

# Clinical and Immunological Characteristics of Cognitive Disorders in Children with Delayed Speech Development

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**Abstract** Ninety children aged 3–7 years were examined and stratified into two groups. The first group consisted of children with delayed speech development (DSD) in combination with attention-deficit/hyperactivity disorder (ADHD), while the second group included children with DSD due to residual-organic brain lesions (ROL). Children with DSD associated with ADHD demonstrated a significantly higher speech development coefficient ( $24.9 \pm 3.9$ ) compared with those with residual-organic brain pathology ( $17.7 \pm 6.7$ ;  $p < 0.001$ ). This finding suggests a more favorable functional prognosis in cases of predominantly functional speech impairment. Conversely, children with residual-organic brain lesions exhibited more severe neurological and cognitive deficits, reflecting delayed cerebral maturation and decreased functional activity of cortical structures.

**Keywords** Delayed speech development, ADHD, Residual-organic lesions, Children, Speech function, Cognitive development

## 1. Introduction

In contemporary pediatric neurology, delayed speech development (DSD) is regarded as one of the most prevalent neuropsychological disorders of early childhood. Speech acquisition represents a complex, multilevel, and multifactorial process that relies on physiological mechanisms and is closely influenced by social, cultural, and psychological factors [7,9].

Speech development is particularly vulnerable to adverse influences, and its impairment often leads to substantial consequences, including difficulties in cognitive functioning and communicative activity, as well as deviations in neuropsychological and social development. These effects are especially pronounced in early childhood, a critical period during which the foundational mechanisms of speech are formed and determine its subsequent maturation [2,4].

In recent years, speech disorders in children have become a major concern for professionals across multiple disciplines, including pediatric neurologists, speech therapists, psychologists, and educators. This heightened attention is обусловлено not only by the increasing prevalence of DSD but also by the challenges associated with its early identification and timely intervention. According to various studies, the prevalence of delayed speech development in children ranges from 5% to

25% [1,6].

From an etiological perspective, DSD may arise from both organic and functional causes. Organic factors primarily include perinatal central nervous system injury, traumatic brain damage, neuroinfections, cerebral palsy, epilepsy, neurosensory hearing loss, and other pathological conditions. These disorders affect brain structures involved in the regulation of motor and cognitive functions, thereby impeding normal speech development [3,7,8].

Conversely, functional forms of delayed speech development are more frequently associated with unfavorable psychoemotional environments, impaired parent–child communication, limited linguistic stimulation, and pedagogical neglect [2,5].

### Purpose of the Research

The objective of this study was to characterize the clinical and neurological features of delayed speech development (DSD) in children, to examine the association between the etiology of speech delay and neurological status, and to identify prognostic indicators distinguishing functional from organic speech disorders. Additionally, the study sought to define clinical criteria that may support early diagnosis and timely therapeutic intervention, thereby enhancing the effectiveness of neurodevelopmental rehabilitation in affected children.

Objective is to identify the clinical and neurological characteristics of delayed speech development in children and to assess the relationship between the type of speech disorder and neurological status across different etiological forms.

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## 2. Materials and Methods

The study was carried out at the clinic of the Tashkent Pediatric Medical Institute. Ninety children aged 3–7 years diagnosed with delayed speech development were examined. The participants were equally allocated into two groups.

Group I (n = 45; 50%) comprised children with delayed speech development (general speech underdevelopment, level II) associated with attention-deficit/hyperactivity disorder (ADHD).

Group II (n = 45; 50%) included children with delayed speech development (general speech underdevelopment, level II) resulting from residual-organic brain lesions (ROL).

In addition, a control group consisting of 15 age- and sex-matched children without speech impairments was included in the study.

## 3. Results

To characterize the age and sex distribution of the examined children, both clinical groups were analyzed according to these variables (Table 1). The resulting data made it possible to identify the age periods in which delayed speech development was most prevalent and to assess potential differences between children with ADHD-associated and residual-organic forms of speech delay.

**Table 1.** Distribution of examined children by age

Age	ADHD n = 45				ROL n = 45			
	Boys n = 25		Girls n = 20		Boys n = 27		Girls n = 18	
	abs	%	abs	%	abs	%	abs	%
3 years	8	32,0	6	30,0	7	25,9	4	22,2
5 years	10	40,0	5	25,0	11	40,7	8	44,4
7 years	7	28,0	9	45,0	9	33,3	6	33,3

– Differences are statistically significant (p < 0.05)

In both groups, boys predominated over girls, which corresponds with literature data indicating a higher incidence of speech disorders in males due to greater vulnerability of immature brain structures during early ontogenesis.

By age distribution, the largest number of cases in both the ADHD and ROL groups was observed at age 5 (40–44%), which corresponds to the period of active development of grammatical and phonetic speech components. At this age,

speech defects become most noticeable and can be reliably diagnosed.

Among 3-year-olds, the frequency of DSD was lower (approximately 25–32%), which may be explained by the early detection stage and the absence of clearly formed speech norms. By age 7, the number of children with speech delay decreased, likely due to partial compensation and the effects of corrective therapy.

To assess the degree of speech development, the speech development coefficient was calculated based on expressive and receptive speech indicators, vocabulary, and grammatical skills.

The highest speech development coefficient was observed in children with DSD associated with ADHD (24.9 ± 3.9), indicating a primarily functional nature of speech impairment. In such cases, preserved intellectual and motor potential enables compensation of speech delay when timely corrective interventions are applied.

In children with residual-organic brain lesions, the coefficient was significantly lower (17.7 ± 6.7; p < 0.001), reflecting pronounced neurodynamic disturbances, delayed cortical maturation, and persistent cognitive deficits.

The findings demonstrate that in children with organic CNS damage, speech function develops more slowly and requires long-term, multidisciplinary rehabilitation. In contrast, DSD associated with ADHD is typically of a functional–discoordinative nature and responds well to neuropsychological and speech therapy methods.

## 4. Discussion

Children whose delayed speech development is associated with attention deficit hyperactivity disorder demonstrate a significantly higher speech development coefficient (24.9 ± 3.9) than children with residual-organic brain damage (17.7 ± 6.7), which indicates a more favorable functional prognosis in non-organic forms of DSD. In contrast, children with organic cerebral lesions show more severe neurological and cognitive deficits, reflecting delayed cortical maturation and decreased functional activity of brain structures. Timely identification of speech delay and early corrective interventions play a key role in improving rehabilitation outcomes and in preventing the development of persistent speech and cognitive impairments.

**Table 2.** Speech Development Coefficient in Children with ADHD and Residual-Organic Lesions

Indicators	Patient Group	M ± SD	95% CI	N	P
Speech Development Coefficient	Attention Deficit Hyperactivity Disorder	24,9 ± 3,9	24,2 – 25,6	45	< 0,001
	Residual-Organic Lesions	17,7 ± 6,7	16,6 – 18,9	45	

## 5. Conclusions

Children with delayed speech development in the context of attention deficit hyperactivity disorder have a significantly higher speech development coefficient ( $24.9 \pm 3.9$ ) compared with children suffering from residual-organic brain lesions ( $17.7 \pm 6.7$ ), which points to a more favorable functional prognosis in non-organic variants of DSD. Conversely, organic brain pathology is associated with more pronounced neurological and cognitive disturbances, indicating delayed cortical maturation and reduced functional activity of cerebral structures. Early detection of speech delay and timely implementation of corrective interventions are crucial for enhancing rehabilitation effectiveness and for preventing the persistence of speech and cognitive deficits.

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