

How Young Children Learn Language and Speech

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Practice Gaps

To prevent delays and provide effective clinical care to children with disorders of language and speech, pediatric clinicians must become familiar with prevailing theories, evidence, and recommendations of professional organizations. Pediatricians should not postpone evaluation or treatment of language and speech delays for boys, children from bilingual environments, second- or third-born children, or children with chronic otitis media with effusion.

Objectives After completing this article, readers should be able to:

1. Apply current theories regarding how young children learn language and speech to accomplish primary prevention of language and speech disorders.
2. List key milestones of typical language development and indicators of high-risk status for language or speech disorders to assist in early detection of disorders.
3. Justify the use of both general and autism-specific screening tools for screening language and speech disorders.
4. Discuss primary and secondary causes of language and speech disorders to develop strategies for secondary prevention.
5. Evaluate the intensity and nature of speech-language pathology therapy to treat children with language and/or speech disorders as part of secondary and tertiary prevention.

Abstract

Pediatric clinicians are on the front line for prevention of language and speech disorders. This review uses prevailing theories and recent data to justify strategies for prevention, screening and detection, diagnosis, and treatment of language and speech disorders. Primary prevention rests on theories that language learning is an interaction between the child's learning capacities and the language environment. Language learning occurs in a social context with active child engagement. Theories support parent education and public programs that increase children's exposure

AUTHOR DISCLOSURE Dr Feldman has disclosed no financial relationships relevant to this article. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

ABBREVIATIONS

AAC assistive and augmentative communication
SLI specific language impairment
SES socioeconomic status

to child-directed speech. Early detection of delays requires knowledge of language milestones and recognition of high-risk indicators for disorders. Male sex, bilingual environments, birth order, and chronic otitis media are not adequate explanations for significant delays in language or speech. Current guidelines recommend both general and autism-specific screening. Environmental and genetic factors contribute to primary language and speech disorders. Secondary and tertiary prevention requires early identification of children with language and speech disorders. Disorders may be found in association with chromosomal, genetic, neurologic, and other health conditions. Systematic reviews find that speech-language therapy, alone or in conjunction with other developmental services, is effective for many disorders. Speech-language interventions alter the environment and stimulate children's targeted responding to improve their skills.

INTRODUCTION

Learning language seems like a monumental task for the young child. The world's languages contain thousands of words that can be combined to convey an infinite number of meanings. Children are born without knowing which of the world's languages they must learn. If born in Brazil, they must learn Portuguese; if born in the Philippines, they must learn Tagalog. If born in Belgium or Quebec, or into an immigrant or refugee family, they may need to learn 2 different languages simultaneously. Despite these challenges, most children acquire the fundamentals of language effortlessly in the toddler and preschool years, without formal instruction or explicit feedback. By age 5 years, they have a vocabulary of thousands of words; create sentences with complex grammatical features; differentiate literal from nonliteral meanings, such as humor or metaphor; observe the social conventions of conversation; and apply language skills in the service of learning to read. By age 8 years, their speech sound inventory is mature.

Variation in the rate and efficiency of language development is substantial. Approximately 16% of children experience delays in the initial phases of language learning, and approximately half of those children show persistent difficulties. (1) In children age 3 to 5 years, speech and language impairment is the most prevalent eligibility criterion that warrants enrollment in special education preschool services (Fig 1). (2) Among school-age children, the category of learning disabilities, often a late manifestation of language and speech disorders, predominates as the eligibility criterion for special education; however, speech-language impairment ranks second. Deficits in language or speech that are sufficiently severe to interfere with daily functioning,

including learning, communication, and/or social interactions, meet the criteria for a disability.

Pediatric clinicians are on the front line for primary, secondary, and tertiary prevention of language and speech disorders. (3) Primary prevention, such as immunizations, prevents the condition from ever occurring. Secondary prevention requires early detection and treatment of a disorder to result in a milder variant than would have

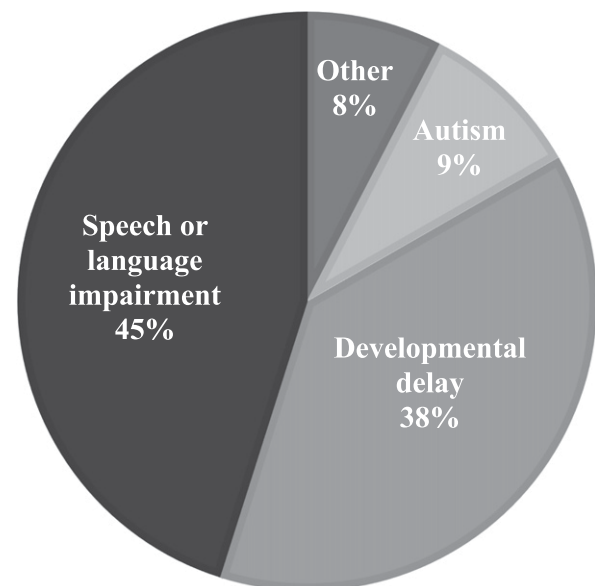


Figure 1. Among the more than 750,000 children in the United States age 3 to 5 years in 2016 who were enrolled in special education services, this pie chart shows the percentages found eligible for services based on speech-language impairment, autism, developmental delays, and other criteria. Speech-language impairment is the most common reason that children are deemed eligible for preschool special education services.

occurred otherwise. Tertiary prevention may not change the disorder but improves functional outcomes of affected children. The overriding objective of this review is to empower pediatric clinicians with prevailing theories, recent evidence, and recommendations to be used to promote primary, secondary, and tertiary prevention of language and speech disorders.

DEFINITIONS

Language is the distinctly human form of communication that binds human social groups. Language uses arbitrary but socially agreed on signals (words and sentences) in a rule-governed system to convey meaning. Unlike animal communication, human language uses signals creatively to communicate beyond the here and now, allowing discussion of past or future events and abstract, hypothetical, or imaginary ideas. Speech is the usual output of the language system, created by the complex and coordinated movements of respiratory, laryngeal, velopharyngeal, and oral structures. Other outputs include sign languages and written languages. Language is subdivided into receptive (ability to understand) and expressive (ability to produce) components. Language is further thought to comprise interacting subsystems: phonology (the system of speech sounds), lexicon (vocabulary), syntax (grammar), semantics (meaning), and pragmatics (social aspects of language that consider the speaker and the context). Speech is also composed of subsystems: articulation (speech sounds), voice and resonance, and fluency.

PRIMARY PREVENTION

Language learning is a product of the interaction between the child's learning capacities and the language environment. (4) Insights about how young children learn language derive from computer simulation models based on "parallel distributed processing" or "connectionist frameworks" that are designed to mimic characteristics of human brain structure and function. (5) Basic processing units in these models are simple and highly interactive, analogous to neurons in the brain. Units that become active simultaneously develop connections, and connections that occur in unison form networks. Knowledge is conceptualized as patterns of activity within the network; learning represents changes in the patterns of activity within and across networks. Importantly, networks do not require any initial biases or built-in organization to become organized. Rather, they organize based on experiences in the environment. These models can explain how infants learn whatever language they are exposed to. These models have also been found to further explain many of the phenomena of language

learning, such as how children learn to correctly conjugate both regular verbs and irregular verbs. (5)

A challenge for the infant is segmenting the sound stream into meaningful units, such as words, that serve as inputs for learning. Children use "statistical learning" for this purpose. Statistical properties of sound sequences vary. For example, sounds that occur within words have a higher frequency of co-occurrence than sounds that occur between words. Infants as young as age 8 months unconsciously detect these distributional statistical properties and use them to segment the continuous sound stream into wordlike units. (6) Sequential statistical learning also allows the young child to detect sequential ordering and co-occurrence of words within sentences to explain the acquisition of syntax. (7) Moreover, infants and children can take advantage of statistics of word referent co-occurrences to learn the meanings of words. (8) Statistical learning is facilitated when parents use child-directed language, colloquially known as *baby talk*. Child-directed language is characterized by limited vocabulary, short sentences, multiple repetitions, relatively few errors, and exaggerated intonation. (9)

An important ingredient for language learning is the social context. Early language learning requires human interactions; televisions and computers are not sufficient. Warm, mutually respectful, low-stress exchanges between infants and competent language users (adults or other children) facilitate learning. Language learning requires the child's active engagement with the input. Children must monitor the input, detecting, for example, differences between what they heard and what they might have said or what they thought a word meant. Recognition of the discrepancy helps children progress in learning semantics and syntax. Talking about what a child is doing or expanding what a child has just said facilitates the child's active engagement.

Another challenge for the infant is learning to map speech perception to speech production. (10) Most of the structures that generate speech sounds in the vocal tract are hidden from view. "Mirror neurons" that fire both when an individual performs an action and when the individual perceives others performing the same action are plausible mechanisms for linking perception to production. Human mirror neuron populations seem to be clustered in several cortical areas in the brain, including the prefrontal cortex, that are often implicated in language use. (10)

Primary prevention of language and speech delays or disorders may be achieved by providing children with a rich language environment within positive social relationships. Therefore, recommendations that primary care clinicians can give to parents of infants and young toddlers are as follows:

- Speak often to infants and young children. Baby talk—the use of simple sentences with exaggerated intonation—is well suited to children's learning needs.

- Use language to describe or explain what a young child is doing or to expand what a child has just said to engage the child for language learning.
- Use language during social interactions, such as reading books and playing. Reading is associated with more language input than meals, baths, or play. (11)
- Limit screen time (12) in favor of active social interactions.
- Support public policy initiatives that provide education to parents about language learning, such as nurse home visiting programs, or that support effective language environments for children, such as publicly funded universal preschools.

Reach Out and Read (<http://reachoutandread.org/>) is a program for primary care offices that provides books to families and counseling on the importance of reading to children. It represents a strategy for modeling as well as counseling on the importance of language and reading.

EARLY DETECTION OF LANGUAGE AND SPEECH DELAYS

Early detection of language and speech delays is predicated on knowledge of the pattern of development. Table 1 documents milestones in the development of language and speech from infancy to age 8 years. Children produce their first words at approximately age 1 year. Initial lexical growth is slow, approximately 1 to 2 words per week. Once the vocabulary reaches approximately 50 words, the pace of development accelerates. Lexical growth increases to 1 to 2 new words per day, and children begin combining words into 2-word phrases. The “vocabulary spurt” has been attributed to biological factors, such as myelination of white matter language pathways. (13) An increase in the pace of learning also conforms to self-organization of a neural network. (5) Between ages 2 and 4 years, children build their lexicon and grammatical skills. Patterns of development vary across children, most likely as a function of their experiences in the environment. By school age, all of the fundamentals of language are typically mastered. Children may still show immaturities in motor speech skills to age 8 years, but intelligibility at school age should be approximately 100%.

Developmental surveillance may detect children at high risk for disorders in language and speech. Surveillance uses all clinical approaches (history, physical and neurologic examinations, observations) at all health supervision visits. “Red flags” (Table 2) are delays or differences that indicate a high prevalence for persistent disorders, and they should prompt an evaluation.

The American Academy of Pediatrics recommends developmental screening with a validated instrument at

least at ages 9, 18, and 24 to 30 months. (14)(15) Screening establishes whether a nonsymptomatic or presymptomatic child is at high or low risk for a language or speech disorder. A 2-step screening process is important. The first step should use a general screening instrument, such as the commercially available Parents’ Evaluation of Developmental Status (<http://www.pedstest.com/>) or Ages and Stages Questionnaires, Third Edition (<http://agesandstages.com/products-services/asq3/>), or other tools that have been developed for use in low- and middle-income countries. (16)(17) The second screen establishes the risk of autism spectrum disorder using an instrument such as the Modified Checklist for Autism in Toddlers, Revised with Follow-up. (18) Both screens are important. Autism screening alone may not be sufficient for establishing risk of language and speech disorders, which are more prevalent than autism (Fig 1). Autism screening may detect some children missed on global screens.

Screening is not necessary when the child is known to have delays; has another condition associated with language or speech disorder, such as hearing loss or preterm birth (see later herein); or is enrolled in therapy for language or speech. In such cases, further description of the child’s strengths and difficulties may be useful for monitoring the child’s progress. The following commercially available instruments could be used in such situations in the clinical setting:

- MacArthur-Bates Communicative Development Inventories (<https://mb-cdi.stanford.edu/>), parent-report instruments for children age 8 to 37 months.
- Language Development Survey (<http://www.aseba.org/?s=Language+Development+Survey&id=m>), a parent-report instrument for children age 18 to 35 months.
- The Clinical Linguistic and Auditory Milestone Scale of The Capute Scales (<http://www.brookespublishing.com/resource-center/screening-and-assessment/the-capute-scales/>), a combination of direct assessment and parent report for children birth to 36 months old.
- Communication and Symbolic Behavior Scales Developmental Profile Infant-Toddler Checklist (<http://brookespublishing.com/wp-content/uploads/2012/06/csbs-dp-itc.pdf>), a direct assessment of social communication for children age 6 to 24 months and useful for children who may have autism.

VARIATIONS IN LANGUAGE AND SPEECH DEVELOPMENT THAT DO NOT TYPICALLY CAUSE DELAY

Boys may show mild delays in the development of language and speech skills compared with girls. (19) However, among typically developing children, the differences are relatively small and not clinically relevant. Boys have higher rates of language and speech

TABLE 1. Key Milestones in the Development of Receptive and Expressive Language and Speech

AGE	RECEPTIVE SKILLS	EXPRESSIVE SKILLS	SPEECH
Newborn	<ul style="list-style-type: none"> Attends to voice Regards face 	<ul style="list-style-type: none"> Cries 	
3 mo	<ul style="list-style-type: none"> Smiles when spoken to 	<ul style="list-style-type: none"> Differentiates cry Coos (makes vowel-like musical sounds) Coos reciprocally with an adult 	
6 mo	<ul style="list-style-type: none"> Turns when name is called 	<ul style="list-style-type: none"> Begins to babble (adds consonant sounds, such as <i>b, d, m</i>) 	
9 mo	<ul style="list-style-type: none"> Stops when told “no” Learns routines, such as “wave bye-bye” 	<ul style="list-style-type: none"> Points to wants or to interesting objects or actions Says <i>mama</i> or <i>dada</i> nonspecifically 	
12 mo	<ul style="list-style-type: none"> Follows simple commands with gestures 	<ul style="list-style-type: none"> Says <i>mama</i> or <i>dada</i> specifically Jargons (strings of babble that sound like speech) Says first words 	
15-18 mo	<ul style="list-style-type: none"> Points to body parts Follows single command without gesture 	<ul style="list-style-type: none"> Acquires words slowly Uses simple and idiosyncratic forms Participates in conversations 	
18-24 mo	<ul style="list-style-type: none"> Understands sentences 	<ul style="list-style-type: none"> Exhibits vocabulary of ≥ 50 words Learns new vocabulary items easily Uses 2-word phrases 	<ul style="list-style-type: none"> 50% correctly use <i>p, m, h, n, w, b</i>
24-36 mo	<ul style="list-style-type: none"> Follows 2 and 3-step commands Answers “wh-questions” 	<ul style="list-style-type: none"> Uses >2-word phrases Uses increasing complex grammar, such as negation, questions 	<ul style="list-style-type: none"> 50% correctly use <i>k, g, d, t, ng, f, y</i>
36-48 mo	<ul style="list-style-type: none"> Understands plurals, pronouns, and possessives Understands questions of “who,” “why,” and “how many” 	<ul style="list-style-type: none"> Combines 3–4 words in a sentence Uses conjunctions, such as <i>and, or, but</i> 	<ul style="list-style-type: none"> 90% correctly use <i>p, m, h, n, w, b</i> 50% correctly use <i>r, l, s, ch, sh, z</i> Able to produce final consonants in words such as <i>bus</i> No longer replaces sound made in the back of the mouth (<i>g, k</i>) with sounds made in the front of the mouth (<i>d, t</i>)
48-60 mo	<ul style="list-style-type: none"> Understands concepts, such as same/different 	<ul style="list-style-type: none"> Uses mature grammar at near-adult levels Constructs narrative discourse, such as tells or retells stories, makes explanations 	<ul style="list-style-type: none"> 50% correctly use <i>j, v, voiceless th (thing)</i> 90% correctly use <i>k, g, d, t, ng, f, y</i> Correct production of consonant clusters, such as <i>st</i> in <i>stop</i> No longer deletes weak and unstressed syllables, such as in <i>banana</i>
60-84 mo	<ul style="list-style-type: none"> Limited by the child’s conceptual knowledge, not language skills Understands humor, metaphor 	<ul style="list-style-type: none"> Mature language constructions Increasing use of sophisticated vocabulary and complex grammar 	<ul style="list-style-type: none"> 90% correctly use <i>r, l, s, ch, sh, z, j, v, th</i> No longer substitutes liquids (<i>r, l</i>) with glides (<i>w, j</i>) Can correctly use fricatives, such as voiceless <i>th</i>

disorders than do girls. Therefore, the probability that a boy with an early delay will develop a disorder is high.

Children raised in bilingual environments are capable of learning 2 languages at the same time, (20) even children with disabilities such as Down syndrome. (21) Bilingual

children may have smaller vocabularies in each of their languages than monolingual children, although their combined vocabulary should be comparable in size to that of monolingual children. (22) They may initially show mixing of the 2 languages, although over time separation of the 2

TABLE 2. **Red Flags Indicating High Risk of Language or Speech Disorder and Prompting Evaluation**

AGE	RED FLAG OR INDICATION FOR REFERRAL FOR EVALUATION
Any age	Failure to participate freely and frequently in social interactions
6 mo	Lack of ability to laugh, vocalize, respond to sound, participate in reciprocal vocal interactions
9 mo	Failure to respond differentially to name or to produce babble (such as <i>baba, dada</i>)
12 mo	Inability to point to objects or actions Lack of use of gestures, such as shaking head "no" Inability to participate in verbal routines, such ability to wave to "wave bye-bye" No use of <i>mama</i> or <i>dada</i> specifically for a parent
18 mo	<5 words beyond <i>mama</i> and <i>dada</i> Failure to follow simple commands with gestures
24 mo	Vocabulary <50 words No 2-word combinations <50% of utterances intelligible to unfamiliar adults
36 mo	Inability to follow simple directions without gestures No ≥3-word combinations <75% of utterances intelligible to unfamiliar adults
>36 mo	Loss of language and speech skills, particularly in the presence of regression in social abilities and in the absence of regression in motor skills

languages occurs. (22) Bilingual exposure is not a full explanation of language or speech delays. Bilingual children have comparable risks of language disorders as monolingual children.

Another source of variation is the child's birth order. Later-born children are likely to hear less adult-generated language directed toward them but are more likely to overhear conversations between adults and their older siblings and have the older siblings as role models. (23) Overall, studies show that later-born children do not acquire language at a later age than do firstborns. Clinicians should use the same assessment and management approaches in the care of later-born children as they do with firstborn children with comparable delays.

Chronic otitis media with effusion does not cause developmental delays in language or speech. Randomized clinical trials comparing early tympanostomy tube placement with watchful waiting showed that the operation changed the duration of effusion and did not change the language outcomes in preschool- or school-age children. (24)(25) Chronic otitis media is more prevalent in situations that also put language learning at risk, including poverty, crowding, limited breastfeeding, and parental smoking. (26) suggesting that chronic otitis media may be a marker for adverse conditions that are associated with poor language or speech development. Clinicians should consider multiple reasons that children with

chronic otitis media with effusion develop language or speech delays.

In summary, it is a misconception that children from the following categories with delays in early language or speech development will catch up to peers without any intervention: boys, children from bilingual homes, later-born children, and children with chronic otitis media with effusion. In all these cases, the same thresholds should be used to define delays and disorders, and the same clinical procedures should be followed when delays are detected.

LANGUAGE AND SPEECH DELAYS

The term *delays* implies that the development of language or speech skills is slower than expected for age and follows an usual developmental pattern. A delay becomes clinically relevant when the rate of development falls below 75% expected, such as when a skill expected at 18 months is not present in a 24-month-old child ($18/24 = 3/4$ or 75% the expected rate). Approximately half of all children who are delayed in language at age 2 years catch up by age 3 years. Children who show good symbolic play skills and/or normal receptive language despite delayed expressive language have a better prognosis than those with delays in symbolic play and receptive language. Children with either language or speech delay should receive a comprehensive pediatric evaluation. Table 3 describes the components of a

TABLE 3. Evaluation of a Child with Language or Speech Delay or Disorder

COMPONENT OF EVALUATION	CRITICAL INFORMATION
History	Age at onset, initial presentation, and subsequent course Affected subcomponents Effects of previous treatments
Medical history	Birth history Previous illnesses and chronic conditions
Review of systems	Associated signs and symptoms
Family history	Family members with language, reading, or intellectual disorders Other health conditions
Psychosocial factors	Primary caregivers, parent education Number in the household, financial resources, stress Nature of parent-child interactions Amount and quality of child-directed speech Out-of-home care, including child care, preschool, or school
Physical examination	Growth parameters Dysmorphic features Oral-motor structure and function
Neurologic examination	Structural abnormalities, such as asymmetry in tone or reflexes Functional disorders, such as seizures
Audiologic assessment	Ear-specific information or sound field testing
Cognitive skills	Developmental assessment or an intelligence test
Symptoms of autism	Social communication and restrictive or repetitive behaviors

comprehensive pediatric evaluation. Based on the results of that assessment, the clinician may refer the child for treatment or place the child on an enhanced surveillance schedule. Factors that cause language or speech delays and that should prompt treatment are described in the following subsections.

Environmental Factors

A recent systematic review found that family environmental factors, such as socioeconomic status (SES) and parental education, parental health, and the level of engagement of parents with children, are all associated with the rate of language development. (27) Variation in the amount of language a child hears may mediate the effect of adverse social conditions on development. The classic observation that social class affects language outcomes came from the work of Hart and Risley, (28) who estimated the number of words children heard by recording weekly samples of conversations in their homes. Children of low SES were exposed to an estimated 30 million fewer words than were children of high SES in the preschool years. Recent studies using daylong recordings of home language have confirmed that the amount of speech that children hear at age 16 or 18 months predicts lexical growth and speed of language

processing at older ages. (11)(29) In interpreting these environmental influences on child language, it is important to recognize the possibility of shared genetic variance between parent and child. (30)

Infants raised in orphanages have profound delays in the development of language and speech, along with many other health and developmental disorders. (31) The Bucharest Early Intervention Project demonstrated that these devastating effects could be eliminated through placement in foster care before 15 months of age. Adverse effects were moderated through placement in foster care before but not after 24 months of age. (32) These encouraging data demonstrate the plasticity of language in its earliest stages.

Sex Differences

Boys have higher rates of language and speech delays and disorders than girls. (33) This finding may reflect genetic variation, implicating sex chromosomes. Male sex is associated with proinflammatory forces and placental lesions. (34) The maternal immune response against the invading interstitial trophoblast may be an initial event leading ultimately to sex differences in language disorders. Another possibility is that prenatal hormones, such as testosterone, exert important influences on the developing brain,

influencing structural features such as the degree of laterality or difference between the left and right hemispheres. (35)

Biological factors interact with environmental factors to explain sex differences in language and speech. Girls prefer to remain in close proximity and to engage in social interactions with adults; boys prefer active, rough and tumble play. Sex differences interact with SES. Boy-girl sex differences have been found in low-SES but not high-SES children. (19) Clinicians are often slow to refer boys with language delays for treatment on the assumption that the child will eventually catch up. However, because boys are at higher risk than girls for disorders, as mentioned previously herein, clinicians should proceed to evaluation and treatment when a delay is detected.

Genetic Factors

Genetic variation seems to be important for variation in how quickly and efficiently children learn. (36) Disorders of speech and language cluster in families; the median incidence of language difficulties was found to be more than 3 times higher in families of children with language impairment than in unaffected families. (37) Twin studies have confirmed that concordance of speech and language disorders is higher in monozygotic pairs than it is in dizygotic twin pairs. The presence of reading disorders in the family also put children at risk for language disorders. (38)

The first reports identifying a specific genetic alteration associated with language and speech disorders came from studies of a large 3-generation family, called the KE family, in which approximately half of the members had complex speech difficulties. A single nucleotide change on a gene called *FOXP2*, located on chromosome 7q31, differentiated affected and unaffected family members. Curiously, this gene is one of a family of genes controlling transcription of other genes rather than a gene that codes traits. One theory is that *FOXP2* influences the expression of other genes, such as *CNTNAP2*, which encodes a neurexin and is expressed in the developing human cortex. Genetic variation in *CNTNAP2* has been associated with language impairment.

Beyond these findings, it has proved difficult to identify specific genes associated with language and speech disorders. (39) It is possible that multiple genes may be involved (40) or that despite behavioral similarities, the disorders are heterogeneous, each with a distinctive genetic etiology. Decisions about genetic testing for children with a speech and language disorder should be individualized, based on the phenotype, symptom severity, family history, and related factors.

PRIMARY DISORDERS OF LANGUAGE AND SPEECH

Secondary or tertiary prevention is predicated on early detection of language or speech disorders and prompt treatment because early treatment is generally associated with better outcomes than is delayed treatment. Language disorders represent deficiencies in the ability to express or understand human communication. Delays become disorders when they persist to school age, follow different developmental trajectories, are severe, and/or negatively affect functioning. One classification subdivides language disorders into receptive, expressive, and mixed expressive-receptive language disorders. However, this classification system may not be accurate. (41) Difficulties with language expression may be accompanied by limitations in language comprehension and processing that are subtle and more difficult to detect than the problems of expression. (41) An alternative classification of disorders of language is based on the aspects of language affected (Fig 2), aligned with subcomponents: phonological disorders, limited lexicon, syntactic disorder, semantic disorder, and pragmatic disorder. Speech disorders can also affect 1 or more subcomponents (Fig 2). Motor speech disorders include articulation disorder, dysarthria, and childhood apraxia of speech. Abnormal vocal quality and resonance may be hoarseness, hypernasal speech, or hyponasal speech. Disorders of fluency include stuttering and other dysfluencies.

A persistent and serious delay in the acquisition of language skills in the absence of other developmental, health, or mental health conditions goes by many names: spoken language disorder, primary language impairment, or specific language impairment (SLI). (42) In SLI, the language disorder is the most relevant finding, although associated conditions may also be present. SLI is clinically heterogeneous. Usually, difficulties with syntax are prominent (Fig 2). Other features may include delays in phonological development, semantics, and/or pragmatics. Children with SLI typically present with delayed emergence of single words, phrases, and sentences. Comprehension often seems to be relatively spared. Speech skills also may or may not be impaired.

Several general neuropsychological processes, such as speed of language processing and memory, are associated with SLI. Speed of language processing at age 18 months, as measured in an eye-tracking task, has been found to be associated with measures of language skills up to age 8 years. (43) Children who are late talkers at age 2 years and at high risk for SLI have slower speed of processing than children with typical early language. Slow speed of processing may result in SLI because affected children may have difficulty understanding, anticipating, and learning from

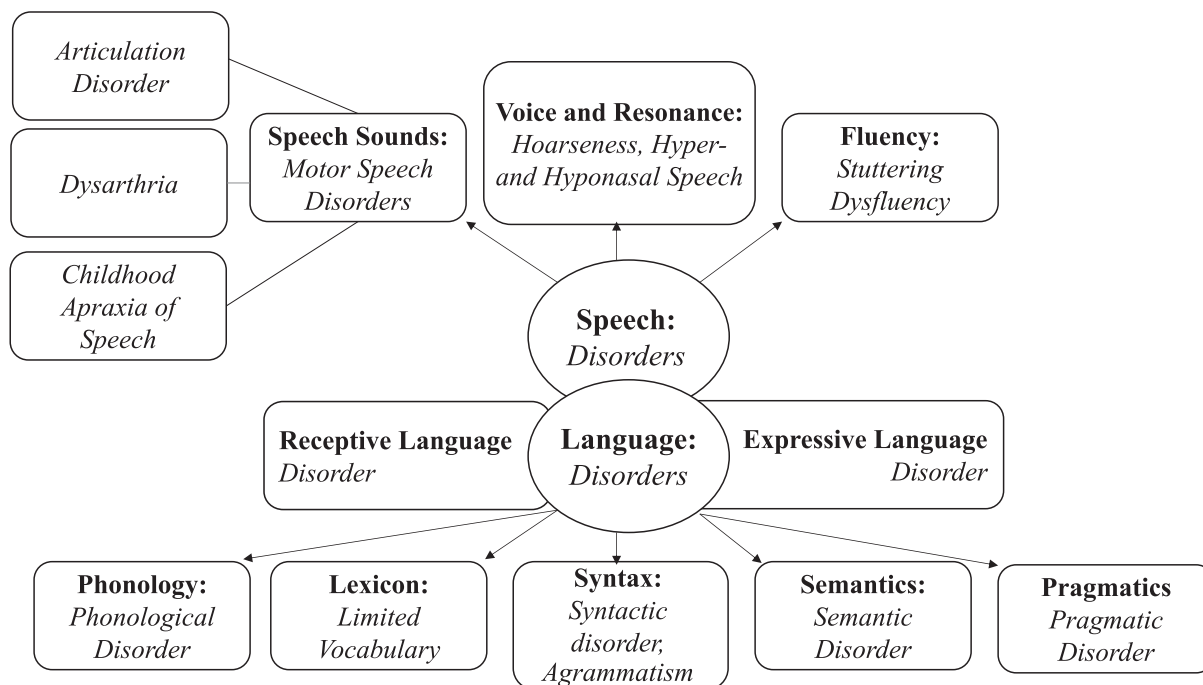


Figure 2. Disorders of language and speech based on the affected subcomponent of the language or speech system. Bold indicates the domain of language or speech, and italics indicate the class of disorders.

speech presented at the usual rapid pace. Deficits in phonological short-term and working memory are also associated with SLI, (44) presumably because it is essential to hold sound patterns in mind in order to learn new words and structures. Phonological short-term memory can be measured by a non-word repetition task that requires children to listen to novel phonetic sequences of varying lengths and repeat them back. At older ages, children with SLI may meet the criteria for attention-deficit/hyperactivity disorder and/or may have difficulties with executive functions, such as response inhibition, working memory, organization, or planning. Children with SLI are at risk for later reading disorders because reading rests on a foundation of language abilities. (45)

Disorders of speech may occur in isolation or in conjunction with disorders of language. Articulation disorders are motor speech disorders that represent difficulties producing specific sounds of the language (Fig 2). Mild articulation disorders are highly prevalent and rarely disrupt communication or social functions. Severe articulation disorders may affect other domains of function. Dysarthria is a disorder of the muscle movements required for speech production and often occurs in the aftermath of brain injury. Childhood apraxia of speech is considered a disorder of planning and executing speech sounds. Hallmarks of the condition include delays in the onset of babbling or single-word productions, errors in articulating vowel sounds, inconsistent errors in producing words, increasing difficulty

with words or phrases of increasing length, increased difficulty with production of spontaneous as opposed to well-rehearsed sentences, and effortful speech. The importance of differentiating childhood apraxia of speech from other disorders is that the treatment approach is distinctive; children typically require an approach that emphasizes motor programming and motor learning to improve production of speech sounds.

Stuttering is a disorder of fluency (Fig 2). Children often experience dysfluency before age 4 years as their thinking processes outpace their speech processes. Developmental dysfluency involves repetition of entire words or phrases. Stuttering is a nondevelopmental problem that includes repetition of individual speech sounds (*p-p-p-pop*); prolongations (*mmmmme*); abnormal pauses between sounds; excessive use of fillers, such as *uh* or *um*; and use of behavioral strategies, such as self-slapping to try to get the words out. Even at ages younger than 4 years, the presence of the features of stuttering should prompt referral for further evaluation and treatment.

SPEECH-LANGUAGE DISORDERS SECONDARY TO KNOWN CONDITIONS

Early detection and treatment of language and speech disorders in children with other health or neurodevelopmental conditions is another strategy for secondary and tertiary prevention. The use of parent-reported questionnaires or

direct observation language and speech instruments in pediatric subspecialty care is recommended for children, especially for those who are not receiving speech-language pathology services, early intervention, or special education (see previously herein). Recommendations for the evaluation of children with language and speech delays or disorders are designed to rule out known causes, including adverse psychosocial conditions (Table 2).

- *Hearing loss.* Language and speech disorders are highly likely with severe to profound hearing loss (threshold >55 dB). Individuals with mild (threshold of 26–40 dB) to moderate (threshold of 41–55 dB) sensorineural hearing loss may be able to detect and discriminate vowel sounds and low-frequency consonants, such as *m* and *b*, but may not detect or discriminate high-frequency consonants, such as *f*, *th*, and *sh*. Universal newborn hearing screening has increased early identification of children with moderate to profound hearing loss. Reevaluation of hearing in children with language or speech abnormalities is critical because the newborn test results may have been a false-negative, the hearing loss may be mild, or the child may have a progressive hearing loss.
- *Global developmental delay and intellectual disability.* Language and speech delay may be the initial presentation of children with global developmental delays. If delays persist and are accompanied by deficits in adaptive skills, children may meet the criteria for intellectual disability. Intellectual disability ranges from mild (IQ = 55–69) to profound (IQ < 25) levels. Language skills are generally commensurate with other developmental abilities. Even children with severe intellectual disability (IQ = 25–39) typically learn at least minimal language skills.
- *Autism.* Autism is defined by 2 key criteria: deficits in the domain of social communication and excessive restricted or repetitive behaviors. The presenting problem in autism is often delays or regression in speech and language skills. The prevalence of autism had been increasing in the past 2 decades and may have stabilized during the past 8 years. (46) Prognosis is better when children receive early intervention services than when behavior management and education are delayed. For these reasons, consideration of the diagnosis of autism is critically important in the evaluation of children with language delay.
- *Known genetic variations.* Chromosomal and genetic conditions have distinctive profiles in terms of speech and language. For example, in trisomy 21 or Down syndrome, deficits in speech and language skills are

often more severe than deficits in nonverbal skills. In Williams syndrome, caused by a deletion on chromosome 7, deficits in nonverbal skills are more severe than deficits in language. Fragile X syndrome is caused by trinucleotide repeats and mutations in the *FMR1* gene. Individuals with fragile X syndrome have deficient language skills in association with poor social skills, high levels of anxiety, and frequent hyperactivity. Approximately 20% to 25% of individuals with fragile X syndrome meet the criteria for a diagnosis of autism.

- *Neurologic disorders.* Structural brain injuries may affect language and speech. Children with injury to the left or right hemisphere frontal and temporal regions may show delays in the early phases of language development and subsequent disorders, although their symptoms are milder than those of adults with similar injuries. (47)(48) Notably, environmental factors influence the rate of language learning after brain injury. By age 5 years, children from high-SES families with brain injury outperformed children without brain injury from low-SES families. (49) Functional magnetic resonance imaging studies have found that children with early left hemisphere injury show multiple pathways of plasticity associated with variation in outcome. (50) Specific epilepsy syndromes are associated with language and speech disorders. Landau-Kleffner syndrome is a rare seizure disorder associated with regression in speech and language skills and, therefore, is part of the differential diagnosis in autism with regression. However, whereas the regression in autism typically occurs before age 3 years, the regression in Landau-Kleffner syndrome occurs later. The cardinal finding is auditory agnosia, a profound disruption of language comprehension with resulting adverse effects on language production. Other neurologic conditions with effects on language and speech include tuberous sclerosis.
- *Cleft palate.* Cleft palate is failure of fusion of the hard and/or soft palate. Even if the defect is repaired, weak velopharyngeal muscles allow air to flow through the nose rather than out the mouth in the production of speech sounds, resulting in hypernasal speech. Children with cleft palate, even as an isolated condition and not part of a broader syndrome, may also experience delays or disorders in the development of language as well as speech although the reasons are not clear.
- *Other health conditions.* Meta-analyses show that children born preterm show persistent delays in the development of language, (51) independent of SES, and even among samples that include only children without

major disabilities, such as cerebral palsy, intellectual disabilities, and sensory impairments. (52) These deficits have been attributed to subtle neurologic deficits that may be present even in the absence of telltale signs on neuroimaging. Similarly, children with congenital heart disease show delays in the development of language associated with changes in white matter. (53)

MANAGEMENT AND TREATMENT

Children with language or speech delays or disorders have failed to learn language from observation and social participation. Therefore, watchful waiting is rarely a good approach. Therapy is warranted. The speech-language pathologist is the professional charged with designing and implementing the treatment plan for a child with language or speech delays or disorders. Speech-language pathology services alone may be adequate for the child with mild to moderate language or speech delays or isolated disorders without complications. Early intervention for children birth to 3 years old or special education services for children older than 3 years is appropriate for children with moderate to severe language and speech disorders, other developmental conditions, and/or behavioral challenges that compromise participation and cooperation. Referral to therapy services is appropriate even while the comprehensive evaluation of the disorder is ongoing because of the long delays for many diagnostic services.

Although the causes of language and speech disorders are diverse, including genetic or neurologic conditions, manipulation of the child's experience in the environment is the main lever available to improve the child's skills and functioning. The speech-language pathologist, implicitly or explicitly, creates environments that increase the odds of the child's learning the weak or missing skill. Effective language interventions may provide a higher number of effective language learning episodes than would be available to children in their typical environment. Therapy may increase the child's opportunities to listen and speak, increase the salience of elements that the child has not mastered, and/or encourage expression of weak and developing skills. Therapy may also provide corrective feedback, such as recasting, that facilitates learning correct forms. Critical ingredients for therapeutic intervention, analogous to primary learning, are the child's active engagement and a warm supportive relationship. Therapy for toddlers and preschool-age children is typically play-based rather than drill. The specific activities chosen for a session focus on interests of the child. Table 4 includes a link to an example of home-based speech-language therapy.

The data on the efficacy or effectiveness of speech and/or language therapy, especially using randomized controlled trials, is limited. However, a systematic review and meta-analysis found that speech and language therapy is generally effective for children with phonological or expressive vocabulary difficulties but less clear for children with expressive syntax difficulties. Little evidence was available considering the effectiveness of the intervention for children with receptive language difficulties. (54)

Children often get a minimal dose of speech-language therapy, such as 30 to 60 minutes of therapy a week or less. The low dose of treatment is driven in part by child factors, such as children's relatively weak attentional capacity, and by systems issues, such as high costs and limited availability of therapists. Participation of parents, family members, and teachers in the program leverages the otherwise limited intensity of service. A systematic review found no significant differences between interventions administered by trained parents and clinicians. (54) A second systematic review reported that home programs can lead to growth in a child's skills and are more effective than no intervention, provided that a high dose of the program is delivered by parents who have received direct training in the intervention techniques. (55) Another strategy to increase the dose of treatment is to provide group therapy sessions; the duration of treatment is not the 30 to 60 minutes reserved for a single child, but 2 to 3 hours for 4 to 8 children. The added advantage of group therapy is that children practice their developing skills with other children in seminaturalistic settings. A systematic review found no differences in the effects of individual versus group therapies. (42) Language and speech therapy are often part of a child's individual educational plan at school. Teachers as well as parents should know the goals and strategies that the speech-language pathologists are using and apply them in the classroom to maximize the effect of therapeutic services.

As children age, it becomes increasingly important that they can use language and speech skills in the service of functional domains, including learning, communication, and social interaction. A systematic review of school-based treatment procedures addressing social communication behaviors found that gains were seen in conversational abilities, including topic management skills, narrative production, and repairs of inadequate or ambiguous comments. (56)

For children with poor motivation or disordered behavior, behavioral measures may be included with rewards and consequences for desired and undesired behaviors, respectively. Behavioral approaches are typically required for children with autism who lack motivation to communicate.

TABLE 4. Resources for Parents and Professionals

TARGET	MEDIUM	TITLE AND SOURCE
Parents	Websites	<ul style="list-style-type: none"> • National Institute on Deafness and Other Communication Disorders Fact Sheet: "Your Baby's Hearing and Communicative Development Checklist": https://www.nidcd.nih.gov/sites/default/files/Documents/health/hearing/NIDCD-Hearing-Development-Checklist.pdf • Babyhearing.org: https://www.babyhearing.org/ • Center for Disease Control and Prevention FREE Milestone Tracker: https://www.cdc.gov/ncbddd/actearly/index.html • First Words Project, 16 Gestures by 16 Months: http://firstwordsproject.com/about-16by16/ • Tips for Parents of Preschoolers on Shared Reading: http://www.nea.org/assets/docs/HE/englishtips.pdf • Autismspeaks.org • Apraxia-kids.org
	Books	<ul style="list-style-type: none"> • Agin MC, Geng, LF, Nicholl MJ. (2003). <i>The Late Talker: What to Do if Your Child Isn't Talking Yet</i>. New York, NY: St Martin's Press • Eichten PI. (2000). <i>Help Me Talk: A Parent's Guide to Speech and Language Stimulation Techniques for Children 1 to 3 Years</i>. Glen Allen, VA: Pi Communication Materials • Feit D. (2007). <i>The Parents' Guide to Speech and Language Problems</i>. New York, NY: McGraw-Hill • Hulit LM, Fahey KR, Howard MR. (2015). <i>Born to Talk: An Introduction to Speech and Language Development</i>. Boston, MA: Pearson
Clinicians	Websites	<ul style="list-style-type: none"> • Information about developmental milestones and clinical indicators of autism available on the CDC's "Learn the Signs. Act Early" website: https://www.cdc.gov/ncbddd/actearly/index.html • American Speech-Language Hearing Association continuing education courses: http://www.asha.org/ce/ • The American Academy of Pediatrics Bright Futures: http://www.brightfutures.org • Autism Navigator for Primary Care: http://www.autismnavigator.com/ <p>Examples of home-based speech-language pathology therapy:</p> <ul style="list-style-type: none"> • Therapy for childhood apraxia of speech: https://www.youtube.com/watch?v=sq7vFWLqodM • How to do speech therapy with toddlers at home: https://www.youtube.com/watch?v=9gTP50cX4VQ • Autismspeaks.org • Apraxia-kids.org
	Books	<ul style="list-style-type: none"> • Batshaw ML, Roizen NJ, Lotrecchiano GR. (2013). <i>Children with Disabilities</i>. Baltimore, MD: Paul H. Brookes Publishing Co • Beukelman DR, Mirenda P. (2012). <i>Augmentative and Alternative Communication: Supporting Children and Adults with Complex Communication Needs</i>. 4th ed. Baltimore, MD: Paul H. Brookes Publishing Co • Coplan J. (2010). <i>Making Sense of Autistic Spectrum Disorders: Create the Brightest Future for Your Child with the Best Treatment Options</i>. New York, NY: Bantam Books

Developmental and naturalistic behavioral techniques are particularly appropriate for young children because they can be applied in everyday activities. For children with motor speech disorders, especially childhood apraxia of speech, a motor learning component is included in the therapy; the child practices carefully planned sequences of emerging sound patterns. Links to video segments demonstrating therapies for childhood apraxia of speech are listed in Table 4. Recommendations for therapy for childhood apraxia of speech include frequent but short sessions, at least 4 times per week, with family and school participation in the treatment program; preliminary evidence demonstrates promising outcomes. (57) Use of nonspeech oral motor exercises, such as blowing, lip strengthening, and lateral tongue movements, are not beneficial for the treatment of motor speech disorders primarily because speech sounds do not use the oral mechanisms in the same movements as eating or drinking. However, cues to placement of the tongue or lips for proper speech sound production may be helpful. For

children with extremely limited verbal output, assistive and augmentative communication devices (AACs), such as sign language, picture exchange, or voice-activated software, may also be considered. AAC methods are often taught in schools. Unfortunately, high-technology devices may not be able to travel home with the student. In addition, family members may not learn the AAC methods and, therefore, cannot help their child to use the technique in home and community settings. To be most effective, parents and teachers should get training in the use of the AAC method and should encourage the child to use the method in all communication settings.

It may be challenging for parents and for clinicians to know whether a child is receiving high-quality speech and language therapy. In addition to the specific recommendations previously herein, high-quality therapy should include the following features:

- The speech-language pathologist establishes explicit objectives to address the areas of need in each of the

domains of language or speech affected. Objectives may also be geared toward solidifying strengths in the various domains.

- Especially in the treatment of toddlers, preschool-age children, and young school-age children, parents are aware of the objectives and the strategies the therapist is using. Parents often follow through with exercises at home.
- Speech-language therapy at school is planned and executed in conjunction with teachers. Speech-language therapy may also be coordinated with other therapeutic services, such as occupational therapy or social skills training.
- The therapy is fun for the child. Therapy may not necessarily be conducted at a desk or table. Therapists are warm and encouraging.
- The speech-language pathologist considers strategies to ensure that improvements during the therapy session generalize to everyday environments, including home and school.
- Progress is monitored frequently and regularly. Progress reports are provided to parents, teachers, and referring clinicians.

Summary

Language is a distinctly human form of symbolic communication. Delays and disorders of language and speech are prevalent. (1) The main points of this review and the clinical implications are as follows:

- Research shows that the amount of child-directed speech is a strong contributor to the child's language development. (11)(28)(29) Based on clinical consensus in relation to these data, primary care clinicians play a role in primary prevention of language and speech disorders by counseling families about the importance of the learning environment. Reach Out and Read supports the development of language and reading.
- The US Preventive Services Task Force concluded that no studies have yet examined the effects of screening on speech and language or other functional outcomes. (58) However, based on some research and consensus, professional organizations recommend a developmental screening at age 9, 18, and 24 or 30 months and, in addition, autism screening at 18 and 24 or 30 months. (14)(15) Resources are available for parents to alert them to the early stages of delays in language and speech (Table 4).
- Research shows that male sex (19), bilingualism, (20) later birth order, (23) and otitis media (24)(25) are not causes of language delays. Therefore, children with delays and these conditions

should be managed in the same manner as all other children with delays.


- Disorders of language are subdivided into receptive, expressive, and mixed receptive-expressive disorders. However, expressive difficulties may be more obvious than concomitant difficulties in comprehension. The specific diagnoses of language and speech disorders may also be predicated on the component of language or speech affected. In addition, disorders may be classified as primary when no other major disorder is present and as secondary when other conditions are present, including severe psychosocial deprivation, hearing loss, global developmental delay or intellectual disability, known genetic variants, neurologic conditions, and other health conditions, such as prematurity. Information that can be shared with parents regarding these disorders are listed in Table 4.
- Speech-language therapy has been shown to be useful for some though not all disorders of language and speech disorders. (54)(58) Nonetheless, based on this research, clinical consensus is that children with speech and/or language delay should be referred for language and/or speech therapy, either in isolation or as part of an early intervention or special education program.
- Ongoing monitoring by the primary care clinician may allow early detection of attention deficits, executive function limitations, or reading disorders, all of which may be associated with language or speech disorders. The ultimate goal of all screening, assessment, referral, and ongoing monitoring is to allow children to reach their maximal functional capacity for language and speech and to participate fully and joyfully in the human community.

To view teaching slides that accompany this article, visit <http://pedsinreview.aappublications.org/content/40/8/398.supplemental>.

How Young Children Learn Language and Speech

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1. The prevention of speech and language delays is an important responsibility of pediatricians. Which of the following is the most appropriate primary prevention activity that pediatricians should focus on?
 - A. Direct parents to use an adult-oriented ("mature") language approach with their children.
 - B. Educate parents about encouraging language development.
 - C. Emphasize the value of unstructured playtime over reading-based activities.
 - D. Encourage parents to take advantage of computer-based interactions with their child.
 - E. Reassure parents that language exposure intensity is only important after 18 months of age.
2. While teaching a class on early intervention for speech delay, your class asks if there is a group of children who have been identified with speech delay that will ultimately catch up and will not require speech therapy services. Of the following groups of children with identified speech delay, which group is most likely to catch up with peers without any intervention?
 - A. Boys.
 - B. Children from bilingual homes.
 - C. Children with chronic otitis media with effusion.
 - D. Later-born children.
 - E. None of the above.
3. A 9-year-old boy diagnosed as having attention-deficit/hyperactivity disorder has not responded to medication treatment alone. When assessed by his local school district, he is found to have a specific language impairment. Which of the following speech features is most likely to be consistent with the results of testing in this patient?
 - A. Abnormal comprehension skills.
 - B. Normal phonological development.
 - C. Normal short-term and working memory.
 - D. Normal syntax and pragmatic language skills.
 - E. Slow processing speed.
4. A 4-year-old boy is referred for further evaluation of his speech and language. The child is difficult to understand and struggles to express himself. After obtaining a speech and language therapy evaluation, the impression is that the most likely diagnosis is, in fact, childhood apraxia of speech. Which of the following speech characteristics is most likely to be consistent with this diagnosis in this patient?
 - A. Abnormal pauses between sounds.
 - B. Excessive use of fillers.
 - C. Inconsistent errors in producing words.
 - D. Repetition of individual speech sounds.
 - E. Use of behavioral strategies.
5. The family of a 2-year-old child is concerned about the quality of the speech-language therapy available in their community. Although they have focused on the frequency of service, which of the following measures are most likely to be suggested by the pediatrician as a better measure of appropriate and high-quality therapy?
 - A. Drill-based activities occur at every therapy session.
 - B. Family receives annual progress reports.
 - C. Interventions are specific to the therapy sessions.
 - D. Practice occurs only during therapy sessions.
 - E. Specific objectives address affected areas.

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Pediatrics in Review 2019;40;398

DOI: 10.1542/pir.2017-0325

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