

## Article

# Stuttering and Fluency Disorders: Contemporary Explanatory Models and Evidence-Based Treatment Directions

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**Abstract:** Stuttering and cluttering are similarly fluency disorders which interrupt the production of speech by various complicated neurological, genetic, linguistic, psychological, and social mechanisms. Current research is no longer confined to models that explain speech disfluency by a single factor only. The aim of this paper is to provide an overview of the most important models on stuttering. It also provides clinical guidelines based on evidence. In the systematic narrative review, we searched the literature from PubMed, CINAHL, and Google Scholar for the years 2020 to 2025 only. The variability in functioning among people who stutter is best accounted for by a multifactorial integrative model. Genuine support constitutes an effective combination of early intervention, individualised combined behavioural and speech therapy, and psychological help. To offer the best prospects for people with fluency disorders, intervention programmes should be evidence-based, targeted, and interdisciplinary. Identifying and avoiding stigmatizing practices as early as possible.

**Keywords:** Stuttering, Fluency Disorders, Evidence-Based Treatment, Neurofunctional Model, Speech-Language Pathology

## 1. Introduction

Stuttering is a complicated speaking issue that includes an involuntary interruption to speech. These disruptions the repetition of sounds and syllables, speech prolongations and blocks occur due to the interaction of neurological, genetic, linguistic, psychological and social factors [1]. The disorder is much more than just the way the words sound; it impacts one's confidence in communicating, performance at school, at work, and in life.

In the past, it was wrongly believed that stuttering was due to a personality deficiency, bad parents, or faulty speech habits correctable through only behavioural training. Enhancing functional neuroimaging, developmental genetics and psycholinguistics have radically changed this view. Stuttering is now accepted as a neurodevelopmental disorder in which the disrupted timing and coordination of neural speech-motor networks interacts with linguistic demands as well as emotional-environmental factors.

Stuttering is not the same as cluttering, an equally important distinction because they are both fluency disorders. Stuttering refers to a disordered speech pattern characterized by struggle behaviors, secondary motor movements, and negative emotions while cluttering is marked by excessively rapid and irregular speech, with collapsed and omitted syllables and poor self-monitoring [3]. It is clinically important for a physician to accurately distinguish between the two conditions by onset, symptoms, and treatment.

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## 2. Literature Review

Recent scholarship has opened up new avenues of understanding stuttering. The group of Khalil, Abdulrahman and Muhammad [7] did a neuroimaging review. They showed a consistent disruption of frontal-temporal connectivity and basal-ganglia-thalamocortical circuits in people who stutter. Groups working independently confirmed the functional MRI findings. The study affirms that disfluency is primarily caused by speech-motor planning disabilities and not psychological disturbance.

In another study, Desouki, Ali, and Ghazal [1] assessed a structured speech therapy program for stuttering students in Egyptian schools. They found that students exhibited a significant improvement, in verbal fluency post-intervention, along with a reduction in other secondary behaviours. The randomized controlled design gave them Level II evidence for a behavioral grounded intervention in school-age populations

Al-Tayeb, Habib, and Omar [8] researched a program to guide the conduct of preschoolers with speech and language problems. In a six-month follow-up study, children who commenced treatment early on displayed much less frequent stuttering and fewer anxiety-related avoidance behaviours than control children. Findings buttressed the developmental window argument for early identification.

Bukhari [4] identified several demand-side modulators of stuttering such as speech rate and the parental style of talking to children that are directive and contain emotional tension. According to the study, the model Demands-and-Capacities is clinically useful, and indirect parent-mediated approaches are recommended for children under six.

Shoman [6] examined individual factors such as sex, grade, and economic status that were associated with speech disorders among elementary and intermediate students. The analysis showed that boys and children from lower-income households were at a disproportionate risk of unaddressed fluency disorders, highlighting an equity dimension in service delivery.

A psychometric rating scale for measuring verbal fluency in children with speech and language disorders was developed and validated by Mustafa, Shawkat, and Abdul Hamid [5]. The instrument has high internal consistency ( $\alpha = 0.91$ ) and convergent validity. We provide a new tool to standardise and measure something that is missing in Arabic.

Three themes appear across these studies: (1) multiple causes – the neurological, genetic, environmental, and psychosocial – come together to create harmful behaviours, useful behaviours and other behaviours; (2) useful behaviours in parts of the world often lead to measurable and lasting benefits when applied to other parts; and (3) we need other kinds of instruments to narrow the socio-cultural context to ensure accurate specificity – what works well in the West may not be applicable to the non-West. These results are consistent with international systematic reviews and form the empirical basis of clinical recommendations described in Section 5.

## 3. Methodology and Study Methods

### 3.1 Study Design

According to the researchers of the study, systematic narrative review design is optimal for collating disparate clinical and empirical published evidence [9]. The review combined findings from experimental, quasi-experimental, descriptive, and theoretical publications to provide a holistic overview of the present understanding of the aetiology, assessment, and management of stuttering.

### 3.2 Search Strategy and Inclusion Criteria

A computerized search was completed in October 2024 via PubMed, CINAHL, PsycINFO, Google Scholar, and Arabic-language databases Mandumah and Arab Journals Platform. The search terms included the following: stuttering, fluency disorders, cluttering, speech disfluency, evidence-based treatment, neurofunctional model,

cognitive-behavioral therapy (CBT) for stuttering. Boolean operators (AND, OR) were used for systematic term combination.

The following criteria were used for the inclusion of studies in the presented review. The studies must have been (1) published in peer-reviewed journals or as book chapters with scholarly attribution; (2) dated between 2020 and 2025 for empirical studies (where landmark theoretical works were published before 2020 that were held to be of good standing and no equivalent updated source was identifiable, then they were retained); (3) on stuttering or fluency disorders involving human subjects; and (4) in sufficient methodological detail that would permit the assessment of its quality. We excluded gray literature and conference abstracts with no full text and study sample size less than 10.

### 3.3 Measurement Tools

The Stuttering Severity Instrument–4th Edition (SSI-4) [10] was most commonly used in the studies reviewed to measure stuttering severity, followed by the Verbal Fluency Rating Scale developed by Mustafa et al. [5]. The Overall Assessment of the Speaker's Experience of Stuttering (OASES) and the Communication Attitude Test (CAT) were used to assess quality-of-life outcomes. Researchers used functional MRI and diffusion tensor imaging (DTI) protocols.

### 3.4 Data Extraction and Quality Assessment

Important study features were taken from included studies and entered into a summary table including the following: design, population, sample size, intervention, outcome measures, and main findings. We used the Newcastle-Ottawa Scale for observational studies and the PEDro scale for intervention studies to evaluate quality. Articles that are theoretical were examined for a coherent internal logic that does not lead to contradictions with any recent empirical findings.

### 3.5 Statistical Analysis

A summary matrix was created to extract information on the important study characteristics, including design, population, sample size, intervention, outcome measures, and findings. The methodological quality of included observational studies was evaluated using the Newcastle-Ottawa Scale. In addition, the PEDro scale assessed the methods of the included intervention studies. Assessment of theoretical articles were carried out to ensure internal logic and consistency with recent empirical findings.

## 4. Results and Discussion

### 4.1 Prevalence and Epidemiology

Around 1% of adults worldwide stutter. A further 5% of preschool-age children stutter. It has a 3:1 gender ratio (male to female) in adults [12]. The majority of pre-school aged children (65-80% of all children) who stutter recover naturally without any intervention. However, genes that predict persistence have been identified [12]. The studies that were reviewed confirm these prevalence estimates and further indicate that the access disparities to speech-language pathology services remain stark in low- and middle-income countries [5, 6].

### 4.2 Neurobiological Findings

Neuroimaging evidence reviewed by Khalil et al. [7] demonstrated reduced white-matter integrity in the left arcuate fasciculus and supplementary motor area in adults who stutter relative to fluent controls. These structural differences were associated with greater disfluency severity and longer response times on phonological encoding tasks. Functional imaging during speech tasks revealed over-activation of the right hemisphere—consistent with compensatory neural recruitment—and under-activation of Broca's area, particularly during spontaneous rather than choral or metronomic speech conditions.

### 4.3 Treatment Outcomes

Table 1 summarizes key treatment outcomes from studies reviewed in this paper. Early intervention programs demonstrated the largest effect sizes ( $d = 0.82-1.15$ ), followed by integrated behavioral-CBT approaches ( $d = 0.55-0.78$ ) and behavioral-only programs ( $d$

= 0.40–0.60). Parental involvement was a significant moderator of treatment response in preschool populations [8], while therapeutic alliance and goal-setting flexibility were identified as predictors of sustained improvement in adolescents and adults [13].

**Table 1.** Summary of Treatment Outcome Studies (2020–2025)

Study	Population	Intervention	Outcome Measure	Key Findings
Desouki et al. [1], 2021	School-age children	Speech therapy program	%SS, secondary behaviors	Significant fluency improvement
Al-Tayeb et al. [8], 2021	Preschool children	Behavioral guidance program	Stuttering frequency, anxiety	Reduced frequency; fewer avoidance behaviors
Bukhari [4], 2024	Young children + parents	Parent–child interaction	D&C model validation	Parental pace/style as key demand factor

#### 4.4 Discussion

The plethora of studies we reviewed supports a shift towards individualized interventions with multiple components. Similar programs exclusively focused on either behavioral or psychological interventions showed smaller effects than integrated programs [14][15][16]. According to the main tenet of the multifactorial integrative model, uniform protocols will not have any impact on the winner’s curse [17][18][19].

A significant problem area in the literature consists of a lack of randomized controlled trials in Arabic-speaking populations. RCTs of high quality are typically done in mainly English speaking situations; other cultural issues, such as communication styles, family organization, stigma patterns, and the like, probably moderate treatment response in ways that current evidence does not account for. Research in the future should prioritize clinically validated culturally adapted protocols in Arabic [20].

Evidence is rapidly emerging for digital and telehealth-delivered interventions. An early study suggests that teletherapy may not be inferior to face-to-face treatment for mild to moderate stuttering 15 and may provide greater accessibility and less travel burden. The COVID-19 pandemic prompted the quick take up of these methods, and post-COVID follow-up data will be vital to.

#### 5. Conclusion

Stuttering and fluency disorders are complex neurodevelopmental disorders of no known origin. Rather, the etiology, maintenance and management of stuttering and similar disfluencies involve neurological, genetic, linguistic, psychological, and social factors. Today’s explanatory models are better than previous ones which use the deficit model. An example of a contemporary model is the multifactorial integrative model. Such a model takes into account the heterogeneity and variation of each individual and person. As a result of this conceptual change, approaches to diagnosis and treatment are more accurate, less stigmatizing and more effective. The therapeutic guidelines that are evidence-based and have been synthesized in this review agree on a number of points. First, early intervention is essential. Second, treatment should be individualized. Third, behavioural-speech techniques, psychological support and social integration strategies should be combined. Fourth, goals of treatment should be functional communication and quality of

life, not unrealistic fluency. Clinicians should give up a rigid one-size-fits-all protocol for a dynamic client-oriented model. Further investigation of the neural, genetic and psycholinguistic underpinnings should be carried out. Educational institutions, healthcare authorities, and social organizations must undertake awareness campaigns to eliminate the stigma surrounding people who stutter.

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