

Normal development and developmental assessment

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CHILD NEUROLOGIST

Introduction

Physicians require knowledge of normal development, and behavior in order to effectively monitor children's progress, identify delays or abnormalities in development.

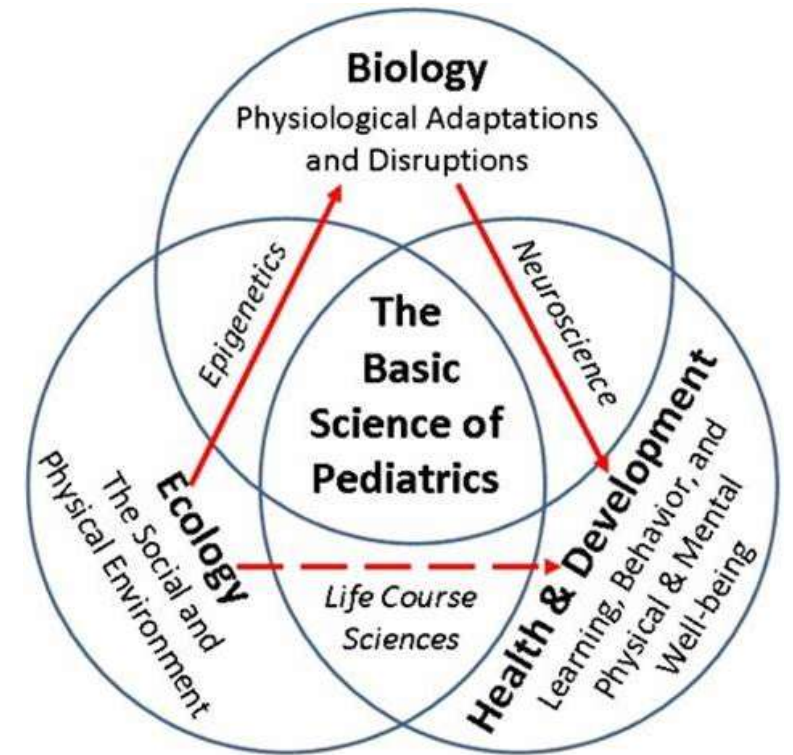


Do all children develop in the same way ?

Ecobiodevelopmental framework:

Development is the outcome of genomics (including epigenetics), molecular biology, and ecology of childhood (social and physical environments)

- in utero exposure to teratogens, the long-term negative effects of low birthweightetc



The Importance of Parenting

Interactions between parents and their children provide stimulation that promotes the development of language, early cognitive skills, and school readiness.

The Role of the Family

Families are changing how they spend time together. Media use for both parents and children has increased dramatically with the advent of tablets and smartphones.

Child Temperament

parenting does not occur in isolation. The child also brings to the parent–child relationship their own personality, Nine traits have been identified in child temperament:

- activity level, predictability of behavior, reaction to new environments, adaptability, intensity, mood, distractibility, persistence, and sensitivity.

Normal Development

0 – 2 months

Language/communication:

- Makes sounds other than crying
- Reacts to loud sounds

Cognitive

- Watches you as you move
- Looks at a toy for several seconds

Motor

- Holds head up when on tummy
- Moves both arms and both legs
- Opens hands briefly

Social-emotional

- Calms down when spoken to or picked up
- Looks at your face
- Seems happy to see you when you walk up to them
- Smiles when you talk to or smile at them



4 months :

Language/communication:

- Makes sounds like "oooo" and "aahh" (cooing)
- Makes sounds back to you when you talk to them
- Turns head toward the sound of your voice

Cognitive

- If hungry, opens mouth when they see breast or bottle
- Looks at their hands with interest

Motor

- Holds head steady without support when you are holding them
- Holds a toy when you put it in their hand
- Uses their arm to swing at toys
- Brings hands to mouth
- Pushes up on elbows/forearms when on tummy

Social-emotional

- Smiles on their own to get your attention
- Chuckles when you try to make them laugh
- Looks at you, moves, or makes sounds to get or keep your attention



6 months :

Language/communication:

- Takes turns making sounds with you
- Blows "raspberries" (sticks out tongue and blows)
- Makes squealing noises

Cognitive

- Puts things in their mouth to explore them
- Reaches to grab a toy they want
- Closes lips to show they do not want more food

Motor

- Rolls from tummy to back
- Pushes up with straight arms when on tummy
- Leans on hands to support themselves when sitting

Social-emotional

- Knows familiar people
- Likes to look at themselves in the mirror
- Laughs



9 months :

Language/communication:

- Makes different sounds like "mamamama" and "babababa"
- Lifts arms to be picked up

Cognitive

- Looks for objects when dropped out of sight (eg, spoon, toy)
- Bangs 2 things together

Motor

- Gets to a sitting position by themselves
- Sits without support
- Uses fingers to "rake" food toward themselves
- Moves things from 1 hand to the other hand

Social-emotional

- Is shy, clingy, or fearful around strangers
- Shows several facial expressions (eg, happy, sad, angry, surprised)
- Looks when you call their name
- Reacts when you leave (eg, looks, reaches for you, or cries)
- Smiles or laughs when you play peek-a-boo



12 months :

Language/communication:

- Waves "bye-bye"
- Calls a parent "mama" or "dada" or another special name
- Understands "no" (pauses briefly or stops when you say it)

Cognitive

- Puts something in a container (eg, a block in a cup)
- Looks for things they see you hide (eg, a toy under a blanket)

Motor

- Pulls up to stand
- Walks holding onto furniture
- Drinks from a cup without a lid, as you hold it
- Picks thing up between thumb and pointer finger (eg, small bits of food)

Social-emotional

- Plays games with you (eg, pat-a-cake)



15 months :

Language/communication:

- Tries to say 1 or 2 words besides mama or dada (eg, "ba" for ball or "da" for dog)
- Looks at a familiar object when you name it
- Follows directions given with both a gesture and words (eg, gives you a toy when you hold out your hand and say, "Give me the toy")
- Points to ask for something or to get help

Cognitive

- Tries to use things the right way (eg, phone, cup, book)
- Stacks at least two small objects (eg, blocks)

Motor

- Takes a few steps on their own
- Uses fingers to feed themselves some food

Social-emotional

- Copies other children while playing (eg, taking toys out of a container when another child does)
- Shows you an object that they like
- Claps when excited
- Hugs stuffed doll or other toy
- Shows you affection (eg, hugs, cuddles, or kisses you)



18 months :

Language/communication:

- Tries to say ≥ 3 words besides mama or dada
- Follows 1-step directions without any gestures, like giving you the toy when you say, "Give it to me"

Cognitive

- Copies you doing chores (eg, sweeping with a broom)
- Plays with toys in a simple way (eg, pushing a toy car)

Motor

- Walks without holding onto anyone or anything
- Scribbles
- Drinks from a cup without a lid and may spill sometimes
- Feeds themselves with their fingers
- Tries to use a spoon
- Climbs on and off a couch or chair without help

Social-emotional

- Moves away from you but looks to make sure you are close by
- Points to show you something interesting
- Puts hands out for you to wash them
- Looks at a few pages in a book with you
- Helps you dress them by pushing arm through sleeve or lifting up foot



24 months :

Language/communication:

- Points to things in a book when you ask (eg, "Where is the bear?")
- Says at least 2 words together (eg, "More milk")
- Points to at least 2 body parts when you ask them to show you
- Uses more gestures than just waving and pointing (eg, blowing a kiss or nodding yes)

Cognitive

- Holds something in 1 hand while using the other hand (eg, holding a container and taking the lid off)
- Tries to use switches, knobs, or buttons on a toy
- Plays with >1 toy at the same time (eg, putting toy food on a toy plate)

Motor

- Kicks a ball
- Runs
- Walks (not climbs) up a few stairs with or without help
- Eats with a spoon

Social-emotional

- Notices when others are hurt or upset (eg, pausing or looking sad when someone is crying)
- Looks at your face to see how to react in a new situation



30 months :

Language/communication:

- Says approximately 50 words
- Says ≥ 2 words, with 1 action word (eg, "Doggie run")
- Names things in a book when you point and ask, "What is this?"
- Says words like I, me, or we

Cognitive

- Uses things to pretend (eg, feeding a block to a doll as if it were food)
- Shows simple problem-solving skills (eg, standing on a small stool to reach something)
- Follows 2-step instructions (eg, "Put the toy down and close the door")
- Shows they know at least 1 color (eg, pointing to a red crayon when you ask, "Which one is red?")

Motor

- Uses hands to twist things (eg, turning doorknobs or unscrewing lids)
- Takes some clothes off by themselves (eg, loose pants or an open jacket)
- Jumps off the ground with both feet
- Turns book pages 1 at a time when you read to them

Social-emotional

- Plays next to other children and sometimes plays with them
- Shows you what they can do by saying, "Look at me!"
- Follows simple routines when told (eg, helping to pick up toys when you say, "It's clean-up time")



3 years:

Language/communication:

- Talks with you in conversation using at least 2 back-and-forth exchanges
- Asks, who, what, where, or why questions (eg, "Where is mommy/daddy?")
- Says what action is happening in a picture when asked (eg, running, eating, or playing)
- Says first name when asked
- Talks well enough for others to understand most of the time

Cognitive

- Draws a circle when you show them how
- Avoids touching hot objects (eg, stove) when you warn them

Motor

- Strings items together (eg, large beads or macaroni)
- Puts some clothes on by themselves (eg, loose pants or a jacket)
- Uses a fork

Social-emotional

- Calms down within 10 minutes after you leave (eg, at child care drop off)
- Notices other children and joins them to play



4 years:

Language/communication:

- Says sentences with ≥ 4 words
- Says some words from a song, story, or nursery rhyme
- Talks about at least 1 thing that happened during their day (eg, "I played soccer")
- Answers simple questions (eg, "What is a coat for?" or "What is a crayon for?")

Cognitive

- Names a few colors of items
- Tells what comes next in a well-known story
- Draws a person with ≥ 3 body parts

Motor

- Catches a large ball most of the time
- Serves themselves food or pours water, with adult supervision
- Unbuttons some buttons
- Holds crayon or pencil between fingers and thumb (not in a fist)

Social-emotional

- Pretends to be something else during play (eg, teacher, superhero, dog)
- Asks to go play with children if none are around
- Comforts others who are hurt or sad (eg, hugging a crying friend)
- Avoids danger (eg, not jumping from tall heights at the playground)
- Likes to be a "helper"
- Changes behavior on the basis of where they are (eg, place of worship, library, playground)



5 years:

Language/communication:

- Tells a story they heard or made up with at least 2 events (eg, a cat stuck in a tree and a firefighter saving it)
- Answers simple questions about a book or story after you read or tell it to them
- Keeps a conversation going with >3 back-and-forth exchanges
- Uses or recognizes simple rhymes (eg, bat-cat, ball-tall)

Cognitive

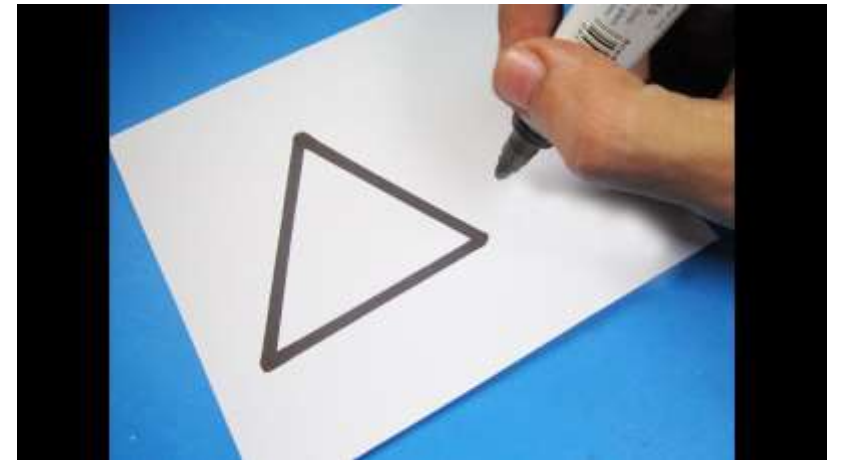
- Counts to 10
- Names some numbers between 1 and 5 when you point to them
- Uses words about time (eg, yesterday, tomorrow, morning, night)
- Pays attention for 5 to 10 minutes during activities (eg, during story time or making arts and crafts); screen time does not count
- Writes some letters in their name
- Names some letters when you point to them

Motor

- Buttons some buttons
- Hops on 1 foot

Social-emotional

- Follows rules or takes turns when playing games with other children
- Sings, dances, or acts for you
- Does simple chores at home (eg, matching socks or clearing the table after eating)



Key components of Developmental Assessment

History

- Parental developmental concerns (C/C)
- Comprehensive perinatal, neurological, family, social ...
- Developmental history
 - Streams of developmental milestone achievement
 - Gross motor
 - Fine motor
 - Verbal speech and language
 - Expressive
 - Receptive
 - Social language and self-help

- **Patterns of abnormality**

- Delay
- Dissociation
- Deviancy or deviation
- Regression

■ Behavior history

- Interactions
 - Familiar settings (e.g. home, school): parents, siblings, other familiar people, peers, other children
 - Interaction in unfamiliar settings (e.g., community): unfamiliar adults and children

■ Patterns of abnormality

- Noncompliance, disruption (including tantrums), aggression, impulsivity, increased activity, decreased attention span, decreased social engagement, decreased auditory or visual attention
- Deviation or atypical behaviors
- Repetitive play, rituals, perseverative thought or action, self-injury

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- Risk factor identification: medical, family, and social history (including social determinants of health)
 - Protective factor identification (also including social determinants)

Developmental Observation

- Movement: gross and fine motor skills
- Verbal communication: expressive speech and language, language understanding
- Social engagement and response
- Behavior: spontaneous and responsive with caregiver and with staff
- Related neurologic function on physical examination

Developmental delay occurs when development is occurring in its usual sequence but at a slower rate, with milestones achieved later than the normal range. Delay can occur in a single area of development or across several streams and can be expressed as a *developmental quotient* (DQ).

The DQ is calculated by dividing the age at which the child is functioning developmentally (*developmental age*; DA) by *chronologic age* (CA) and multiplying by 100 ($DQ = DA/CA \times 100$). A DQ of 100 indicates that the child is developing at the mean or average rate, whereas a DQ below 70 is approximately 2 standard deviations (SD) below the mean and suggests a significant delay that requires further evaluation.

Global developmental delay (GDD) is a term often used to describe young children whose limitations have not yet resulted in a formal diagnosis of ID.

In DSM-5, GDD is a diagnosis given to children <5 yr of age who display significant delay (>2 SD) in acquiring early childhood developmental milestones in 2 or more domains of development.

Developmental dissociation indicates delay in a single stream with typical development in other streams

Deviancy or deviation is defined by development occurring out of sequence, as when a child stands before sitting (as in diplegic cerebral palsy) or has better expressive vocabulary than receptive understanding of words

Regression refers to a loss of skills. It may also be identified earlier or more subtly by a slowing or lack of advancement in skills

Red Flags” in Developmental Screening and Surveillance

These indicators suggest that development is seriously disordered and that the child should be promptly referred to a developmental or community pediatrician

Positive Indicators

Presence of Any of the Following:

- Loss of developmental skills at any age
- Parental or professional concerns about vision, fixing, or following an object or a confirmed visual impairment at any age (simultaneous referral to pediatric ophthalmology)
- Hearing loss at any age (simultaneous referral for expert audiologic or ear, nose, and throat assessment)

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- Persistently low muscle tone or floppiness
 - No speech by 18 mo, especially if the child does not try to communicate by other means, such as gestures (simultaneous referral for urgent hearing test)
 - Asymmetry of movements or other features suggestive of cerebral palsy, such as increased muscle tone

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- Persistent toe walking
 - Complex disabilities
 - Head circumference above the 99.6th centile or below 0.4th centile; also, if circumference has crossed 2 centiles (up or down) on the appropriate chart or is disproportionate to parental head circumference
 - An assessing clinician who is uncertain about any aspect of assessment but thinks that development may be disordered

Negative Indicators

Activities That the Child Cannot Do:

- Sit unsupported by 12 mo
- Walk by 18 mo (boys) or 2 yr (girls) (check creatine kinase urgently)
- Walk other than on tiptoes
- Run by 2.5 yr
- Hold object placed in hand by 5 mo (corrected for gestation)
- Reach for objects by 6 mo (corrected for gestation)
- Point at objects to share interest with others by 2 yr

THANK YOU

