Child's Healthcare

Growth and development

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KEY MILESTONES IN CHILDHOOD DEVELOPMENT

Social workers who work with children understand the key milestones in their development.

COGNITIVE	SOCIAL & EMOTIONAL	SPEECH & LANGUAGE	FINE MOTOR SKILLS	GROSS MOTOR SKILLS
Learning and problem solving	Interacting with others	Comprehending language and speaking	Using small muscles to pick up and hold	Using large muscles to sit, walk, and move

- **Growth and development are the two most important biological processes of childhood.**
- **Growth and development go hand in hand.**

GROWTH: **an increase in the <u>physical size</u> of the body as a whole or any of its parts Associated with increase in cell number and/or cell size. *Quantitative* (kg, cm).**

DEVELOPMENT: **Acquiring functions and skills that involves motor, social, emotional and intellectual abilities of the child. Mainly related to the nervous system (Qualitative) (skills).**

DEFINITIONS

Embryo at 8 weeks Fetus at 12 weeks 16 20 24 28 32 36 40

Stages of growth and development:

A. Intrauterine stage:

This stage begins with the fertilization of the ovum and concludes with birth. It consists of two distinct periods:

Two periods.

1. **Embryonic period:** up to end of week 9 (period of organogenesis). (exposure to any adverse factors can result in congenital anomalies or miscarriage).

2. **Foetal period :** week 10- birth. during this period the mother provides the foetus through the placenta with body stores of nutrients and immunoglobulins. Still birth, LBW , and preterm labour can occur in this period.

Stages of growth and development:

B. Extrauterine stage:

1. At birth

Body Weight: 2.5-4.2 kg

Respiratory Rate (RR): 40-50/min

Pulse: 120-160/min

2. Neonatal period (28 days)

3. Infancy period (1st year of life)

4. Childhood period

5. Adolescence period

Factors affecting growth and development

- **A) genetic factors:**

These include: Hereditary factors, Biological or Constitutional factors.

Ex: ethnicity, size of the parents particularly of the mother, the body structure, sex: boys tend to be taller and heavier than girls.

These factors are fixed, hard to modify and influence growth from conception to adulthood.

- **B) environmental factors**

These include:

1. **Nutrition status**
2. **Infections during infancy and childhood** (acute and chronic)
3. **Hormonal influences:** Growth hormone and thyroxin deficiency and sex hormone deficiency during puberty affects growth.
4. **Lack of stimuli and Emotional deprivation, anxiety…**

Areas of Development
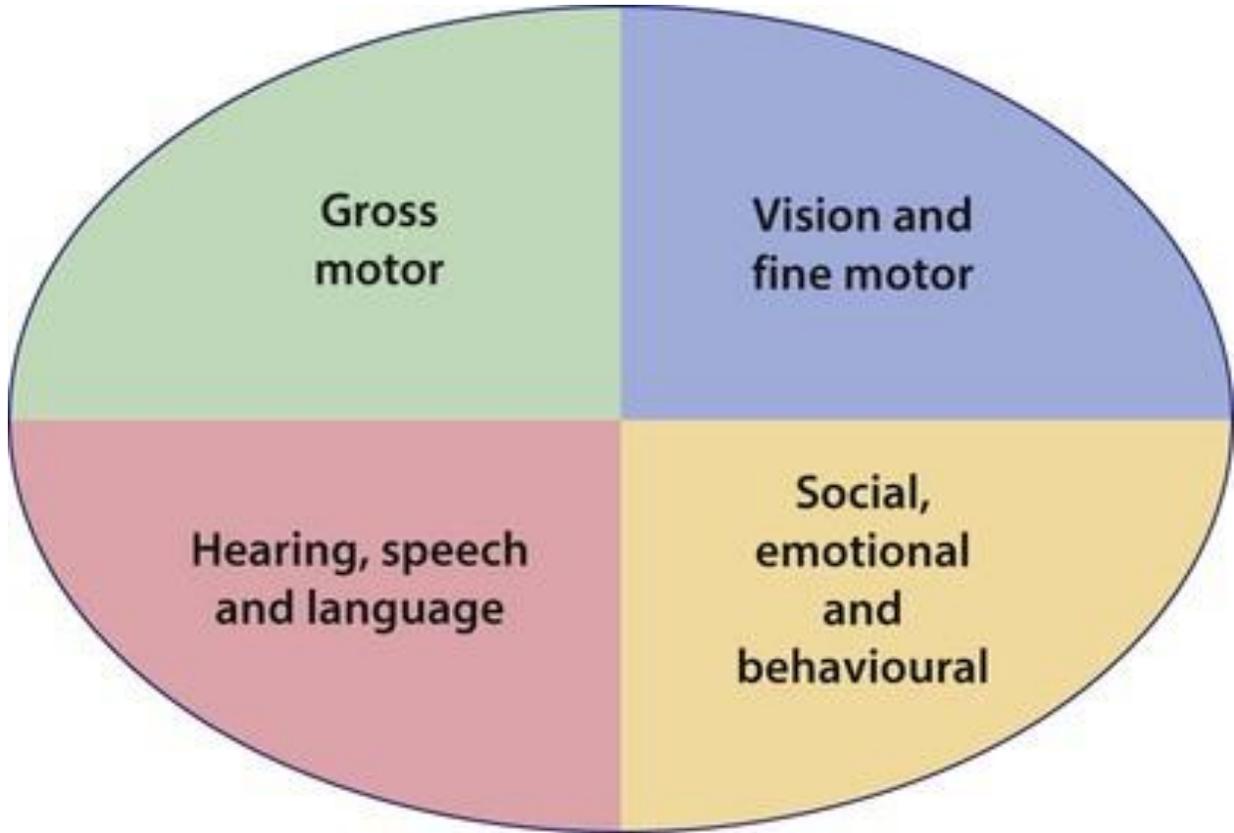
S. N.	Developmental areas	Examples
1	Gross motor	Sitting, walking, running, climbing & jumping etc
2	Fine motor	Hand skills like writing, buttoning, holding objects and visual development
3	Cognitive development	Thinking, decision making, recalling, learning of maths etc.,
4	Speech, Language and hearing development	Speaking, understanding language, replying and responding by verbal and non verbal communication
5	Personal social behavior development	Feeding, toileting, dressing, establishing and maintaining social relationship.

Course of development

- Development depends upon the maturation and myelination of the nervous system.
- The sequence of development is the same for all children, but the rate of development varies from child to child.
- The direction of development is cephalocaudal. Proximodistal. And from general to specific.
- There are developmental landmarks (milestones) that should be checked.

Cephalocaudal head to foot

Proximodist midline to extremities
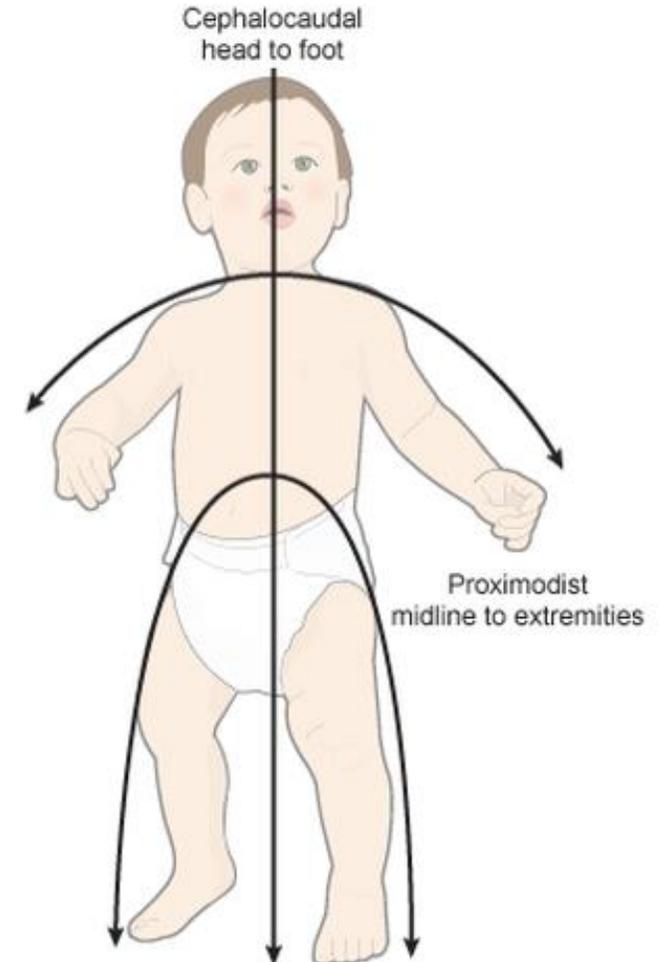
Growth monitoring

- Growth monitoring is the *best available indicator* of the overall nutritional status of the child. (Changes in growth patterns, including weight, height, and head circumference, can reflect the adequacy of nutrition.)
- Growth monitoring can identify high-risk infants and children, who need attention.(Slowed or abnormal growth may indicate nutritional deficiencies or underlying health issues that require attention.)
- Can determine if there are growth abnormalities that point to the presence of an underlying disease
- To prevent nutritional disorders and the morbidity and mortality that accompany them.

Assessment of growth

• The assessment of growth may be longitudinal or cross sectional.

• **Longitudinal** tracking the growth of an individual (same child) or a same group over an extended period (regular times)

• **Cross sectional** This involves comparing the growth of different individuals or groups at a single point in time. (ex. large number of children of same age at one time)

Assessment of growth

Basic growth assessment involves :

Anthropometry: It is the most common method. It includes:

- **Weight**
- **Height/Length**
- **Head Circumference**
- **Mid-Arm Circumference and**
- **Chest Circumference**

Weight

The most used measure is the *weight for age* (by using the growth chart).

It is a very sensitive measure of growth, easily done, with a high level of accuracy.

Average weight gain during the *first year of life is about 750 g / month* in *the first four months*, 500 g / month in the second four months and 250 g / month in the third four months.

RULE OF 👍

Wt. loss for the first few days: 5-10% of birth weight -Return of BWT at 7-10 days of age.

The infant can double his BWT by 4-5 months, and triple by the end of first year and quadruple by the age of two years.

Weighing Method : Baby Undressed/Minimal light clothing: electronic type of weighing scale

Assessment of growth

In growth monitoring, the weight of the child is plotted on the growth chart at:

Monthly intervals during the first year of life,

Every two months during the second year of life,

Every three months thereafter up to five years of age.
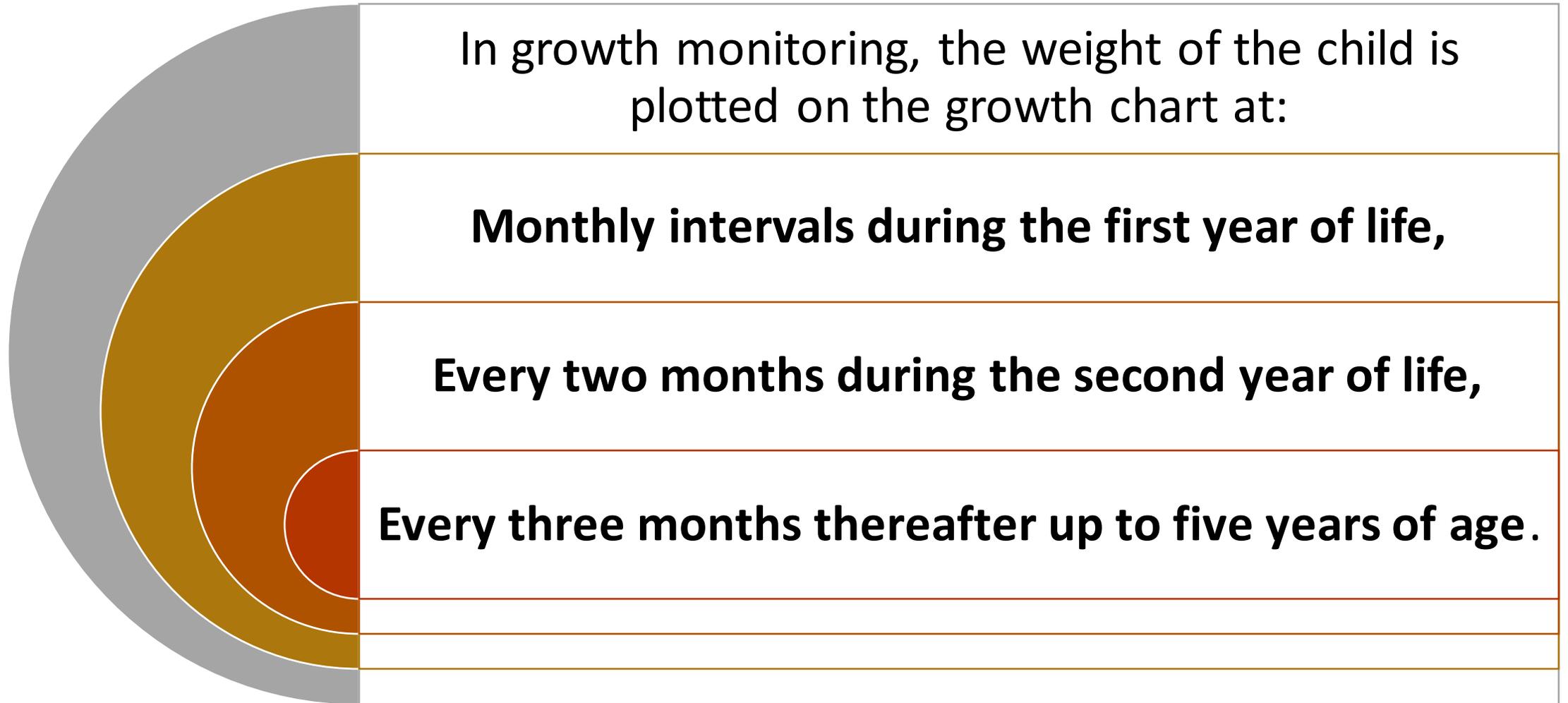
HEIGHT/LENGTH:

<2 years: length

- Measured in supine position

- Total Length
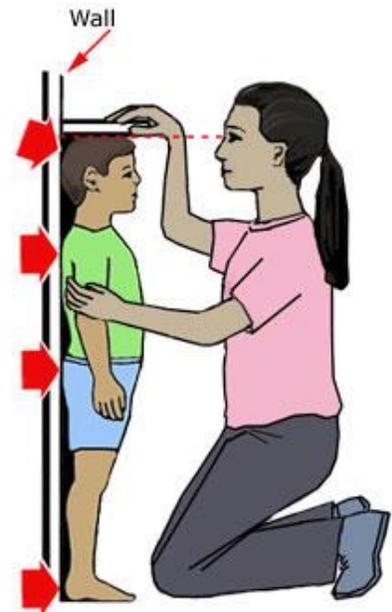 - Upper – Head-Pubis
  - Lower – Pubis - Toe

  U/L : 1.7 -birth
  1.0 -7year

Upper segment

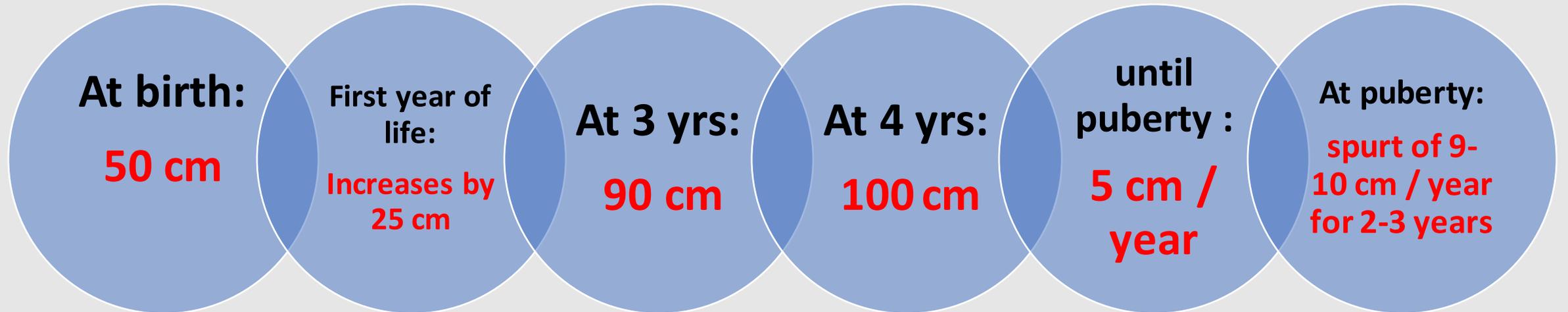Pubic symphysis

Lower segment
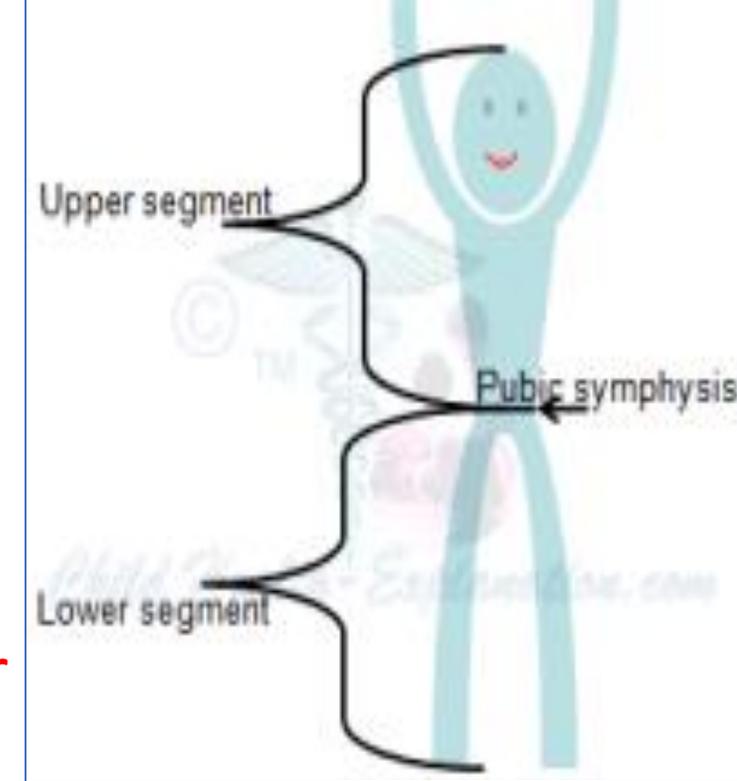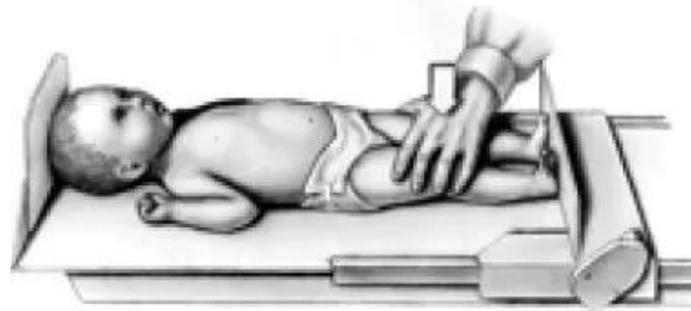
>2 years: Height

- Measured in upright standing posture by stadiometer
- Vertical distance between head and heel of foot
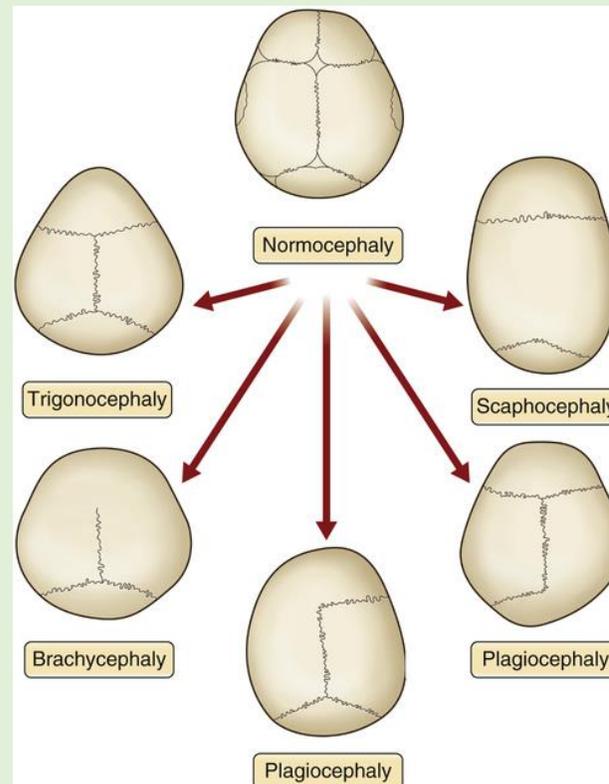- Predicted Adult Height (cm)=(Age in years×6)+77

Wall

HEIGTH/LENGTH:

At birth:
50 cm

First year of life:
Increases by 25 cm

At 3 yrs:
90 cm

At 4 yrs:
100 cm

until puberty :
5 cm / year

At puberty:
spurt of 9-10 cm / year for 2-3 years

HEAD CIRCUMFERENCE:

Measurement of head circumference

- HEAD CIRCUMFERENCE:
- It is an estimate of brain growth
- Most useful in 2 years of life
- Method: Use a non-stretchable tape on occipital protuberance to the supra-orbital ridges on forehead .
- Clinical correlate: Microcephaly , Macrocephaly, Cranisynostosis

At Birth: 35 cm, At 1 yr: 47 cm

Normocephaly

Trigonocephaly

Scaphocephaly

Brachycephaly

Plagiocephaly

Plagiocephaly

Normal head size   Microcephaly

CHEST CIRCUMFERENCE:

- It is clinically important in the 5th year of life. Heart and lung development and nutrition.

- Method:

Measure at the level of nipples midway between expiration and inspiration by Cross-tape method.

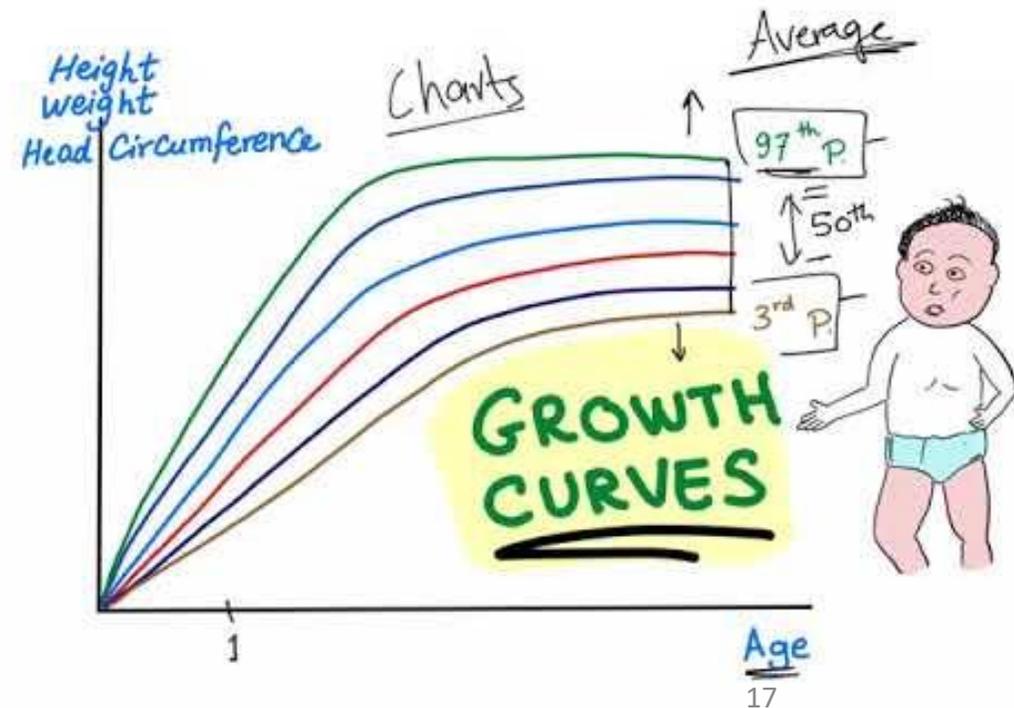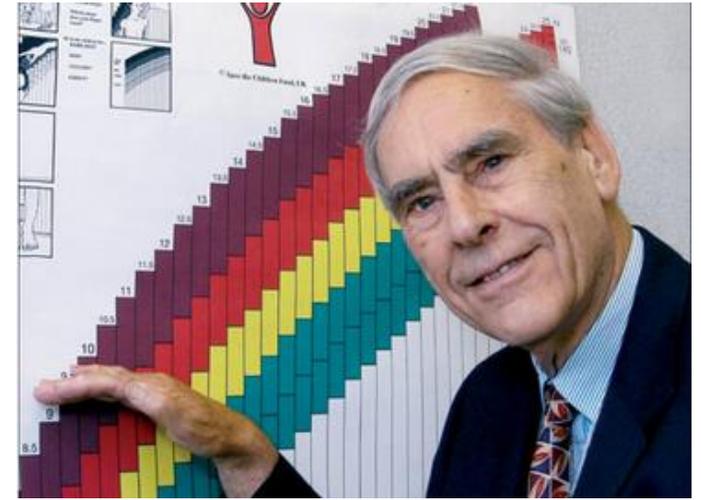**At Birth CC < HC**

At 1 yr: HC=CC

Later: CC>HC

Growth chart:

Growth charts are visible display of child's physical growth and development.

It was first designed by David Morley and was later modified by WHO.

- Growth chart is the simplest, inexpensive, effective and convenient tool for monitoring the child's health & nutritional status → changes can be interpreted over time.

Description Of the chart :

- The WHO growth charts <u>use the growth of breastfed infants as the norm for growth</u>.
- The WHO growth charts are <u>international standards</u> that show how healthy children should grow.
- The WHO growth charts are <u>global and for all children</u>, should be used with all children <u>up to age 2 years, regardless of type of feeding</u>.

The WHO charts support the theory that optimal nutrition + optimal environment + optimal care = optimal growth regardless of time, place or ethnicity

Indicators

❖ **The reference lines on the WHO growth charts are either <u>percentile lines</u> or <u>z-scores</u>**
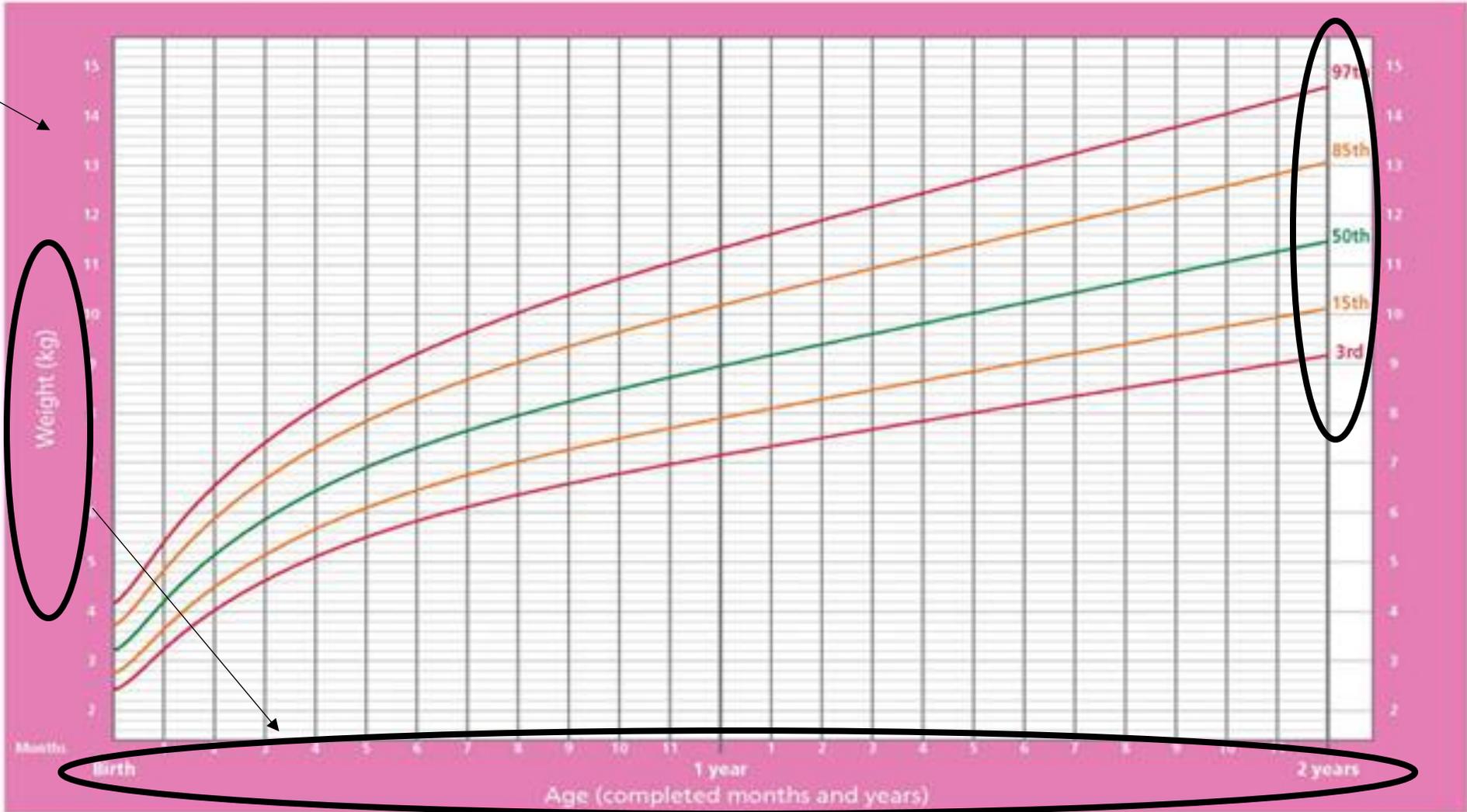
❖ **There are separate charts for *boys* and *girls***

<u>Growth indicators are used to assess growth:</u>

➢ **Length/height-for-age**

➢ **Weight-for-age**

➢ **Weight-for-length/height**

➢ **BMI (body mass index)-for-age**
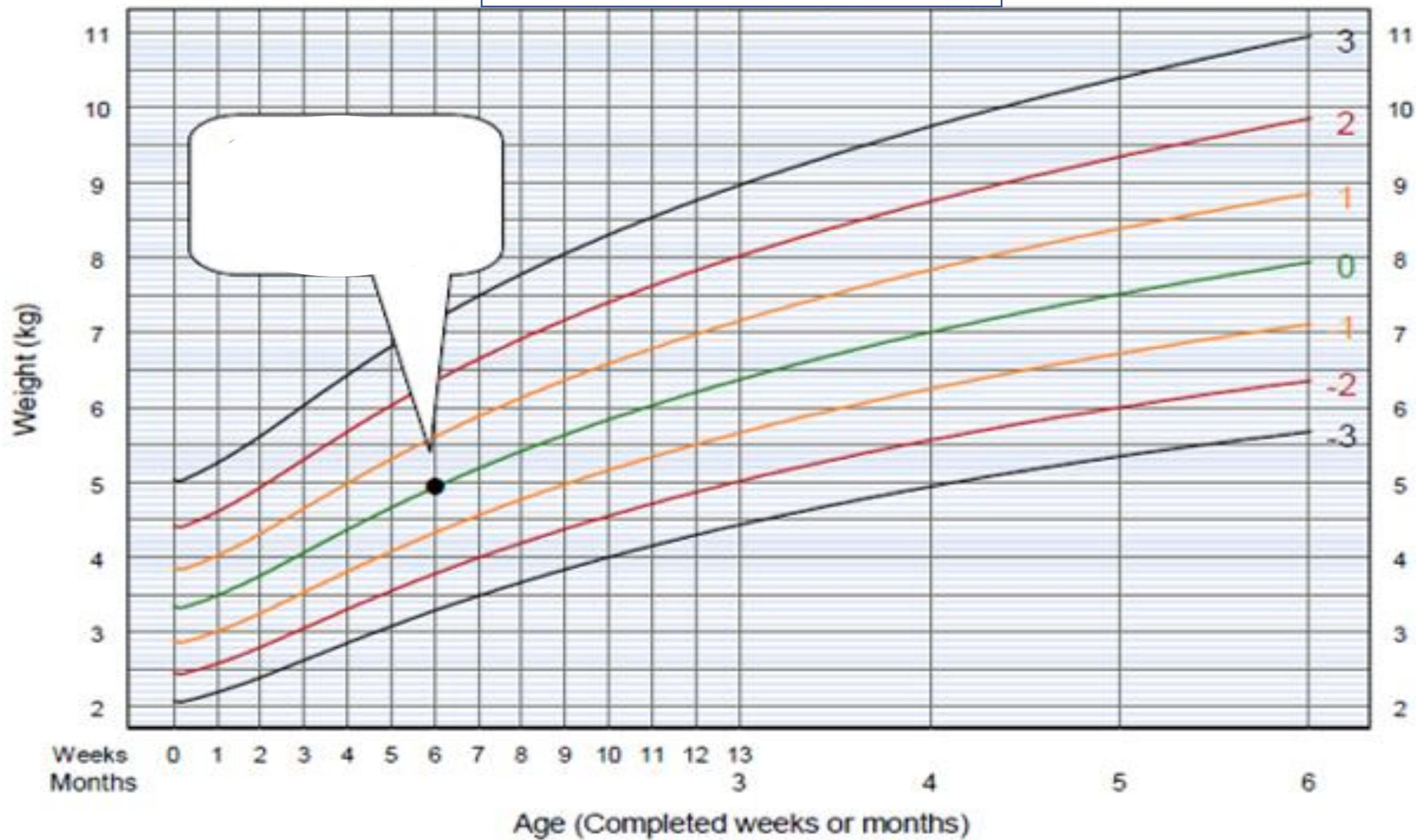
➢ **Head circumference for age**

➢ **Others.**

WHO GROWTH CHART

• X-axes show age. (completed age in months, or years)

• y-axes show length/height, weight, or BMI.

World Health Organization

Weight (kg)

97th
85th
50th
15th
3rd

Months | Birth | 1 year | 2 years
Age (completed months and years)

WHO Child Growth Standards

WHO Child Growth Standards
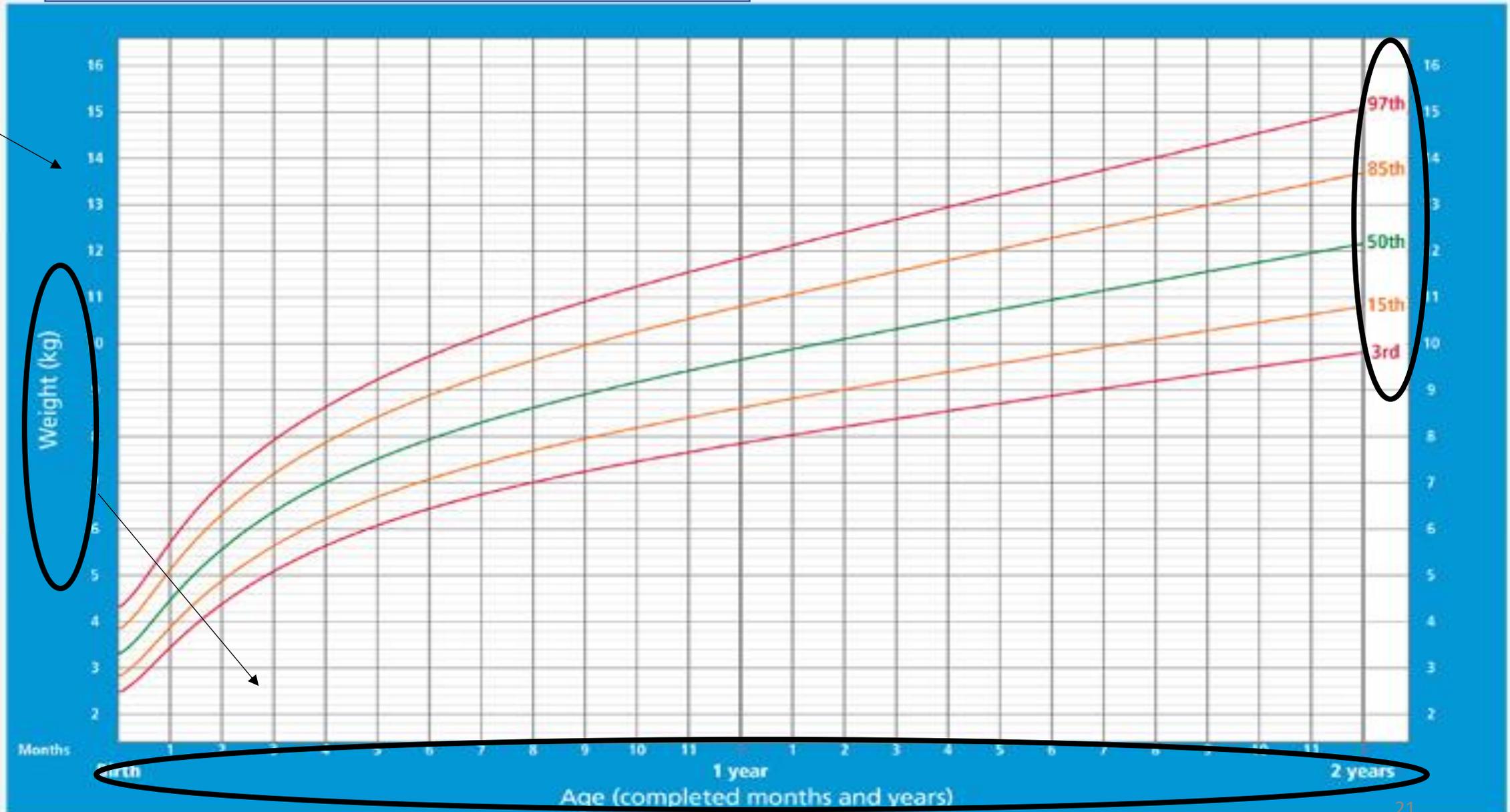
Weight-for-age

- Weight-for-age reflects body weight relative to the child's age on a given day. This indicator is used to assess whether a child is underweight or severely underweight, **but it is not used to classify a child as overweight or obese.**

- Because weight is relatively easily measured, this indicator is commonly used, but it cannot be relied upon in situations where the child's age cannot be accurately determined (e.g. refugee situations).

- **Note:** If a child has **oedema of both feet**, fluid retention increases the child's weight, masking what may actually be very low weight.

Length/height-for-age

This indicator can help identify children who are stunted (short) due to **prolonged undernutrition or repeated illness**. Children who are tall for their age can also be identified, but tallness is rarely a problem unless it is excessive and may reflect uncommon endocrine disorders.

weight-for-length/height

This indicator is especially useful in situations where children's ages are unknown (e.g. refugee situations).

low weight-for-height might indicate a child may be wasted or severely wasted. *Wasting is usually caused by a recent illness or food shortage that causes acute and severe weight loss*. These charts also help identify children with high weight-for-length/height who may be at risk of becoming overweight or obese.
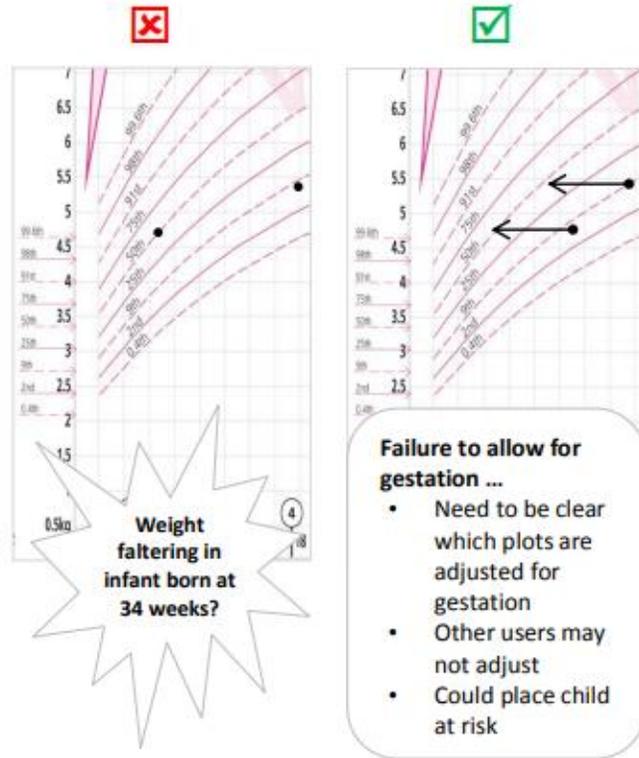
BMI-for-age

BMI-for-age is an indicator that is especially useful for screening for overweight and obesity.

Using the growth chart

The figure below shows how weight for a baby born at 34 weeks would be plotted. First work out how many weeks early this infant was, which is 40 minus the gestation at birth. For example a child born at 34 weeks is 40-34 = 6 weeks early.
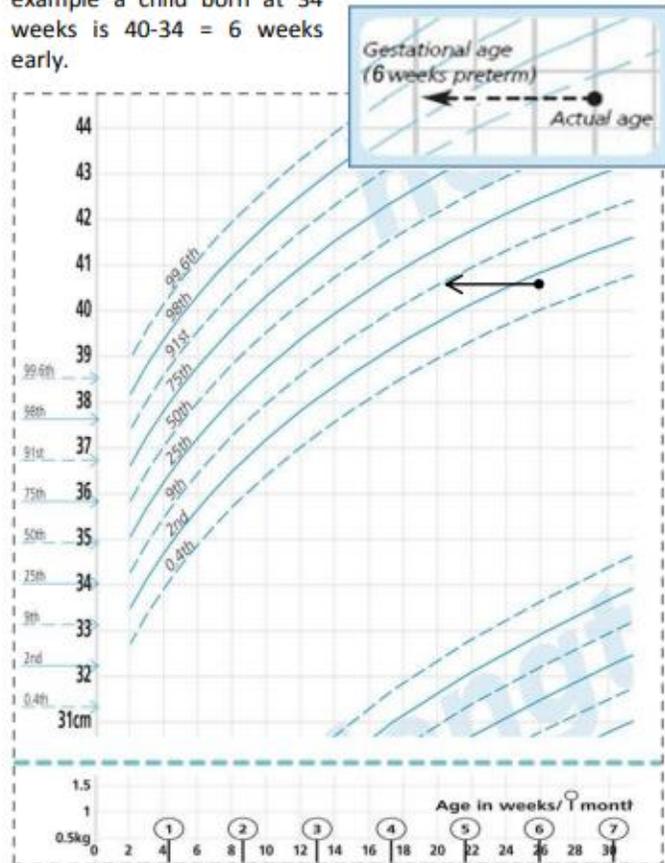
measurements it is fine to just plot at actual age for most infants, as long as you use the arrow drawn back for every 2nd or 3rd plot.
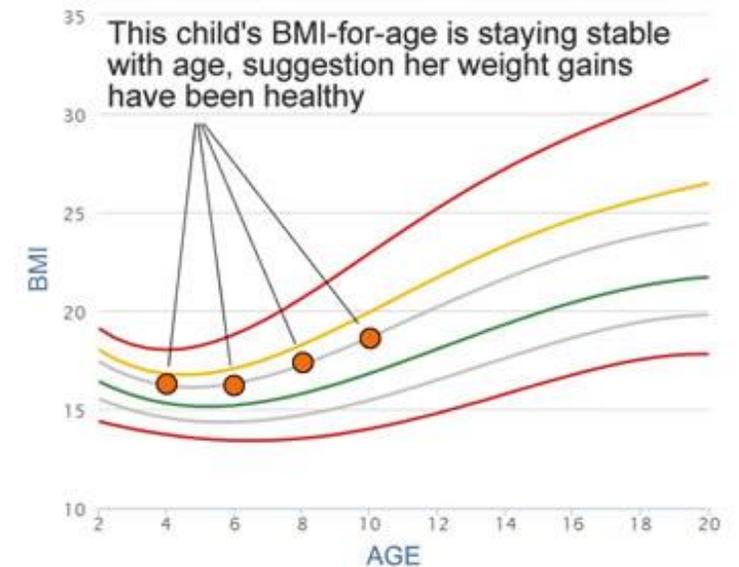

Growth in preterm infants

Failure to allow for gestation ...
- Need to be clear which plots are adjusted for gestation
- Other users may not adjust
- Could place child at risk

- Obtain accurate measurements
- **Adjust for prematurity** (Plot the corrected gestational age on growth charts rather than the chronological age.)
- Select the appropriate growth chart: Select the growth chart to use based on the age and sex of the child.
- Record data: Determine age **to the nearest month for infants and children up to 2 years** and **to the nearest 1/4-year for children above 2 years.**
- Enter the child's age, weight, and length or stature, immediately after taking the measurement.

Interpretation (z-score)

- The line labeled 0 on each chart represents the **median**.

- The other curved lines are **z-score lines**, which indicate distance from the average.

- Z-score lines on the growth charts are numbered positively (1, 2, 3) or negatively (-1, -2, -3).

- <u>The growth curve of a normally growing child will usually follow a track that is parallel to the median. The track may be above or below the median.</u>

This child's BMI-for-age is staying stable with age, suggestion her weight gains have been healthy

- When interpreting growth charts, the following situations, may indicate a problem or suggest risk:

- A plotted point that is far from the median in either direction

- A child's growth line crosses a z-score line (a sharp incline or decline in the child's growth line).

- The child's growth line remains flat (stagnation); i.e. there is no gain in weight or length/height.
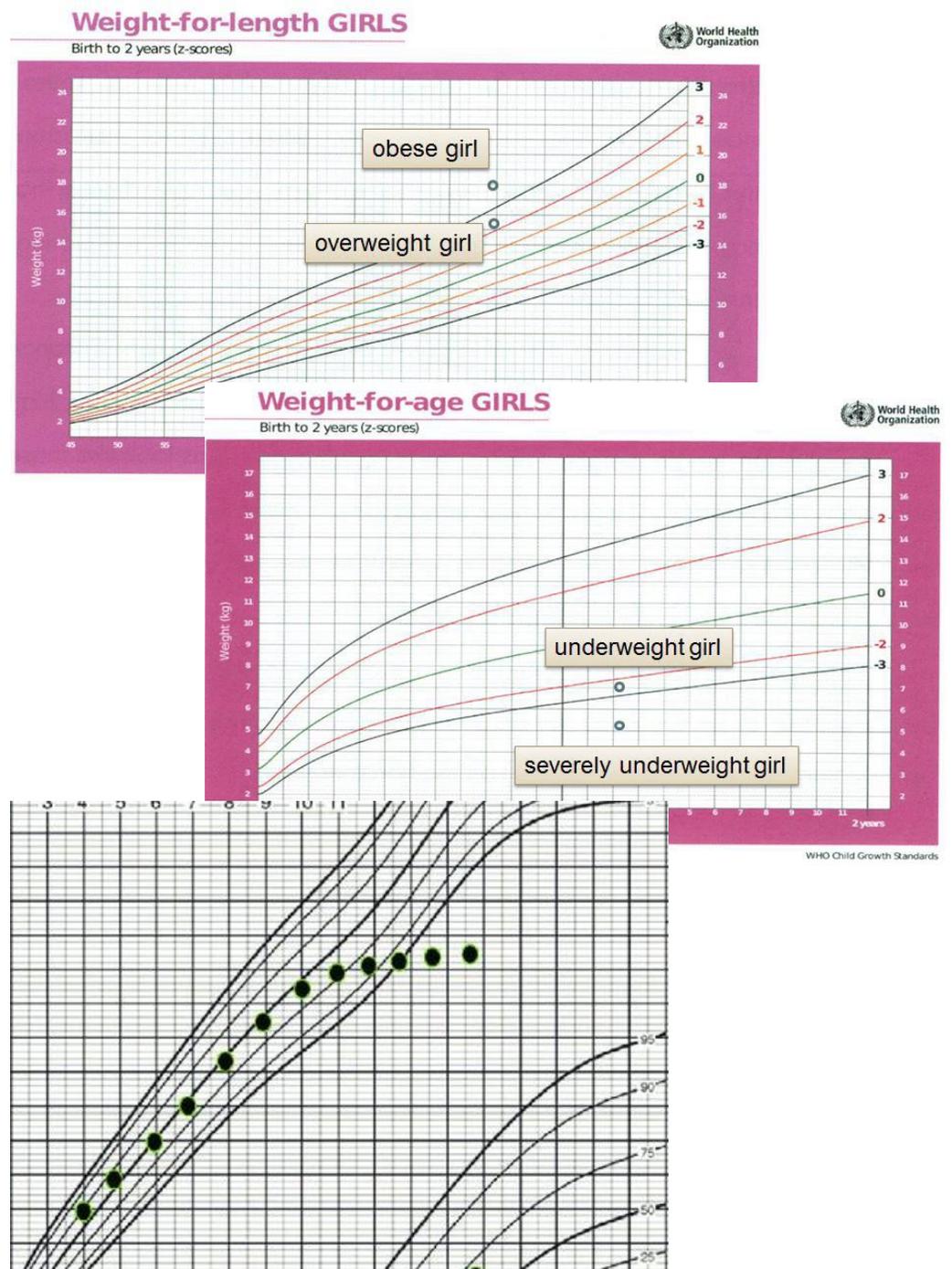
Identify growth problems from plotted points

Weight for-age chart :

A child whose weight-for age is below the line –2 is *underweight*.

Below –3 is severely underweight. Clinical signs of marasmus or kwashiorkor may be observed.

Length/height for-age chart :

- A child whose length-for age is below the line –2 is stunted.
- Below –3 is *severely stunted*.

Weight-for-length/height :

A child whose weight-for length/height is above the line 3 is **obese**.

Above 2 is **overweight**.

Above 1 shows **possible risk of overweight**.

Below the line –2 is **wasted**.

Below –3 is **severely wasted**. **Refer for urgent specialized care**.

BMI-for-age chart :

A child whose BMI for-age is above the line 3 is **obese**.

Above 2 is **overweight**.

Above 1 shows **possible risk of overweight**

To interpret the plotted graph

Z-score	Growth indicators			
	Length/height-for-age	Weight-for-age	Weight-for-length/height	BMI-for-age
Above 3	See note 1	See note 2	Obese	Obese
Above 2			Overweight	Overweight
Above 1			Possible risk of overweight (See note 3)	Possible risk of overweight (See note 3)
0 (median)				
Below −1				
Below −2	Stunted (See note 4)	Underweight	Wasted	Wasted
Below −3	Severely stunted (See note 4)	Severely underweight (See note 5)	Severely wasted	Severely wasted

Measurements in the shaded boxes are in the normal range.
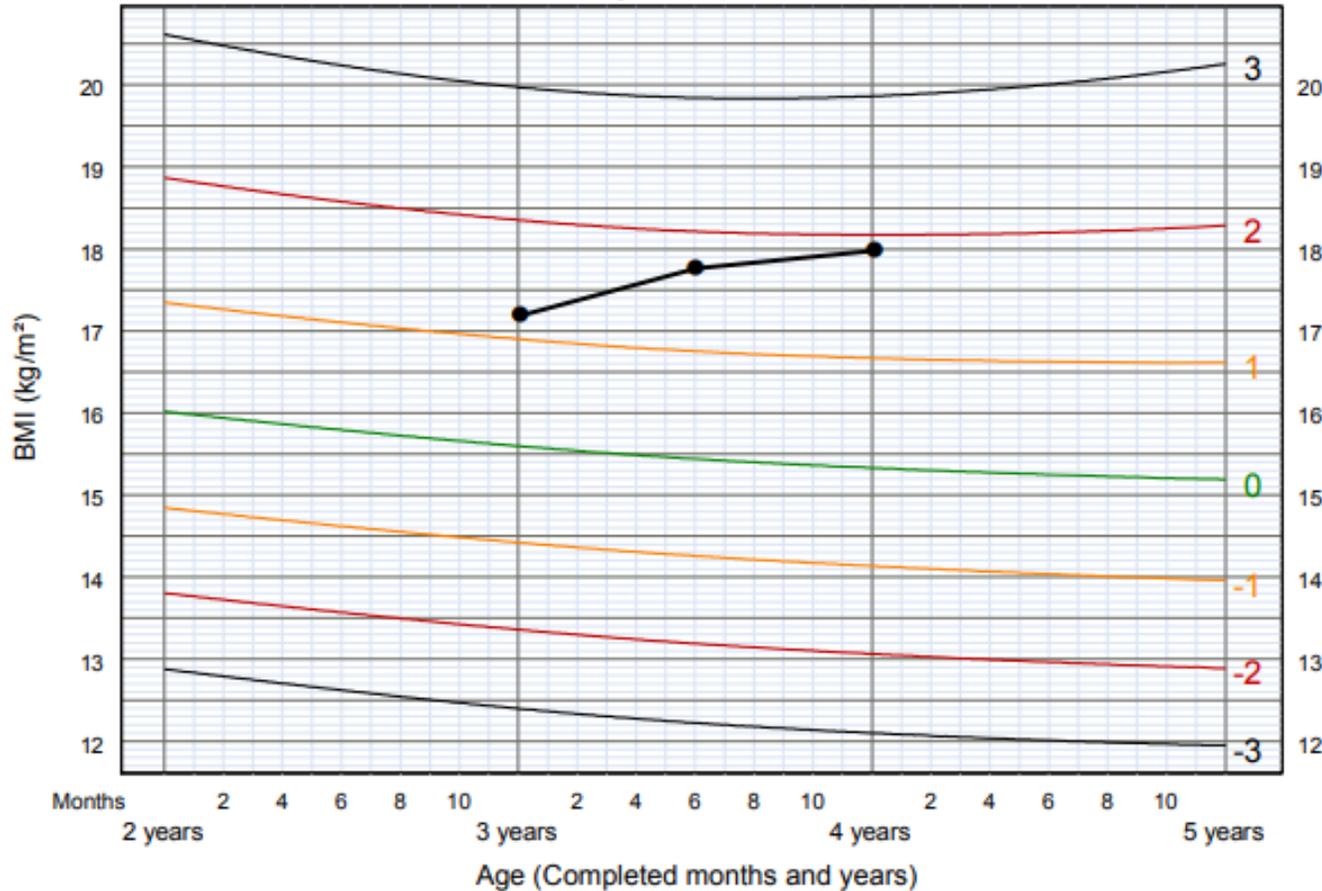
Example??

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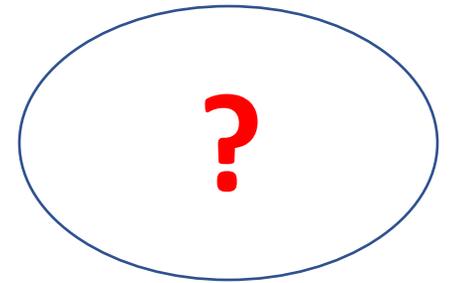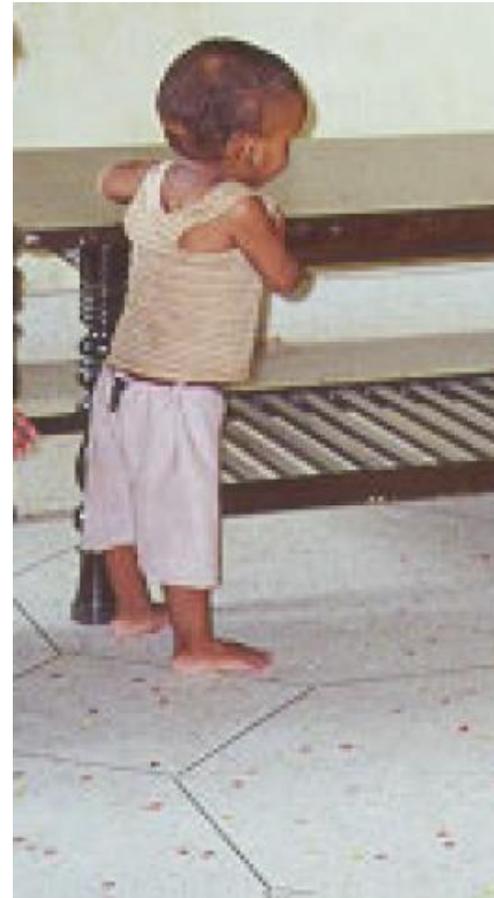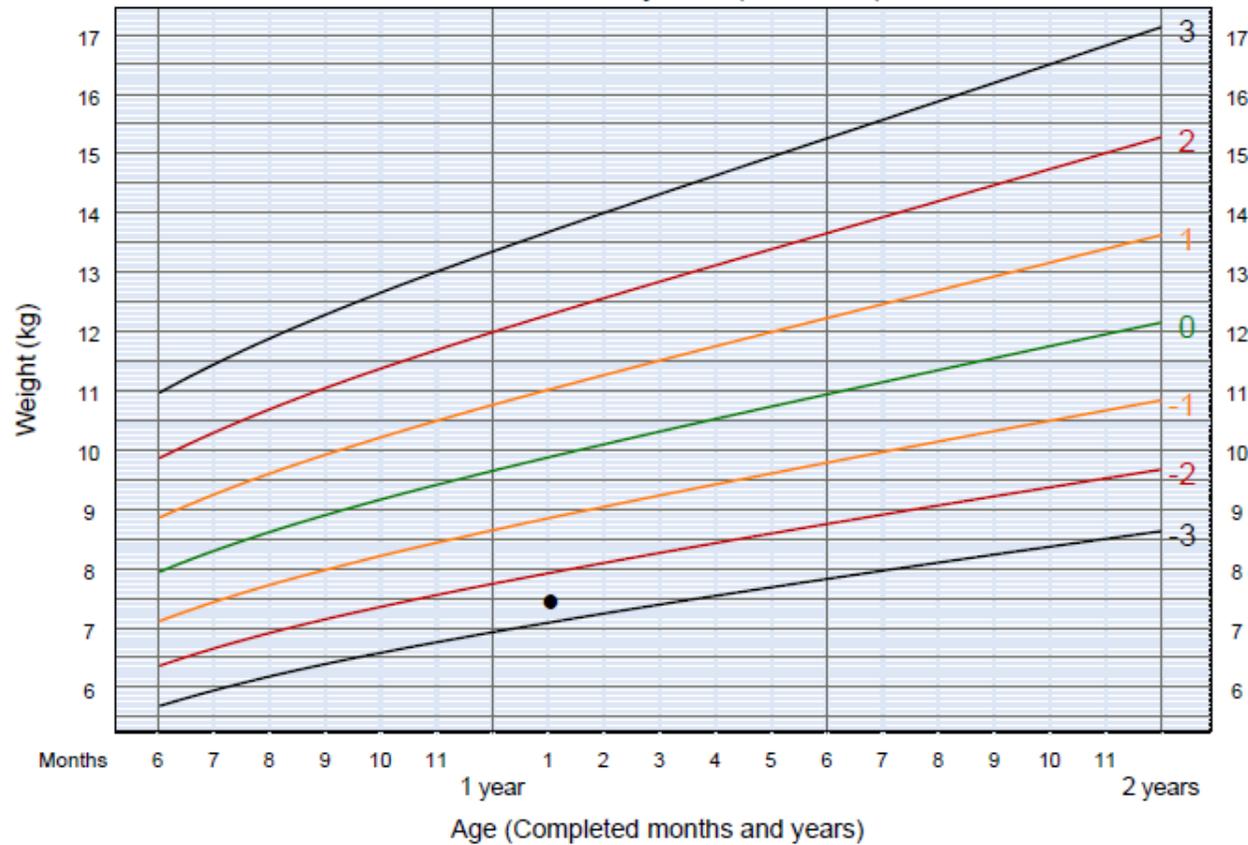
Example??

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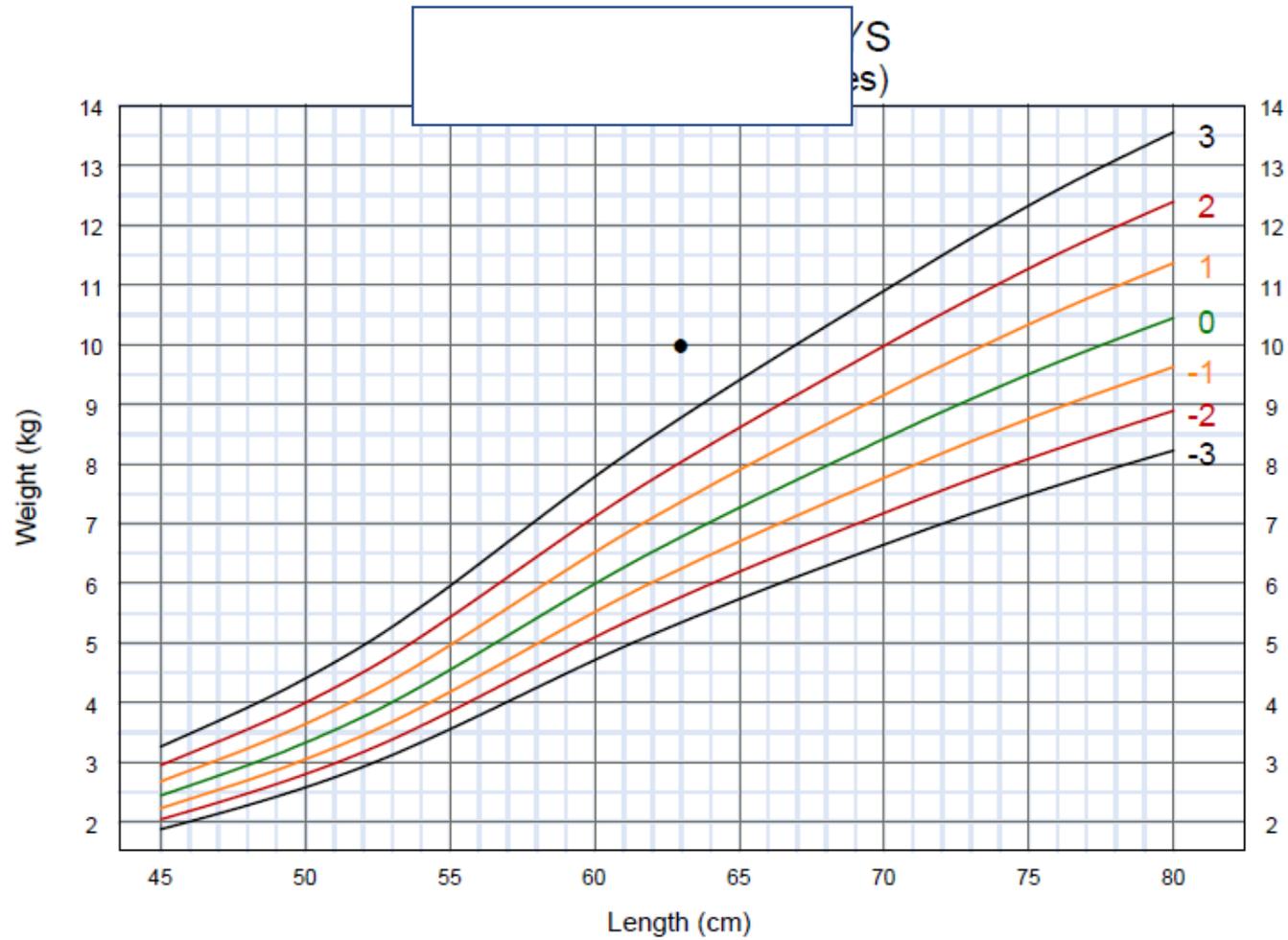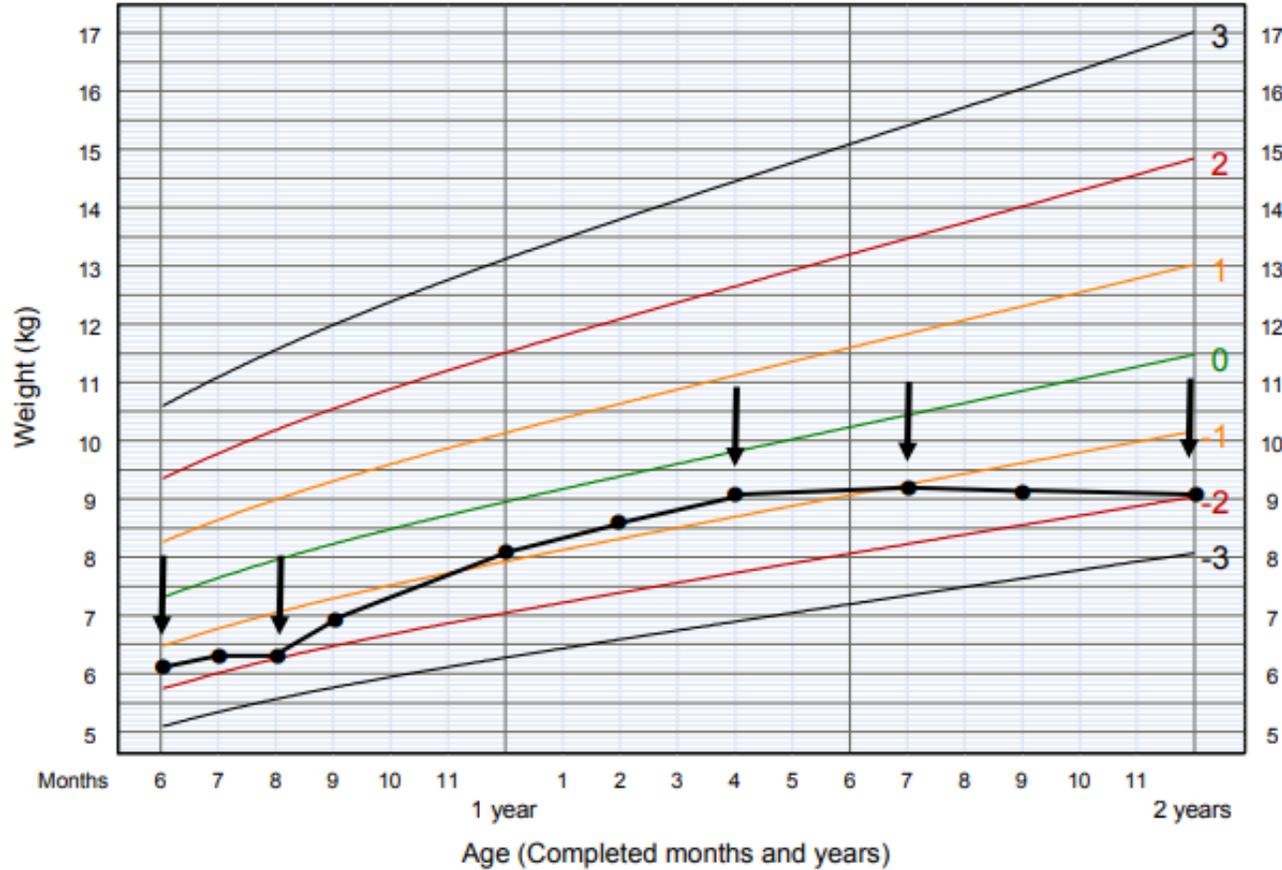
Adil:

BMI-for-age BOYS
2 to 5 years (z-scores)

• Adil's BMI-for-age chart shows a trend towards overweight. If his growth line crosses the 2 z-score line, he will be considered overweight.

Salma

Weight-for-age GIRLS
6 months to 2 years (z-scores)

- Salma's weight-for-age chart shows a flat growth line (stagnation) from age 6 months to 8 months and again from about 1 year and 4 months to 2 years. These periods of stagnation correspond to times when Salma was having diarrheal episodes (indicated by arrows). From 8 months up to 1 year and 4 months, she grew. Due to periods of stagnation, Salma's weight for-age is about to cross the -2 z-score line.

Length-for-age GIRLS
6 months to 2 years (z-scores)
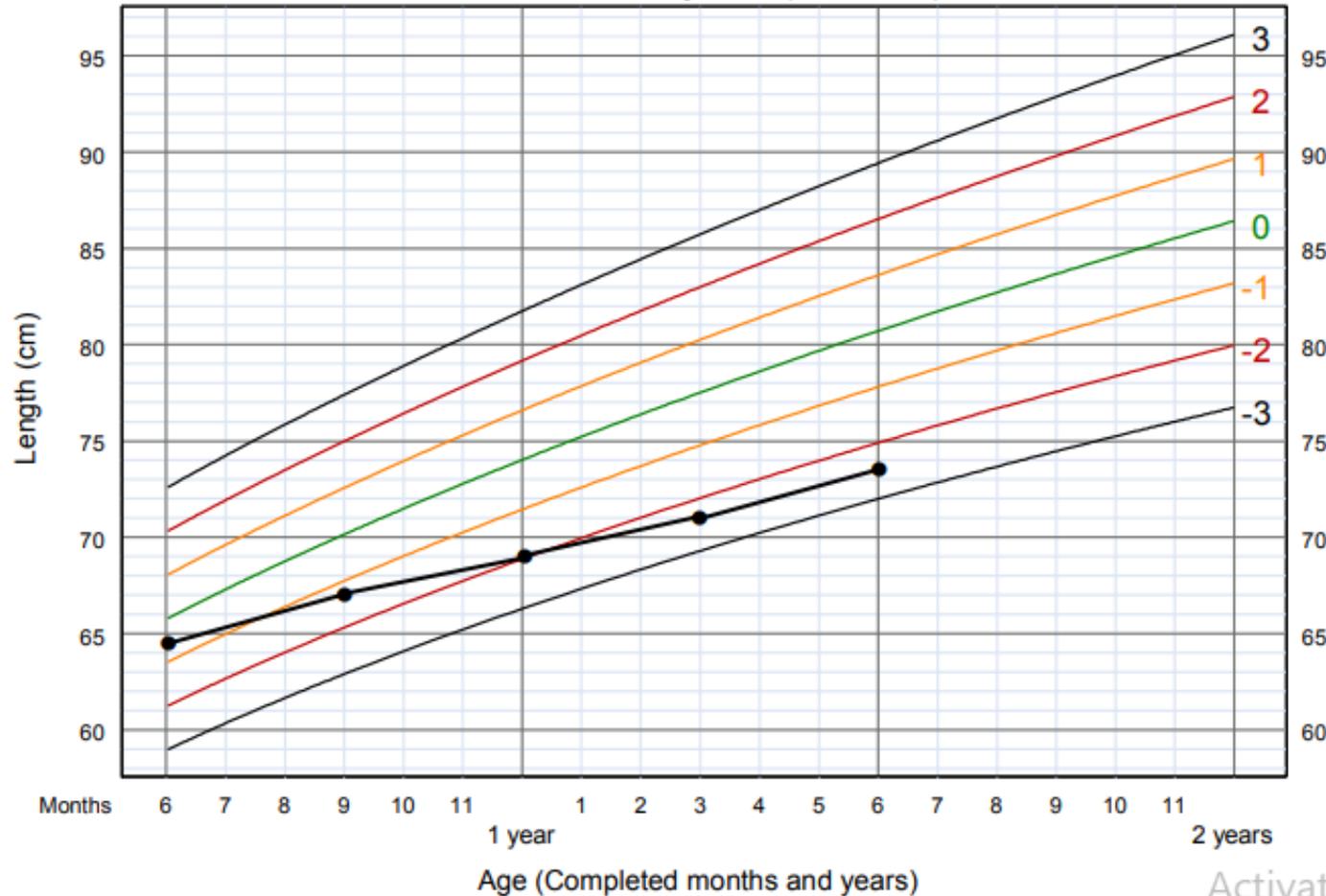
Luna

- Luna's length-for-age chart shows points plotted at five visits from the age of 6 months to 1 year and 6 months

- Luna's height-for-age dropped from above -1 to below -2 in a period of 9 months, crossing two z-score lines.

- Her growth in length have slowed down at an age when rapid growth is expected. She is stunted.

Extra info:

Notes:

1. A child in this range is very tall. Tallness is rarely a problem, unless it is so excessive that it may indicate an endocrine disorder such as a growth-hormone-producing tumor. Refer a child in this range for assessment if you suspect an endocrine disorder (e.g. if parents of normal height have a child who is excessively tall for his or her age).

2. A child whose weight-for-age falls in this range may have a growth problem, but this is better assessed from weight-for-length/height or BMI-for-age.

3. A plotted point above 1 shows possible risk. A trend towards the 2 z-score line shows definite risk.

4. It is possible for a stunted or severely stunted child to become overweight.

5. This is referred to as very low weight in IMCI training modules. (Integrated Management of Childhood Illness, In-service training. WHO, Geneva, 1997).

- For details on growth and development:
- https://www.who.int/tools/child-growth-standards/standards

- https://www.who.int/publications/i/item/9789241595070