

Growth evaluation

Dr. M Shakiba

Mofid Children hospital

Shahid Beheshti university of medical science



Normal Growth

- As multifactorial and complex as the process of growth is, children normally grow in a remarkably predictable manner
- Deviation from a normal pattern of growth can be the first manifestation of a wide variety of disease processes including endocrine and non endocrine disorder and involving any organ system of the body
- Frequent and accurate assessment of growth is therefore of primary importance to physician and nurse caring for children

Measurement

- Measurement of supine length is employed in children younger than two years of age
- When children are old enough to stand erect, it is best to employ a wall-mounted “ Harpenden” stadiometer
- The patient should be fully erect with the head in the Frankfurt plane
- The back of the head , thoracic spine, buttocks and heels should be touching the vertical axis of the stadiometer

- 
- Serial measurement should be made at the same time of day because diurnal variation in standing height has been observed.
 - It is critical that height determination be performed by an individual with proper training rather than by an inexperienced member of staff.
 - The height be measured in triplicate, that variation be no more than 0.3 cm, and that the mean height be recorded

- 
- It is obviously better to have the same individual performing the determination
 - A minimum interval of 3 months' is necessary for accurate height velocity computation.
 - 6 months' data are preferable because of the seasonal variation in height velocity



Figure 7 : Height assessment in standing position



Figure 8 : Height assessment in lying position

Growth Chart

Most pediatric endocrine clinic continue to use the cross –sectional data provided by NCHS(CDC, which were originally introduced in 1977 and recently update

Limitation

- subjects were white formula-fed , middle class infants from southwestern Ohio

The NCHS can be used to compute standard deviation scores (Z- scores)

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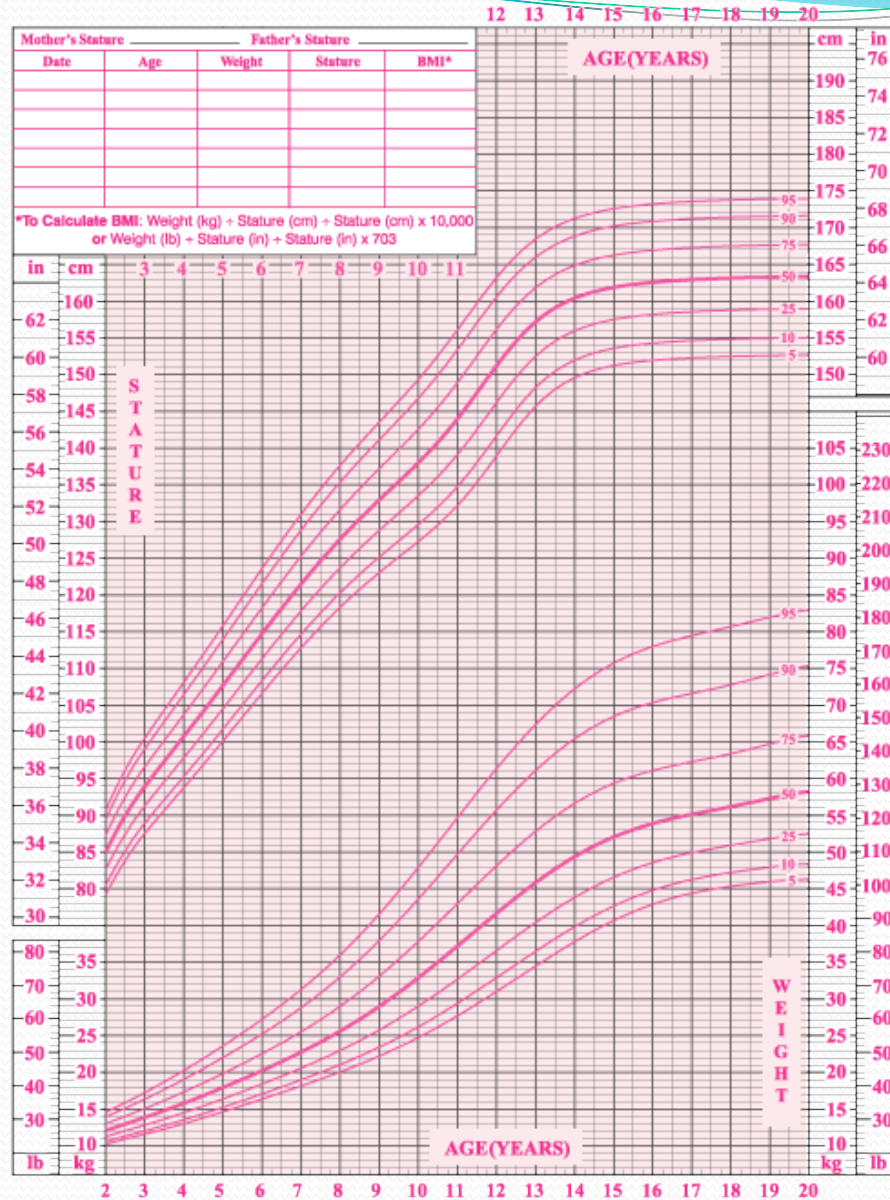
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2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

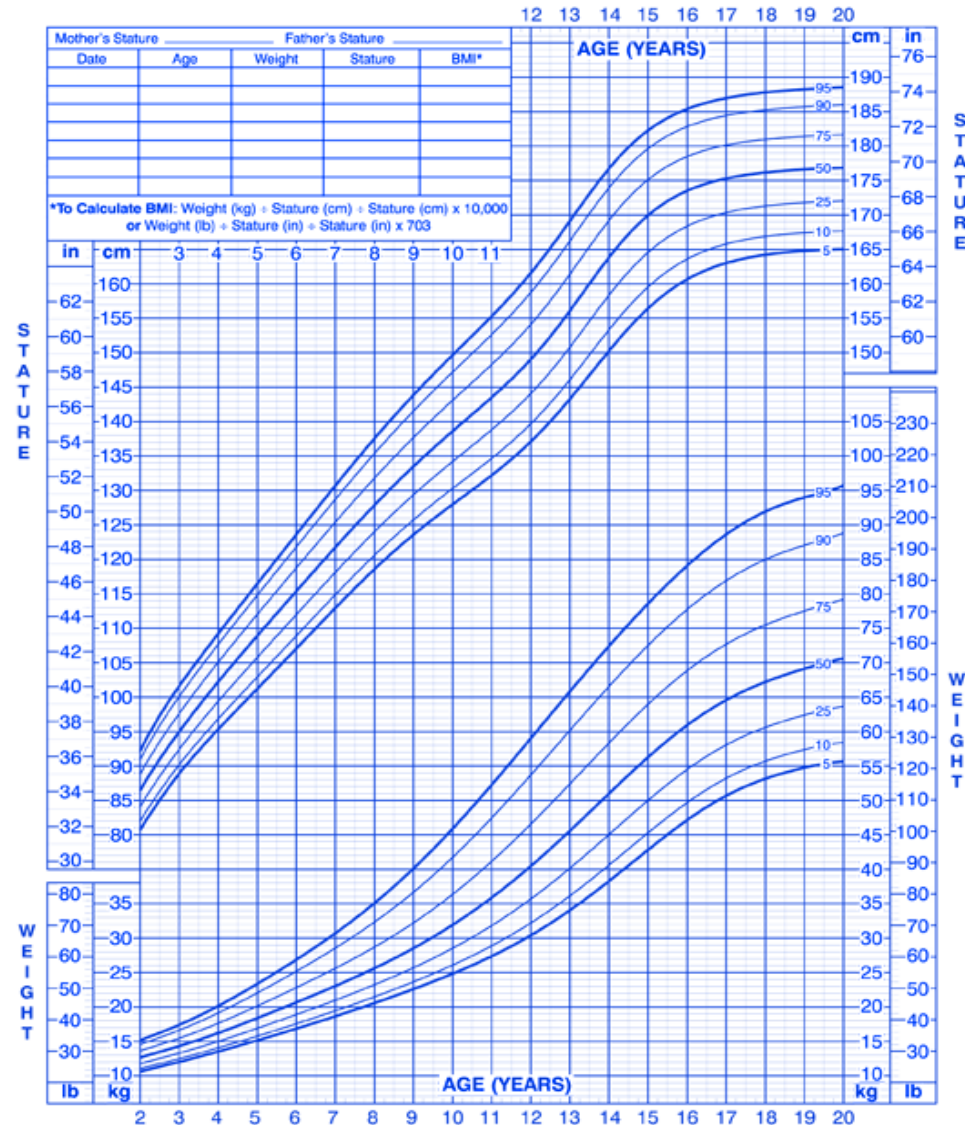
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2 to 20 years: Boys
Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

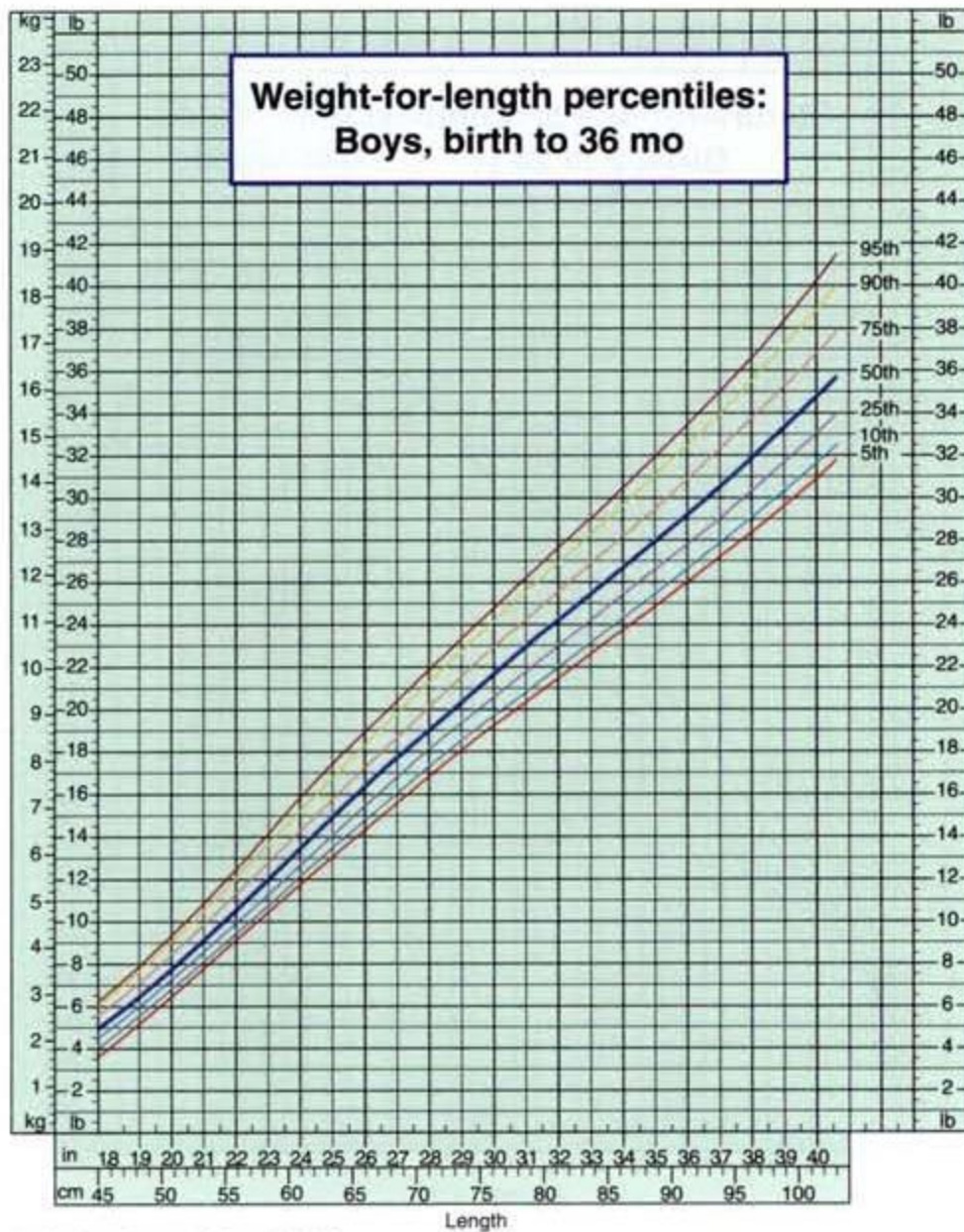


Published May 30, 2000 (modified 11/21/00).
SOURCE: Developed by the National Center for Health Statistics in collaboration with
the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>

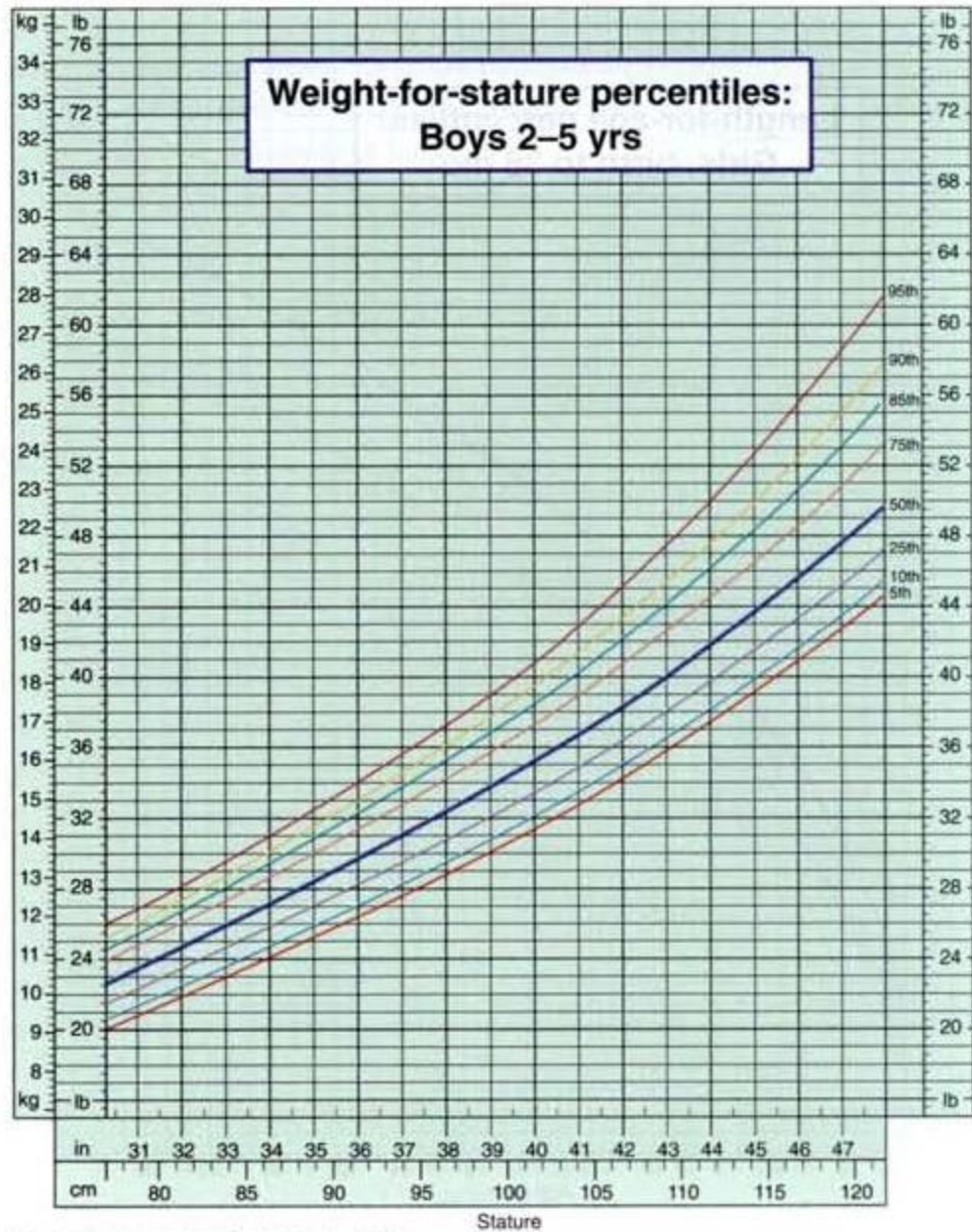


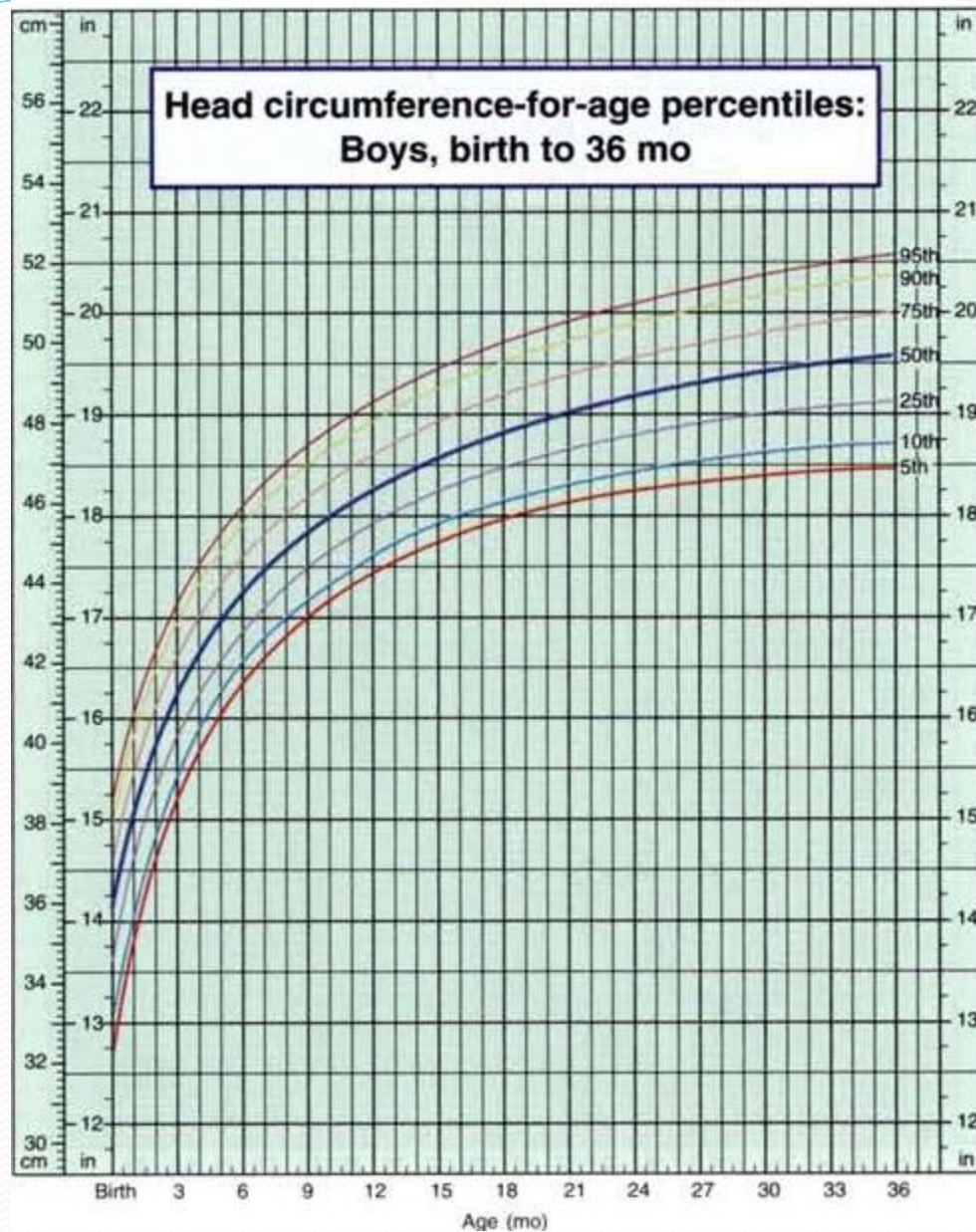
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Weight-for-length percentiles: Boys, birth to 36 mo

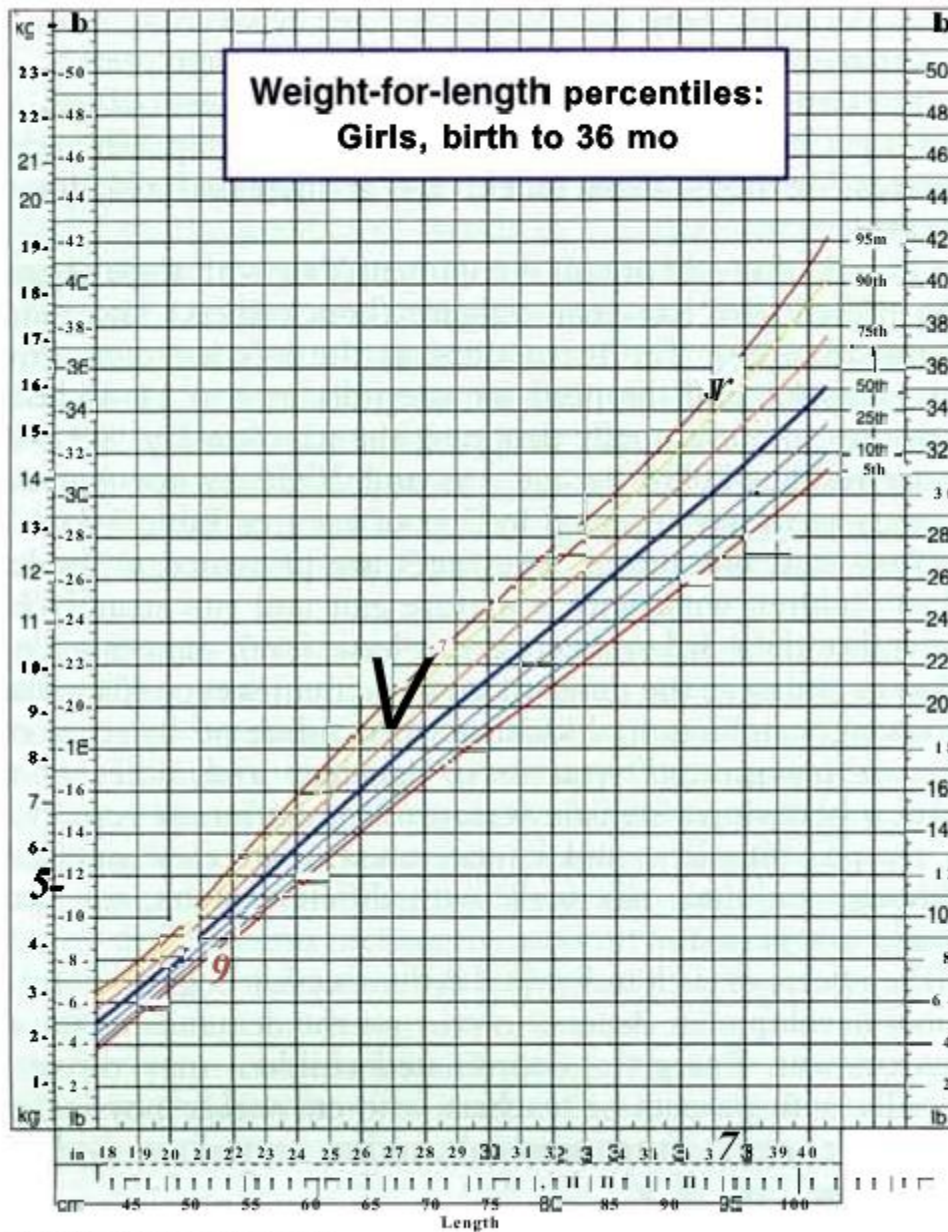


Weight-for-stature percentiles: Boys 2-5 yrs

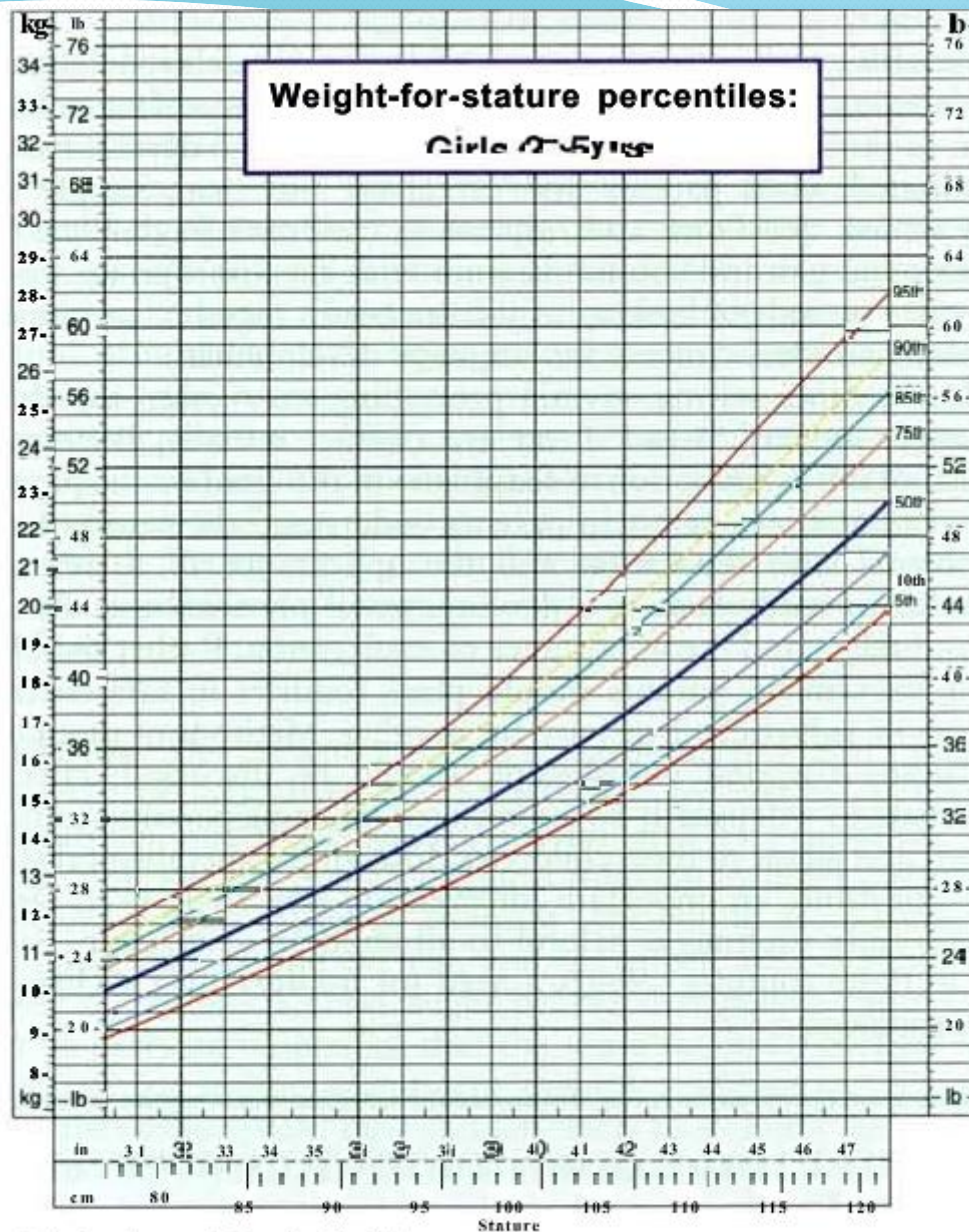




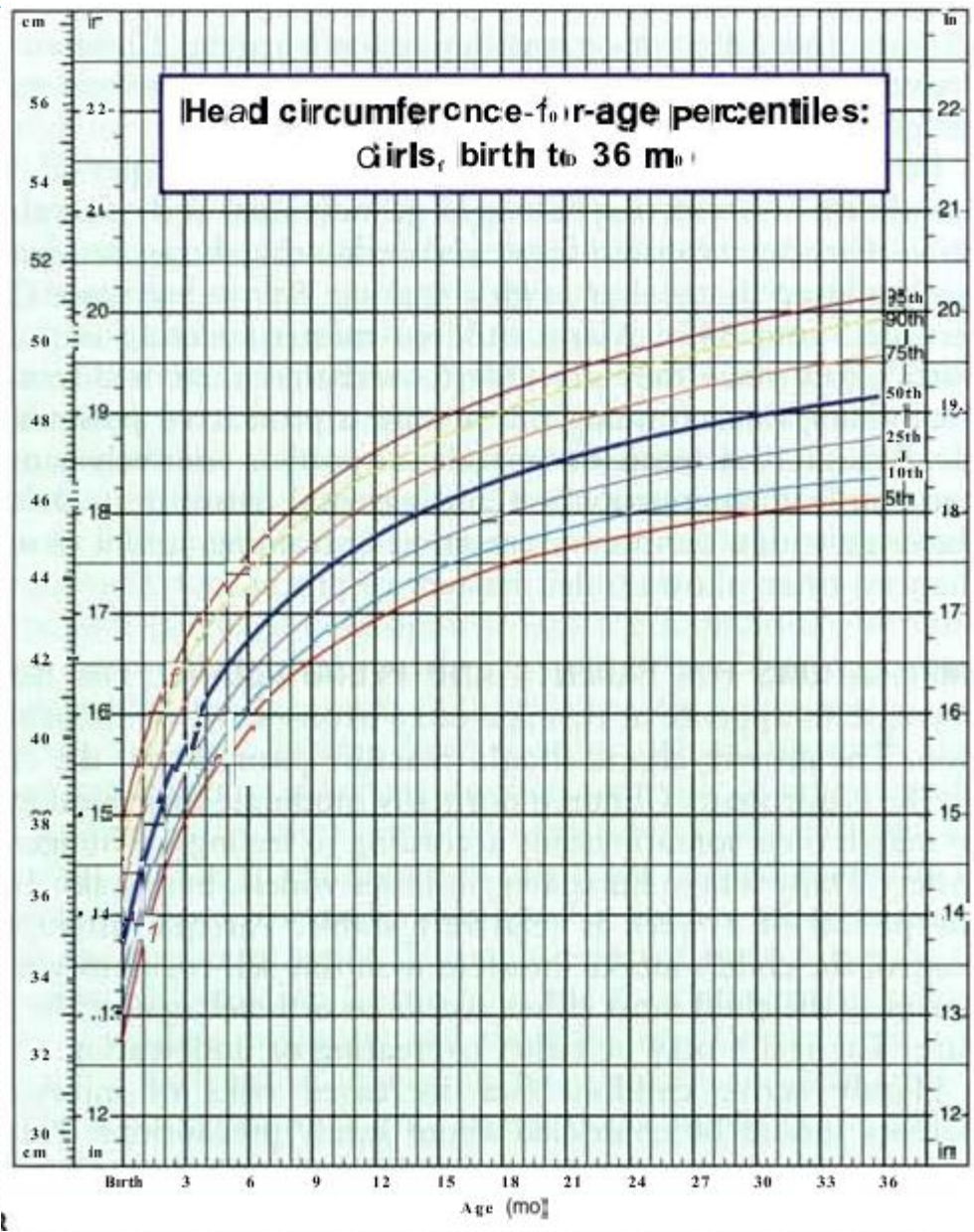
Weight-for-length percentiles: Girls, birth to 36 mo



Revised and corrected June 8, 2000.



Revised and corrected November 21, 2000.



Height and weight SDS

- $$\text{SDS} = \frac{1.645 \cdot (\text{Ht. or Wt. patient} - \text{Ht. or Wt } 50\%) }{(\text{Ht. or Wt. } 50\% - \text{Ht. or Wt } 5\%)}$$
- $$\text{SDS} = \frac{1.881 \cdot (\text{Ht. or Wt. patient} - \text{Ht. or Wt } 50\%) }{(\text{Ht. or Wt. } 50\% - \text{Ht. or Wt } 3\%)}$$

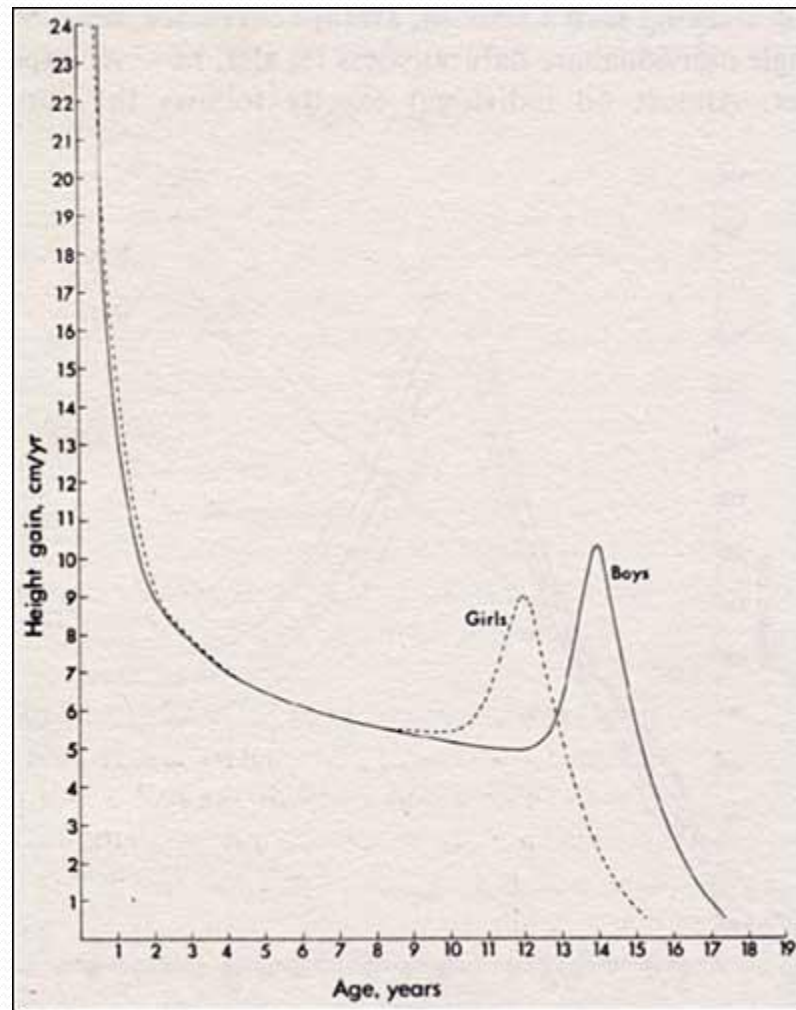


TABLE 12-3. Classification of Sex Maturity States in Boys

SMR STAGE	PUBIC HAIR	PENIS	TESTES
1	None	Preadolescent	Preadolescent
2	Scanty, long, slightly pigmented	Minimal change/ enlargement	Enlarged scrotum, pink, texture altered
3	Darker, starting to curl, small amount	Lengthens	Larger
4	Resembles adult type, but less quantity; coarse, curly	Larger; glans and breadth increase in size	Larger, scrotum dark
5	Adult distribution; spread to medial surface of thighs	Adult size	Adult size

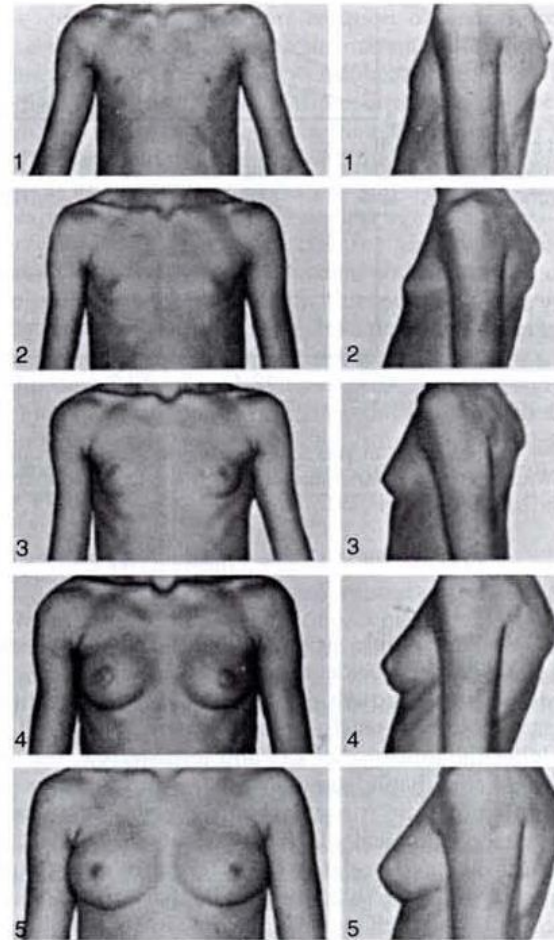
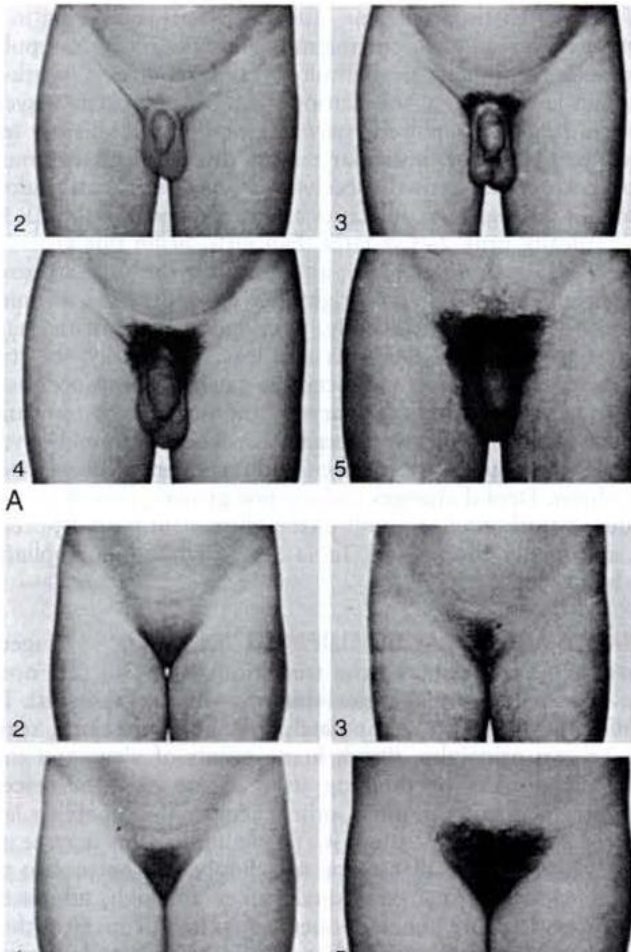
From Tanner JM: *Growth at Adolescence*, 2nd ed. Oxford, England, Blackwell Scientific Publications, 1962.

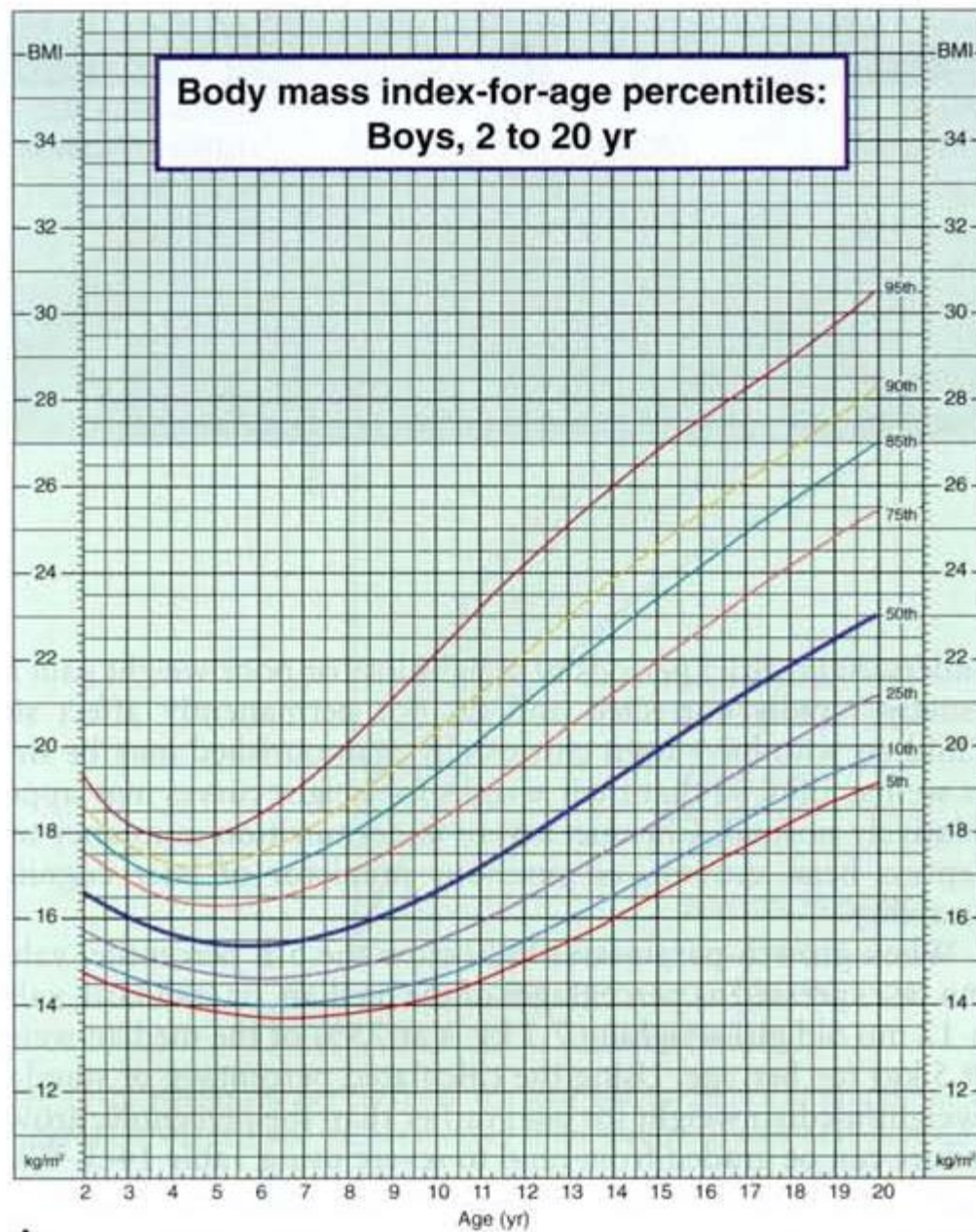
TABLE 12-2. Classification of Sex Maturity States in Girls

SMR STAGE	PUBIC HAIR	BREASTS
1	Preadolescent	Preadolescent
2	Sparse, lightly pigmented, straight, medial border of labia	Breast and papilla elevated as small mound; diameter of areola increased
3	Darker, beginning to curl, increased amount	Breast and areola enlarged, no contour separation
4	Coarse, curly, abundant, but less than in adult	Areola and papilla form secondary mound
5	Adult feminine triangle, spread to medial surface of thighs	Mature, nipple projects, areola part of general breast contour

From Tanner JM: *Growth at Adolescence*, 2nd ed. Oxford, England, Blackwell Scientific Publications, 1962.
SMR, sexual maturity rating.

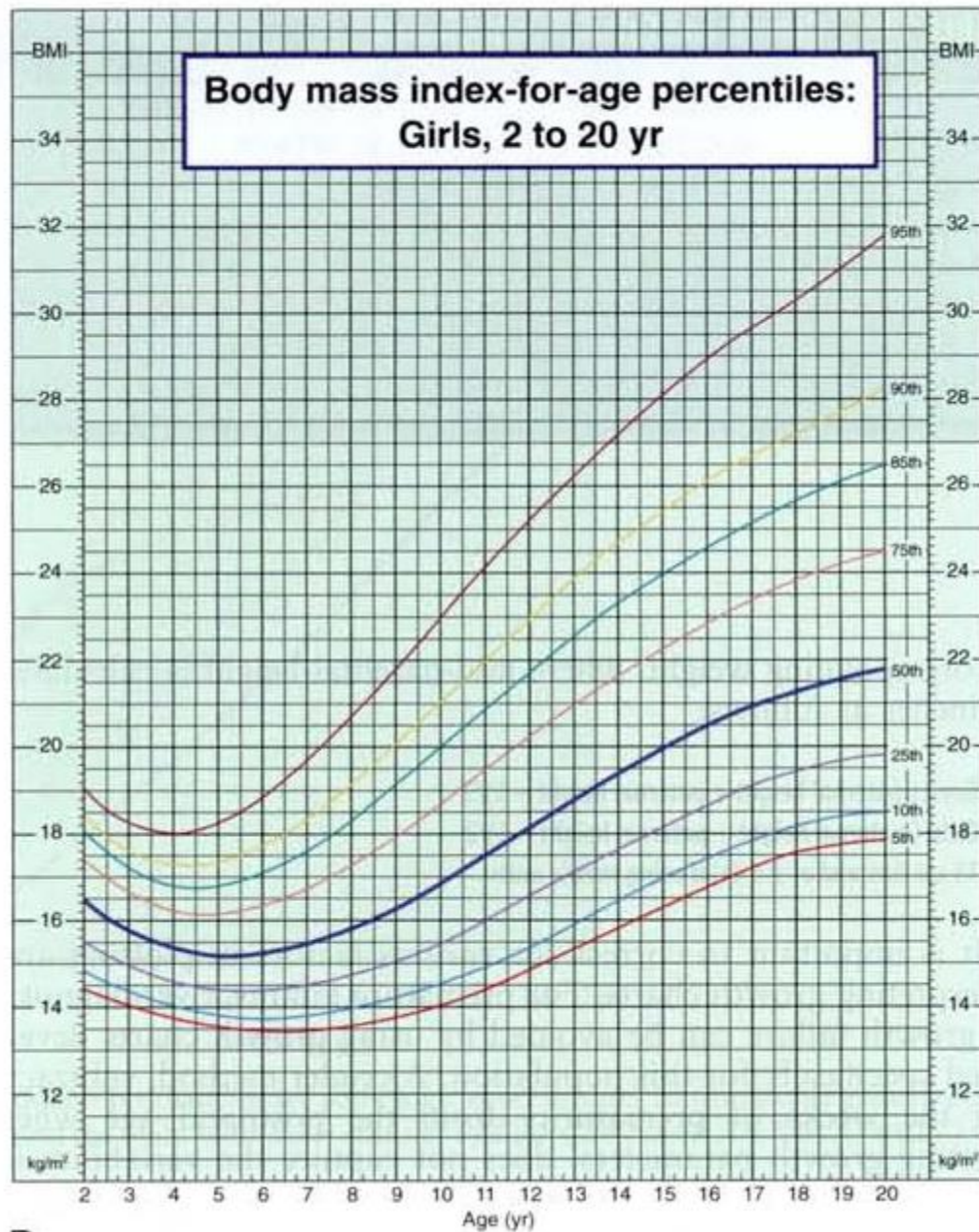
Sexual maturity rate





A

**Body mass index-for-age percentiles:
Girls, 2 to 20 yr**



BMI

- $$\text{BMI} = \frac{\text{WT}}{\text{Ht}^2 \text{ (m)}}$$

BMI percentile for age

- | | |
|--------------------------|--------------------|
| • <5th percentile | Underweight |
| • 5th-84th percentile | Normal |
| • 85th-94th percentile | At risk overweight |
| • $\geq$ 95th percentile | Overweight |

TABLE 14-1. Growth and Caloric Requirements

AGE	APPROXIMATE DAILY WEIGHT GAIN (g)	APPROXIMATE MONTHLY WEIGHT GAIN	GROWTH IN LENGTH (cm/mo)	GROWTH IN HEAD CIRCUMFERENCE (cm/mo)	RECOMMENDED DAILY ALLOWANCE (Kcal/kg/day)
0-3 mo	30	2 lb	3.1	2.00	115
3-6 mo	20	1.25 lb	2.0	1.00	110
6-9 mo	15	1 lb	1.5	0.50	100
9-12 mo	12	13 oz	1.2	0.50	100
1-3 yr	8	8 oz	1.0	0.25	100
4-6 yr	6	6 oz	3 cm/yr	1 cm/yr	90-100

Adapted from National Research Council, Food and Nutrition Board: *Recommended Daily Allowances*. Washington, DC, National Academy of Sciences, 1989; Frank D, Silva M, Needman R: Failure to thrive: Myth and method. *Contemp Pediatr* 1993;10:114.

TABLE 14-2. Formulas for Approximate Average Height and Weight of Normal Infants and Children

WEIGHT	KILOGRAMS	(POUNDS)
At birth	3.25	(7)
3–12 mo	$\frac{\text{Age (mo)} + 9}{2}$	(age [mo] + 11)
1–6 yr	$\text{Age (yr)} \times 2 + 8$	(age [yr] $\times 5 + 17$)
7–12 yr	$\frac{\text{Age (yr)} \times 7 - 5}{2}$	(age [yr] $\times 7 + 5$)
HEIGHT	CENTIMETERS	(INCHES)
At birth	50	(20)
At 1 yr	75	(30)
2–12 yr	$\text{age (yr)} \times 6 + 77$	(age [yr] $\times 2\frac{1}{2} + 30$)

TABLE 14-3. Severity of Malnutrition: Stunting and Wasting

GRADE OF MALNUTRITION	WEIGHT FOR AGE* (WASTING)	HEIGHT FOR AGE† (STUNTING)	WEIGHT FOR HEIGHT‡
0, normal	>90	>95	>90
1, mild	75-90	90-95	81-90
2, moderate	60-74	85-89	70-80
3, severe	<60	<85	<70

Values represent percentage of median for age.

*Data from Gomez F, Galvar RR, Frank S, et al: Mortality in second- and third-degree malnutrition. *J Trop Pediatr* 1958;2:77.

†Data from Waterlow JC: Evolution of kwashiorkor and marasmus. *Lancet* 1974;2:712.

‡Data from Waterlow JC: Classification and definition of protein-calorie malnutrition. *BMJ* 1972;3:586.

Algorithm biochemical evaluation of growth failure

Step I-Defining the risk of GH/IGF Deficiency

Auxologic Abnormality

- Severe short stature height SDS<-3SD
- Severe growth deceleration(height velocity<-2SD over 12month
- Ht<-2SD and HV<-1SD over 12month
- Ht<-1.5SD and HV<-1.5SD over 2 years
- Features of GHD or GHI

Risk factors

History of a brain tumor ,cranial irradiation, or other documented organic pituitary abnormality

Incidental finding of pituitary abnormality on MRI

If any of the above exists, proceed to step 2: if not , follow clinically an return to step 1 in 6 month

Step2-Screening for GH/IGF deficiency and other diseases

- A. Order a laboratory panel including assessment of bone age, thyroid function, chromosomes(in females), and nonendocrine tests(CBC diff, ESR, CRP,FBS, Bun, Cr, VBG, Na, K, Cl , Ca, P, ALP, SGOT, SGPT, U/A, U/C , S/E, Anti TTG IgA, Anti EMA IgA, Total IgA) and if indicated, treat diagnosed conditions as appropriate.
- B. Order an IGF-1 and an IGFBP-3 level
 - If IGF-1/ IGFBP-3 are above the mean, follow clinically and return to step 1 in 6 months
 - If IGF-1/ IGFBP-3 are low , proceed to step 3; but if the MRI is abnormal, GH stimulation test is optional.
 - If height <-2.25 SDS proceed to step 3 regardless of the screening tests.

Step-3 Testing Gh secretion

This step can be bypassed if a clear GHD risk factor and a severe IGF deficiency are identical.

Perform two of the following GH stimulation tests (if appropriate , sex hormone prime):

- Clonidine
- Arginine
- Insulin
- Glucagon
- Levodopa
- Propranolol

If both are below 10 ng/ml, go to step 4

If GH > 15 ng/ml, obtain GHBP; if GHBP, -2 SDS. Consider an IGF-I generation test, and , if abnormal IGF treatment

If GH > 10 and height is < -2.25 SDS consider GH treatment for ISS(step 5)

Step4-Evaluating the pituitary

- Perform MRI
- Test HPA , if not already done(CRH stimulation or ITT), and teach cortisol supplementation as needed

Step 5- Treating for Growth promotion

- Initiate GH therapy (or if GHIS is suspected , consider IGF-I)
- Regularly evaluate growth parameters, IGF-I, and IGFBP-3, as well as compliance and safety.
- GH secretion should be retested at the end of GH treatment if the diagnosis was GHD.

GH stimulation test

TABLE 8-9

Growth Hormone Stimulation Tests*

Stimulus	Dosage	Samples (Min)	Comments/side Effects
Levodopa (PO)	< 15 kg: 125mg 15-30 kg: 250 mg >30 kg: 500 mg	0, 60, 90	Nausea
Clonidine (PO)	0.15 mg/m ²	0, 30, 60, 90	Tiredness, postural hypotension
Arginine HCl (IV)	0.5 g/kg (max 30 g) 10% arginine HCl in 0.9% NaCl over 30 min	0, 15, 30, 45, 60	
Insulin (IV)	0.05-0.1 IU/kg	0, 15, 30, 45, 60, 75, 90, 120	Hypoglycemia; requires supervision [†]
Glucagon (IM)	0.03 mg/kg (max 1 mg)	0, 30, 60, 90, 120, 150, 180	Nausea

* Tests should be performed after an overnight fast. It is generally recommended by some authorities that prepubertal children be "primed" with sex steroids (e.g., premarin, 5 mg PO the night before and the morning of the test, or ethinyl estradiol, 50 to 100 µg/d for 3 consecutive days before testing; or depo testosterone, 100 mg 3 days before testing). Patients should be euthyroid at time of testing.

[†] Insulin-induced hypoglycemia is a potential risk of this procedure, which is designed to lower the blood glucose by at least 50%. Documentation of appropriate lowering of blood glucose is recommended. If growth hormone deficiency, the lower dosage of insulin may be advisable, especially in infants. D₅₀W solutions and glucagon should be available.

IGF-I generation test

- Ensure that nutritional intake is adequate prior to and during the performance of this test
- Protocol
 1. day 1: take blood for IGF-I and IGFBP 3 estimation.
 2. day 2-4: give SC GH ($0.1 \text{ IU/Kg/day} = 33 \mu\text{g/Kg/day}$)
 3. Day 5: take blood for IGF-I and IGFBP 3 estimation.
- Interpretation

An incremental increase in IGF-I of $> 20 \mu\text{g/L}$ and IGFBP-III of $> 0.4 \text{ mg/l}$ above the basal exclude GH insensitivity.

TABLE 8-3

Classification of Growth Retardation

I. Primary Growth Abnormalities

- A. Osteochondrodysplasias
- B. Chromosomal abnormalities

II. Secondary Growth Disorders

- A. Malnutrition
- B. Chronic disease
- C. Intrauterine growth retardation
- D. Endocrine disorders
 - 1. Hypothyroidism
 - 2. Cushing syndrome
 - 3. Pseudohypoparathyroidism
 - 4. Vitamin D deficient or resistant rickets

III. IGF Deficiency

- A. Secondary IGFD
 - GH deficiency due to hypothalamic dysfunction
 - GH deficiency due to pituitary GH deficiency
- B. Primary IGFD (GH insensitivity)
 - Primary GH insensitivity
 - Secondary GH insensitivity (Stat-5b)
 - Primary defects of IGF synthesis
 - Primary defects of IGF transport/clearance (ALS)
- C. IGF resistance
 - Defects of the IGF-1 receptor
 - Post-receptor defects

IV. Idiopathic Short Stature

- 1. Constitutional delay of growth and puberty with normal height prediction
- 2. ISS with delayed bone age and tempo of puberty
- 3. ISS with normal bone age and tempo of puberty
- 4. ISS with a familial component
- 5. ISS without a familial component

GH, growth hormone; IGF, insulin-like growth factor.

TABLE 8-5

Etiology of Intrauterine Growth Retardation

Intrinsic fetal abnormalities
Chromosomal disorders
Syndromes associated with primary growth failure
Russell-Silver syndrome
Seckel syndrome
Noonan syndrome
Progeria
Cockayne syndrome
Bloom syndrome
Prader-Willi syndrome
Rubinstein-Taybi syndrome
Congenital infections
Congenital anomalies
Primary abnormalities of insulin-like growth factor axis
Placental anomalies
Abnormal implantation of the placenta
Placental vascular insufficiency; infarction
Vascular malformations
Maternal disorders
Malnutrition
Constraints on uterine growth
Vascular disorders
Hypertension
Toxemia
Severe diabetes mellitus
Uterine malformations
Drug ingestion
Tobacco
Alcohol
Narcotics

From Underwood LE, Van Wyk JJ: Normal and aberrant growth. In Wilson JD, Foster DW (eds): Williams Textbook of Endocrinology, 8th ed. Philadelphia, WB Saunders, 1992; p 1110.

Normal Growth

- ▶ An intact hypothalamic/pituitary /IGF-1 axis, adequate nutrition, and absence of significant systemic disease are requirements for normal linear growth.
 - ▶ As multifactorial and complex as the process of growth is, children normally grow in a remarkably predictable manner
 - ▶ A comprehensive past medical, family, and social history with assessment of an accurate growth velocity is required for the initial investigation of abnormal growth.
 - ▶ Deviation from a normal pattern of growth can be the first manifestation of a wide variety of disease processes including endocrine and non endocrine disorder and involving any organ system of the body
 - ▶ Frequent and accurate assessment of growth is therefore of primary importance to physician and nurse caring for children
- 

Secondary Growth disorders

- Malnutrition
- Chronic diseases
 - Malabsorption
 - Cardiovascular disease
 - Renal disease
 - Hematologic disorders
 - Diabetes mellitus
 - IEM
 - Pulmonary disease
 - Chronic infections

Endocrine disorders

- Hypothyroidism
- Cushing syndrome
- Pseudohypoparathyroidism
- Ricketes
- IGF deficiency (Hypothalamic dysfunction, pituitary GHD, primary and secondary GHI)
- IGF-I resistance

TABLE 8-6**Established Genetic Defects of the GH-IGF Axis Resulting in IGF Deficiency**

Mutant Gene	Inheritance	Phenotype
HPA		Developmental abnormalities
HESX1	AR	Septo-optic dysplasia; variable involvement of pituitary hormones
PROP1	AR	GH, PRL, TSH, LH, FSH deficiencies; variable ACTH deficiency
POU1F1 (Pit1)	AR, AD	GH, PRL deficiency; variable degree of TSH deficiency
RIEG	AD	Rieger syndrome
LHX3	AR	GH, TSH, LH, FSH, prolactin deficiencies
LHX4	AD	GH, TSH, ACTH deficiencies
SOX3	XL	GH deficiency, mental retardation
GLI2	AD	Holoprosencephaly, hypopituitarism
GLI3	AD	Pallister-Hall syndrome, hypopituitarism
Isolated GHD		
GHRHR	AR	IGHD, Type IB form of IGHD
GHS-R	AD	GHD and ISS
GH1	AR	Type IA form of IGHD
	AR	Type IB form IGHD
	AD	Type II form of IGHD
	X-linked	Type III form of IGHD; hypogamma-globulinemia
	AD	Bioinactive GH molecule
GHI		
GHR		
Extracellular domain	AR, AD	IGF- I deficiency; decreased or normal GHBP
Transmembrane	AR	IGF-I deficiency; normal or increased GHBP
Intracellular domain	AD	IGF-I deficiency; normal or increased GHBP
IGF		
IGF1	AR	IGF-I deficiency; IUGR and postnatal growth failure
ALS	AR	IGF-I deficiency; variable postnatal growth failure, delayed puberty

HPA, hypothalamic pituitary; ACTH, adrenocorticotrophic hormone (corticotropin); AD, autosomal dominant; AR, autosomal recessive; FSH, follicle-stimulating hormone; GH, growth hormone; GHBP, GH-binding protein; GHRHR, GH-releasing hormone receptor; IGF, insulin-like growth factor; IGHD, isolated GHD; IUGR, intrauterine growth retardation; LH, luteinizing hormone; PRL, prolactin; TSH, thyroid-stimulating hormone; and ALS, acid labile subunit.

TABLE 8-7

Proposed Classification of Growth Hormone (GH) Insensitivity

A. Primary GH Insensitivity (Hereditary Defects)

1. GH receptor defect (may be positive or negative for GH-binding protein)
 - Extracellular mutation
 - Cytoplasmic mutation
 - Intracellular mutation
2. GH signal transduction defects (distal to cytoplasmic domain of GH receptor)
Stat-5b mutations
3. Insulin-like growth factor-1 defects
 - IGF-1 gene deletion
 - IGF-1 transport defect (ALS mutation)
 - IGF-1 receptor defect
4. Bioinactive GH molecule (responds to exogenous GH)

B. Secondary GH Insensitivity (Acquired Defects)

- Circulating antibodies to GH that inhibit GH action
- Antibodies to the GH receptor
- GH insensitivity caused by malnutrition, liver disease, catabolic states, diabetes mellitus
- Other conditions that cause GH insensitivity

Definitions:

- *GH insensitivity*: Clinical and biochemical features of IGF-1 deficiency and insensitivity to exogenous GH, associated with GH secretion that would not be considered abnormally low.
- *GH insensitivity syndrome*: GH insensitivity associated with the recognizable dysmorphic features described by Laron.
- *Partial GH insensitivity*: GH insensitivity in the absence of dysmorphic features described by Laron.

TABLE 8-8

Clinical Features of Growth Hormone Insensitivity

Growth and Development

Birth weight: near-normal

Birth length: may be slightly decreased

Postnatal growth: severe growth failure

Bone age: delayed, but may be advanced relative to height age

Genitalia: micropenis in childhood; normal for body size in adults

Puberty: delayed 3 to 7 years

Sexual function and fertility: normal

Craniofacies

Hair: sparse before the age of 7 years

Forehead: prominent; frontal bossing

Skull: normal head circumference; craniofacial disproportion due to small facies

Facies: small

Nasal bridge: hypoplastic

Orbits: shallow

Dentition: delayed eruption

Sclerae: blue

Voice: high-pitched

Musculoskeletal/Metabolic/Miscellaneous

Hypoglycemia: in infants and children; fasting symptoms in some adults

Walking and motor milestones: delayed

Hips: dysplasia; avascular necrosis of femoral head

Elbow: limited extensibility

Skin: thin, prematurely aged

Osteopenia

CC: short stature

- A 4 year old boy who refer to us because of growth abnormality
- ROS: polyuria
- F/E : weight SDS: -3.5
Height SDS: -3.4



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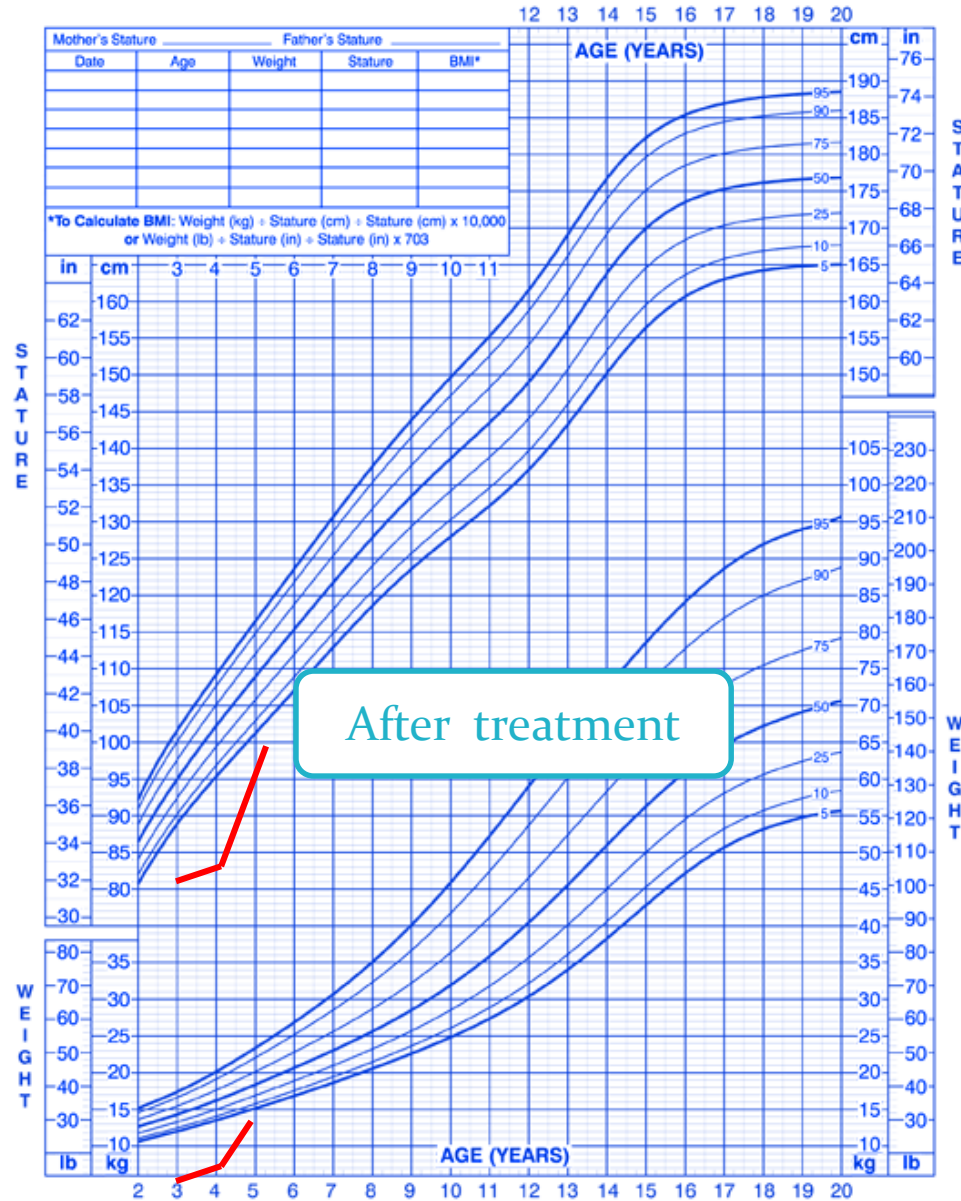
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	BUN:14	Cr:0.6				
	Na:132	K:2.5	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.5	PCO2:39	HCO3:30			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1005	WBC:1-2	RBC:1-2			
S/E	Neg					

- BP:70/40
Renin: 34 (0.5-4.5 ng/ml/hr)
Aldosterone:1100(100-800 pmol/L)
Urine(Na: 57 meq/L ,CL: 80 meq/L, K: 45)
- Diagnosis : BARTER SYNDROME

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



CC: short stature

- A 3 year old boy who refer to us because of growth abnormality
- ROS: polyuria
- F/E : weight SDS: -3.2
Height SDS: -3.4





CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:14	Cr:0.6				
	Na:132	K:2.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.25	PCO2:29	HCO3:13			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1005	WBC:1-2	RBC:1-2	PH: 8		
S/E	Neg					

- 
- Ultrasonography : nephrocalcinosis
 - Urine (ca: 438 cr:159mg volume:1200cc)
 - Diagnosis : Distal RTA



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Cc: abnormal growth

- A 5 months old boy refer to us because of FTT and history of recurrent fever

F/E

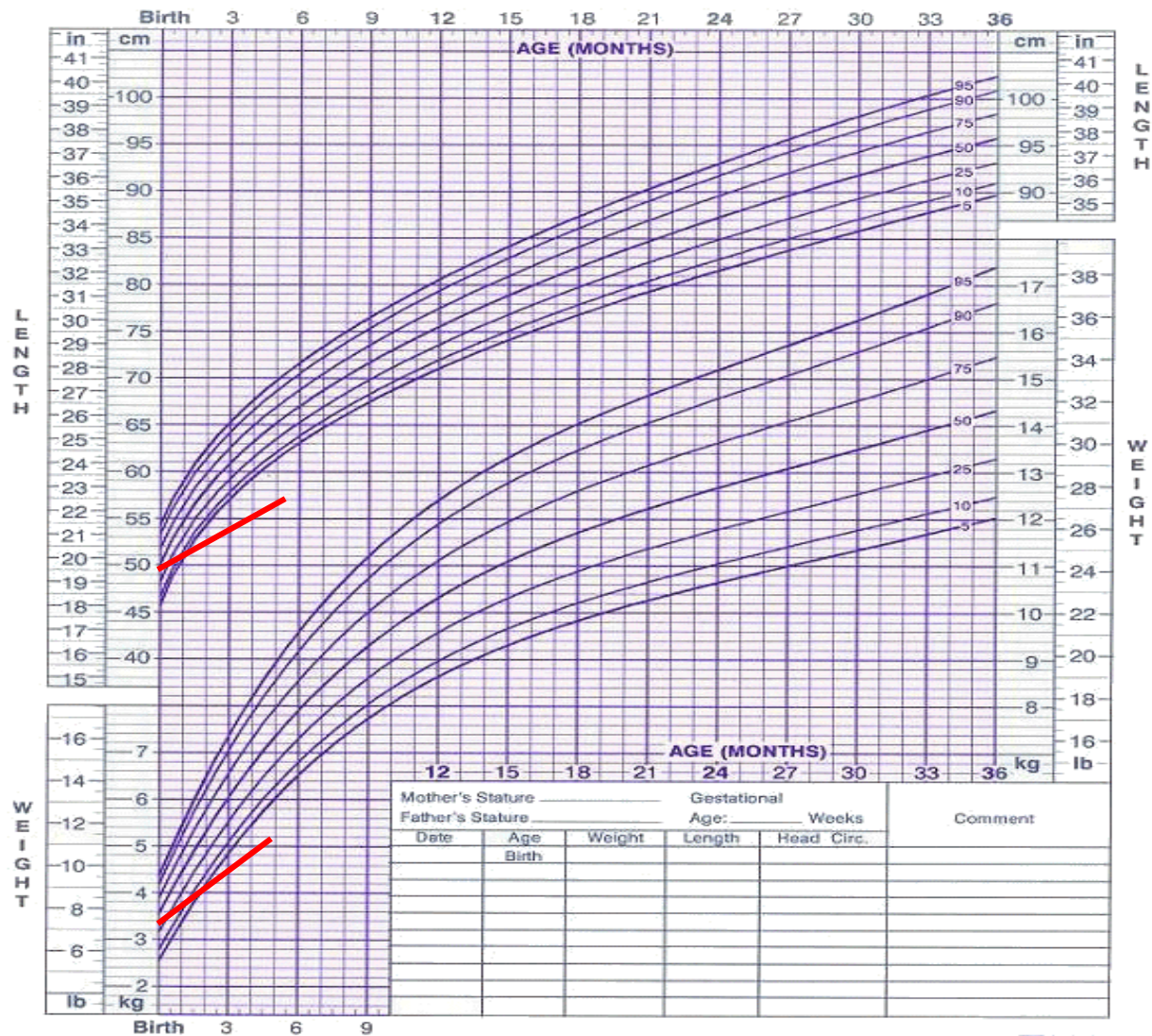
hypotonia

Temp: 37.8

Mild dehydration

Birth to 36 months: Boys
Length-for-age and Weight-for-age percentiles

NAME _____



Published May 30, 2000 (modified 4/20/01).
 SOURCE: Developed by the National Center for Health Statistics in collaboration with
 the National Center for Chronic Disease Prevention and Health Promotion (2000).
<http://www.cdc.gov/growthcharts>

CBC	WBC: 8.5	HB:10	PLT:234000			
	BUN:45	Cr:0.9	BS 90			
	Na:150	K:4.7	ALP:860	Ca: 10	P: 4.2	
VBG	PH :7.45	PCO2:29	HCO3:20			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1001	WBC:1-2	RBC:1-2	PH:7		
S/E	Neg					

- Plasma osmolality : 321mosmol/kg
- Urine osmolality : 100mosmol/kg
- Ultrasonography : severe hydronephrosis and megaureter
- AVP challenge test:
 - SG: 1003
 - Plasma osmolality : 316 mosmol/kg
 - Urine osmolality : 120 mosmol/kg
- Diagnosis: nephrogenic DI

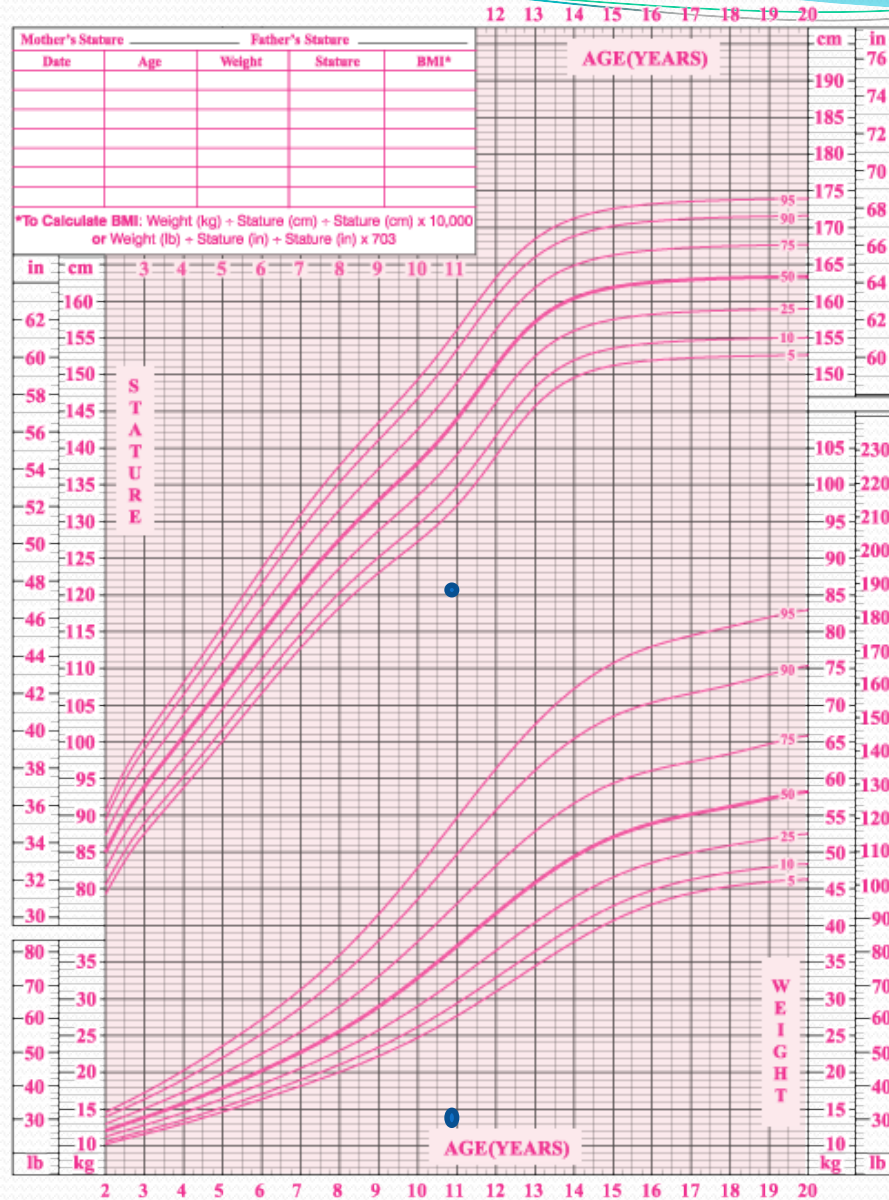
CC: short stature

- A 11 years old girl who refer to us because of growth abnormality
- ROS : loss of appetite
- P/E : non specific
 - height SDS: - 3.7
 - weight SDS: -4
 - SMR: B1p1

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



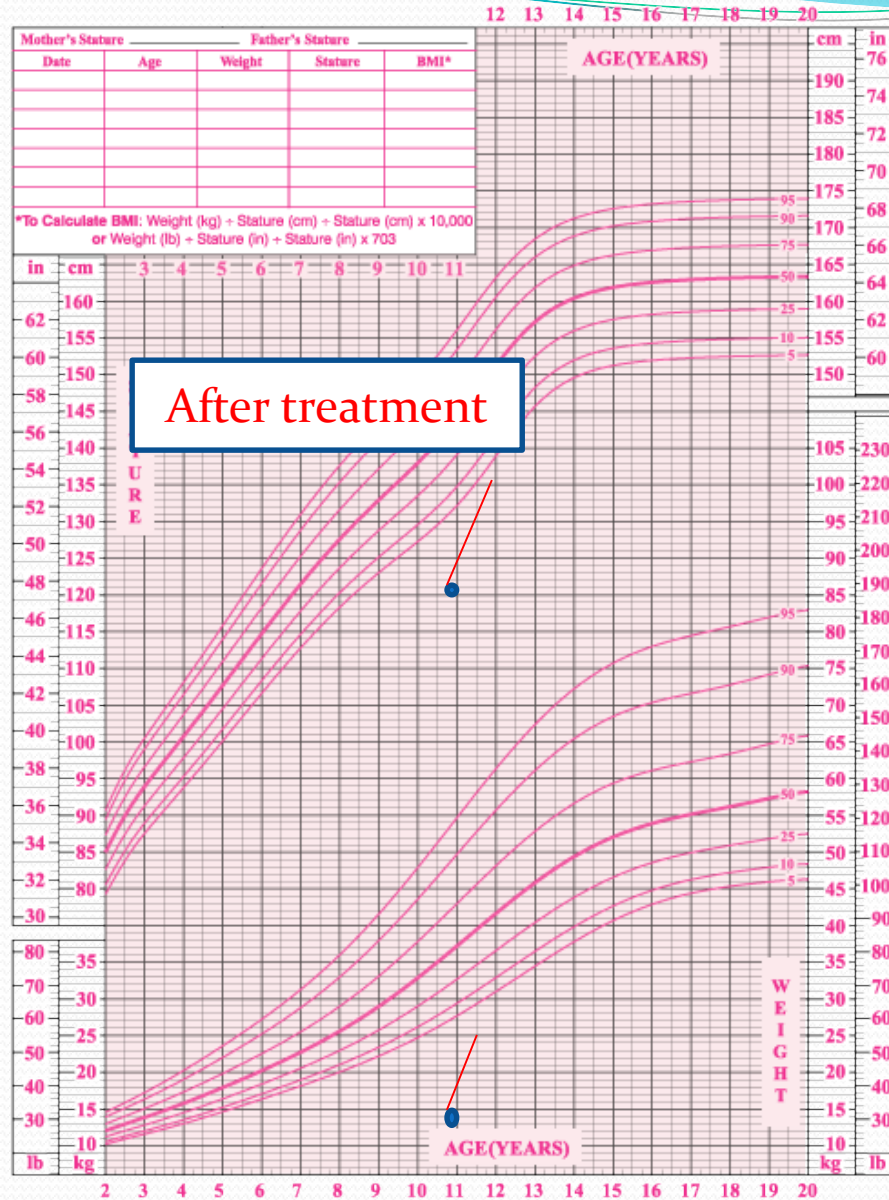
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	BUN:14	Cr:0.6				
	Na:137	K:3.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.3 5	PCO2:39	HCO3:22			
	EMA:pos	TTG>200				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1015	WBC:1-2	RBC:1-2	PH: 8		
S/E	Fat drop+					

- 
- Endoscopic findings and pathologic report compatible with celiac disease

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



CC: short stature and leg bowing

- A 6 years old boy who refer to us because of genue varum and leg bowing
- P/E: genue varum and widening of wrist



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:15	Cr:0.7	BS 90			
	Na:137	K:4.7	ALP:1860	Ca:9.3	P: 2.5	
VBG	PH :7.45	PCO2:29	HCO3:20			
	EMA:neg	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1014	WBC:1-2	RBC:1-2	PH:7		
S/E	Neg					

- Ca: 9.8 , p :2.5 cr : 0.7 ALP: 1800 PTH: 48 (7-60 pg/ml)

24 hr Urine (ca: 20, P : 670 , cr: 340 volume :970)

FEP : 55%

urine aminoacid and carbohydrate
chromatography:Neg



- 
- Diagnosis : familial hypophosphatemic rickets

CC: short stature

- A 4 years old boy refer to us because of short stature
- ROS: -
- P/E : pallor
 - height SDS: -2.5
 - weight SDS : - 2.7



CBC	WBC: 8.5	HB:10	PLT:234000			
	BUN:55	Cr: 2.3	BS 90			
	Na:137	K:3.7	ALP:1160	Ca: 10	P:5	
VBG	PH :7.45	PCO2:29	HCO3:20			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1008	WBC:1-2	RBC:1-2	PH:6		
S/E	Neg					

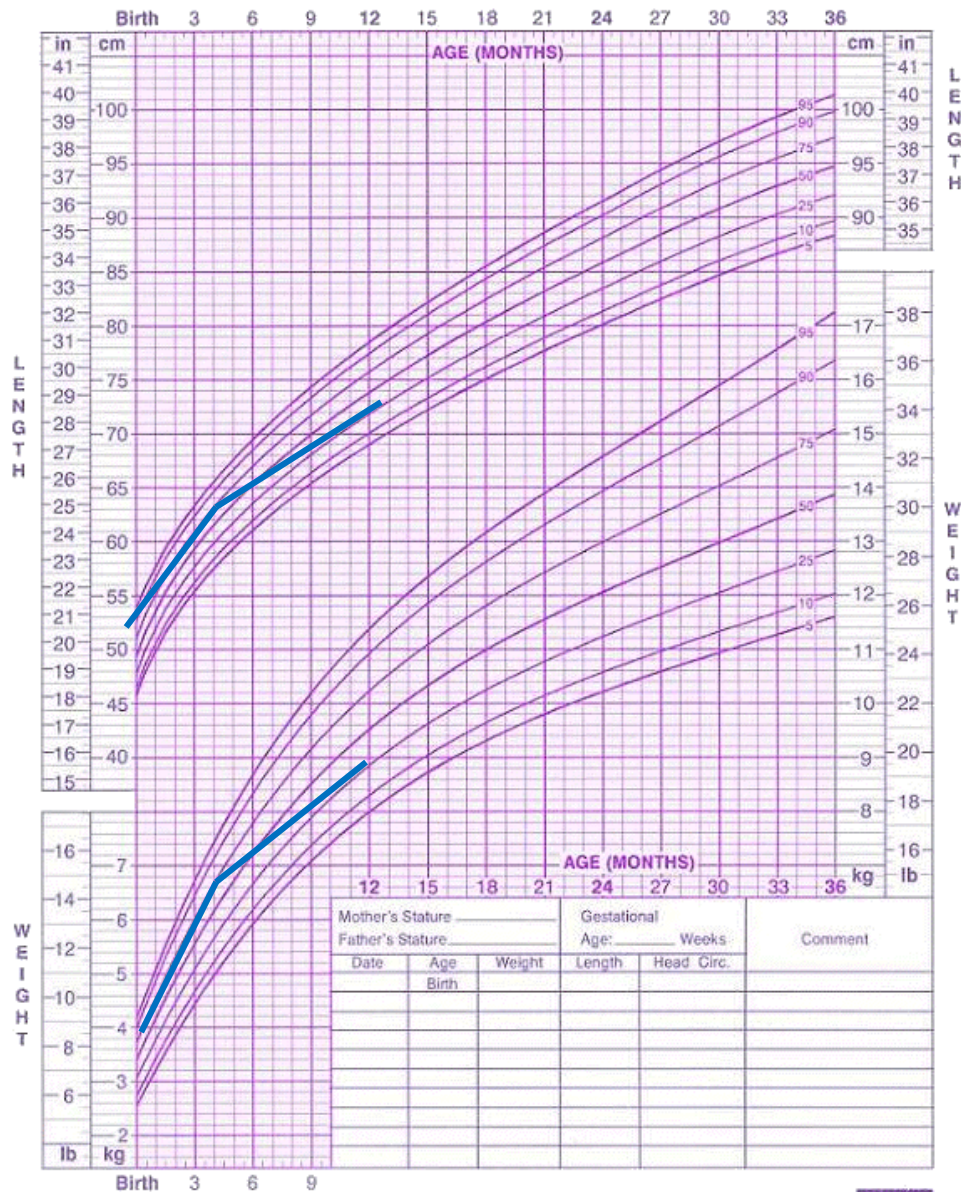
- 
- Ultrasonography : decreased in size of both kidney
 - VCUG: VUR grade 2
 - Diagnosis : CRF



Cc : abnormal growth

Birth to 36 months: Girls
Length-for-age and Weight-for-age percentiles

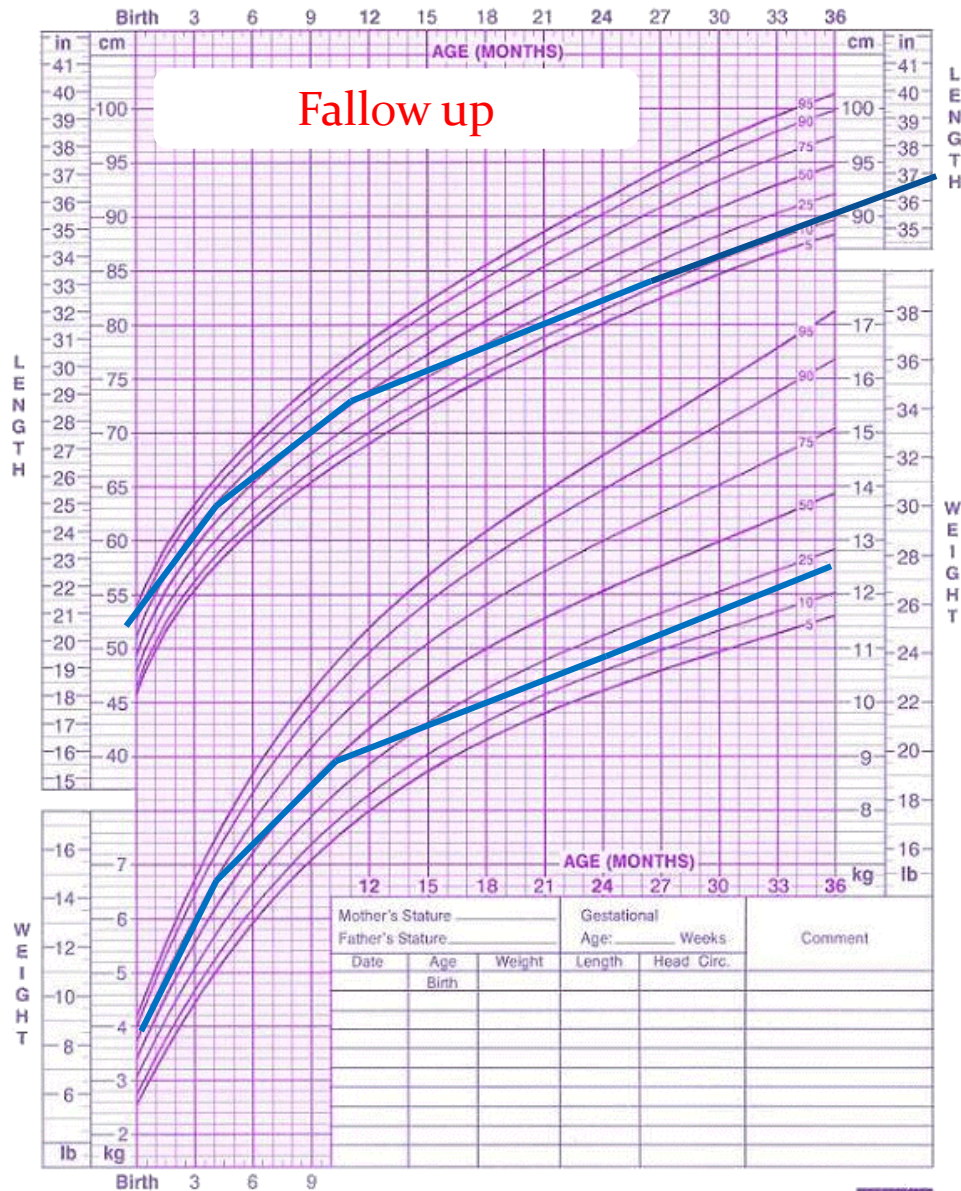
NAME _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:14	Cr:0.6	BS:90			
	Na:132	K:4.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.4 5	PCO2:39	HCO3:22			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1025	WBC:1-2	RBC:1-2	PH: 8		
S/E	Neg					

Birth to 36 months: Girls
Length-for-age and Weight-for-age percentiles

NAME _____



Diagnosis

- Channelization

CC: abnormal growth

- A 5.5 years old girl with short stature
- F/E :

SMR: B3P1

dry skin and hair

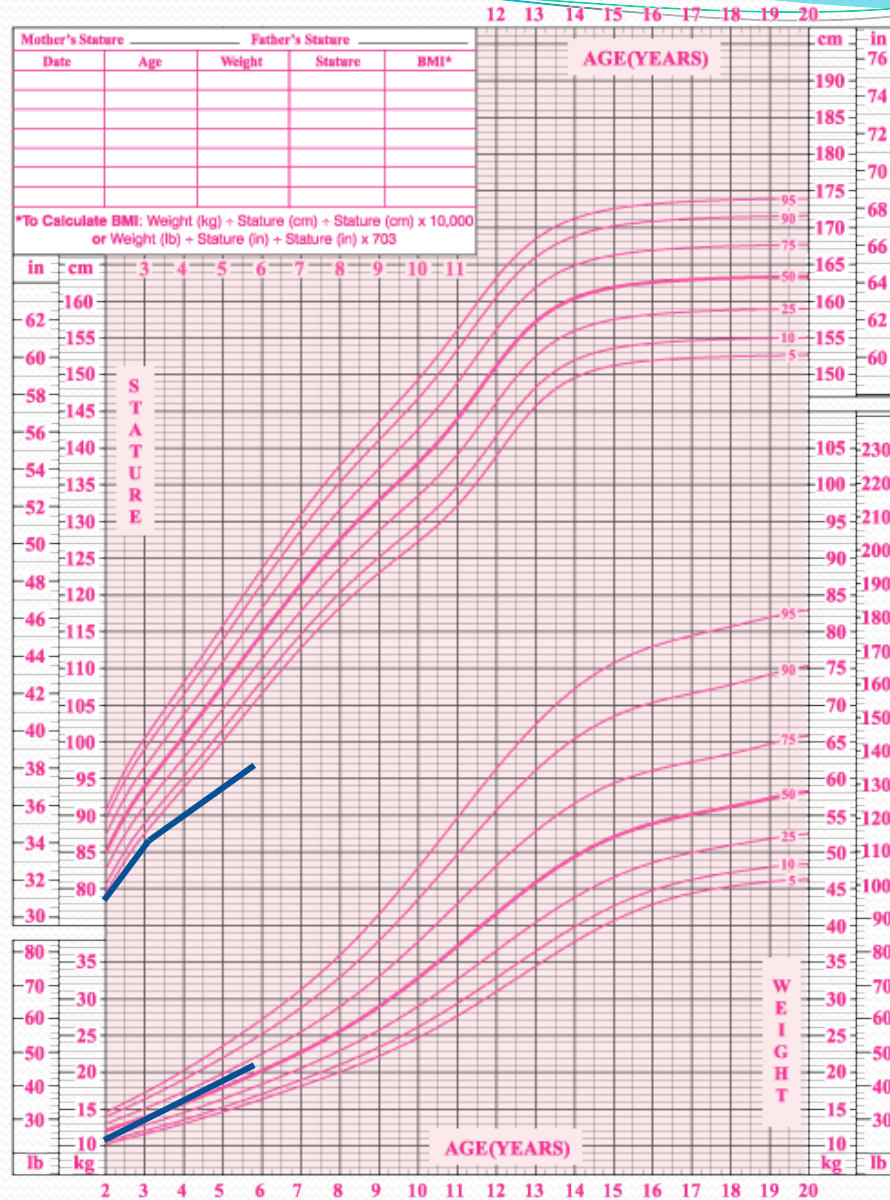
puffiness

+/- goiter

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:15	Cr:0.7	BS 90			
	Na:137	K:4.7	ALP:1060	Ca: 10	P:5.5	
VBG	PH :7.45	PCO2:29	HCO3:20			
	EMA<0.1	TTG :1				
	T4:3µg/dl	T3U:25	TSH> 100			
U/A	SG: 1001	WBC:1-2	RBC:1-2	PH:7		
S/E	Neg					

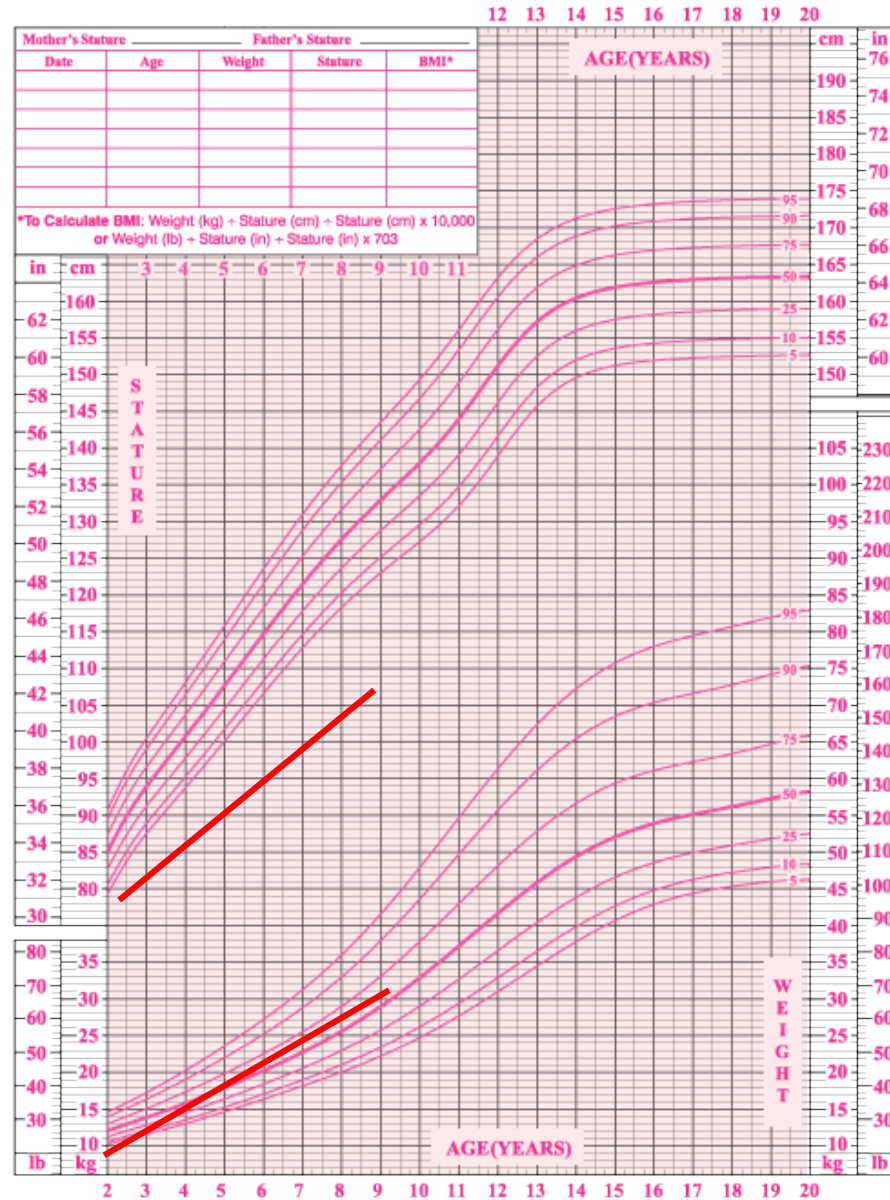
- 
- Diagnosis : hypothyroidism

CC: short stature

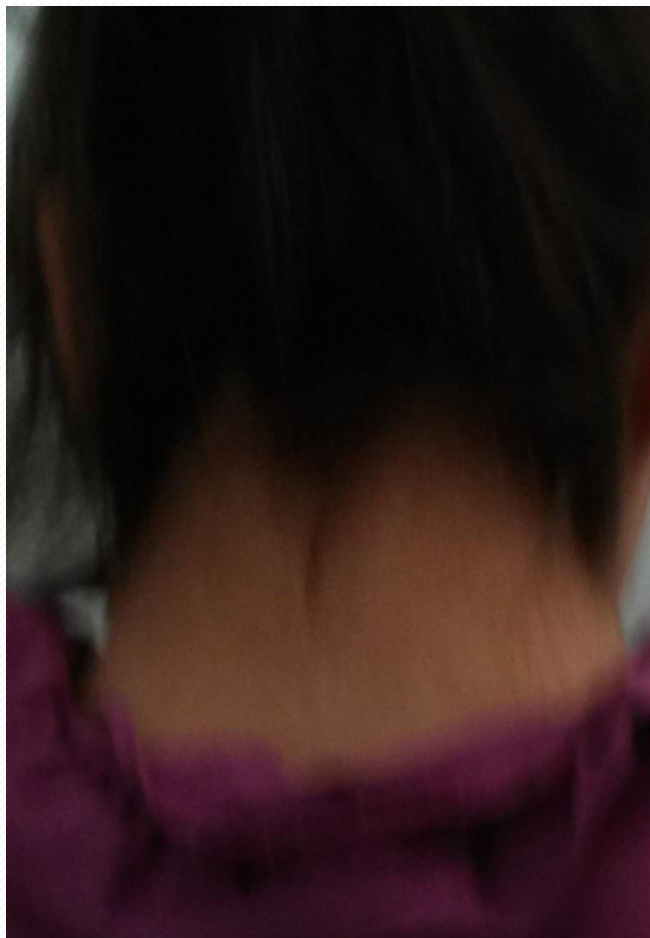
- A 9 years old girl who complains of short stature

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

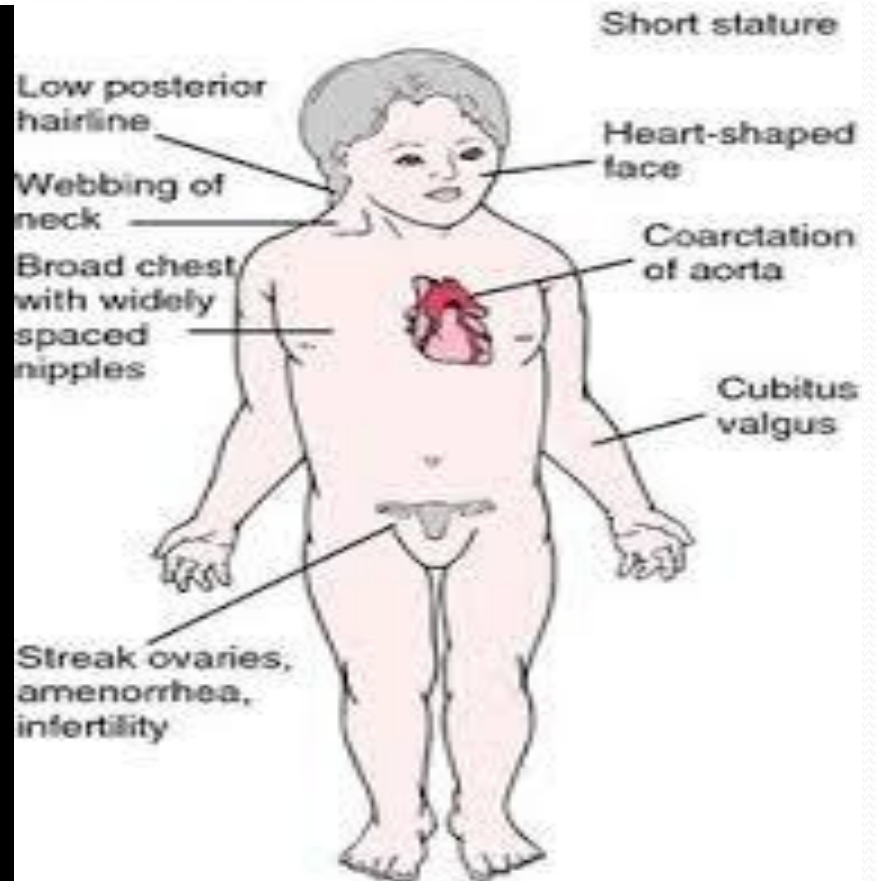
NAME _____













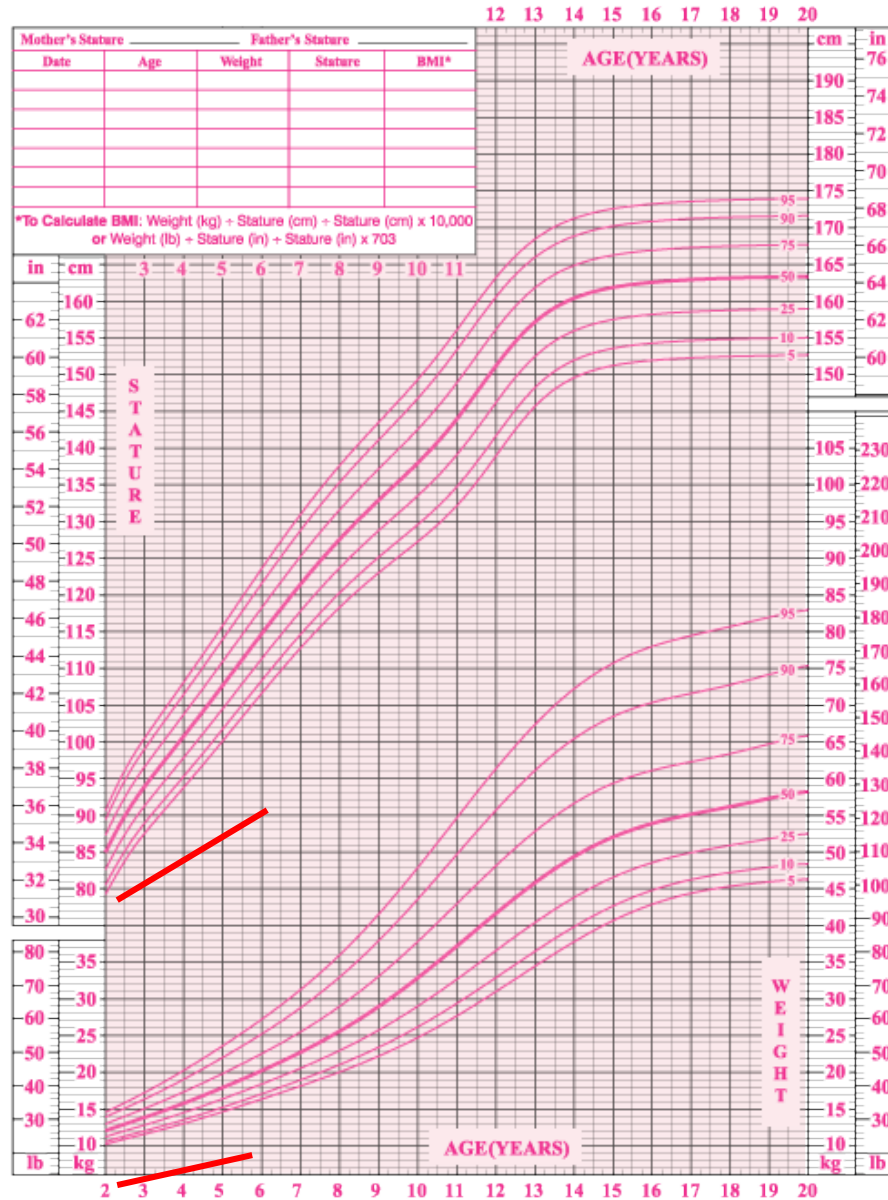
- 
- FSH: 45
 - Karyotype: 45 X
 - Diagnosis : Turner syndrome

CC: abnormal growth

- BW:1400gr
- P/E: triangular faces
fifth finger clinodactyly
asymmetry in Rt and Lt limbs
UDT

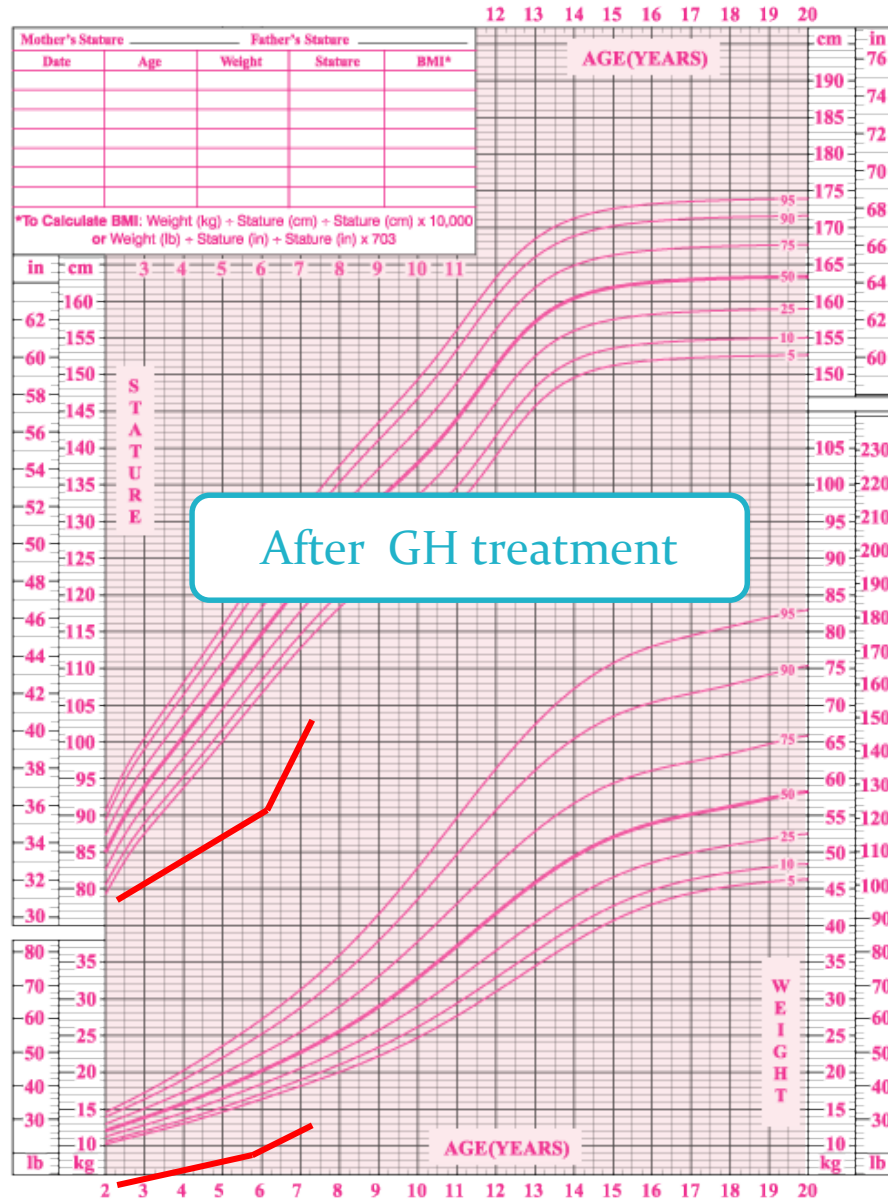
2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____



2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____





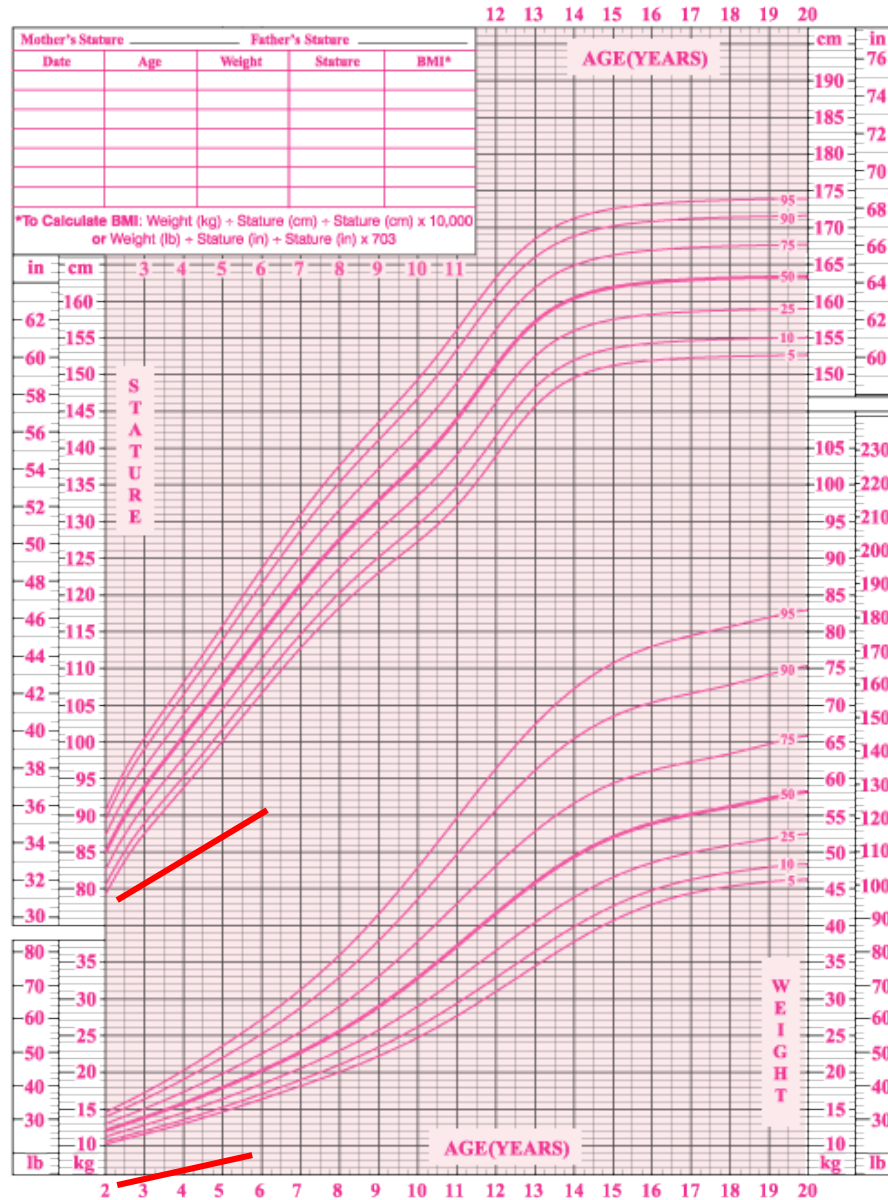
- 
- Diagnosis: silver Russell syndrome

CC: short stature

- RFR: short stature and body disproportion

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____







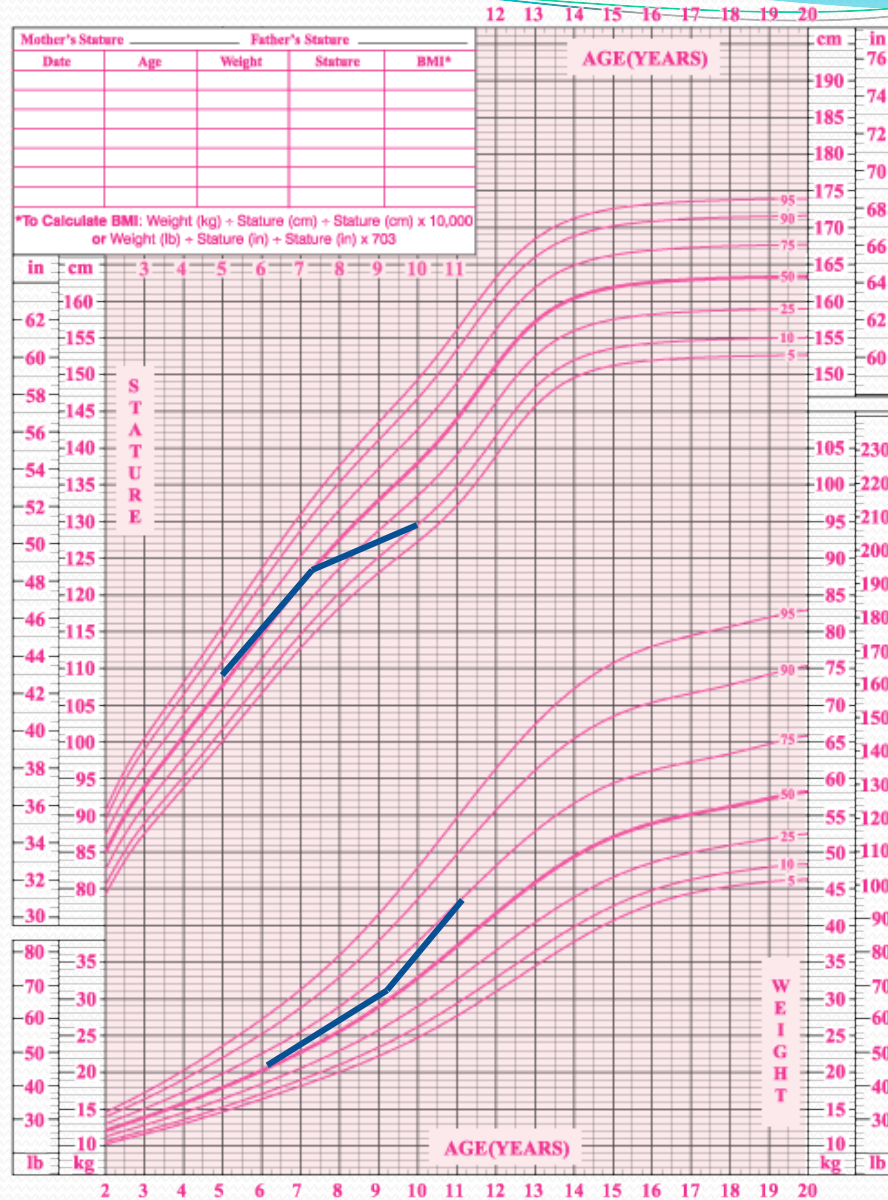
- 
- Diagnosis : Achondroplasia



CC:Short stature and weight gain

2 to 20 years: Girls Stature-for-age and Weight-for-age percentiles

NAME: _____



Diagnosis

- Cushing syndrome
- Hypothyroidism
- Acquired GHD

- Routine lab test : normal
- DST: NL
- TFT:NL
- GH provocative test : 0.3 , 0.1, 1.8 , 1.2 mIU/ml
- IGF1:36 ng/ml



- 
- Diagnosis : Craniopharyngioma

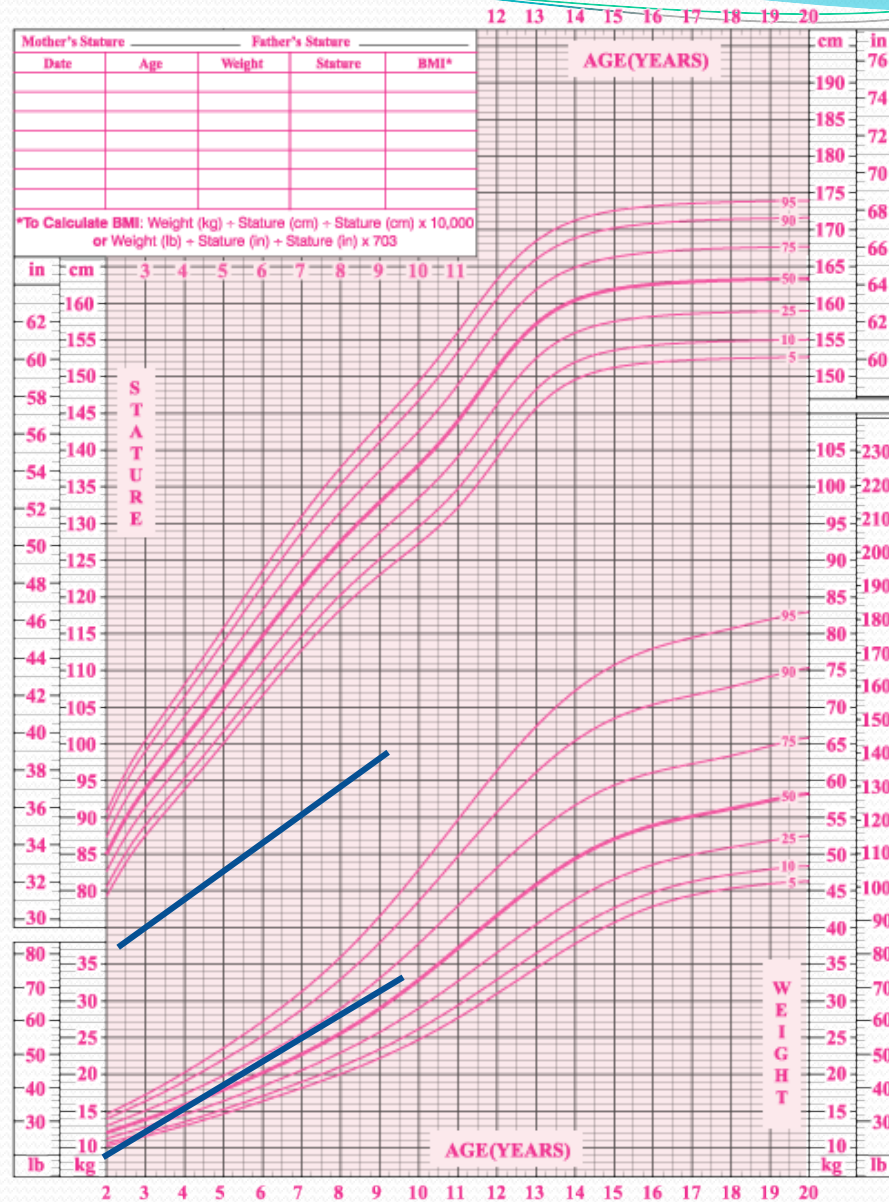


Short stature and Obesity

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____

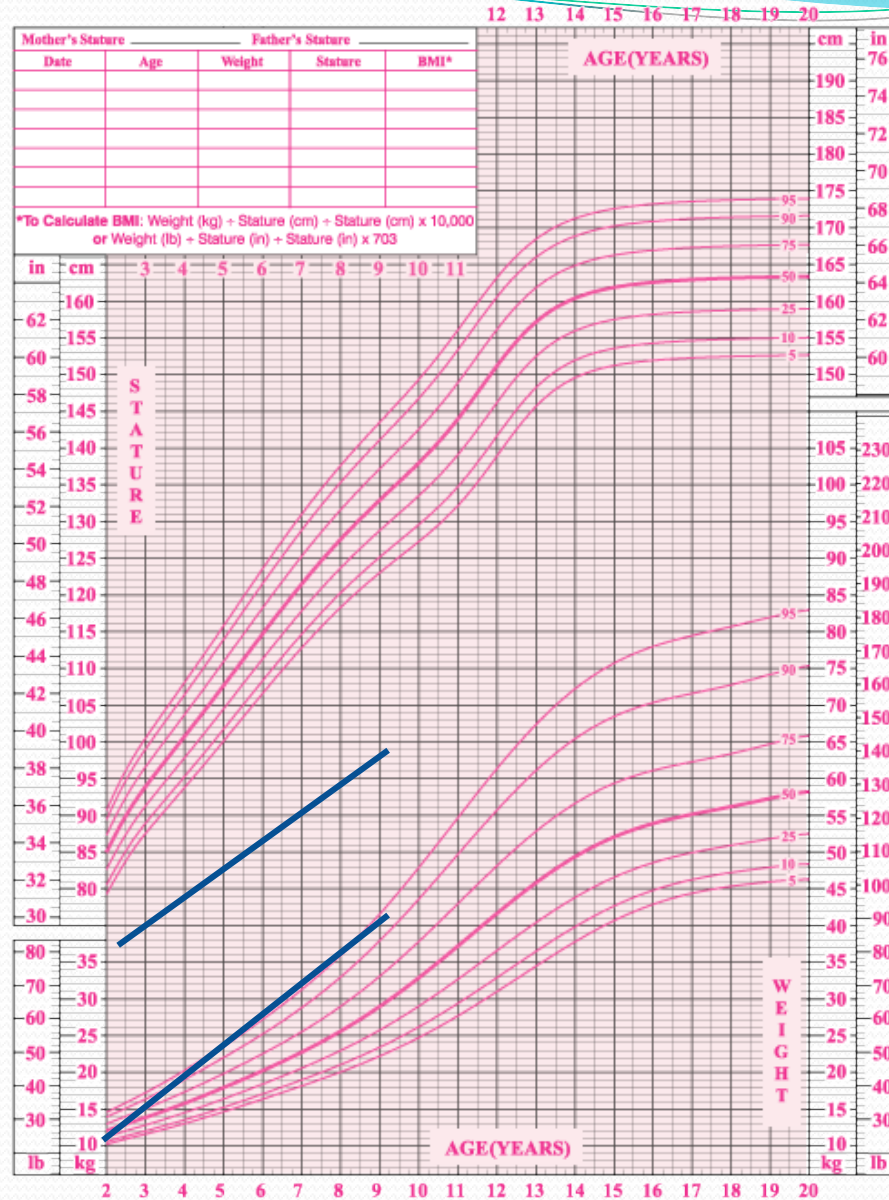


Diagnosis

- Cushing syndrome
- Hypothyroidism
- Syndrome with obesity(Prader willi, Down, Alstrome, Leurance moon bardet biedel, Albright phenomenon, Turner)
- GHD

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:15	Cr:0.7	BS 90			
	Na:137	K:4.7	ALP:1860	Ca:7.8	P:8.9	
VBG	PH :7.45	PCO2:29	HCO3:20			
	EMA<0.1	TTG :1				
	T4:13µg/l	T3U:35	TSH:2			
U/A	SG: 1001	WBC:1-2	RBC:1-2	PH:7		
S/E	Neg					

- 
- Ca: 7.7, P: 8.9 ALP: 560 PTH: 350pg/ml



- 
- Diagnosis : Albright phenomene (pseudohypoparathyroidism)

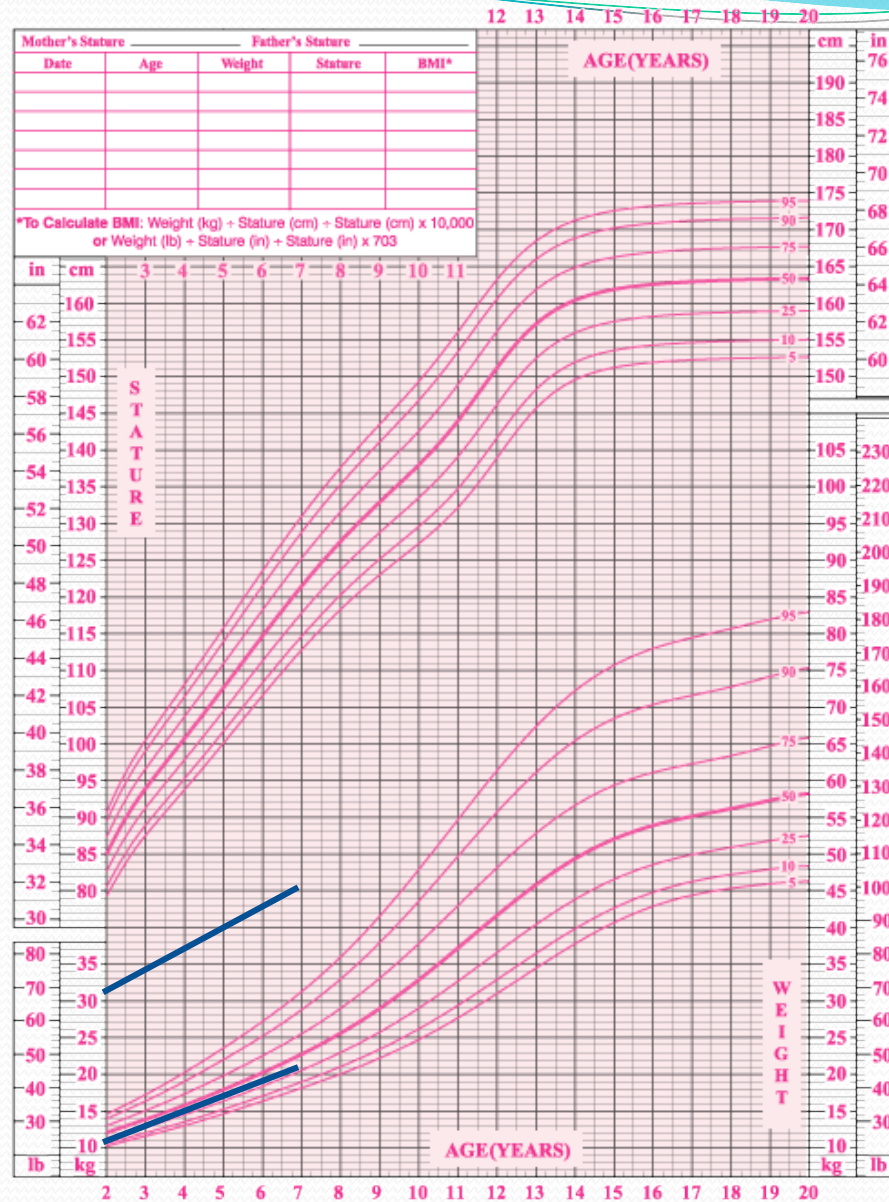


CC: Growth abnormality

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:14	Cr:0.6	BS:90			
	Na:132	K:3.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.4 5	PCO2:39	HCO3:22			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1025	WBC:1-2	RBC:1-2	PH: 8		
S/E	Neg					

GH provocative test with clonidine and fasting

MIN	0	30	60	90	120
GH mIU/ML	0.2	1	1.2	2.5	2.2
IGF I ng/ml	43				
Cortisol 8AM:	22µg/dl				

[illegible]

SOURCE : Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000). <http://www.cdc.gov/growthcharts>

- 
- Diagnosis : IGHD

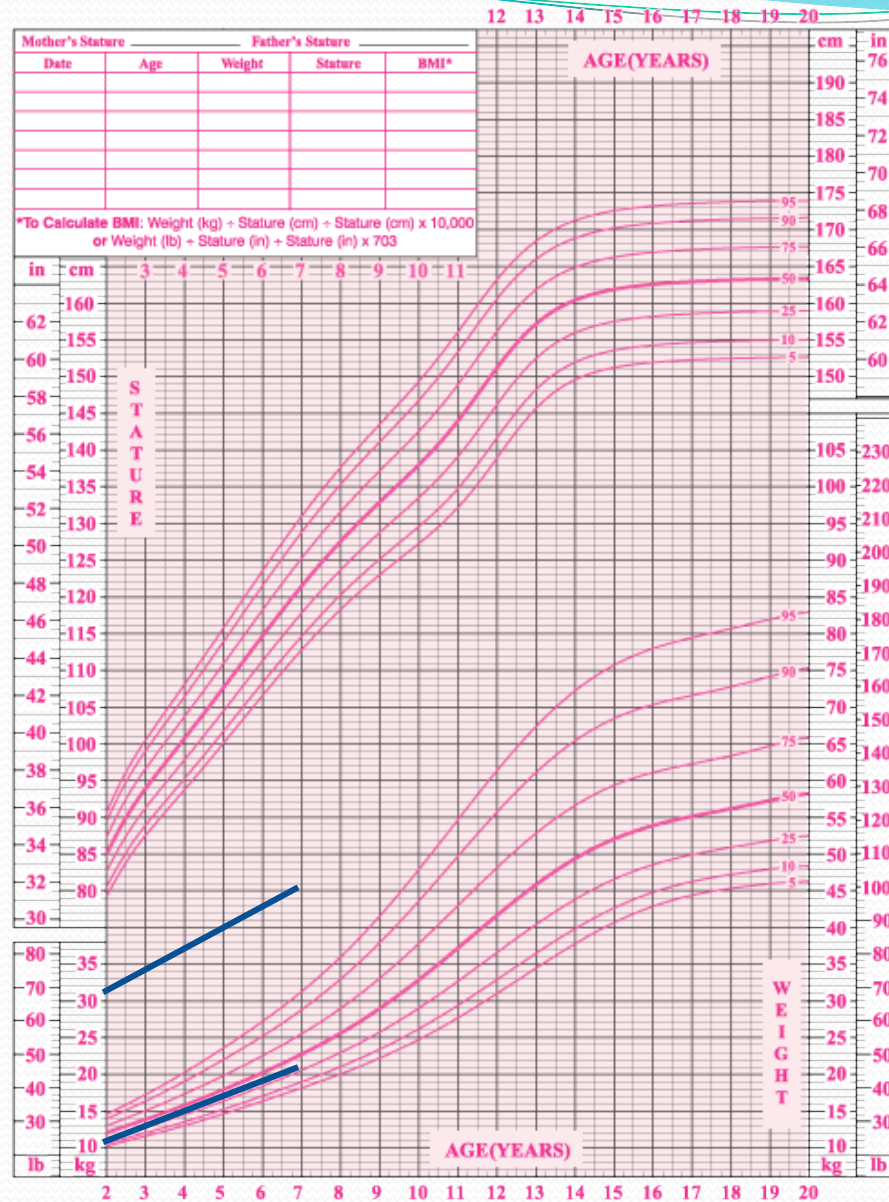


CC: Growth abnormality

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:14	Cr:0.6	BS:90			
	Na:132	K:4.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.4 5	PCO2:39	HCO3:22			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1025	WBC:1-2	RBC:1-2	PH: 8		
S/E	Neg					

GH provocative test with clonidine

MIN	0	30	60	90	120
GH miu/ML	26	57	123	120	75
IGF 1	43ng/ml				

IGF 1 Generation test

- Basal IGF 1 : 43 ng/ml
- IGF1 after GH administration (0.1 u/kg/ day /3 days): :45

- 
- Diagnosis :GH resistance





Fig. 3. Preoperative child 14 years of age. All over full and weighing 20.25 kg with growth hormone deficiency. The patient also showed mental retardation, muscular hypotonia, and mild scoliosis. She had malocclusion, a tongue defect, and a cleft palate.



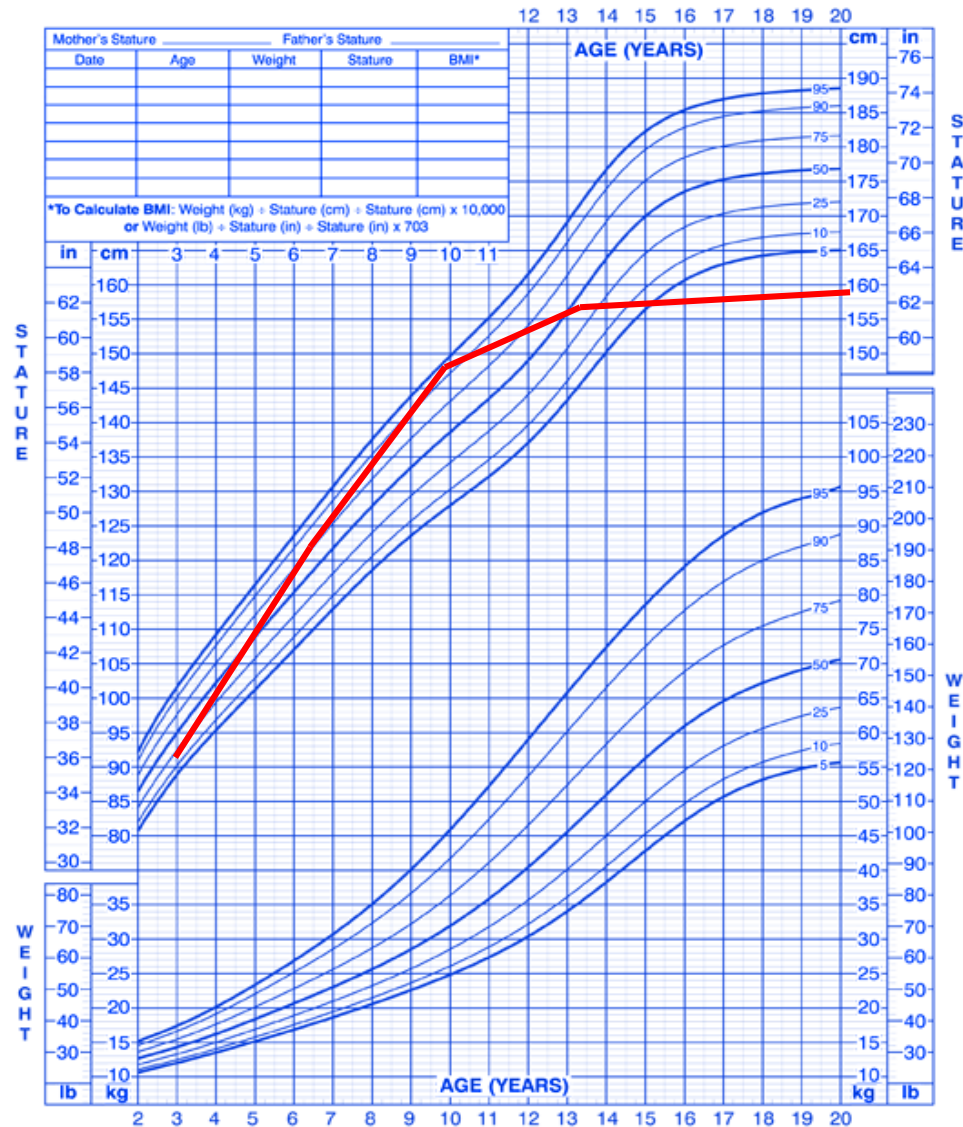
Fig. 4. Frontal and lateral view of the case showing: (a) brachycephaly, mid-face hypoplasia, mild hypomyelination, upslowing palpebral fissures, prominent upper-lip ridges, depressed nasal bridge, web nose, asymmetrical ears, long philtrum, high-arched palate, and micrognathia.



2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Diagnosis

- Precocious puberty



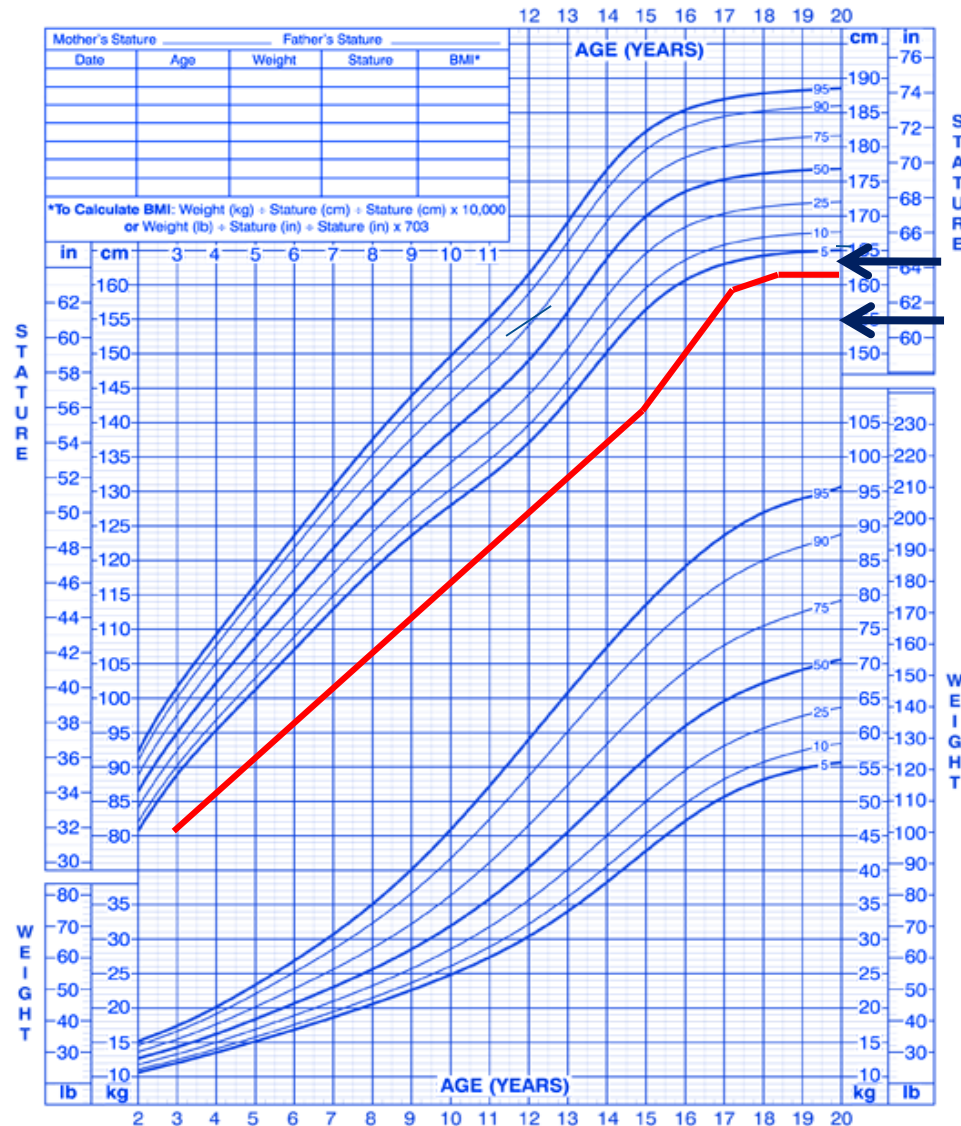
Diagnosis

- Genetic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Diagnosis

- Genetic short stature

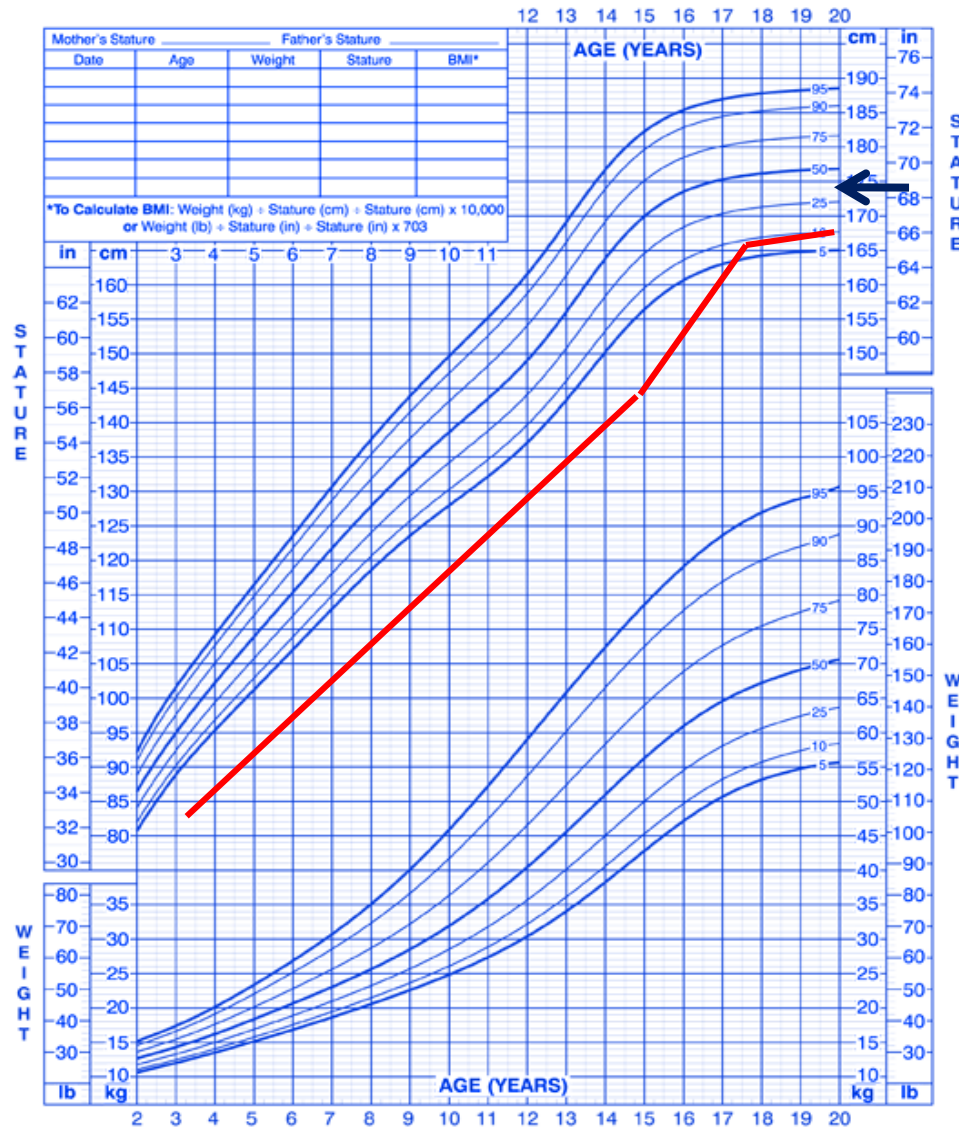


- 
- Diagnosis : genetic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Diagnosis

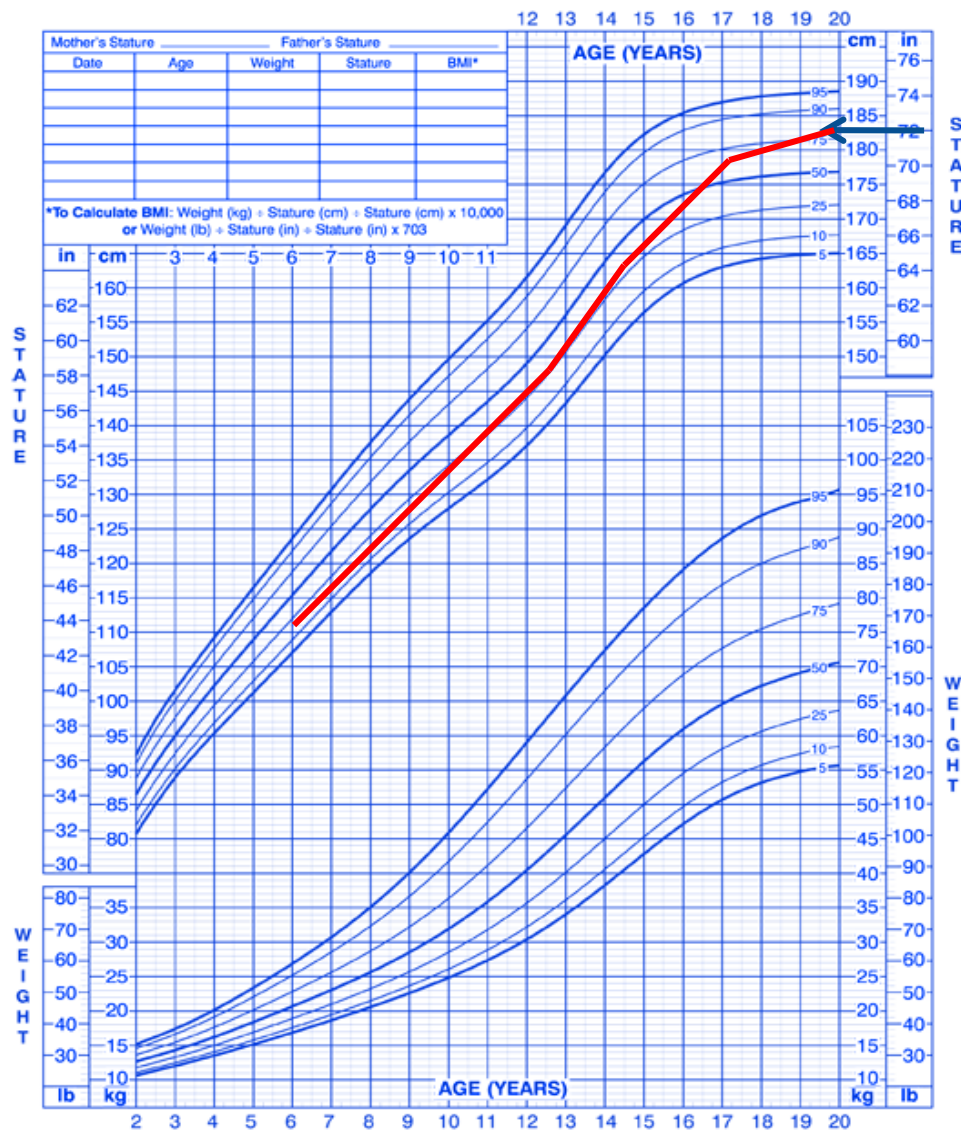
- Constitutional delay of growth and puberty

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NewParent

NAME _____

RECORD # _____



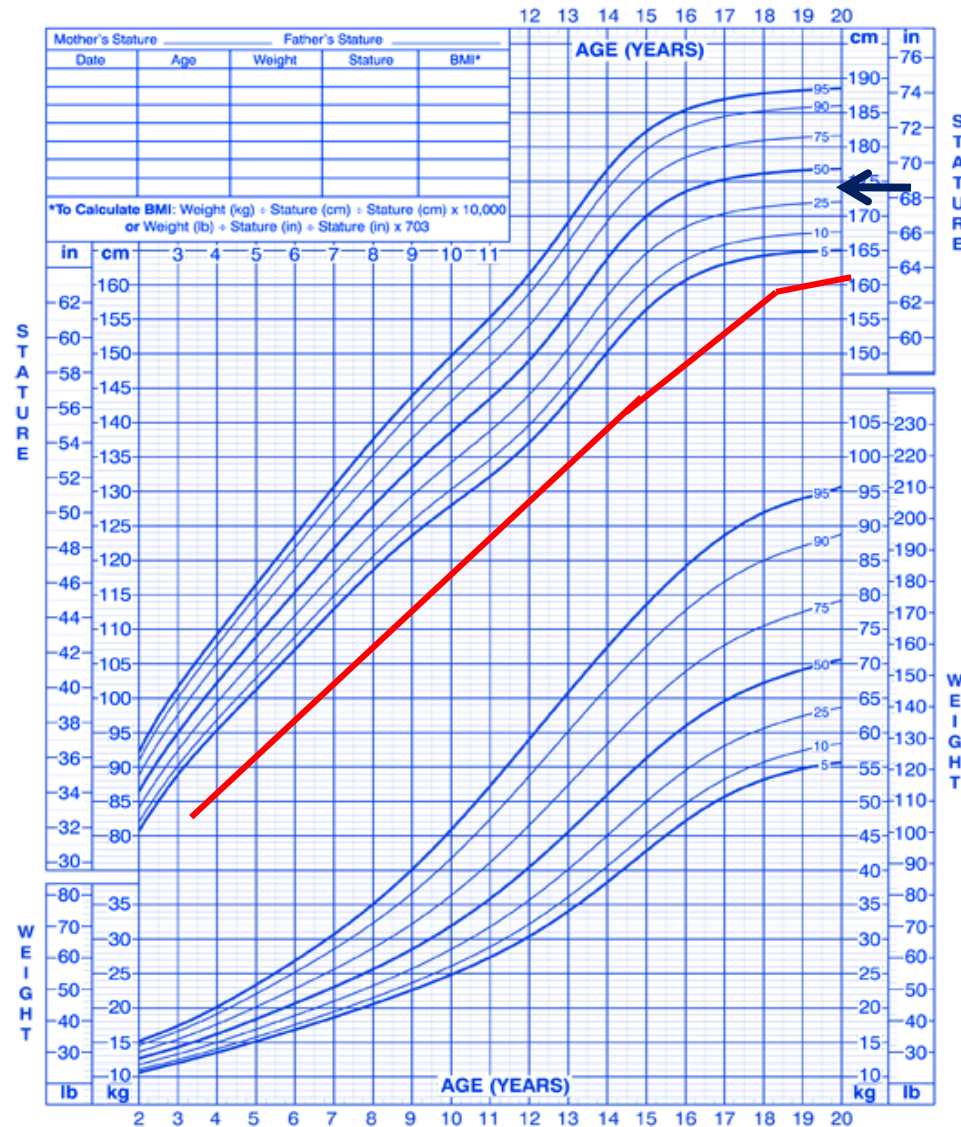
Diagnosis

- Constitutional delay of puberty

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



CBC	WBC: 8.5	HB:12	PLT:234000			
	BUN:14	Cr:0.6	BS:90			
	Na:132	K:4.7	ALP:800	Ca: 10	P: 4.2	
VBG	PH :7.4 5	PCO2:39	HCO3:22			
	EMA<0.1	TTG :1				
	T4:11	T3U:30	TSH :3.5			
U/A	SG: 1025	WBC:1-2	RBC:1-2	PH: 8		
S/E	Neg					

GH provocative test with clonidine

MIN	0	30	60	90	120
GH mIU/ML	2	5	23	20	7
IGF I ng/ml	243				

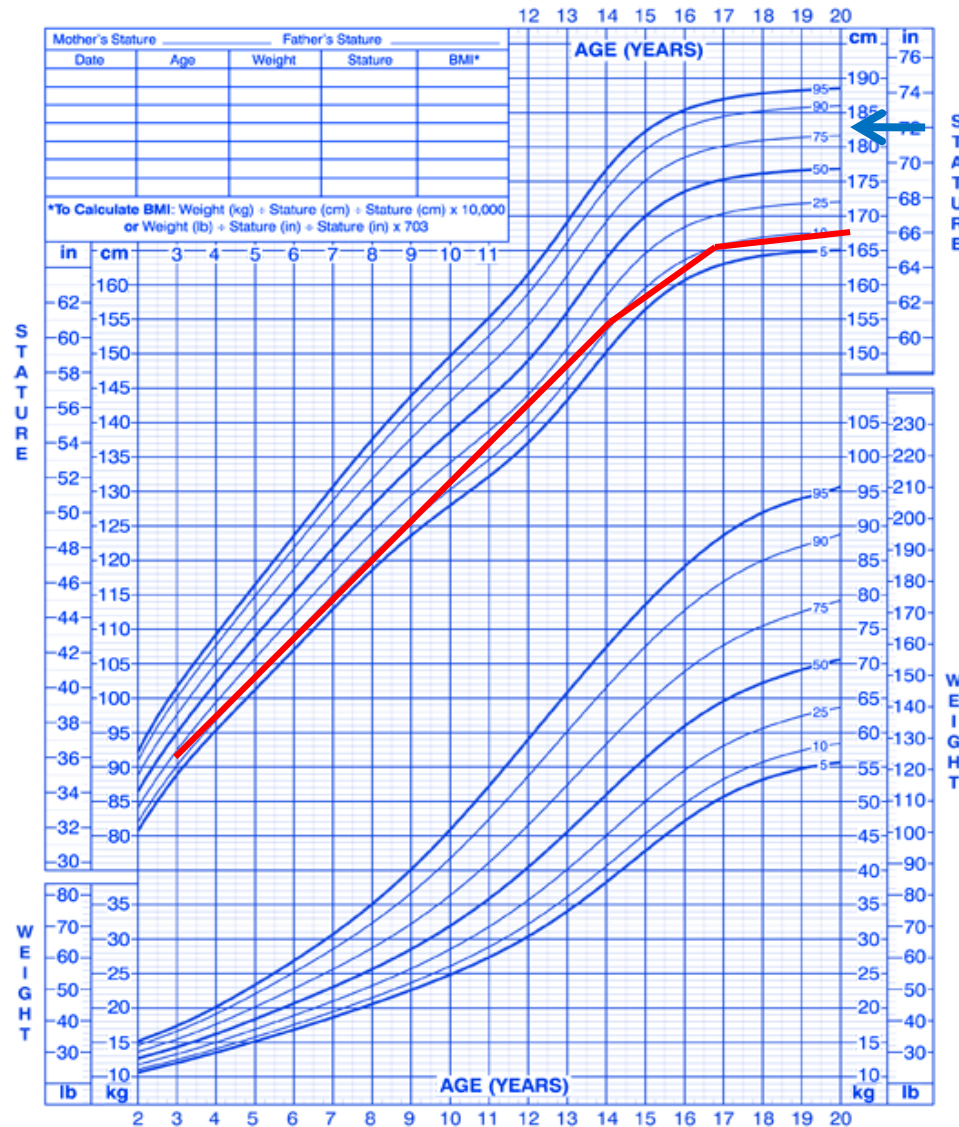
- 
- Idiopathic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____

NewParent

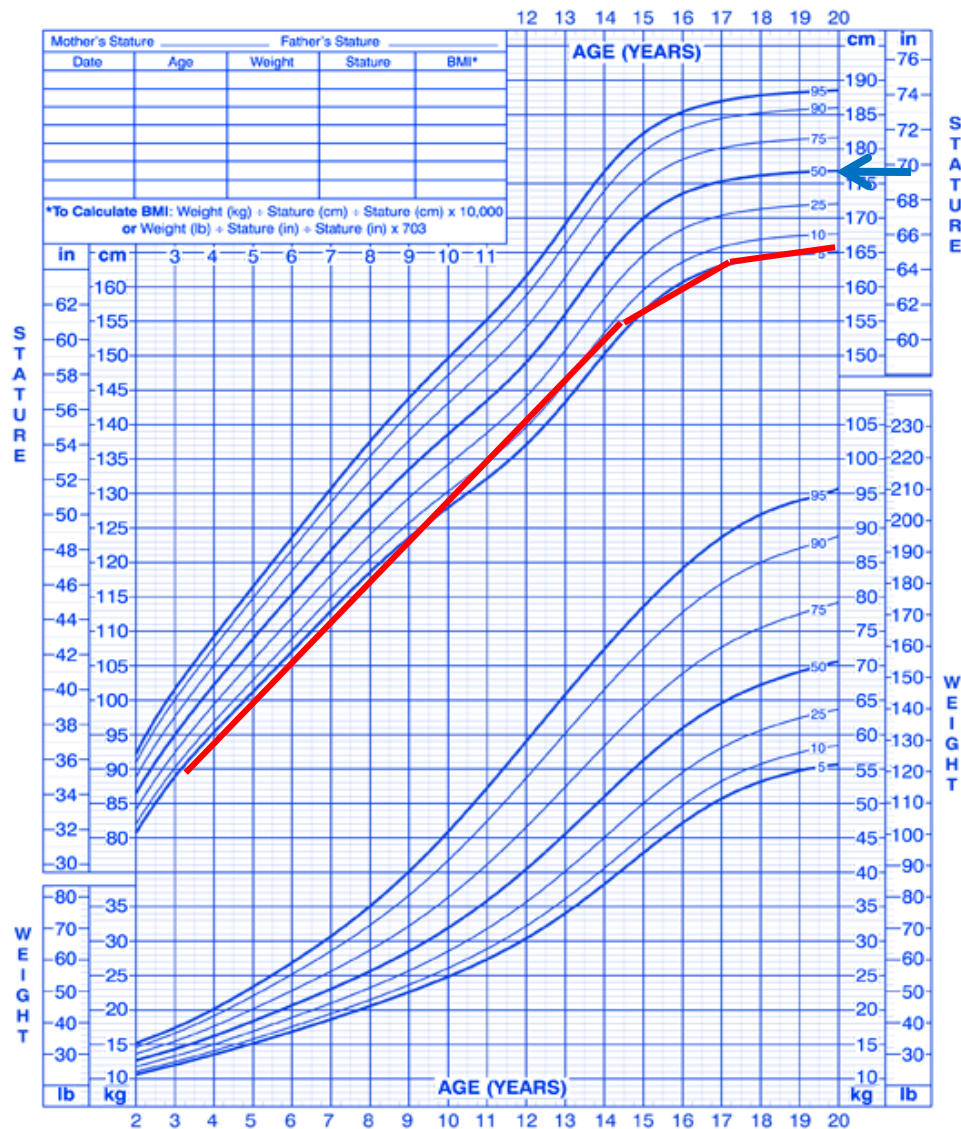


2 to 20 years: Boys

Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Diagnosis

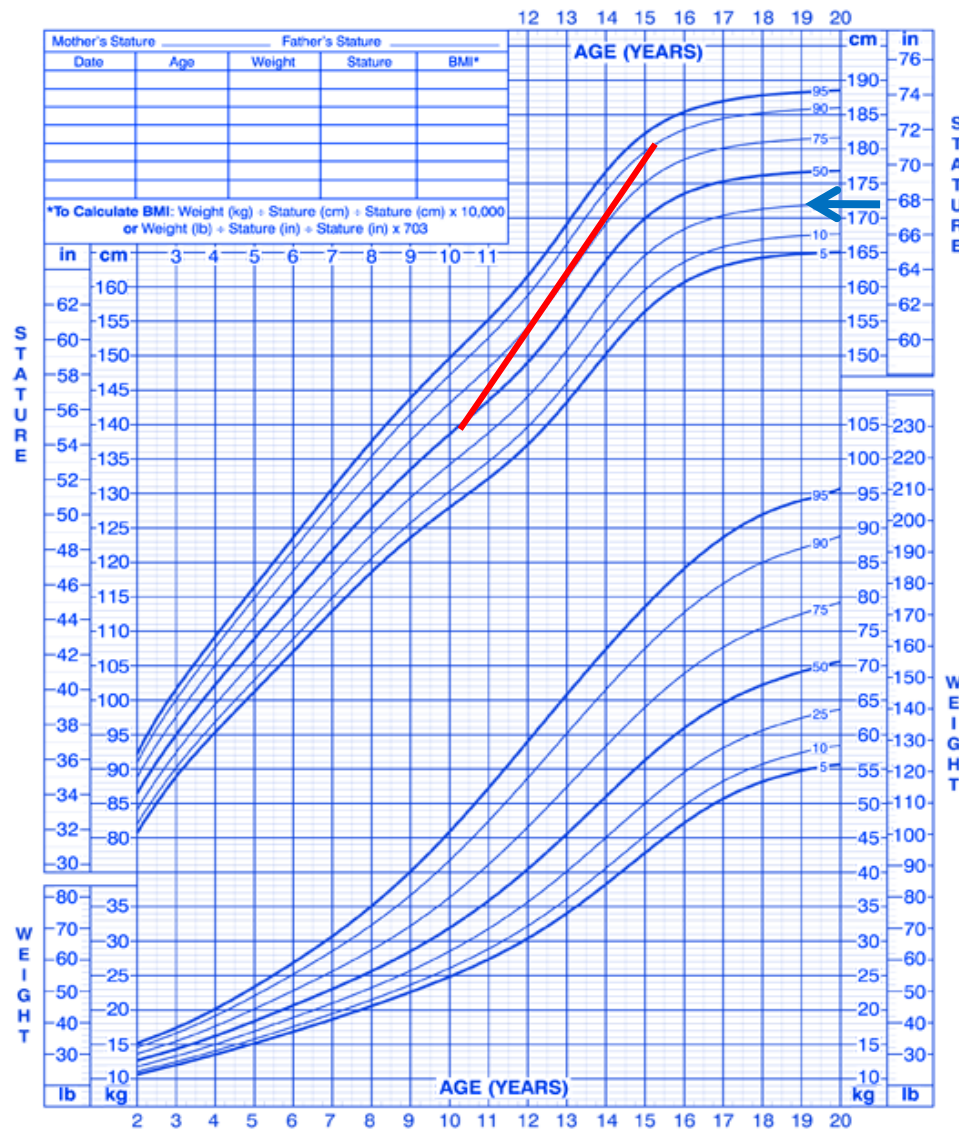
- Hormonal disorder
- Systemic disorders
- Idiopathic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NewParent

NAME _____

RECORD # _____



- 
- Normal growth spurt
 - GH excess

Birth to 36 months: Boys
Length-for-age and Weight-for-age percentiles

NAME _____



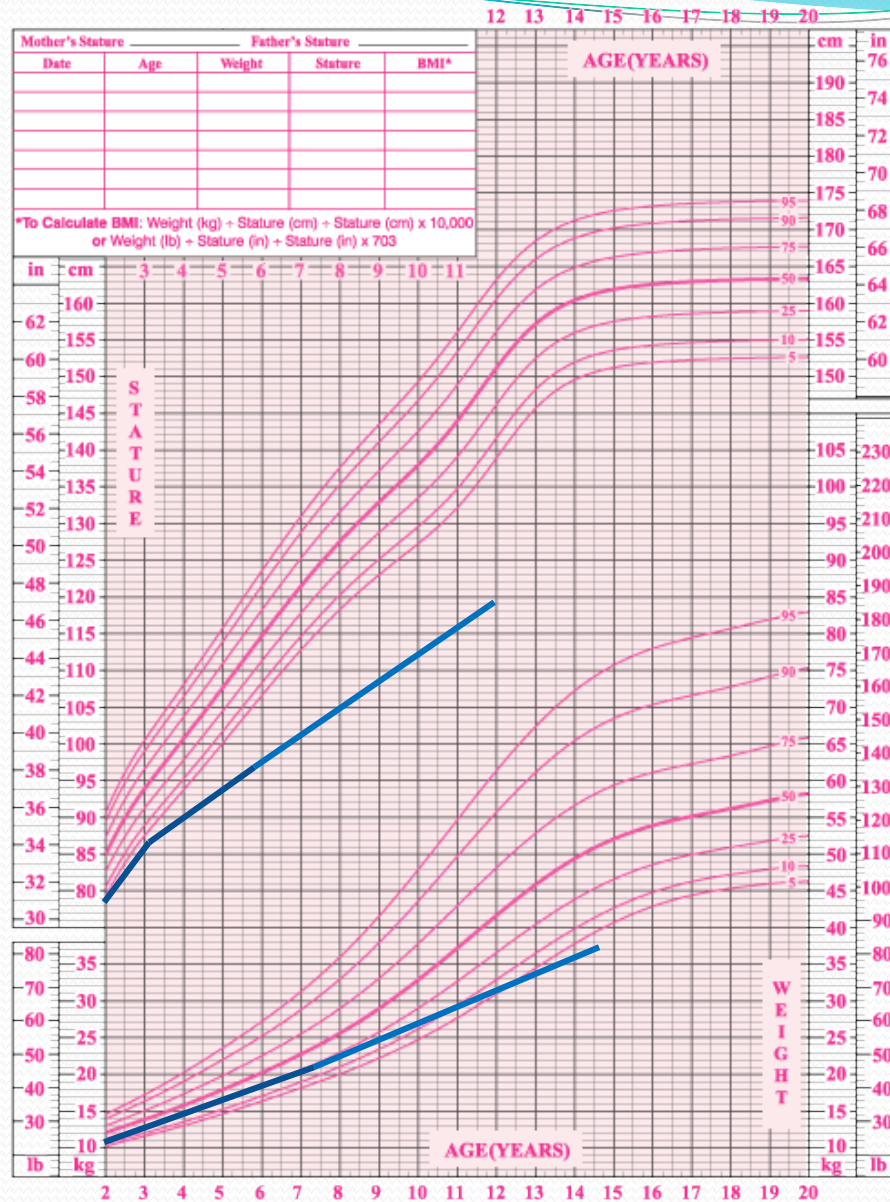
Diagnosis

- Systemic disorders
- Malabsorption
- Celiac disease
- Food Allergy

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



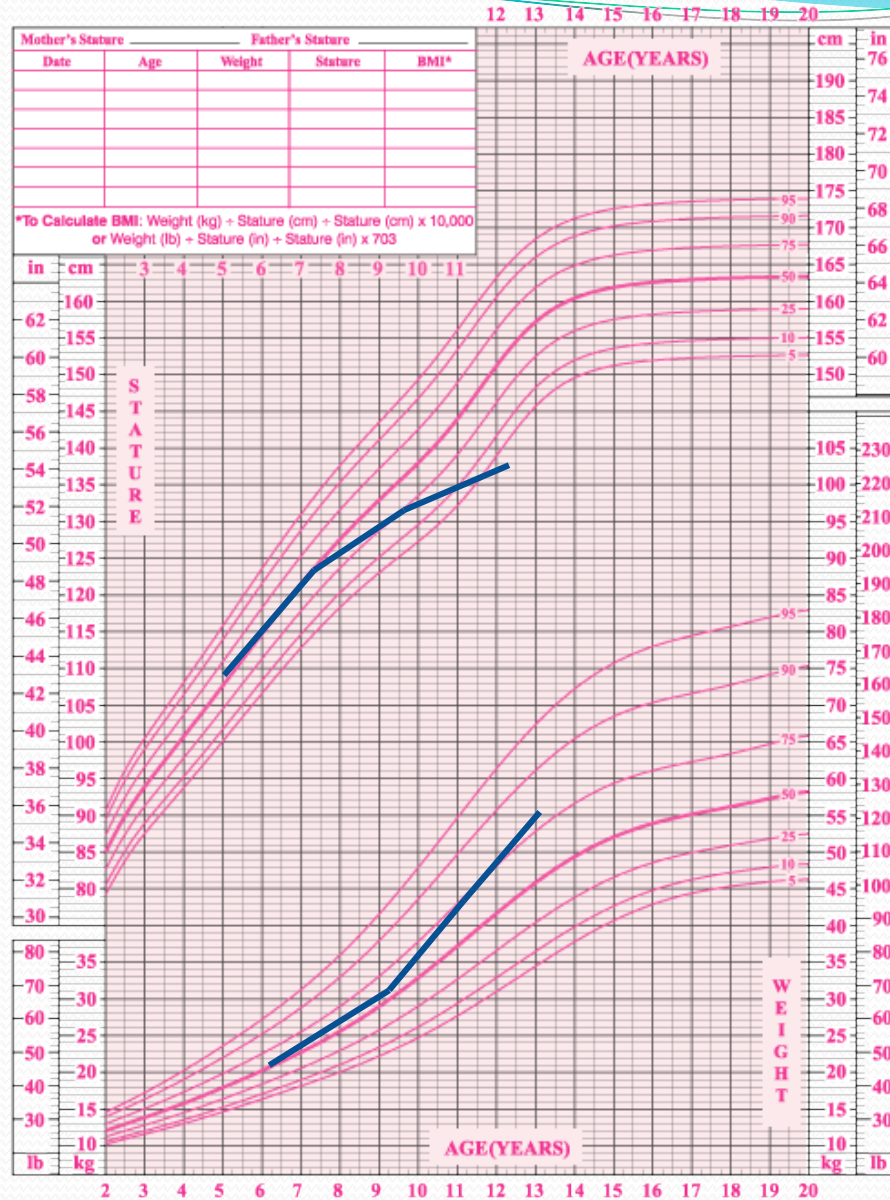
Diagnosis

- Turner syndrome or other syndromic disorder
- GHD
- Hypothyroidism
- Cushing dis

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____

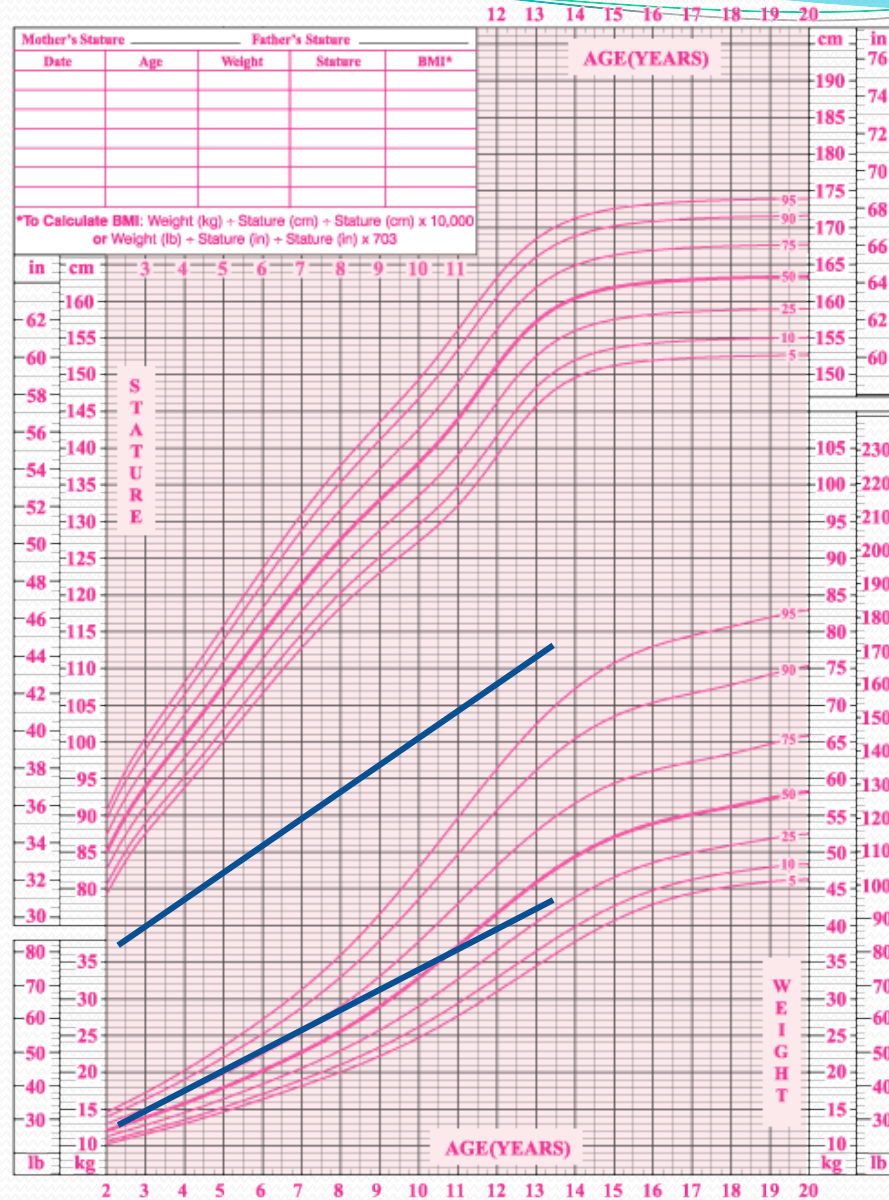


Diagnosis

- Cushing syndrome
- Hypothyroidism
- Acquired GHD

2 to 20 years: Girls
Stature-for-age and Weight-for-age percentiles

NAME _____



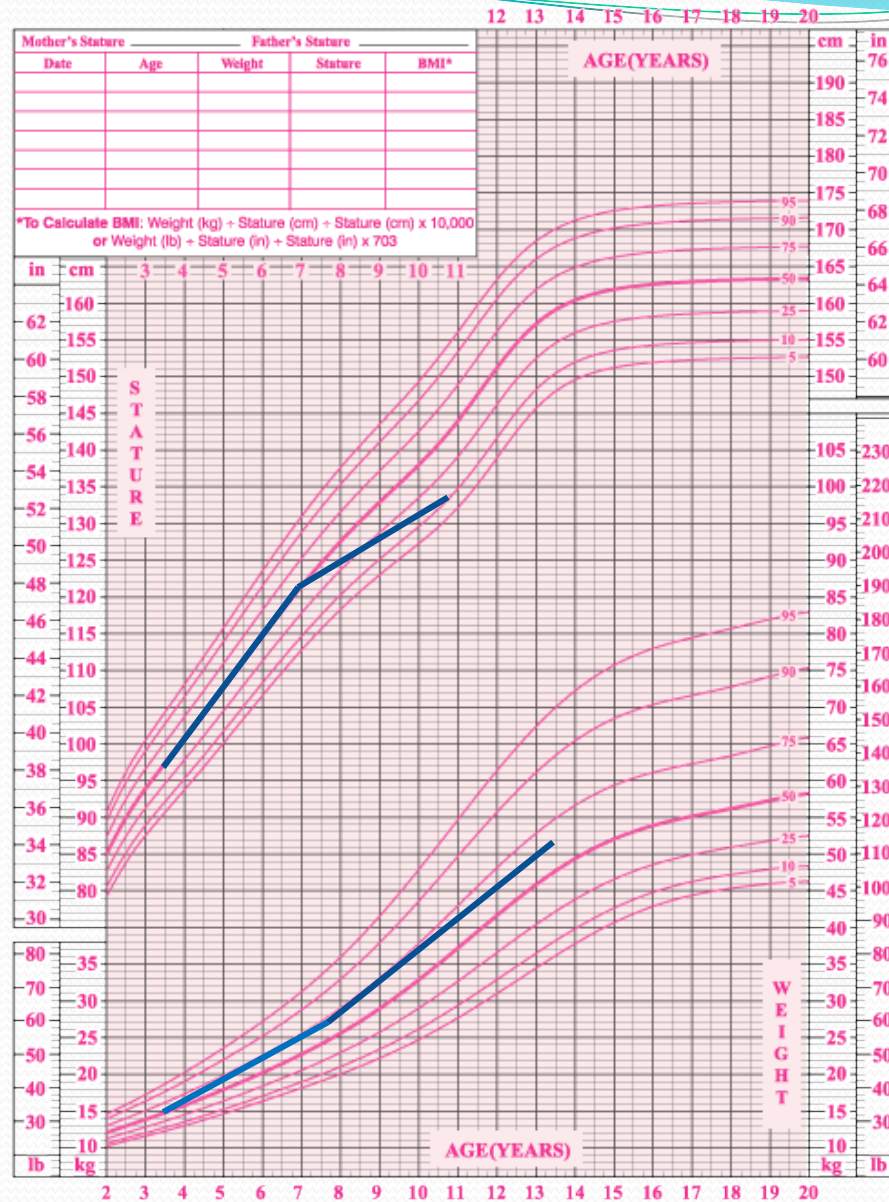
Diagnosis

- GH IGF1 Axis disorders
- Cushing syndrome
- Hypothyroidism
- Syndrome with obesity(Prader willi, Down, Alstrome, Leurance moon bardet biedel)

2 to 20 years: Girls

Stature-for-age and Weight-for-age percentiles

NAME _____



Diagnosis

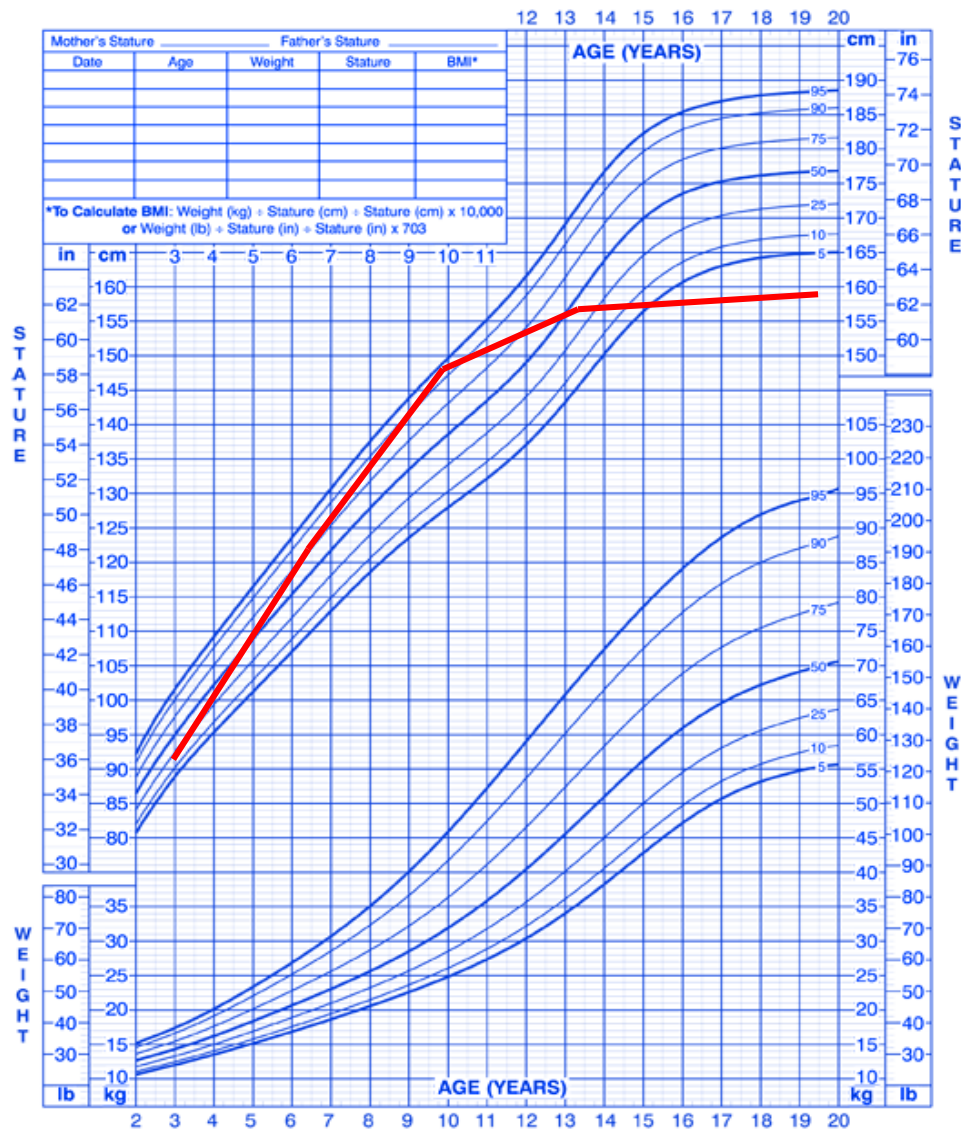
- Cushing syndrome
- Hypothyroidism
- Acquired GHD

2 to 20 years: Boys

Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



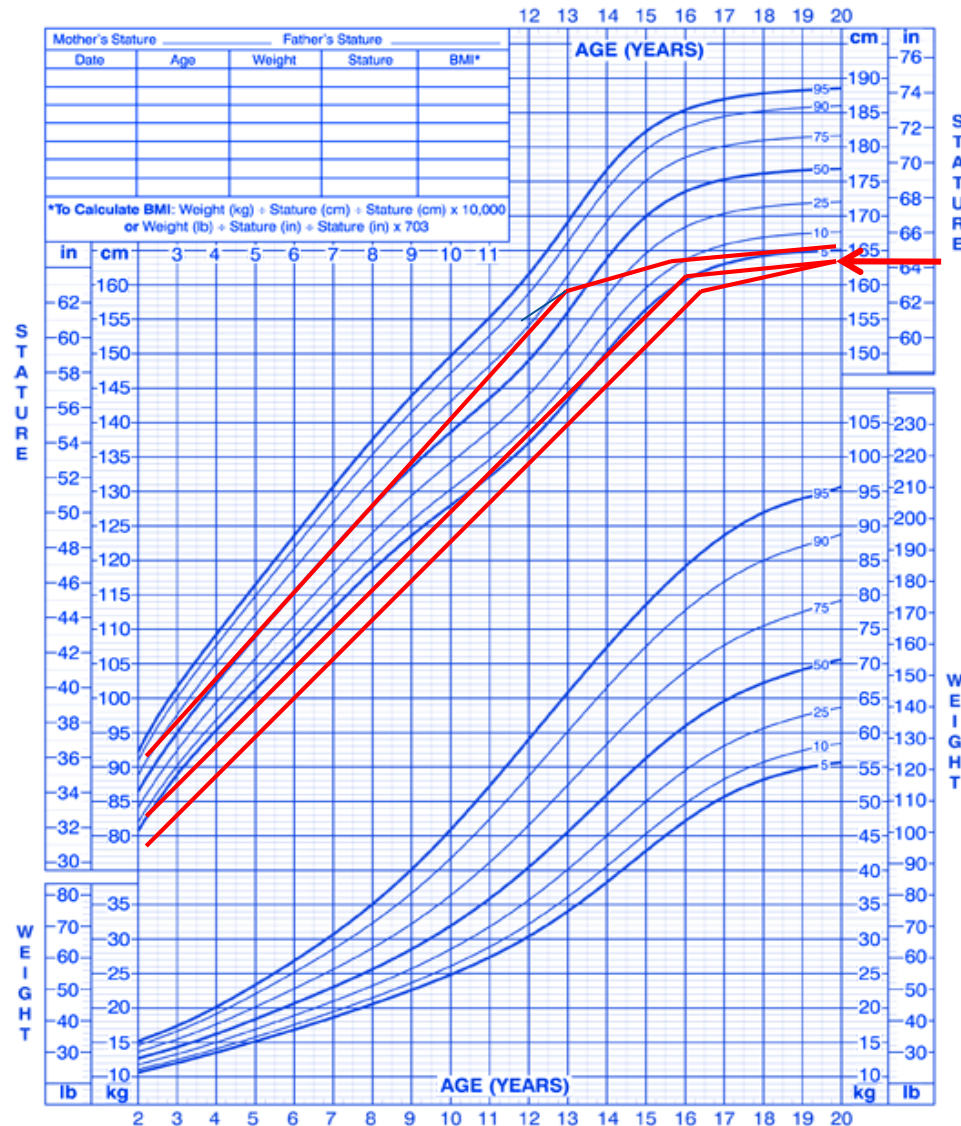
Diagnosis

- Precocious puberty

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



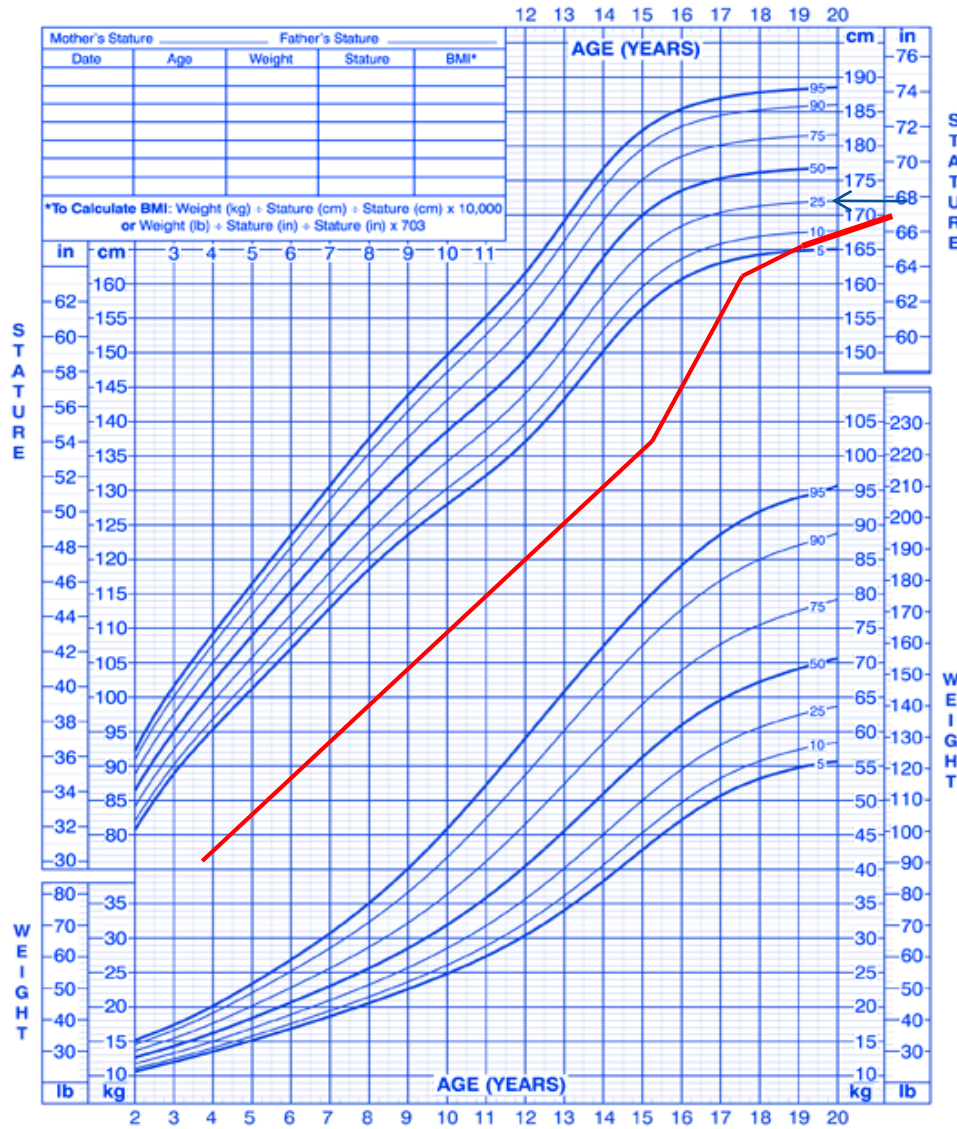
Diagnosis

- Genetic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



Diagnosis

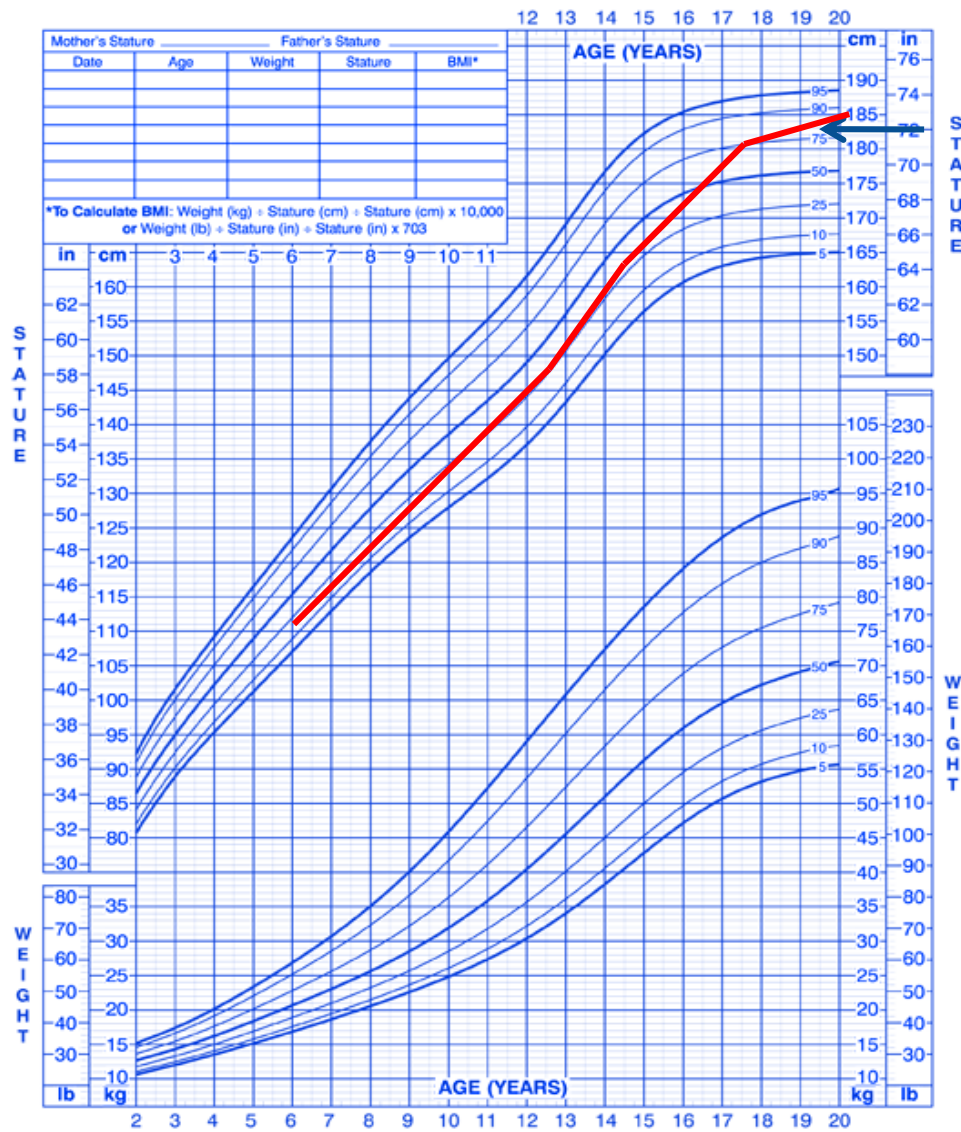
- Constitutional delay of growth and puberty

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NewParent

NAME _____

RECORD # _____



Diagnosis

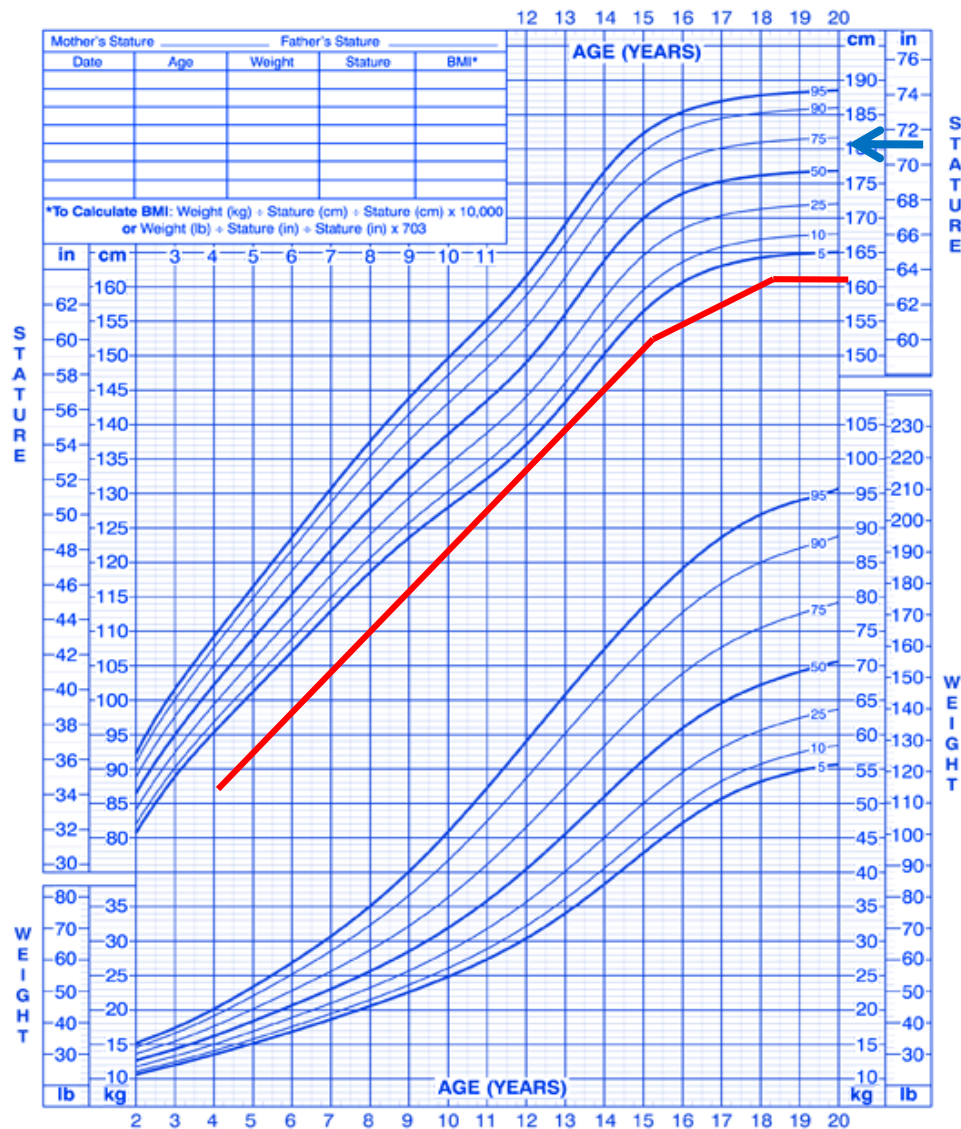
- Constitutional delay of puberty

2 to 20 years: Boys

Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



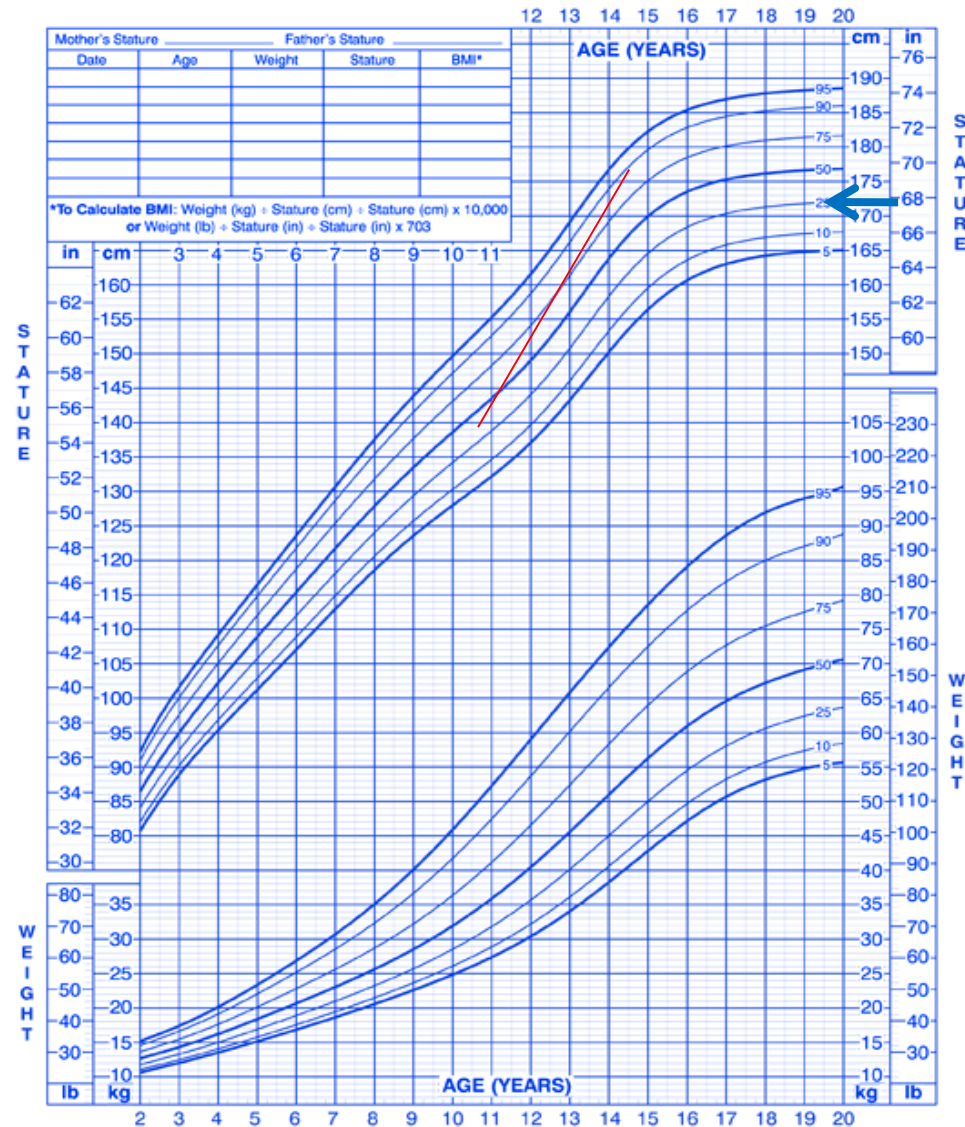
Diagnosis

- GHD
- Idiopathic short stature

2 to 20 years: Boys Stature-for-age and Weight-for-age percentiles

NAME _____

RECORD # _____



- 
- GH excess
 - Normal growth spurt

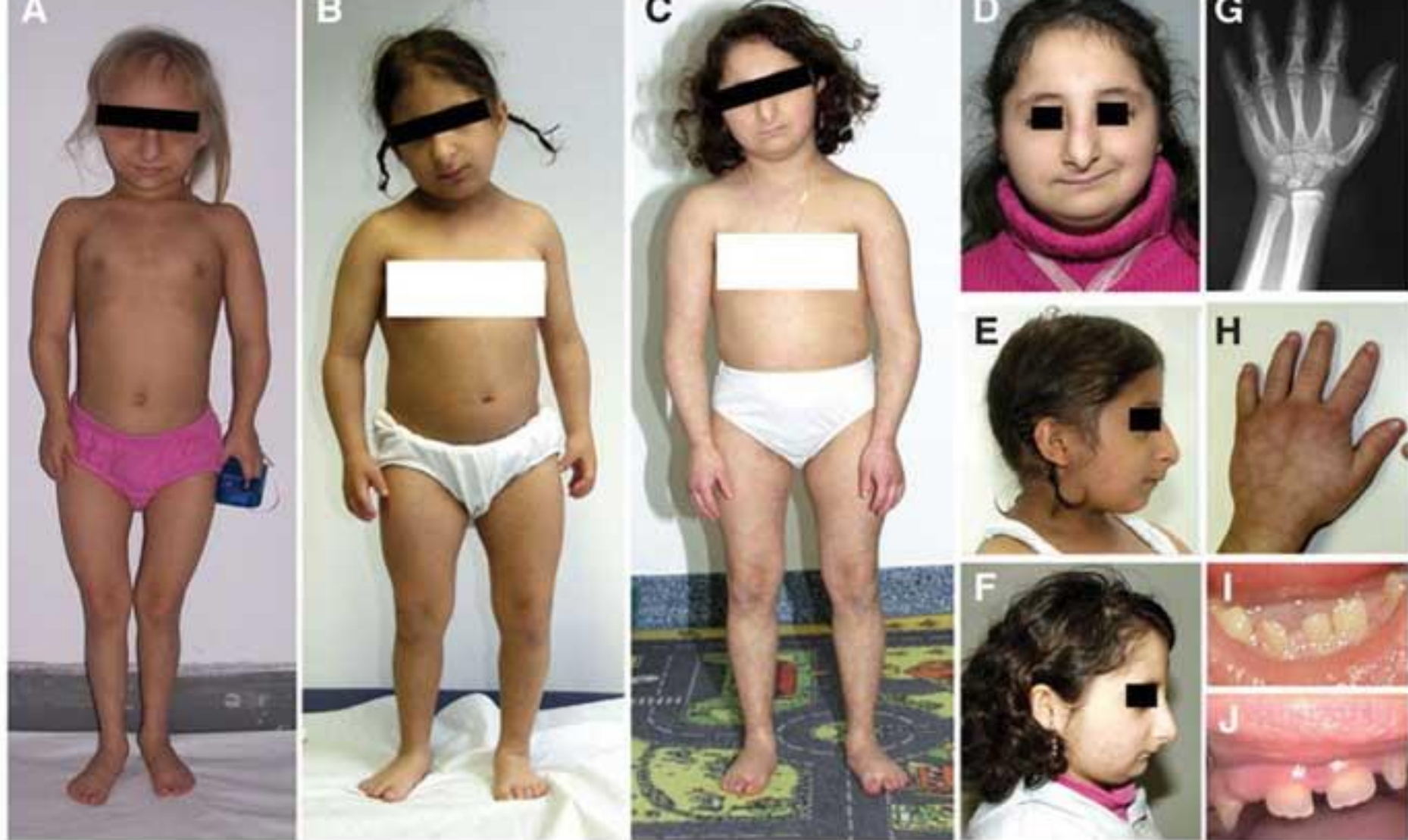


Figure 1. Phenotype of MOPD II patients. (A) P18 at age 8 years 3 months with a height of 84 cm corresponding to a normal size for a female infant aged 1 year 3 months; (B and E) P1 at age 8 years 8 months with a height of 85 cm; (C and F) P2 at age 12 years 6 months with a height of 95 cm and at age 14 years with a height of 96 cm (D) corresponding to a normal size for a female aged 3 years. Note short lower arms especially in P18, mild truncal obesity and premature puberty in P1, significant facial asymmetry in P2 (D), and absence of a sloping forehead typical of microcephaly syndromes. All three patients demonstrate a long nose with prominent tip and hypoplastic alae and small mandible described as typical for patients with MOPD II. (G and H) X-ray and an image of the dorsum of the left hand of patient P2 showing generalized brachydactyly with diaphyseal constriction (overmodeling) of metacarpals and phalanges, as well as abnormal flat shape of the distal radius and ulna epiphyses. (I and J) Hypoplasia and partial agenesis of teeth from patient P2, enamel hypoplasia in teeth from patient P18. Reprinted with permission Rauch A. *Science*. 2008;319:816-9. Copyright © AAAS 2008. All rights reserved.















