

## Evidence Summary - Childhood Apraxia of Speech – July 2022

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

**This evidence summary is only valid until December 2023.**

### Background

Childhood Apraxia of Speech is a severe, permanent and lifelong disorder of speech motor programming and planning which 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 in preschool and primary years should reduce this extended prevalence tail over time however there is emerging evidence that a significant burden of psychosocial, educational, economic and communication deficits remain across the lifespan with resultant restrictions on participation and daily life. CAS speech looks different across the lifespan, with therapy, and when there are other co-occurring conditions.

To date, most people with CAS have an idiopathic diagnosis (unknown cause) however since 2001, more than 40 genetic variations (whole genes and micro duplications and deletions) have been reported as causing CAS. CAS has increased frequency in children and adults with galactosaemia, epilepsy, or Down Syndrome but has no increased prevalence in children with autism above the population prevalence of approximately 1 in 1000 children.

CAS may occur as an isolated disorder or may present in combination with other speech, language, literacy, and developmental disorders. CAS appears to exist in most, if not all, languages and has been documented in at least Arabic, Cantonese, Danish, Dutch, French, German, Italian, Korean, Portuguese, Spanish, Swedish, Tagalog 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.

### Suggested Assessment Protocols in English\*

Younger or more severe speech impairment	Older or milder speech impairment
Single word speech sound inventory – the word list does not have to be standardised but should include at least 50 common words appropriate for age and cultural background with a range of sounds, syllable shapes and number and word shapes.	Single word inventory using at least 30 polysyllabic words appropriate for age, language, accent, and culture and including weak onset word structures. Single and two syllable words can be included
Comprehensive oral musculature structural and functional evaluation.	Comprehensive oral musculature structural and functional evaluation.
Diagnostic evaluation of motor speech skills (DEMSS) or TOCS+ or Nuffield Dyspraxia Programme – 3 <sup>rd</sup> edition assessment	Speech diadochokinesis tasks (e.g. 'peteke')
Hearing assessment prior to speech pathology assessment	Sample of connected speech including polysyllabic words (words of 3 or more syllables)
	Measure of inconsistency such as DEAP, SRT or repeated productions from the single word test used.

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

**Diagnosis** of CAS requires that a child, at a minimum, meets all three ASHA (2007) consensus-based features of CAS:

1. *Inconsistency of consonants or vowels across words and syllables*
2. *Lengthened and disrupted coarticulatory transitions (which may be slow, distorted or staccato speech for example)*.
3. *Inappropriate prosody (usually lexical stress errors).*

Many researchers also use the Mayo-10 checklist which requires children to have at least 4/10 of the features listed across three speech tasks (Shriberg et al 2011). Clinically, moderate-profound CAS in young children (aged 3-7) can also be diagnosed using the DEMSS assessment tool (Strand et al, 2019). For a diagnosis of CAS to be accurate, children need to have a clear intent to communicate regardless of age or severity. Slow progress in speech therapy is not diagnostic of CAS. There are no clear diagnosis guidelines for adolescents or adults yet.

**Severity of CAS** has not been formally defined within the literature 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 and syllable structures) in comparison 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 two sources (ASHA, 2007 and Shriberg, et al 2010).
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.

### **Treatment**

Until 2015 there were no randomised control trials in treatment of CAS. Murray, et al (2015) reported an RCT comparing the Nuffield Dyspraxia Programme (3rd ed; NDP3) with Rapid Syllable Transition Treatment (ReST). Both treatments were effective in changing the speech of children aged 4-12 with CAS. NDP3 had better immediate effect and ReST had better long-term effect. Both treatments are therefore currently recommended when delivered as per the RCT (ie 4 days per week for 3 weeks @ 1 hour per day). Work is underway on RCTs evaluating other CAS treatments (DTTC, ultrasound, speech motor chaining).

Three systematic reviews have been conducted in the past 8 years. The first two (Murray et al 2014 and Maas, et al 2014) examined a broad range of treatment evidence for a range of quality measures. The most recent (Morgan et al., 2018) provides a critique of the current state of the research evidence. Murray et al recommended clinicians use:

1. **Rapid Syllable Transition Treatment (ReST)** – [www.rest.sydney.edu.au](http://www.rest.sydney.edu.au)
2. **Nuffield Dyspraxia Programme 3<sup>rd</sup> edition (NDP3)**
3. **Dynamic Temporal and Tactile Cueing (DTTC)** [//childapraxiatreatment.org/diagnosis-and-treatment-of-cas-online-course/](http://childapraxiatreatment.org/diagnosis-and-treatment-of-cas-online-course/)
4. **Integrated Phonological Awareness (IPA)** - [www.canterbury.ac.nz/education/research/phonological-awareness-resources/](http://www.canterbury.ac.nz/education/research/phonological-awareness-resources/)

From this list, ReST and IPA are suitable for less severe and/or older children. DTTC and NDP3 are more suitable for younger and/or more severe children. Resources and clinician training for ReST, IPA and DTTC are freely available on the internet and NDP3 is a kit which can be purchased from the UK. Maas and colleagues (2014) examined the treatment research to determine likely treatment approach and dose: on average effective treatment requires 2-6 sessions per week for an undescribed maximum (more than 1 year). In addition to these treatments, Maas (2014) also included:

5. **Ultrasound biofeedback** [speechproductionlab.syr.edu/resources/ultrasound-biofeedback/](http://speechproductionlab.syr.edu/resources/ultrasound-biofeedback/)

This is more suitable for primary school aged and older children with milder speech issues. Ultrasound biofeedback is beyond the scope of many clinicians due to costs of equipment.

**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 studies of children who clearly had CAS.

Effective treatment for children with CAS and comorbid communication disorders needs to consider both evidence for CAS treatment and for their other disorder. For example, a child with dysarthria and CAS may benefit from DTTC or ReST both of which have evidence of efficacy with both disorders.

### **Telehealth treatment**

Several treatments have been tested via telehealth (ReST, DTTC) and been effective. As with all other modes of treatment, sufficient and intense treatment is required to ensure a treatment effect (Thomas et al 2016; Maas et al 2022).

### Treatment Intensity

The CAS treatment evidence shows that therapy 4 times a week in blocks of 12-16 sessions followed by a 4-6 week break from therapy is optimal (Murray et al, 2015). All studies to date have showed that the greater the treatment intensity the more effective the therapy and the more efficient the progress (e.g., Edeal et al, 2012). A minimum of two sessions a week has been shown to work clinically (e.g., Namasivayam et al, 2015; Thomas et al, 2014). Session length ideally should be 45-60 minutes but will depend on both the child and the treatment selected.

### Group Therapy

There is no evidence for any group treatment being trialed in any level of research with any child 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 comorbid conditions.

### Treatment in Languages other than English

Most treatment research has been conducted in English however some treatments (e.g., DTTC, ReST) have been shown to be effective, with minor modifications in other languages including Portuguese, Spanish, Italian, Dutch, Swedish, Finnish, Danish and Korean. There is no theoretical reason why treatments for CAS based on a motor-speech approach should not work in other languages however, since stress is language specific, treatments should be modified for the new language.

### 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 have provided therapy. Two studies (Thomas et al 2017; Lim 2020) have trialed parent delivered therapy with limited success and it is not recommended. One study (Lim et al, 2019) trained teacher's aides providing DTTC therapy and was moderately successful. Most high quality interventions have not included home practice due to the intensity of the sessions.

### References

- American Speech-Language-Hearing Association. (2007). Childhood Apraxia of Speech [Technical Report]. Available from [www.asha.org/policy](http://www.asha.org/policy).
- Edeal, D. M., & Gildersleeve-Neumann, C. E. (2011). The importance of production frequency in therapy for childhood apraxia of speech. *American Journal of Speech-Language Pathology*, 20(2), 95-110.
- Lim, J., McCabe, P., & Purcell, A. (2019). Another tool in my toolbox<sup>®</sup>: Training school teaching assistants to use Dynamic Temporal and Tactile Cueing with children with Childhood Apraxia of Speech. *Child Language Teaching and Therapy*, 35 (3) 241-256.
- Maas, E., Gildersleeve-Neumann, C. E., Jakielski, K. J., & Stoeckel, R. (2014). Motor-Based Intervention Protocols in Treatment of Childhood Apraxia of Speech (CAS). *Current Developmental Disorders Reports*, 1 197.
- Morgan, A. T., Murray, E., & Liégeois, F. J. (2018). Interventions for childhood apraxia of speech. *Cochrane Database of Systematic Reviews*, 2018 (5).
- Murray, E., McCabe, P. & Ballard, K.J. (2015). A Randomized Control Trial of Treatments for Childhood Apraxia of Speech. *Journal of Speech, Language and Hearing Research* 58 (3) 669-686.
- Murray, E., McCabe, P., Heard, R. & Ballard, K.J. (2015). Differential Diagnosis of children with suspected Childhood Apraxia of Speech. *Journal of Speech, Language and Hearing Research* 58, (1) 43-60.
- Murray, E., McCabe, P., & Ballard, K. J. (2014). A Systematic Review of Treatment Outcomes for Children with Childhood Apraxia of Speech. *American Journal of Speech-Language Pathology*, 23(3), 486-504.
- Namasivayam, A. K., Pukonen, M., Goshulak, D., Hard, J., Rudzicz, F& ... Lieshout, P. (2015). Treatment intensity and childhood apraxia of speech. *International Journal of Language & Communication Disorders*, 50(4), 529-546.
- Preston, J.L., Brick, N., & Landi, N. (2013). Ultrasound biofeedback treatment for persisting childhood apraxia of speech. *American Journal of Speech Language Pathology*. 22 627-43.
- Shriberg, L. D., Potter, N. L., & Strand, E. A. (2011). Prevalence and phenotype of childhood apraxia of speech in youth with galactosemia. *Journal of Speech, Language, and Hearing Research*, 54(2), 487-519.
- Strand, E. A., & McCauley, R. J. (2019). Dynamic evaluation of motor speech skill (DEMSS) manual. Paul H. Brookes Publishing Co.
- Thomas, D. C., McCabe, P., & Ballard, K. J. (2014). Rapid Syllable Transitions (ReST) treatment for Childhood Apraxia of Speech: The effect of lower dose-frequency. *Journal of Communication Disorders*, 51, 29-42.
- Thomas, D. C., McCabe, P., & Ballard, K. J. (2017). Combined clinician-parent delivery of rapid syllable transition (ReST) treatment for childhood apraxia of speech. *International Journal of Speech-Language Pathology*, 20(7), 683-698.
- Thomas, D. C., McCabe, P., Ballard, K. J., & Bricker-Katz, G. (2018). Parent experiences of variations in service delivery of Rapid Syllable Transition (ReST) treatment for childhood apraxia of speech. *Developmental Neurorehabilitation*, 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. *International Journal of Language & Communication Disorders*, 51(6), 654-671.