CAS, whether it is a single gene change or a chromosomal deletion or duplication (Morgan et al, 2025). CAS also has increased frequency in children and adults with rare single gene conditions (e.g., *SETBP1-HD*, *FOXP2*), galactosemia, intellectual disability, global developmental delay, Down syndrome, cerebral palsy, epilepsy, and in autistic people who do not speak. However, it appears to have the same rate in autistic children who speak as the rest of the population, a prevalence of approximately 1 in 1000 children (Shriberg et al., 2019). Having other communication and/or neurodevelopmental disorders with CAS is likely to increase the impact of both conditions.

CAS appears to exist in most, if not all, languages although the signs and symptoms will vary slightly due to the nature of the language spoken. It has been documented in at least Arabic, Cantonese, Danish, Dutch, French, German, Italian, Portuguese, Spanish, Swedish, Tagalog, Turkish and English.

Assessment

Diagnosis of CAS requires skilled assessment by **a suitably qualified and experienced speech pathologist**. Best practice in assessment depends on the child's age, severity and comorbidities and should use at least 3 speech tasks. Additional tasks are required to describe other parts of communication, such as language, reading, spelling or social communication.

Suggested Assessment Protocols in English*

* Assessment of CAS in languages other than English will require similar tasks however the literature is less clear about which to select.

Younger children or those with severe speech difficulties	Older children or those with milder speech difficulties
<i>Hearing screening or assessment</i>	
<i>Comprehensive oral musculature structural and functional evaluation</i>	
<i>Single word productions appropriate for age, language, accent, and culture</i>	
A set of single words should ideally include 50 common words with a range of sounds, syllable shapes and numbers, and word shapes. Repeated productions of the same words is helpful in looking at speech consistency.	Single word list of at least 50 words should include at least 30 polysyllabic words including weak onset word structures. Repeated productions of the same words is helpful in looking at speech consistency.
Specific tasks can include: - Diagnostic Evaluation of Motor Speech Skills (DEMSS, Strand & McCauley, 2019) OR - Nuffield Dyspraxia Programme (NDP3) Assessment (Williams & Stephens, 2009) OR - Verbal Motor Production Assessment for Children-Revised (VMPAC-R, Hayden & Namasivayam, 2021) OR - Diagnostic Evaluation of Articulation and Phonology – Inconsistency Subtest (Dodd et al, 2002)	Specific tasks can include: - Speech diadochokinesis tasks (e.g. 'peteke') (Diepeveen et al, 2019) - Syllable Repetition Test (Shriberg et al, 2012) - Multisyllabic Rapid Naming tasks (Preston et al, 2021) "Buy Bobby A Puppy" inconsistency assessment (Iuzzini-Seigel et al, 2017) OR - Single Word Test of Polysyllables (Gozzard et al, 2016)
<i>Connected speech samples</i>	
Sample of typical communication in interaction with their carer or in play (including use of sounds, speech, gesture and communication devices). It could include a picture description or talking about a favourite toy or photo.	Connected speech including polysyllabic words (words of 3 or more syllables) to sample the child's connected speech accuracy and prosody. This could include a story retell, conversation or a polysyllabic words in sentences task.

Diagnosis of CAS currently requires that a child meets either all three ASHA (2007) consensus-based features of CAS (*Inconsistency across words and syllables; Lengthened and disrupted coarticulatory transitions; Inappropriate prosody*) or has vowel distortions and at least another 3 /10 criteria on the Mayo 10+1 checklist across at least 3 speech tasks (Shriberg et al, 2019, Table 1). The Pro-CAD (Iuzzini-Seigel et al, (2022) may be used to discriminate CAS from dysarthria.

Please note: for a diagnosis of CAS to be accurate, children need to have a clear intent to communicate regardless of age or severity and some attempts at speech. Slow progress in speech therapy is not diagnostic of CAS.

Severity of CAS has not been formally defined however clinicians may use the following factors in determining severity:

1. Intelligibility – children with more severe CAS will struggle to be intelligible even to immediate family
2. Speech inventory (number of sounds & syllable structures) compared to other people of the same chronological or language age.
3. Number of features of CAS present and severity of features. These lists of features come from three sources (ASHA, 2007; Shriberg et al, 2019; Iuzzini-Seigel et al, 2022).
4. In older children, adolescents, and adults: Difficulty saying new or longer words, avoiding speaking tasks such as using the phone, social isolation, or reduced quality of life (Cassar et al., 2023).

The presence of other communication, developmental or cognitive issues may also make progress in therapy slower and decrease intelligibility.

Treatment

There are two kinds of high level research evidence about treatment: Systematic reviews which evaluate a range of research studies and randomised control trials (RCT) which are the gold standard for individual treatment studies. A recent systematic review (McCabe et al., 2026) has shown that eight speech treatment approaches have enough evidence for clinicians and families to use them with confidence when their child is similar to those in the research. Any other treatment should be used with caution as we currently do not have sufficient evidence of it working broadly.

In alphabetic order, these are the first line treatments: Dynamic Temporal and Tactile Cueing (DTTC); Kaufman Speech to Language Program (K-SLP); Motor Speech Treatment Protocol (MSTP); Nuffield Dyspraxia Programme (3rd ed; NDP3); Rapid Syllable Transition Treatment (ReST); Speech Motor Chaining (SMC); Ultrasound Biofeedback; and SMC + Ultrasound Biofeedback combined.

From this list, **DTTC, NDP3, KSLP and MSTP** may be more suitable for those with more severe difficulties and/ or younger children. **ReST, SMC and Ultrasound** are likely to be more suitable for those with less severe difficulties and/or older children. Resources and training for DTTC, ReST, SMC and Ultrasound are freely available online. NDP3 and KSLP have manuals and kits which can be purchased online. Ultrasound is beyond the scope of many SLPs due to equipment costs.

Some treatments have less evidence but may be trialed if none of the above is suitable. These include Concurrent Treatment; Integrated Phonological Awareness (IPA), and PROMPT. Parents should be cautious about an immediate recommendation of any of these. Ask your speech pathologist to explain why none of the best treatments is appropriate.

There is limited research to guide treatment decisions when children have more than one co-occurring speech disorder, however, a logical choice would be to select a treatment that has demonstrated effectiveness for both of the child's speech disorders. For example, a child with dysarthria and CAS may benefit from DTTC or ReST or PROMPT which have evidence of efficacy with both disorders. The only treatment to date for autistic children with CAS is ACT4CAS, a modified version of DTTC which has low-moderate evidence to date (Beiting & Maas, 2021). There is also a tutorial available for neurodiversity-affirming motor speech intervention for autistic individuals with CAS (Moore et al, 2024).

Many children would benefit from alternative or augmentative communication (AAC) such as sign language or a specialised app with voice output to ensure they have ways to communicate while they develop their speech. AAC has been shown to both reduce speech distress and frustration, support the development of vocabulary and putting sentences together and aid in improving speech accuracy and intelligibility (Adams et al, 2026)

Other treatments have less well-developed evidence and should be undertaken with caution as they have not yet been shown to be effective in multiple and/or randomised studies of children who clearly had CAS.

Treatment intensity and frequency

On average effective treatment requires 2-6 sessions per week for an undescribed maximum (more than 1 year) (Maas et al., 2014). Some studies have shown that the greater the treatment intensity, the more effective the therapy, and the more efficient the progress (e.g., Edeal, 2012) however other studies have not seen the same effect (e.g. Iuzzini et al., 2025). From the literature we know that session length should be 45-60 minutes but will depend on both the child and the treatment selected. Two studies have explicitly tested therapy once per week and shown it to be ineffective (Namasivayam et al, 2015; Thomas et al., 2023).

A recent systematic review (McCabe et al., 2026) shows that more weeks of therapy is important in predicting change in a child's speech. In the first CAS RCT (Murray et al., 2015), children continued to improve after the end of intensive therapy for at least 4 weeks, despite no treatment being provided. This shows that taking short breaks from intensive therapy can be beneficial.

Research studies are time-limited with treatment provided in blocks of 12-18 sessions which usually doesn't reflect children's needs or clinical reality. If a study shows an effect after X sessions, this doesn't mean therapy must stop after that number of sessions; what it means is that clinician expertise and family choice are required to decide to continue, to take a break, or to change to a different treatment based on the child's response to therapy.

Some treatments (ReST; Nuffield, DTTC) are effective for some children when delivered by telehealth (Bahar et al., 2022; Lim et al., 2026; Thomas et al., 2016). Caregivers generally want in-person therapy when their child is young or new to speech therapy (Iuzzini-Seigel et al., 2024).

Group Therapy

There is no evidence for any group speech treatment being trialed in any level of research with anyone with CAS since 1960. Group treatment is not recommended for any CAS feature and there is no theoretically sound reason for it to be trialed. People with CAS may benefit from evidence-based group therapy interventions for their co-morbid conditions but again there is no research evidence for such treatments in people with CAS who have these comorbid conditions.

Therapy by people who are not Speech Pathologists.

There is very limited evidence that therapy for CAS can be provided by anyone other than a speech pathologist. In all but three studies, speech pathologists or supervised speech pathology students have provided therapy. Two studies (Thomas et al., 2017; Lim et al., 2020) trialed parent delivered therapy with limited success and it is not currently recommended. One study (Lim et al., 2019) trained teacher's aides providing DTTC therapy which was moderately successful.

Caregiver concerns

The effects of a child's CAS may extend beyond the child's speech, to other areas of their life, and to the whole family. Caregivers express frustration about (1) delays in obtaining a CAS diagnosis- often not receiving this diagnosis until the child has seen three or more speech pathologists, (2) waiting time for therapy, (3) the limited number of funded sessions and (4) not knowing how to help their child. Clinicians consider these concerns when providing advice to families and discuss timely referral to other health, educational and family services.

Although most speech production treatments for CAS use motor speech principles, there are aspects of these treatments that caregivers dislike (e.g., drill practice, repetitive practice of a small set of targets, the child receiving feedback about incorrect productions, and, as is required for some treatments, the child needing to look at the clinician's mouth). Despite this, caregivers note that treatments focused on the movements that underpin speech are effective for their child. See Dawoud et al., 2026, Highman et al., (2025) and Thomas, Bricker-Katz et al., (2026) and Thomas, Gomez et al., 2026 for more detail about caregiver's concerns.**

References

- Adams, S., Zakrzewski, K., King, T., Vecchio, S., Lim, J., & Conlon, C. (2026). A scoping review of augmentative and alternative communication use in children with childhood apraxia of speech. *Augmentative and alternative communication* (Baltimore, Md. : 1985), 1–12. Advance online publication. <https://doi.org/10.1080/07434618.2026.2619162>
- American Speech-Language-Hearing Association. (2007). Childhood Apraxia of Speech [Technical Report]. www.asha.org/policy.
- Bahar, N., Namasivayam, A. K., & van Lieshout, P. (2022). Telehealth intervention and childhood apraxia of speech: a scoping review. *Speech, Language and Hearing*, 25(4), 450–462. <https://doi.org/10.1080/2050571X.2021.1947649>
- Cassar, C., McCabe, P., & Cumming, S. (2023). "I still have issues with pronunciation of words": A mixed methods investigation of the psychosocial and speech effects of Childhood Apraxia of Speech in adults. *International Journal of Speech-Language Pathology*, 25(2), 193–205. <https://doi.org/10.1080/17549507.2021.2018496>
- Dawoud, M., Gomez, M., McCabe, P., & Thomas, D. C. (2025). Australian caregiver's experiences and needs when their child has Childhood Apraxia of speech: A qualitative study. *International Journal of Speech-Language Pathology*, 1-14.
- Diepeveen, S., van Haaften, L., Terband, H., de Swart, B., & Maassen, B. (2019). A Standardized Protocol for Maximum Repetition Rate Assessment in Children. *Folia phoniatrica et logopaedica*: 71(5-6), 238–250.
- Dodd, B., Hua, Z., Crosbie, S., Holm, A., & Ozanne, A. (2002). *Diagnostic evaluation of articulation and phonology (DEAP)*. London, England: The Psych Corp.
- Edeal, D. M., & Gildersleeve-Neumann, C. E. (2011). The importance of production frequency in therapy for childhood apraxia of speech. *AJSLP*, 20(2), 95
- Hayden, D., & Namasivayam, A., (2021) *Verbal Motor production Assessment for children – Revised edition*. Available from: <https://ympac-r.com/>
- Highman, C., Wylie, K., Overby, M., Leitão, S., Thilakarathne, R., & McCabe, P. (2025). "I Just Want Him to Be Understood": Parent Perspectives of the Long-Term Desired Outcomes and Experiences of Early Intervention for Children With Childhood Apraxia of Speech. *American Journal of Speech-Language Pathology*, 34(6), 3263-3278.
- Iuzzini-Seigel, J., Allison, K. M., & Stoeckel, R. (2022). A tool for differential diagnosis of childhood apraxia of speech and dysarthria in children: A Tutorial. *LSHSS*: 53(4), 926–946.
- Iuzzini-Seigel, J., Murray, E., Velleman, S. L., Bricker-Katz, G., & Thomas, D. (2024). Clear masks do not prevent gains during Dynamic Temporal and Tactile Cueing treatment: An explanatory sequential mixed methods pilot study. *American Journal of Speech-Language Pathology*, 33(5), 2438-2460.
- Iuzzini-Seigel, J., Hogan, T.P., & Green J.R. (2017). Speech Inconsistency in Children with Childhood Apraxia of Speech, Language Impairment, and Speech Delay: Depends on the Stimuli. *Journal of Speech, Language, and Hearing Research*, 60(5), 1194-1210.

- Iuzzini-Seigel, J., Murray, E., Velleman, S. L., Bricker-Katz, G., & Thomas, D. (2024). Clear masks do not prevent gains during Dynamic Temporal and Tactile Cueing treatment: An explanatory sequential mixed methods pilot study. *American Journal of Speech-Language Pathology*, 33(5), 2438-2460.
- Kaspi, A., Hildebrand, M.S., Jackson, V.E., Braden, R., van Reyk, O., Howell, T. et al. (2023). Genetic aetiologies for childhood speech disorder: novel pathways co-expressed during brain development. *Molecular Psychiatry*, 28: 1647–1663.
- Lim, J., McCabe, P., & Purcell, A. (2019). Another tool in my toolbox”: Training school teaching assistants to use Dynamic Temporal and Tactile Cueing with children with CAS. *Child Lang Teaching & Therapy*. 35 (3) 241–256.
- Lim, J. M., McCabe, P., & Purcell, A. (2020). Look at Mumy: challenges in training parents to deliver a home treatment program for childhood apraxia of speech in a rural Canadian community. *Rural and Remote Health*, 20(2), 59-68.
- Lim, J., Allen, M., Allen, J., Burey, M., van Reyk T. & McCabe, P. (2026) Engagement and effectiveness of a telehealth dynamic temporal and tactile cueing treatment program for children with childhood apraxia of speech. *International Journal of Speech-Language Pathology*
- Maas, E. (2024). Treatment for childhood apraxia of speech: Past, present, and future. *Journal of Speech, Language, and Hearing Research*, 67(9S), 3495-3520. https://doi.org/10.1044/2024_JSLHR-23-0023
- Maas, E., Gildersleeve-Neumann, C. E., Jakielski, K. J., & Stoessel, R. (2014). Motor-based intervention protocols in treatment of childhood apraxia of speech (CAS). *Current Developmental Disorders Reports*, 1 197.
- McCabe, P., Thomas, D.C., Choo, J., Heard, R., & Ng, D. (2026). A systematic review and meta-analysis of dose effects in treatment for childhood apraxia of speech. *International Journal of Language & Communication Disorders*.
- Morgan, A. T., Amor, D. J., St John, M. D., Scheffer, I. E., & Hildebrand, M. S. (2024). Genetic architecture of childhood speech disorder: a review. *Molecular Psychiatry*, 29(5), 1281-1292.
- Murray, E., McCabe, P. & Ballard, K.J. (2015). A randomized control trial of treatments for childhood apraxia of speech. *JSLHR*: 58, (3) 669-686.
- Murray, E., McCabe, P. Heard, R. & Ballard, K.J. (2015). Differential diagnosis of children with suspected childhood apraxia of speech. *JSLHR*: 58,(1) 43-60.
- Namasivayam, A. K., Pukonen, M., Goshulak, D., Hard, J., Rudzicz, F& ... Lieshout, P. (2015). Treatment intensity and childhood apraxia of speech. *IJLCD*: 50(4), 529-546.
- Shriberg, L. D., Kwiatkowski, J., & Mabie, H. L. (2019). Estimates of the prevalence of motor speech disorders in children with idiopathic speech delay. *Clinical Linguistics & Phonetics*, 33(8), 679-706.
- Shriberg, L. D., Lohmeier, H. L., Strand, E. A., & Jakielski, K. J. (2012). Encoding, memory, and transcoding deficits in Childhood Apraxia of Speech. *Clinical Linguistics & Phonetics*, 26(5), 445–482.
- Strand, E. A., & McCauley, R. J. (2019). *Dynamic Evaluation of Motor Speech Skill (DEMSS) Manual*. Baltimore, MD: Brookes Publishing.
- Thomas, D. C., McCabe, P., & Ballard, K. J. (2017). Combined clinician-parent delivery of rapid syllable transition (ReST) treatment for childhood apraxia of speech. *IJSLP*: 20(7), 683-698.
- Thomas, D. C., McCabe, P., Ballard, K. J., & Bricker-Katz, G. (2018). Parent experiences of variations in service delivery of ...ReST treatment for childhood apraxia of speech. *Developmental Neurorehab.*, 21(6), 391-401.
- Thomas, D. C., McCabe, P., Ballard, K. J., & Lincoln, M. (2016). Telehealth delivery of Rapid Syllable Transitions (ReST) treatment for childhood apraxia of speech. *IJLCD*: 51(6), 654-671.
- Thomas, D., Murray, E., Williamson, E., & McCabe, P. (2023). Weekly treatment for childhood apraxia of speech with Rapid Syllable Transition Treatment: A single-case experimental design study. *JSLHR*: 1-22.
- Thomas, D. C., Gomez, M., Muis, A., Trezise, N., Williamson, E., Choo, J. X. M., ... & Velleman, S. L. (2026). Caregivers' experiences of assessment and treatment for their child with childhood apraxia of speech: An international questionnaire study. *American Journal of Speech-Language Pathology*, 35(2), 743-762.
- Thomas, D. C., Bricker-Katz, G., Murray, E., Velleman, S. L., & Iuzzini-Seigel, J. (2026). Finding the Right Fit: Caregiver and Clinician Perspectives on Intensive Treatment Schedules for Childhood Apraxia of Speech. *American Journal of Speech-Language Pathology*, 35(4), 1681-1696.
- Williams & Stephens (2009). *The Nuffield Dyspraxia Programme*. Retrieved from <http://www.ndp3.org>
- Yuan, W., Dunn, M., Kennedy, J., & Hsiao, Y. J. (2024). Impact of Speech Generating Device Interventions on Vocalizations of Individuals with Autism and Severe Communication Impairment: A Systematic Review of the Research. *Education and Training in Autism and Developmental Disabilities*, 59(3), 233–256.

* Thanks to Professor Angela Morgan for her comments on the previous version of the causes section of this document.

** Parents and clinicians can always email authors for free copies of their papers.

Contact: tricia.mccabe@sydney.edu.au for more information