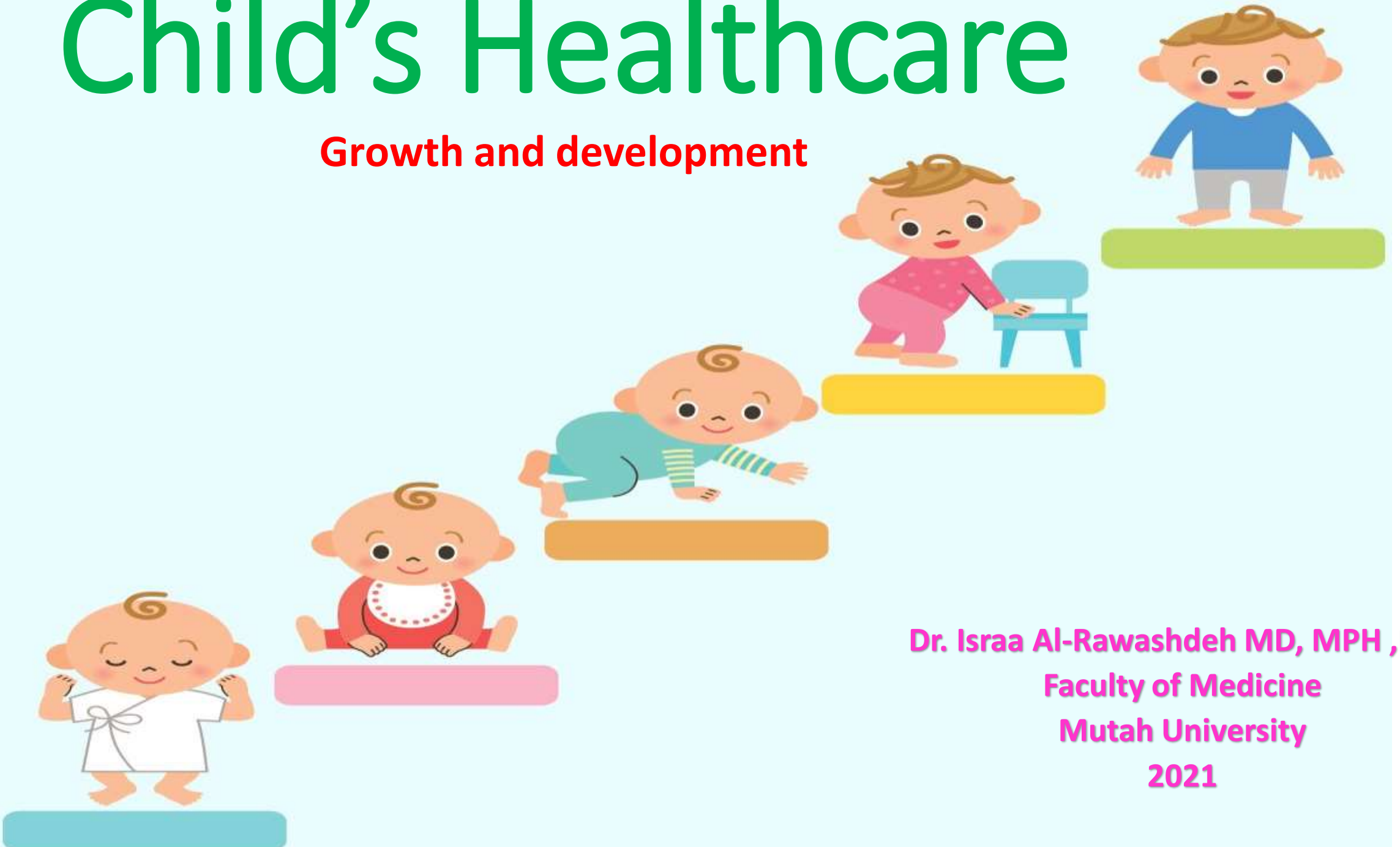
Child's Healthcare

Growth and development



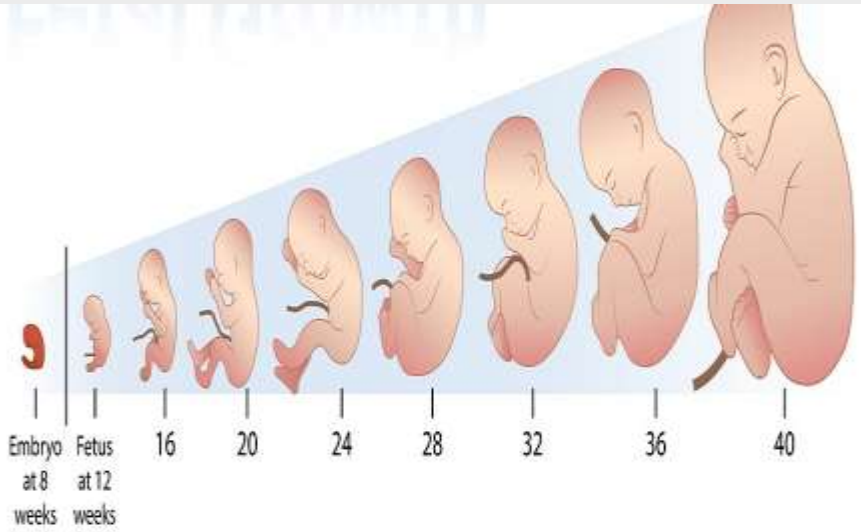
Dr. Israa Al-Rawashdeh MD, MPH ,PhD
Faculty of Medicine
Mutah University
2021

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

GROWTH: an increase in the physical size 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)

Definitions



Stages of growth and development:

A. Intrauterine stage:

This stage begins with fertilization of the ovum and ends with birth.

Two periods.

1. **Embryonic period (period of organogenesis): during the first trimester of pregnancy during which exposure to any adverse factors can result in congenital anomalies or miscarriage.**
2. **Foetal period : 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:

A. Extrauterine stage:

1. At birth

Body weight: 2.5-4.2 kg

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: ethnic ccc, size of the parents particularly of the mother, the body structure.

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

- **B) environmental factors**

These include:

1. Nutrition.
2. Infections during infancy and childhood
3. Stimulation and loving care of the child

Growth monitoring

Purpose:

- Growth monitoring is the *best available indicator* of the overall nutritional status of the child.
- Growth monitoring can identify high-risk infants and children, who need attention.
- Can determine if there are growth abnormalities that point to the presence of an underlying disease
- To prevent nutritional disorders and the increased morbidity and mortality that accompany them

Assessment of growth

- The assessment of growth may be longitudinal or cross sectional.
- **Longitudinal** assessment of growth entails measuring the same child at regular intervals.
- **Cross sectional** comparisons involve large number of children of same age at one time.

Assessment of growth

Basic growth assessment involves :

Anthropometry: It is most common method used it includes:

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

Weight

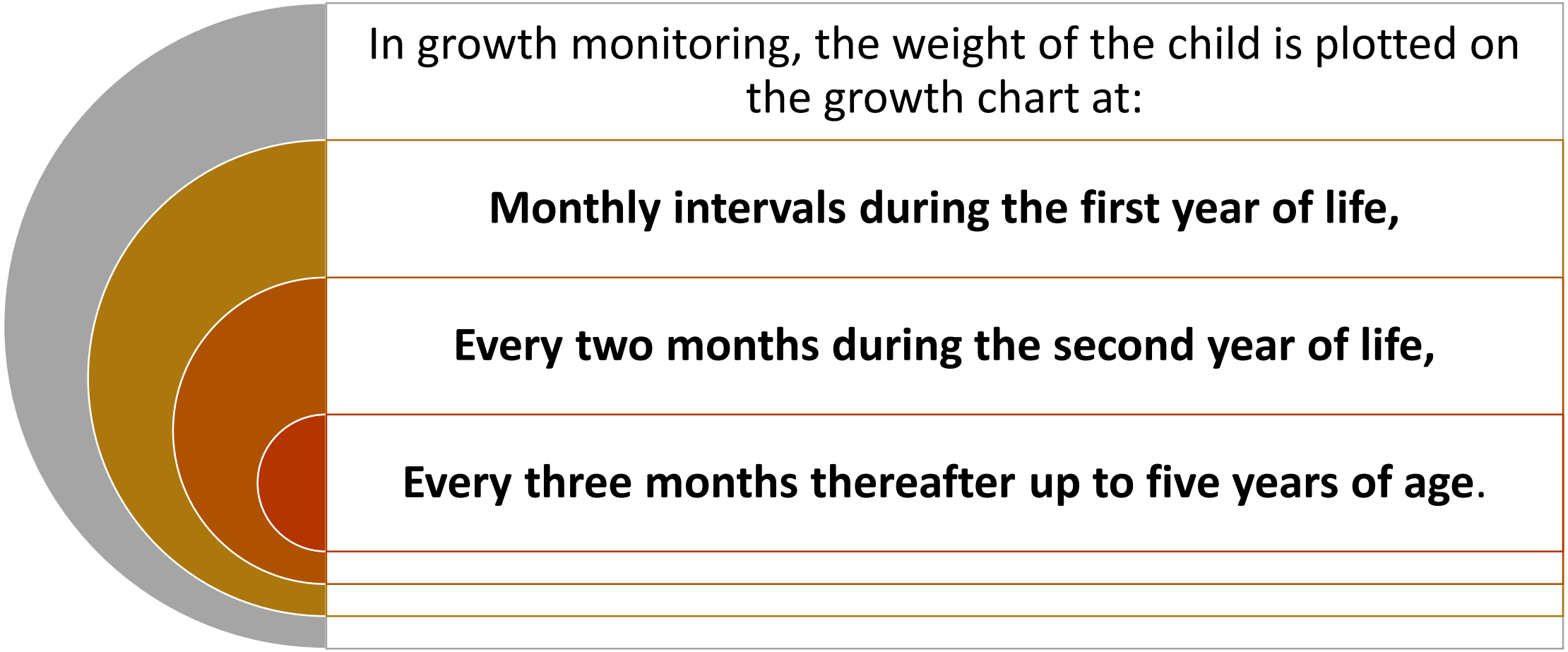
The most used measure is the *weight for age* (by using the growth chart). It is a very sensitive measure of growth, easily made, with a high level of accuracy.

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.

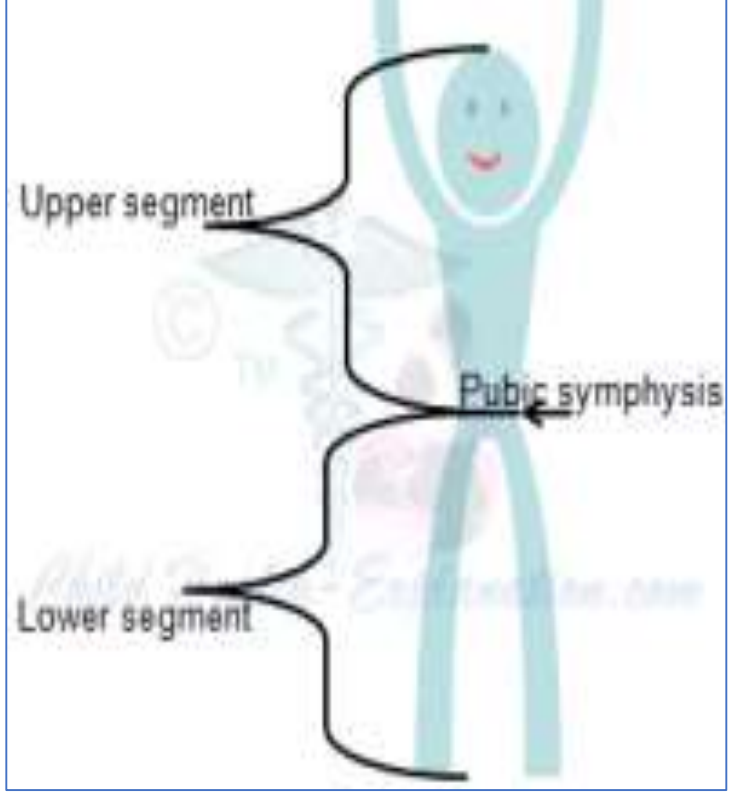
Wt. loss for the first few days: 5-10% of birth weight -Return of BWT at 7-10 days of age. The infant can double his BWT by 4-5 months, and triple by the end of first year and quadruple by the age of two years.

WEIGHT: Method : Nude/ Minimal light clothing: electronic type of weighing scale

Assessment of growth



HEIGHT/LENGTH:



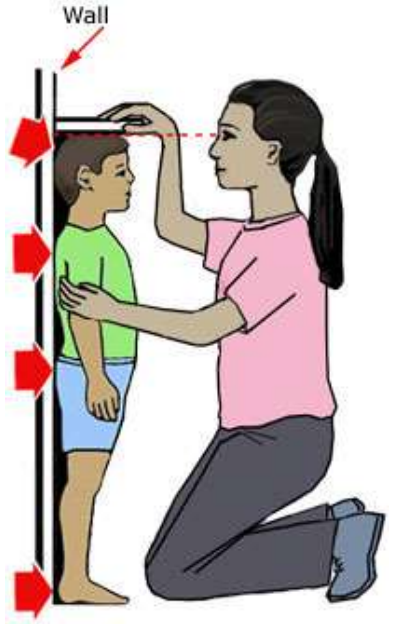
<2 years: length

- Measured in recumbent position
- Total Length
  - Upper – Head-Pubis
  - Lower – Pubis - Toe

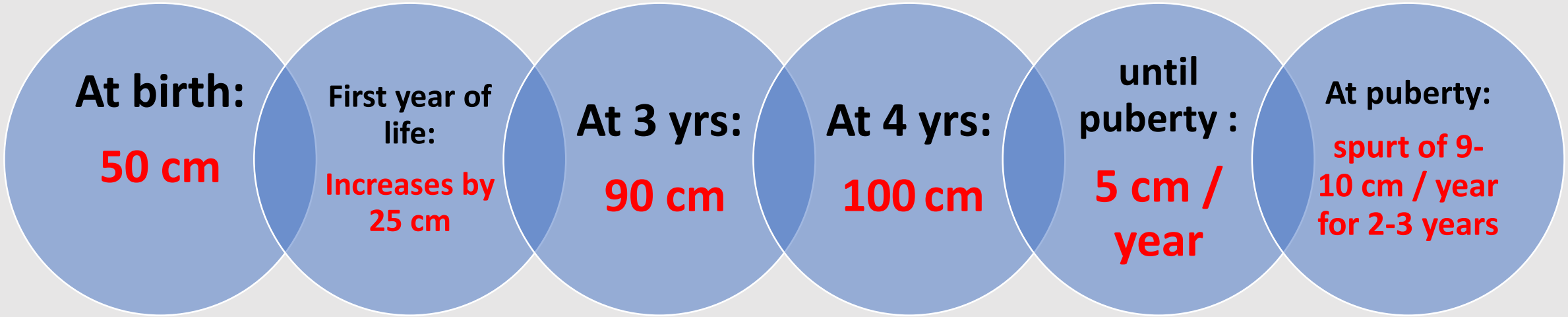
  U/L : 1.7 -birth
  1.0 -7year

>2 years: Height

- Measured in erect standing posture by stadiometer
- Vertical distance between head and heel of foot
- Formula: Age (y) x 6 +77



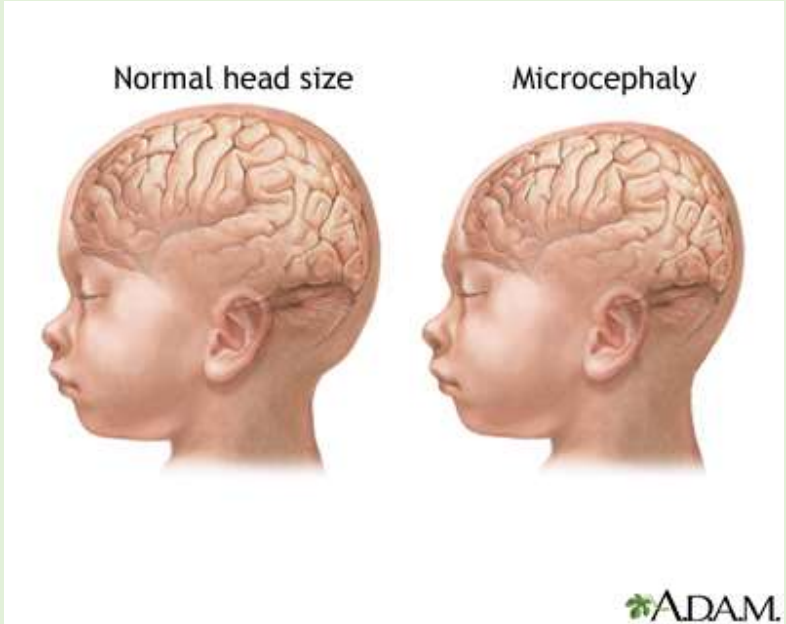
HEIGHT/LENGTH:



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



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

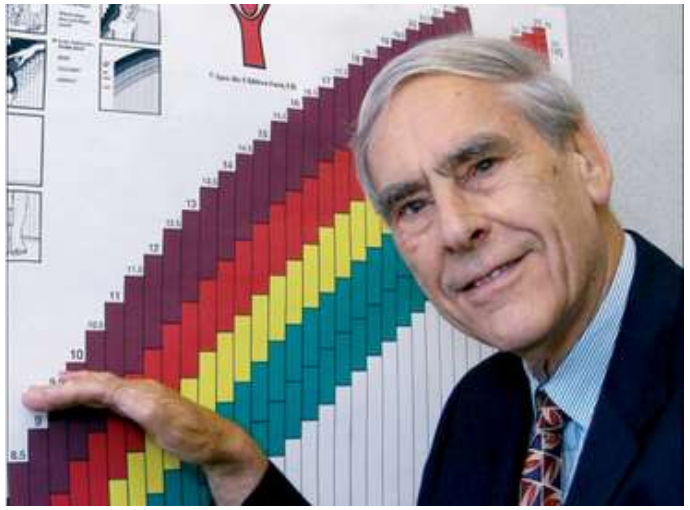
Later: CC>HC

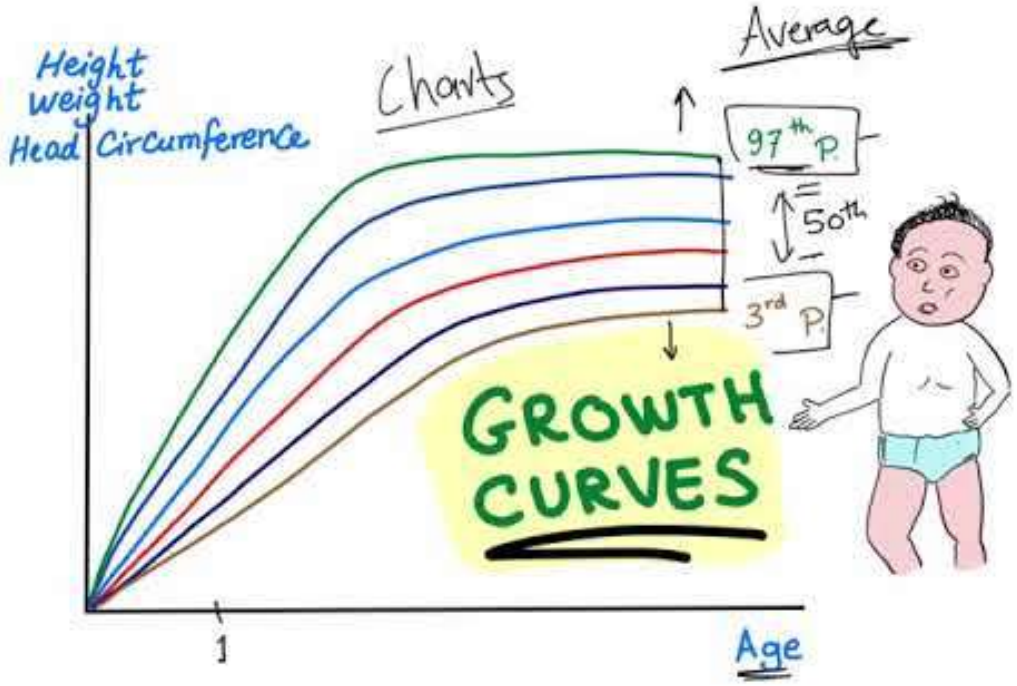
Growth chart:

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

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

WHO GROWTH CHART

- X-axes show age. Points plotted on vertical lines corresponding to completed age (in months, or years)

- y-axes show length/height, weight, or BMI. Points plotted on or between horizontal lines corresponding to length/height, weight or BMI as precisely as possible.

Indicators

- **The reference lines on the WHO growth charts are either percentile lines or z-scores**
- **There are separate charts for both *boys and girls***

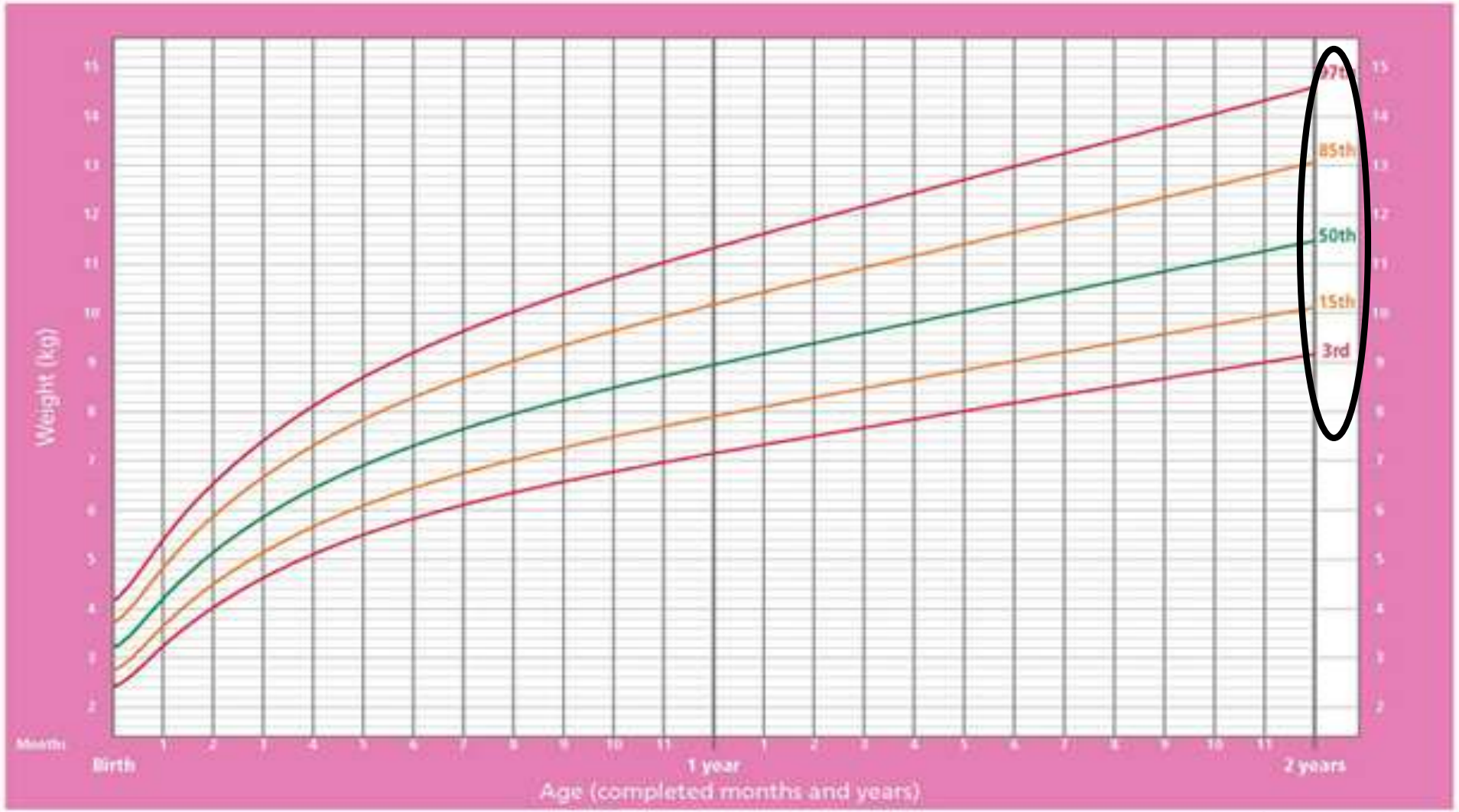
Growth indicators are used to assess growth:

- **Length/height-for-age**
- **Weight-for-age**
- **Weight-for-length/height**
- **BMI (body mass index)-for-age**
- **Head circumference for age**
- **Others.**

Weight-for-age GIRLS

Birth to 2 years (percentiles)

World Health Organization

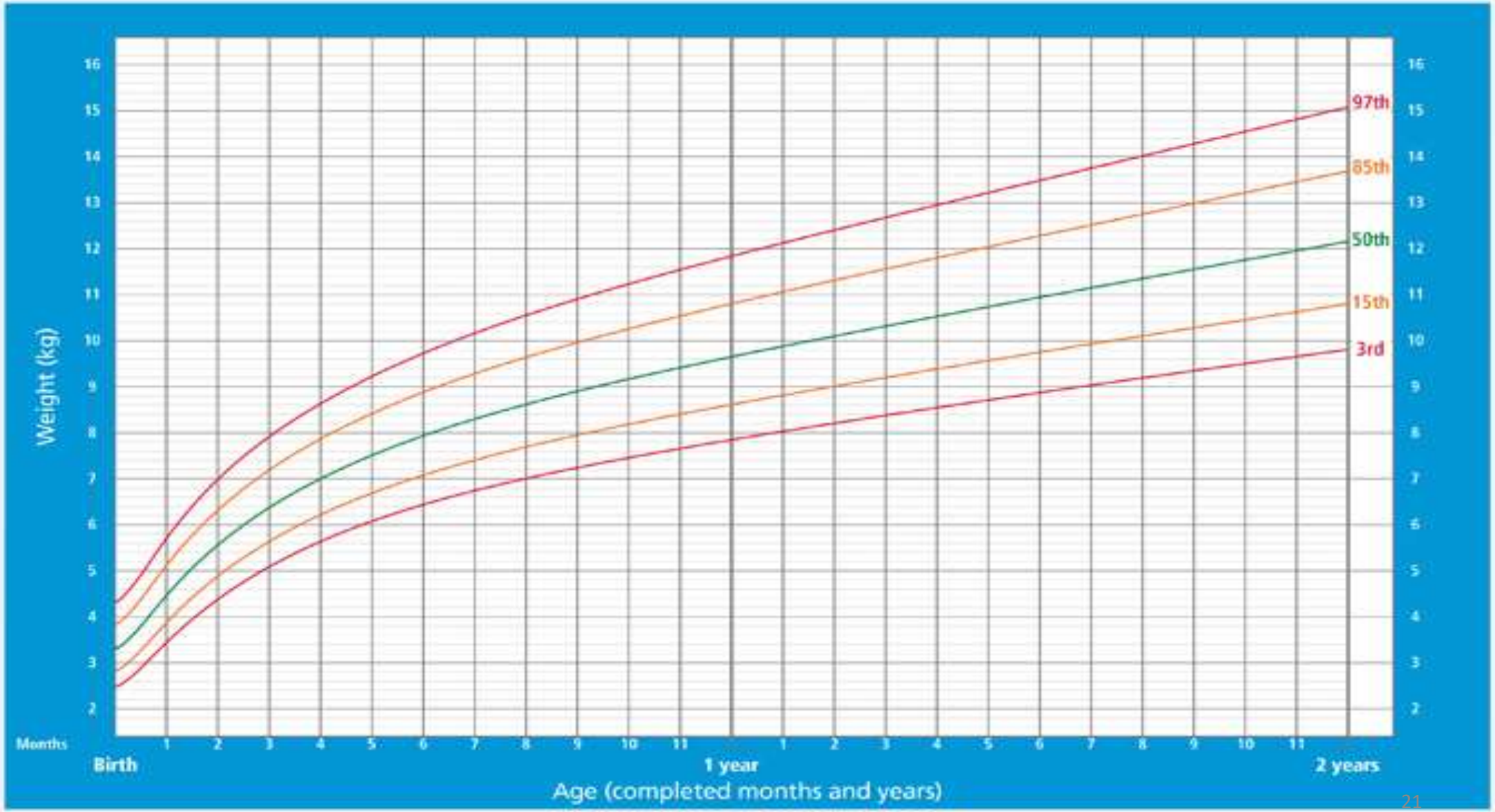


WHO Child Growth Standards

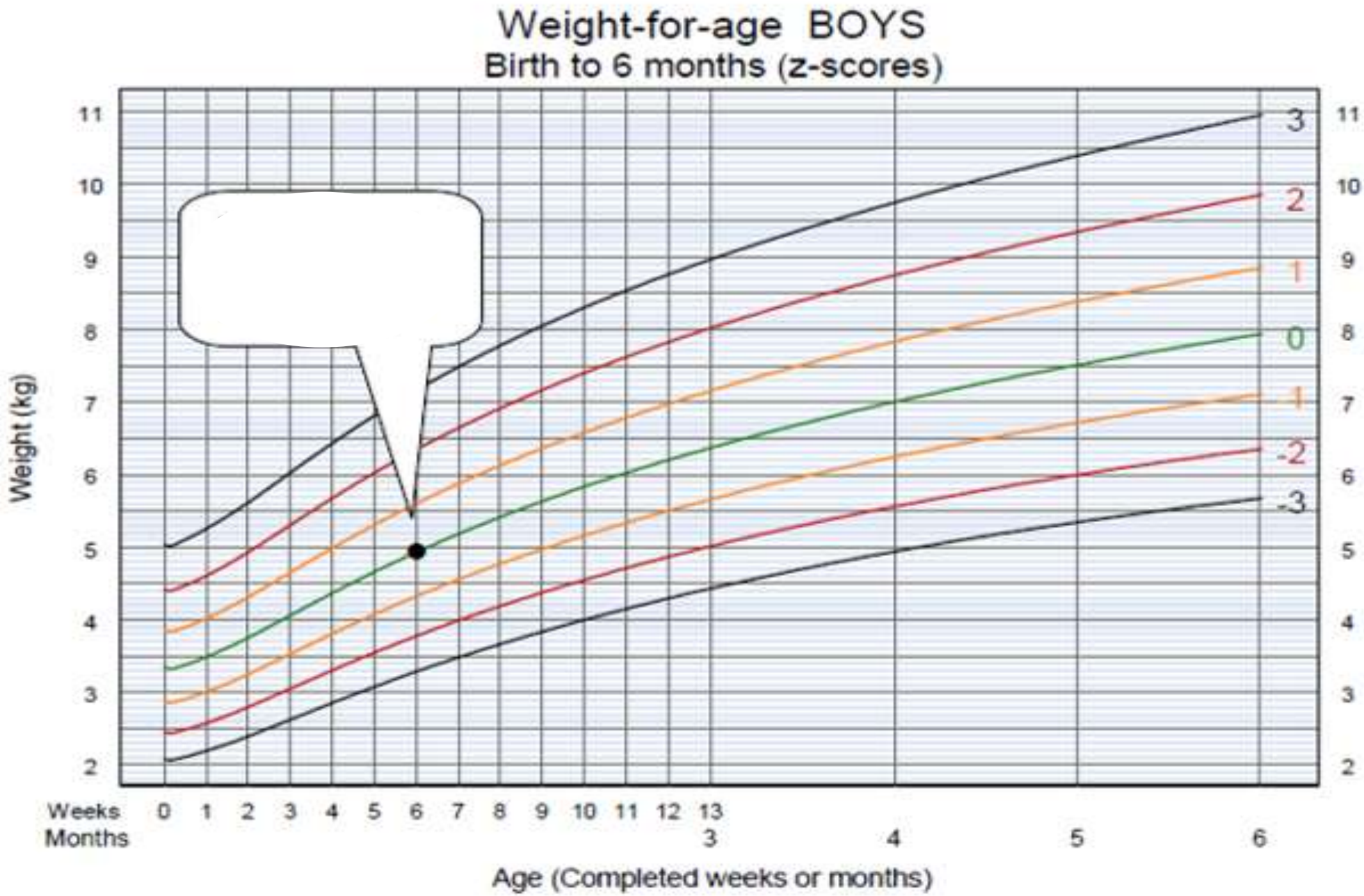
Weight-for-age BOYS

Birth to 2 years (percentiles)

World Health Organization



WHO Child Growth Standards


Weight-for-age BOYS
Birth to 6 months (z-scores)
Weight (kg)
11
10
9
8
7
6
5
4
3
2
3
2
1
0
-1
-2
-3
Weeks 0 1 2 3 4 5 6 7 8 9 10 11 12 13
Months 3 4 5 6
Age (Completed weeks or months)

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.


Weight-for-age BOYS
6 months to 2 years (z-scores)
Weight (kg)
17
16
15
14
13
12
11
10
9
8
7
6
3
2
1
0
-1
-2
-3
Months
6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11
1 year
2 years
Age (Completed months and years)

Using the growth chart

- Obtain accurate measurements
- **<u>Adjust for prematurity.</u>**
- 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**, which is the average.
- 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).
- 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.
- In general, a plotted point that is far from the median in either direction (for example, close to the 3 or -3 z-score line) may represent a growth problem (other factors must be considered, such as the growth trend, the health condition of the child and the height of the parents).
- Any quick change in trend (the child's curve upward or downward from its normal track) should be investigated to determine its cause and treat any problem.
- A flat line might indicate that the child is not growing. This is called **stagnation** and need to be investigated.
- A growth curve that crosses a z-score line may indicate risk. A health care provider can interpret risk based on where (relative to the median) the change in trend began and the rate of change.

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 for-age chart :

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

Weight for-length chart:

A child whose weight-for length 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**.

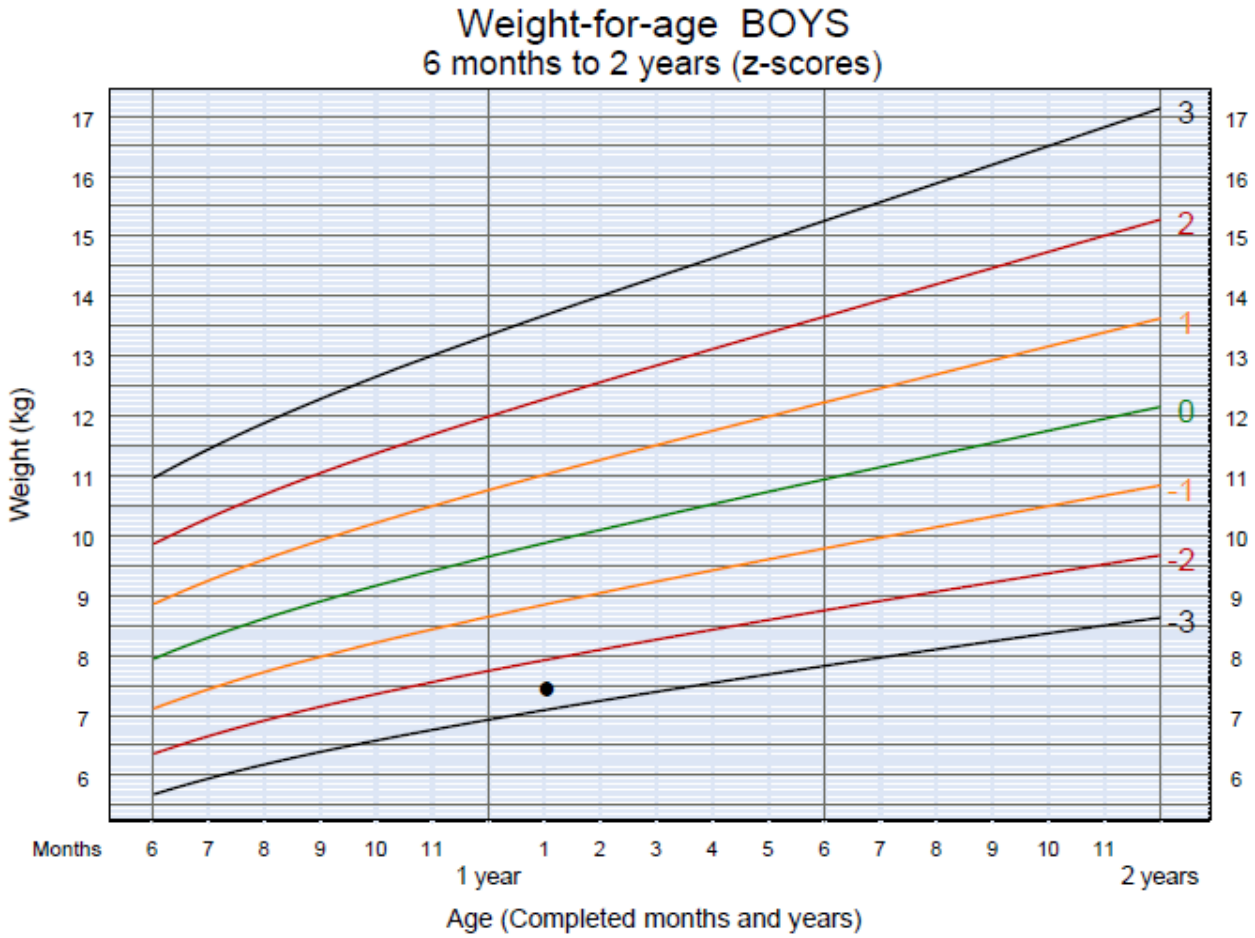
Above 1 shows **possible risk of overweight**

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*

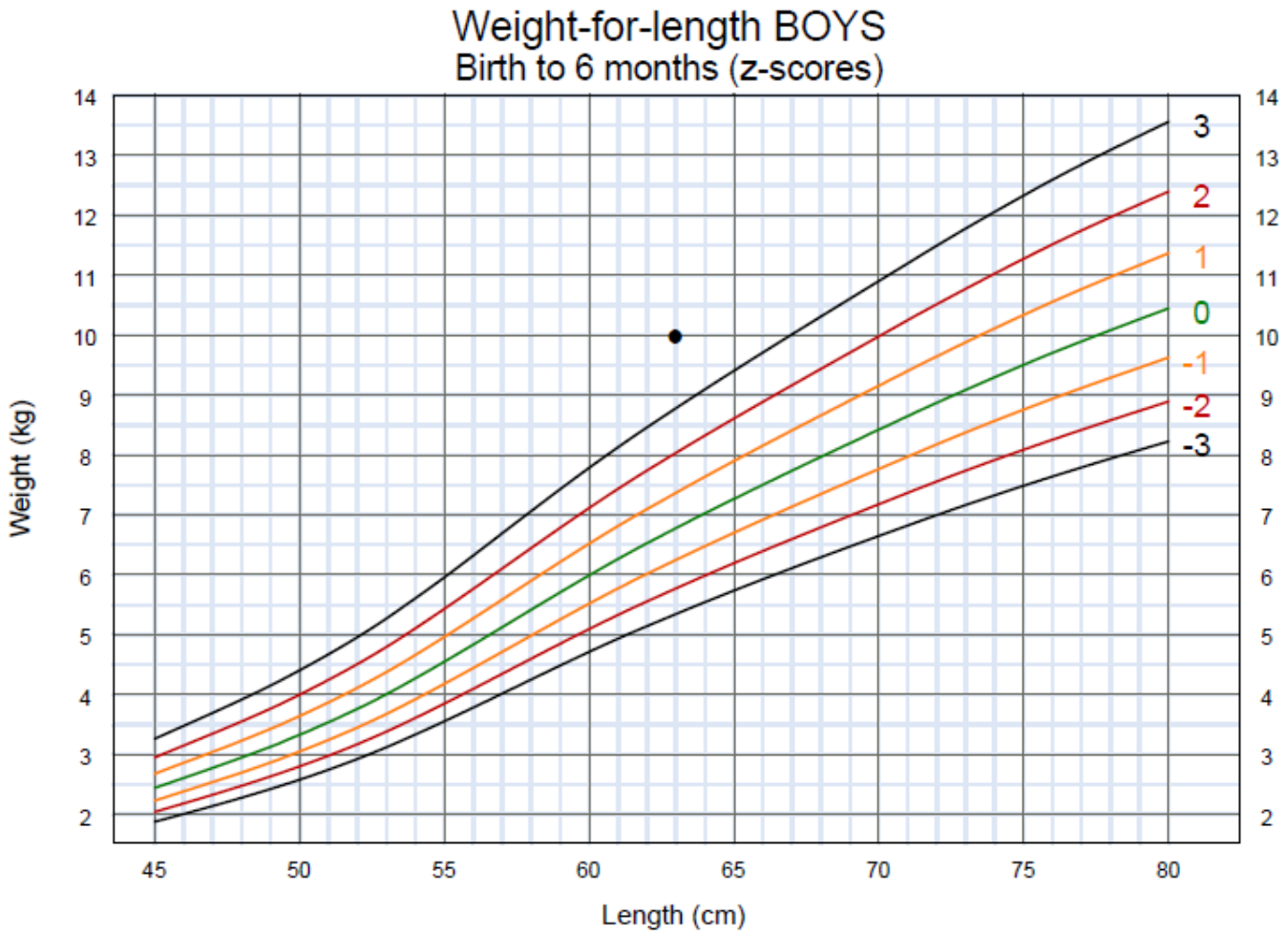
Measurements in the shaded boxes are in the normal range.

Example??


Weight-for-age BOYS
6 months to 2 years (z-scores)
Weight (kg)
17
16
15
14
13
12
11
10
9
8
7
6
3
2
1
0
-1
-2
-3
Months
6 7 8 9 10 11 1 2 3 4 5 6 7 8 9 10 11
1 year
2 years
Age (Completed months and years)

?

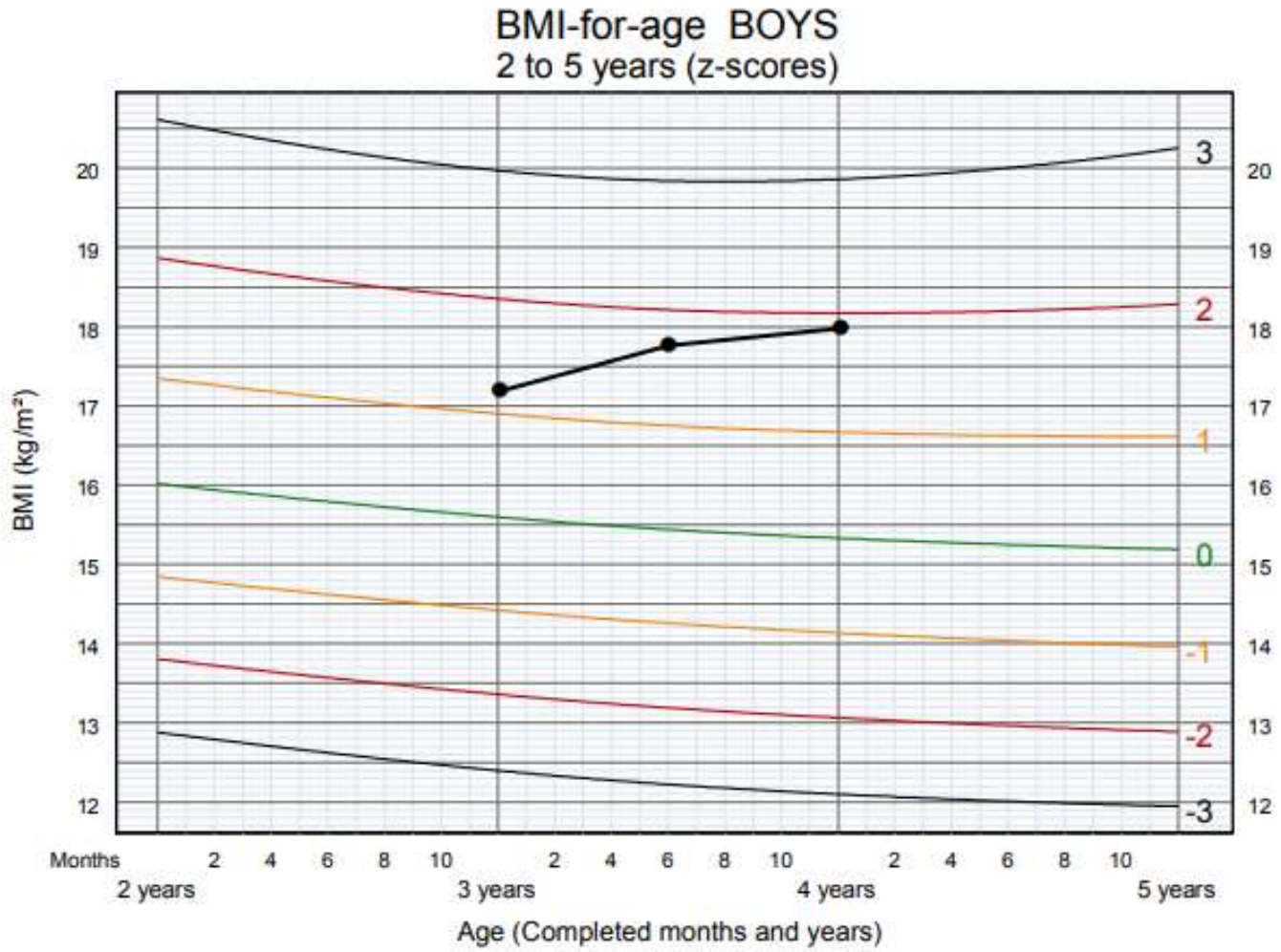
Example??


Weight-for-length BOYS
Birth to 6 months (z-scores)
Weight (kg)
Length (cm)
14
13
12
11
10
9
8
7
6
5
4
3
2
45
50
55
60
65
70
75
80
3
2
1
0
-1
-2
-3


© CAMERAPRESS

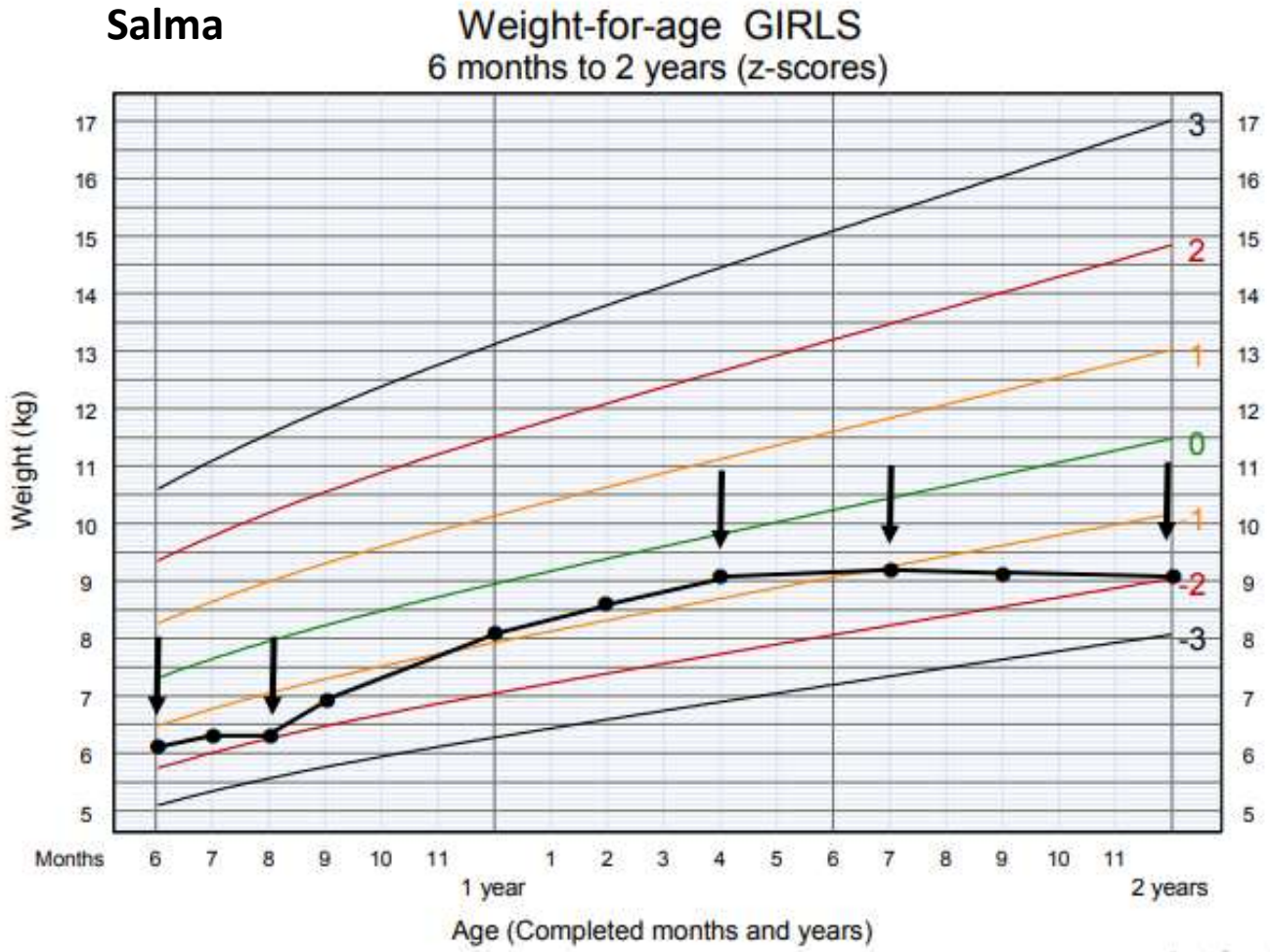
?

Adil:



- 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

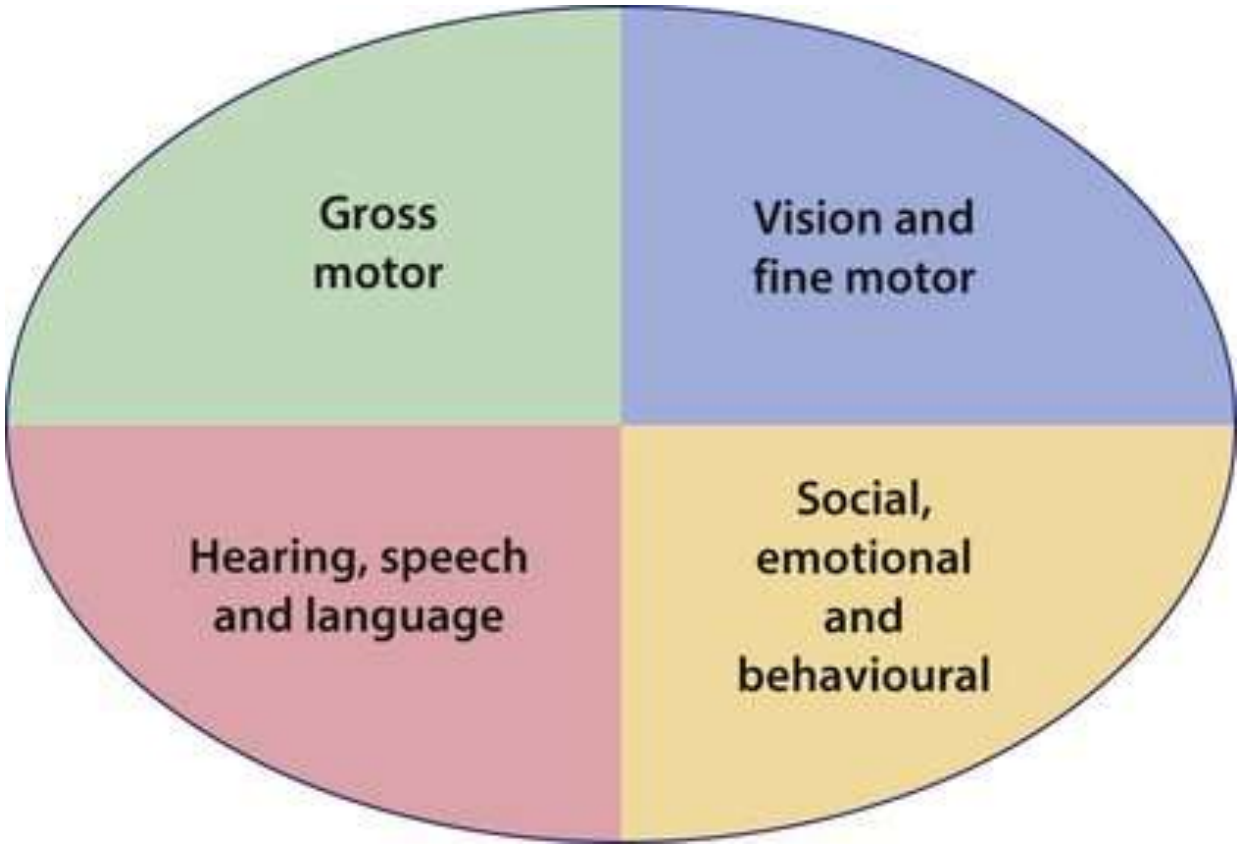


- Salma's weight-for-age chart shows a flat growth line (stagnation) from age 6 months to 8 months and again from about 1 year and 4 months to 2 years. These periods of stagnation correspond to times when Salma was having diarrheal episodes (indicated by arrows). From 8 months up to 1 year and 4 months,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

Luna

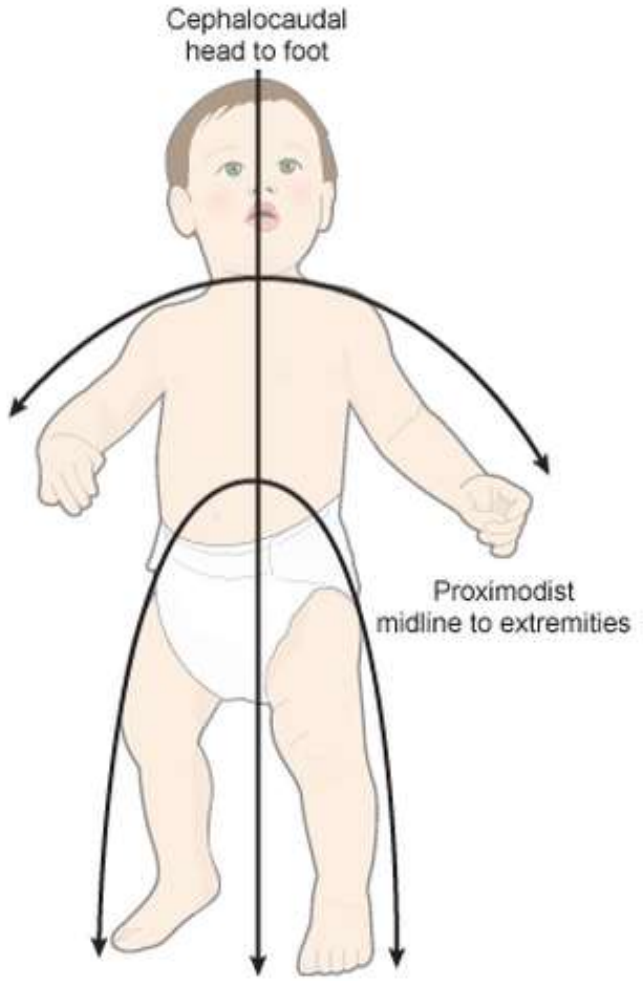
- Luna's length-for-age chart shows points plotted at five visits from the age of 6 months to 1 year and 6 months
- Luna's height-for-age dropped from above -1 to below -2 in a period of 9 months, crossing two z-score lines.
- Her growth in length seems to have slowed down at an age when rapid growth is expected. She is stunted.

Areas of Development



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 general to specific.
- There are developmental landmarks (milestones) that should be checked.



Development is assessed in two major aspects:

Motor: Involves *gross* motor development (control of head, sitting, standing. Etc.) and *fine* motor development (movement of hands, fingers, eyes. Etc.)

Psychological development: attachment to special figures (mother and other care takers), vocalization expected at around 9 months which largely depend on environmental stimuli. Development of fear (strangers) at around seven to eight months.

Factors that predispose to delay in development:

Lack of training by the family

Lack of environmental stimuli

Emotional deprivation

Health problems such as malnutrition, rickets, congenital anomalies. Etc.

Extra info:

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

- https://www.who.int/childgrowth/training/module_c_interpreting_indicators.pdf

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).*

- Thank you