Child Health, Growth and Development

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By the end of this lecture, you should be able to:

- Define child health
- Describe key child mortality indicators
- Identify factors affecting child health
- Understand basic concepts of growth and development
- Interpret growth charts at a basic level

Definitions:

- A child is a person **18 years or younger**, unless national law defines adulthood earlier
- Child health: is a state of physical, mental, intellectual, social and emotional well-being and not merely the absence of disease or infirmity.

Within the life course, the period of life before reaching adulthood is divided into three age subgroups based on epidemiology and healthcare needs:

The first 5 years (under-5 children)

- Neonatal period (the first 28 days of life) early + late
- Infancy (the first year of life)
- Pre-school years (from 1 to less than 6 years).

The next 5 years (older children)

The second decade of life (adolescents).

Child Mortality indicators

- **Under-five mortality rate U5MR** - Probability of dying *between birth and exactly five years of age* expressed per 1,000 live births.
- **Infant mortality rate IMR** - Probability of dying between *birth and exactly one year of age* expressed per 1,000 live births
- **Neonatal mortality rate NMR**: Probability of dying during *the first 28 days of life, expressed per 1,000 live births. (early and late)*
- **Post Neonatal mortality rate PNMR:** *Probability of dying between 28 days and exactly one year* of age expressed per 1,000 live births

Infants and children

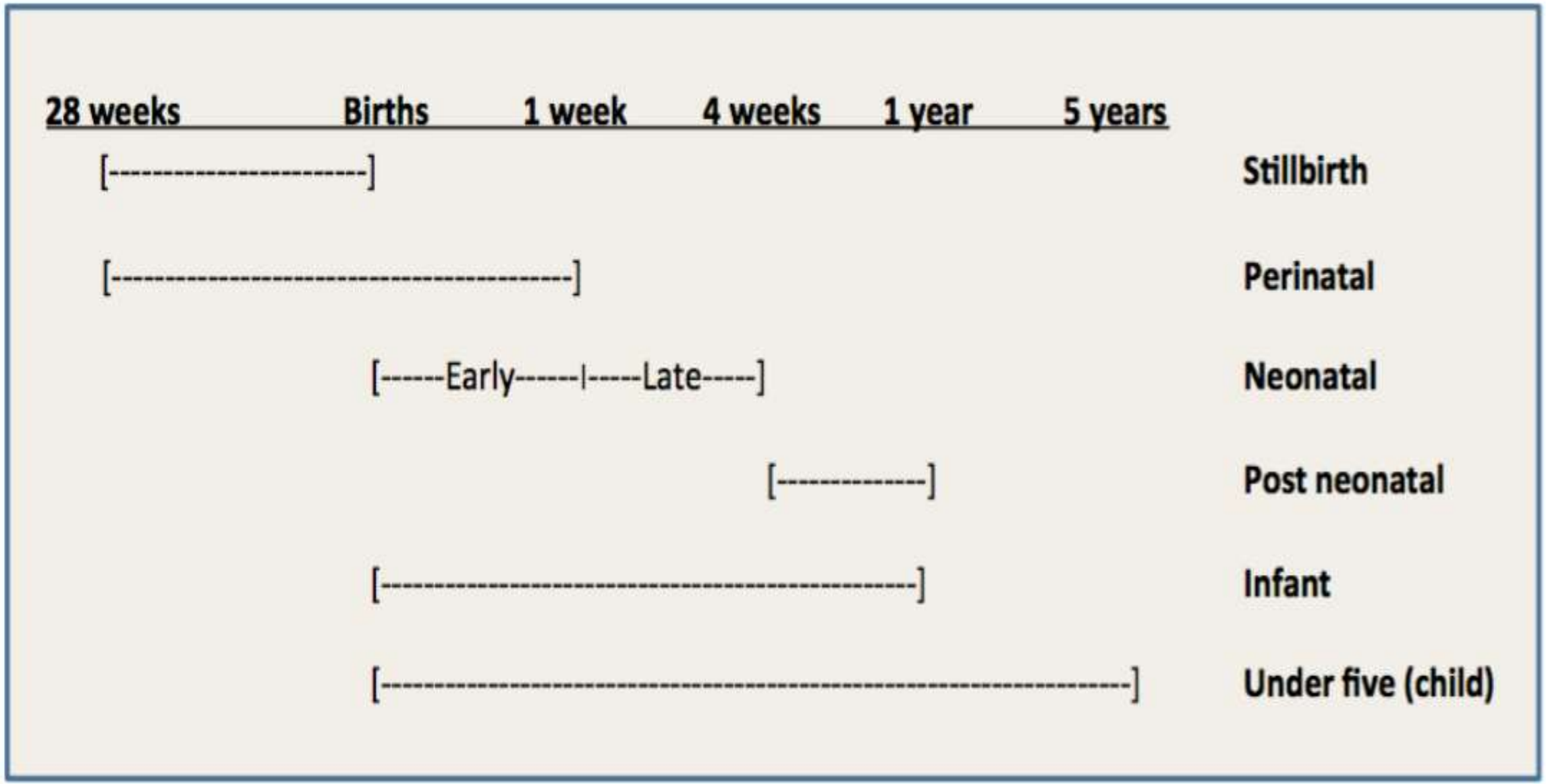
$$\text{Neonatal mortality rate} = \frac{\text{Annual no. of deaths in the first 28 days}}{\text{No. of live births in a year}} \times 1{,}000$$

$$\text{Postneonatal mortality rate} = \frac{\text{Annual no. of deaths between 28 days and 1 year}}{\text{No. of live births in a year}} \times 1{,}000$$

$$\text{Infant mortality rate} = \frac{\text{Annual no. of deaths in the first year}}{\text{No. of live births in a year}} \times 1{,}000$$

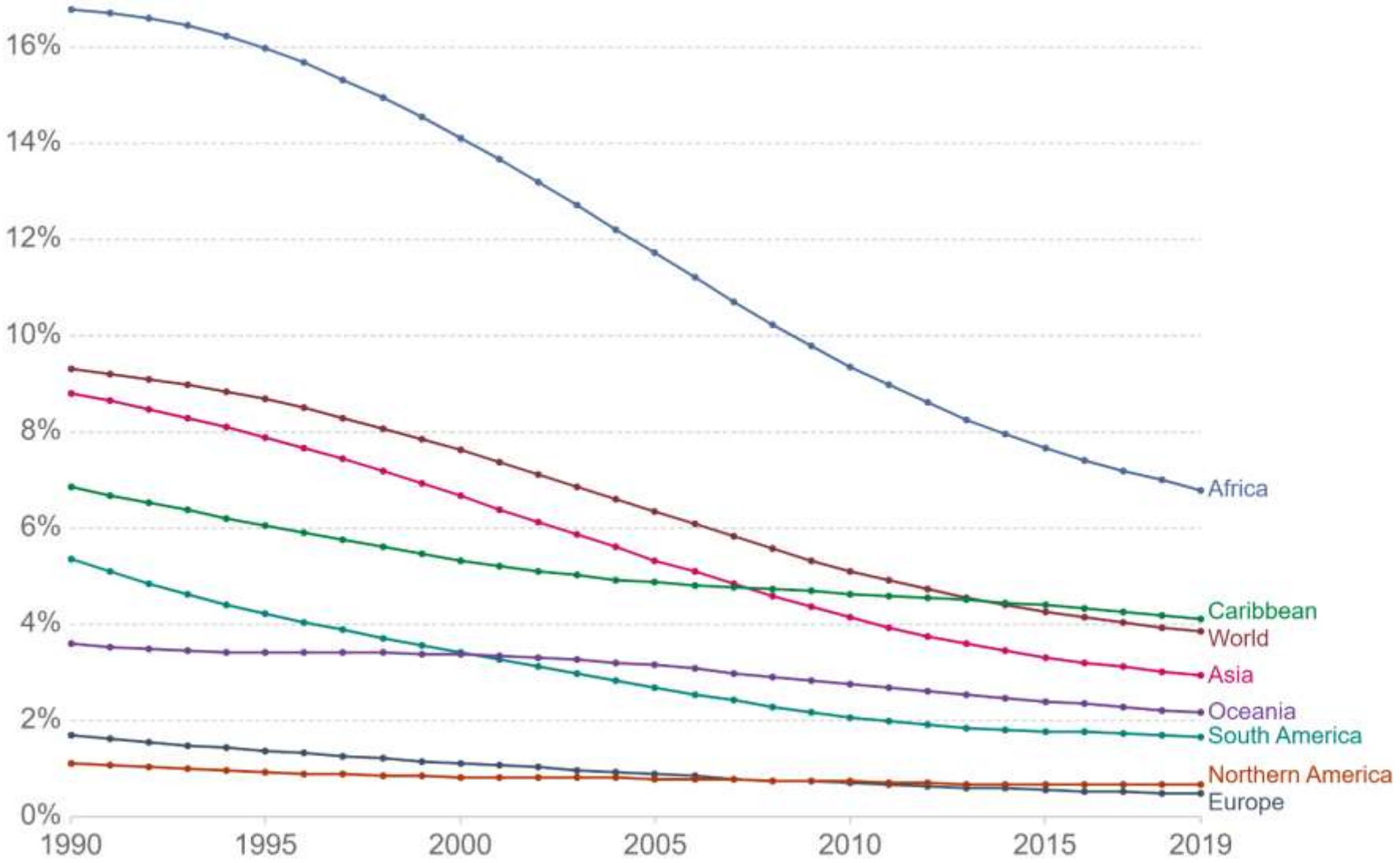
$$\text{Child death rate} = \frac{\text{Annual no. of deaths between 1 and 4 years}}{\text{No. of live births in a year}} \times 1{,}000$$

$$\text{Under five mortality rate} = \frac{\text{Annual no. of deaths under 5 years}}{\text{No. of live births in a year}} \times 1{,}000$$


28 weeks
Births
1 week
4 weeks
1 year
5 years
[----------]
Stillbirth
[----------]
Perinatal
[------Early------|-----Late-----]
Neonatal
[----------]
Post neonatal
[----------]
Infant
[----------]
Under five (child)

Child mortality

Share of children, born alive, dying before they are five years old.



Source: United Nations – Population Division (2019 Revision)

OurWorldInData.org/child-mortality/ • CC BY

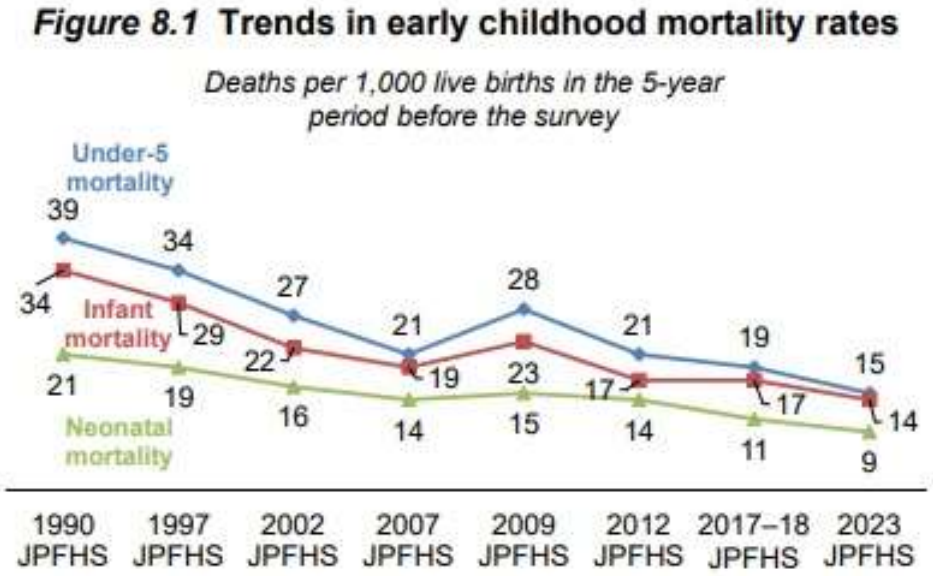
In Jordan ,

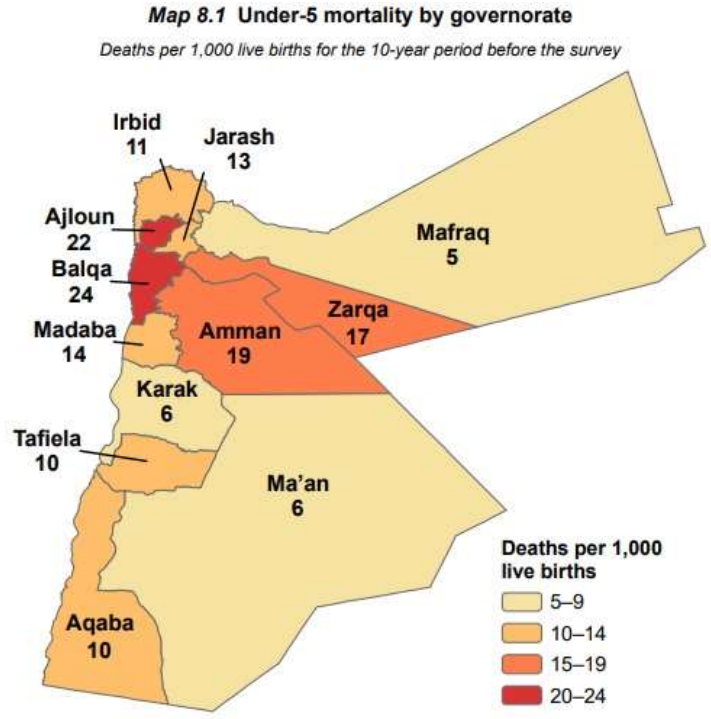
Under five mortality and infant mortality decreased between 1997 and 2012, but not enough to meet the targets of the MDGs.

- Neonatal mortality: 9 / 1,000 live births
- Infant mortality: 14 / 1,000 live births
- Under-five mortality: 15 / 1,000 live births
- Higher rates among poorer households

Some neonatal deaths may not be reported because registration depends on families, not hospitals

1 in 60 children in Jordan die before reaching their fifth birthday





Factors Affecting Child Health

- 1. Biological
- 2. Socio-economic
- 3. Cultural

1. **Biological:**

- Low birth weight < 2 kg, High BW >4 Kg
- Maternal age (<19 or >40 years)
- Short birth spacing (<2 years)
- Multiple births
- High birth order

2. Socio-economic Factors

- Poverty
- Poor maternal education
- Inadequate nutrition
- Formula milk use vs Breastfed
- Limited access to health services
- Poor environmental conditions (Conflict/War/Disaster)

3. Cultural Factors

- Early marriage
- Traditional child-care practices (restrictive swaddling, rubbing a newborn's body with salt, and the ingestion of herbs for newborns, Treating new-born jaundice)
- Gender preference
- Harmful newborn practices

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Growth and development



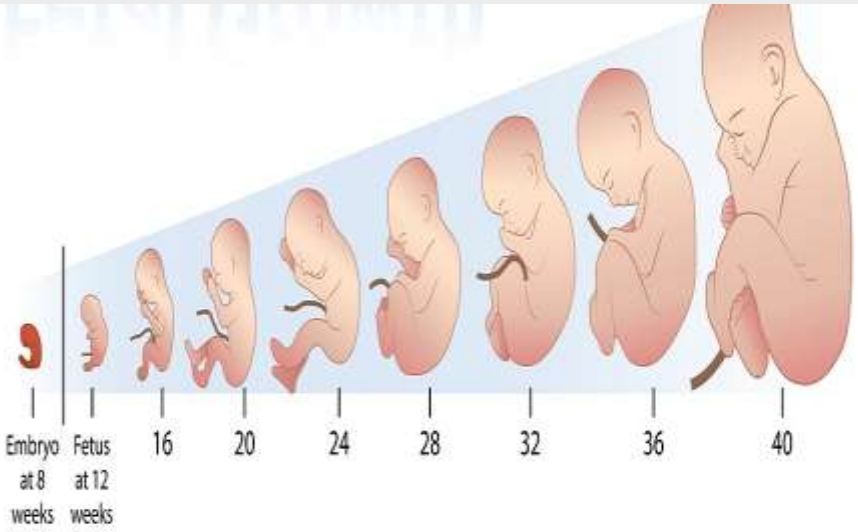


- Growth and development are the two most important biological processes of childhood.
- Growth and development are interrelated biological processesBoth are essential indicators of child health
- Growth and development go hand in hand.

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: Acquisition of skills and functionsMotor, social, emotional, cognitive (Qualitative process)

DEFINITIONS



Stages of growth and development:

✓**Intrauterine stage** (Fertilization of ovum---Birth)

- **Embryonic period** (organ formation) up to end of week 9
- **Fetal period** (growth and maturation) week 10-- birth

Average birth weight: 2.5–4.2 kg

Newborn vital signs:

Respiratory rate: 40–50 /min

Pulse rate: 120–160 /min

✓**Extrauterine stage**

- **Neonatal period** (28 days)
- **Infancy** (1st year of life)
- **Childhood**
- **Adolescence**

Factors affecting growth and development

- **Genetic factors:**

Sex

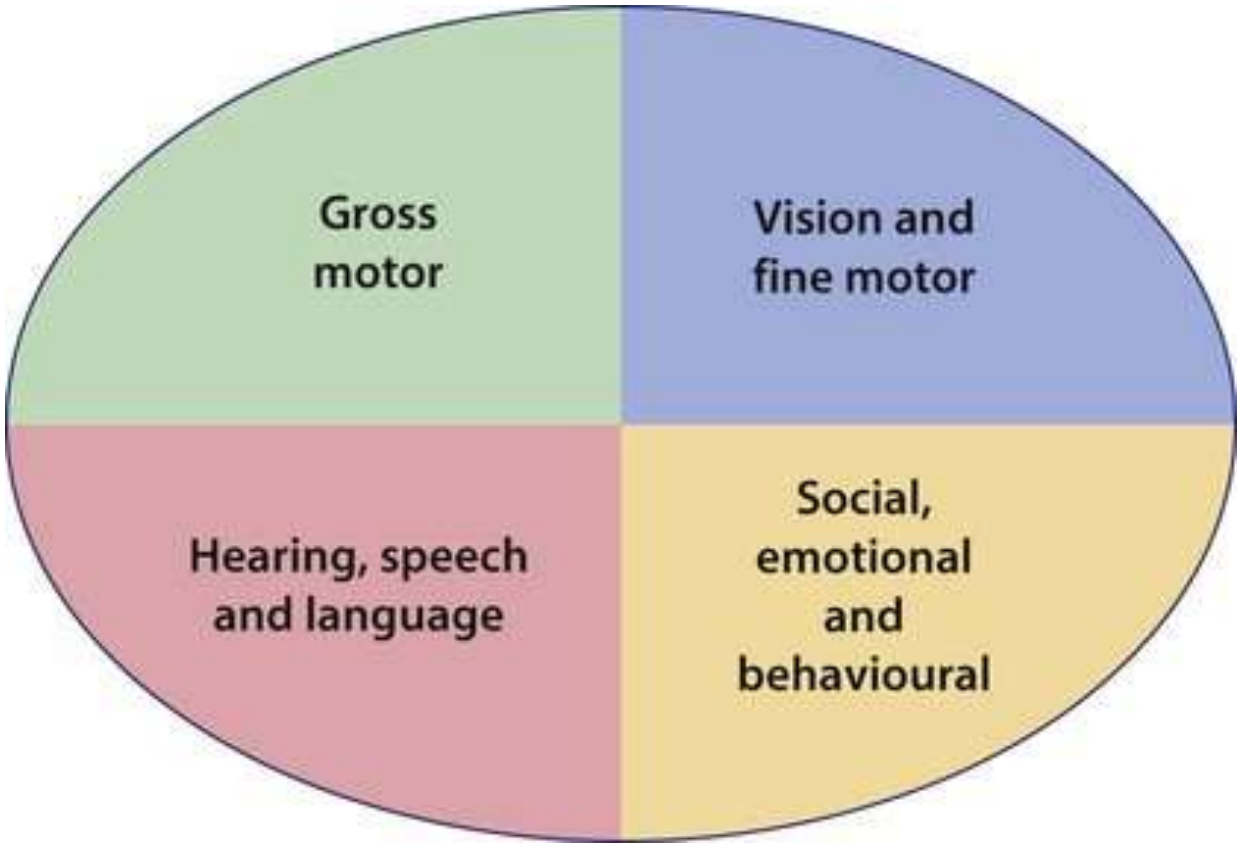
Ethnicity

Parental size

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

- **Environmental factors:**
- **Nutrition**
- **Infections**
- **Hormonal influences**
- **Emotional stimulation**

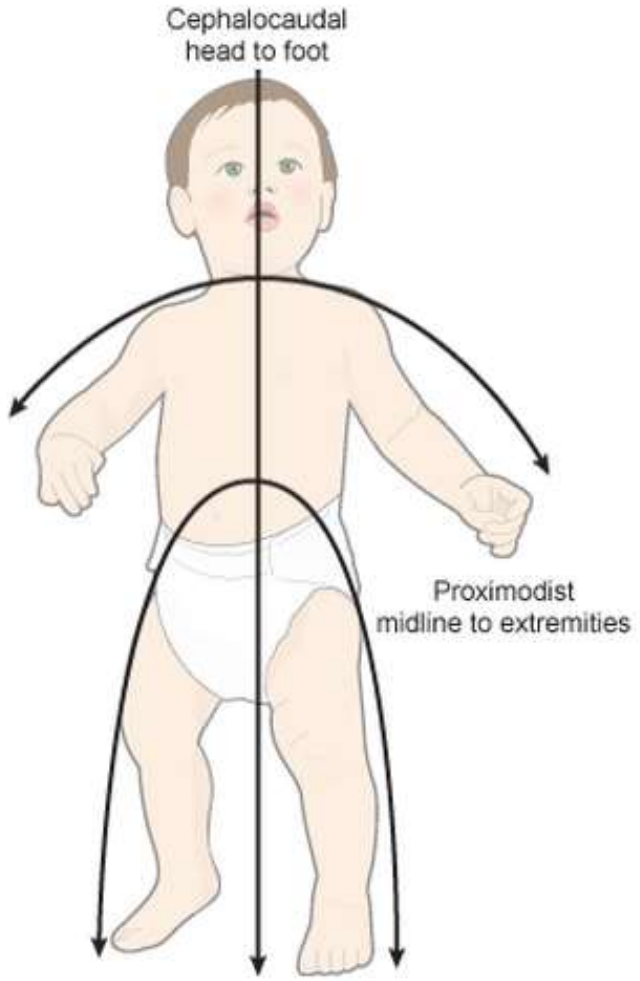
Areas of Development



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.

Principles 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.
- Development follows a **predictable sequence**
- Direction of development:
  - Cephalocaudal
  - Proximodistal
  - General to specific
- There are **Developmental Milestones** that should be checked:
- Represent expected skills at certain ages
- Used to assess normal development
- Delay may indicate health or nutritional problems



Growth Monitoring & Measurements

- Growth monitoring is the *best available indicator* of the overall nutritional status of the child.
- 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.
- **longitudinal:** Follow the same child or a same group over an extended period (regular times)
- **Cross-sectional:** Compare children of the same age at a single point in 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

Weighing Method : Infant weighed undressed or lightly clothed Use calibrated electronic scale Recorded in kilograms

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.

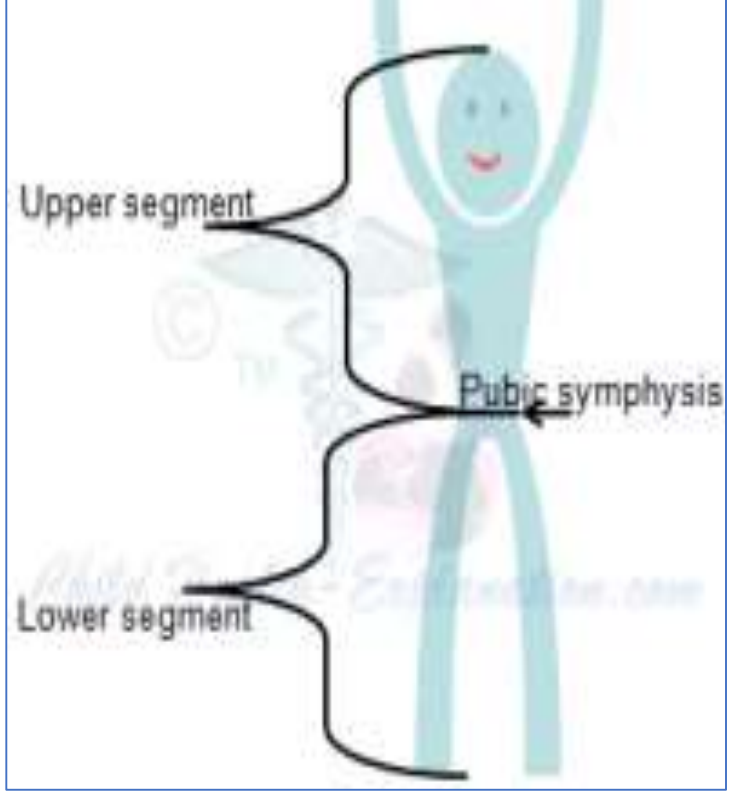
Average weight gain during the *first year of life is about 750 g / month* in *the first four months*, 500 g / month in the second four months and 250 g / month in the third four months.

Newborns may lose up to 10% of birth weight in the first days
Birth weight is usually regained by 7–10 days

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.

Growth assessment relies on growth charts, not fixed numbers

HEIGHT/LENGTH:



<2 years: length

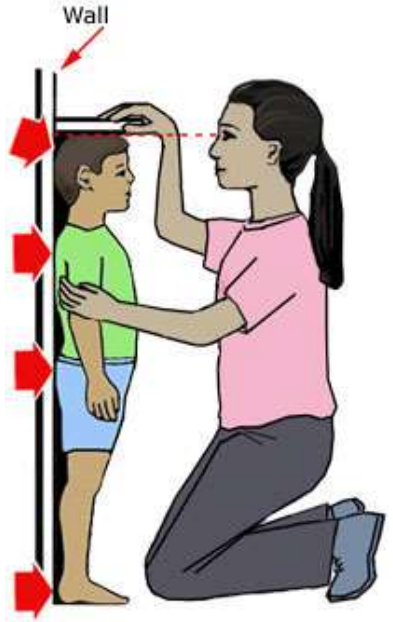
- Measured in supine position
- Total Length
  - Upper – Head-Pubis
  - Lower – Pubis – Toe

U/L : 1.7 -birth

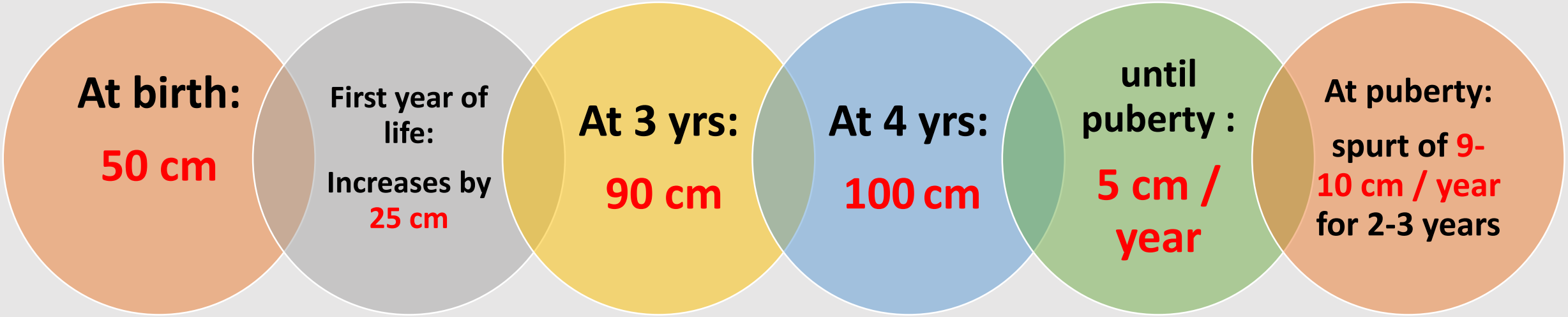
1.0 -7year

>2 years: Height

- Measured in upright standing posture by stadiometer
- Vertical distance between head and heel of foot

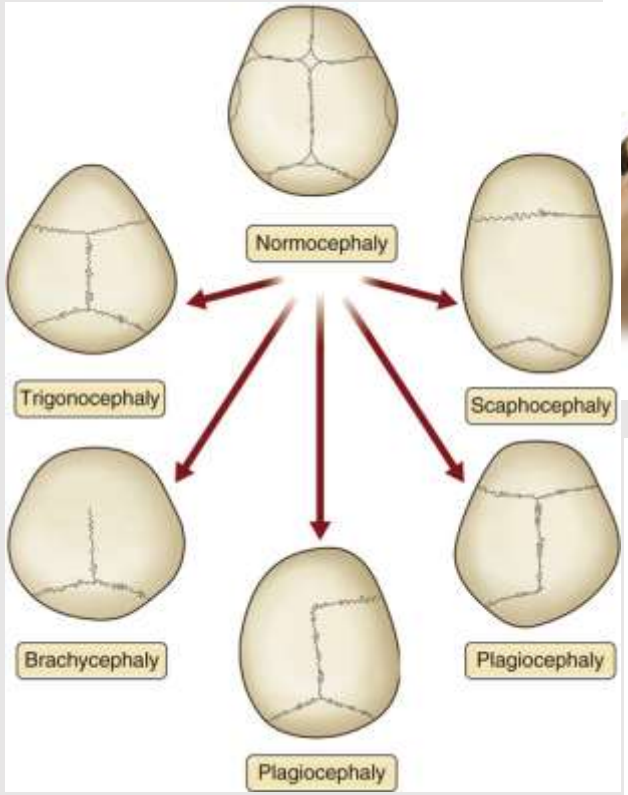


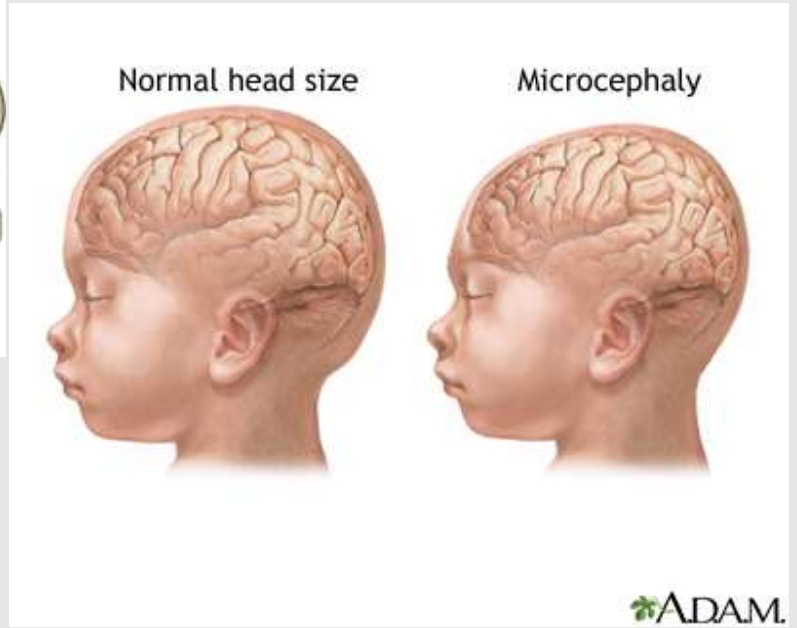
HEIGHT/LENGTH:



HEAD CIRCUMFERENCE:

- Reflects brain growth
- Most important in first 2 years
- At birth: ~35 cm
- At 1 year: ~47 cm
- Method: Use a non-stretchable tape on occipital protuberance to the supra-orbital ridges on forehead .





CHEST CIRCUMFERENCE:

- Assessed mainly in older children
- Reflects lung and heart growth
- Less commonly used than head circumference
- Method:

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

At Birth CC < HC

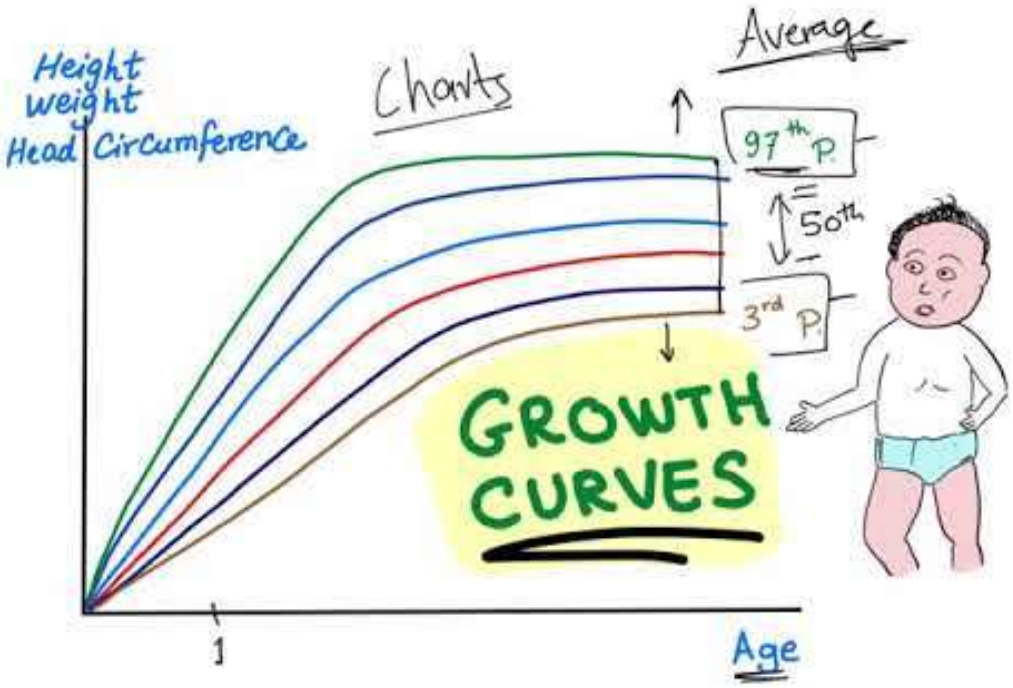
At 1 yr: HC=CC

Later: CC>HC

Growth chart:

- Visual tools for monitoring growth
- Developed and standardized by WHO
- Allow assessment of growth trends over time
- Based on optimal nutrition and environment (breastfed infants as the norm for growth)
- Applicable to all children worldwide regardless of type of feeding
- Separate charts for **boys** and **girls**

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

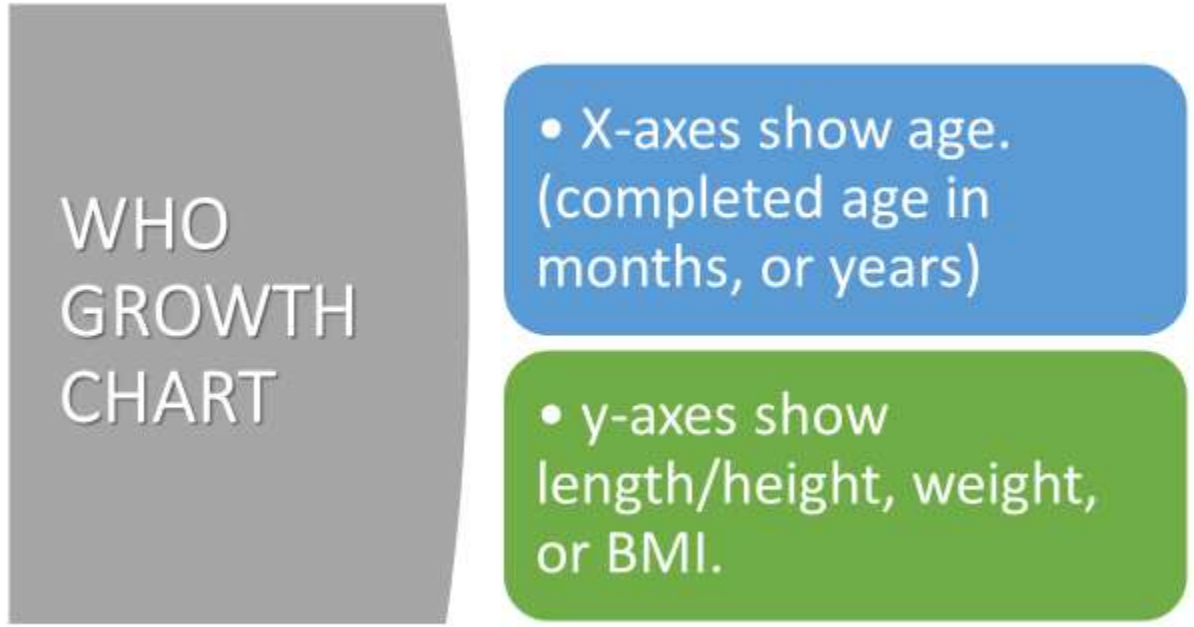


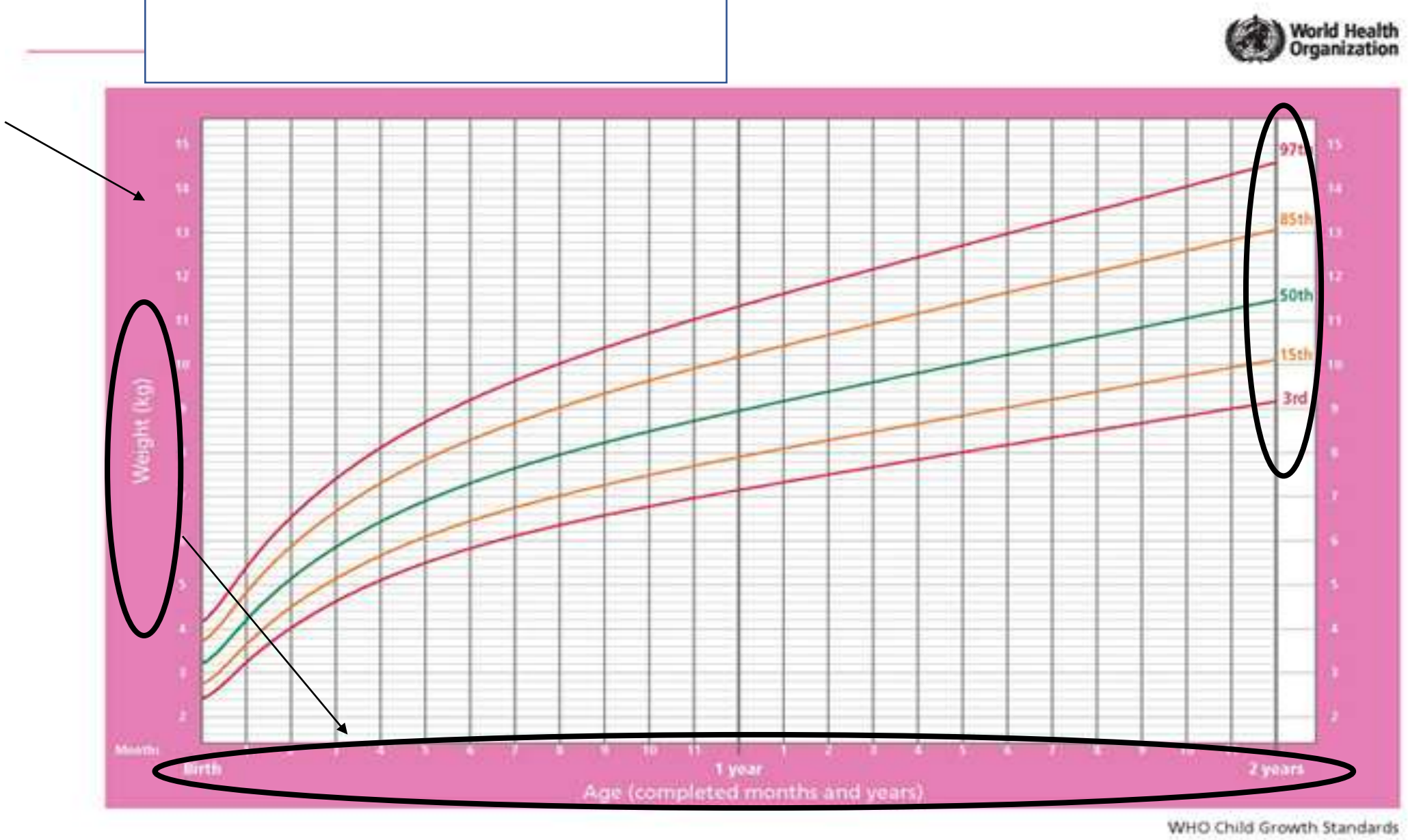
Indicators

❖**The reference lines on the WHO growth charts are either <u>percentile lines</u> or <u>z-scores</u>**

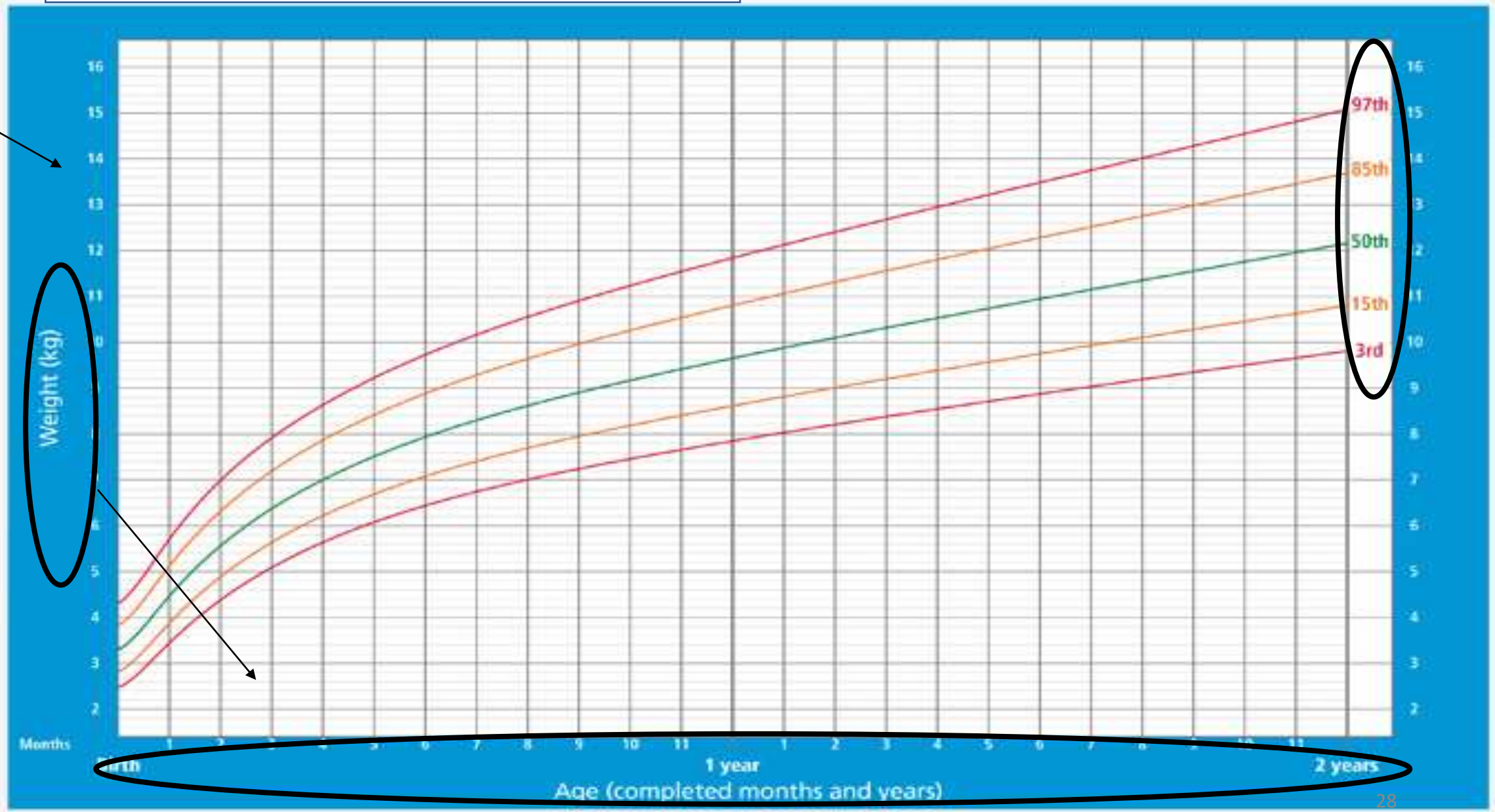
<u>Growth indicators are used to assess growth:</u>

- ➢**Length/height-for-age**
- ➢**Weight-for-age**
- ➢**Weight-for-length/height**
- ➢**BMI (body mass index)-for-age**

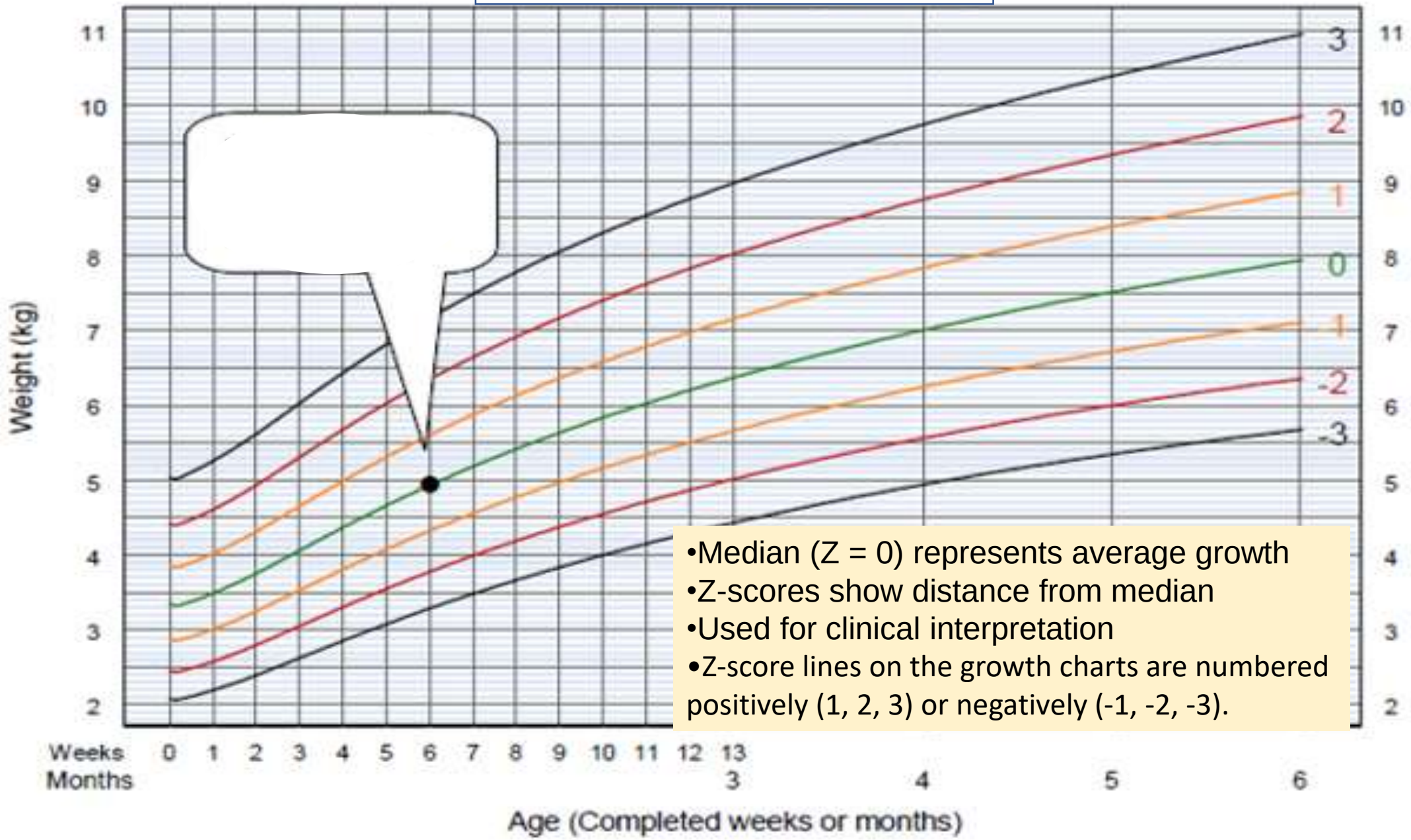



World Health Organization
97th
85th
50th
15th
3rd
Weight (kg)
Birth
1 year
2 years
Age (completed months and years)
WHO Child Growth Standards

World Health Organization

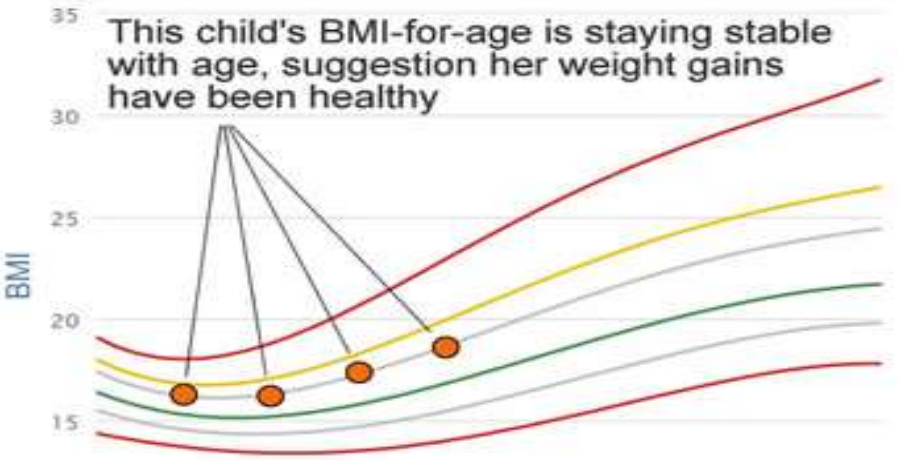


WHO Child Growth Standards


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)
•Median (Z = 0) represents average growth
•Z-scores show distance from median
•Used for clinical interpretation
•Z-score lines on the growth charts are numbered positively (1, 2, 3) or negatively (-1, -2, -3).

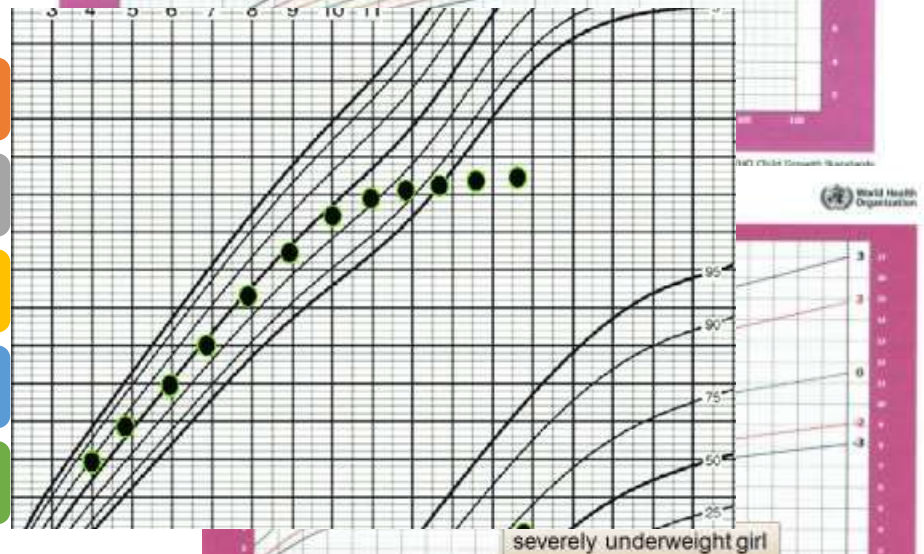
How to Use Growth Charts

- Measure accurately
- Select correct chart (age and sex)
- Plot measurements regularly
- Observe trends over time



Interpreting Growth Trends

- Normal growth follows a parallel curve <u>The track may be above or below the median.</u>
- Warning signs:
- Crossing z-score lines (a sharp incline or decline in the child‘s growth line).
- Flat growth line (stagnation); i.e. there is no gain in weight or length/height
- Extreme values A plotted point that is far from the median in either direction



Weight-for-age

- Reflects body weight relative to the child's age on a given day.
- Used to identify underweight and severe underweight.
- Not used to classify overweight or obesity.
- Commonly used due to ease of measurement, but unreliable when age is unknown (e.g. refugee settings).
- Note: Oedema of both feet may falsely increase weight and mask undernutrition.

Length/height-for-age

Assesses linear growth relative to age.

Identifies stunting resulting from chronic undernutrition or repeated illness.

Tallness is rarely a concern unless excessive and may indicate rare endocrine disorders.

weight-for-length/height

Particularly useful when the child's age is unknown.

Low values indicate wasting or severe wasting.

Wasting usually reflects acute weight loss due to recent illness or food shortage.

High values identify children at risk of overweight or obesity.

BMI-for-age

A screening indicator for overweight and obesity in children.

Commonly used in older infants and children.

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**.

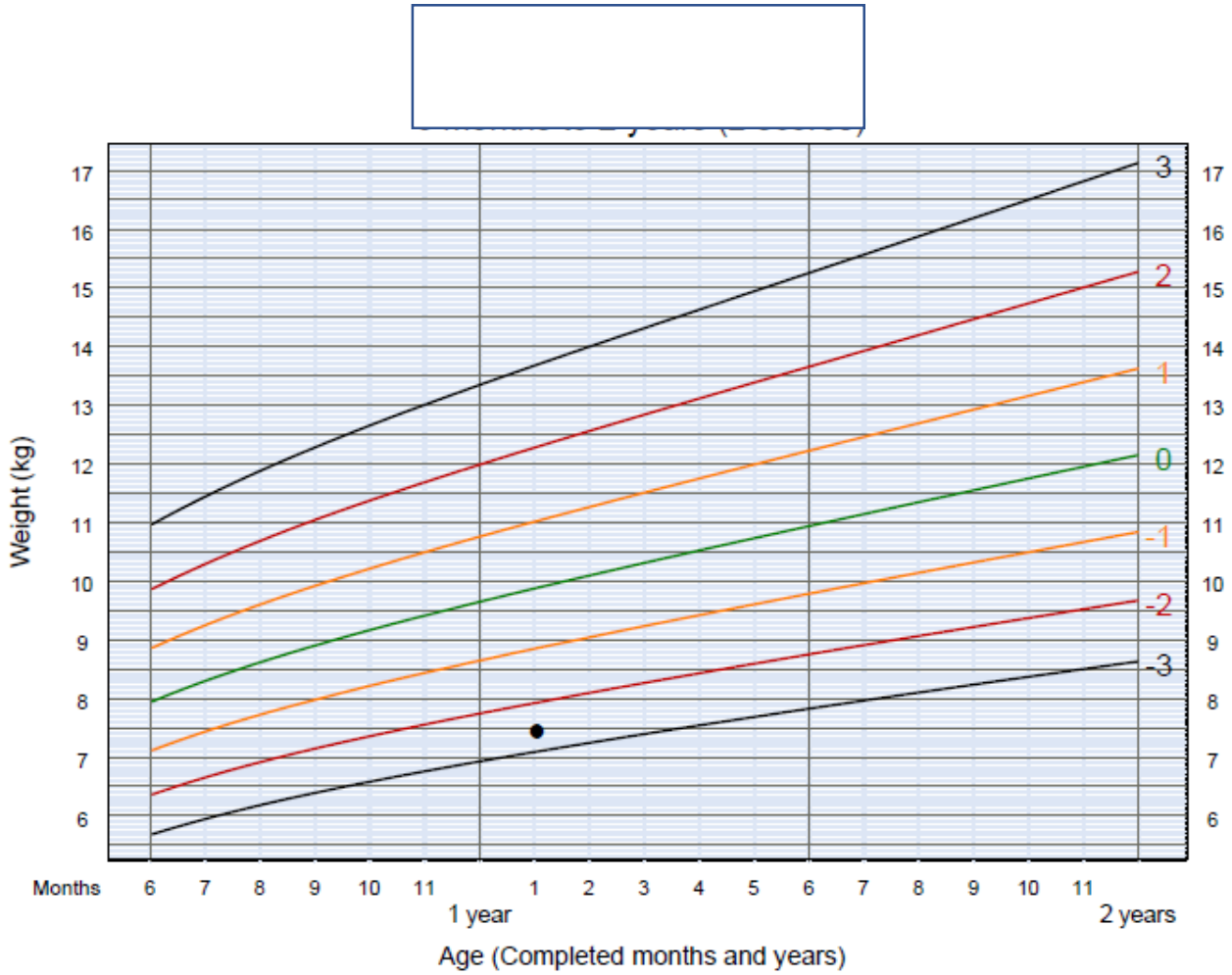
Above 1 shows **possible risk of overweight**

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*

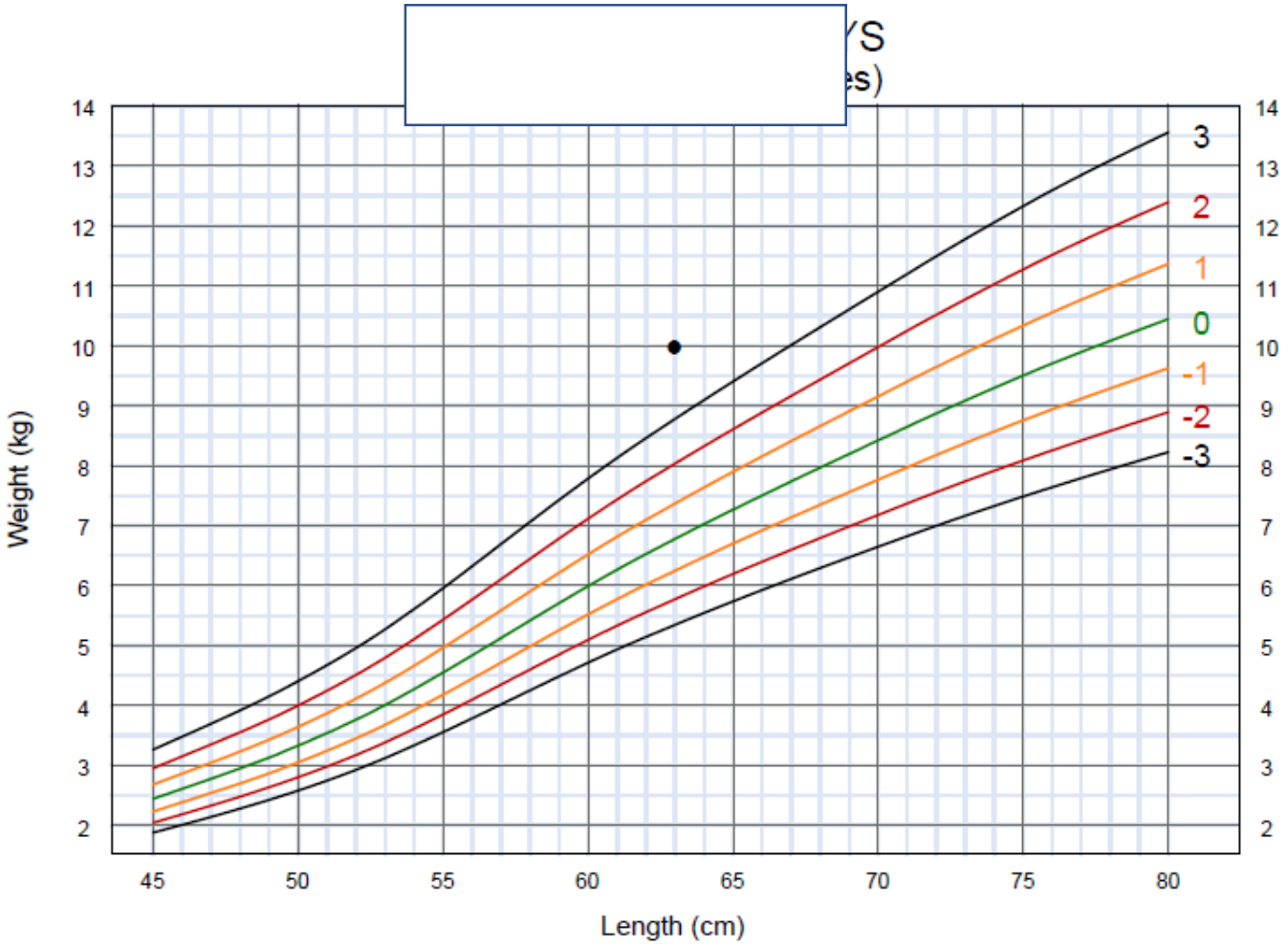
Measurements in the shaded boxes are in the normal range.

Example??


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 (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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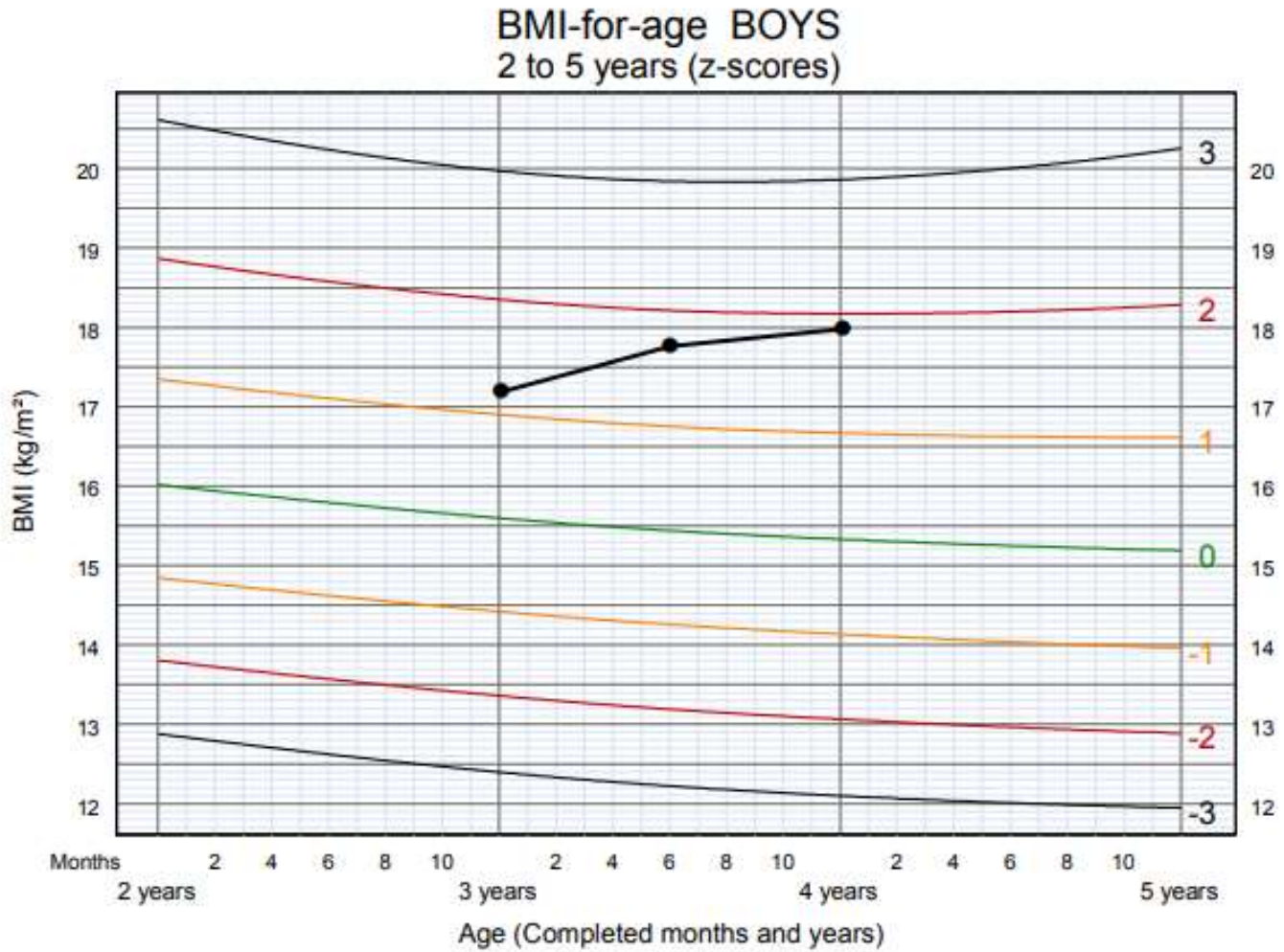
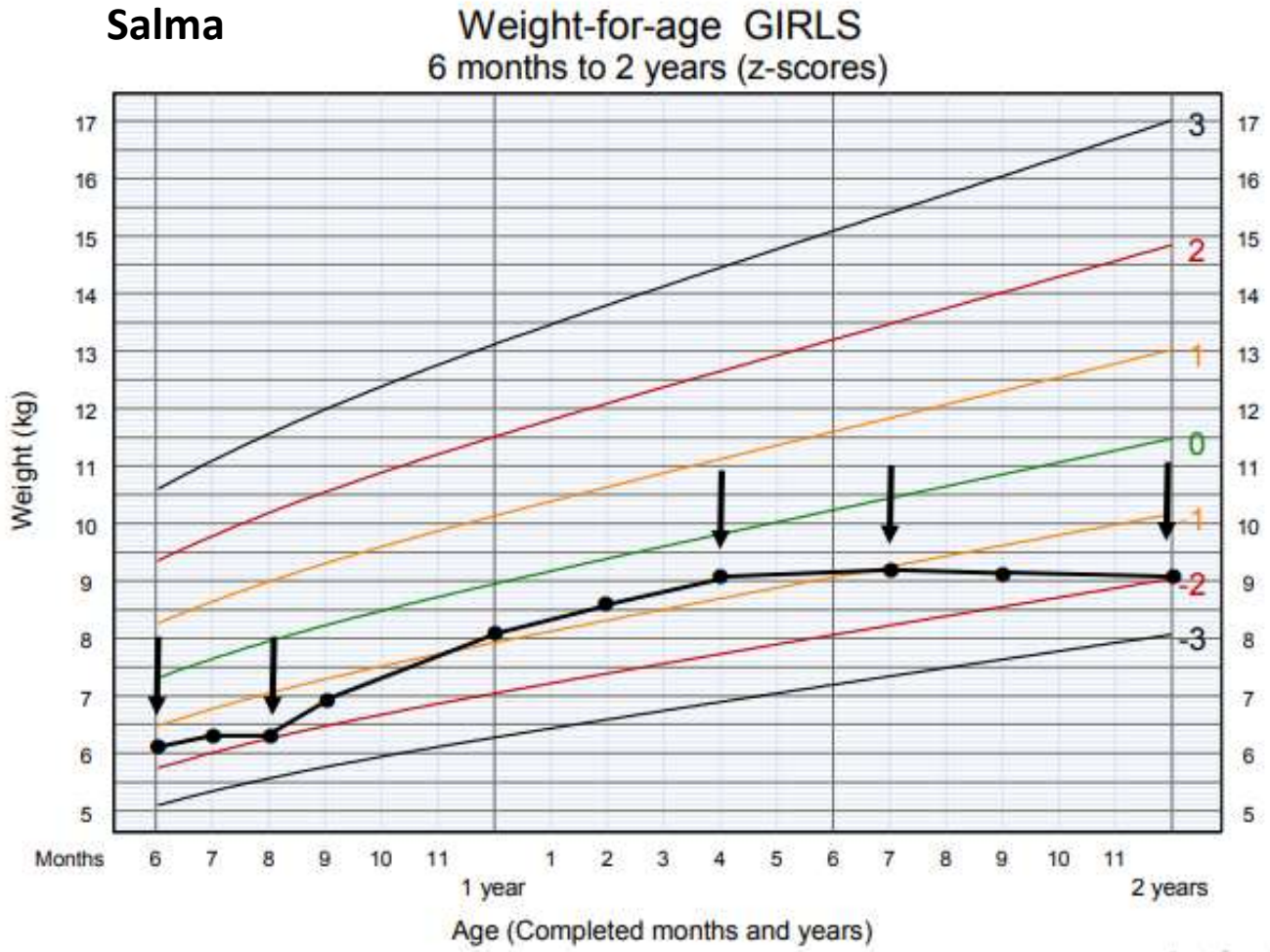
Adil:



- 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



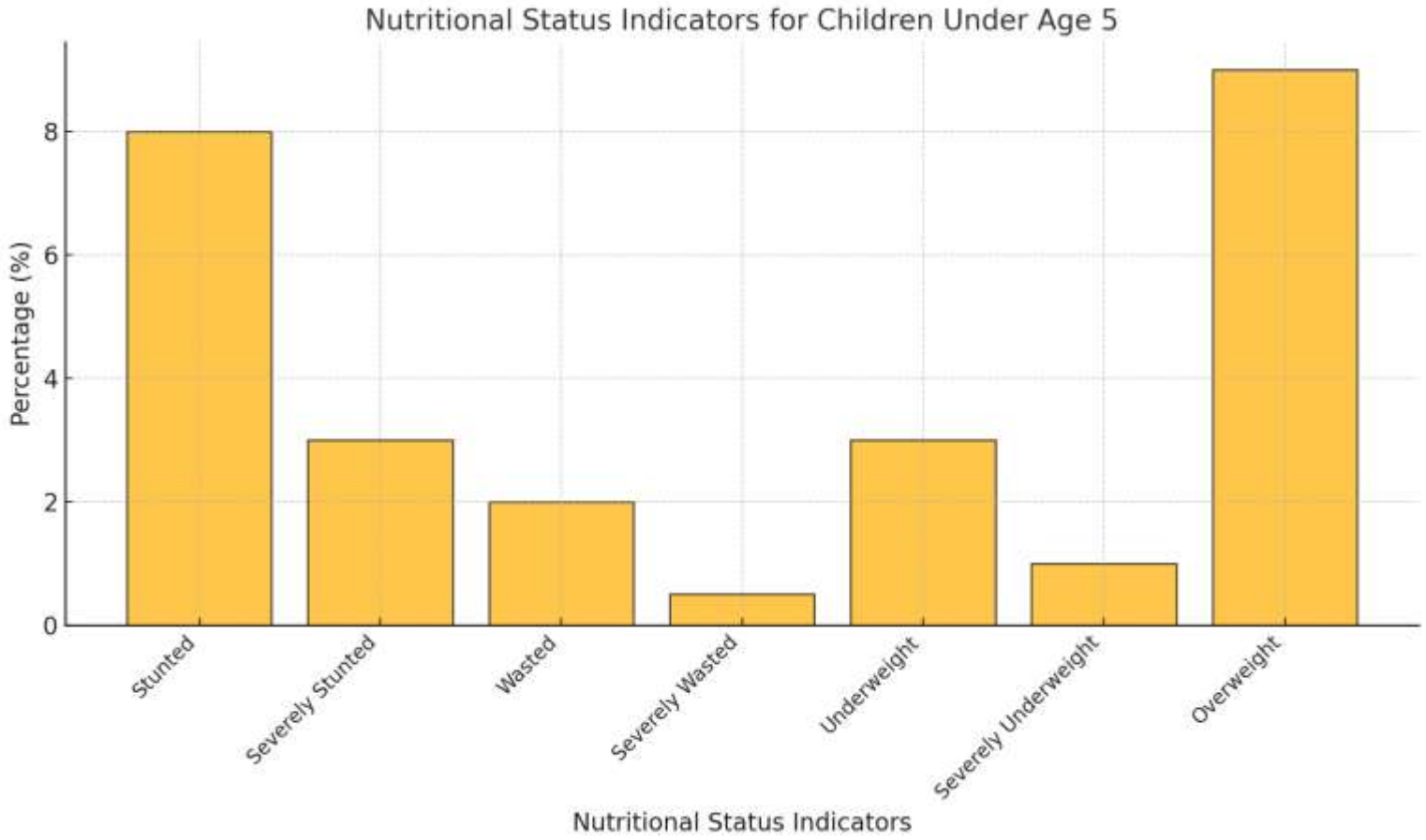
- Salma's weight-for-age chart shows a flat growth line (stagnation) from age 6 months to 8 months and again from about 1 year and 4 months to 2 years. These periods of stagnation correspond to times when Salma was having diarrheal episodes (indicated by arrows). From 8 months up to 1 year and 4 months, 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 have slowed down at an age when rapid growth is expected. She is stunted.

In Jordan: Growth Monitoring Statistics from the DHS 2023 Report

- **Nutritional Status Indicators**:
- **Stunting: 8%**
- **Wasting: 2%**
- **Underweight: 3%**
- **Overweight: 9%** (high weight-for-height).



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

- Thank you

Questions?