

How many blocks is this kid supposed to be stacking?

Assessing Development in Children

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Disclosures

Relevant Financial Relationship(s)

None

Off Label Usage

None



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Learning Objectives

- Appreciate the prevalence of developmental delay
- Highlight pertinent developmental milestones
- Review key components of the history when assessing development
- Understand how to use the physical exam to localize neurologically and form a differential diagnosis
- Demonstrate how evaluations are used to make a diagnosis or at least narrow/rule out the differential



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How Common?

- CDC 2018 annual report
 - 16.7% children have a history of developmental delay (DD)
- Nationally representative cross-sectional survey (1997-2016)
 - Caregivers reported a prevalence of intellectual disability (ID), autism spectrum disorder (ASD), and other DDs children 3-17 yrs ranged between 6-15%



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How Common?

- Inborn errors of metabolism
 - Gene defect → enzyme deficiency → ↓ interm and end products → dev plateau/regression
 - Most incidence <1/100,000 births
 - Combined incidence may approach 1/800-2500 births



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Becoming More Common?

- Prevalence of developmental disabilities has increased since the 1990s, esp. with ASD and ADHD
 - increased awareness and improved identification
 - increased survival of children born preterm
 - increased survival of children born with congenital anomalies and genetic disorders
 - increased prenatal risk factors such as older parental age and multiple births



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HPI: Localization

- Cerebral: cognitive dysfunction, seizures
- Brainstem: dysphagia, hoarseness, dizziness, impaired equilibrium
- Cerebellar: altered coordination or equilibrium
- Spinal cord: motor or sensory level, bowel/bladder dysfunction
- Motor unit: weakness



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PMH: Prenatal

- **Maternal** and paternal age
- Gravida para, miscarriages
- Ultrasounds
- Fetal movements (decr or incr)
- Maternal history during pregnancy
 - Medical and surgical history
 - Weight gain
 - Prescription and recreational drug use



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PMH: Labor and Delivery

- Gestational age
- Spontaneous, induced, scheduled, urgent/emergent
- Vaginal vs. C-section
- Vacuum or forceps extraction
- Apgar scores
- Resuscitation



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PMH: Labor and Delivery

- Complications
 - Fetal heart tones
 - Delay or failure to progress
 - Nuchal cord
 - Infection or chorioamnionitis



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PMH: Neonatal

- Neonatal
 - Nursery/NICU duration of stay
 - Medical/surgical complications?
 - Prematurity
 - Feeding
 - Respiratory
 - Hyperbilirubinemia
 - Apnea
 - Retinopathy



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Past Medical History

- Acute or chronic illnesses
- Major hospitalizations or surgeries
- Psychiatric history
- Medications and supplements
- Allergies
- Family history: 1st degree relatives, multiple individuals, consanguinity



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Gross Motor/Coordination Development

- Tummy time
- **Rolls** 4-6 mo
- Sits unassisted 7 mo
- **Crawls** 8-9 mo
- Pulls to stand 9 mo, cruises 10-11 mo, steps **12 mo, walking** 15 mo
- Runs well, throws ball 18 mo
- Kicks ball, stairs (one step) 24 mo
- Jumps 2-1/2 yrs
- Stairs (alternating), *tricycle*, catches ball 3 yrs
- Skips, *training wheels* 5 yrs
- Tandem gait 6 yrs
- *Bicycle* w/o TW 7 yrs



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Fine Motor/Self Help Development

- Hands and fisting
- Bats 3 mo
- Reaches and grabs 4 mo
- Objects to midline 5 mo
- Transfers, feeds self snacks, bottle 6-7 mo
- **Fine pincer**, scribbles **12 mo**
- Straight line 18 mo
- Circle, spoon, cup/straw, undresses 24 mo
- Scissors, toilet trained? 3 yrs
- Square, stick people, fork well, wipes, brushes teeth 4-5 yrs
- Triangle, first name, dressing 5-6 yrs
- Diamond, combs hair 6-7 yrs
- Homework and chores 7-8 yrs



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Speech/Language/Social Development

- Recognizes parent, coos, smiles 2 mo
- Visually tracking across room 3 mo
- Babbling and laughing 4 mo
- Attachment, responds to name 5 mo
- Stranger anxiety 6 mo
- Repetitive consonant sounds 8 mo
- Separation anxiety 9 mo
- Waves 10 mo
- Listens to "no" 11 mo
- **First word**, pointing, solitary/functional play **12 mo**
- 1-step command 14 mo
- Empathy 15 mo



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Speech/Language/Social Development

- 10-15 words, passes **MCHAT** 18 mo
- 50+ words, 2 word sentences, parallel play, 2-step command 24 mo
- Pronouns 2-1/2 yrs
- 200+ words, 3 word sentences, interaction with peers and imaginative play 3 yrs
- 300-1000 words Group play, 3-step commands, 100% intelligible, stories 4-5 yrs
- 2000 words, reads 25 words, counts to 10 5-6 years
- 10,000 words, reads 250 words 6-7 yrs
- Masters "r" sound 7-8 yrs



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Autistic Behaviors

- Poor eye contact
- Minimal interaction with peers
- Toe-walking
- Stereotypies
- Uses others' hands as tools
- Lines toys up and spins wheels
- Echolalia
- Lack of pointing
- Rigid schedule
- Sensory processing difficulties



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Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F)

- 2-stage tool to assess risk for ASD btw 16 and 30 months
- Available in many languages
- Revised: less questions, different order, simplified language and scoring, examples



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Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F)

- Stage 1
 - 20-item yes/no parent questionnaire
 - <5 minutes to administer, 2 minutes to score
 - Determines risk category and follow-up
 - 0-2 low risk, no further evaluation
 - 3-7 medium risk, stage 2 required
 - 8-20 high risk, pursue diagnostic evaluation, stage 2 not needed



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Modified Checklist for Autism in Toddlers, Revised with Follow-Up (M-CHAT-R/F)

- Stage 2
 - Structured questionnaire administered by health care professional
 - Same questions, probes for additional info and gives examples
 - 5-10 minutes to administer



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M-CHAT-R™

Please answer these questions about your child. Keep in mind how your child usually behaves. If you have seen your child do the behavior, the child, but he or she does not usually do it, then please answer no. Please circle yes or no for every question. Thank you very much.

1. If you point at something across the room, does your child look at it? (For Example, if you point at a toy or animal?)	Yes	No
2. Does your child respond to your voice when you call him or her? (For Example, if you call him or her from another room?)	Yes	No
3. Does your child play pretend or make-believe? (For Example, pretend to drink from an empty cup, pretend to talk on a phone, or pretend to feed a doll or stuffed animal?)	Yes	No
4. Does your child like climbing on things? (For Example, furniture, playground equipment, or stairs.)	Yes	No
5. Does your child make "grasp" finger movements near his or her eyes? (For Example, does your child wiggle his or her fingers close to his or her eyes?)	Yes	No
6. Does your child point with one finger to ask for something or to get help? (For Example, pointing to a snack or toy that is out of reach.)	Yes	No
7. Does your child point with one finger to show you something interesting? (For Example, pointing to an airplane in the sky or a big truck in the road.)	Yes	No
8. Is your child interested in other children? (For Example, does your child watch other children, smile at them, or go to them?)	Yes	No
9. Does your child show you things by bringing them to you or holding them up for you to see – not to get help, but just to show? (For Example, showing you a flower, a stuffed animal, or a toy truck.)	Yes	No
10. Does your child respond when you call his or her name? (For Example, does he or she look up, look around, or stop what he or she is doing when you call his or her name?)	Yes	No
11. When you smile at your child, does he or she smile back at you?	Yes	No
12. Does your child get upset or extremely upset? (For Example, does your child scream or cry to make noise as a tantrum or out of frustration?)	Yes	No
13. Does your child wave?	Yes	No
14. Does your child look you in the eye when you are talking to him or her, playing with him or her, or dressing him or her?	Yes	No
15. Does your child try to copy what you do? (For Example, wave bye-bye, clap, or make a funny noise when you do.)	Yes	No
16. If you have your child look at something, does your child look around to see what you are looking at?	Yes	No
17. Does your child try to get you to watch him or her? (For Example, does your child look at you for praise, or say "look" or "watch me"?)	Yes	No
18. Does your child understand when you tell him or her to do something? (For Example, if you don't point, can your child understand "put the book on the shelf" or "bring me the blanket"?)	Yes	No
19. If something new happens, does your child look at your face to see how you feel about it? (For Example, if the child hears a siren or funny noise, or sees a new toy, will he or she look at your face?)	Yes	No
20. Does the child like movement activities? (For Example, being swung or bounced on your knee.)	Yes	No

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Developmental history

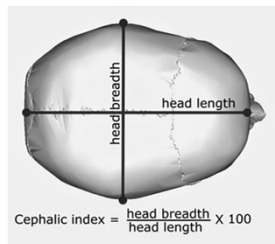
- Evaluations
 - Newborn screen
 - Hearing and vision screens
 - Growth parameters
- Therapies: PT, OT, speech, behavioral/play
- Early Intervention
- Education
 - 504 or IEP



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Physical exam

- General appearance and observations
 - Seated in parent's lap and playing
- Head: shape, fontanelles, OFC, cephalic index
- Hair color and abundance



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Physical exam

- Eyes: size/shape, position, intercanthal distance, palpebral fissures, epicanthal folds, conjunctivae/corneas, iris pigmentation



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Physical exam

- Ears: Size, shape, position, otoscopic exam
- Nose: Mucosa, size, shape, position, symmetry, septum midline
- Lips and philtrum



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Physical exam

- Mouth and throat: Mucosa, frenula, tongue, teeth and gums, palate, uvula



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Physical exam

- Neck: Palpate, auscultate carotids
- Lungs: Breath sounds
- Heart: Rate and rhythm, murmurs?
- Abdomen: Observe for distension or **organomegaly**, auscultate, palpate



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Physical exam

- Skin: Neurocutaneous findings, rashes
- Spine: curvature, bony prominences or masses, sacral dimple or hair tuft



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Neurologic exam

- Mental status
 - Awakeness, alertness, NAD?
 - Orientation
 - Mood and affect
- Speech and Language
 - Rate, volume, articulation
 - Vocabulary and sentence formation
 - Receptive and nonverbal language



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Cranial nerves

- I: genetic, closed head injury, midline defects, COVID-19
- II: fundoscopy, red reflex, visual fields, pupils and pupillary reflex
 - Ophthalmology/optometry
- III/IV/VI: extraocular movements, eyelids, nystagmus?



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Cranial nerves

- V: light touch (sensory) and masseter strength (motor)
- VII: forehead wrinkles, eyelid strength, spontaneous smile, taste
- VIII: hearing with tuning fork, vestibular testing
 - Audiology and ENT



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Cranial nerves

- IX/X: movement of the palate/uvula, gag reflex, hoarseness
- XI: trapezius and sternocleidomastoid strength
- XII: tongue movement and strength



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Motor exam

- Observation
 - Posture
 - Activity
 - Involuntary movements
- Muscle bulk
 - Atrophy
 - Pseudohypertrophy



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Motor exam

- Tone
 - Hypotonia: “floppy,” frog-legged, W-sitting
 - Hypertonia: “tight,” fisting, scissoring
 - Mixed
 - Generalized, hemi-, focal, axial and appendicular
 - Proximal and distal



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Motor exam

- Strength
 - 5/5 good against gravity and resistance
 - 4/5 good against gravity, some resistance
 - 3/5 against gravity only
 - 2/5 no movement against gravity
 - 1/5 only slight movement (flickers)
 - 0/5 no movement
- Generalized, hemi-, focal
- Proximal (myopathy) and distal (peripheral neuropathy)



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Motor exam

- Range of motion
 - Passive and active
 - Affected by tone, mechanics, and discomfort



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Reflexes

- Primitive reflexes
 - Neonate/infant
 - Suck and root
 - Palmar and plantar
 - Moro
 - Babinski
- Superficial reflexes
 - Localize injury, consciousness level
 - Babinski
 - Corneal and conjunctival
 - Abdominal
 - Cremasteric and anal



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Reflexes

- Deep tendon reflexes
 - Hyperreflexia (UMN) and clonus
 - Hyporreflexia (LMN)
 - Generalized or focal
 - Jaw, **biceps**, triceps, brachioradialis, **patellar**, achilles



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Sensory exam

- Small fiber
 - Temperature
 - Pain
- Large fiber
 - Vibratory
 - Joint position sense
- Sensory level
- Subjective, EMG may be needed



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Coordination

- Fine finger movements
- Finger-nose-finger
- Heel-to-shin
- Rapid alternating movements
- Romberg and pronator drift tests



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Gait

- Normal gait
- Toes
- Heels
- **Tandem**



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Evaluations: Labs

- Metabolic
 - CBC, CMP, TSH/free T4, CK, lactate, ammonia, pyruvate, amino acids, acylcarnitine panel, urine organic acids
- Genetic
 - Fragile X syndrome
 - Chromosomal microarray
- Neuropsych
 - Ceruloplasmin, ANA, autoimmune encephalopathy panel
- Lumbar puncture and CSF analysis



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Evaluations: Imaging

- Ultrasound
 - Prenatal
 - Head (anterior fontanelle)
 - Ventriculomegaly, IVH
 - Lumbar spine
 - Spina bifida, tethered cord



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Evaluations: Imaging

- CT
 - Craniosynostosis (3D image reformations)
 - Craniofacial abnormalities
 - Hearing/vestibular deficits



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Evaluations: Imaging

- MRI
 - Gold standard in most cases
 - Brain and entire spine, with and without contrast
 - Congenital malformations, injury, masses
- Vascular imaging
 - MRA/CTA
 - MRV/CTV
 - Doppler ultrasound



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Evaluations: Referrals

- | | |
|---|--|
| • Audiology | • Neuropsychology/
Psychology/Psychiatry |
| • Ophthalmology/
Optometry | • Developmental and
behavioral pediatrics |
| • PT, OT, speech | • Other pediatric
subspecialties |
| • Autism or other
diagnostic testing | • Pediatric neurology
subspecialties |
| • Educational
evaluations | |



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Resources

- Applegarth DA, Toone JR, Lowry RB. Incidence of inborn errors of metabolism in British Columbia, 1969-1996. *Pediatrics* 2000; 105:e10.
- Boyle CA, Boulet S, Schieve LA, et al. Trends in the prevalence of developmental disabilities in US children, 1997-2008. *Pediatrics* 2011; 127:1034.
- Centers for Disease Control and Prevention. Developmental Disabilities. Available at: <https://www.cdc.gov/ncbddd/developmentaldisabilities/>
- Lipkin PH, Macias MM, COUNCIL ON CHILDREN WITH DISABILITIES, SECTION ON DEVELOPMENTAL AND BEHAVIORAL PEDIATRICS. Promoting Optimal Development: Identifying Infants and Young Children With Developmental Disorders Through Developmental Surveillance and Screening. *Pediatrics* 2020; 145.
- Mayo Clinic. <https://mayoclinic.org>.



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Resources

- Modified Checklist for Autism in Toddlers, Revised with Follow-Up. http://www2.gsu.edu/~psydlr/M-CHAT/Official_M-CHAT_Website_files/M-CHAT-R_F.pdf
- National Center on Birth Defects and Developmental Disabilities (NCBDDD) Fiscal Year 2018 Annual Report. www.cdc.gov/ncbddd/aboutus/report/
- Pina-Garza JE. *Fenichel's Clinical Pediatric Neurology*. 7th ed.
- Radiopaedia. <https://radiopaedia.org>.
- Swaiman KF. Neurologic examination of the older child. In: *Neurology, Principles and Practice*, 4th, Swaiman KF, Ashwal S, Ferriero DM (Eds), Mosby Elsevier, Philadelphia 2006. p.17.
- Swaiman KF et al. *Swaiman's Pediatric Neurology: Principles and Practice*. 5th ed.
- UpToDate. <https://uptodate.com>.



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Questions?

