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Growth & Development: School Age

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Spring 2010

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Learning Objectives

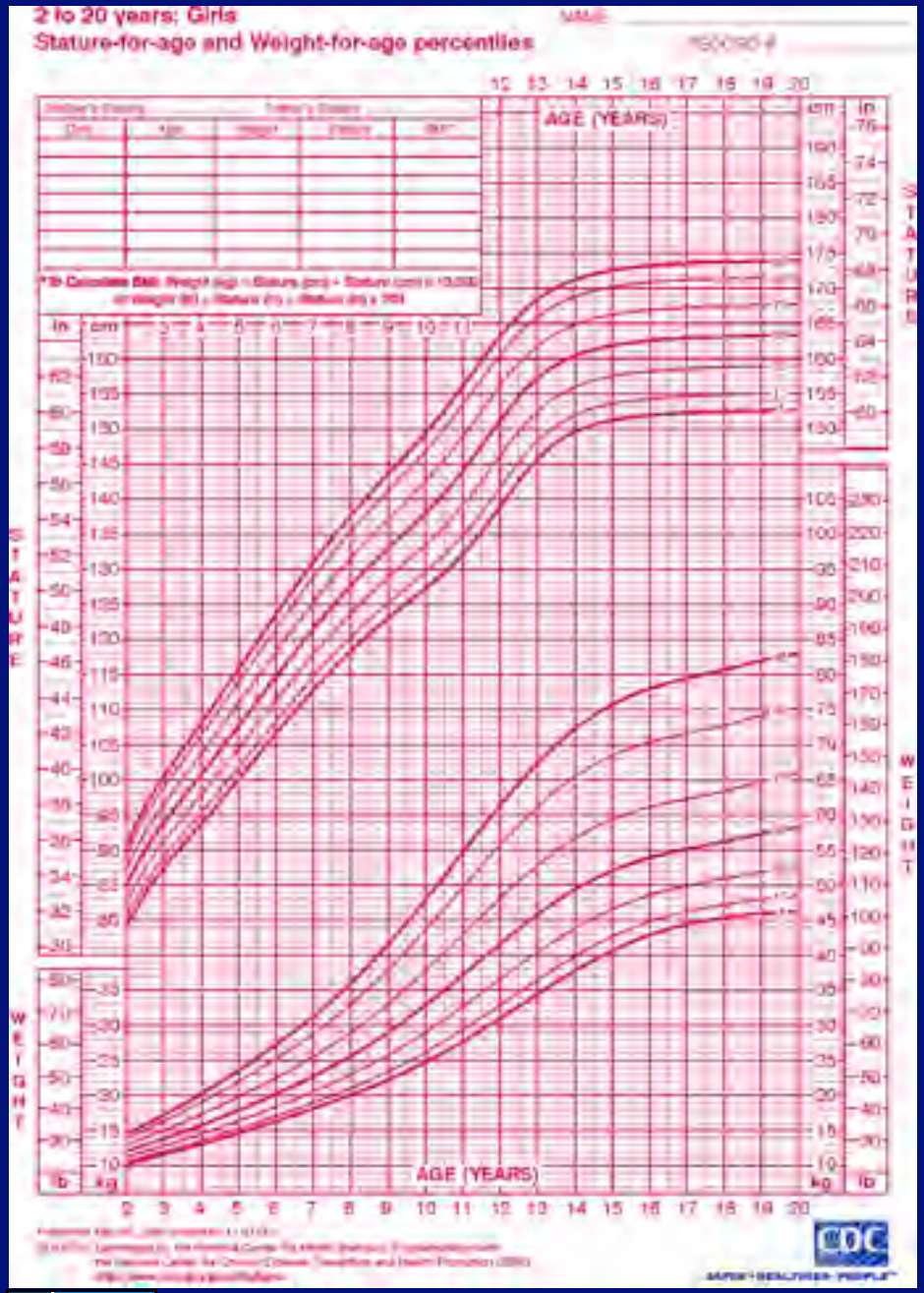
For ages 2 to 12 years:

- Physical Growth
  - Normal
  - Patterns and characteristics of abnormal
- Nutrition
- Physical Activity
- Development
  - Normal
  - Patterns and characteristics of abnormal

Physical Growth

Normal Growth: Weight and Height

- Separate growth charts for:
  - Girls and boys
  - Birth to 36 months
  - 2 to 20 years
  - Publicly available via CDC website
- Specialized growth charts for children with chromosomal abnormalities that alter growth potential (e.g. Turner's syndrome, Down syndrome)



PD-GOV CDC

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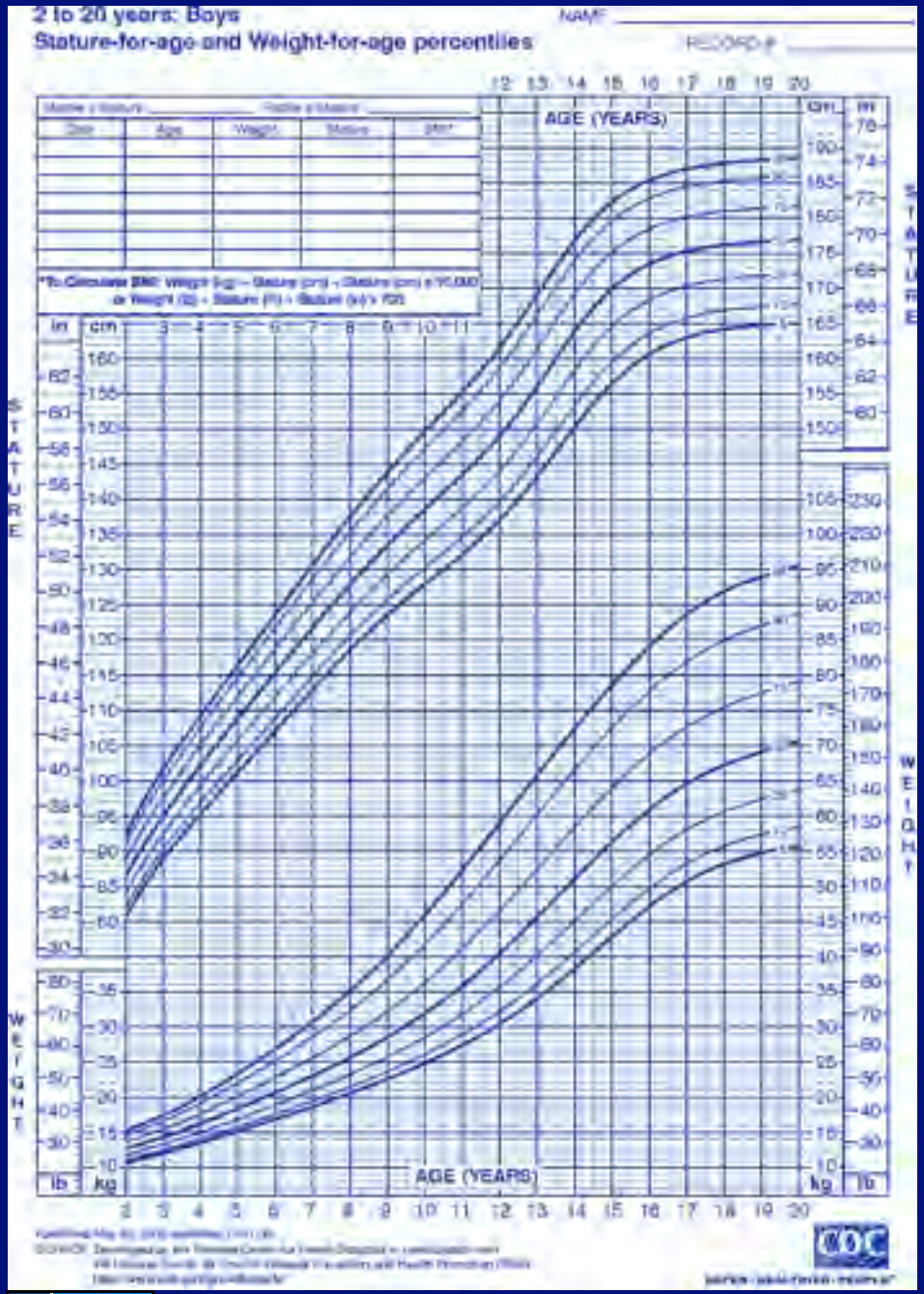
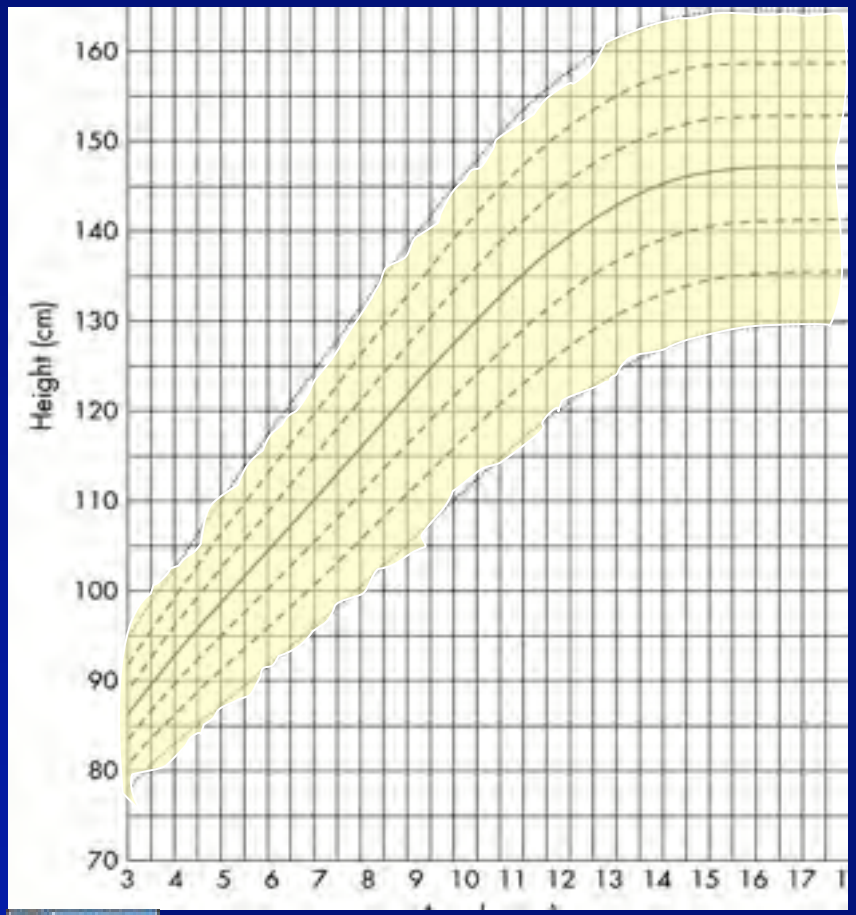

2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles
NAME
RECORD #
AGE (YEARS)
STATURE
WEIGHT
cm
in
kg
lb
AGE (YEARS)
CDC

Height

Down Syndrome Norms



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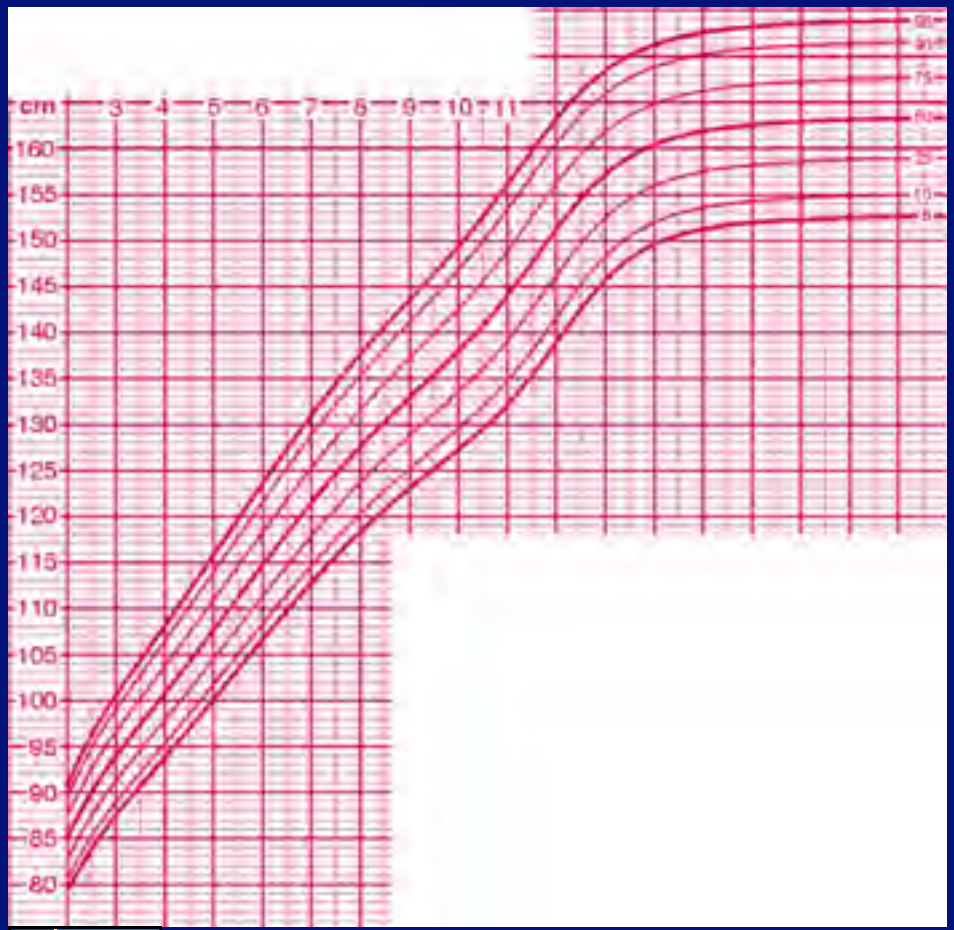
Adapted from Cronk, C. Growth Charts for Children With Down Syndrome: 1 month to 18 years of Age.

U.S. General Population Norms



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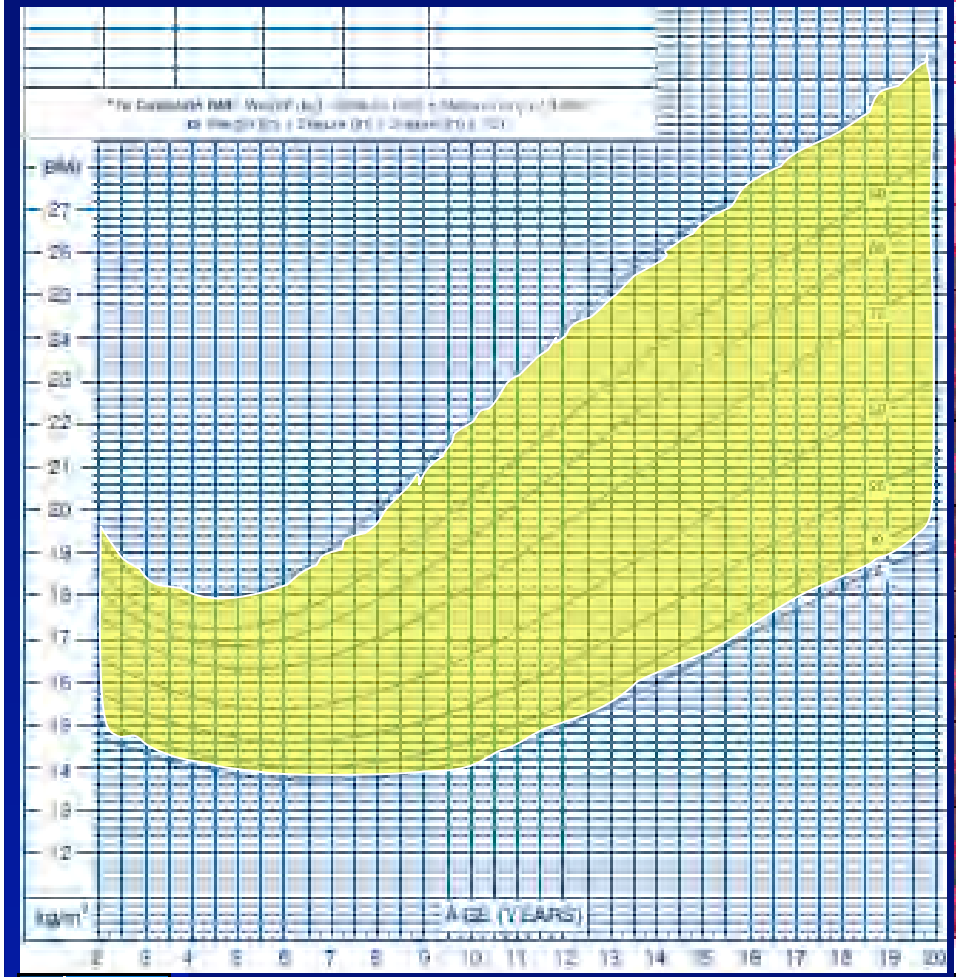
Normal Growth: Body Fat

- Body fatness is measured clinically by body mass index (BMI)
  - BMI = weight in kilograms/(height in meters)^2
- BMI is a valid method of screening for overweight in children ages 24 months and older
- BMI is a screening tool and is not a perfect indicator of body fatness

Normal Growth

- The amount of fat mass that is normal for a child changes with age and differs by gender.

"Normal" BMI in Children 2 to 20 years Differs by Age and Gender



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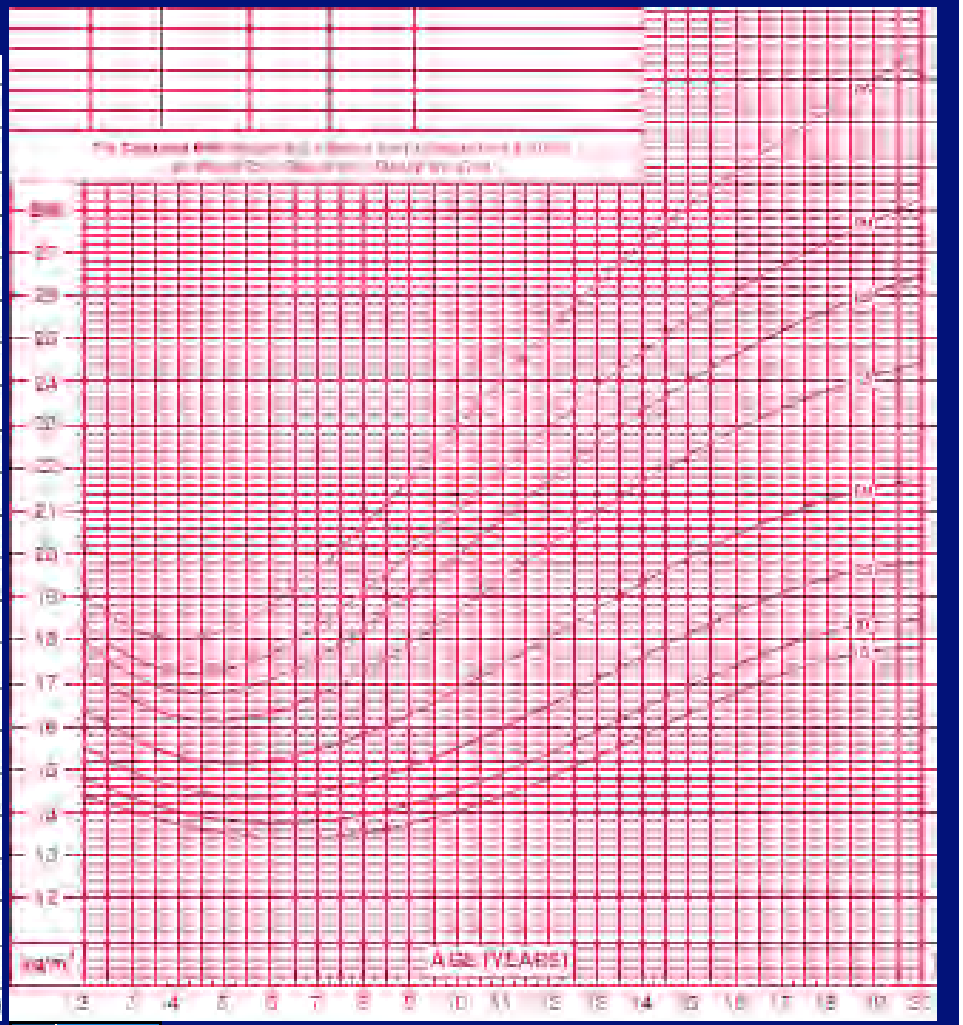

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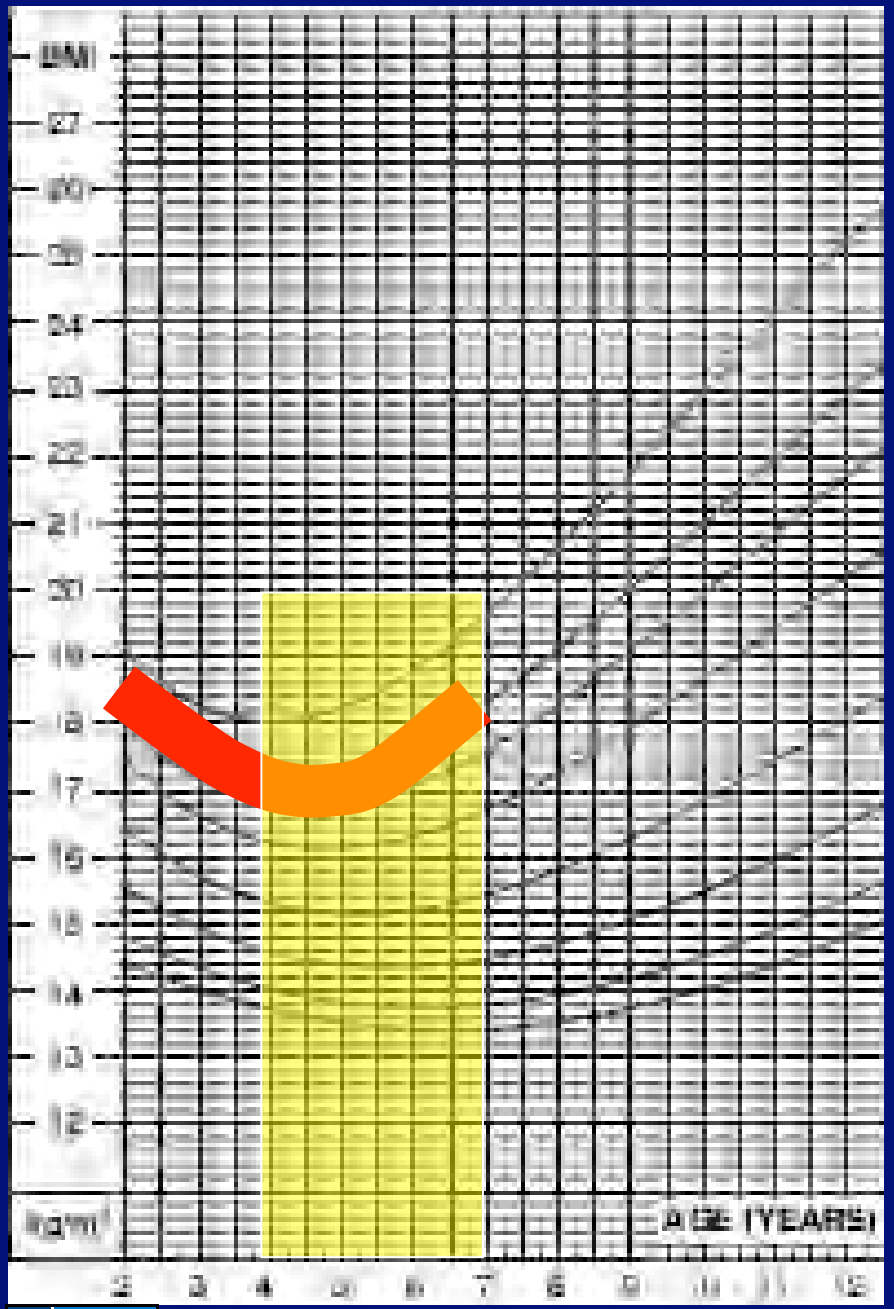
Adiposity Rebound

- Body fatness decreases during early childhood and rebounds as children grow older
- In normally growing children, occurs between ages 4 and 7 years



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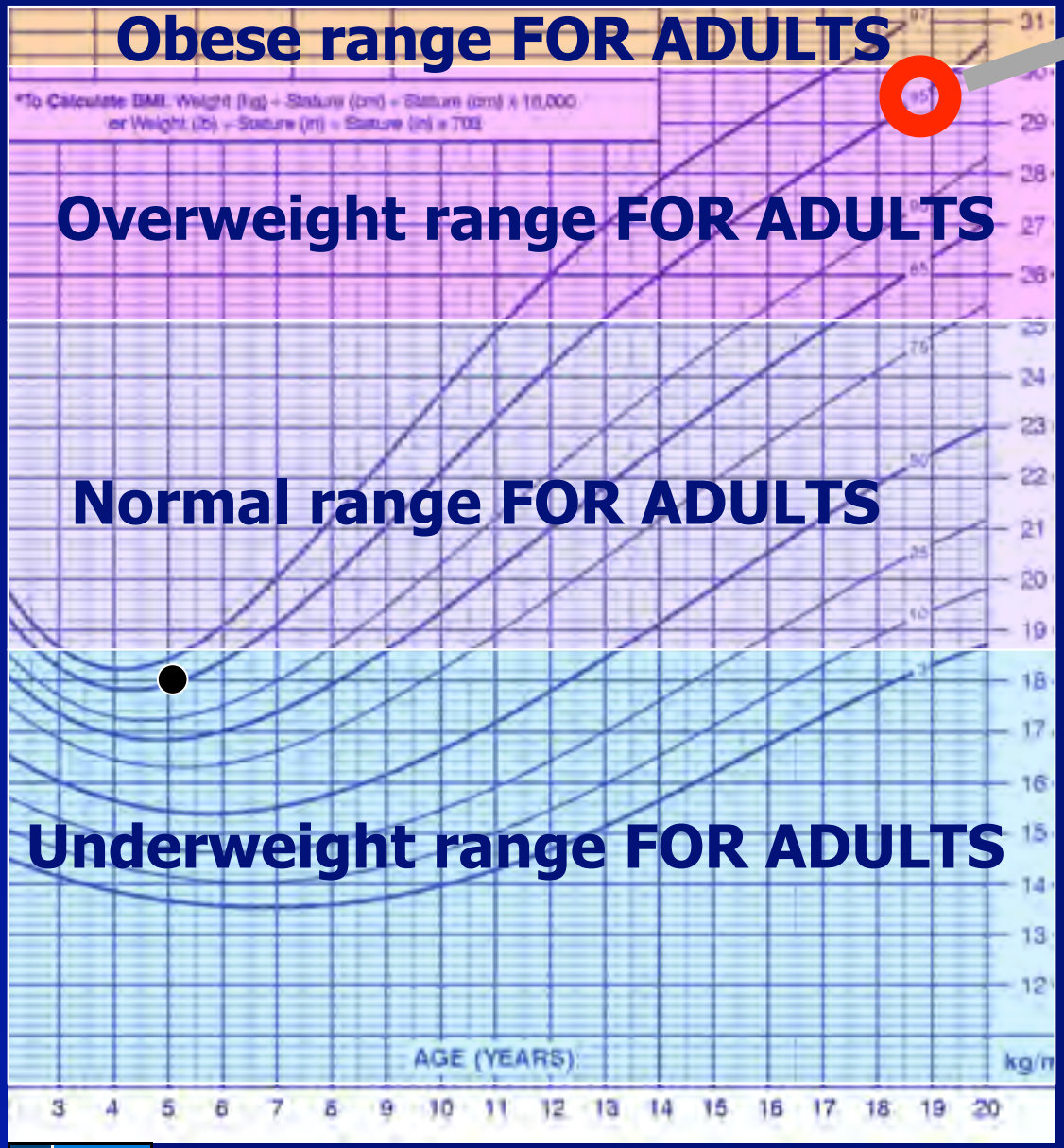
Normal BMI ranges in children



Adapted from CDC

- A normal BMI in a child often would fall in the underweight range if adult cut-offs for normal weight ranges are used

EXAMPLE

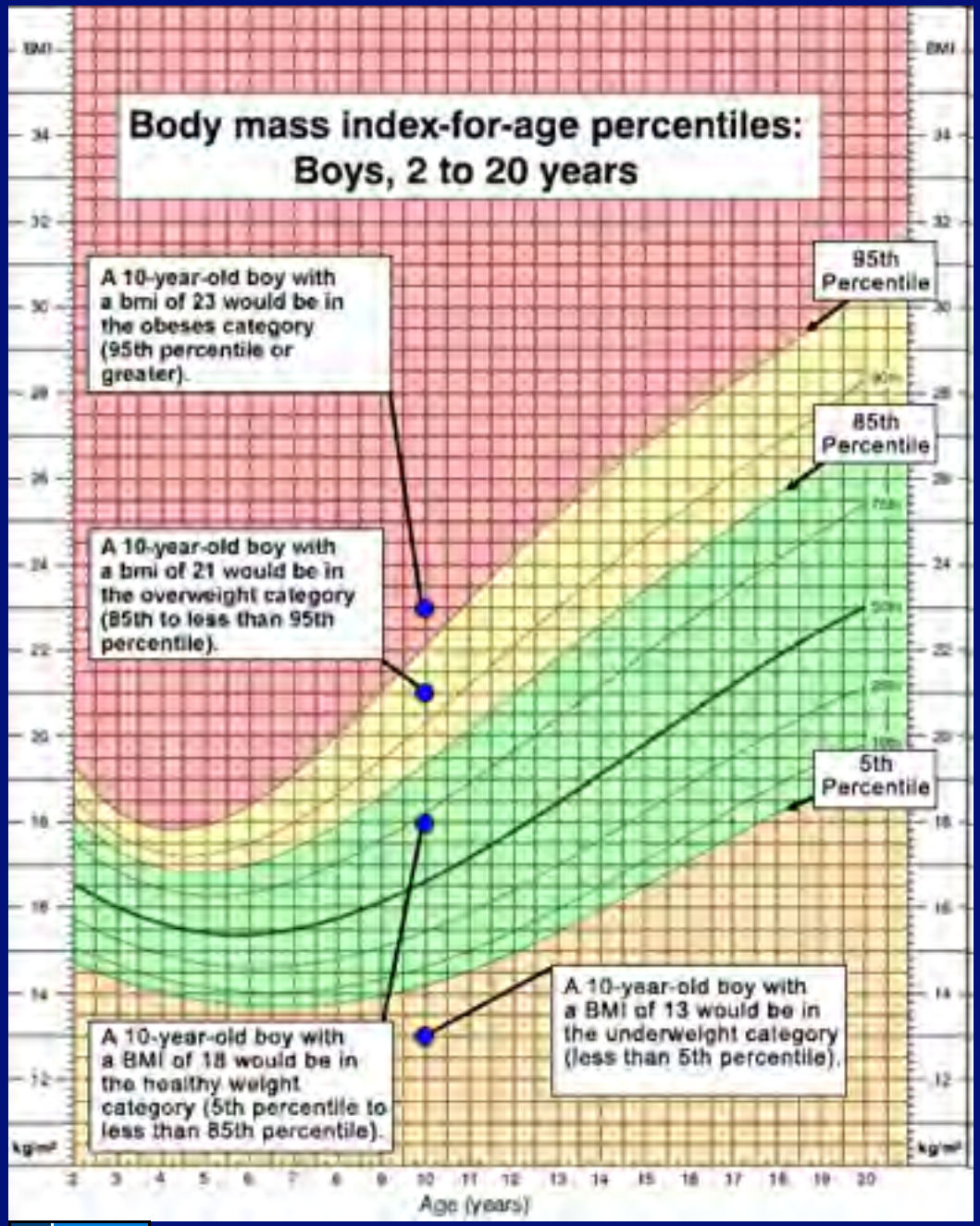
- A 5-year-old with a BMI of 18
- By adult standards, is 'underweight'
- Using appropriate norms for children, is in the "obese" range (95th percentile)

Abnormal Growth

- Types of abnormal growth during school age:
  - Weight
    - Obesity and Overweight
    - Underweight
  - Height

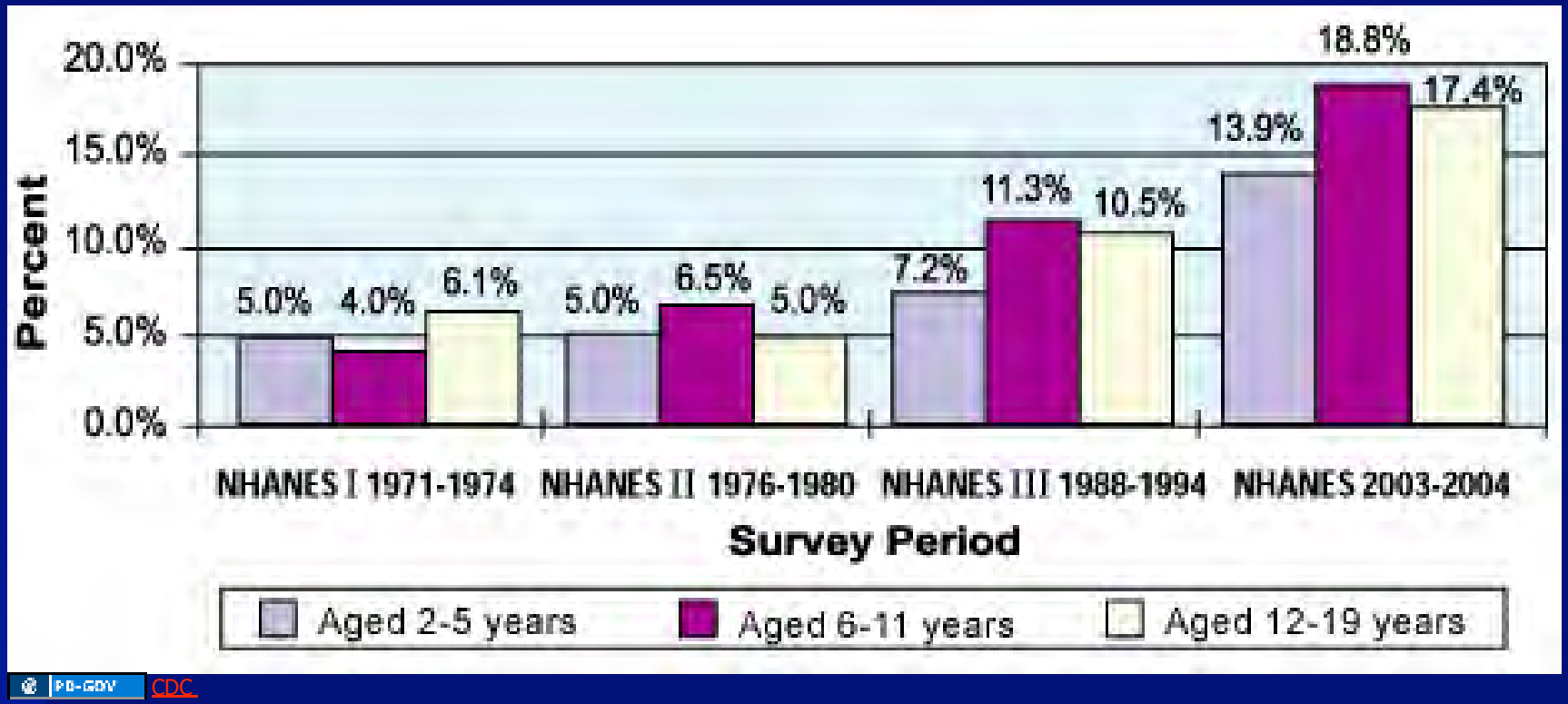
Abnormal Growth: Obesity

- Terminology
  - "Obese" is a BMI $\geq$ 95th percentile for age and sex
  - "Overweight" is a BMI $\geq$ 85th but < 95th percentile for age and sex
  - "Underweight" is a BMI < 5th percentile for age and sex


Body mass index-for-age percentiles:
Boys, 2 to 20 years
A 10-year-old boy with a bmi of 23 would be in the obeses category (95th percentile or greater).
A 10-year-old boy with a bmi of 21 would be in the overweight category (85th to less than 95th percentile).
A 10-year-old boy with a BMI of 18 would be in the healthy weight category (5th percentile to less than 85th percentile).
A 10-year-old boy with a BMI of 13 would be in the underweight category (less than 5th percentile).
95th Percentile
85th Percentile
5th Percentile
BMI
kg/m²
Age (years)
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

PD-GOV CDC

Childhood Obesity Epidemic



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- Prevalence of obesity in children has nearly tripled in the last 30 years

Q: If to be defined as "obese", a child's BMI must be at the 95th percentile or above, how can 17% of children in the U. S. be obese?

A: The 95th percentile is based on a normal distribution of BMI's from the 1970's. In the 1970's, 5% of children had a BMI $\geq$ 95th percentile. Now, 17% of children have a BMI $\geq$ 95th percentile. The normal distribution has shifted.

Risk Factors for Child Obesity

- Low socioeconomic status
- Minority race/ethnicity
- Genetic susceptibility interacting with environment
  - Rare single gene syndrome (e.g. Prader Willi)
  - Increase in obesity in population not due to single gene
- Maternal and paternal obesity
- Consumption of sugar-sweetened beverages
- Media use (TV, computers)
  - ↓ physical activity
  - ↑ sedentary activity
  - ↑ consumption (when eating while watching)
  - ↑ consumption of unhealthy foods advertised
  - ↓ metabolic rate

Abnormal Growth: Underweight

- Less common today than obesity
- More common in hospitalized and chronically ill populations most commonly seeking medical care
- Single greatest risk factor is poverty

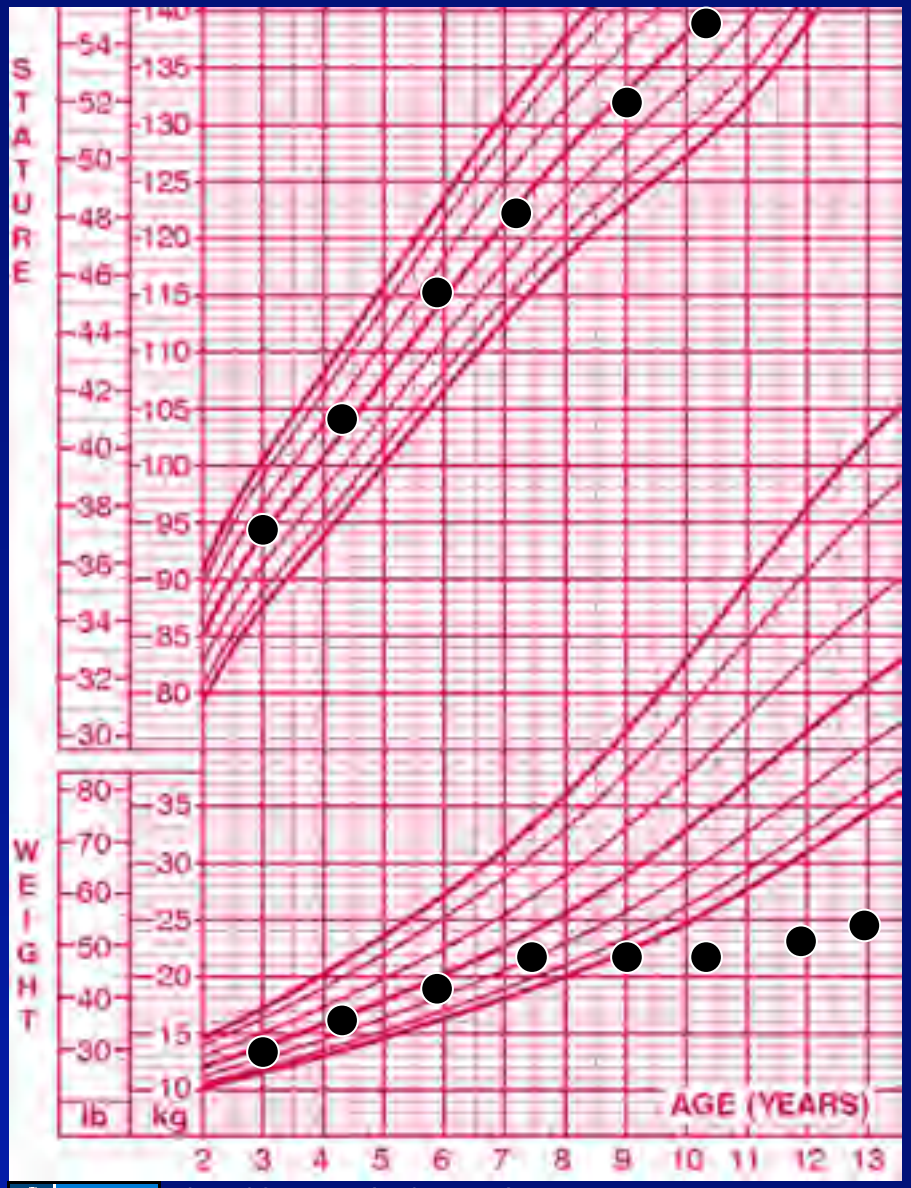
Two Types of Poor Growth

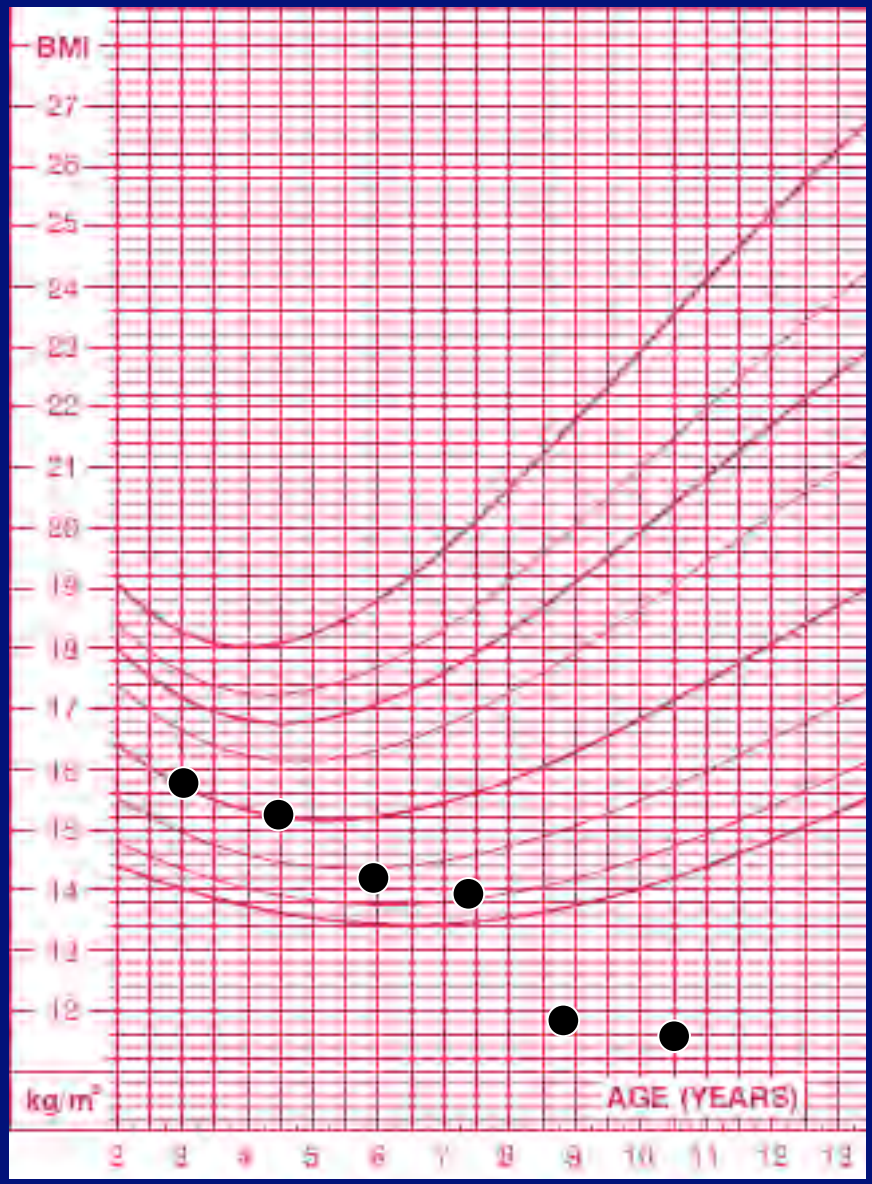
- Wasting
  - Child appears "skinny"
- Stunting
  - Child appears short

- Both types may be caused by undernutrition
  - "Undernutrition" = Inadequate calories to meet caloric needs
    - Differential diagnosis vast
    - May be due to
      - Inadequate food intake
      - Normal food intake in the face of extra caloric needs
      - Normal food intake but malabsorption

Wasting	Stunting
Weight < 5th %ile	Weight < 5th %ile
Height 'normal'	Height < 5th %ile
BMI < 5th %ile	BMI 'normal'
Appears skinny	Appears 'petite'
Differential diagnosis: ■ Acute undernutrition ■ Not endocrine cause	Differential diagnosis: ■ Chronic undernutrition ■ Endocrine

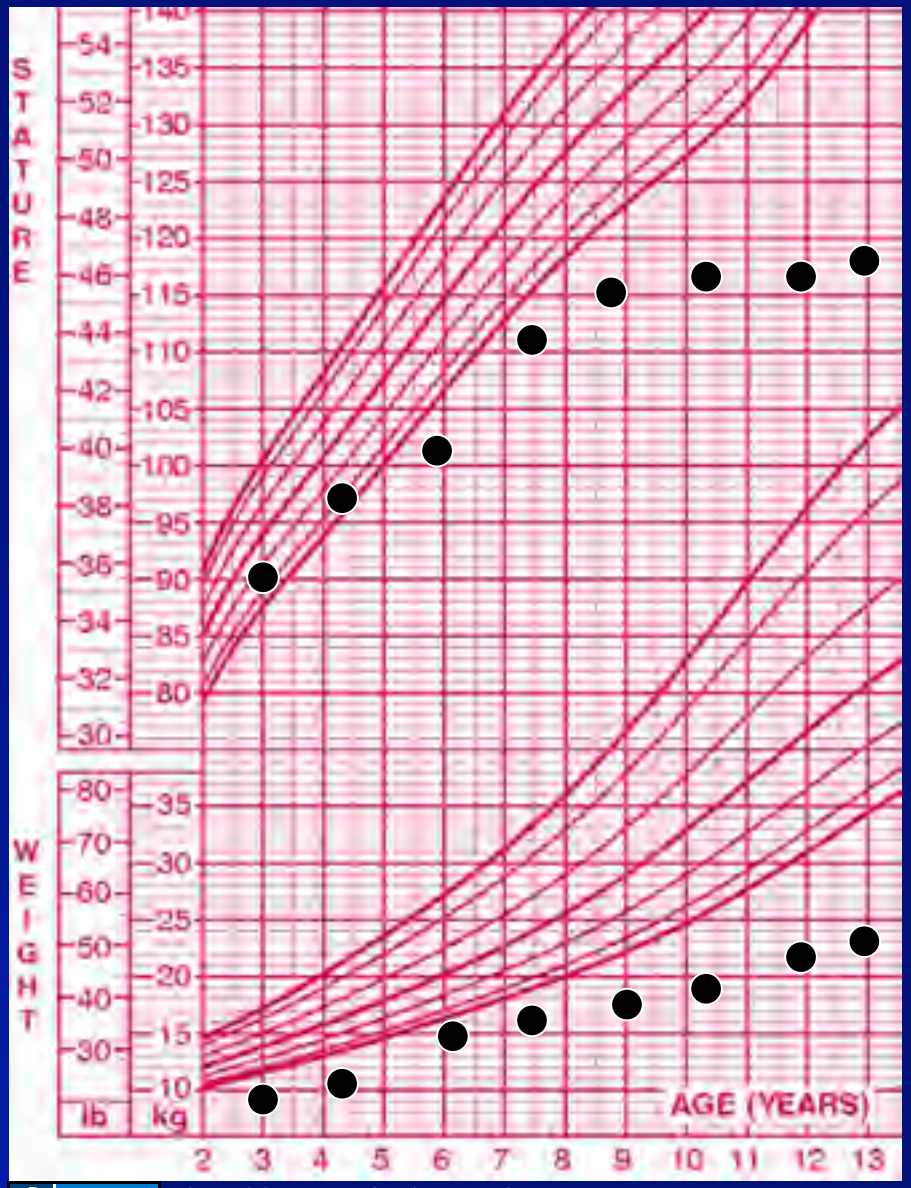
Wasting

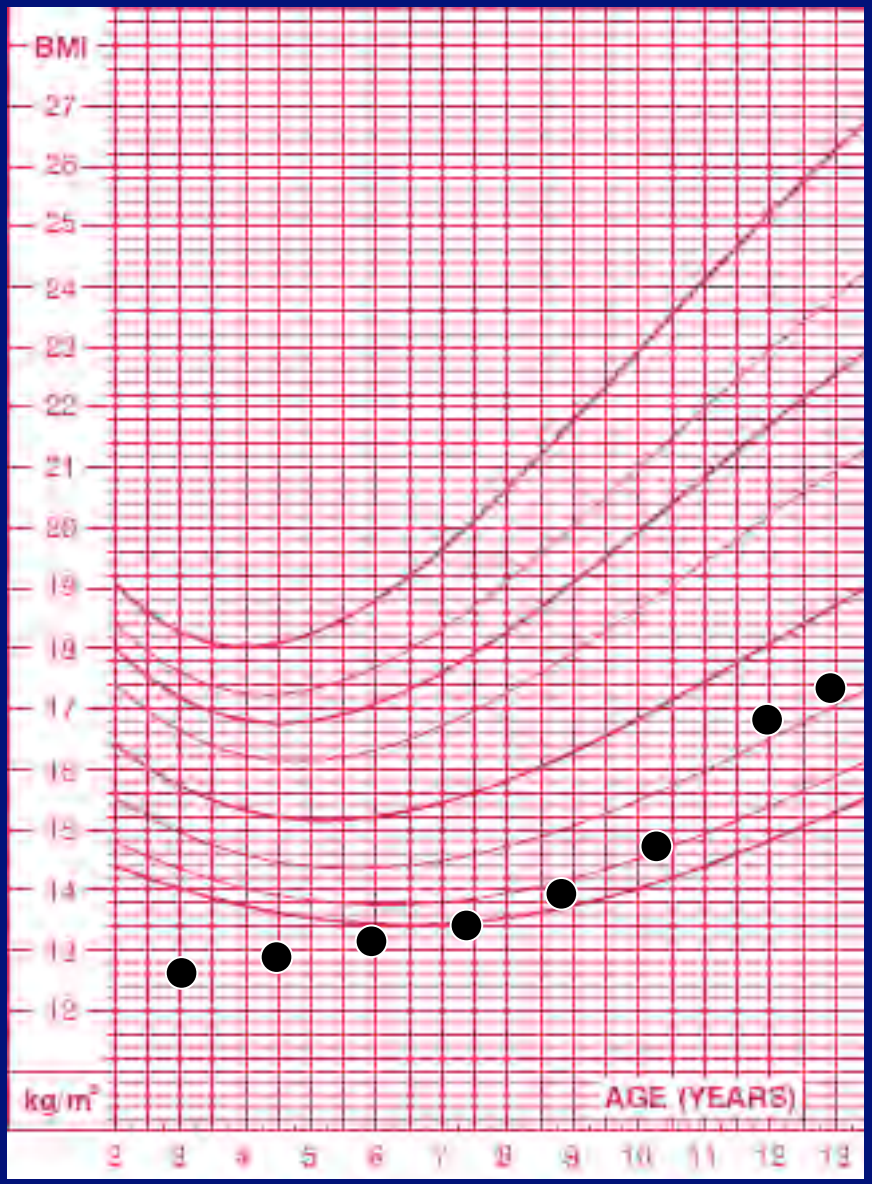




 Adapted from CDC (Both images)

Stunting





 Adapted from CDC (Both images)

Nutrition

Daily Intakes of Each Food Group Needed by a Moderately Active Male

FOOD GROUP	2-year-old	8-year-old	22-year-old
Energy (kcal/day)	1000	1,600	2800
Grains (oz/day)	3	5	10
Vegetables (cups/ day)	1	2	3.5
Fruits (cups/day)	1	1.5	2.5
Milk (cups/day)	2	2	3
Meat, beans (oz/day)	2	5	7

Common Causes of Inadequate Calories Consumed

- Food insecurity: Inadequate access to food
  - 8% of all U.S. households
  - 20-30% of households headed by single mothers who are Hispanic or African American
- Inappropriate dietary composition
  - Should include about 25-40% calories from fat
  - Limit fruit juice intake to 4-6oz/day
- Eating schedule
  - Should have mid-morning, mid-afternoon snack
- Picky Eating

Common Causes of Excessive Calories Consumed

- Calorically dense food
- Liquid calories (sugar-sweetened beverages)
- Restaurant eating
- Portion sizes
- Excessive (often unsupervised) snacking

Physical Activity

- Physical activity in childhood predicts physical activity in adulthood
- Physical activity levels typically decline into adolescence
- Children are less active today than several decades ago
- Physical inactivity associated with increased risk of obesity even in children
- More barriers reported in low income groups
- Of 9- to 13-year-old children
  - 23% no free time physical activity
  - 62% no organized non-school physical activity

Physical Activity Recommendations for Children

- Goal is to establish physical activity patterns in childhood that will persist
- Focus on promoting free-time (as opposed to organized) physical activity
- At least 60 minutes per day of moderate to vigorous physical activity
- Should be enjoyable
- Parents should model
- Parents should provide opportunities and praise

Development

Normal Development

- Language
- Social Emotional
- Cognitive
- Fine Motor
- Gross Motor
- Adaptive

Normal Development: Speech & Language

- Speech
  - –Articulation, pronunciation
  - –Motor production of sounds
- Language
  - –Expressive
    - – Ability to produce words (breadth of vocabulary, construction of sentences, not simply ability to pronounce)
  - –Receptive
    - – Ability to understand spoken words

Normal Development: Speech

Age	% intelligible to a stranger
2 years	2/4 = ½ (50%)
3 years	¾ (75%)
4 years	4/4 (100%)

Normal Development: Language

Age	Receptive	Expressive
8 – 12 months	Responds to simple commands ("Point to your nose.")	First words ("Mama", "Dada", "ball")
13 – 20 months	Recognizes vocabulary for objects ("Show me the cookie.")	Vocabulary of 10 – 50 words, points to objects with vocalizing
18 – 24 months	Recognizes many nouns, understands simple questions ("Where is your cup?")	Vocabulary of 50 – 75 words, 2-word sentences (TWO WORDS TOGETHER BY AGE TWO)

Pointing by 18 months

Normal Development: Language: 2 to 5 years

Age	Number of words child uses (expressive language)
2 years	50 - 75
3 years	200
4 years	1500
5 years	2700

Normal Development: Language: 2 to 5 years

- Mean length of utterance (number of words in a sentence) about equal to age
- Number of steps in a command a child is able to follow increases with age
- Correct use of all parts of speech by age 6 years

Normal Development: Language: School Age

- Pragmatics
  - Explaining information to a listener to effectively communicate
    - What does listener know and not know?
  - Initiate and maintain a conversation
  - Grasping main idea without getting lost in details
  - Make inferences

Normal Development: Cognitive

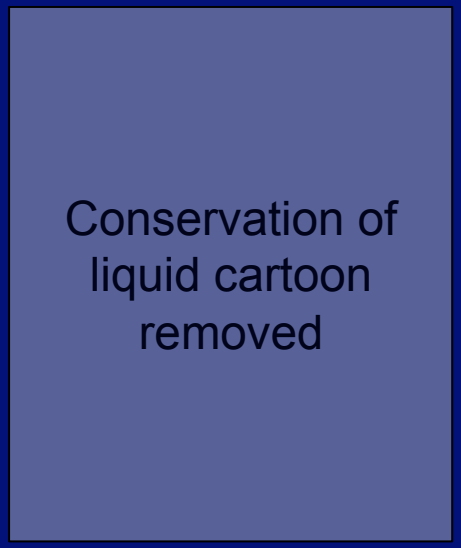
	Preoperational	Concrete Operations	Formal Operations
Age	**2-7**	**7-11**	**>12 (or never)**
Problem Solving and Reasoning	Concrete (based on past experience), trial and error, magical thinking	Based on rules of logic, planning	Abstract, flexible, rational, testing hypotheses
Ability to take perspective of another person	No	Yes	Yes
Morality	Objective (rules only)	Subjective (can by gray)	Laws are valid if they are just. "Question authority."
Ability to work with symbols (i.e. numbers)	Sorting, matching, ordering	Manipulating (i.e. add and subtract)	Abstract concepts (geometry, algebra)
Understanding that characteristics of object conserved despite looking different	No	Yes	Yes

Example of Pre-Operational Reasoning: Lack of Understanding of Conservation

Calvin and Hobbes comic strip removed

Please see: http://lobo.sbc.edu/Images%20for%20webpage/Toast_permanence.jpg

Example of Pre-Operational Reasoning: Lack of Understanding of Conservation



Please see: http://lobo.sbc.edu/ChildDump2.html

Normal Development: Cognitive

- Symbolic and Pretend Play
  - Pretends to drink from empty cup by age 1 year (symbolic play)
  - Pretends to feed doll by age 2 years
  - Complex play schemas (role play, dramatic play) emerge in preschool years

Normal Development: Cognitive

- Testing cognition:

IQ (Intelligence Quotient) Test

  - Mean 100, Standard Deviation 15
  - Normal range is between 70 and 130

Normal Development: Social Emotional

- Joint Attention: Child brings toy to show to mother or points to fire truck on the street, simply to share the experience
- Parallel play: Children play side by side, but not interactively
- Theory of mind: A child understands that you may not hold the same idea or opinion in your mind that she (herself does)

Normal Development: Social Emotional Preschool Age

Age range	Type of social interaction that emerges
18 – 30 months	Joint attention
2 – 3 years	Parallel play
3 years	Theory of mind
3 – 4 years	Cooperative pretend play

Normal Development: Social Emotional School Age

- Reading social scenes and acting in a way that fits into it
- Appropriate eye contact
- Interpreting feedback
- Conflict resolution
- Interpreting feelings
- Code switching (using language that matches the situation)

Normal Development: Social Emotional

From ages to 2 to 12 years, increasing ability to:

- Sustain attention
- Regulate emotion
- Avoid acting immediately on impulse

Speech and Language Delay

- 5 – 10 % of children
- When parents are worried, they are correct 75% of the time
- Differential Diagnosis
  - Hearing loss
  - Global Developmental Delay
  - Psychosocial Deprivation
  - Autism
  - Selective mutism

Atypical Speech and Language

- Echolalia: Repeating back to the speaker what he or she said
- Jargoning: Meaningless words and phrases strung together, sometimes as "fillers"; abnormal beyond about age 2 years

Abnormal Cognitive Development: Mental Retardation

- Definition
  - IQ < 70 with impaired adaptive functioning
- Prevalence is 2-3%
- Cause
  - Mild (IQ 55 – 70)
    - Cause identifiable in less than half
    - Genetic syndromes
    - Intrauterine exposures
    - Perinatal insults
  - Moderate/Severe/Profound (IQ < 55)
    - Cause identifiable in ¾
    - Most causes genetic

Autism

- Prevalence
  - 3 to 6 out of every 1000 children
  - Increasing
  - More common in boys
- Cause
  - Unknown, though VERY active area of research
  - Interaction of genes and environment
  - NOT parenting
- Treatment
  - No cure
  - No medical treatment, interventions are intense behavioral approaches

Diagnostic Criteria for Autism

1. Impaired social interaction
2. Impaired communication
3. Restricted repetitive and stereotyped patterns of behavior

Features of Autism

- Impairments in
  - Eye contact
  - Peer relationships
  - Joint attention
  - Theory of mind
  - Pretend play
  - Pragmatic Language
  - Pointing
- Presence of
  - Echolalia
  - Jargoning
  - Lining things up
  - Restricted interests
  - "Spinning"
  - Interest in parts of toys (e.g. wheels of car)
  - Self-stimulating behavior (e.g. rocking, head banging)
  - Oversensitivity to sensory stimuli

ADHD

- Prevalence
  - 3 to 5% of all children
  - More common in boys
- Cause
  - Does not arise purely from parenting or social factors
  - Multi-factorial
  - Not definitively known
- Treatment
  - Medication and behavioral
  - Medication alone is more effective than behavioral alone

Diagnostic Criteria for ADHD

- Inattention
- Hyperactivity/Impulsivity
- Must cause impairment
- Must occur in 2 or more settings

Additional Source Information

for more information see: http://open.umich.edu/wiki/CitationPolicy

Slide 7: Center for Disease Control and Prevention, http://www.cdc.gov/
Slide 8: Center for Disease Control and Prevention, http://www.cdc.gov/
Slide 9: Adapted from Cronk, C. Growth Charts for Children With Down Syndrome: 1 month to 18 years of Age. Pediatrics, Jan 1988; 81: 102-110; Center for Disease Control and Prevention, http://www.cdc.gov/
Slide 12: Adapted from Center for Disease Control and Prevention, http://www.cdc.gov/; Center for Disease Control and Prevention, http://www.cdc.gov
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