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Practical Guide to Growth Charts Interpretation



مدرسة جارية

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Health Cluster



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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَاخْفِضْ لَهُمَا جَنَاحَ الذُّلِّ مِنَ الرَّحْمَةِ

وَقُلْ رَبِّ ارْحَمْهُمَا

كَمَا رَبَّيَانِي صَغِيرًا



OBJECTIVES

1. To understand different components that create the growth chart.
2. To define the normal curve based on growth velocity.
3. To be able to identify pathognomonic feature of pathologic vs normal curves:
 - Macrocephaly and microcephaly
 - Failure to thrive
 - Short stature
 - Tall stature





Introduction



OVERVIEW

- Growth charts are used to compare the child's height, weight, and head size against children of the same age.
- Growth charts consist of a series of percentile curves that illustrate the distribution of selected body measurements in children.

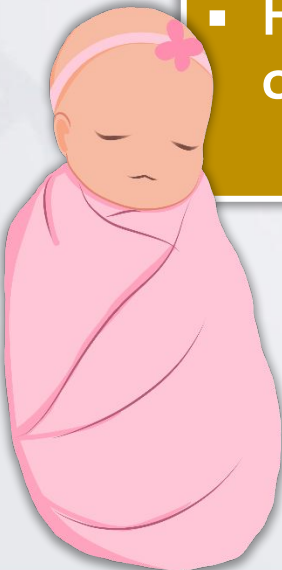
Growth charts are *not intended to be used as a sole diagnostic instrument*. Instead, growth charts are tools that contribute to forming an overall clinical impression for the child being measured.



Growth parameters

Birth - 2 years

- Length
- Weight
- Head circumference

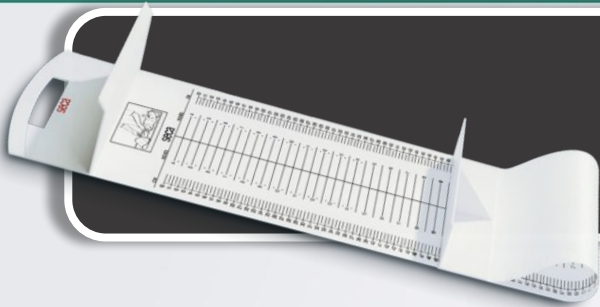


2 years - 20 years

- Height
- Weight
- Body mass index



Measurements



Length:

- Is used in children from birth to 2 years.
- Length is measured in the recumbent position.



Height:

- Is used in children from 2 years to 20 years.
- Height is measured while standing.



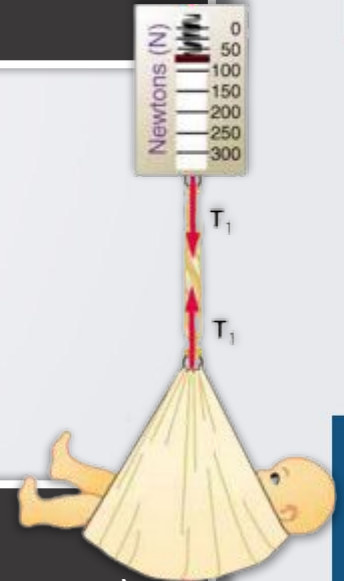
Head circumference:

- Is used in children from birth to 2 years.
- Normal term newborn HC: 32 to 38 cm.



Weight:

- Pan scale or hanging-spring scale (up to 25 Kg).
- Stand-on scale: if able to stand unsupported.



Normal expected growth

Length/height:

- Average at birth is 50cm.
- Doubled by the age of 4 years.
- Tripled by the age of 13 years.

Head circumference (HC):

- Normal HC at birth is 32 – 38 cm.
- On average, it increases by 1 cm per month in the first year of life.
- It increases by 2 cm per year between 1 to 3 years of age.
- It increases by 1 cm per year between 3 to 5 years of age

Weight:

- Normal weight at birth is 2.5 – 4 Kg.
- Doubled by the age 6 months.
- Tripled by the age of 1 year.
- Quadrupled by the age of 2 years.

If age < 12 months

$$\text{Weight (kg)} = [\text{Age (mo)} + 9] \div 2$$

If age ≥ 1 year

$$\text{Weight (kg)} = [\text{Age (yr)} \times 2] + 8$$



GROWTH CHART RECOMMENDATION

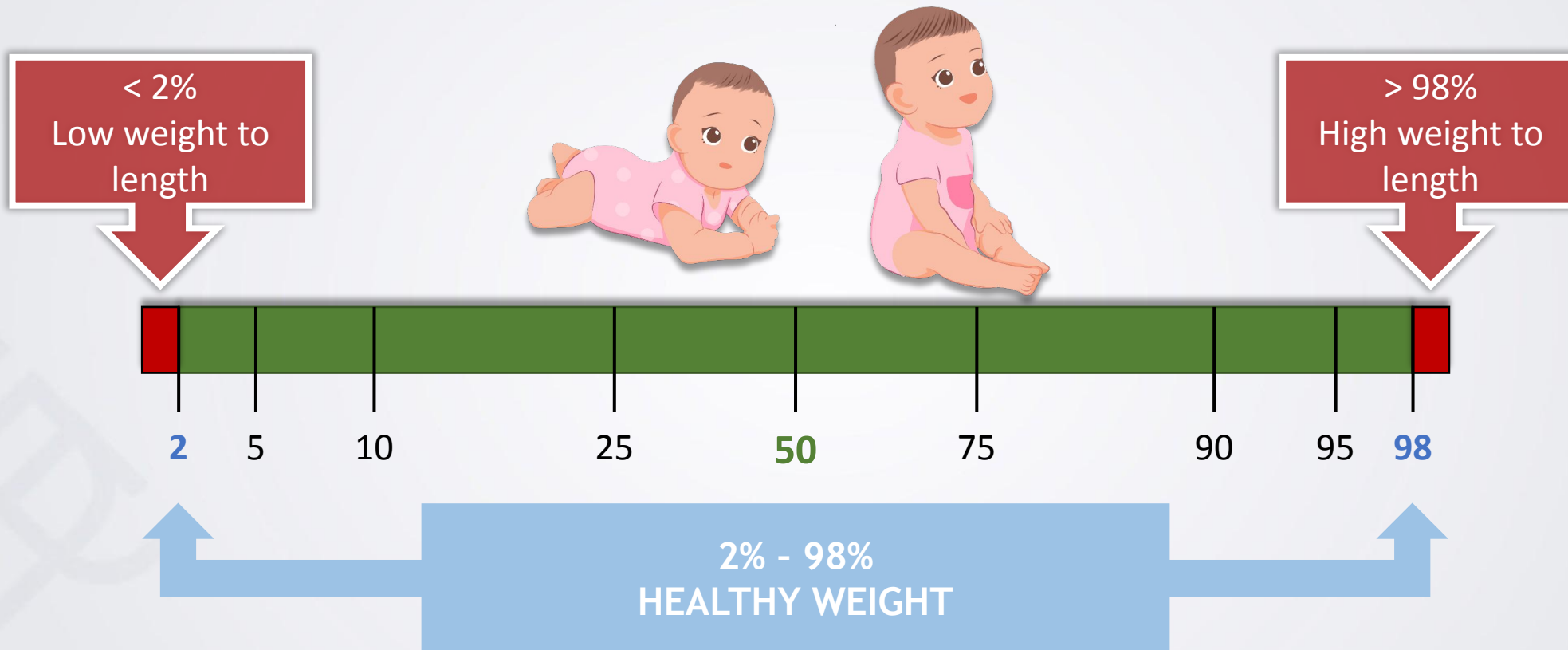
CDC recommends that health care providers

- Use the *WHO growth charts* for infants and children 0 to 2 years of age.
- Use the *CDC growth charts* for children ages 2 to 20 years.



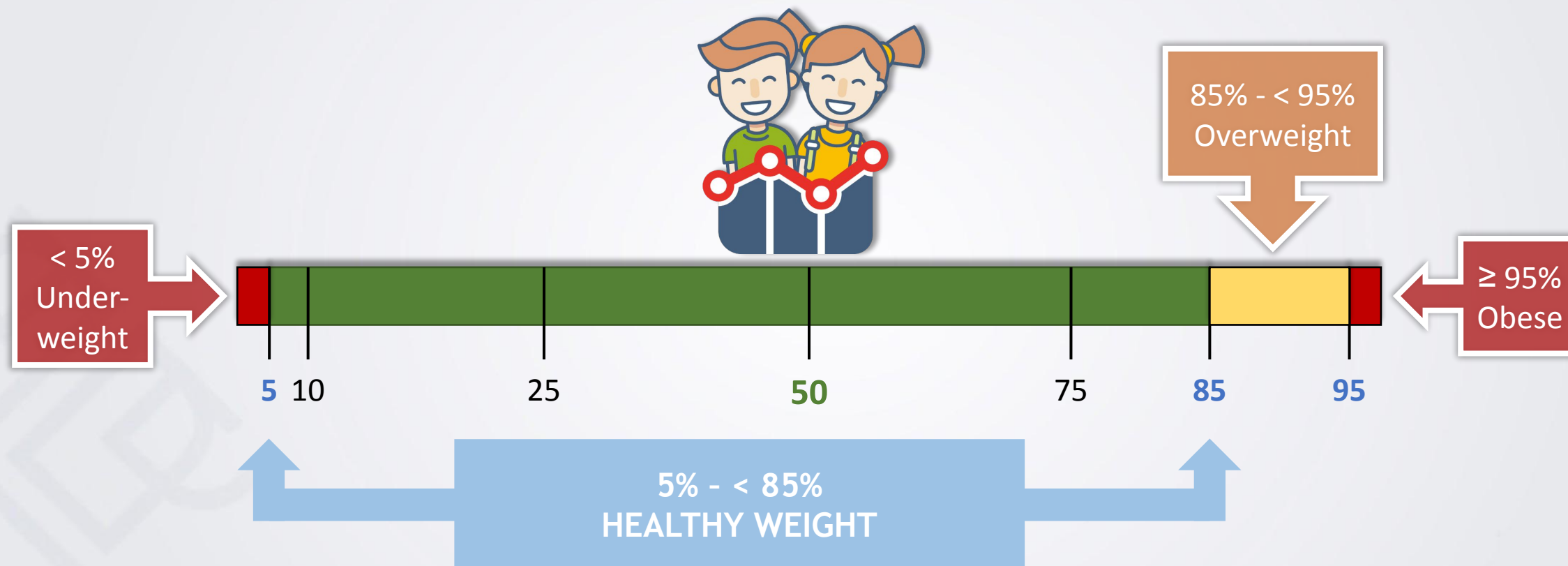
RECOMMENDED CUT-OFFS

WHO Growth Charts - Birth to 24 months



RECOMMENDED CUT-OFFS

CDC Growth Charts - 2 to 20 years

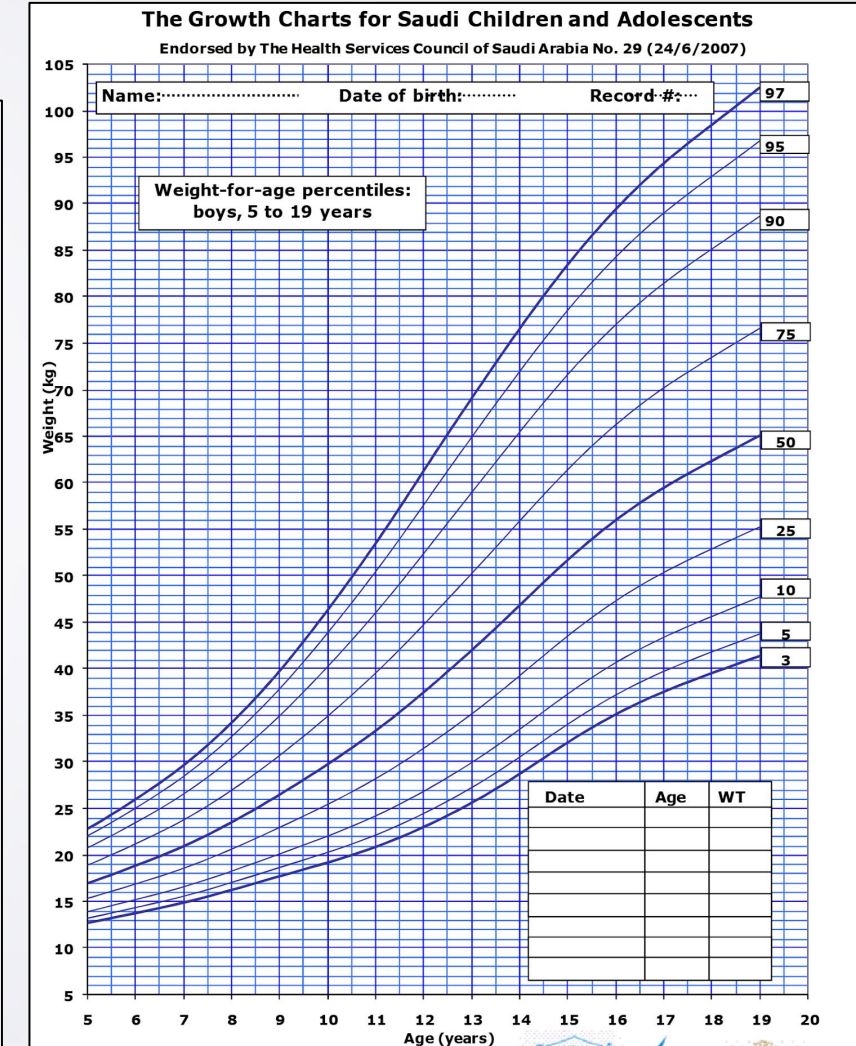
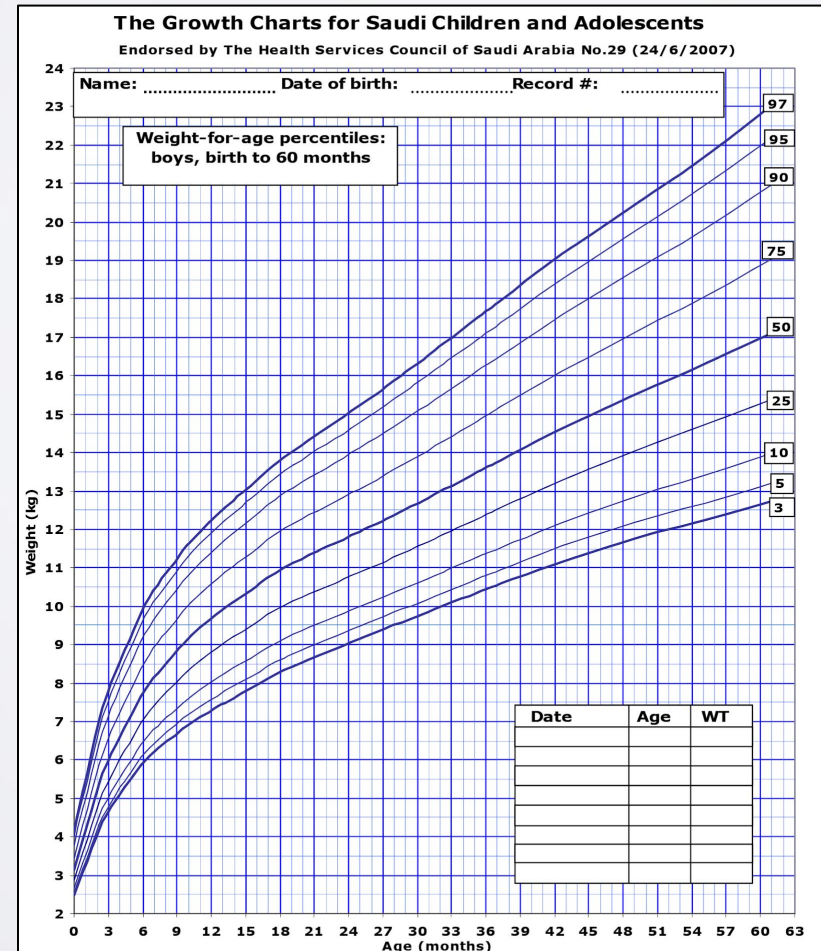


RECOMMENDED CUT-OFFS

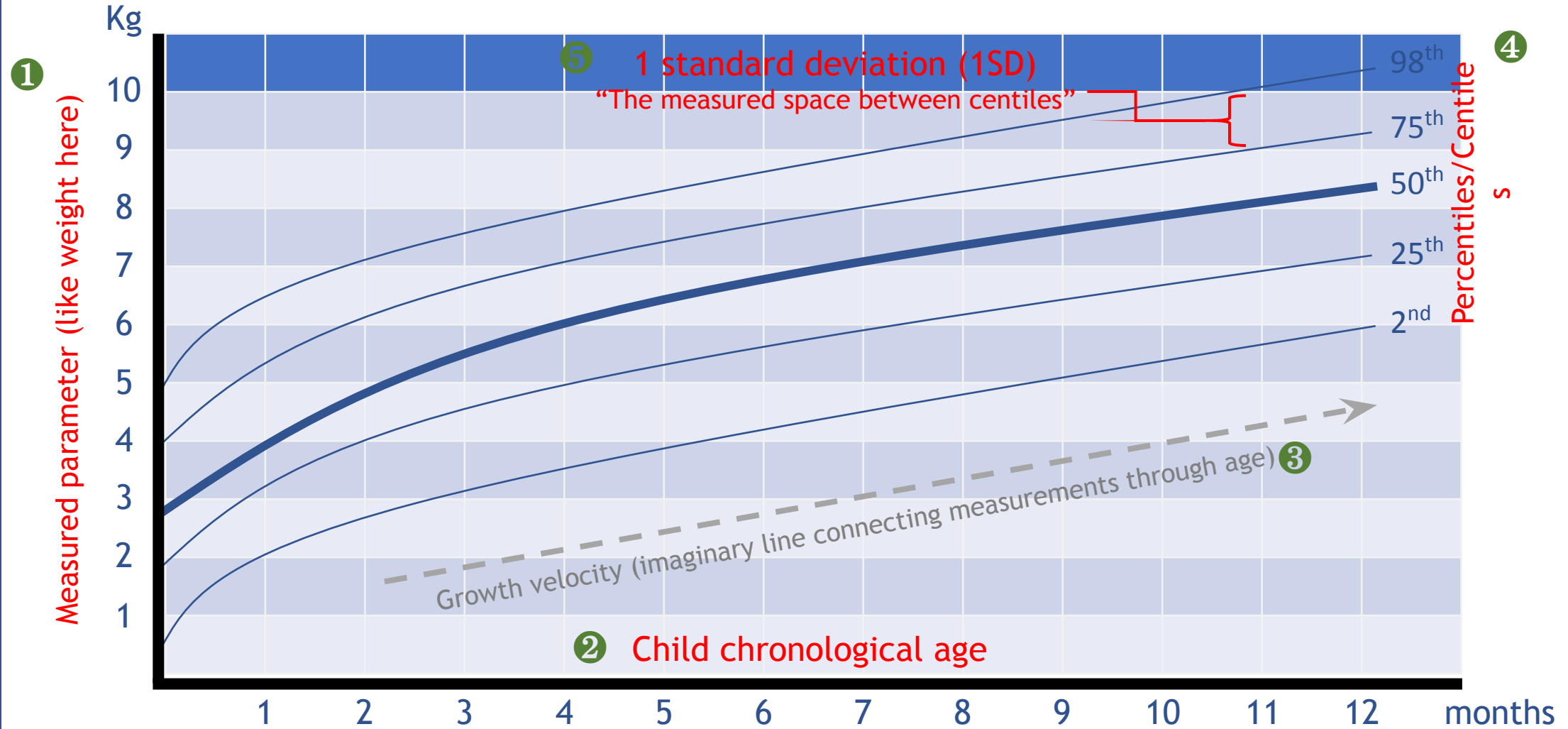


Important

Since each nation has its own characteristics, **use growth chart for age that is approved in your country**, whatever the cut-point is.

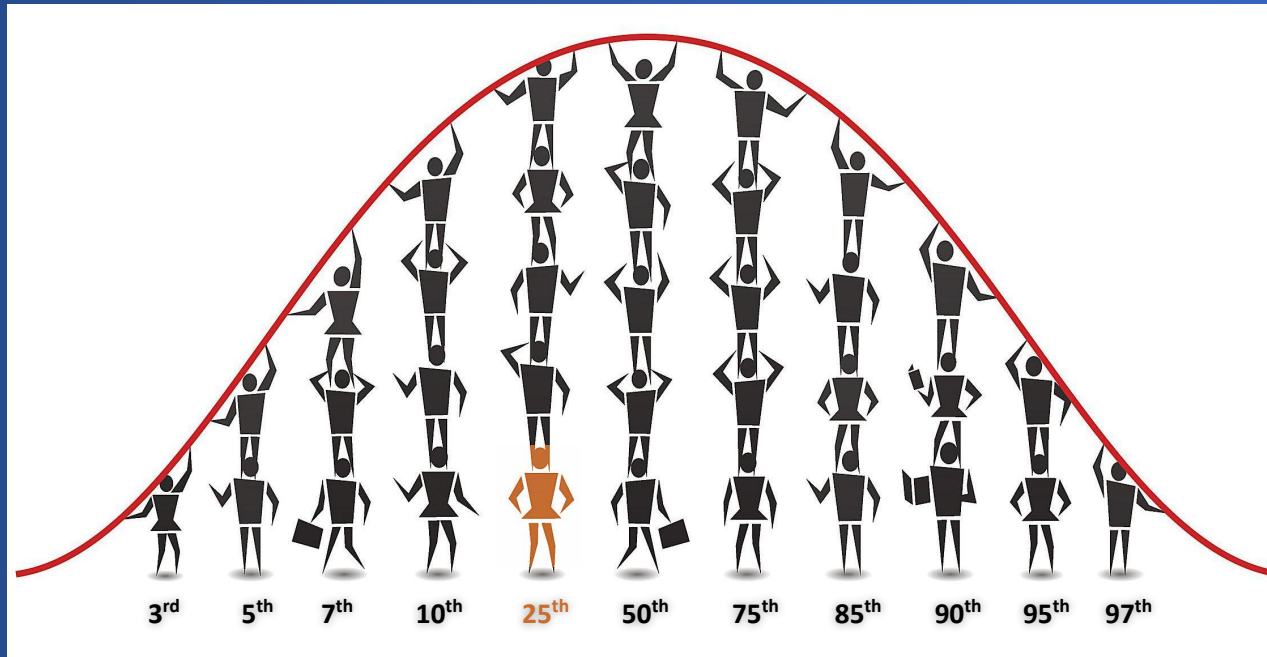


COMPONENTS OF GROWTH CHART



PERCENTILES/CENTILES

A percentile shows the relative position of the child's BMI, weight, or height among children of the same sex and age.

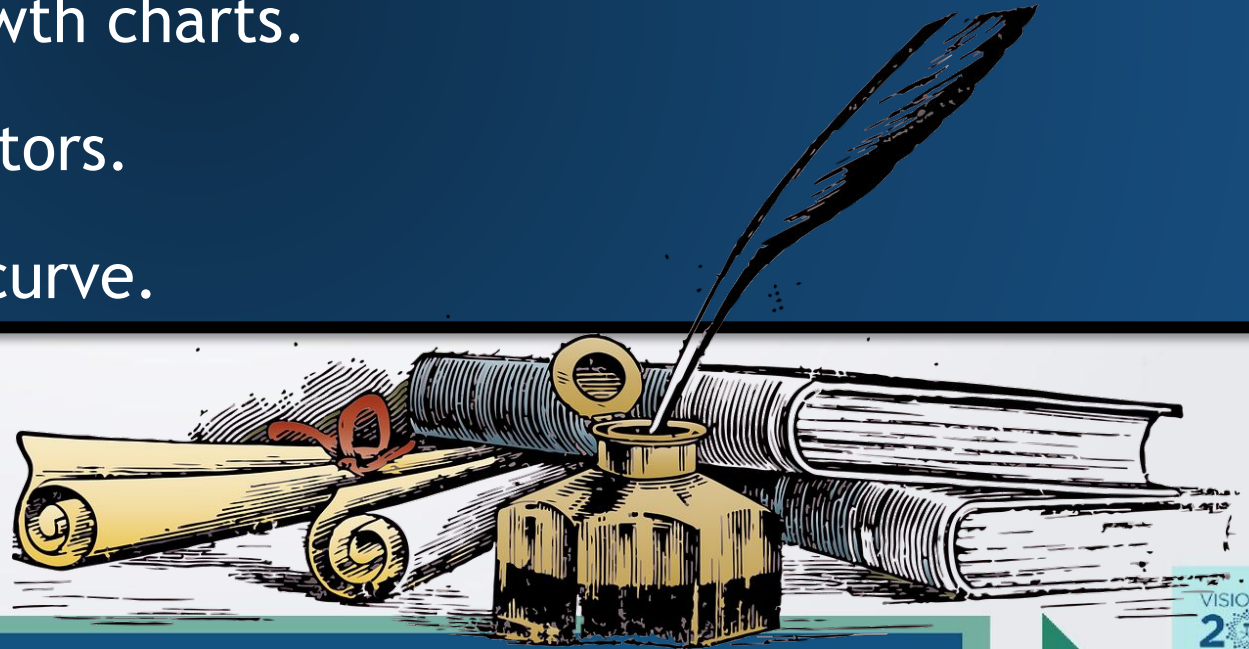


Example:

A boy at the 25th percentile for weight means if we took 100 normal boys and measure their weight, this boy will be at 25th position compared to other.

How to get started

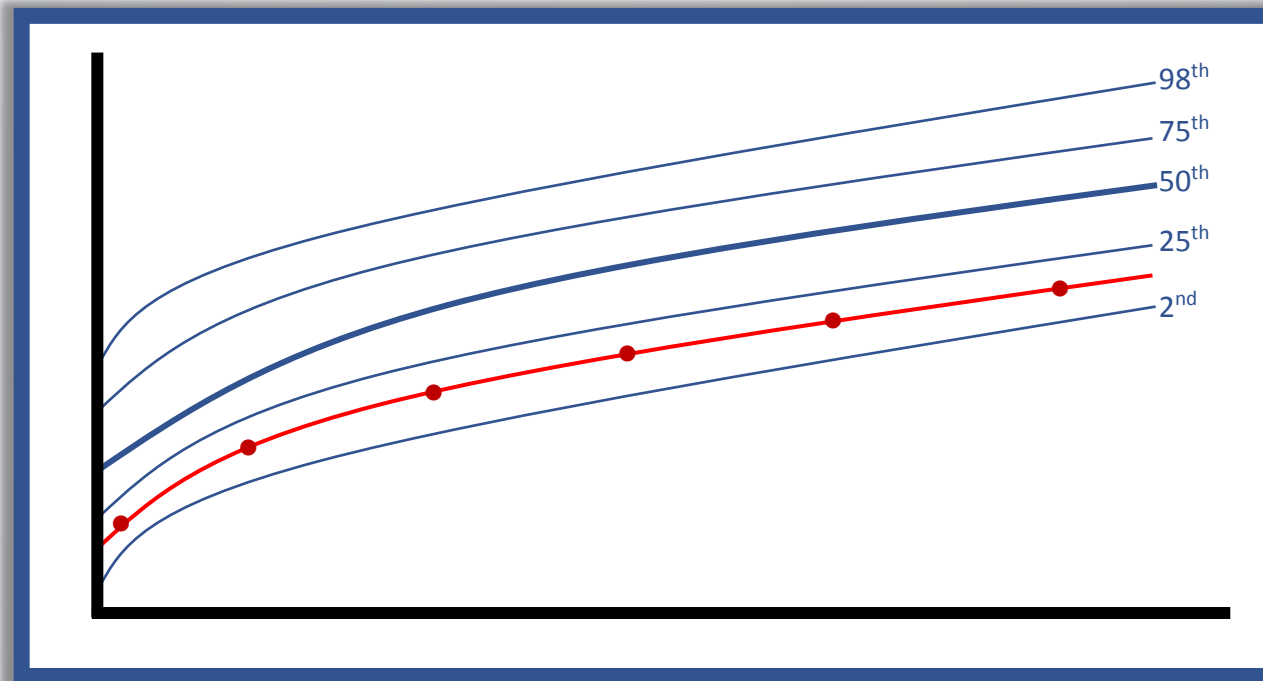
1. Take measurements.
2. Select appropriate growth charts for age and gender.
3. Record and plot on growth charts.
4. Interpret growth indicators.
5. Evaluating the growth curve.



Normal curve

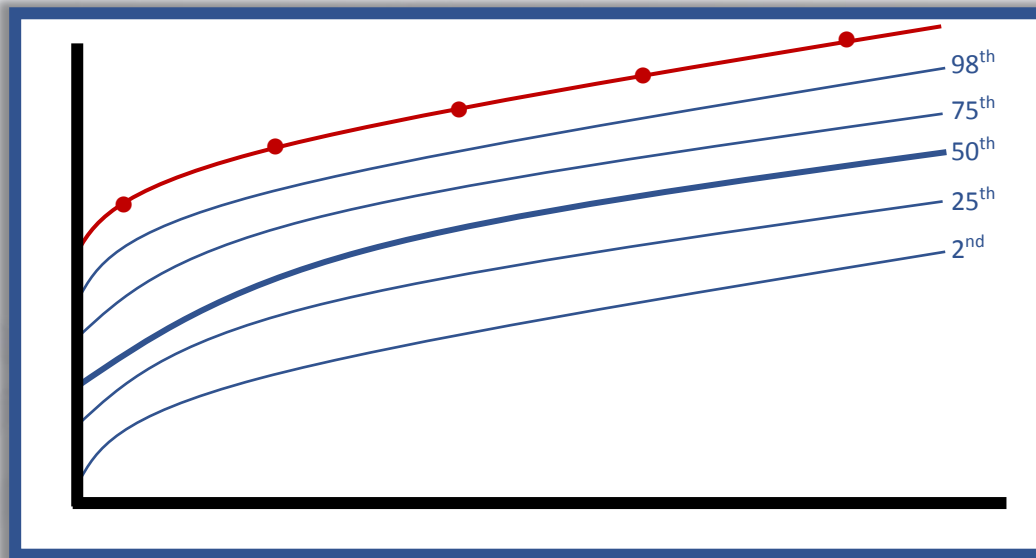
Normal characteristics of growth chart:

1. Growth velocity line is in between the upper and lower normal centile limit.
2. Growth velocity line is in parallel with adjacent centiles.
3. If there is deviation, it should NOT cross any other centile line "less than 1SD".



Normal curve

What is wrong with the following growth charts?



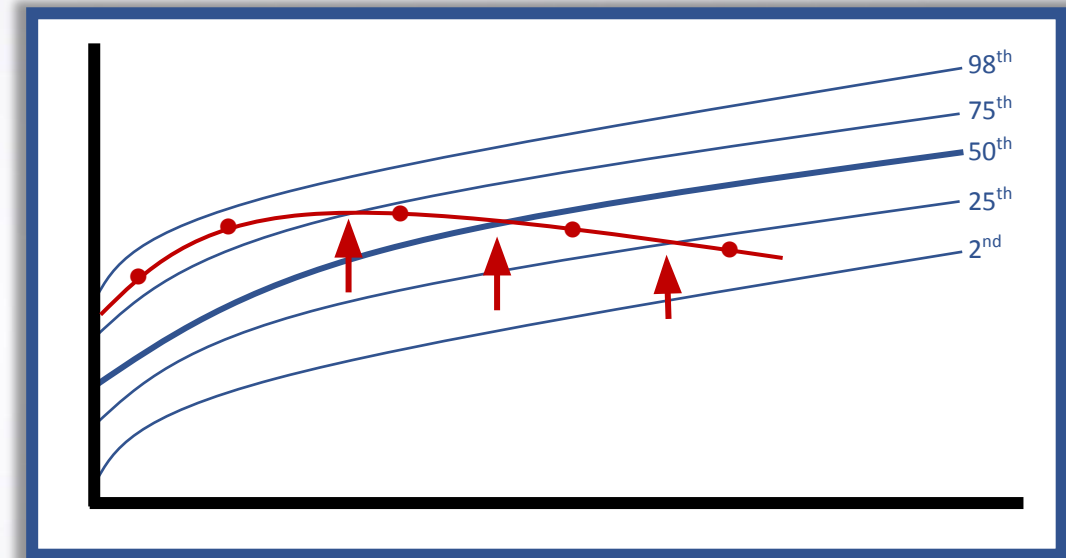
PARALLEL



NOT IN-BETWEEN



CROSSING = 0



NOT PARALLEL



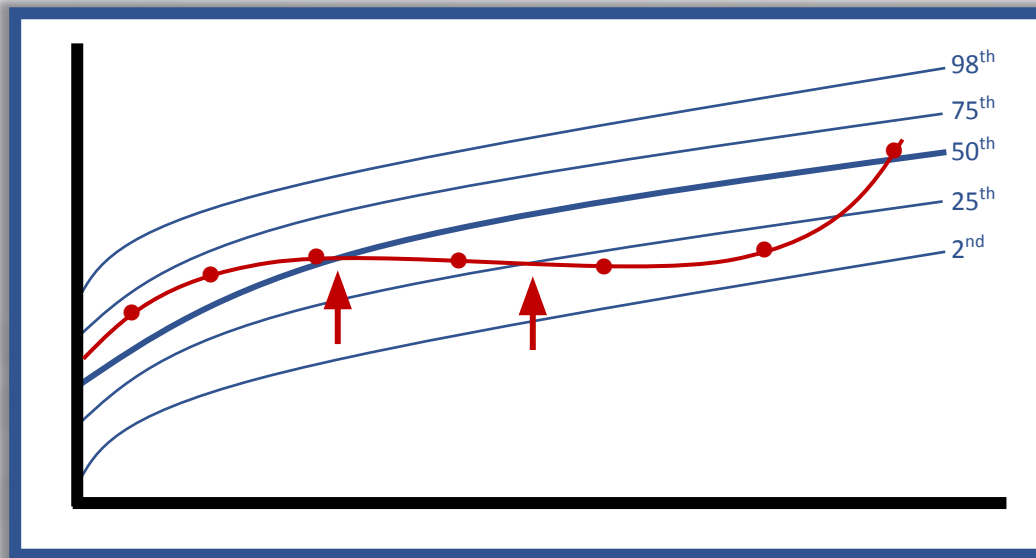
IN-BETWEEN



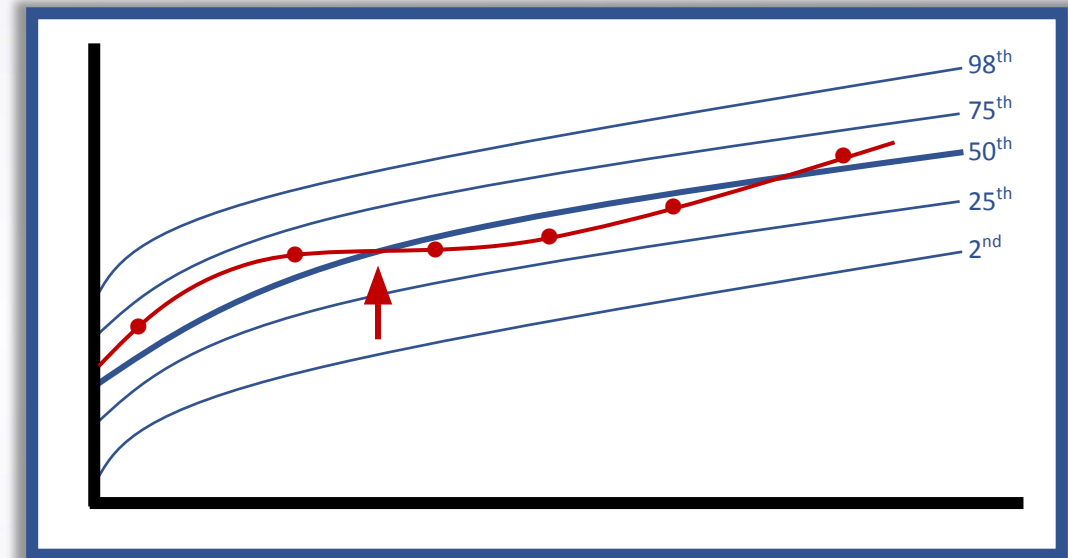
CROSSING = 3 (CHRONIC)

Normal curve

What is wrong with the following growth charts?



- ✗ NOT PARALLEL
- ✓ IN-BETWEEN
- ✗ CROSSING = 2 (CHORONIC)



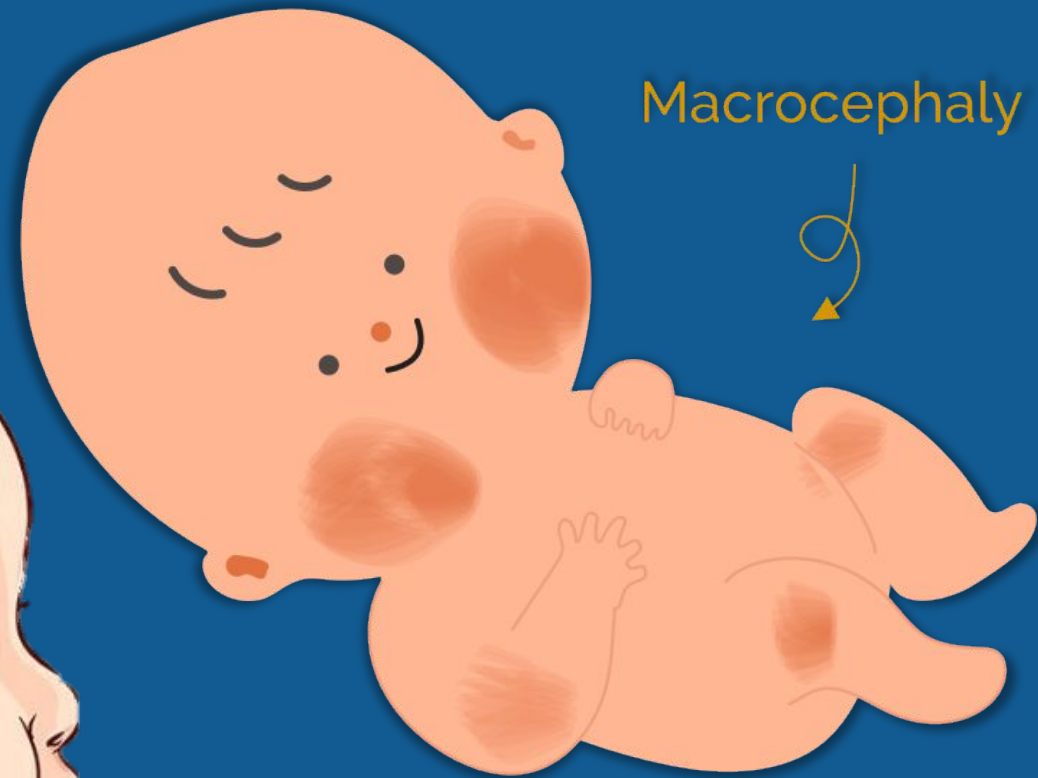
- ✗ NOT PARALLEL
- ✓ IN-BETWEEN
- ✗ CROSSING = 1 (ACUTE)

Macrocephaly and microcephaly

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Macrocephaly: Overview

Macrocephaly is defined as head circumference greater than two standard deviations above the mean (i.e. crossing ≥ 2 centiles) or greater than the 97th centile for a given age and sex.
It can be presented at birth or later during development.

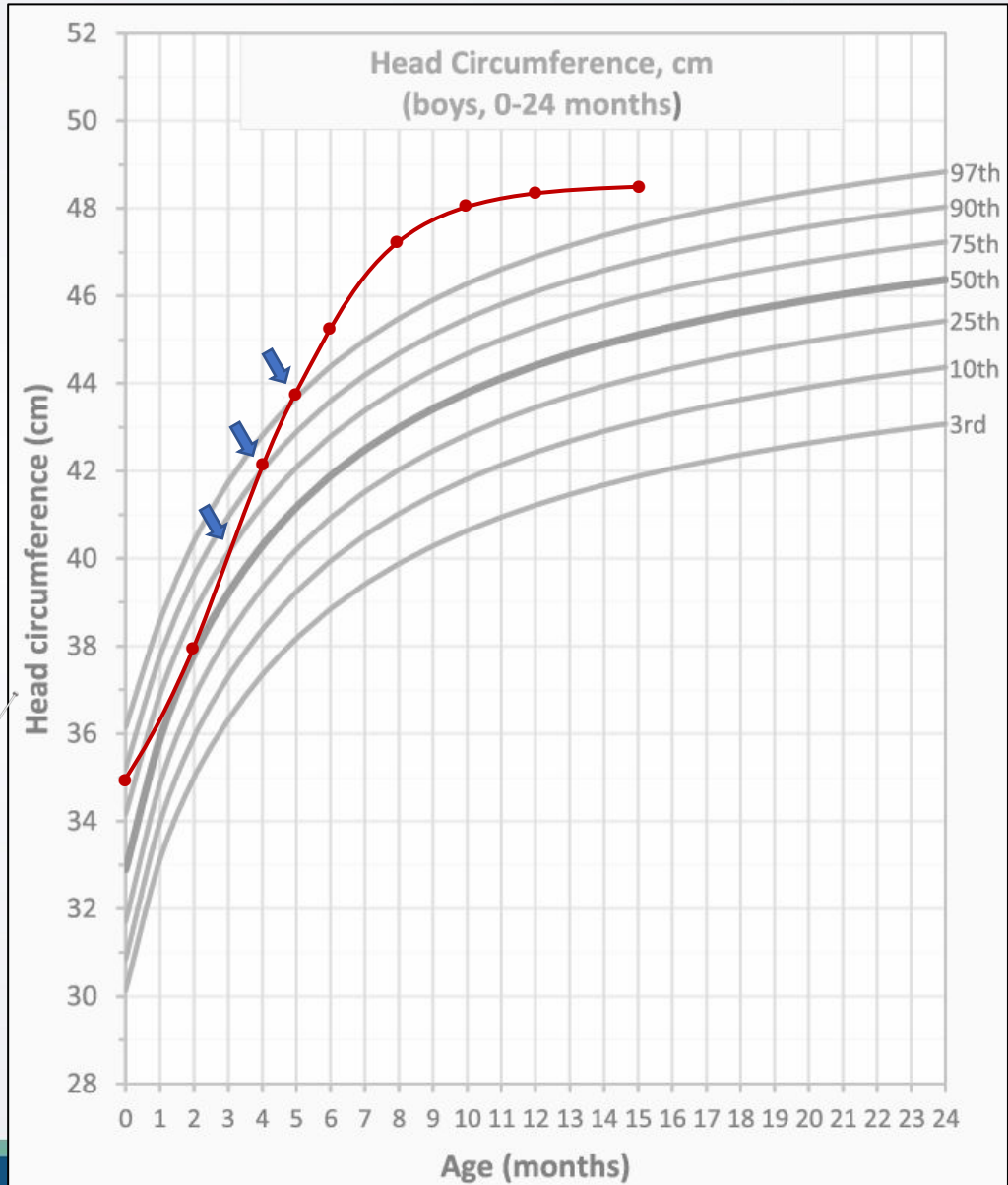
Causes:

- **It could be benign** without any neurological manifestations in case like familial macrocephaly.
- Other causes can be due to increased brain parenchyma (megalencephaly), or increased blood, thickened bone, or increased intracranial pressure (ICP) due to increased CSF or space occupying lesion.

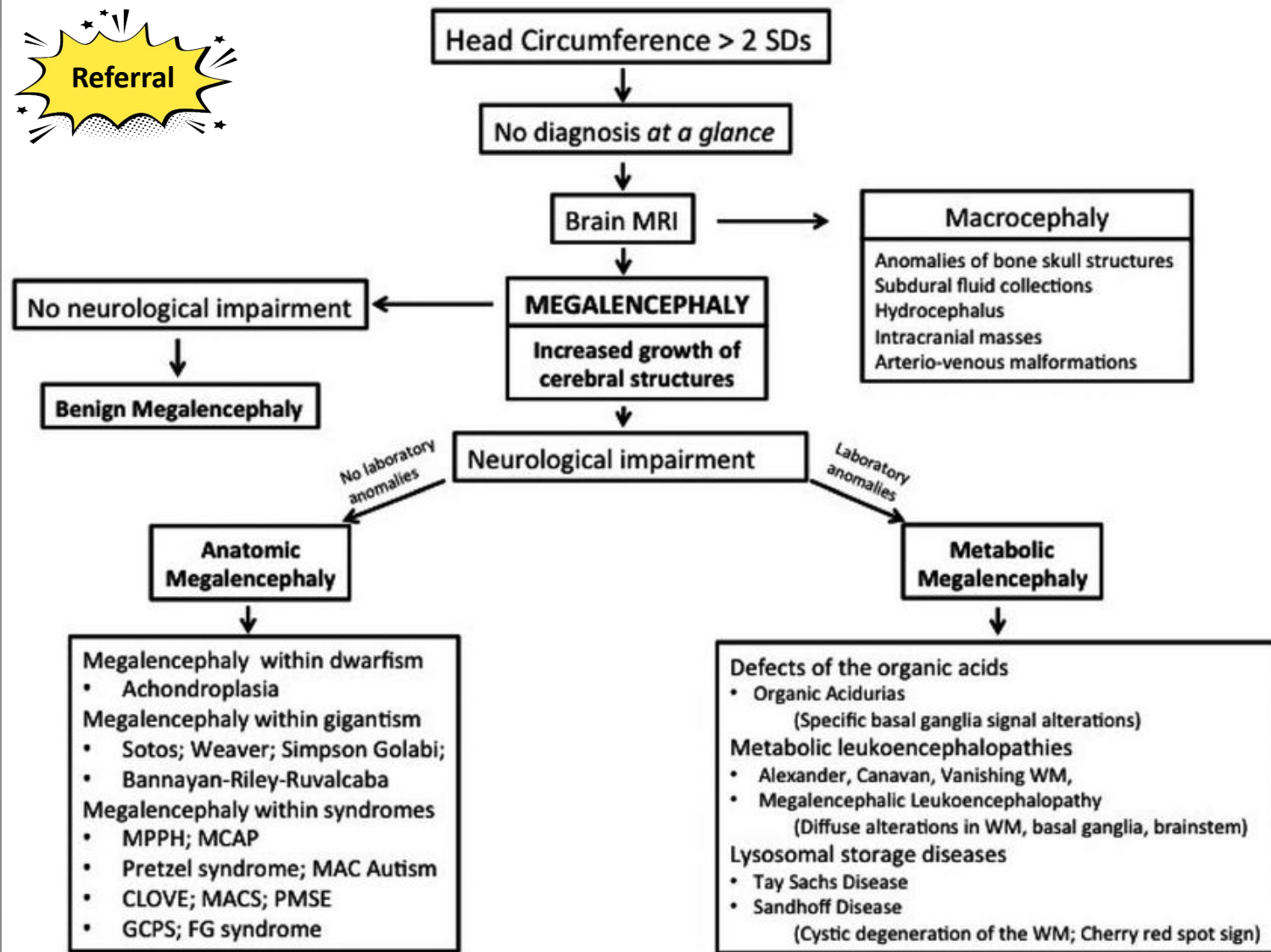
Macrocephaly: curve characteristics

Curve characteristics:

- HC curve crossed ≥ 2 centiles (> 2 SD) [blue arrows] above the mean.
- HC curve passes above the 97th centile.



Macrocephaly: workup

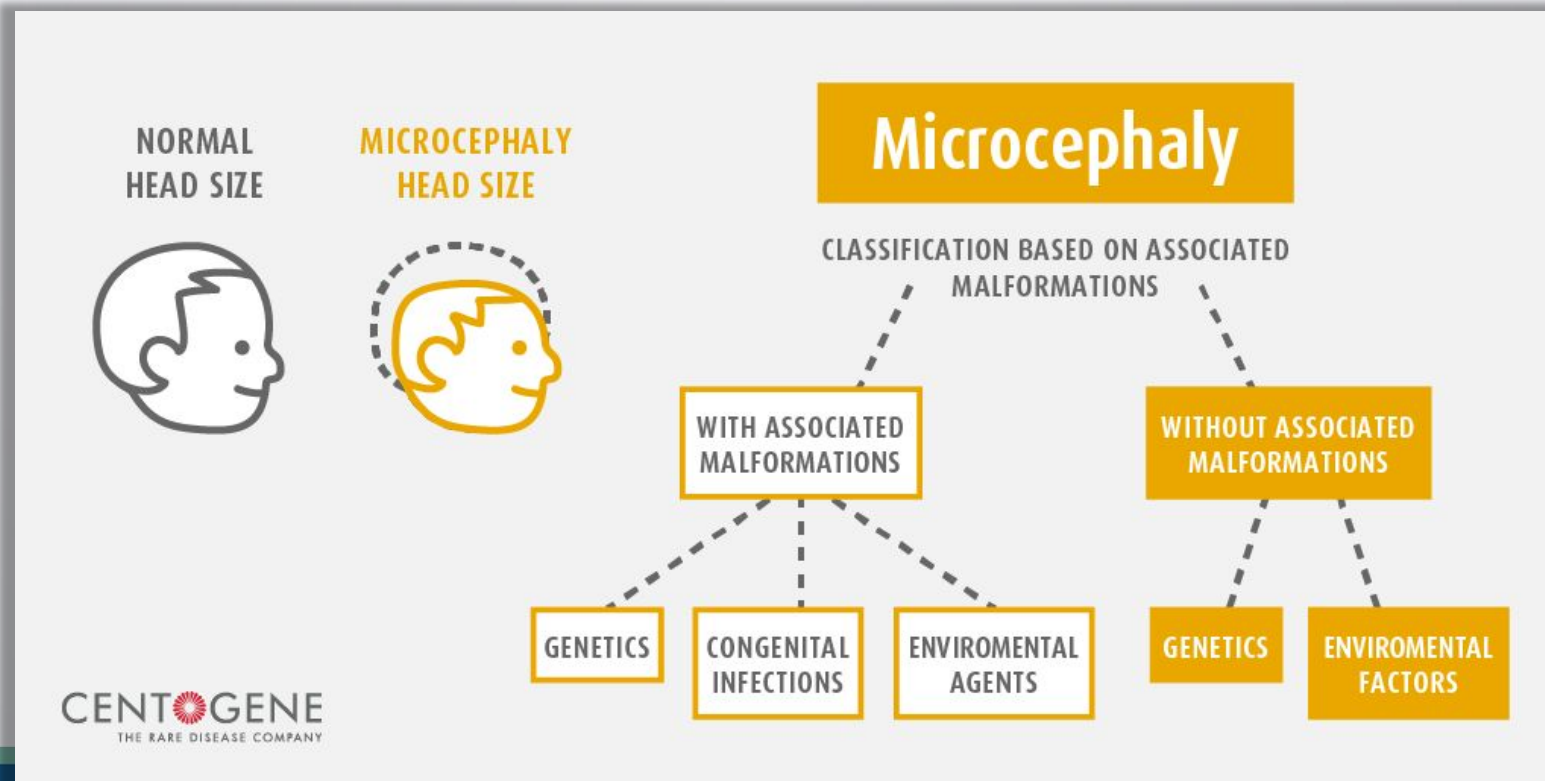


Microcephaly: Overview

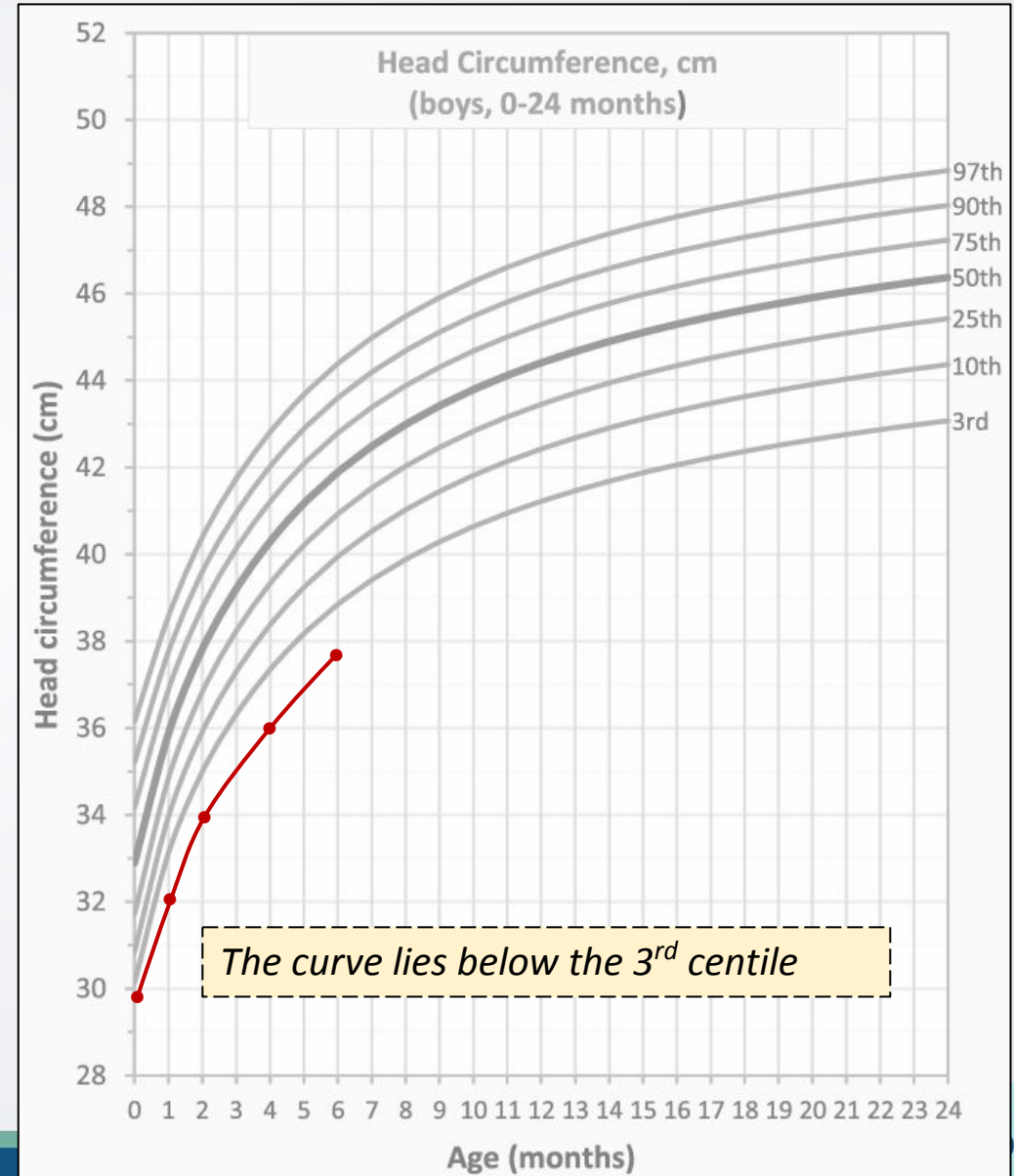
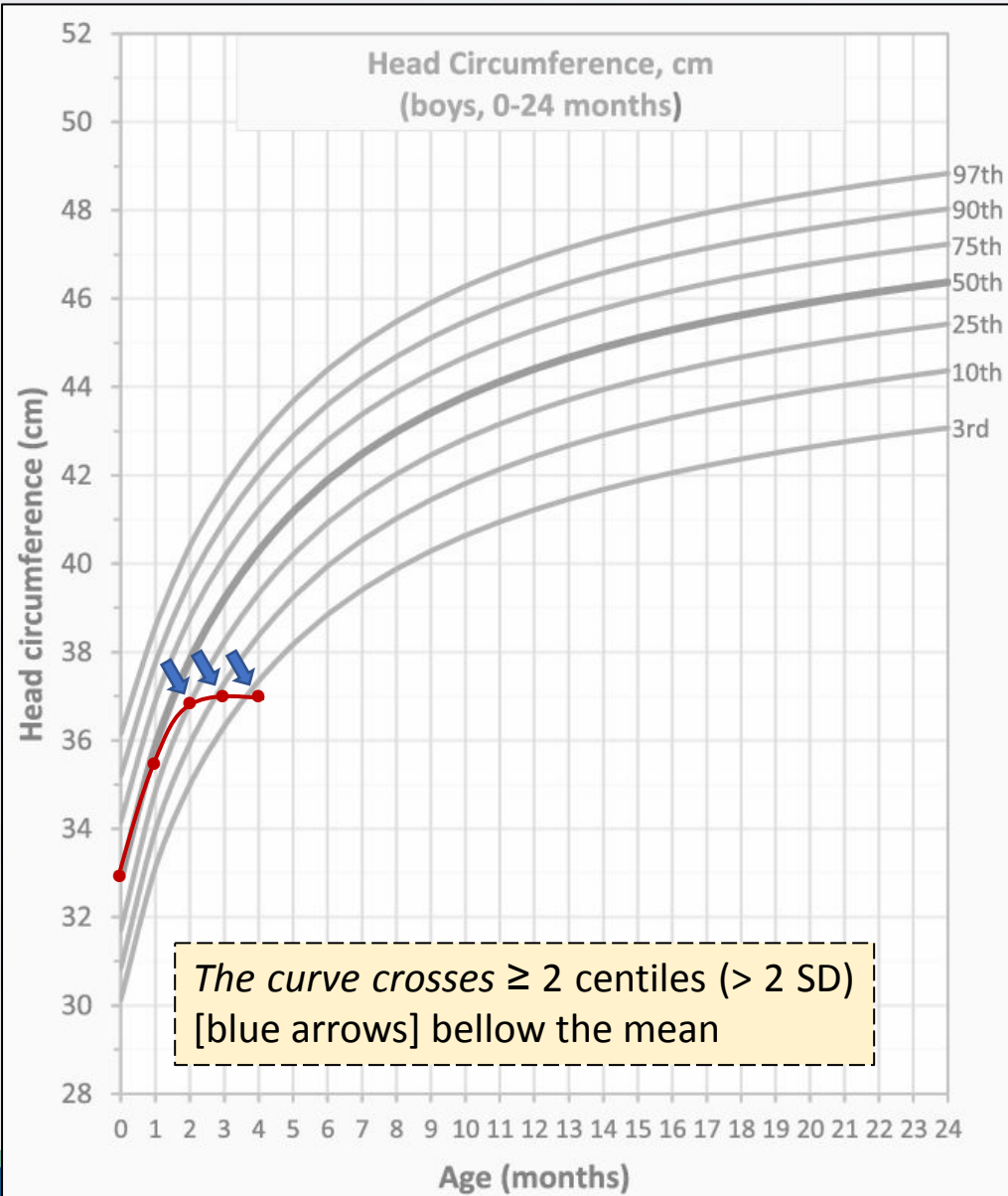
Microcephaly is defined as head circumference greater than two standard deviations below the mean (i.e. crossing ≥ 2 centiles) or lesser than the 3rd centile for a given age and sex.

It is commonly congenital, but it can happen later with stunted head growth.

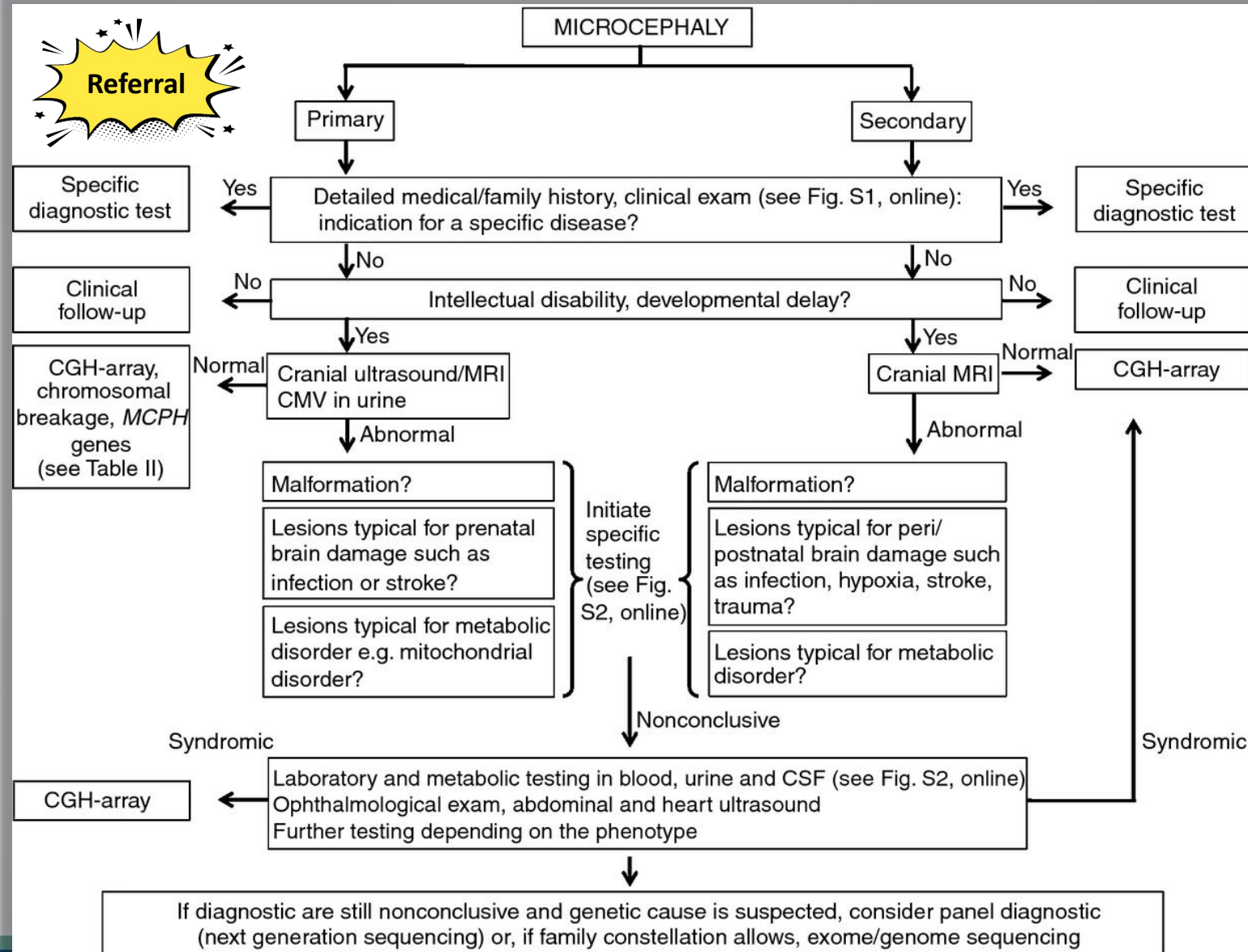
It is associated with brain development abnormalities.



Microcephaly: curve characteristics



Microcephaly: workup



Failure to thrive



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Overview

Failure to thrive (FTT) is an abnormal pattern of weight gain defined by the lack of sufficient usable nutrition and documented by inadequate weight gain over time.

Table 1. Potential Causes of Failure to Thrive

Inadequate caloric intake	Inadequate nutrient absorption	Increased metabolism
Gastroesophageal reflux	Anemia, iron deficiency	Chronic infection (e.g., human immunodeficiency virus infection, AIDS, tuberculosis)
Inadequate breast milk supply or ineffective latching	Biliary atresia	Chronic lung disease of prematurity
Incorrect formula preparation	Celiac disease	Congenital heart disease
Mechanical feeding difficulties (e.g., cleft lip or palate)	Chronic gastrointestinal conditions (e.g., irritable bowel syndrome), infections	Hyperthyroidism
Neglect or abuse	Cystic fibrosis	Inflammatory conditions (e.g., asthma, inflammatory bowel disease)
Poor feeding habits	Inborn errors of metabolism	Malignancy
Poor oral neuromotor coordination	Milk protein allergy	Renal failure
Toxin-induced gastrointestinal upset (e.g., elevated lead levels leading to anorexia, constipation, or abdominal pain)	Pancreatic cholestatic conditions	

About 80% of cases, the cause is non-organic (incorrect formula preparation, poor feeding habits, neglect, poverty ...etc.)

Case approach

HISTORY

Dietary history:

- Duration of mealtime.
- Type of food.
- Amount of intake.
- Formula mixing technique.

Medical history:

- Chronic disease of any type.
- Food allergy.
- Gastroesophageal reflux.
- Frequent recurrent illness and infection.

Pre and perinatal history:

- Low birth weight.
- Intra-uterine growth retardation.
- Prenatal exposures (drugs, smoking, alcohol)

Social and family history:

- Family economic status.
- Stressors.
- Family history of FTT.
- Mental illnesses.

Case approach

EXAMINATION

Finding	Potential Underlying Causes
Dysmorphic appearance	Genetic abnormality, undiagnosed syndrome
Edema	Renal, liver disease
Hair color/texture change	Zinc deficiency
Heart murmur	Anatomic cardiac defect
Hepatomegaly	Infection, chronic illness, malnutrition
Mental status change	Cerebral palsy, poor social bonding
Poor parent-child interaction	Depression, social stress
Rash, skin changes, bruising	Human immunodeficiency virus infection, cow's milk allergy, abuse
Respiratory compromise	Cystic fibrosis
Wasting	Cerebral palsy, cancer

Tips for interpretation



The weight curve will be affected *before* height curve.

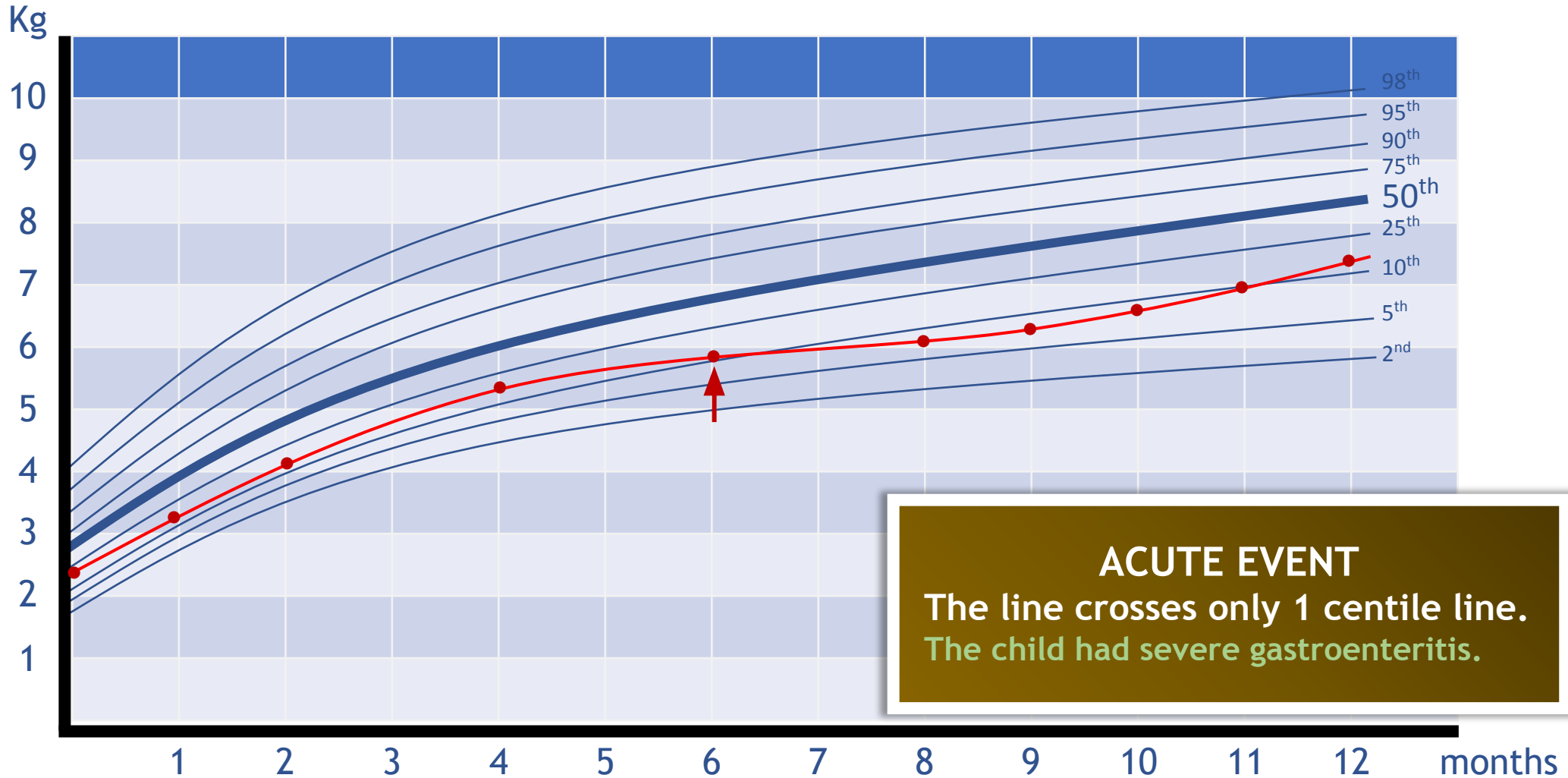
Acute
events

Growth velocity line *CROSSES only 1 centile line* when there is deviation *from normal growth*.

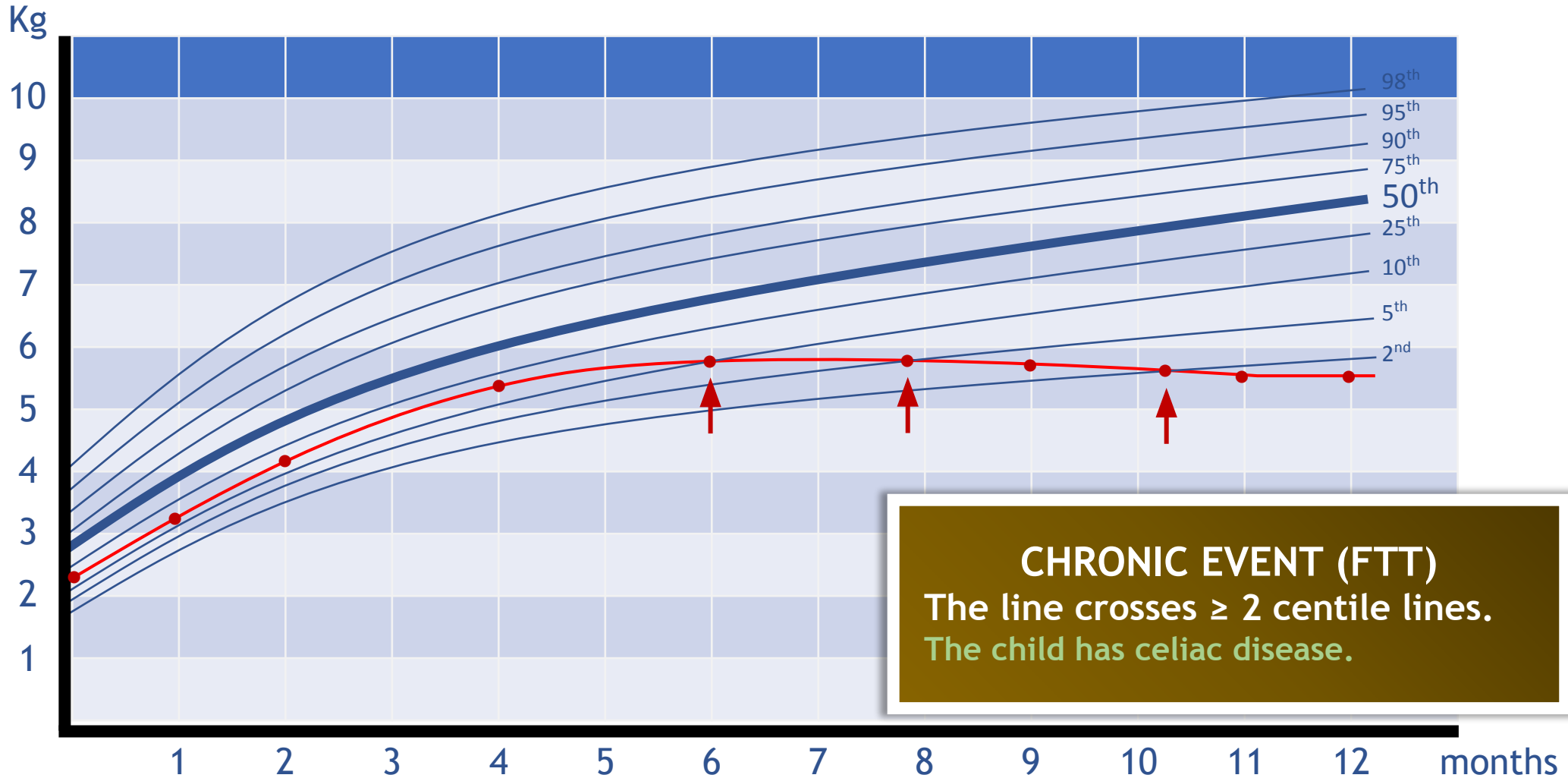
Chronic
events

Growth velocity line *CROSSES 2 or more centile lines* when there is deviation *from normal growth*. FTT lies in this category.

Acute and chronic events



Acute and chronic events



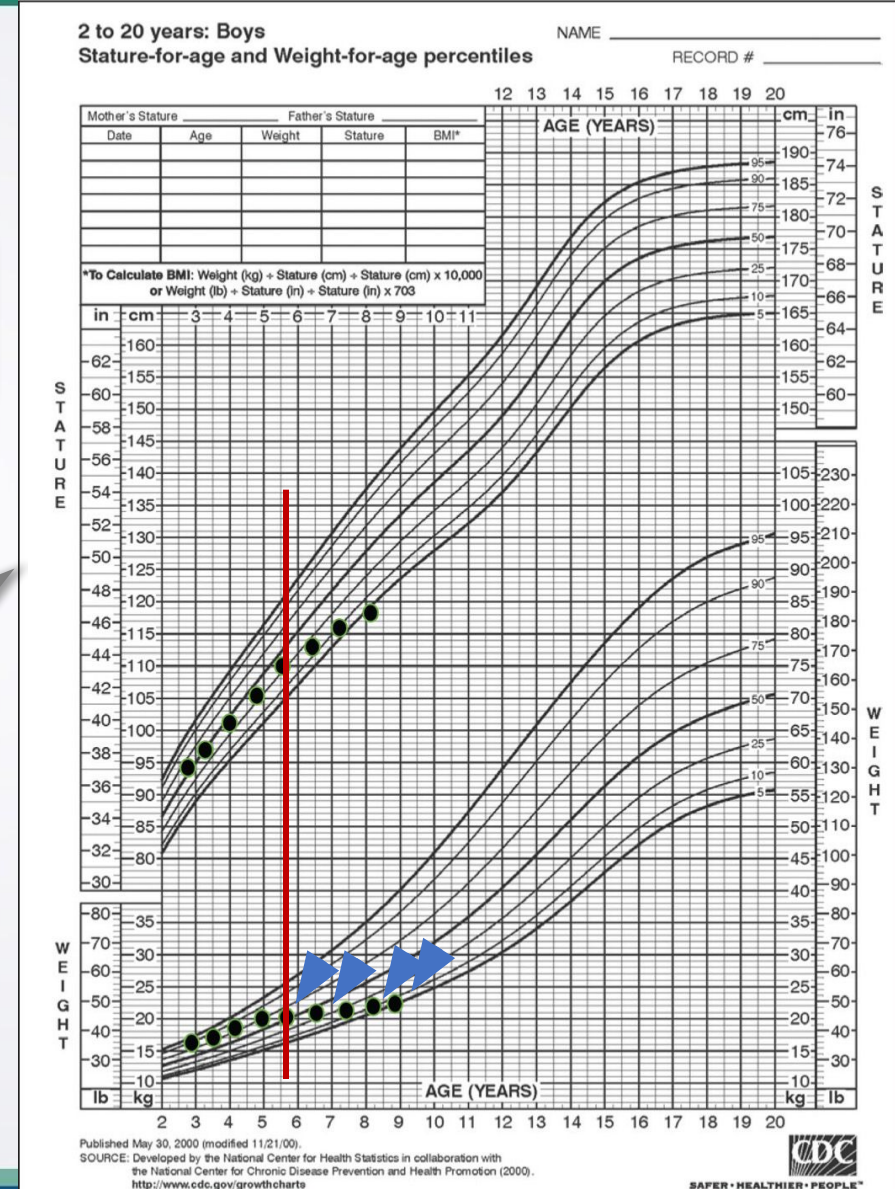
FTT curve characteristics



Curve characteristic

- The weight will be affected *before* height.
- The curve is depressed *crossing* ≥ 2 centiles.

Here in this chart, the weight curve is affected before height curve (red line), and the curve is depressed crossing 4 centiles (blue arrows) ☐ chronic event ☐ FTT case



Workup

No standard set of laboratory tests is recommended for FTT

The following is reasonable initial workup:

- CBC.
- Urinalysis.
- Electrolytes.
- Thyroid function test.
- Tissue transglutaminase IgA (IgA-tTG) as a screening for celiac disease.

Specific testing for certain diseases like Cystic fibrosis, food allergies, HIV, TB may be indicated depending on the presentation.



Management

Non- organic causes:

- **Multidisciplinary approach:** primary care physician, dietitian, psychologist, social work.
- **Nutritional:** educate about age-appropriate foods, calorie boosting, mealtime schedules; goal to reach 90-110% ideal body weight, correct nutritional deficiencies.
- **Behavioral:** positive reinforcement, mealtime environment.

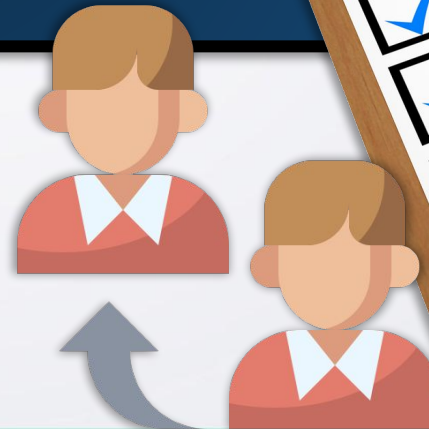
Organic causes:

- Treat the underling causes.



Referral

1. Outpatient treatment failure.
2. Psychosocial factors that put the child's safety at risk.
3. Serious underlying illness or medical problem.
4. Severe malnutrition or dehydration.



Scenario

A 12-months-old boy presenting with vomiting that began 2 months ago but had become more forceful and persistent over the past 2 weeks.

In addition, he was reported to be losing weight over the past 2 months.

Review of systems is negative for fever, diarrhea, and rash. Diet is appropriate for an 12-month-old. Family history is noncontributory

How are you going to proceed?

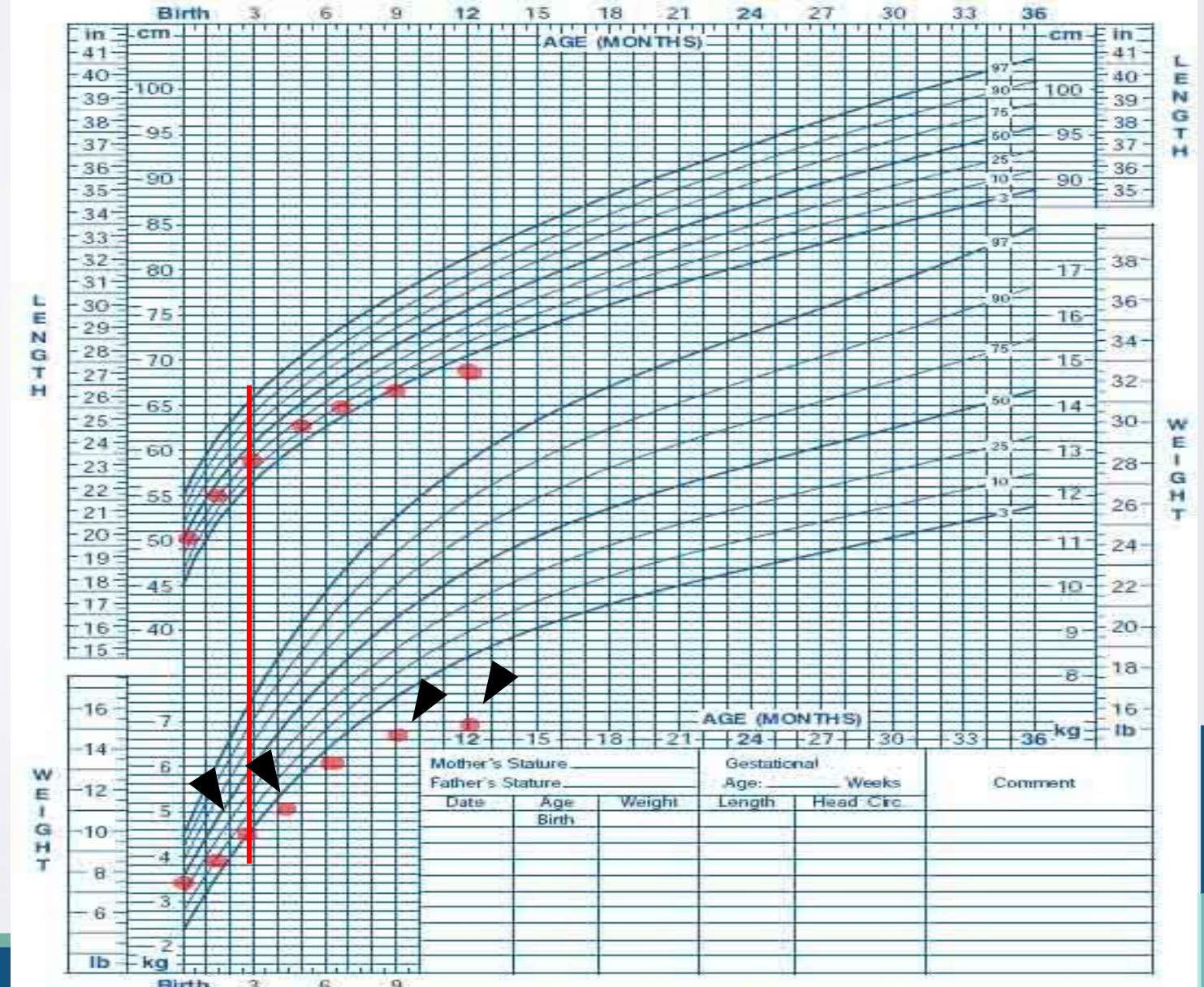


Scenario



The weight is affected before height (red line), and the curve crossed at least 4 centiles (black arrows) ☐ chronic case ☐ FTT case

Most likely diagnosis is chronic GERD



Short stature



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Overview

Short stature is defined as a height more than two standard deviations below the mean for age, or less than the 3rd percentile.



History and physical examination findings should guide further evaluation for pathologic causes of short and tall stature.



Mid-parental height growth velocity should be calculated to evaluate a child's growth vs. potential height.



Bone age should be compared with chronologic age to help narrow the differential diagnosis of short or tall stature.

Mid-parental and projected height

Estimated mid-parental height:

Is an equation based way to find out the most likely the final height of the child when they are 20 years old. This method will not take on account the skeletal maturity!!

Formula (boys):

$$\frac{\text{paternal height (cm)} + \text{maternal height (cm)} + 13 \text{ cm}}{2}$$

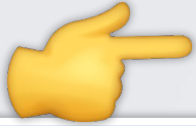
Formula (girls):

$$\frac{\text{paternal height (cm)} + \text{maternal height (cm)} - 13 \text{ cm}}{2}$$

Estimated projected height (potential height, final height or target height):

A rough estimate of the child's projected height by extrapolating the child's growth along his or her own height percentile to the corresponding 20-year point.

Mid-parental and projected height



Normal for
the family

The projected potential height should be within ± 10 cm (± 2 SD) range of calculated mid-parental height.

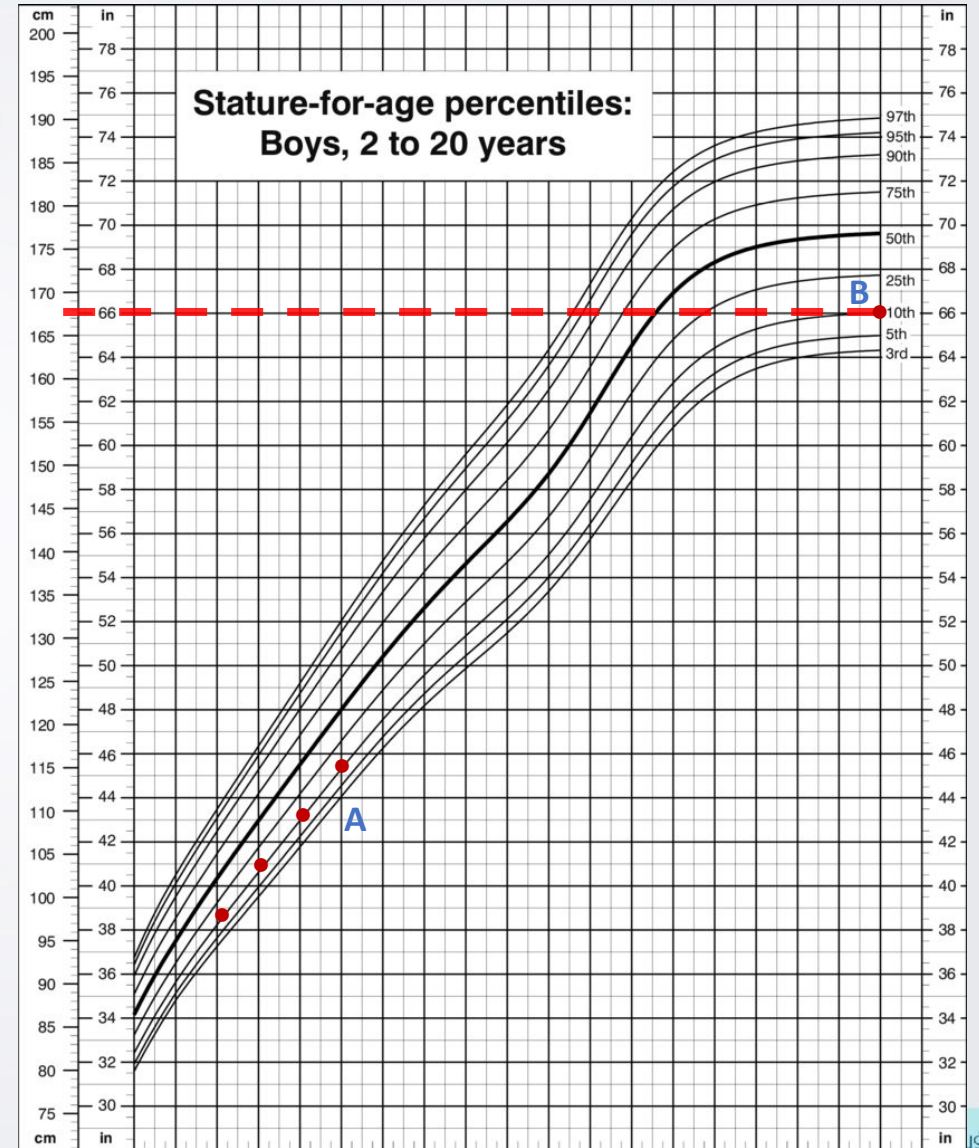
Example #1:

- **Point A** represents current child height centile (10th here).
- **Point B** is the estimated projected height, obtained by extrapolating following the child current centile (10th centile here) till 20 years old end point (same 10th centile). The projected height here is 168 cm.

- The measured father height is 175 cm
- The measured mother height is 160 cm

The calculated mid-parental height = 174 cm for boys

The normal deviation for the family is ± 10 cm. So the future boy's height will fall anywhere between 164 cm and 184 cm. Since the projected height from the graph is 168 cm, it is within the 164 cm to 184 cm range, so this is considered normal.



Mid-parental and projected height

Example #2:

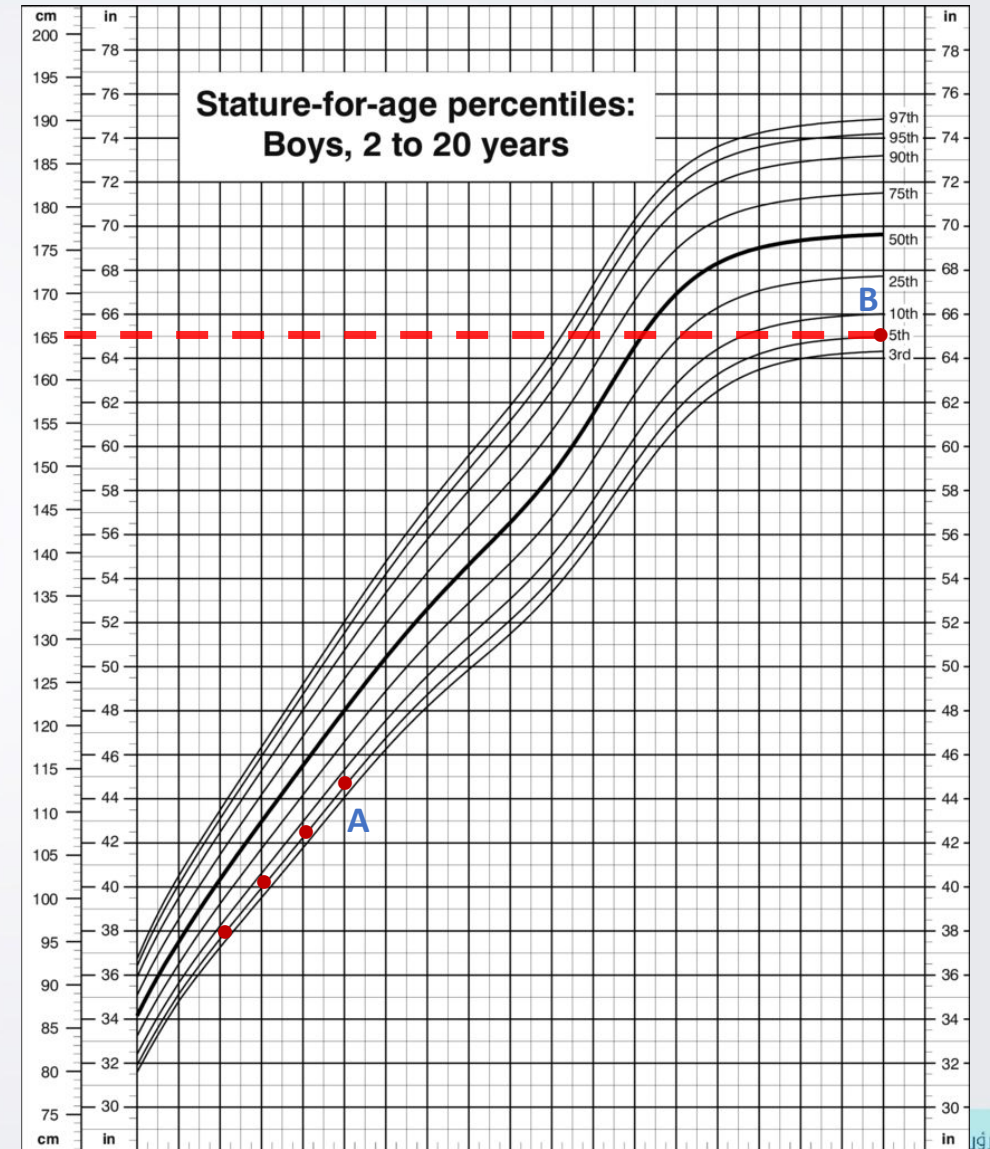
- **Point A** represents current child height centile (5th here).
- **Point B** is the estimated projected height on the same 5th centile at age 20-year old.
The projected height here is 165 cm.

- The measured father height is 180 cm
- The measured mother height is 165 cm

The calculated mid-parental height = 179 cm for boys

The normal deviation for the family is ± 10 cm. So the future boy's height will fall anywhere between 169 cm and 189 cm.

The projected height here is 165 cm, it **DOES NOT** fall between 169 cm to 189 cm range, this suggests a **possible pathologic condition**.



Mid-parental and projected height

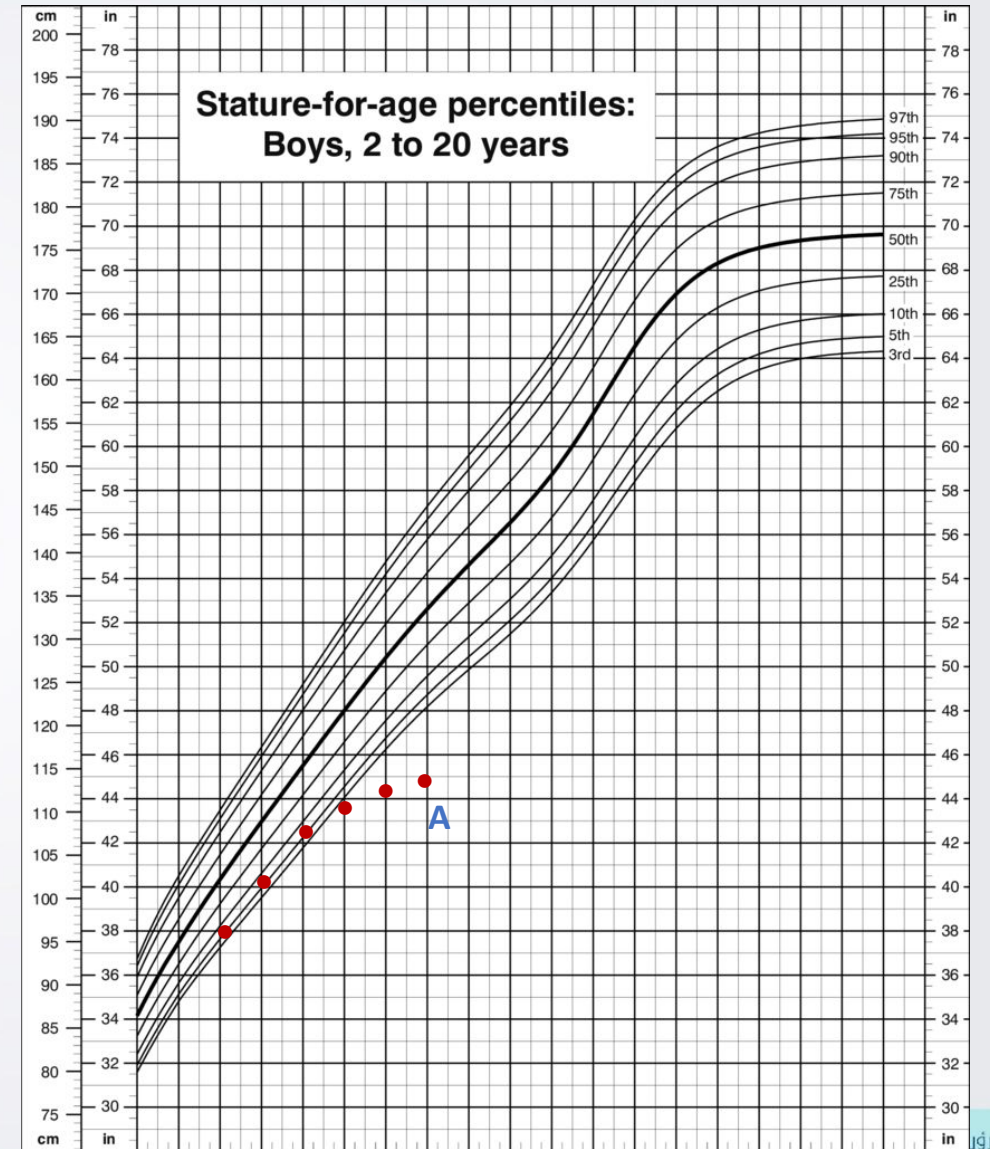
Example #3:

- **Point A** represents current child height centile (5th here).
- The height curve is **NOT** parallel to other centiles.

- The measured father height is 180 cm
- The measured mother height is 165 cm

The calculated mid-parental height = 179 cm for boys
The normal deviation for the family is ± 10 cm. So the future boy's height will fall anywhere between 169 cm and 189 cm.

The projected height here can NOT be plot because of un-parallel curve. This suggests a **possible pathologic condition**.



Bone age

A method of comparing a plain radiograph of the left wrist and hand to a database of norms.
Bone age should be compared with chronologic age to narrow the differential diagnosis of short stature.



Normal appearance x-ray
of 5 years old child

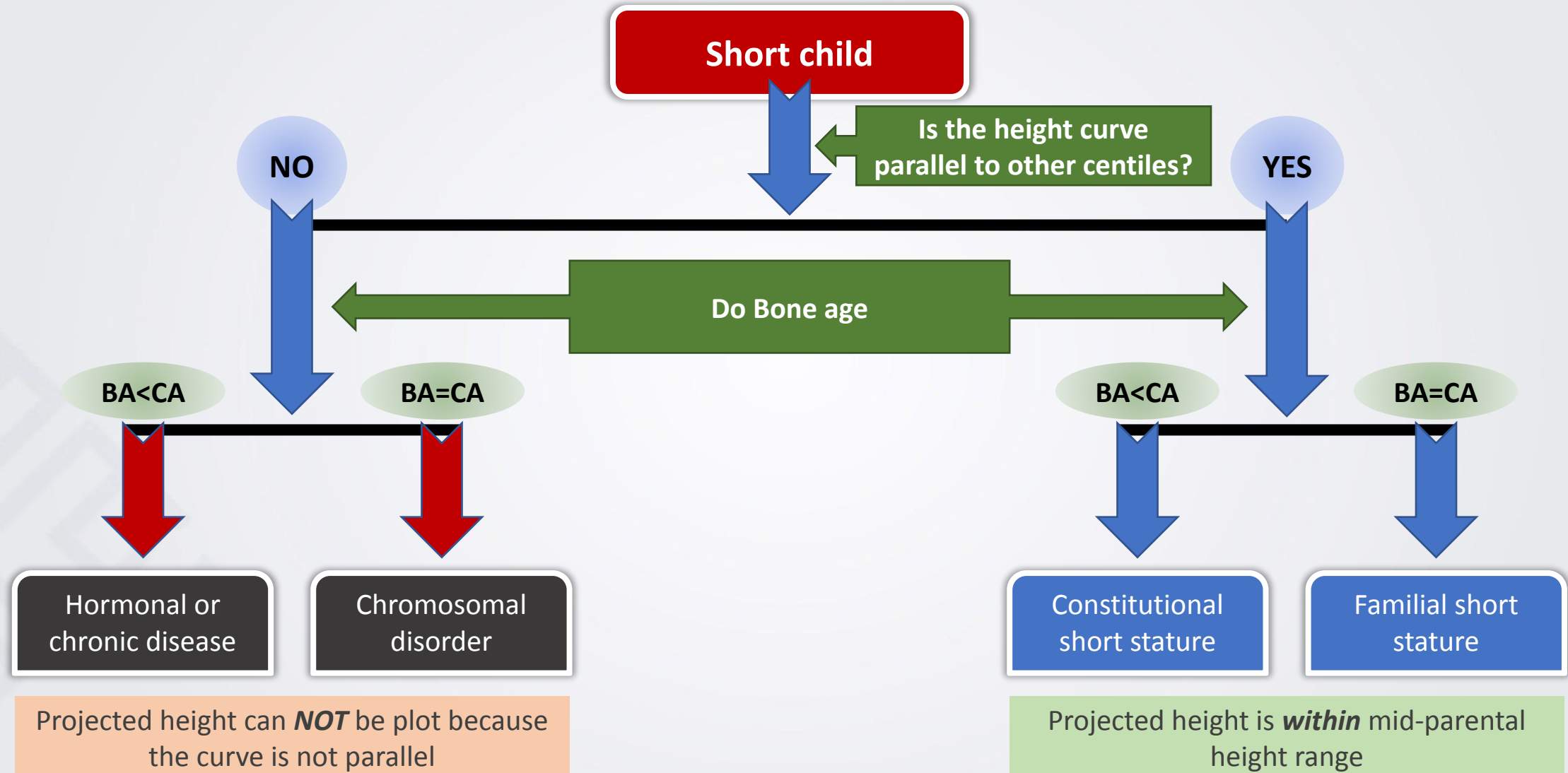


Normal appearance x-ray
of 7 years old child



Normal appearance x-ray
of 9 years old child

Short stature evaluation algorithm



BA: Bone age CA: Chronological age

Short stature evaluation



The height curve will be affected *before* or *at the same time* of weight curve.



Important

If the height curve is *parallel* **BUT** the projected height is *BELLOW* mid-parental height range, you should do at least:

- **BOYS:** Hormonal assay (priority), then karyotyping.
- **GIRLS:** Karyotyping (priority), then hormonal assay.

SHORT CHILD #1

Bassam is a 12 year old boy who has always been shorter than his peers. His mother is 149 cm and his father is 169 cm. His mother had menarche at age 15 years, and his father had late pubertal development.

His physical examination is unremarkable, with pubertal development Tanner I.

Mid-parental height is 165.5 cm, projected potential height is 164 cm and bone age is delayed.

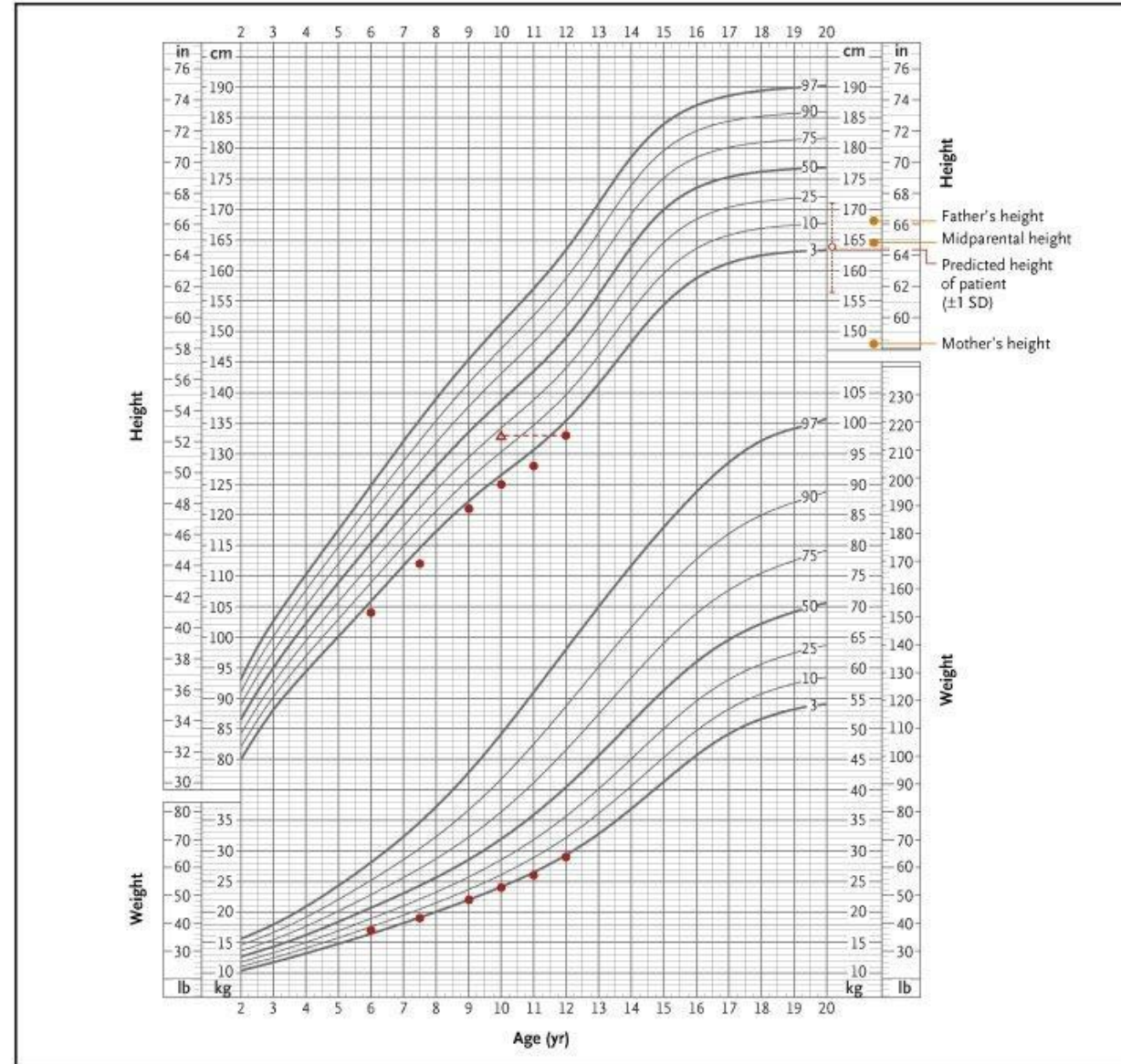
How are you going to proceed?



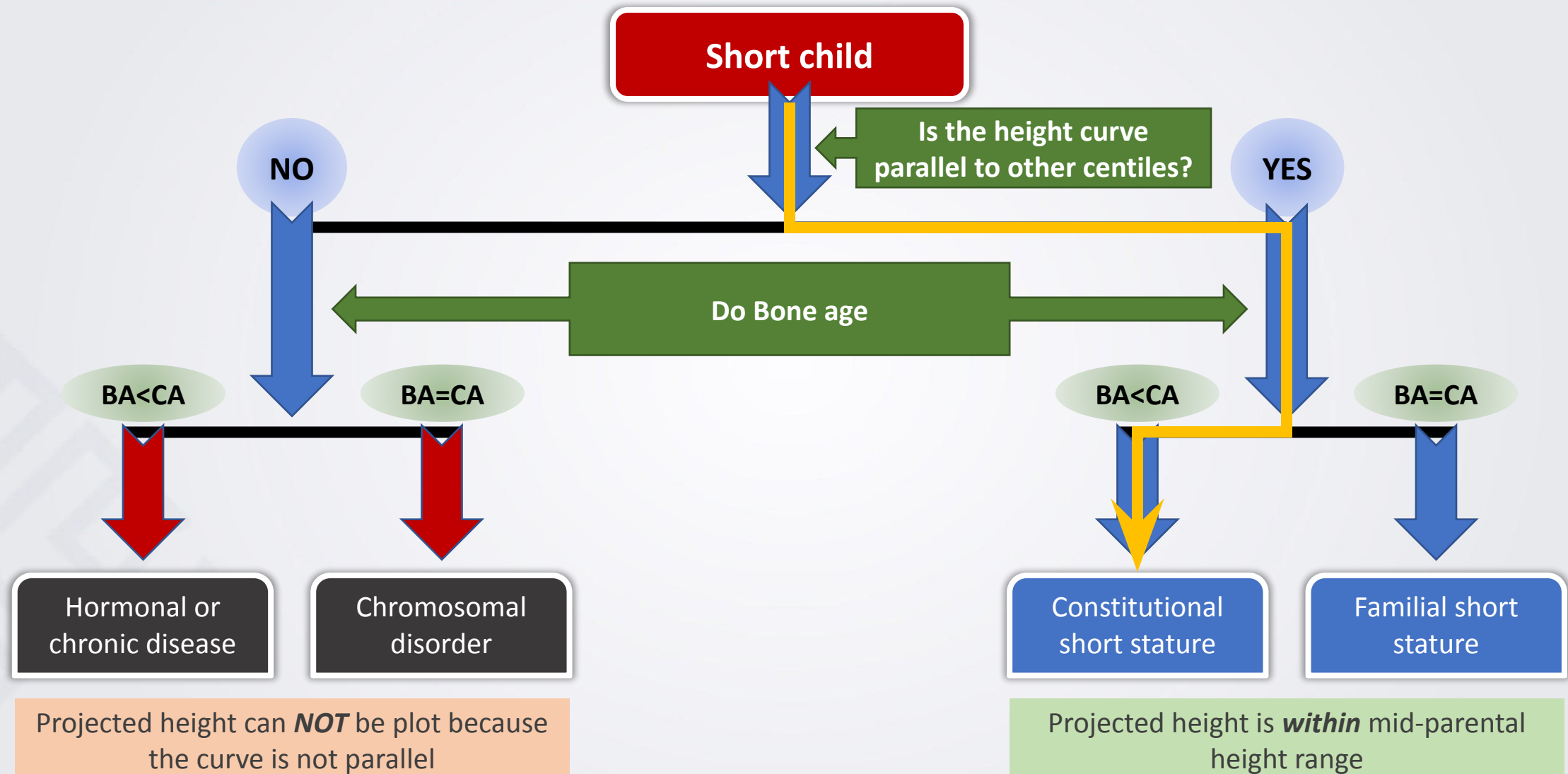
SHORT CHILD #1



- The measured father height is 169 cm
- The measured mother height is 149 cm
- Projected height is 164 cm
- Mid-parental height is 165.5 cm
- The accepted range is (155.5 – 175.5)
- The projected height is within the range
- Bone age is delayed
- The curve is parallel to other centiles



SHORT CHILD #1



BA: Bone age CA: Chronological age

Constitutional short stature

Characterized by:

- Family history of similar pattern.
- **Delayed** puberty.
- **Delayed** bone age.
- Normal predicted adult height in context of family pattern.
- No organic or emotional cause of growth failure.
- Eventually they will grow to their destined height normally (late bloomers)
- More common in **boys**.

Management: Reassurance.

SHORT CHILD #2

Continue the case...

After few years, Bassam came for assessment as his mother is concerned that he is not gaining appropriate height in the past 2 years.

Looking at his file, his mid-parental height is 165.5 cm and expected potential projected height is 164 cm and bone age is delayed.

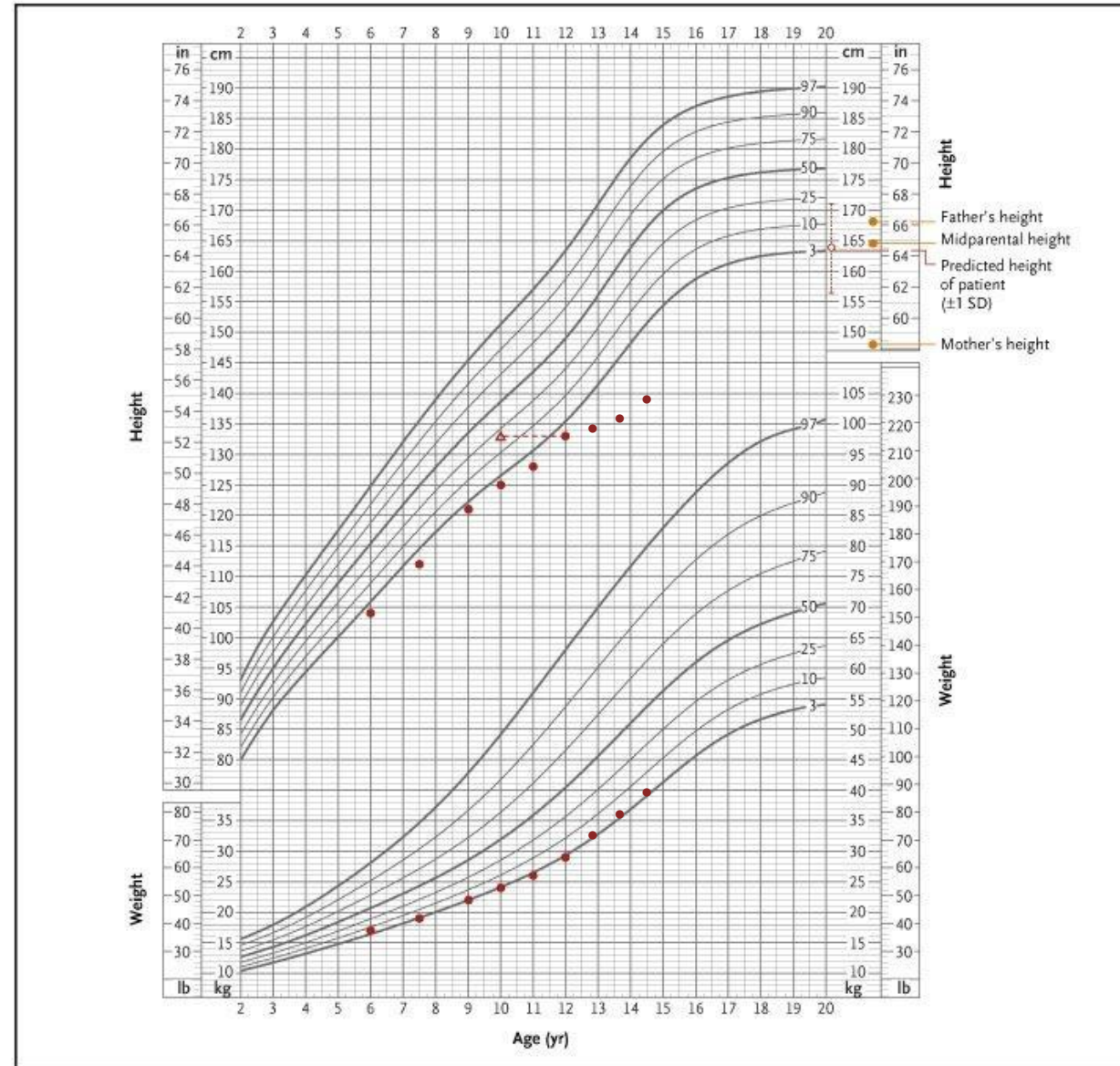
The following is his current growth chart:



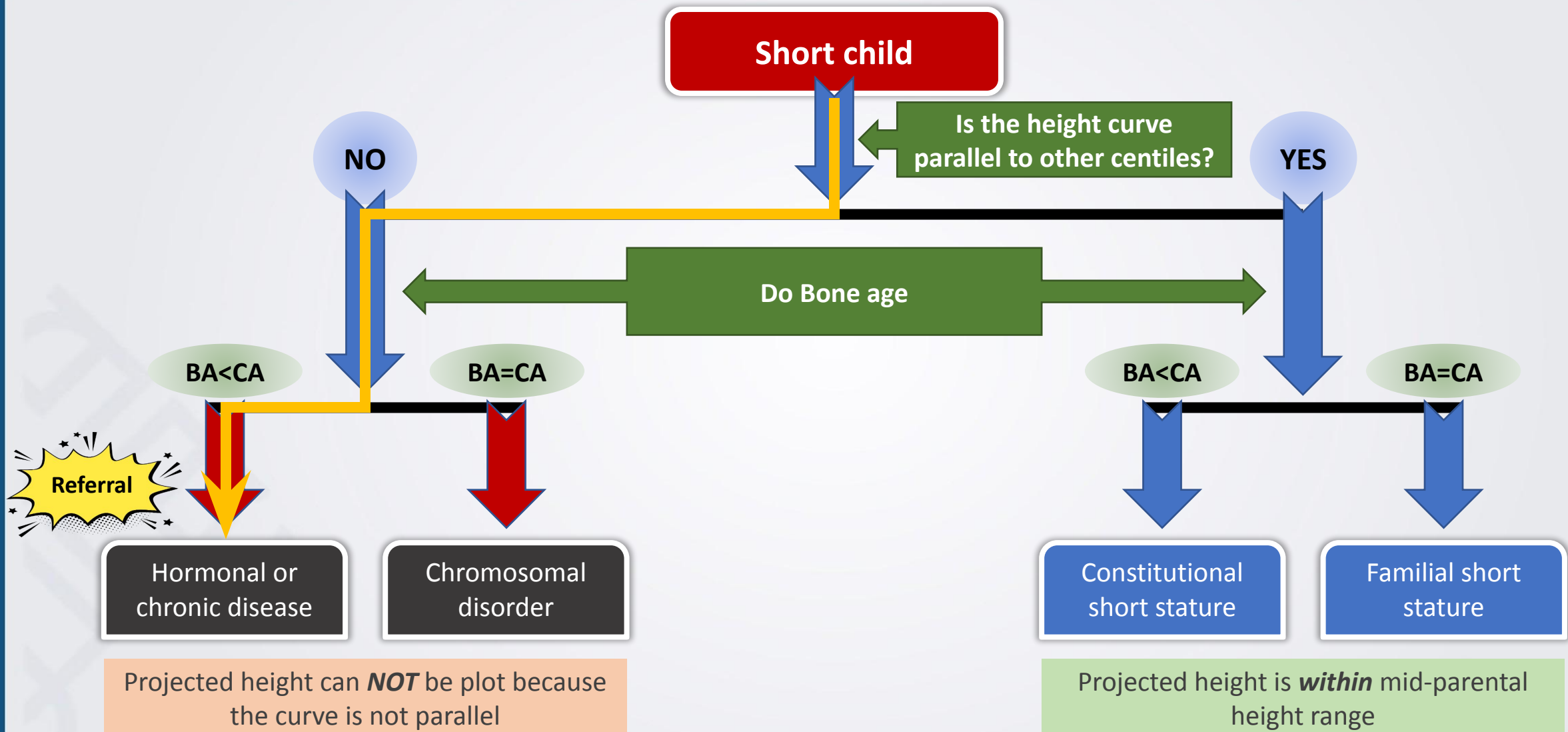
SHORT CHILD #2



- Projected height CAN NOT be obtained now
- Mid-parental height is 165.5 cm
- Bone age is delayed
- The curve now IS NOT parallel to other centiles



SHORT CHILD #2



BA: Bone age CA: Chronological age

SHORT CHILD #2

Work-up

The following is reasonable initial workup:

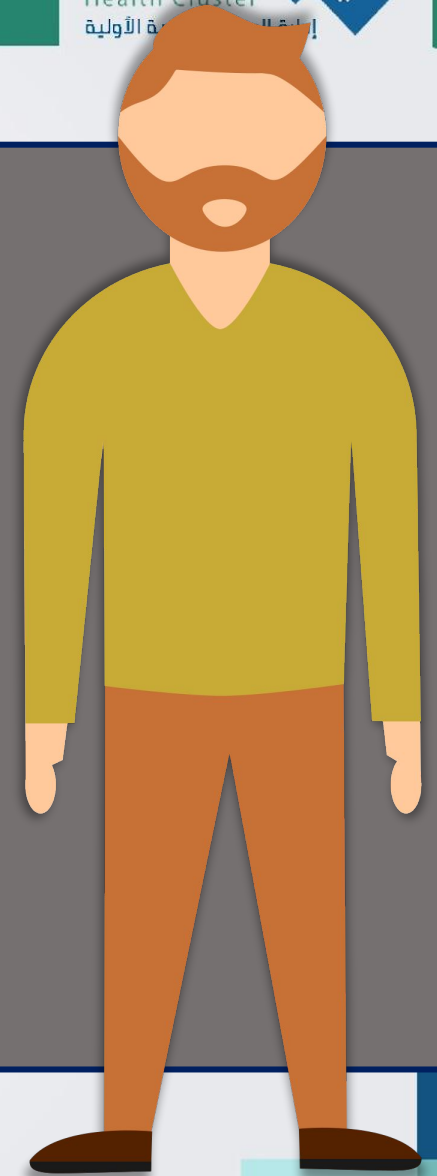
- ■ ■
- CBC: anemia, evidence of chronic illness.
- ESR: IBD, other chronic illness.
- Biochemistry and electrolytes: Renal disease (renal tubular acidosis)
- Thyroid function test: TSH, if ↑ then free T4 (hypothyroidism).
- 24hr urine collection for urinary free cortisol: screening for Cushing syndrome.
- Tissue transglutaminase IgA (IgA-tTG): screening for celiac disease.
- Insulin-like growth factor 1 (IGF-1) and Insulin-like growth factor-binding protein 3 (IGFBP-3): screening for growth hormone deficiency.

SHORT CHILD #2

Continue the case...

Referral feedback of Bassam from pediatric endocrinologist showed unremarkable results and suggested to follow the case as this could be a late bloomer case (constitutional short stature).

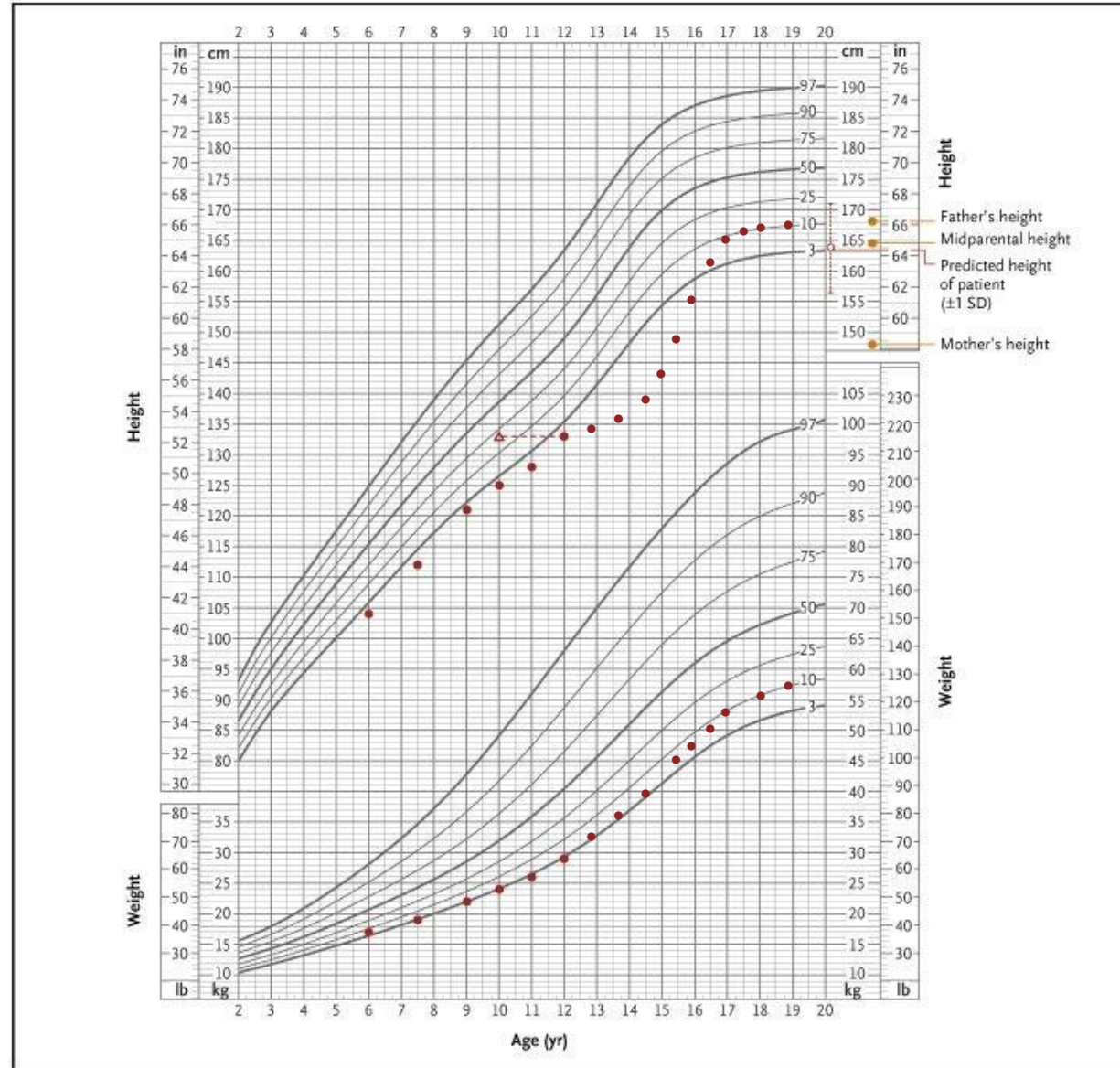
At his 19th year birthday, Bassam came with the following growth chart:



SHORT CHILD #2



- Bassam's height starts to catch-up
- At age of 19-year old, his height is 168cm which is within the range of calculated mid-parental height (155.5 – 175.5)



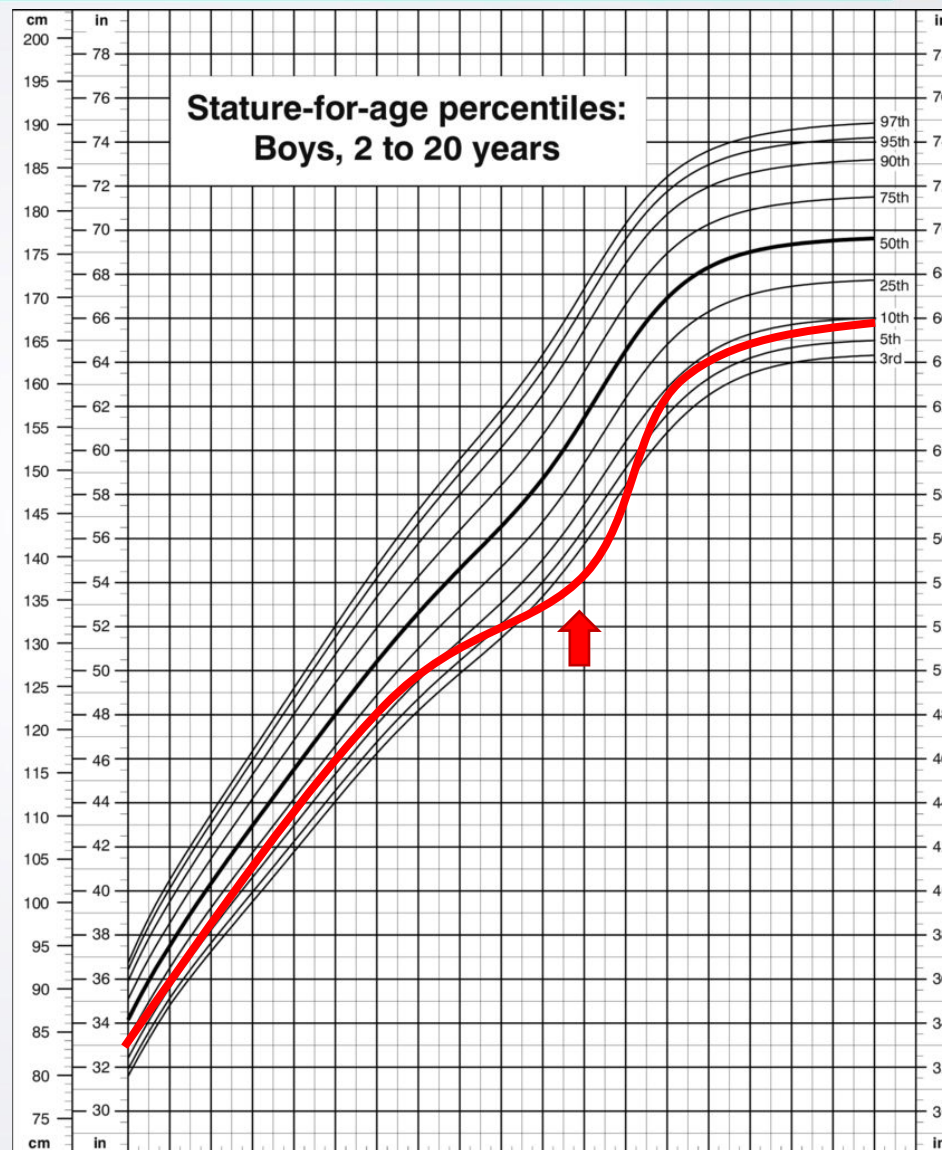
SHORT CHILD #2

Typical look of constitutional
short stature curve
(Bone age < chronological age)



TIP

In constitutional short stature the bone age is
delayed usually by 1 or 2 years.



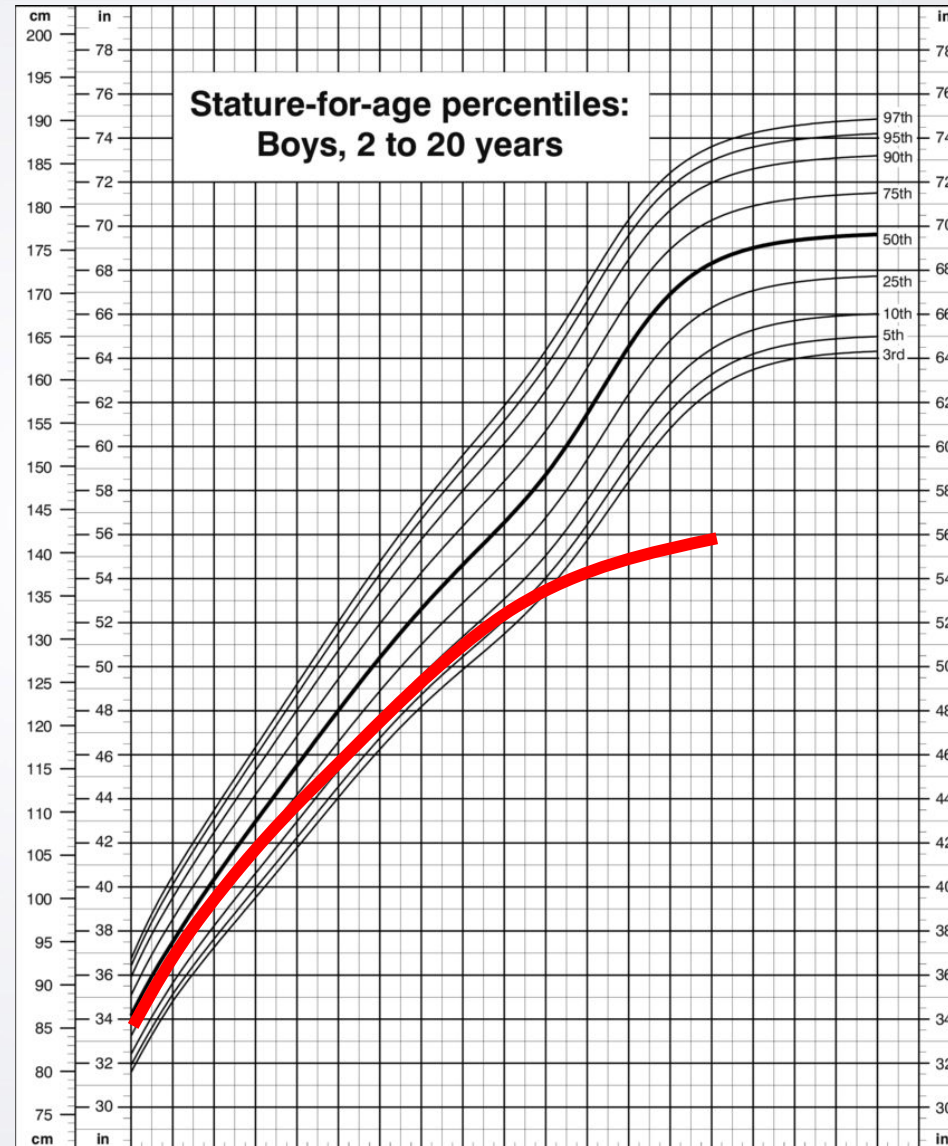
SHORT CHILD #2

Typical look of hormonal or
chronic disease short stature curve
(Bone age < chronological age)



TIP

In hormonal or chronic disease short stature
the bone age is delayed usually by > 2 years.



SHORT CHILD #3

Jawhara is 11 year old girl who always been “short for her age”. Her mother is 152 cm, her father is 165 cm.

Her physical exam is normal and her breasts are Tanner II, pubic hair is Tanner II.

Bone age is normal for her age.

How are you going to proceed?

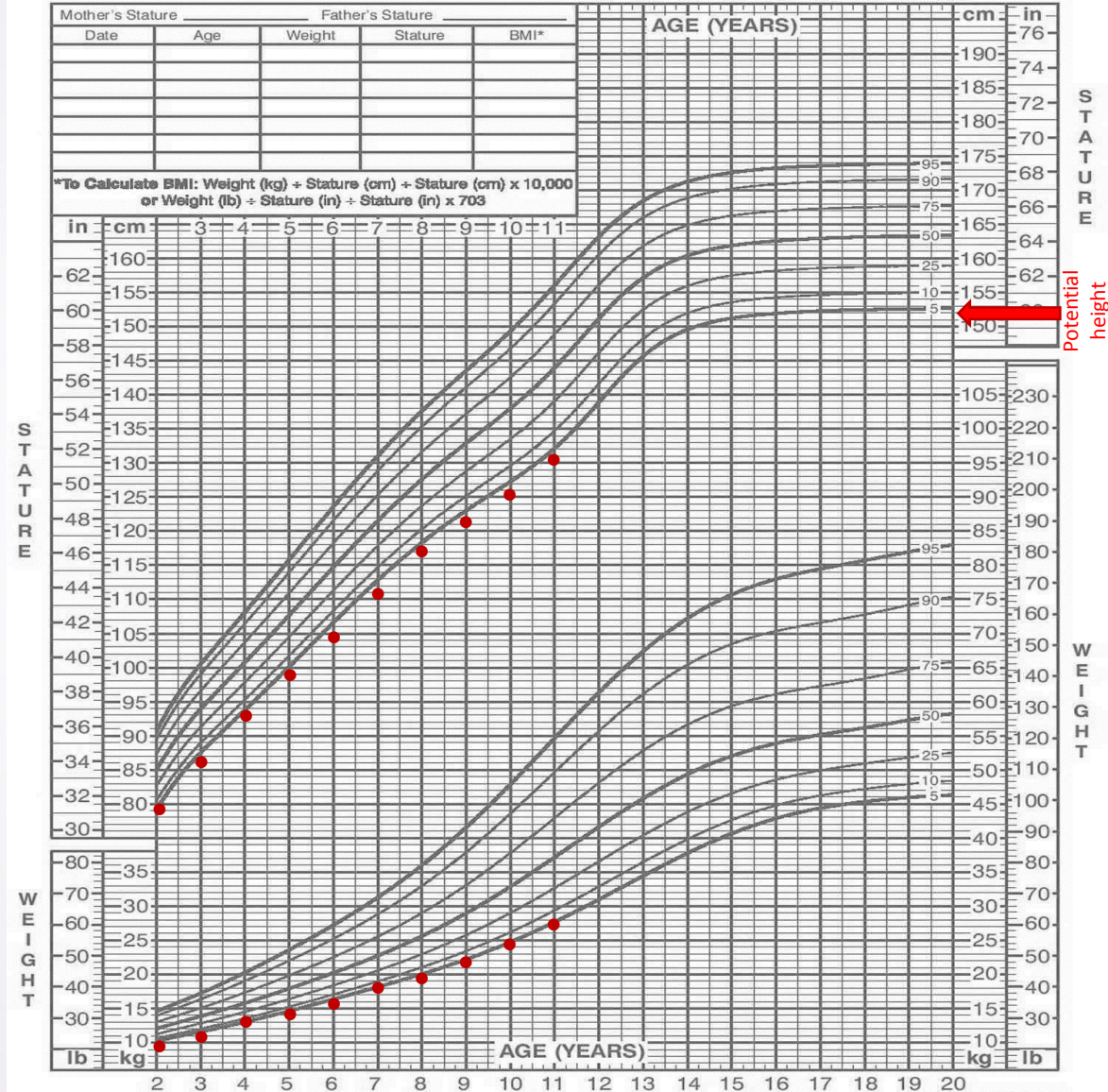


SHORT CHILD #3

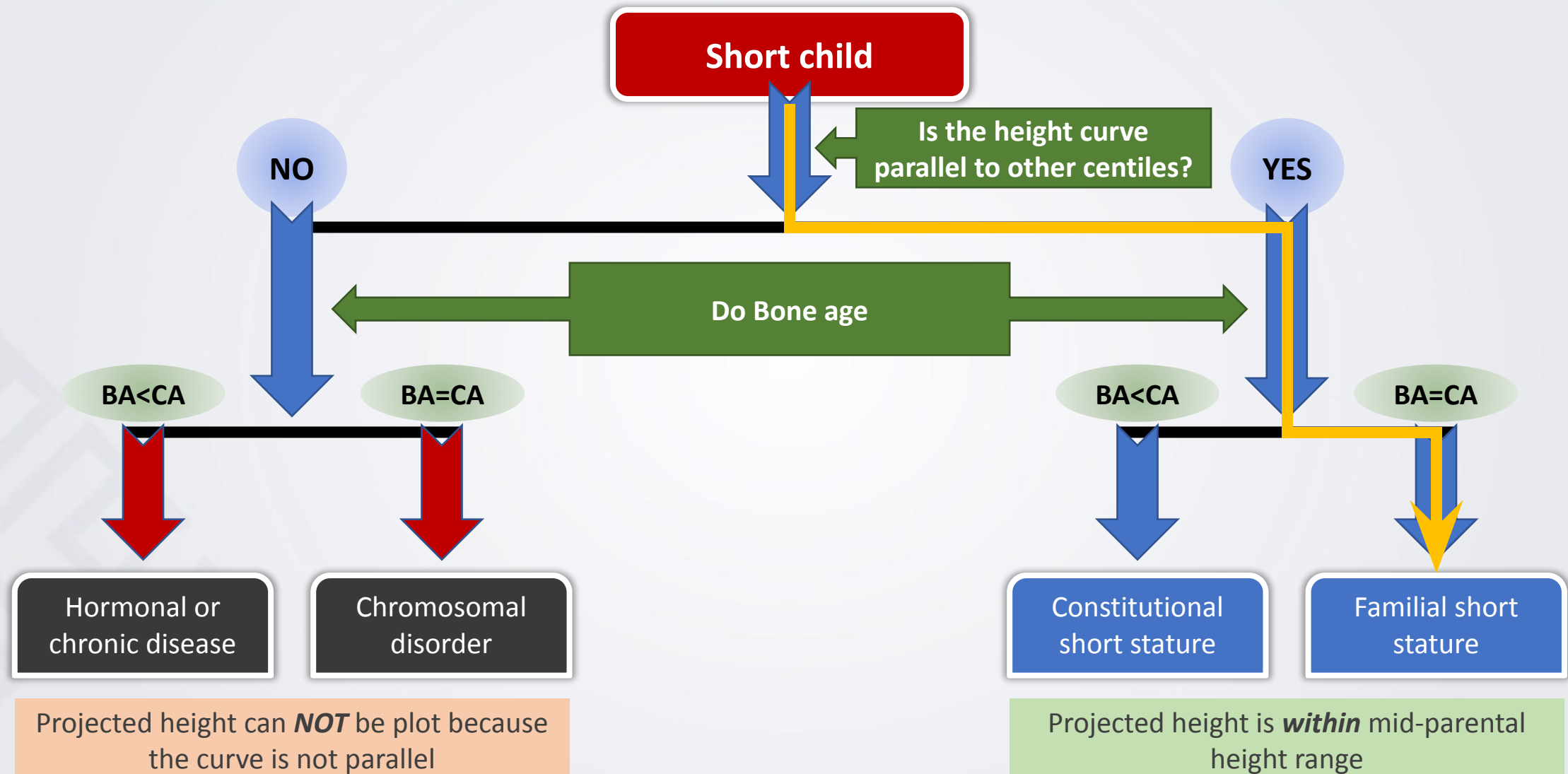
*The girl calculated mid-parental height =
paternal height + maternal height - 13*

$$\frac{165 + 152 - 13}{2} = 152 \text{ cm}$$

- The measured father height is 165 cm
- The measured mother height is 152 cm
- Projected height is 152 cm
- Mid-parental height is 152 cm
- The accepted range is (142 – 162)
- The projected height is within the range
- Bone age is normal for age
- The curve is parallel to other centiles



SHORT CHILD #3



BA: Bone age CA: Chronological age

Familial short stature

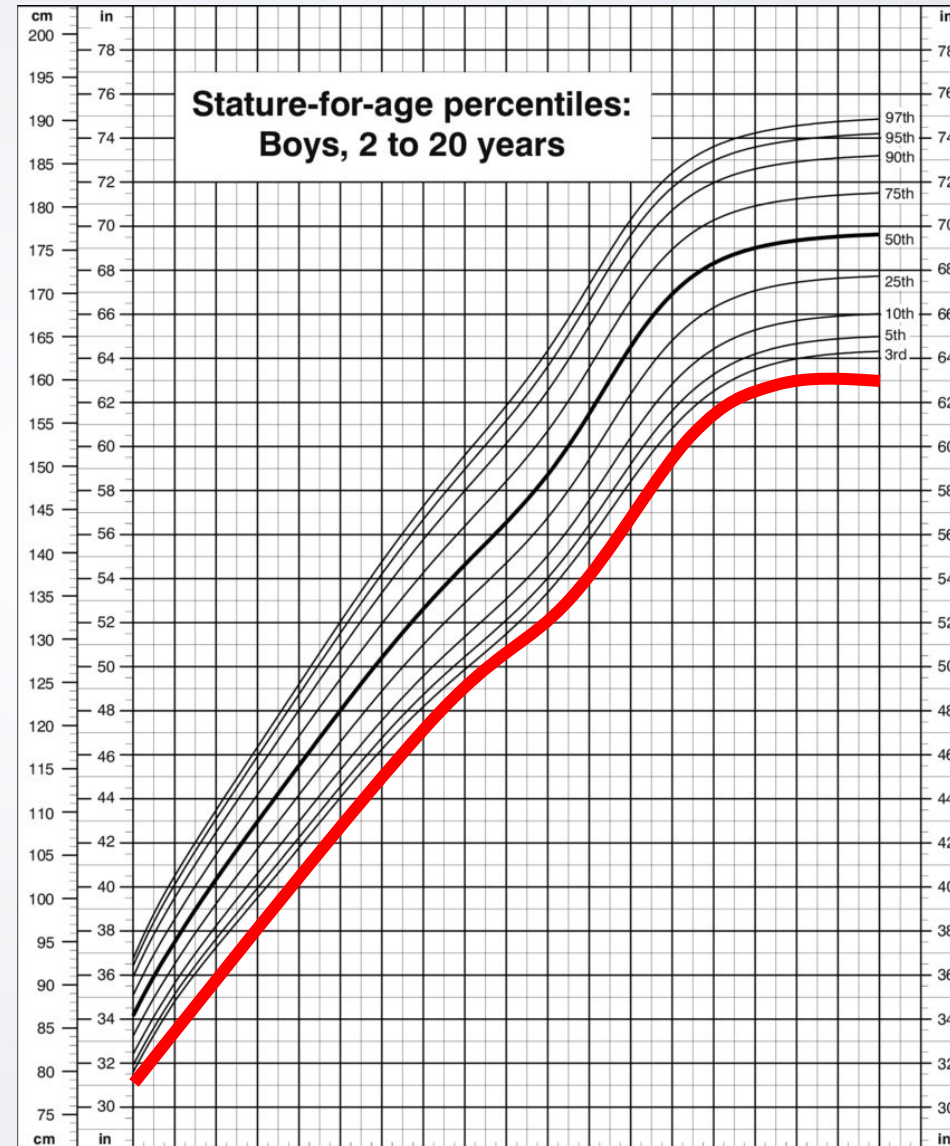
Characterized by:

- Family History of short stature.
- Birth weight > 2.5 kg.
- Height $<$ lowest percentile for chronological age.
- Growth curve parallel but at or below the lowest percentile.
- Predicted adult height $<$ lowest percentile.
- No organic or emotional cause of growth failure.
- **Normal** annual growth rate and bone age.
- **Normal** pubertal onset.

Management: Reassurance.

SHORT CHILD #3

Typical look of familial
short stature curve
(Bone age = chronological age)



SHORT CHILD #4

Sara is an 11 year old girl with short stature and history of recurrent otitis media.

Her mother is 162 cm and her father is 175 cm.

Her physical exam is remarkable for:

Multiple nevi, low posterior hairline, webbed neck, widely spaced nipples,
and increased carrying angle.

Her breast and pubic hair development are Tanner I.

Her bone age is appropriate for her age.

How are you going to proceed?



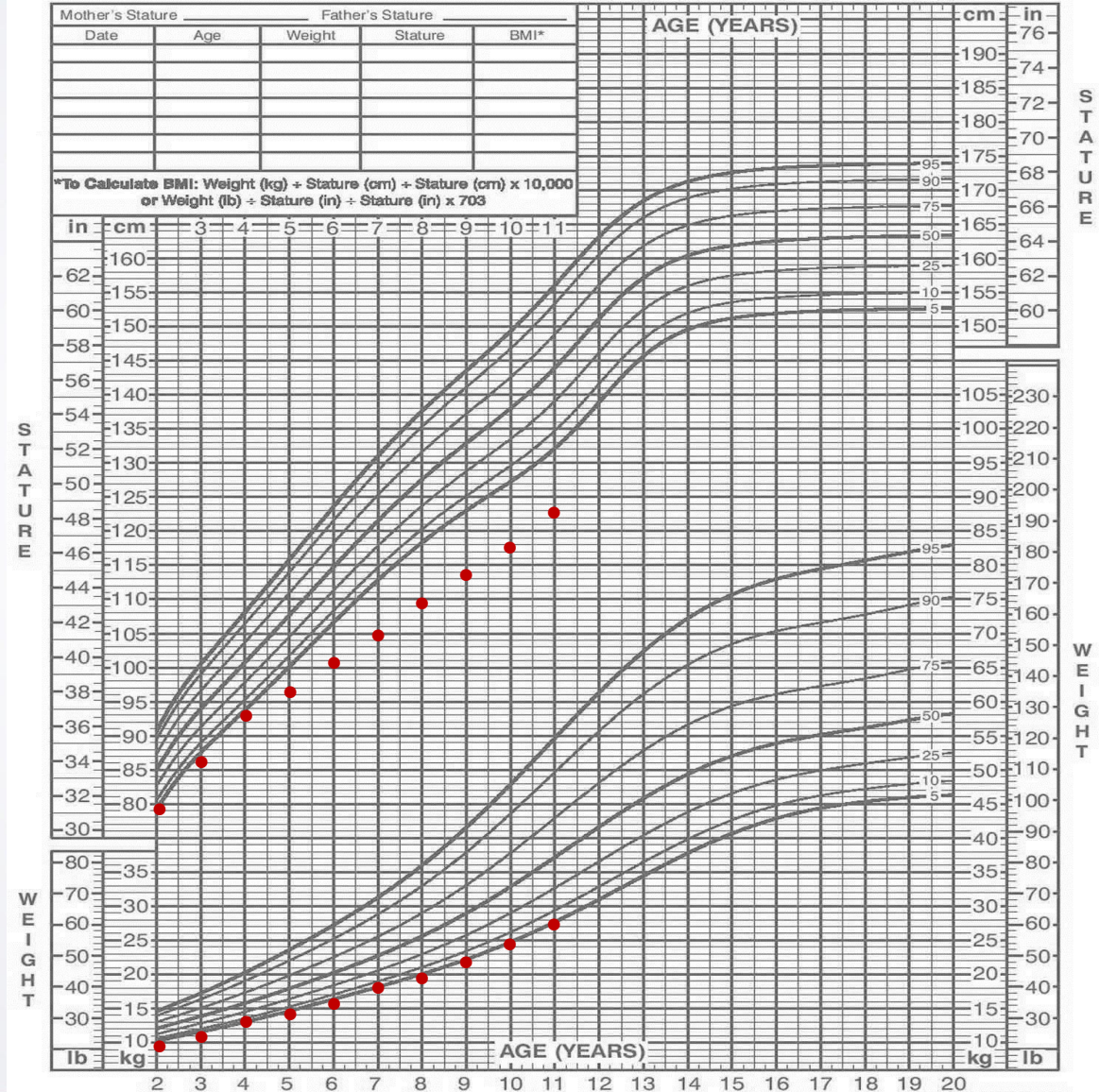
SHORT CHILD #4

The girl calculated mid-parental height =

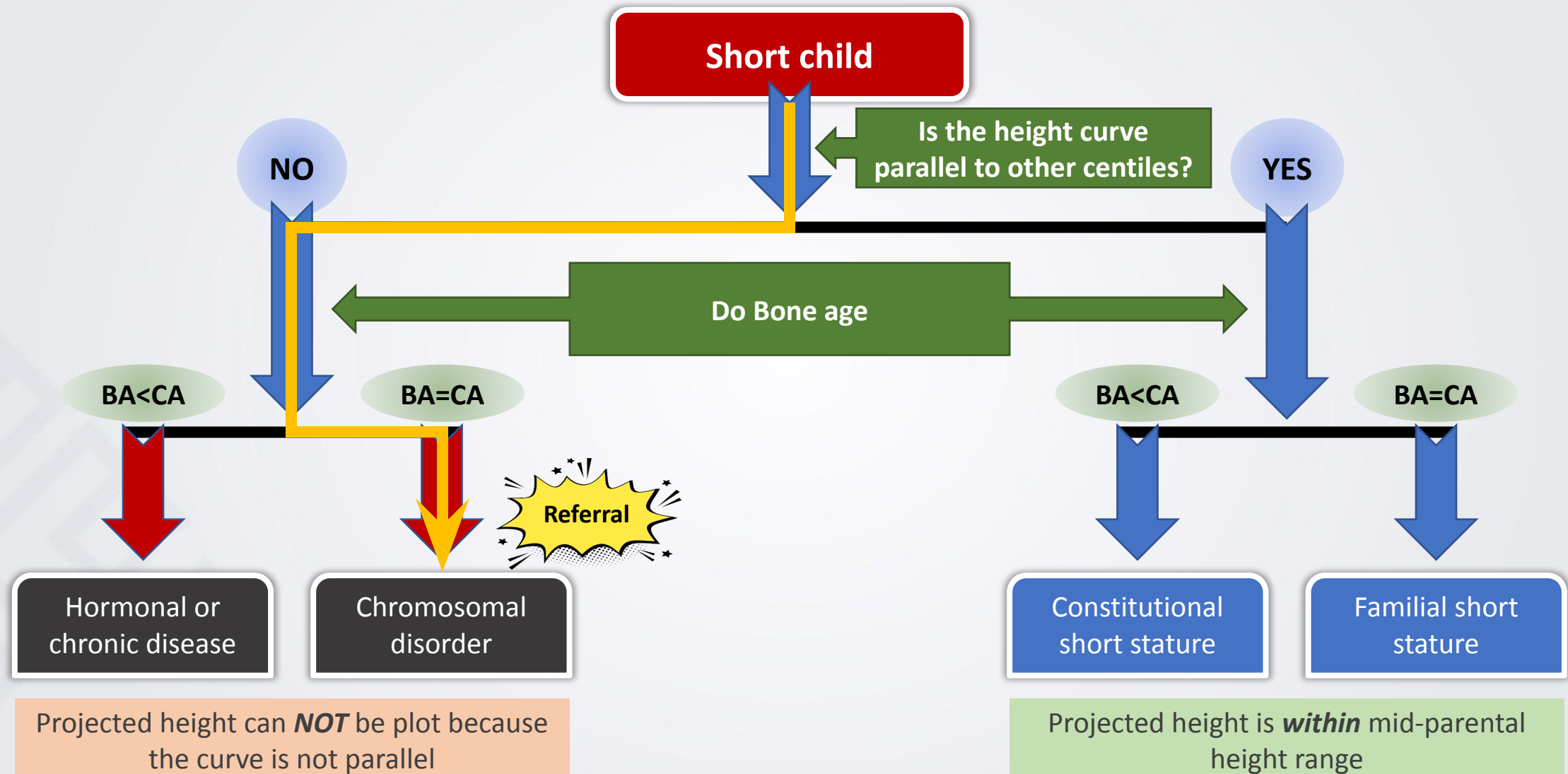
$$\frac{\text{paternal height} + \text{maternal height} - 13}{2}$$

$$\frac{175 + 162 - 13}{2} = 162 \text{ cm}$$

- The measured father height is 175 cm
- The measured mother height is 162 cm
- Projected height CAN NOT be obtained
- Mid-parental height is 162 cm
- Bone age is normal for age
- The curve is NOT parallel to other centiles



SHORT CHILD #4



BA: Bone age CA: Chronological age

Chromosomal disorders short stature

The most common causes are:

- Turner syndrome (as in this case scenario).
- Down syndrome.
- Prader-Willi syndrome.
- Noonan syndrome.

Investigation: Karyotype and genetic mutation analysis.

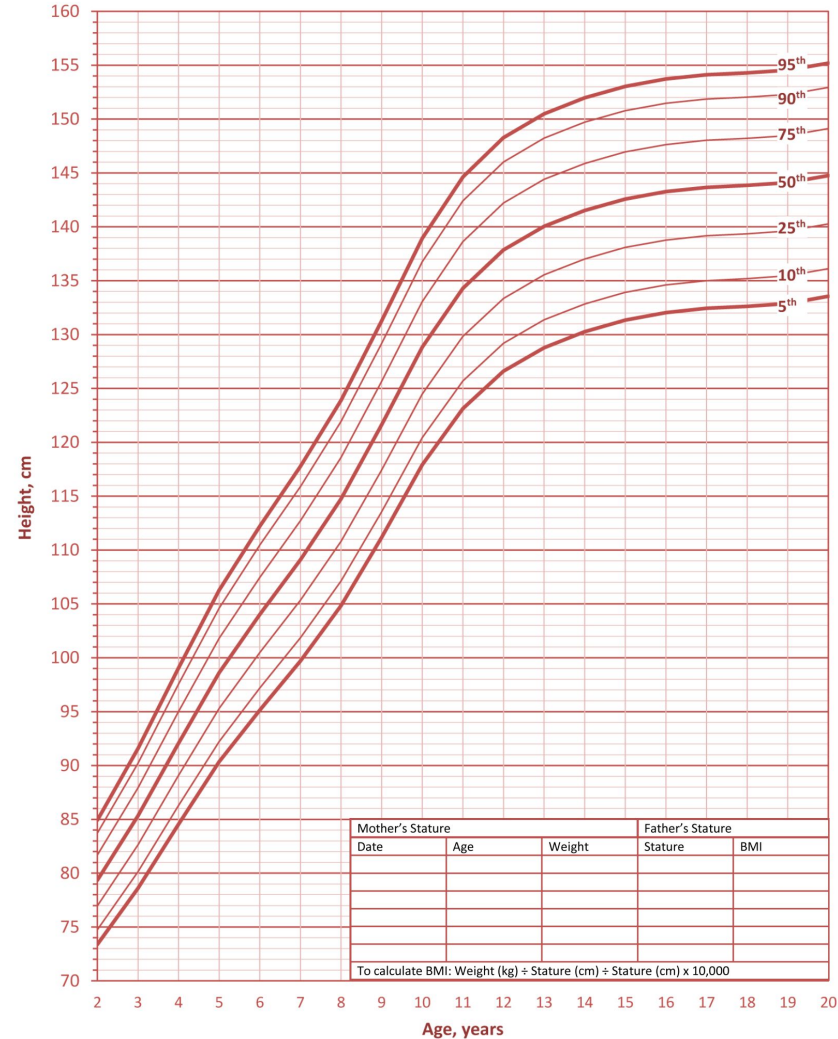
Growth chart consideration: Replot the measurements on the specialized growth chart for the syndrome.

Chromosomal disorders short stature

Growth Charts for Children with Down Syndrome
2 to 20 years: Girls
Height-for-age percentiles

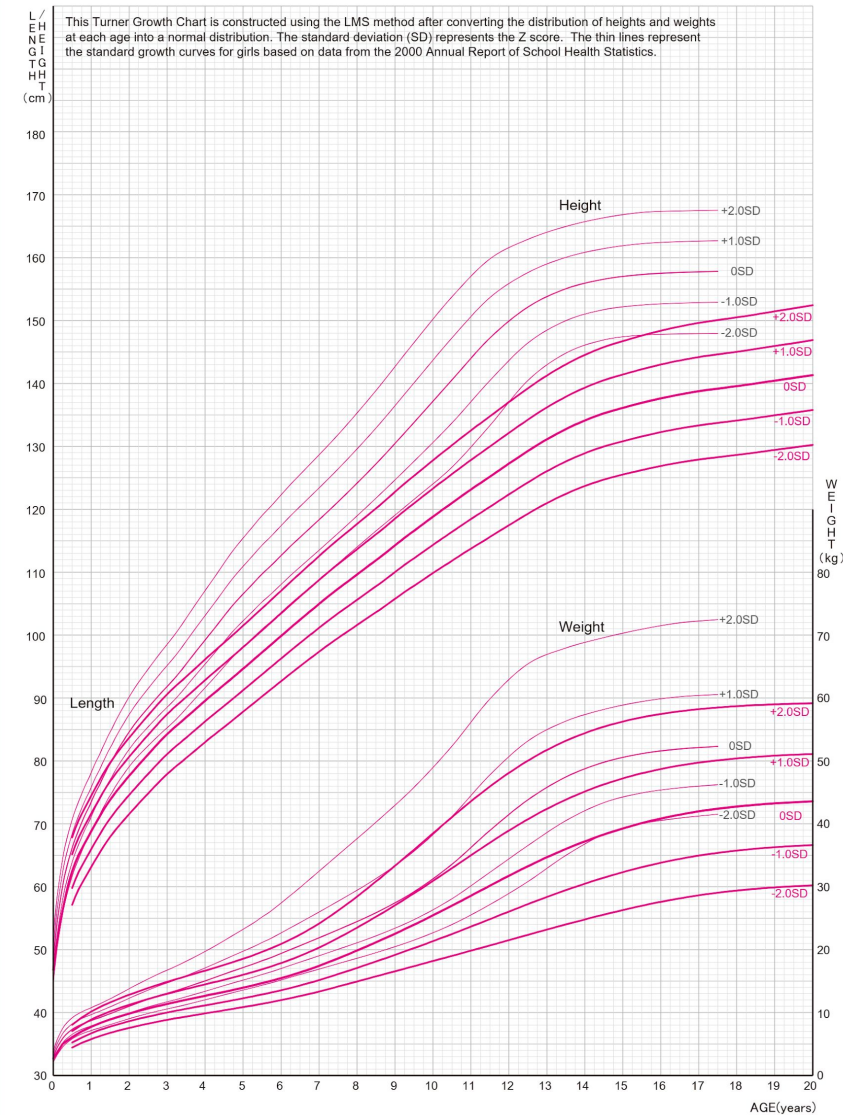
Name _____

Record _____



Published October 2015.
Source: Zemel BS, Pipan M, Stallings VA, Hall W, Schgadt K, Freedman DS, Thorpe P. Growth Charts for Children with Down Syndrome in the U.S. Pediatrics, 2015.
CS260242-8

Growth Chart for Girls with Turner syndrome (0-20yrs)

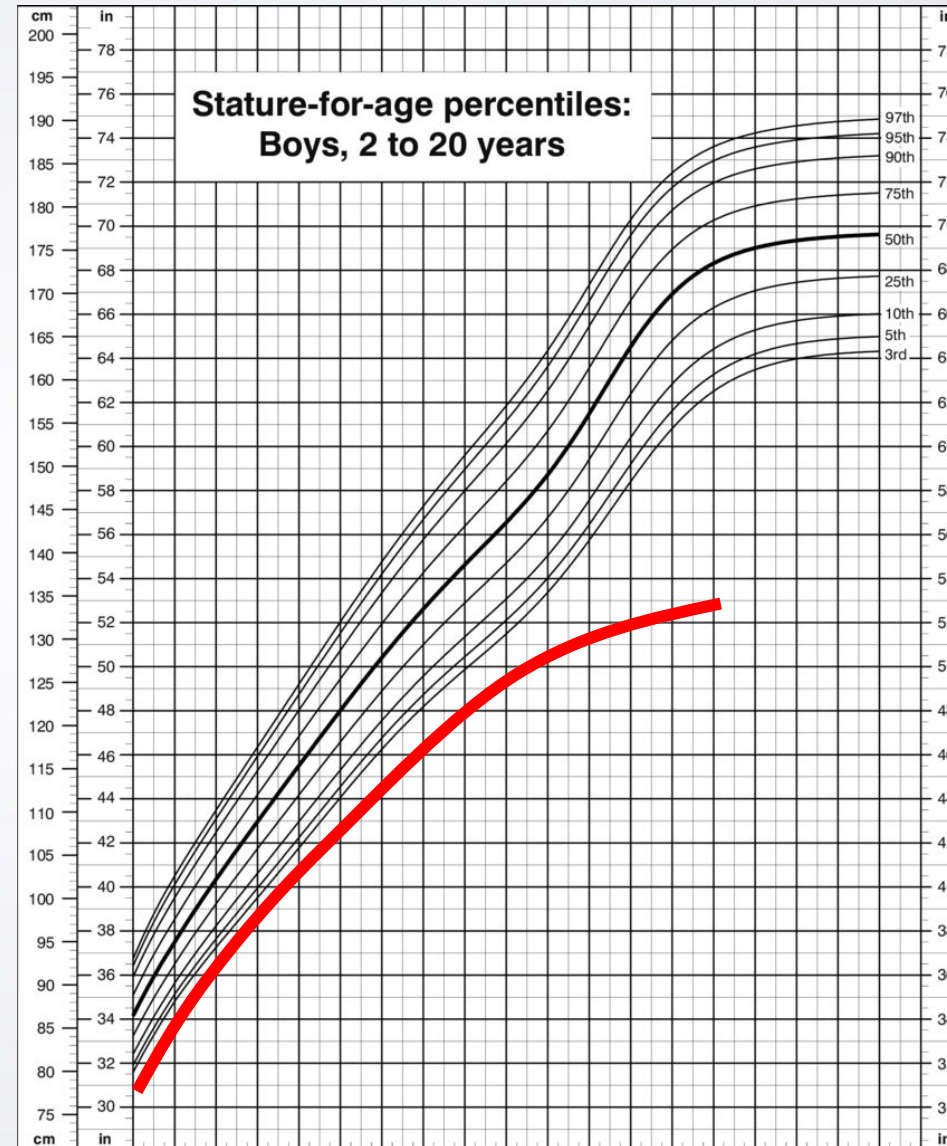


Source: T Isojima, S Yokoya, J Ito, Y Naiki, R Horikawa, T Tanaka Clin Pediatr Endocrinol 19:69-82, 2010

© The Japanese Society for Pediatric Endocrinology

SHORT CHILD #4

Typical look of chromosomal
short stature curve
(Bone age = chronological age)



Tall stature

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AlAhsa الصحي
Health Cluster

هضي

Dr. Majdi AlJasim



Overview

Tall stature is defined as a height more than two standard deviations above the mean for age (greater than the 97th percentile) or projected height more than two standard deviations from the mid-parental height.



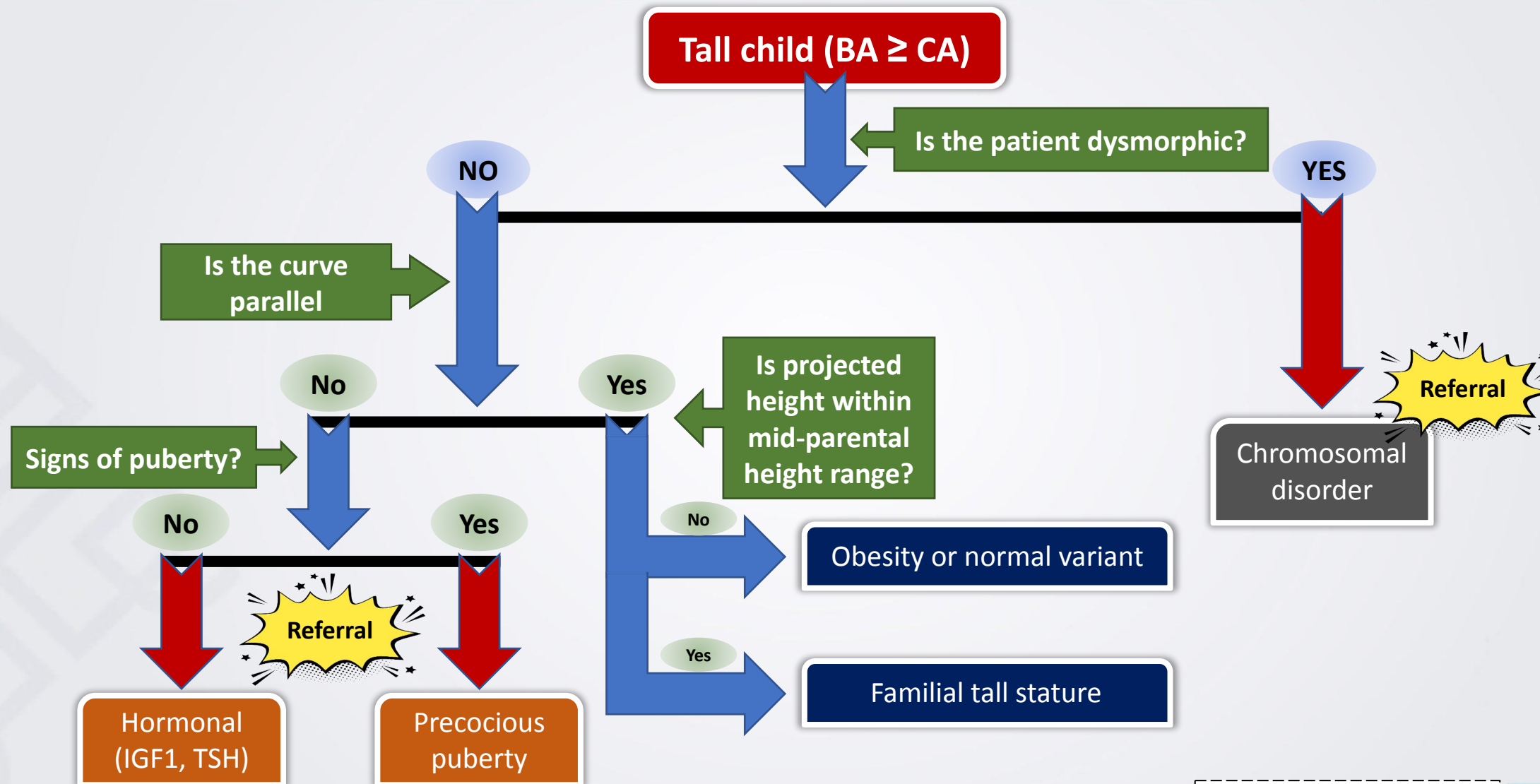
History and physical examination findings should guide further evaluation for pathologic causes of short and tall stature.



Mid-parental height growth velocity should be calculated to evaluate a child's growth vs. potential height.

Children with tall stature are much less likely to be referred to subspecialty care.

Tall stature evaluation algorithm



BA: Bone age

CA: Chronological age

TALL CHILD #1

Ghadeer is a 17 year old girl who has been overweight “for as long as she can remember.” and taller than her other girls-classmates.

Her family history is positive for obesity on both the paternal and maternal sides of the family.

Her father is 165 cm height, and her mother is 150 cm height.

Her dietary history is notable for bad eating habits and skipping meals; she has a high intake of fat and concentrated sweets. She has regular menses.

Her breast and pubic hair development are Tanner V. Her bone age is normal for age.

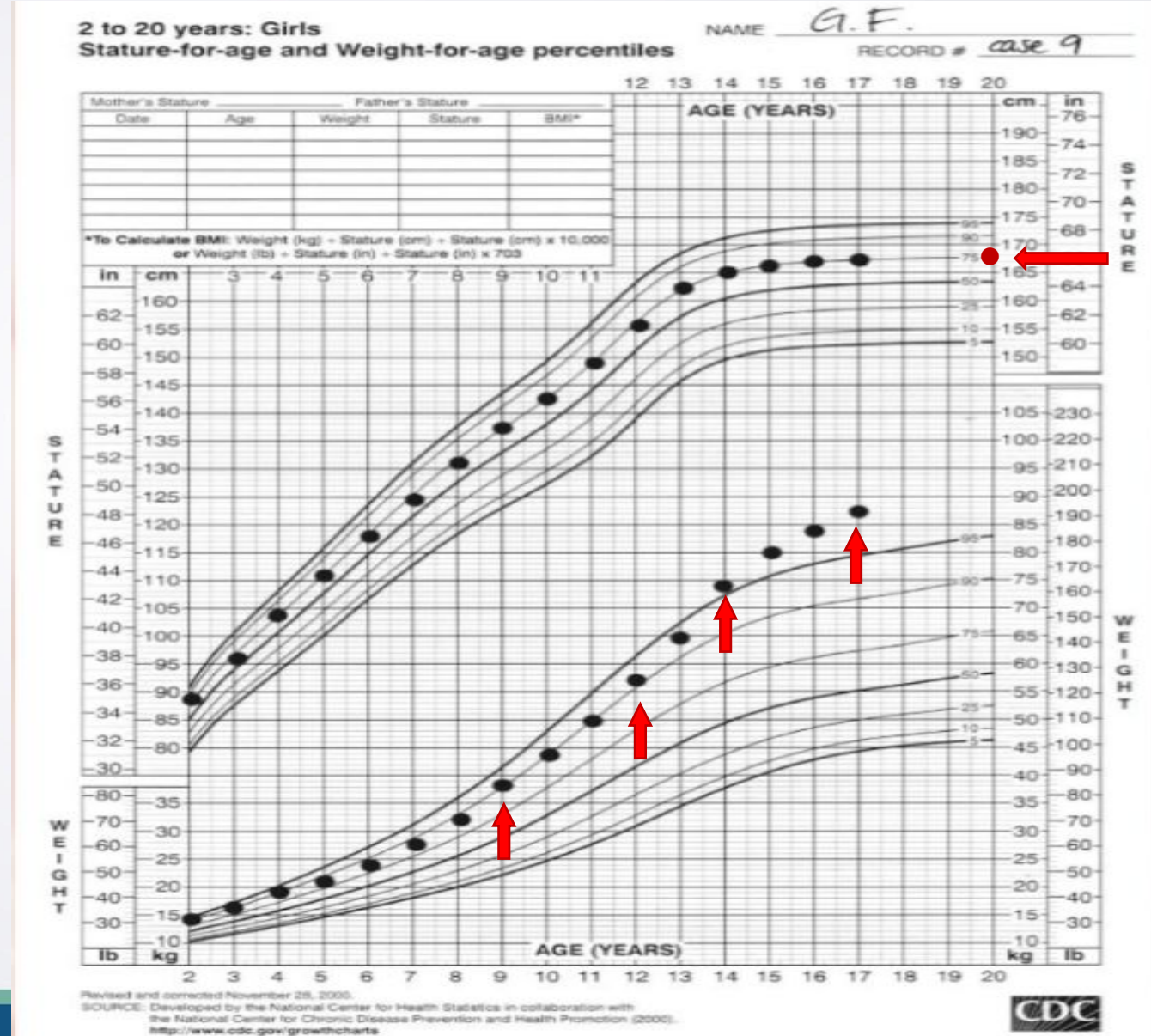
How are you going to proceed?



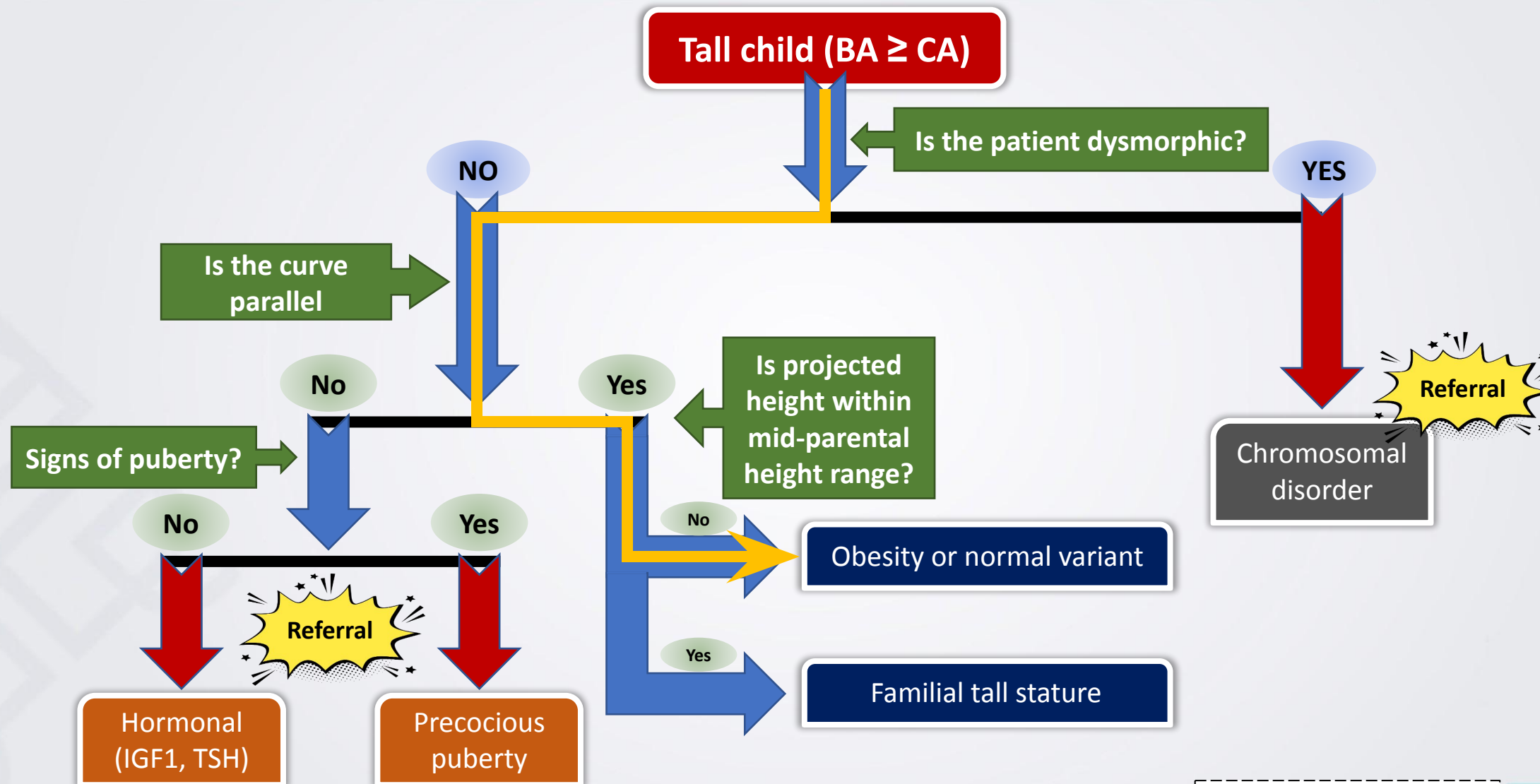
TALL CHILD #1



- The measured father height is 165 cm
- The measured mother height is 150 cm
- The height curve is parallel to other centiles.
- Projected height is 168 cm
- Mid-parental height is 151 cm
- The accepted range is (141 – 161)
- The projected height is **ABOVE** the range.
- Bone age is normal.
- Current weight crosses > 2 centiles (chronic case) and is above the upper centile.



TALL CHILD #1



BA: Bone age

CA: Chronological age

Obesity and tall stature

Characterized by:

- Body mass index is $> 95^{\text{th}}$ percentile.
- ***Slightly*** early onset of puberty.
- ***Modest*** tall stature.
- ***Normal*** to ***minimal*** advanced bone age.

Management:

- For height: reassurance.
- For weight: initially, dietary and nutritional consultation.

TALL CHILD #2

Amal is a 4 year and 9 months old girl who developed breast buds at age 3 year and 10 months.

Height acceleration was noted from the age of 4 years.

Her father is 165 cm height, and her mother is 150 cm height.

Pubic hair development and apocrine axillary odor were noted at age 4 years and 6 months. Her bone age is advanced for her age.

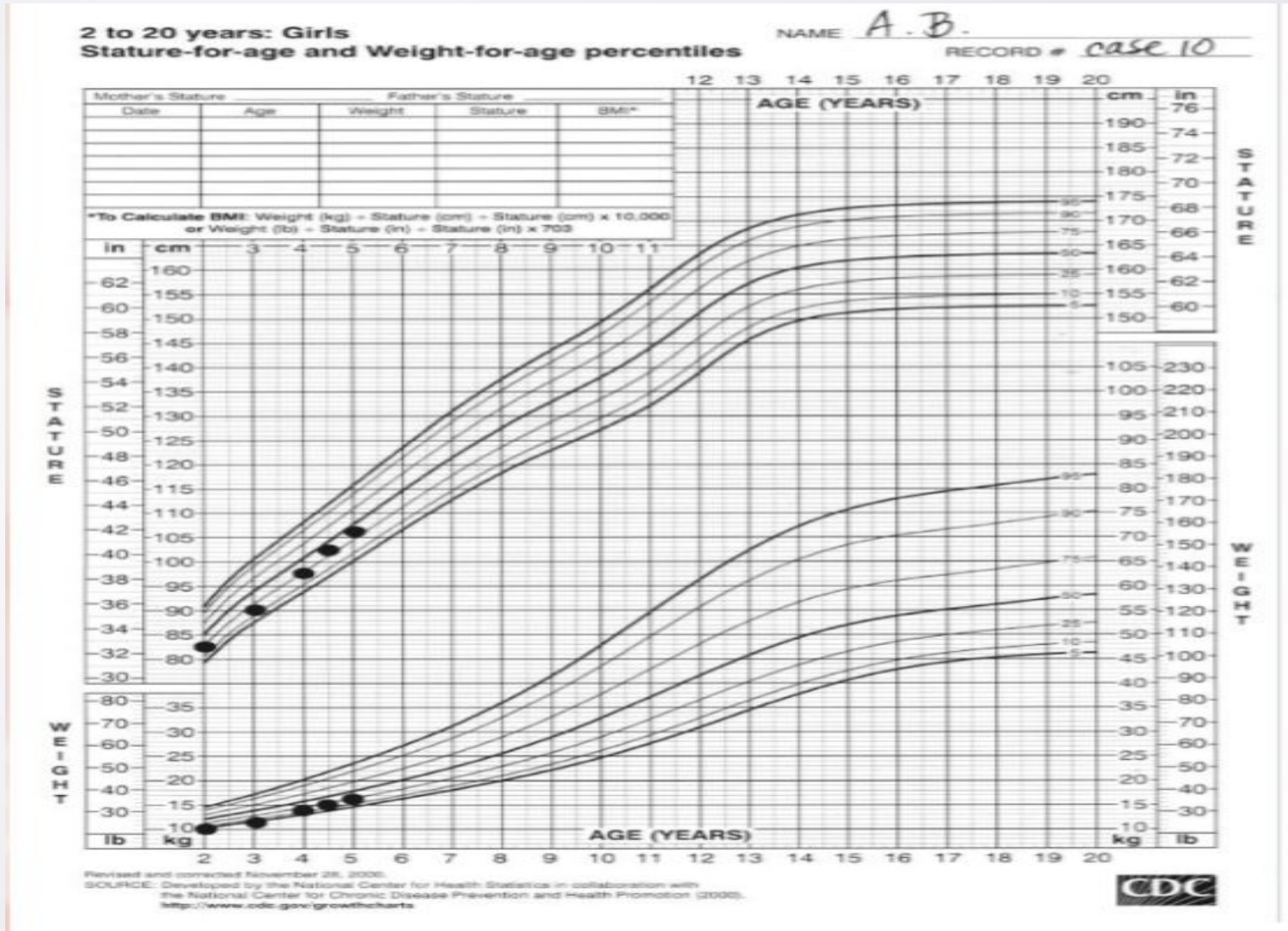
How are you going to proceed?



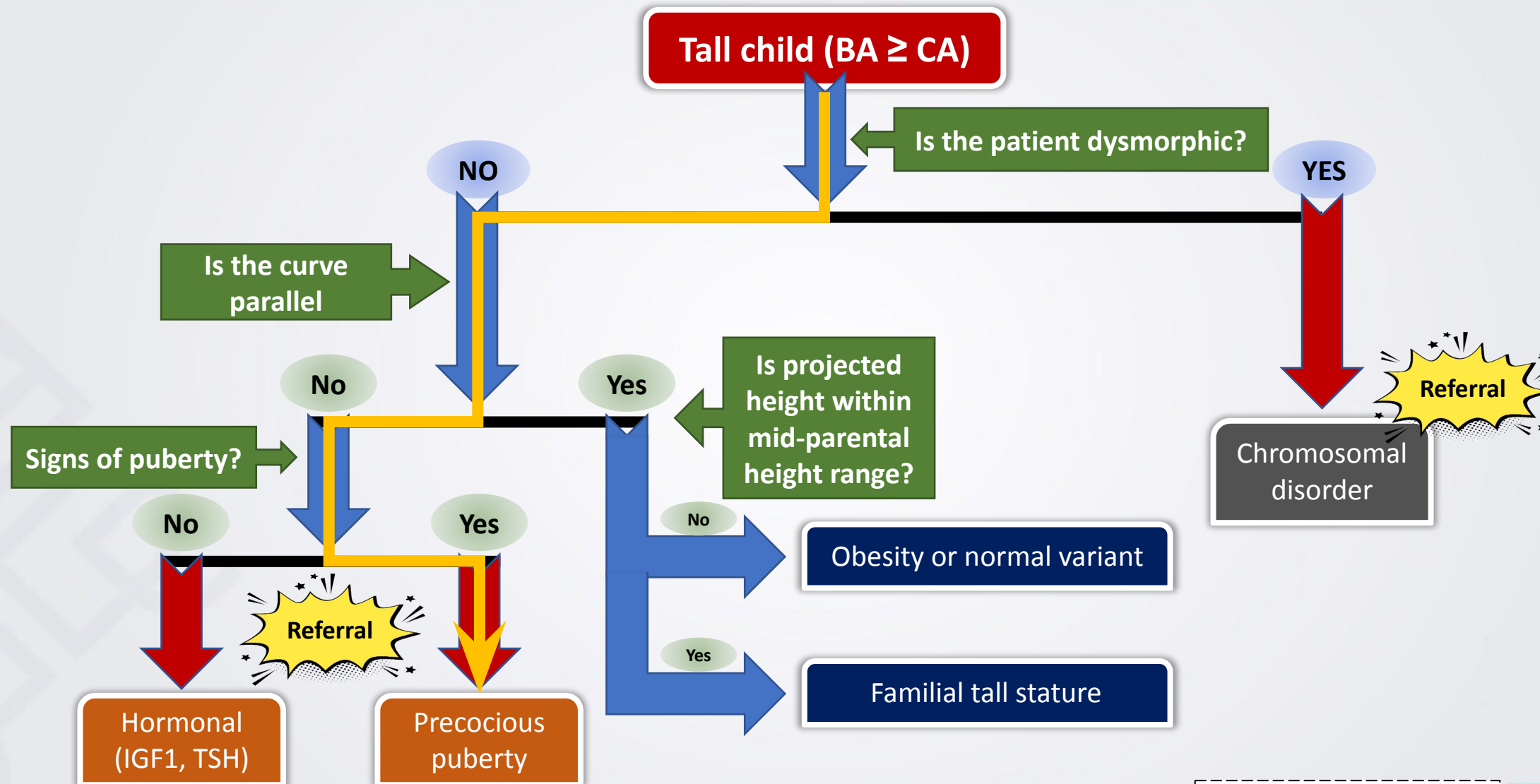
TALL CHILD #2



- The measured father height is 165 cm
- The measured mother height is 150 cm
- Mid-parental height is 151 cm
- Bone age is advanced.
- Development of puberty signs at early 4 years.
- The height curve is **NOT** parallel to other centiles.
- Projected height can **NOT** be plot because of un-parallel curve



TALL CHILD #2



BA: Bone age

CA: Chronological age

Precocious puberty

It is the appearance of secondary sexual characteristic's in

- Girls before 8 years of age.
- Boys before 9 years of age.

Bone age is generally advanced relative to chronologic age in precocious puberty.

Common causes:

- Idiopathic (80%)
- CNS lesions.
- Primary hypothyroidism.
- Ovarian cyst / gonadal tumors.

TALL CHILD #3

Salem is an 18 years old male presented to the clinic concerning about his weird looking chest cage.

His physical exam is remarkable for:

Tall stature (210 cm), thin, pectus carinatum chest deformity, arachnodactyly, increased arm span/height, malar hypoplasia, retrognathia, grade 3 pansystolic murmur, and oral high arched palate.

His father is 170 cm height, and his mother is 160 cm height.

His genital and pubic hair development is Tanner V, and bone age is appropriate for his age.

How are you going to proceed?



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 Al-Ahsa Health Cluster
 إدارة الرعاية الصحية الأولية



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

NAME _____ RECORD # _____

Mother's Stature		Father's Stature		
Date	Age	Weight	Stature	BMI*

*To Calculate BMI: $\text{Weight (kg)} \div \text{Stature (cm)} \div \text{Stature (cm)} \times 10,000$
or $\text{Weight (lb)} \div \text{Stature (in)} \div \text{Stature (in)} \times 703$

STATURE

WEIGHT

AGE (YEARS)

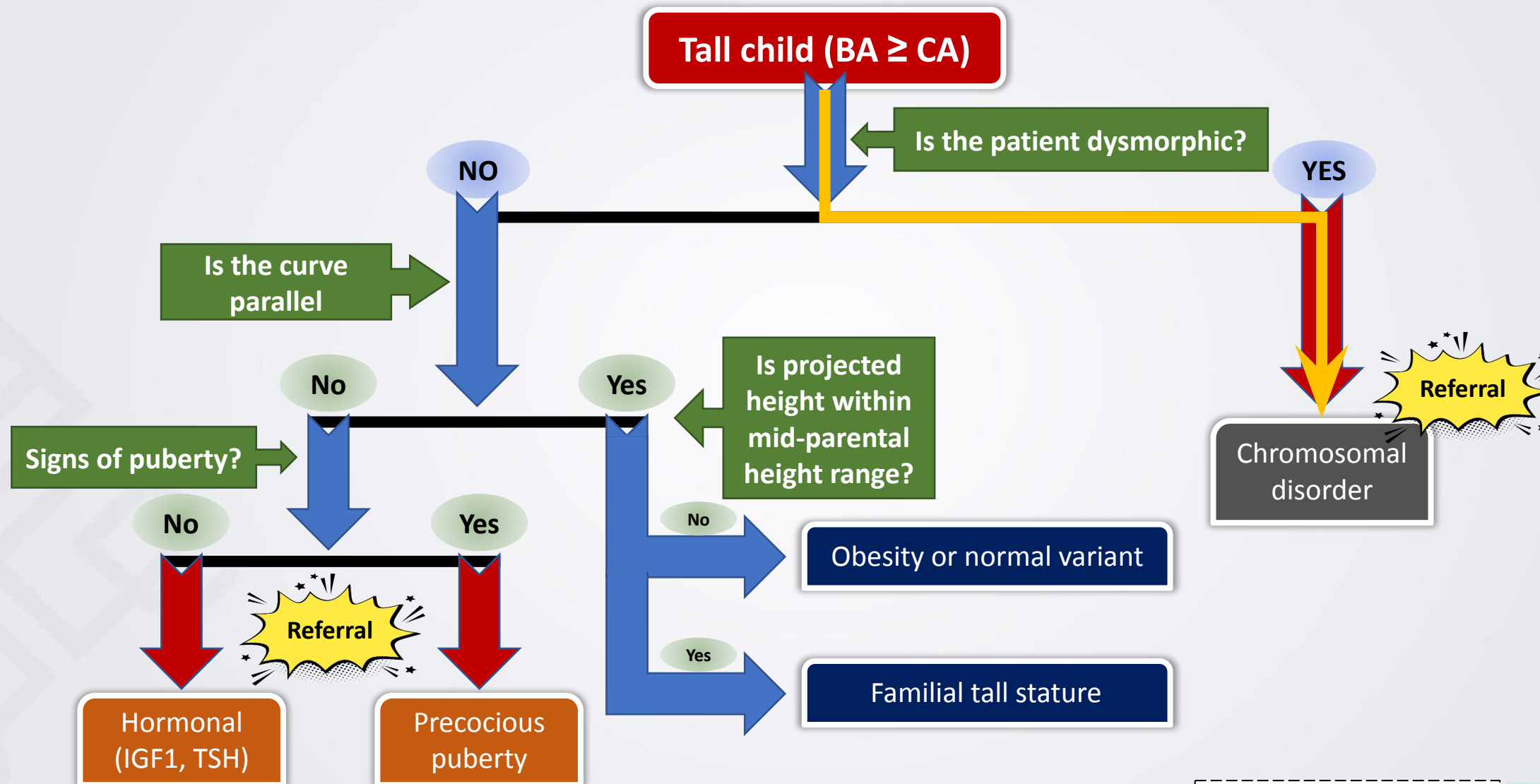
cm **in**

kg **lb**

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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TALL CHILD #3



BA: Bone age

CA: Chronological age

Chromosomal disorders tall stature

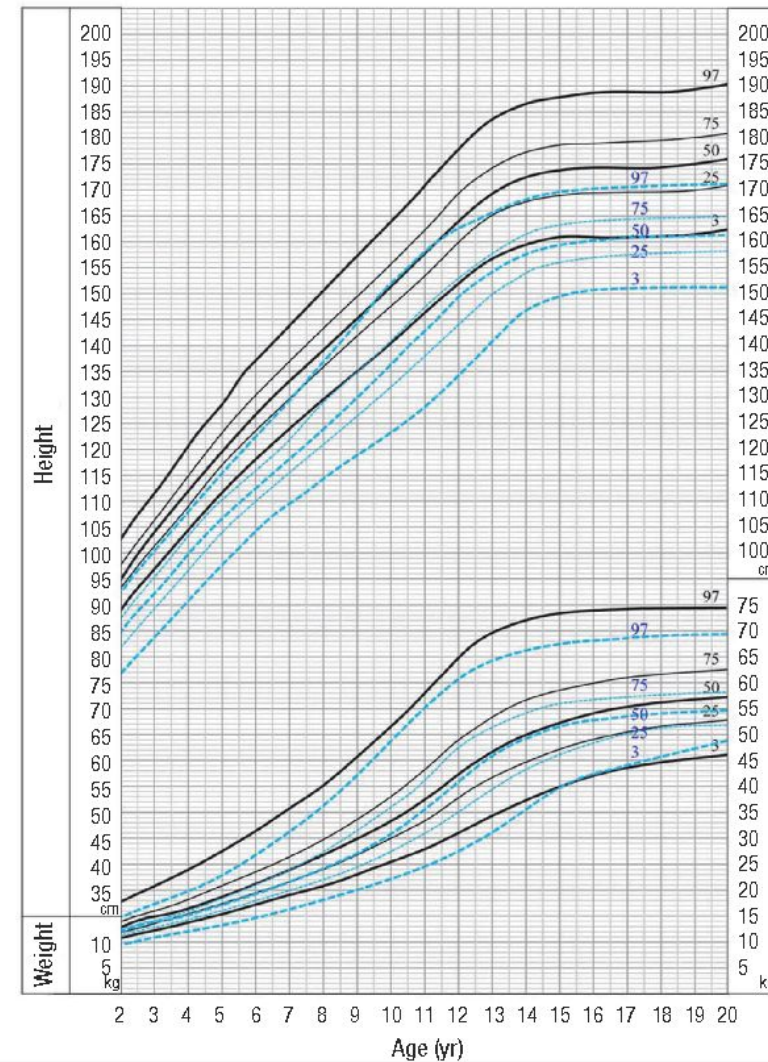
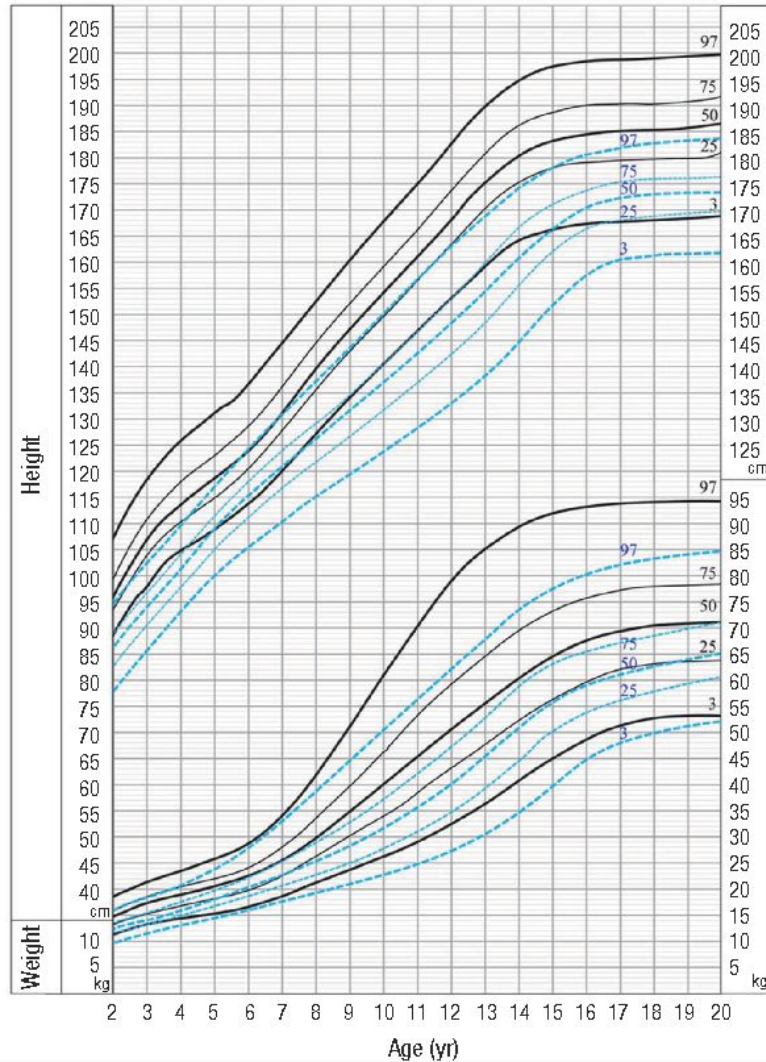
The most common causes are:

- Marfan syndrome (as in this case scenario).
- Klinefelter syndrome (XXY).
- Fragile X syndrome.
- Weaver syndrome.

Investigation: Karyotype and genetic mutation analysis.

Growth chart consideration: Replot the measurements on the specialized growth chart for the syndrome.

Chromosomal disorders tall stature



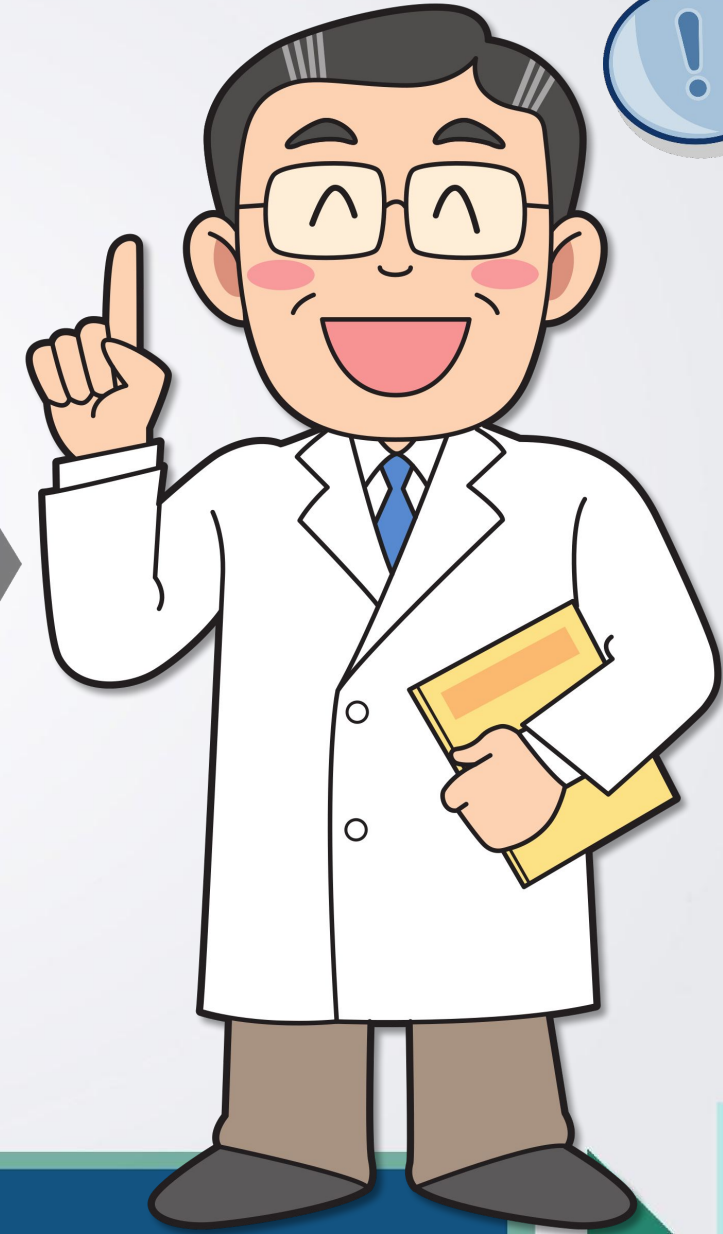
Special growth curve of patients with Marfan syndrome. (A) Male. (B) Female

Bottom line!!



Remember to...

Share management with pediatrics subspecialty for any child with dysmorphic feature or un-parallel growth curve.





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AlAhsa الصحي
Health Cluster



Dr. Majdi AlJasim

وَقَدْ عَلِمْنَا

قَالُوا سُبْحَانَكَ
لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

تجمع الأحساء
AlAhsa الصحي
Health Cluster



Any
Questions



Thank
you

