



HHS Public Access

Author manuscript

Child Adolesc Psychiatr Clin N Am. Author manuscript; available in PMC 2018 July 01.

Published in final edited form as:

Child Adolesc Psychiatr Clin N Am. 2017 July ; 26(3): 539–554. doi:10.1016/j.chc.2017.03.001.

Intellectual Disability and Language Disorder

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Keywords

Intellectual disability; global developmental delay; language disorder; early intervention; multidisciplinary care

Introduction

Among parents' foremost developmental concerns are cognitive delays, in particular delays in language and adaptive function. Both are features of intellectual disability (ID), or, when language is specifically affected, language disorders. Child psychiatrists will frequently encounter these conditions, particularly as they are associated with an increased risk of challenging behaviors and psychopathology. In working with affected children and their families, child psychiatrists should be prepared to identify relevant signs and symptoms, manage psychiatric comorbidities, refer to specialists for comprehensive assessment and multidisciplinary treatments, and foster family-centered care. Child psychiatrists thus play an important role in addressing the multifaceted nature of these conditions and in optimizing independence and functional outcomes.

Intellectual Disability

Intellectual disability (ID) is a neurodevelopmental disorder characterized by 3 features (1):

- deficits in cognition,
- deficits in adaptive function, and
- onset during the developmental period.

Collective attitudes towards ID have shifted from a model of static deficiencies to a more dynamic, strength-based perspective, and “mental retardation,” the prior diagnostic term, has fallen out of favor. The introduction of “Intellectual Disability” in DSM 5 was presaged by Rosa’s Law, a 2010 federal statute requiring that intellectual disability replace mental retardation in health, legal and educational policy (P.L. 111-256). Also in contrast to DSM-IV-TR, absolute IQ cut-offs no longer define severity; mild, moderate, severe, or profound ID is now classified by level of adaptive functioning within a range of IQ scores. Adaptive functioning encompasses 3 domains:

- the conceptual domain, which includes language, knowledge, and memory;

- the social domain, which includes empathy, social judgment, and rule-following ability; and
- the practical domain, which includes self-care, organization, and daily living skills.

Estimates of intellectual disability range between 1–3%, with a male to female ratio of 1.6:1 (2). Causes of ID include genetic abnormalities, as well as prenatal, perinatal, and postnatal environmental factors (3, 4)(Figure 1). Suspicion of ID can arise during infancy, although children under 5 years of age are typically diagnosed with global developmental delay, which requires delays in 2 or more functional domains and shows some correlation with ID. ID can be determined with greater certainty by age 5 years, when cognitive abilities become more stable. Children with less severe ID may not be diagnosed until school age, when academic demands highlight weaknesses in cognition (5). Outcomes vary depending on severity – individuals with mild ID may achieve some signs of independence, such as having a job or starting a family (6), although more severe ID requires long-term community supports for housing, occupational, and recreational activities.

Evaluation

A comprehensive history entails a birth/prenatal history, family history, 3-generation pedigree, and information on the course and timing of delays in language, motor, social-emotional, and adaptive functioning (7). Children with ID may have a history of delays in talking, sitting up, crawling or walking; immature play and social interaction; and poor comprehension, learning, and problem solving. Screening tools, such as the Ages and Stages Questionnaire (8) can usefully clarify the extent of these concerns (see (9) for other examples). Frequent neurological comorbidities, such as seizures and motor signs (e.g., spasticity, ataxia, hypotonia), as well as developmental regression, should be assessed. Physical examination includes a complete neurological examination, measurement of head circumference, and attention to features associated with genetic syndromes, such as facial dysmorphisms and skin findings (3). A comprehensive evaluation of intellectual and adaptive functioning through neuropsychological testing is ultimately necessary for diagnosis.

Medical work-up includes testing for genetic syndromes, metabolic disorders, acquired hypothyroidism, and lead exposure (3). When a genetic syndrome or metabolic disorder is suspected, referral to a geneticist is recommended to assure the most comprehensive testing. A neurology referral is recommended for any neurologic concerns. A brain MRI is advised if microcephaly, macrocephaly, seizures, or neurologic signs are present (7, 10). Children with ID are more likely to have other medical conditions, including cataracts, vision and hearing impairments, congenital heart disease, constipation, obesity, and sleep disorders, which may prompt additional referrals. Such comorbidities not only impact overall function and quality of life, but can also increase challenging behaviors.

Differential Diagnosis

The differential diagnosis for ID includes other neurodevelopmental disorders, which can also be comorbid with ID:

- Autism spectrum disorder (ASD), which exhibits a similar prevalence as ID, is characterized by impaired social communication, restricted interests, and repetitive behaviors. At least 25% of children with ASD have ID (11).
- Language disorders, like ID, feature language delays. The occurrence of language delay should prompt investigation of other delays, so that ID is not overlooked.
- Epilepsy may manifest with delays and regression in core developmental domains, such as language. Behaviors suggestive of epilepsy including staring spells, shaking spells, and intermittent changes in levels of consciousness with associated automatisms (e.g., blinking, lip smacking).

These potential diagnostic confounds highlight the importance of comprehensive evaluations and neuropsychological testing.

Challenging Behaviors, Comorbidity, and Management

Challenging behaviors are very common in ID and can be more strongly associated with parental stress than level of delay (12). These may include non-compliance, property destruction, tantrums, meltdowns, and physical aggression towards self or others. While challenging behaviors occur in 4–9% of typically developing children, they occur in 25% of children with ID (13). A major factor in ID stems from communication impairment, which limits the ability to express frustration and/or explain external factors or underlying physical or emotional distress. Children and adolescents with ID are also known to have higher prevalence of psychiatric disorders, including ADHD, mood disorders, anxiety disorders, and psychotic disorders (14).

The psychopharmacological evidence base is relatively limited in ID, although there is support for judicious use of medication for disruptive behaviors and psychiatric comorbidities (15, 16). Box 1 lists common medication classes, typical uses, side effects, and suggested monitoring. In preschoolers, behavioral treatment options are first-line, given their effectiveness and more frequent medication side effects in younger children. Nevertheless, when safety or ability to engage in therapy are concerns, medication may be instrumental for successful implementation of a treatment plan and reducing caregiver stress. Medication is also an element of combined therapy (medication plus behavioral management), and psychiatrists can guide the appropriate balance of behavior and medication. Low starting doses are recommended, with slow titration, along with systematic evaluation of both positive and negative effects in the context of the entire treatment plan.

Among behavioral treatments, applied behavioral analysis (ABA) has a well-established evidence base (17). ABA attempts to modify antecedents and/or consequences of specific behaviors, either to discourage a problematic behavior or encourage an alternative behavior. Functional behavioral analyses provide detailed measurement of potential instigators of challenging behavior, such as need for attention or help, escape from demands, attempt to get what is wanted, protest, or self-stimulation (13). Behavioral planning is then tailored to a child's behavioral profile and developmental level. In addition to ABA, parent-training

approaches, e.g. Stepping Stones Triple P (18) and Parent Child Interaction Therapy (19), show evidence for improving disruptive behaviors in ID.

Promotion of Developmental Progress

Children with ID/global developmental delay benefit from intensive early intervention and multidisciplinary services (20). Federal law under the Individuals with Disability Education Act (IDEA) mandates that state-run programs identify children with disabilities and provide developmental services. Prior to age 3, families will receive an Individualized Family Service Plan (IFSP), which will implement an individualized program of services and developmental therapies. These may include speech and language therapy, occupational and physical therapy, psychological and behavioral services, medical services, nutrition counseling, assistive technology, family counseling and training, home visitation, and social services. The IFSP applies for ages 0-3 years, after which children who qualify for ongoing services are transitioned to an Individual Education Plan (IEP) with multidisciplinary preschool programming.

Language Disorders

In DSM 5, language disorders are classified as communication disorders. Communication comprises all verbal and nonverbal input used to transmit information between individuals, including language and speech. Language involves conveying information through the form, content, and function of symbolic systems according to specified rules (Figure 2). Speech is the oral production of language. Delayed talking may thus reflect disturbances in speech, language, and/or communication. Historically, language disorders have been referred to by a variety of terms, including developmental language disorders and specific language impairment. This section focuses on early childhood features of language disorders per DSM 5, which implicate language form and function (Figure 2).

Prevalence estimates for language disorder generally range between 3 and 8% (21, 22), with a male to female ratio of 1.33:1 in an epidemiologic sample (21). Language disorders are heritable and generally appear polygenic, although some specific genetic factors, including the FOXP2 gene and linkage markers on chromosomes 3, 6, and 19, have been identified (23). Language disorders can also be acquired secondary to infection, brain injury, neglect, and abuse.

Early language difficulties are a risk factor for impaired literacy skills, memory skills, and nonverbal abilities (24, 25), although individual patterns of strengths and weaknesses in distinct aspects of language may vary over time. In some cases, “illusory recovery” occurs (26), whereby a child’s language appears to normalize, but deficits resurface with subsequent increases in demands. Additionally, rates of language growth may plateau by early adolescence, increasing the gap between children with and without language disorders (27). Receptive language impairments have worse prognoses than expressive language impairments. Deficits of comprehension are less responsive to therapy and do not resolve spontaneously; they are linked to increased likelihood of social difficulties (28), struggles with nonverbal reasoning (29), and psychiatric conditions (30).

Language Delay and “Late Talkers” vs. Language Disorder

Natural variability in language acquisition can make it challenging to assess early delays and to distinguish them from language disorders, which involve more persistent symptoms. Prevalence of late language emergence in 2-year-old children ranges between 10% and 20% (31), and males are 3 times more likely to be affected (32, 33). The majority of these children do not ultimately have language disorders (34). This “late-talkers” group may have only a few words at age 2 years, but by age 3 years matches peers in expressive language skills (34, 35).

Because only some children with late language emergence will have language disorders, assessment and management of this group has been debated. Compared to those who develop language disorders, late talkers use more communicative gestures (36), are less likely to have receptive language delay (37), and exhibit better recall of sentences on standardized testing (38). Nonetheless, toddlers and preschoolers with late language emergence should be referred to a speech/language therapist, as they may be at risk for later language and literacy difficulties (39). In the presence of associated risk factors for language disorders, such as ASD, global developmental delay, or hearing impairment, direct speech and language services are generally indicated. For children at lower risk, periodic monitoring is recommended, together with guidance for parents to provide indirect language stimulation (Box 2). If persistent delays or additional developmental concerns arise, a complete assessment and direct intervention may be warranted.

Evaluation

The history should review not only language development and milestones, but also any other delays, challenging behaviors, mood and anxiety, and trauma which could result in developmental setbacks. In language disorders, progress is generally slow from the outset, and regression is uncommon, unlike ASD (40). Although speech delays frequently co-occur, they are not a hallmark. Box 3 provides a description of typical language milestones and clinically significant red flags. Impaired receptive and expressive language commonly co-occur, and difficulties with comprehension, in particular, are a red flag for chronic language difficulties (41). The mental status examination should note form, function, and use of language, including articulation, fluency, and tone, comprehension, the frequency and complexity of verbal communication, vocabulary, social reciprocity, and use and responsiveness to nonverbal communication, such as gestures, body language, and facial expression.

The utility of language screeners has been deemed inconclusive (42), although in cases of clinical suspicion, screeners can help index the level of concern. Two accessible parent-report measures are the MacArthur Communicative Development Inventory (M-CDI) (43) and the Language Development Survey (LDS) (31). The M-CDI features long and short versions (requiring 20 and 5 minutes, respectively) for ages between 8 and 36 months. The LDS, which applies up to 42 months, is embedded in the Child Behavior Checklist, which conveniently queries general behavioral concerns. It is also worthwhile to screen for anomalous social development, given the association of language delay and ASD. Two of the more common brief ASD screeners are the Modified Checklist for Autism (M-CHAT),

for ages 16-30 months (44), and the Social Communication Questionnaire, for ages over 4 years (45).

Medical work-up first involves ruling out hearing conditions, and referral for an audiological evaluation is an important initial step. An oral-motor evaluation should be considered if there are phonological concerns, or the child has feeding difficulties or drooling. For laboratory testing, a CBC may be considered to evaluate for anemia, which has been associated with developmental delay, as well as lead testing (46). Genetic testing is not routine, as there are no common, strongly associated genetic markers of language disorders (47), but a genetics referral is advised for features suggesting a genetic syndrome (see above). In cases of regression or concern for seizures, rapid referral to a neurologist is warranted.

Differential Diagnosis

Several conditions may present with communication difficulties in early childhood; in some cases, these may be comorbid with language disorders, so that a speech/language referral remains indicated:

- **Hearing impairment:** As mentioned above, this possibility should be considered early in the evaluation. For children with ID and impaired language, there is a risk of reduced hearing over time, and hearing should therefore be monitored.
- **ID:** Language delays frequently occur in ID, although only a subset of individuals ultimately shows deficiencies consistent with a language disorder. Marked language problems in individuals with ID should receive comprehensive evaluation and treatment.
- **ASD:** Language delay and disorders are common in ASD, even when accounting for pragmatic language issues, which are universal. Consideration of ASD is important given the strong benefit of early intervention for ASD.
- **ADHD:** Inattention and impulsivity may detract from opportunities to learn and practice language skills, particularly as related to pragmatics. Children with ADHD also have higher rates of language disorders.
- **Selective mutism:** In this condition, poor language output manifests in specific environments, e.g., at school but not at home. Selective mutism is conceptualized as an anxiety disorder, although speech/language issues often co-occur.

Challenging Behavior and Comorbidities

Similar to children with ID, children with language disorders are at increased risk of challenging behaviors and psychiatric co-morbidities. Among children with a language disorder, 40–75% exhibit challenging behaviors (48) and 30–50% have psychiatric disorders (49, 50), most commonly ADHD, anxiety disorders, conduct disorders, and mood disorders. Conversely, research suggests that 40% of children with psychiatric diagnoses also have a language impairment (51). Work by Beitchman and colleagues showed that increased rates of psychiatric diagnoses continue up to early adulthood (52), and decreased psychiatric comorbidity was associated with special education (53).

Common challenging behaviors include both internalizing and externalizing symptoms. Hyperactivity and attentional difficulties are frequently observed (54, 55), as well as shyness, social withdrawal, and poor self-esteem (56). Socioemotional deficits may also be present, including difficulty inferring emotional reactions (57) and regulating emotions (58). As children get older, they may struggle with forming and maintaining close relationships (59), and are more likely to be bullied (60) and experience abuse (61).

Management

Psychiatrists play an important role in managing psychiatric comorbidities, as well as monitoring progress and coordinating care. In addition to making a speech/language referral, they can assist families in obtaining an evaluation for an IFSP or IEP and advocate for further services or educational accommodations. Because psychiatrists are in a position to correlate language function with psychiatric symptoms, they can provide important contextual information about the relationship between a child's language function and associated behavioral concerns. This information may result in more appropriately structured and targeted behavioral interventions and reduce misattributions of challenging behavior (62).

Language Interventions: Principles, Approaches, and Modalities

Language intervention aim to enhance language output and comprehension, ensure access to academic content, and advance communication to the next developmental level. Principles of effective intervention include language facilitation in the context of communication; dynamic, generalizable interventions; regular assessment of response; and adaptation of treatment goals and strategies according to individual learning style, progress, and needs (63). Early intervention is recommended, as accelerated language growth tends to occur earlier vs. later in childhood (41, 64), and earlier (65) as well as longer duration of intervention have been shown to be more effective (66). A meta-analysis of speech/language therapies supported efficacy in expressive, but not receptive, language impairment, and treatments over 8 weeks showed better results (67).

Language interventions encompass a variety of approaches, treatment types, and modalities (Box 4). Therapy should be based on the child's specific needs and learning style, as identified by standardized testing, parental concerns, and teacher input. Targets are identified and learned through drill, repetition, and carryover tracking. For preschoolers, goals will include augmenting vocabulary, conceptual understanding, and sentence variety and complexity. Associated communication targets may involve improving intelligibility and phonological awareness, as well as conversational and narrative skills. Social skills should also be emphasized, given the known interrelationship of social and language function.

In preschoolers with emerging language skills, parent-mediated interventions are often implemented. These confer similar benefit as direct approaches by a speech/language pathologist (67), are well-suited to language facilitation in a variety of naturalistic environments, and offer many opportunities for language input. Among therapeutic modalities, augmentative and alternative communication has accumulated a relatively large body of evidence, especially in children with developmental delays (68). Some concern has

been expressed that augmentative forms of communication may replace speech entirely and therefore restrict the child's communicative development; however, prevailing evidence suggests that augmentative communication promotes language development.

Discussion

Common Aspects of Managing ID and Language Disorders

Management of ID and language disorders shares several overarching features and principles. Because comprehensive assessments from other specialties are needed for diagnosis, sound clinical judgment must be exercised regarding referrals and following up on recommendations. The long-term impact and early emergence of these conditions is especially challenging for families; sensitivity and clarity are thus vital when delivering these diagnoses. Surveillance often occurs via a multidisciplinary team of speech and language pathologists, behavioral therapists, occupational and physical therapists, educators, social workers, and others. Maintaining clear communication and a strength-based perspective is important for implementation of therapies which promote ongoing learning and gains in adaptive function. Finally, the importance of culturally sensitive, family-centered care is increasingly emphasized. By respectfully listening to families, psychiatrists can ensure that their preferences and priorities contribute to treatment planning.

Future Directions

Although early childhood mental health and neurodevelopmental disorders are increasingly recognized, concerns remain for delays in diagnosis (69, 70). Development of improved screeners and expanded training for child psychiatrists in neurodevelopmental disorders (71) are worthwhile public health considerations to promote earlier identification and management. Further research on evidence-based treatment is also a priority, since extant literature frequently involves small samples or less rigorous study designs. Translational research in genetics, as well as neuroscience, will be important to elucidate mechanisms by which cognitive impairments interact with risk for psychopathology, thereby improving diagnostic sensitivity, treatments, and prevention.

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Box 1			
Medications for ID			
Medications By Class	Target Behaviors	Adverse Effects	Monitoring
Typical Antipsychotics (e.g. haloperidol, chlorpromazine)	Agitation, aggression, hyperactivity, self-injury	Extrapyramidal symptoms, tardive dyskinesia	AIMS
Atypical Antipsychotics (e.g. risperidone, aripiprazole, olanzapine)	Irritability, aggressiveness, hyperactivity, self-injurious behavior, repetitive behaviors	Weight gain, somnolence, increased risk of diabetes, extrapyramidal symptoms, akathisia, tardive dyskinesia	Blood glucose, HbA1C, lipids AIMS
Mood Stabilizers (e.g., lithium, valproic acid, carbamazepine)	Mood lability, aggression, impulsivity, self-injurious behavior	Lithium: tremor, renal and thyroid toxicity, Valproate: tremor, sedation, weight gain Carbamazepine: nausea, vomiting	Renal and thyroid monitoring for lithium, liver function tests, CBC, and ammonia with valproic acid, regular drug levels for all three
SSRIs (e.g. fluoxetine, sertraline, fluvoxamine)	Depressed mood, anxiety, self-injurious behavior, repetitive behaviors	Activation, agitation, aggression, nausea	None specific
Stimulants (e.g. methylphenidate)	Hyperactivity, inattention, impulsivity	Loss of appetite, insomnia, depressed mood	Height, weight, vital signs
Alpha-agonists (e.g. clonidine, guanfacine)	Hyperactivity, inattention, impulsivity, tics	Hypotension, sedation, increased depression	Vital signs
<p>Abbreviations: AIMS, Abnormal Involuntary Movement Scale; CBC, complete blood count; HbA1c, hemoglobin A1c; SSRI, selective serotonin reuptake inhibitor.</p> <p><i>Data from</i> Handen BL, Gilchrist R. Practitioner Review: Psychopharmacology in children and adolescents with mental retardation. <i>J Child Psychol Psychiatry</i> 2006;47(9): 871–82.</p>			

Box 2**Indirect stimulation of language competence in young children****Responsiveness**

- Provide responses directly related to a child's communication act or focus of attention.
- Follow the child's lead in play.
- Discuss what the child is doing versus asking lots questions.

Language Modeling

- Imitate or expand the child's actions or words.
- Rephrase what the child says in grammatically correct form.
- Provide examples of using gestures and other nonverbal cues.

Reinforcement of Communication

- Provide opportunities to communicate wants and choices rather than anticipate all the child's needs.
- Allow adequate time to initiate communication and respond.
- Praise communication attempts.

Data from American Speech-Language-Hearing Association (n.d.). Spoken Language Disorders (Practice Portal). Available at: www.asha.org/Practice-Portal/Clinical-Topics/SpokenLanguageDisorders. Accessed Oct 1 2016.

Box 3

Language Milestones and Red Flags

	Receptive	Expressive	Receptive	Expressive
12 months	Recognizes words as symbols for objects, 3–50 words, recognizes name	First words, communicative games	Does not respond to name or gestures	No babbling, pointing, gesturing
18 months	Words are understood outside context of routine games	50–100 words, intents include requesting, answering questions, acknowledging	Does not follow 1- step directions	No “ma-ma,” “da- da,” or other names
2 years	Single words for objects out of sight	200–300 words, two-word utterances, telegraphic speech with few grammar markers, symbolic play, speech is 50% intelligible	Does not point to pictures or other body parts when named	Does not use at least 25 words
2.5 years	What/who/where questions	Use of questions, early emerging grammar, narratives are primarily labels and descriptions	Does not verbally respond or nod/shake head to questions	Does not combine 2 words into unique phrases
3 years	Why questions and basic spatial terms (in/on/under); simple time concepts (e.g., tomorrow)	Simple sentences, Narratives are sequences with them but no plot, speech is 75% intelligible	Does not understand prepositions or action words, does not follow 2-step instructions	Does not use at least 200 words, does not ask for things by name, repeats phrases in response to questions, unintelligible most of the time
4 years	When/how questions, basic colors, shapes, sizes	Can tell a story, uses conjunctions to conjoin sentences; speech is 100% intelligible	Poor understanding of instructions or question words	Disordered speech, no 5–6 word phrases, echolalia, unintelligible most of the time
5 years	Letter names and sounds; numbers and counting	Correct use of past tense, Uses conjunction words when, so, because, if; Narratives are chains with some plot	Poor understanding of instructions or question words	Unintelligible most of the time, deletes parts of words, echolalia, can’t describe short sequences of events
Any age			Regression or loss of milestones	

Data from Chapman R. Children's language learning: An interactionist perspective. *Journal of Child Psychology and Psychiatry* 2000; 41:33–54; and Miller J. Assessing language production in children. Boston, MA: Allyn & Bacon; 1981.

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Box 4**Overview of Evidence-Based Aspects of Language Interventions**

Approach Key	Features	Comments
Clinician-directed *Clinician	specifies treatment type, goals, and reinforcement	*Less naturalistic *Maximize practice of specific targets
Child-directed *Clinician	provides naturalistic opportunities for a child response *Clinician follows the child's lead	*Useful when poor compliance with clinician-directed approaches *Useful for "unassertive communicators"
Parent-mediated	*Parents use direct, individualized intervention practices with their child *Increased opportunity for language input	*Cost effective *Growing evidence for early intervention
Treatment Type	Key Features	Comments
Behavioral Therapies	*Use behavioral learning principles *Increase desired behaviors *Decrease inappropriate behaviors	*Instructional: Discrete Trial Training *Play-based: Pivotal Response Training *Frequently used ASD and DD
Milieu Therapy	*Therapist elicits and reinforces targeted responses *Naturalistic settings *Child may select topic to initiate interaction	*Evidence in several groups: late-talkers, ASD, ID, children from high-risk and low income families
Relationship Based Approaches	*Promotes parent-child interactions *Common in early intervention programs	*Greenspan/DIR/Floortime encourages interaction through play *Used in ASD
Modalities Key	Features	Comments
Augmentative Alternative Communication	*Supplemental methods to replace speech *Can address impaired production or comprehension	*Aided symbols: Picture Exchange Communication System (PECS) and speech generating devices *Unaided symbols: manual signs *Strong evidence in ASD & ID
Computer Based Instruction	*Computer programs teach language skills	*Advantage of higher number of trials than with therapist *Example: FastForWord
Video Modeling	*Videos show desired behaviors *Learners are video-taped *Practice videos are reviewed	*Parent-mediated example: Hanen Program

Abbreviations: DD, development delay; DIR, Developmental Individual-difference Relationship

Data from American Speech-Language-Hearing Association (n.d.). Spoken Language Disorders (Practice Portal). Available at: www.asha.org/Practice-Portal/Clinical-Topics/SpokenLanguageDisorders. Accessed Oct 1 2016.

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Key Points

- * Intellectual disability (ID) and language disorders are neurodevelopmental conditions arising in early childhood.
- * Child psychiatrists are likely to encounter children with ID and language disorders as both are strongly associated with challenging behaviors and psychopathology.
- * Because early intervention is associated with optimal outcomes in ID and Language Disorders, child psychiatrists must be aware of their signs and symptoms, particularly as related to delays in cognitive and adaptive function.
- * Optimal management of both ID and language disorders requires a multidisciplinary, team-based, and family-centered approach. Child psychiatrists play an important role on this team, given their expertise with contextualizing and treating challenging behaviors.

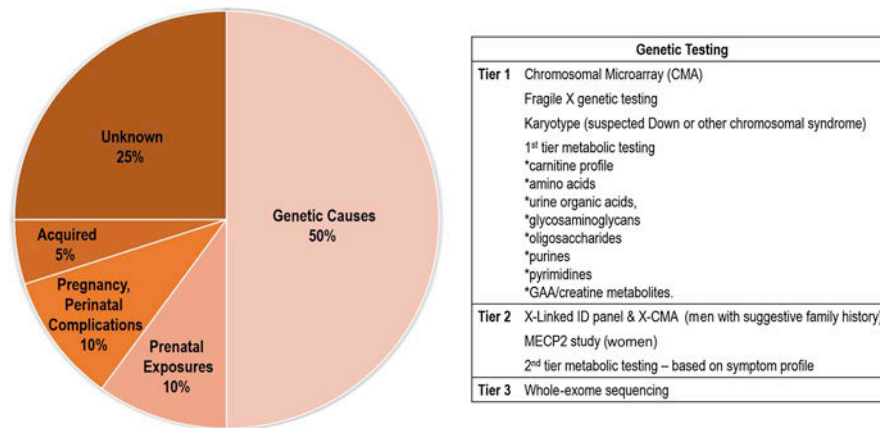


Figure 1.

Causes of ID and their respective percentages are shown, together with a list of currently recommended genetic testing. Several non-genetic factors also lead to ID, including congenital infections, exposures to teratogens or toxins, prematurity, hypoxia, trauma, intracranial hemorrhage, central nervous system infection or malignancy, psychosocial deprivation, malnutrition, or acquired hypothyroidism.

Data from Moeschler JB, Shevell M. Comprehensive Evaluation of the Child With Intellectual Disability or Global Developmental Delays. Pediatrics 2014;134(3):e903-e918; and Pivalizza P, Lalani SR. Intellectual disability in children: Evaluation for a cause. UpToDate. Waltham, MA; 2016.

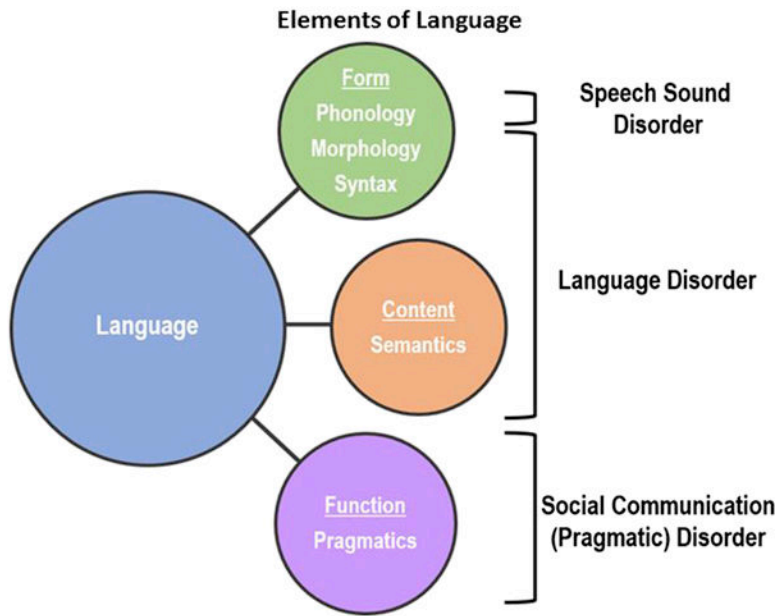


Figure 2. Language disorders affect one or more fundamental aspects of language: form, content, and function. Deficits may involve morphology (understanding and use of the building blocks of words), syntax (grammar), and semantics (vocabulary). Phonology, the ability to distinguish and use speech sounds appropriately, is affected in Speech Sound Disorder. Disorders of pragmatics, the use of language, are encompassed within Social Communication (Pragmatic) Disorder.

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