



Understanding basic concepts of developmental diagnosis in children

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Abstract: Developmental diagnosis is based on an understanding of basic concepts of typical and atypical developmental progression. Child development is influenced by multiple factors, including the development of the nervous system and other organ systems, and the child's physical and social environment. Different factors interplay with each other in influencing the overall development of the child. Development and behavior of the child are intricately associated. Typical child development follows certain basic principles. Some of the more commonly reported developmental concerns include global developmental delay, intellectual disability, cerebral palsy, delayed speech and language, attention deficits, autism, and specific learning disabilities. The clinical presentation of atypical development varies, depending up on the age of the child; with motor delay in early infancy, and learning difficulties in school age child. Regular surveillance and periodic screening help identify specific areas of developmental and behavioral concerns and suggest a need for further appropriate psychological, medical and laboratory evaluation. The principles of management of a child with developmental concerns include early intervention and response to treatment approach, remediation, accommodation, and specific behavioral and pharmacological interventions when indicated.

Keywords: Atypical development; delay; deviation; dissociation; surveillance; screening; global developmental delay; developmental quotient (DQ); intelligence quotient (IQ)

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Introduction

Child development is generally described in terms of streams or domains of development. The four domains or streams of development are, (I) motor development—gross motor and fine motor, (II) speech and language development—expressive and receptive, (III) social and emotional, and (IV) cognitive (1-12). Development in motor adaptive abilities, language and communication, and intellectual capacity provide a basis for social and emotional development (7,8,13,14). Problem solving skills is a reflection of cognitive development, which also includes

visual perceptual and visual motor abilities. Development is also described in terms of its progression as either typical or atypical for the age of the child.

The acquisition of developmental skills is a function of interplay between development of the nervous system and other organ systems, and child's social and physical environment and stimuli. Typical development is characterized by certain basic tenets. These are, (I) gross motor development progresses in a cephalo-caudal sequence, (II) fine motor development progresses from midline to lateral sequence, (III) primary motor patterns or primitive reflexes are integrated into more complex motor

Table 1 Developmental surveillance, screening, and evaluation

Process	Goal	Definition
Surveillance	Identify children who may have developmental problems	Gathering and synthesizing information about developmental progress of the child based on history, observations by parents or other caretakers and health care practitioners, and during periodic visits on a longitudinal and continuous basis over time
Screening	Identify children at risk of a developmental disorder	The administration of a brief standardized screening test
Evaluation	Identify a specific developmental disorder and its etiology if known	A diagnostic process that may involve appropriate laboratory, genetic, or metabolic testing; neuroimaging studies, and psychological testing as well as specialist consultations

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Table 2 Characterization of atypical development

Atypical development	Definition
Delay	Significantly delayed attainment of milestones or skills in one or more domains, but in an expected sequence, compared to that of typically developing children
Deviation	Attainment of developmental skills in a given domain that is out of sequence, for example, when an infant rolls from supine to prone before prone to supine
Dissociation	Attainment of developmental skills at significantly different rates between two or more domains of development. For example, when there is delayed motor development relative to other domains in cerebral palsy
Regression	Loss of previously acquired developmental milestones or skills or failure to acquire new skills

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patterns to allow for later, sequential voluntary motor development, (IV) the rate of attainment of developmental skills between infants vary; however, the sequence remains the same, and (V) there is progression from generalized reflexive responses to a more specific and purposeful response pattern (4,7-9). Periodic surveillance and screening help identify infants and children who may need additional evaluation (*Table 1*), and the application of the basic tenets of typical development allow for an understanding of different patterns of atypical progression of development (*Table 2*) (1-3,7,8).

Definitions

Intelligence quotient (IQ) as measured by individually administered standardized tests, is a widely used measure of cognitive abilities or intelligence. IQ is calculated by dividing mental age (MA) by chronologic age (CA)

multiplied by 100, and can be measured reliably in children ≥ 6 years of age (8,11,13-15). IQ is used as one criterion to define intellectual disability. In addition to sub-average IQ, the definition of intellectual disability requires the presence of limitations in adaptive functioning (as measured by individually administered standardized tests) (16-21). Adaptive functioning comprises conceptual, social, and practical adaptive skills. IQ of 70 or less with a standard error of measurement of 5 is considered to be sub-average. Because it is difficult to accurately and reliably measure IQ in children younger than 6 years of age, the term global developmental delay is used when development is significantly delayed in 2 or more domains. Developmental quotient (DQ) is calculated as follows: $DQ = [\text{developmental age (DA)}] \text{ divided by } CA \times 100$ (7,8). Significant developmental delay is defined as DQ of 70 or less. Atypical development is described as delay, deviation, dissociation or regression (*Table 2*) (1-3,7-10). DQ is a measure of rate of

Table 3 Diagnostic and statistical manual of mental disorders classification of neurodevelopmental disorders

Disorder	Sub-categories
Intellectual disabilities	Intellectual disability: mild, moderate, severe, profound Global developmental delay Unspecified intellectual disability
Communication disorders	Language disorder Speech sound disorder Childhood-onset fluency disorder (stuttering) Social (pragmatic) communication disorder Unspecified communication disorder
Autism spectrum disorder	Autism spectrum disorder with a known medical or genetic condition or environmental factor Associated with another neurodevelopmental, mental or behavioral disorder
Attention-deficit/hyperactivity disorder	Predominantly inattentive Predominantly hyperactive/impulsive Combined inattentive and hyperactive/impulsive Other Unspecified
Specific learning disorder	Impairment in reading Impairment in written expression Impairment in mathematics
Motor disorders	Developmental coordination disorder Stereotypic movement disorder Tourette disorder Tic disorders
Other	Other or unspecified neurodevelopmental disorders

Source: American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th edition. Washington DC: American Psychiatric Press, 2013:33-86.

progression of development in a given domain.

Clinical presentations

The predominant clinical presentation of atypical development varies in infants, children and adolescents. Various neurodevelopmental disorders are described based on their clinical features; the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) classification of neurodevelopmental disorders is shown in *Table 3 (5)*.

Infants

Atypical motor development

Parents are more likely to first notice if infant fails to attain expected motor milestones. Often, parents compare infant's development to other infants. Because typical development occurs within a range of period, most infants with apparent motor delay likely have normal variation or maturational lag (8,10). Cerebral palsy is the most significant cause of motor delay in infancy. In addition to motor delay, infants and children with cerebral palsy have abnormal tone and posture

Table 4 Early clinical signs suggestive of cerebral palsy

Age	Clinical signs
3–6 months	Head falls back when picked up while lying on back Feels stiff Feels floppy Seems to overextend back and neck when cradled in someone's arms Legs get stiff and cross or scissor when picked up
≥6 months	Doesn't roll over in either direction Cannot bring hands together Has difficulty bringing hands to mouth Reaches out with only one hand while keeping the other fist
≥10 months	Crawls in a lopsided manner, pushing off with one hand and leg while dragging the opposite hand and leg Scoots around on buttocks or hops on knees, but does not crawl on all fours

Source: Public domain: <https://www.cdc.gov/features/cerebral-palsy-11-things/index.html>

or movements (8-10,13,14,22,23). Delay in attaining motor milestones is an early sign of cerebral palsy. Other clues that parents first notice are listed in *Table 4* (22,23). Other major causes of predominant motor delay during infancy include birth injury to the brain, stroke, metabolic insult affecting brain, congenital central nervous system infections and neuromuscular disorders (10,13-15,17,18).

Atypical development in social and language domains

Another area of concern in infancy and toddler age is atypical progression of development in social, cognitive and language domains. A complete evaluation is indicated in infants or toddlers with following signs: no babbling, no pointing (joint attention) or gestures by 12 months of age; no single words by 16 months; and no 2-word spontaneous phrases by 24 months (11,12,14). Absence of joint attention, the ability to attend to both and object and a person at the same time, is considered an early sign of autism (5,12). Any loss or regression of a previously acquired skill at any age is any indication for complete diagnostic evaluation including neurological, metabolic and genetic as appropriate (15). Developmental regression is often seen in infants and toddlers with autism between 18 and 24 months of age (10,12). Other significant causes of regression before 2 years of age include metabolic conditions such as disorders of amino acid metabolism, lysosomal storage disease, hypothyroidism, mitochondrial diseases, tuberous sclerosis, Lesch-Nyhan syndrome, Rett syndrome, Canavan disease, and Pelizaeus-Merzbacher disease (10). In addition

to autism spectrum disorder, other conditions that should be considered in infants with predominant language, cognitive and social deficits include hearing impairment, severe cognitive deficit, genetic disorders, inborn errors of metabolism, hypothyroidism, and severe nutritional or environmental deprivation (1,3,10,15).

Children

Atypical language development

Concerns about development of speech and language (*Table 5*) are predominant presentations in children. In a typically developing child, intelligibility of speech progresses from about 25% by age 2 years to 100% by age 4 years. In addition to poor intelligibility for given age, persistent baby talk, mispronunciations of words or lack of spontaneous speech suggest speech and language delay (24-30). The basic components of a language are phonology, grammar, lexicon, semantics and pragmatics (*Table 6*); any of which can be affected in a child with atypical language development (24-30).

Autism spectrum disorder, intellectual disability, and developmental language disorder are main causes for atypical language development in a young child (9,11-14,18,20,31). Autism spectrum disorder is characterized by qualitative impairment in social relatedness, stereotypical behaviors and a spectrum of impairment in communication ability, especially social communication (5,12,32). Autism spectrum disorder can be generally

Table 5 Basic speech and language terms

Term	Description
Speech	Production of sounds for words
Language	System of symbolic knowledge represented in the brain used for meaningful communication
Prosody	Pattern of rhythm, stress, and intonation of speech
Phoneme	A unit of sound in speech
Morpheme (word)	The smallest meaningful unit of language

Table 6 Basic components of language

Component	Subcomponent	Description
Structure or form of language	Phonology	Sound system of the language that is made of phonemes. Use of phonemes and conventions for their combinations
	Grammar	Morphology: rules or conventions for constructing meaningful words, e.g., adding -s/-es to a word to indicate plural (duck/ducks) Syntax: rules or conventions for constructing meaningful phrases or sentences and their relationship, e.g., word order “Daddy go there” But “There Daddy go” is not typical English structure
Content of language	Lexicon	Vocabulary
	Semantics	Relationship among words. Symbols representing universal concepts. Meaning of words. (e.g., in relation to objects, agents, an action, states, attributes or locations). Meaning and relationship of abstract concepts (e.g., idioms and proverbs)
Use of language	Pragmatics	Rules or conventions for use of language in a socially and culturally appropriate manner and in the appropriate context, e.g., turn taking, eye contact, maintaining a topic in conversation

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recognized between 18 and 24 months of age when parents first bring their child concerned about his or her unusual behaviors or difficulty with social communication (5,12). A child with autism spectrum disorder may not be socially engaged, may demonstrate intense focus on a particular object for a prolonged period, may appear withdrawn at times, have poor eye contact, get attached to a particular object (toy), have specific rituals, and resist change in routine (5,12,32-38). A child with autism has difficulty understanding other person’s feelings, and may not engage in playing pretend games (5,12,22-38). Individuals with Asperger syndrome (also considered to be a form of high functioning autism spectrum disorder) demonstrate normal cognitive and language abilities and predominant deficits in social development (29-41).

A child with predominant cognitive deficit or intellectual

disability generally has typical progression of motor development and his or her behaviors are commensurate with MA (18-20). Although a child with intellectual disability has both cognitive and adaptive functioning deficits, his or her social participation is also consistent with MA. In addition to language delay, a child with predominant cognitive deficit has difficulty problem solving and may not be able to relate their behaviors to consequences (18-20). In most cases, no specific etiology can be identified in children with intellectual disability, especially those with mild deficits; a specific cause is more likely to be identified in those with severe deficits (15,17-21). The most common cause of inherited intellectual disability is Fragile X syndrome (19,20). Other major causes of intellectual disability are fetal alcohol syndrome, lead toxicity, iron deficiency, and congenital brain malformations (15,17-21).

Developmental language disorder is characterized by predominant deficit in language development and typical development in other domains—social, motor and cognitive (24-26,30). In addition to autism and intellectual disability, the differential diagnosis of speech and language disorders should include hearing deficit, speech and voice disorders, maturational language delay, and a lack of environmental stimulation for language and learning (24-26). A bilingual home environment is not a cause for language delay. The various sub-types of developmental language disorders have been described that are based on particular aspects of the language that is affected (*Table 7*) (24-30).

Disorders of speech include speech sound disorder, stuttering, dysarthria, verbal dyspraxia and resonance disorders (*Table 8*) (5,25). Disturbance of airflow through nasopharyngeal airway results in either hypernasal or hyponasal voice; it is important to note that airflow obstruction is associated with the production of consonant sounds, and not associated with the production of vowel sounds (25). Selective mutism is not considered a language disorder, rather a specific type of anxiety disorder in which a child consistently fails to be able to speak in a given situation when he or she is expected to speak (5).

Regression of or failure to acquire expected new skills

In addition to developmental regression seen in children with autism, other conditions in which regression of skills is seen include Rett syndrome and Landau-Kleffner syndrome (LKS) (10,14). A child with Rett syndrome shows regression of acquired skills following a period of relatively typical development during infancy. Rett syndrome is an X-linked disorder predominantly affecting females (10). Other clinical features of Rett syndrome are autistic behavior, abnormal wringing hand movements, deceleration of head circumference, hyperventilation, breath holding, air swallowing, gait dyspraxia, autonomic dysfunction, inappropriate laughing, and intense eye contact (10). Often there is some recovery following a period of regression followed by further deterioration.

The clinical features of LKS are generally recognized between 3 and 8 years of age (10). Following a period of typical development during the first 3 years, the child with LKS loses language skills; whereas, no deficits are noted in cognitive or social development (10). The sleep electroencephalograph in LKS shows seizure pattern (10). Other causes of developmental regression in children older

than 2 years of age include some genetic disorders, inborn errors of metabolism, and disorders of white and gray matter (10).

Early learning difficulties and behavioral symptoms

Learning difficulty and associated behavioral symptoms are most apparent first during early elementary grades. Poor academic performance is often the main parental concern. Other indications of learning difficulty include delay in completing assigned school work, inattentiveness in the classroom setting, difficulty learning new skills, and difficulty with reading and comprehension (42,43). Children with learning difficulty are also shy and reluctant to participate in activities with other children. In addition to various types of specific or developmental learning disorders other conditions to be considered in the differential diagnosis in these children include attention deficit hyperactivity disorder (ADHD), hearing or vision impairment, cognitive deficit and developmental coordination disorder (42).

Vision and hearing impairment may be associated with other developmental disabilities. A child with visual impairment might close or cover one eye; squint the eyes or frown; complaint that things are blurry or hard to see; have trouble reading or doing other close-up work, or hold objects close to eyes; blink more than usual or seem cranky when doing close-up work such as looking at a book. A child with complete or partial hearing impairment might not turn to the source of a sound from birth to 3 or 4 months of age; may not say single words, such as “dada” or “mama” by 1 year of age; turn head when he or she sees you but not if you only call out his or her name. This often is mistaken for not paying attention or just ignoring.

Developmental coordination disorder affects school-age children and persists into adolescent years (5). Difficulties in motor coordination will cause substantial impairment in academic function or activities of daily living (5). Early manifestations may include difficulty sucking and swallowing, drooling during infancy, speech difficulties and delayed motor milestones during early childhood. Parents may observe that the child has difficulties with many of the fine motor tasks such as using scissors, tying shoe laces or buttoning or unbuttoning (5). They also may drop objects, have poor handwriting, or will frequently bump into furniture or other people. Differential diagnosis in these children include ADHD, visual impairment, and intellectual disability.

Table 7 Sub-types of developmental language disorders

Disorder	Key characteristics
Verbal dyspraxia (developmental apraxia of speech)	Expressive language disorder Difficulty planning, sequencing and executing voluntary speech sounds Dysfluent, significantly delayed, unintelligible speech Inconsistent articulation errors
Speech programming deficit disorder	Expressive language disorder Fluent, unintelligible, jargon Considered by some to be similar to verbal dyspraxia
Verbal auditory agnosia (word deafness)	Mixed receptive-expressive disorder Profound impairment in comprehension of spoken words Most children non-verbal or very limited verbal expression Very rare in children
Phonologic or syntactic deficit disorder	Mixed receptive-expressive disorder Comprehension relatively better than expression Telegraphic speech, limited vocabulary Grammatical errors Significant omissions, distortions, and substitution of words Short sentences, difficulty in repeating words or sentences
Lexical deficit disorder (lexical-syntactic deficit)	Higher order processing disorder Severe deficits in word finding and paraphrasing Jargon and pseudo stuttering Significant deficiency in understanding connected speech Impoverished syntax, syntactic distortions Spontaneous language relatively better than language on demand Ability to decode wh- questions is limited
Semantic-pragmatic deficit disorder	Higher order processing disorder Poor discourse of connected speech Apparent talkativeness Phonology and (simplified) syntax preserved Atypical choices of words Word finding deficits Significant deficits in comprehension and verbal reasoning Tangential and stereotyped speech, echolalia Speaking aloud to no one in particular Poor maintenance of topic Responding inaccurately or out of context Rare disorder in children

Table 8 Developmental speech disorders

Disorder	Description
Speech sound disorder	Also described as functional articulation disorder or phonological disorder. Characterized by errors in articulation and speech sounds, consistent substitution of simple sounds for complex sounds or single consonants for blended consonants, dropped consonants, and errors within words. Problem may not be recognized until preschool
Stuttering	Disturbed speech fluency with atypical rate and rhythm, and repetitions of sounds, syllables, words, and phrases generally accompanied by evidence of stress or physical tension. There may be sound prolongations, interjections, pauses within words, blocking of words. Typical onset between 2 and 7 years with peak at age 5 years
Resonance disorders	Can be either hypernasal or hyponasal voice due to anatomical factors. Hypernasality may be due to dysfunction of the velopharyngeal mechanism, seen for example in cleft palate. Hyponasality is seen, for example, in nasal congestion, upper respiratory infections, nasal anomalies, hypertrophied adenoids
Dysarthria	Due to dysfunction of the neuromuscular or motor mechanism for speech production (e.g., cerebral palsy). Characterized mainly by inconsistent misarticulations of speech sounds and words, poor intelligibility, and slow speech
Verbal dyspraxia and speech programming disorder	Both terms describe similar types of largely speech production problems. These disorders may significantly influence expressive language as well

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Adolescents

Academic difficulties

The predominant concern in adolescents is difficulty in learning as the burden and complexity of academic work increase with advancing grade levels. Difficulty in learning may affect one or more areas of learning. Children and adolescents with specific learning disorder may present with associated behavioral symptoms. The differential diagnosis of learning disorders should include specific or developmental learning disorder, anxiety, depression, ADHD, and substance use disorders (42-57). Learning is also affected by the adequacy and quality of support system and instructions. Nutritional and psychosocial factors can also affect learning and academic performance.

Specific or developmental learning disorder is diagnosed when scores on an individually administered standardized achievement tests (in reading, mathematics, or written expression) are substantially below that expected for the child's age, intelligence and education level (5,43). Non-verbal specific learning disorder is characterized by difficulty in problem solving ability, and deficits in visual-spatial and visual-perceptual abilities; language-based skills and intelligence are normal. Key features of reading disorder, mathematics disorder and disorder of written expression are summarized in *Table 9* (42-58).

Clinical approach

Surveillance

Developmental and behavioral surveillance is recommended at every preventive or health maintenance visit (1,11). Information should be obtained from multiple sources including care givers and parents, teachers, and academic performance reports. A detailed prenatal, birth, perinatal, neonatal, and developmental history is essential aspect in the diagnostic evaluation of children with atypical development. Parental concerns regarding child's development and behavior provides a basis for the direction of evaluation. The developmental history should assess areas of typical and atypical progression of milestones in all streams or domains of development—gross motor, fine motor, speech and language, and social (1).

Although, specific emphasis on a particular aspect of physical examination is guided by the presenting symptoms, some aspects are of fundamental consideration in all children. These include serial measurements of growth parameters—height, weight, head circumference, visual acuity, hearing, and a thorough search for congenital anomalies and dysmorphic features. The growth parameters should be plotted on appropriate graphs. In older children and adolescents mental status examination should be included and in adolescents external genital examination

Table 9 Key features of specific learning disorders

Disorder	Most likely to be recognized by	Some key features
Mathematics	2 nd or 3 rd grade level	Key problem is with arithmetics Difficulties in: Understanding or naming mathematical terms Math operations or concepts Decoding or recognizing math symbols or signs Copying numbers or figures Following sequences of math steps Counting or multiplication tables
Reading	4 th grade level	Delayed language milestones Spelling errors Slow reading Problems with rhyming words or words that sound alike Difficulty decoding unfamiliar or nonsense words or single words
Written expression	5 th grade level	Poor writing skills Grammatical errors Punctuation errors Poor paragraph organization Spelling errors Very poor handwriting

sexual maturity rating should be noted.

The pattern of atypical progression of development—delay, dissociation, deviation, regression—is ascertained based on the information obtained from the history and physical examination. Developmental maturation and behavior of the child are closely linked and any evaluation of child's development should include a behavioral history. Child's interactions and behavior, both in familiar (home, school) and unfamiliar (community) settings, should be ascertained. Information should be obtained about child's interactions with peers, parents, other care givers, teachers, and other adults (1). The behavioral history provides the basis to describe any atypical pattern of child's behavior, such as aggression, impulsivity, decreased social engagement, repetitive behaviors or self-injurious behavior (1). Behavior is generally assessed based on direct observation, spontaneous activities or responsive behaviors across different settings (1). As part of surveillance, information should be obtained about possible risk and

protective factors relative to child's developmental and behavioral concerns (1,3,11).

Screening

Developmental screening that screen across all streams of development with appropriate standardized screening instrument is recommended as part of the periodic health maintenance examinations in the primary care setting at 9, 18, 24 or 30 months of age (*Table 10*) (1,11). Although screening is across all streams, certain areas are of specific focus at each visit. In addition, autism specific screening is recommended at 18- and 24-month visits (1,11,12). Examples of standardized tools for general developmental screening, general behavioral screening, language screening, and autism screening are listed in *Table 11* (59-67).

It is important to use standardized, validated screening tool to reduce the false positive and false negative results, which can have implications for further evaluation. A systematic

review analyzed 11 studies that described developmental screens performed by primary care physicians (6). This review determined the sensitivity of these screens to range between 14% and 54% while their specificities ranged between 69% and 100%. There was 1 outlier in this review with a sensitivity of 85% and a specificity of 61%. Sensitivity of the developmental screenings, excluding the outlier, was consistently low. Thus, developmental screens correctly identified children with developmental delays a low

number of times. On the other hand, the specificity of the developmental screens was up to the standards of 70%.

Evaluation

A more comprehensive evaluation is guided by findings on developmental surveillance and screening. Specific clinical psychological or neuropsychological evaluation and psychological testing should be performed by clinical psychologists with appropriate expertise and experience in the evaluation of children with atypical development. Based on findings on clinical history and physical examination further medical evaluation may be indicated. Such evaluation may include neuroimaging, electroencephalography, tests for genetic disorders, and specific laboratory tests for inborn errors of metabolism and should be considered in consultation with appropriate medical specialists (11,12,14,15).

Both hearing screening and vision screening are part of periodic health maintenance or preventive health visits. In addition, parental concerns about a child's hearing or vision are indications for further audiological testing and complete vision evaluation. In the United States, based on current guidelines, universal hearing screening is done in all newborns by 1 month of age, with a follow-up audiological testing, if indicated, by 3 months of age. Treatment

Table 10 Screening

Screening	Focus area	Identified concerns
9 months	Vision	Hearing deficit
	Hearing	Vision deficit
	Gross and fine motor	Neuromotor problem
	Receptive language	
18 months	Expressive language	Hearing and vision deficits
	Receptive language	Autism
		Language problem
		Cognitive deficits
30 months	Behavioral interactions	Attention problems
		Disruptive behaviors

Table 11 Examples of standardized screening tools

Category	Screening tool	Source
General developmental screening	Ages and States Questionnaires-3 (ASQ-3)	Paul H Brooks Publishing www.brookespublishing.com
	Parents' Evaluation of Developmental Status (PEDS)	Ellsworth & Vandermeer Press; www.pedstest.com
	Parents' Evaluation of Developmental Status: Developmental Milestones (PEDS:DM) Screening Version	
	Survey of Wellbeing of Young Children (SWYC)	www.theswyc.org
General behavioral screening	Ages and Stages Questionnaire: Social-Emotional-2 (ASQ:SE-2)	www.agesandstages.com
	Brief Infant Toddler Social Emotional Assessment (BITSEA)	Pearson Assessments https://www.pearsonassessments.com
	Pediatric Symptom Checklist-17 items (PSC-17b)	https://www.massgeneral.org
Language	Communication and Symbolic Behavior Scales: Developmental Profile (CSBS-DP): Infant Toddler Checklist	www.brookespublishing.com
Autism	Modified Checklist for Autism in Toddlers. Revised with Follow-up (M-CHAT-R/F)	www.m-chat.org
	Social Communication Questionnaire (SCQ)	www.wpspublish.com

intervention is started by 6 months of age in any infant identified having a hearing loss. Similarly, any concerns about a child's speech and language development is an indication for complete evaluation by a speech-language pathologist. Often, no specific signs or symptoms are evident suggestive of a developmental disorder; however, based on their observations, parents remain concerned about their child's development. In these cases, a further evaluation is indicated.

Principles of management

The key principle of management of children with developmental concerns is early intervention. The content and delivery of early intervention services may vary in different health systems. For example, in the United States, many federal and state regulations provide a basis and framework for such services to be delivered within the context of the local formal education system (68,69). When a developmental problem is recognized, the child is enrolled in the early intervention service, while further evaluation may proceed at the same time. This approach is based on the principles of response to intervention concept (68,69). Rather than waiting for a definitive diagnosis, intervention is implemented and further course of action is guided by response to the intervention. Among the major services included in the intervention programs are occupational therapy, physiotherapy and speech therapy. School age children are evaluated further to develop individualized learning plans that include various remediation, accommodation or psychoeducational strategies (43). In addition, environmental risk factors are considered and addressed in home, school and community settings as appropriate. When a specific developmental or behavioral disorder is identified, treatment is tailored to the condition and may include specific behavioral and pharmacological interventions.

Conclusions

The development from infancy through adolescence is described under four main streams or domains of development, namely, (I) gross and fine motor, (II) speech-language, (III) social-emotional, and (IV) cognitive. However, overall typical development progresses concomitantly in all domains. Typical development follows certain well recognized patterns, an understanding of

which, helps us identify atypical patterns of developmental progression. Developmental delay, deviation, dissociation and regression are recognized as atypical patterns of development. The predominant clinical presentations of atypical patterns of development vary depending up on the age of the infant or child at presentation. The DQ is used as a measure of rate of development in any given domain; similarly, intelligence quotient is used as measure of intelligence. The clinical approach to developmental diagnosis is based on the principles of regular surveillance, periodic screening and diagnostic evaluation when indicated based on finding on surveillance and screening. Early recognition of atypical development is important as early treatment interventions, based on response to intervention model, have been shown to the most effective.

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Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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