Growth monitoring

Assistant professor Mayasah A. Sadiq FICMS-FM

GROWTH AND DEVELOPMENT

- Definition: A phenomenon peculiar to the paediatric age group is growth and development.
- The term growth refers to increase in the physical size of the body, and development to increase in skills and functions.
- Growth and development are considered together because the child grows and develops as a whole.
- Growth and development include not only physical aspect, but also intellectual, emotional and social aspects.
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Measuring and Plotting

- Normal growth and development take place only if there is:
- Optimal nutrition.
- Freedom from recurrent episodes of infections.
- Freedom from adverse genetic and environmental influences.

Determinants of growth and development

- (1)**GENETIC INHERITANCE** : Genetic factors influence growth and development, especially height and weight, mental and social development and personality.
- (2)**NUTRITION** : Nutrition influences growth and development before as well as after birth. In fact, retardation of growth rate is an indication of malnutrition.
- When the diet is improved the child begins to grow in height and weight.

Determinants of growth and development

- (3) **AGE**: Growth rate is maximum during fetal life, during the first year of life and then again at puberty.
- Another periods, growth is slower.
- (4) **SEX:** At about the age of 10 to 11 years, female children show a sudden increase in height and weight. This growth spurt corresponds to puberty. In male children, the growth spurt occurs a little later, i.e., between 12 and 13 years.

Determinants of growth and development

- (5) **PHYSICAL SURROUNDINGS** : Sunshine, good housing, lighting and ventilation have their effects on growth and development.
- (6) **PSYCHOLOGICAL FACTORS**: Love, tender care and proper child-parent relationship do affect the social, emotional and intellectual development of children.

Determinants of growth and development

- (7) **INFECTIONS AND PARASITOSIS**: Certain infections of the mother during pregnancy (e.g., rubella, syphilis) affect the intrauterine growth of the fetus.
- Infections after birth (e.g., diarrhea, measles) slow down growth and development, especially in the malnourished child. The intestinal parasites (e.g., roundworms) by consuming considerable quantities of nutrients hamper growth and development.

Determinants of growth and development

- (8) **ECONOMIC FACTORS** : The standard of living of the family is an important factor. Children from well-to-do families have better height and weight. The economic factor is connected with the nutrition and living of the people.
- (9) **OTHER FACTORS**: These comprise the birth order of the child, birth spacing, birth weight in single and multiple pregnancies, education of the parents, etc.

Surveillance of growth and development

- Surveillance of growth and development is a specific function of the mother and child health services.
- It is an important component of the routine anticipatory care of children.
- The main purpose of growth surveillance is to identify those children who are not growing normally.
- Surveillance also reflects the effectiveness of other components of child care such as nutrition, sanitation and control of infection.

PHYSICAL GROWTH

- **1. Weight-for-age**
- Measurement of weight and rate of gain in weight are the best single parameters for assessing physical growth.
- A single weight record only indicates the child's size at the moment; it does not give any information about whether a child's weight is increasing, stationary or declining.
- This is because, normal variation in weight at a given age is wide.
- What is important is careful repeated measurement at intervals, ideally monthly, from birth to 1 year, every two months during the second year and every 3 months thereafter up to 5 years of age, since this age group is at greatest risk from growth faltering.
- By comparing the measurements with reference standards of weight of children of the same age ,the trend of growth becomes obvious.

PHYSICAL GROWTH

- **2. Height (length)-for-age**
- Height should be taken in a standing position without foot wear.
- The measuring scale fixed to the wall can be employed.
- This arrangement is suitable for children 2 years and above.
- The measuring scale should be capable of measuring to an accuracy of 0.1 cm.
- A very great effort should be made to measure children accurately.
- Errors in the measurement of a young child may lead to significant errors in the classification of the nutritional status.

- **3. Weight-for-height**
- Height and weight are interrelated.
- Weight in relation to height is now considered more important than weight alone.
- It helps to determine whether a child is within range of "normal" weight for his height.
- Low weight for height : This is also known as nutritional wasting or emaciation {acute malnutrition). It is associated with an increased risk of mortality and morbidity

Measuring and Plotting

- **4. Head and chest circumference** At birth the head circumference is about 34 cm.

THE GROWTH CHART

- The growth or **"road-to-health"** chart (first designed by David Morley and later modified by WHO) is a visible display of the child's physical growth and development.
- It is designed primarily for the longitudinal follow-up (growth monitoring) of a child, so that changes over time can be interpreted.
- It is important to note that in the weight-for-age chart, the height of the child is not taken into consideration.
- This is because weight is the most sensitive measure of growth, and any deviation from "normal" can be detected easily by comparison with reference curves.
- A child can lose weight, but not height.
- In short, the growth chart offers a simple and inexpensive way of monitoring weight gain, and in fact child health over time.

Cont.....

- When growth slows or stops, we say growth "falters". This is a sign that something is wrong with the child and must be discovered at the earliest and set right.
- It can be said that "A GROWING CHILD IS A HEALTHY CHILD", and equally true that, "A CHILD WHO IS NOT GROWING IS NOT HEALTHY".
- THE MOST ACCURATE AND SENSITIVE MEASURE OF GROWTH IS WEIGHT GAIN.

Growth monitoring definition

- Refers to the process of tracking child growth by regularly measuring the child and comparing his or her growth (i.e., height or weight) to a standard, assessing growth adequacy, and linking the growth trend with a target action through tailored counseling and referral.

Why Monitor Growth?

- Growth is the **most sensitive indicator of child's health**
  - normal growth only occurs if a child is healthy
- Growth assessment is an **essential** part of the examination or investigation of any child.
- Allows **objective detection of growth disorders** at population level at earliest opportunity
- It helps in early identification and treatment of the growth disorder which improves outcome.
- It identifies under or over nutrition

STEPS IN GROWTH MONITORING

- Five steps :-
  -
  -
  -
  -
  -

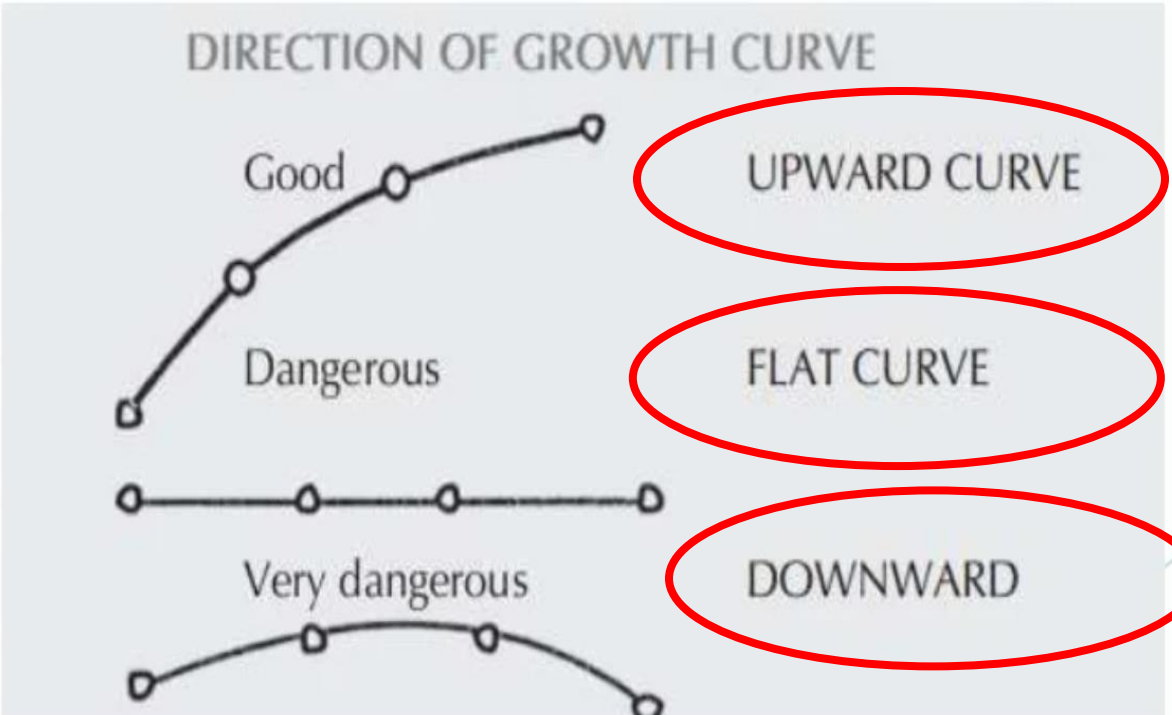
GROWTH CURVE

- Formed by joining the plotted points on a growth chart
- Direction of the growth curve indicates whether the child is growing or not
- Helps in determining the growth pattern of a child.
- It is very important to consider the child's whole situation while assessing the growth pattern

DIRECTION OF CHILD'S GROWTH CURVE

- The growth curve of a normally growing child usually follows a track that is roughly parallel to the 1ST or 2nd printed curve lines.

- The direction of the growth curve of the child can be upward, flat or downward



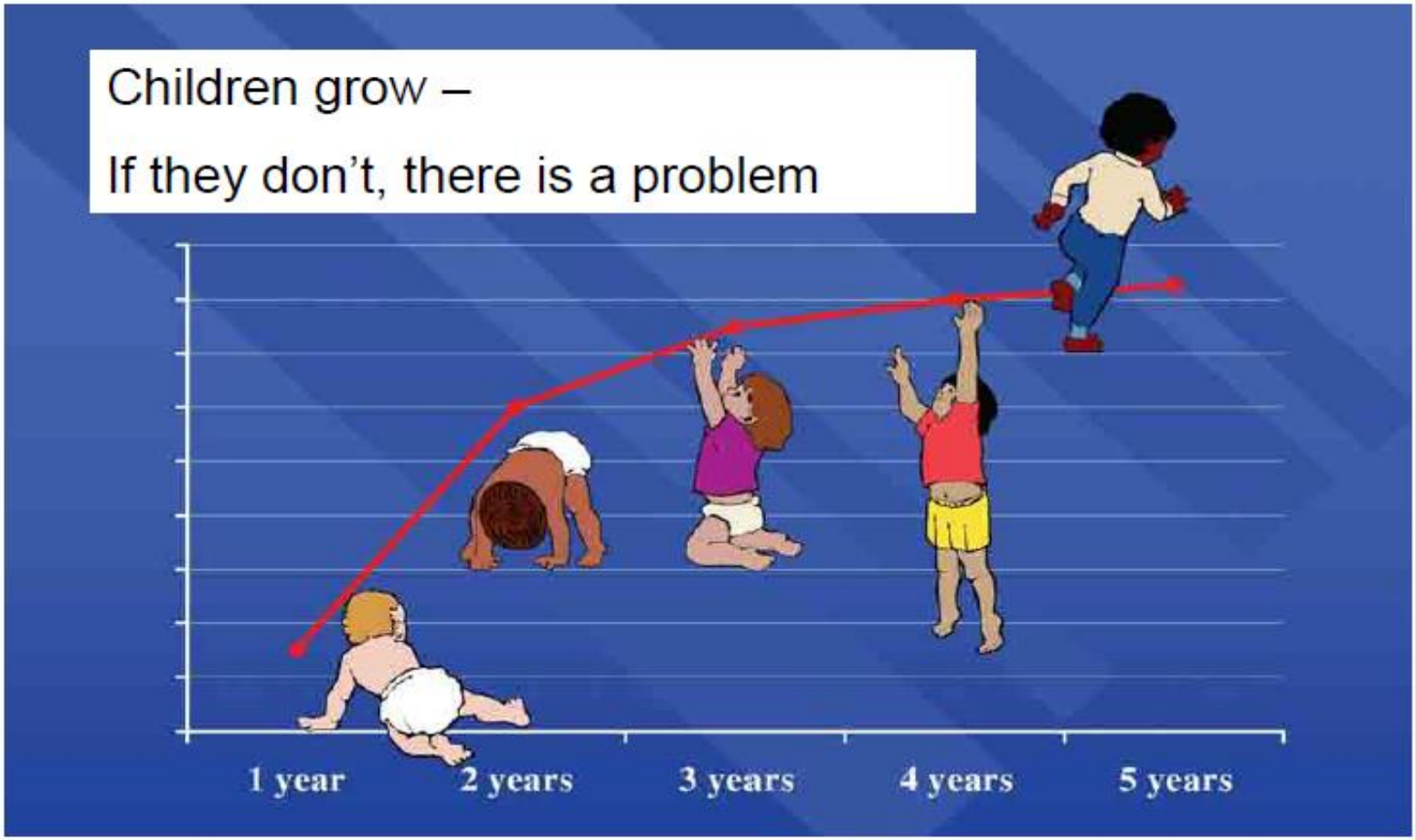
Measuring and Plotting

Direction of Growth Curves	Growth Pattern
Upward Growth Curve	**Good** Indicates adequate weight gain for the age of the child. The child is growing well and is healthy.
Flat Growth Curve	**Dangerous** Indicates that the child has not gained weight and is not growing adequately. This is called stagnation. The child needs attention by the mother and the health worker
Downward Growth Curve	**Very dangerous** Indicates loss of weight. The child requires immediate referral and health care.

Child Growth = marker of health and development

- Quick, non-invasive techniques
- Plotting serial measurements on charts
- Abnormal growth can indicate underlying health or developmental problems

Measuring and Plotting



Standardized tables or charts are used to assess weight, length or height, skull circumference, and growth velocity

Main influence on growth

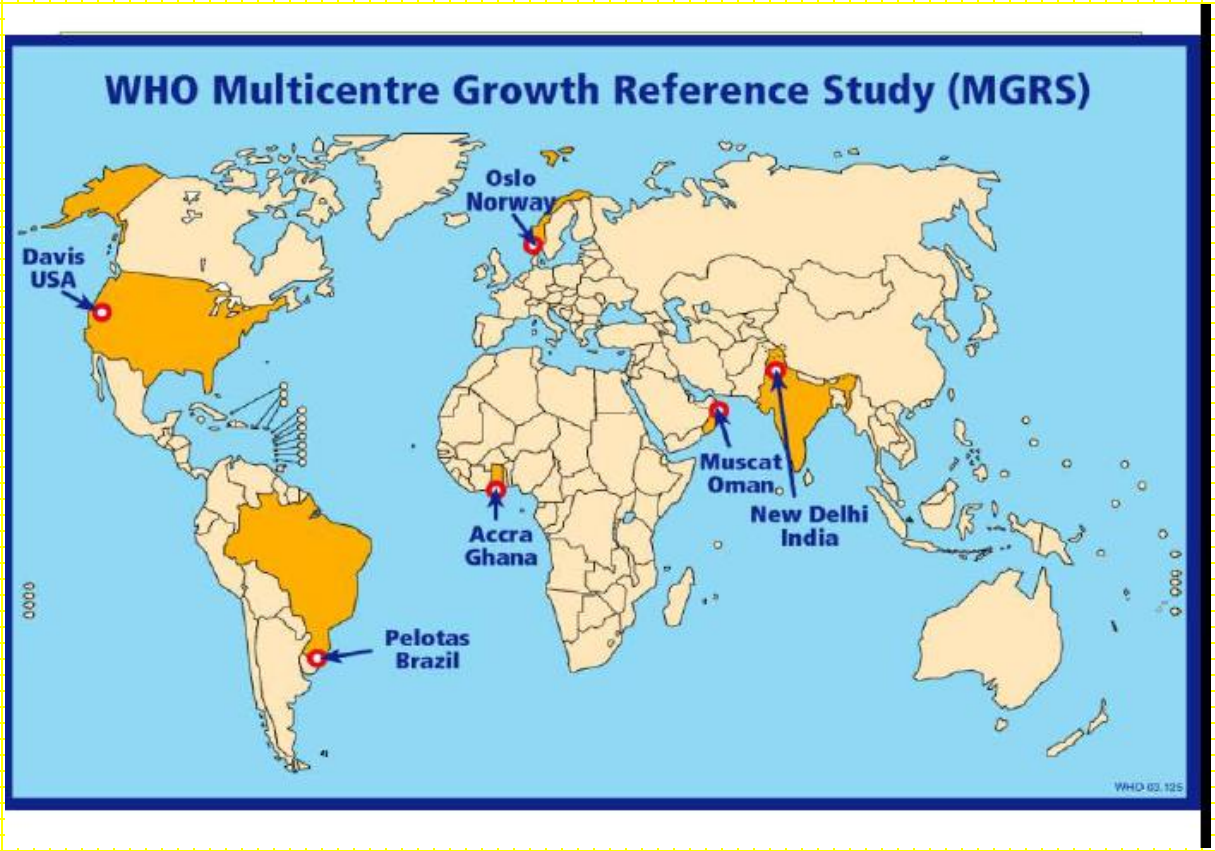
- Infancy : (up to 2 years)
  - Food/ nutrition
  - Chronic disease
- Childhood
  - Genes
  - Growth Hormones
  - Chronic disease
- Puberty
  - Sex hormones

NCHS(National Center for Health Statistics USA) or WHO charts

- •Growth charts are established on large populations of normal children living under near-optimal conditions and therefore representing the range of normal growth for children at different ages.
- •NCHS : USA population, cross-sectional
- •New growth standards have been developed by the World Health Organization (WHO) based on the growth of normal breast-fed infants in various regions of the world. **International growth reference standard**

Measuring and Plotting

In response WHO undertook the Multicentre Growth Reference Study (MGRS) between 1997 and 2003 to generate new curves for assessing the growth and development of children the world over.



For the assessment WHO has provided

- Charts for both boys and girls.
- To assess growth considering a child‘s age and measurements together.
  - length/height-for-age
  - weight-for-age
  - weight-for-length/height
  - BMI (body mass index)-for-age
  - HC(head circumference)-for-age

What are growth charts?

- Growth charts are a series of percentile curves that show the distribution of body measurements in children over time.
- Growth charts are not diagnostic instruments. They are screening tools that help you form an overall clinical impression for the child being measured.
- The positions of the individual points on the graph are less important than the overall trajectory of the growth curve over time.

How to use a growth chart

- Accurately determine age .
- Accurately measure weight and recumbent length
- Plot measurements on appropriate chart
- Use the percentile lines to assess body size and growth, and ***monitor growth over time***
- Gather additional history, exam as needed
- Discuss growth pattern with parent and agree on subsequent action if required

USES OF THE GROWTH CHART

1. For growth monitoring which is of great value in child health care
2. Diagnostic tool: for identifying "high risk" children.
3. Planning and policy making: by grading malnutrition, it provides an objective basis for planning and policy making in relation to child health care.
4. Educational tool: for mothers.
5. Tool for action : helps health worker on the type of intervention needed
6. Evaluation: of the effectiveness of corrective measures and the impact of the programme or of special intervention

Measuring and Plotting

Birth to 2 years

Weight to nearest 10g

To nearest 0.1cm

purpose‘infantometer’ to nearest 0.1cm

Measuring and Plotting

2 & 3 ½ years

Portable or fixed

'for purpose'

To 100g / 0.1cm

Measuring Weight

Babies should be weighed without any clothes or nappy

Children older than two years can be weighed in vest and pants, but no shoes, footwear, and dolls or teddies in hand

Only grade 3 clinical electronic scales in metric setting should be used -green sticker with background letter M (which means approved for medical use). Scales should be calibrated and maintained annually.

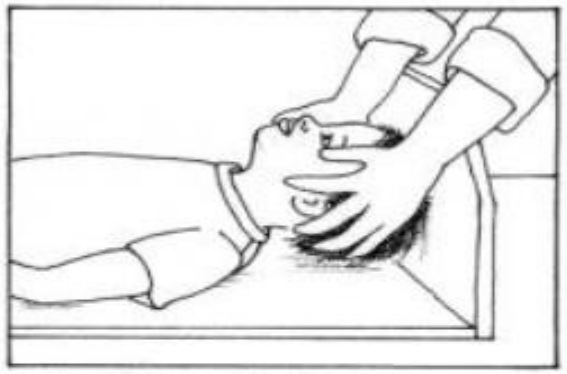
Measuring Head Circumference

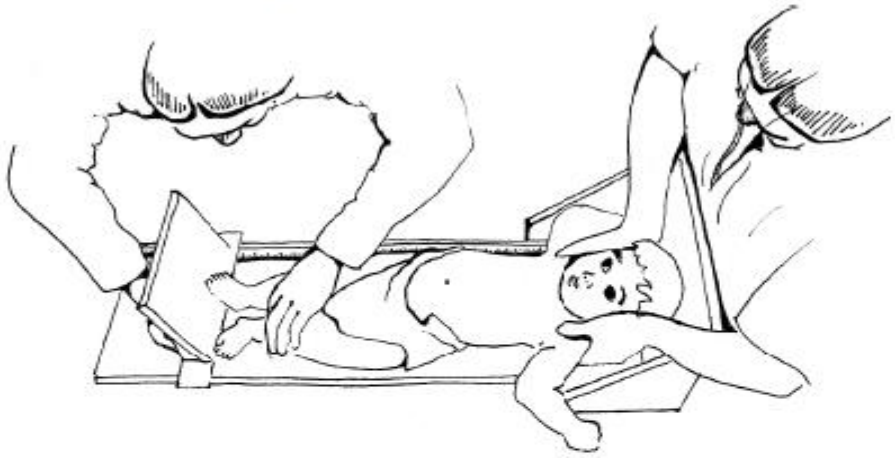
Head circumference should be measured using a narrow non-stretchable plastic or disposable lasso tape. Clean tape with antiseptic wipes [or soapy water] between child use

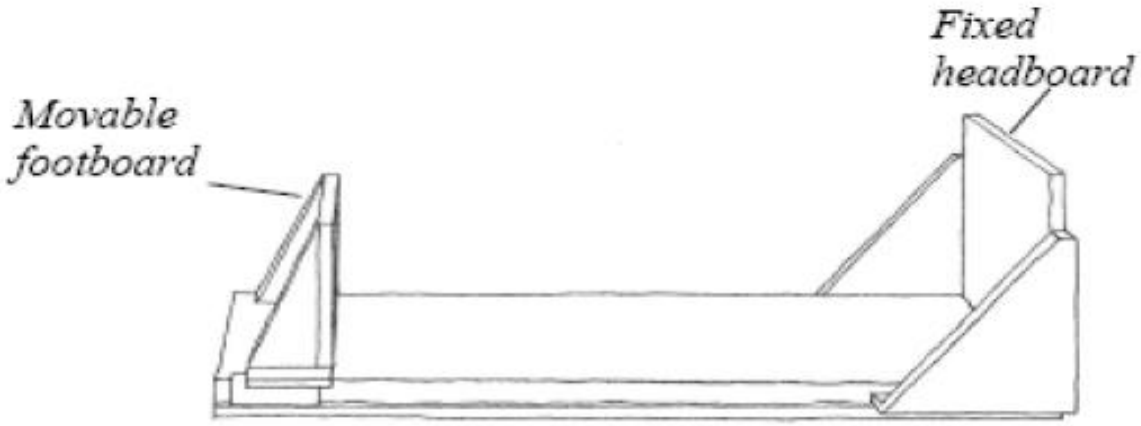
Measurement should be taken at the maximum occipito-frontal circumference taking the largest of 3 consecutive measurements

Lasso tape

Length vs height







Measurement of stature

Feet flat together against the wall

Buttocks, Back against the wall

Stand straight!

Horizontal mark opposite top of head

Measure against the wall

Is this boy really 6 years old?

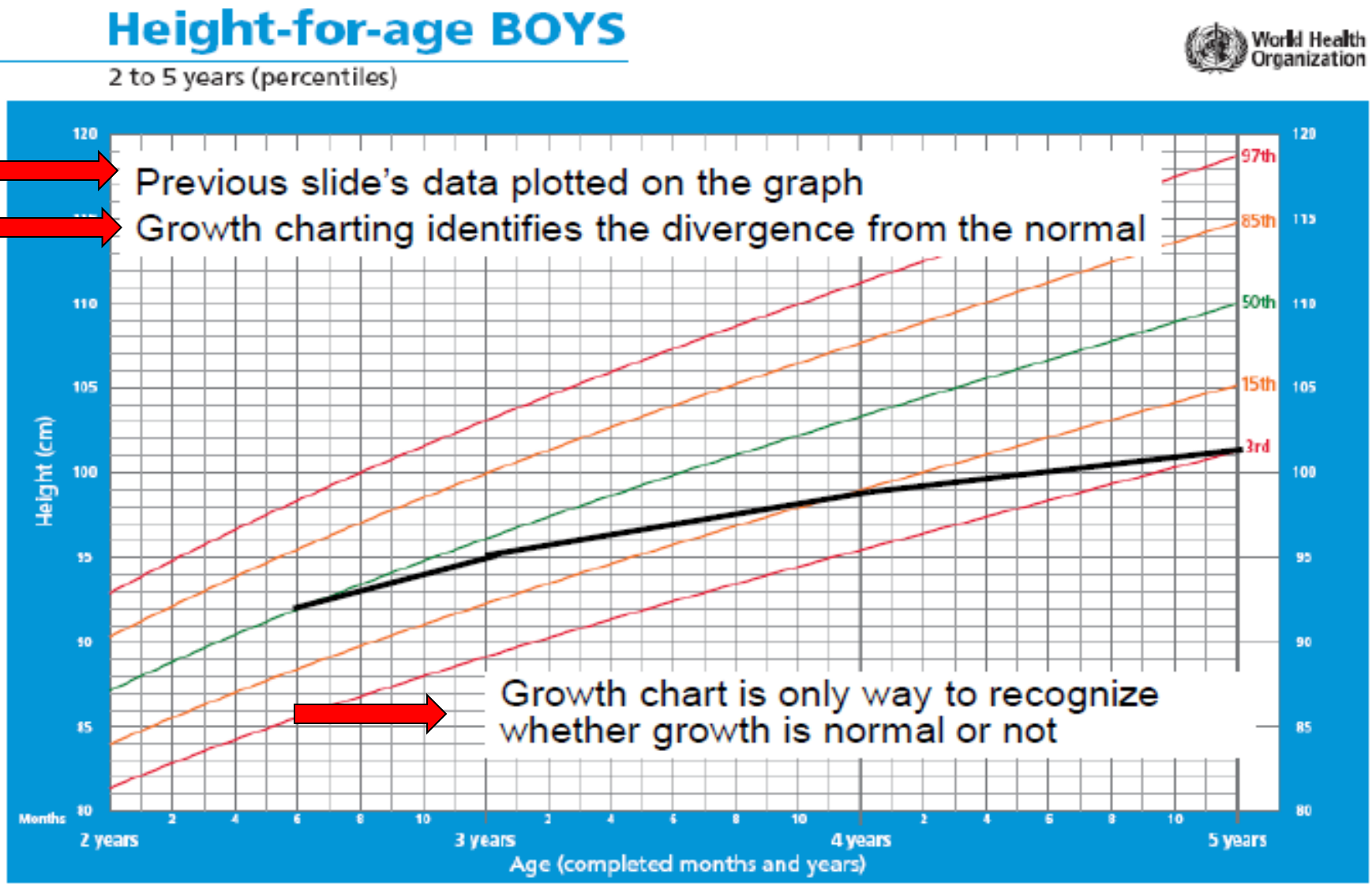
Measurement is the only way to recognize whether growth is normal or not

Measurement of growth

- Length or height measurement
- Example of a little boy's data:

eg	Age	Ht
	2.5 yrs	92 cm
	3.0 yrs	95 cm
	3.5 yrs	97 cm
	4.0 yrs	99 cm
	5.0 yrs	101 cm

Measuring and Plotting

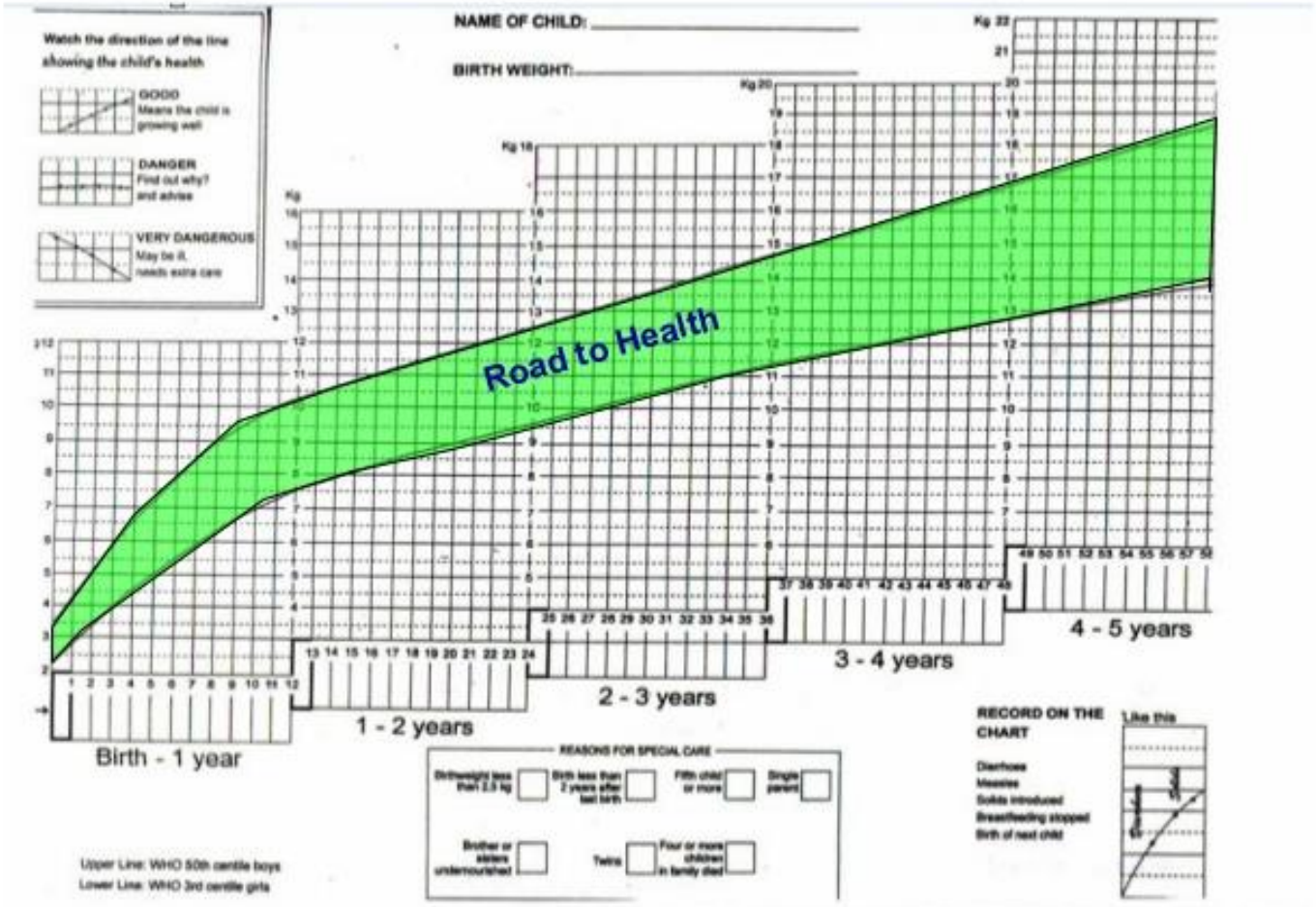


The most important feature of growth charts

- A measure to compare and monitor the physical status of an individual child with the childhood population on an ongoing basis.

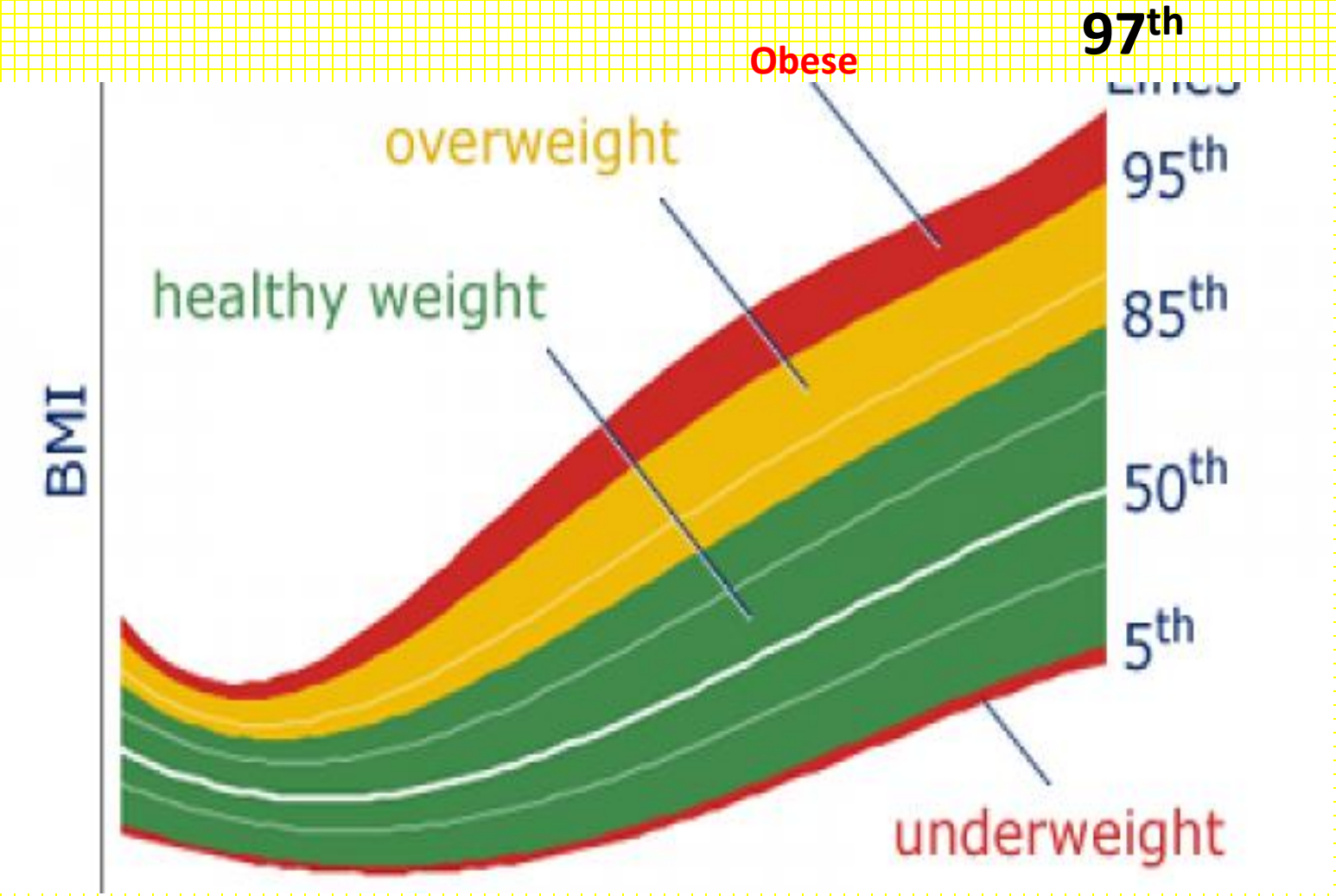
- **Different types of growth charts**
  - Road-to-Health Chart :
    - mainly a weight for age chart
  - Longitudinal growth charts
    - Percentile graphs
    - Z score graphs
  - BMI charts
  - Weight for length/height charts

Measuring and Plotting

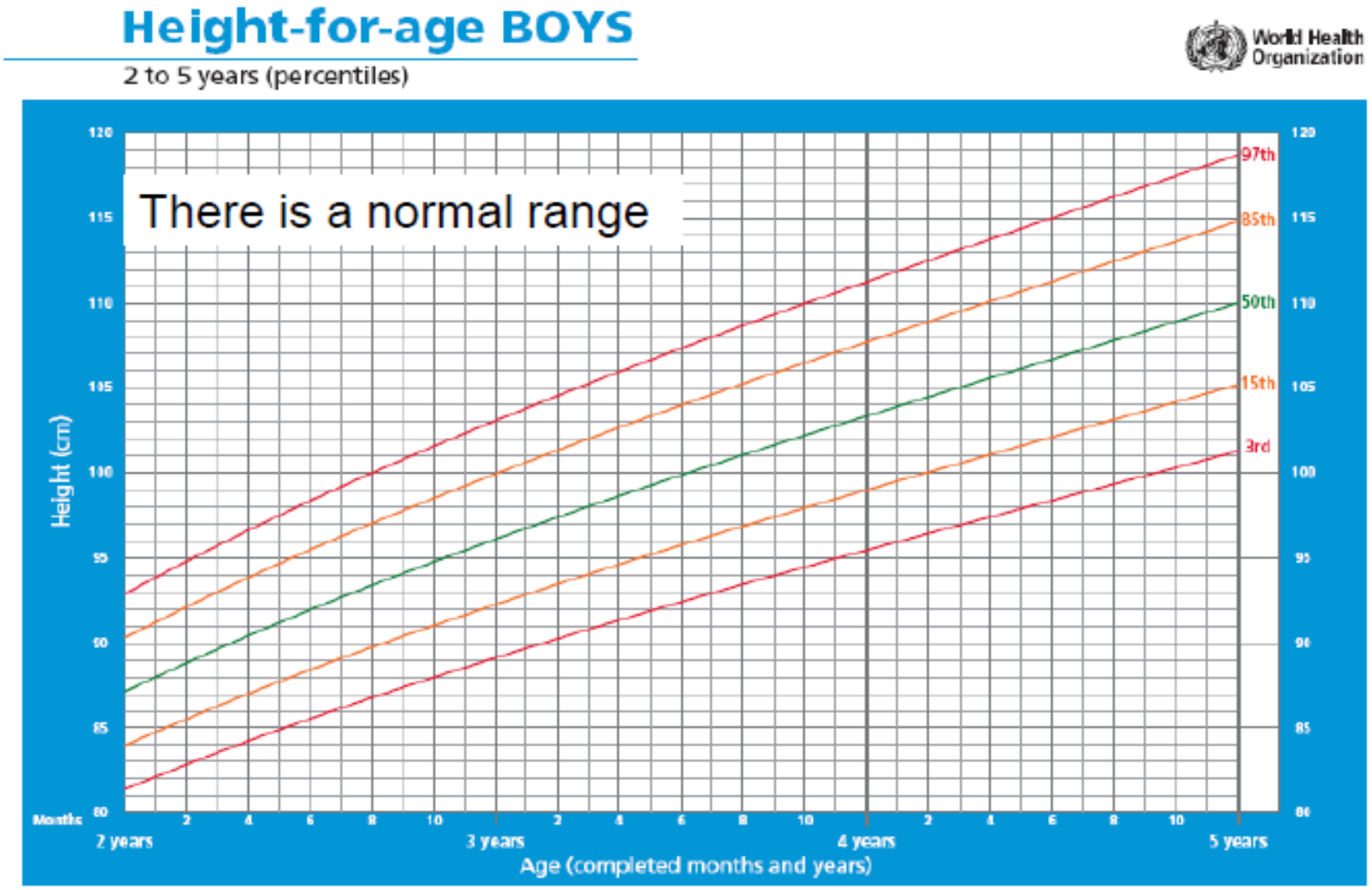


Growth chart 'Road to Health chart'

Measuring and Plotting



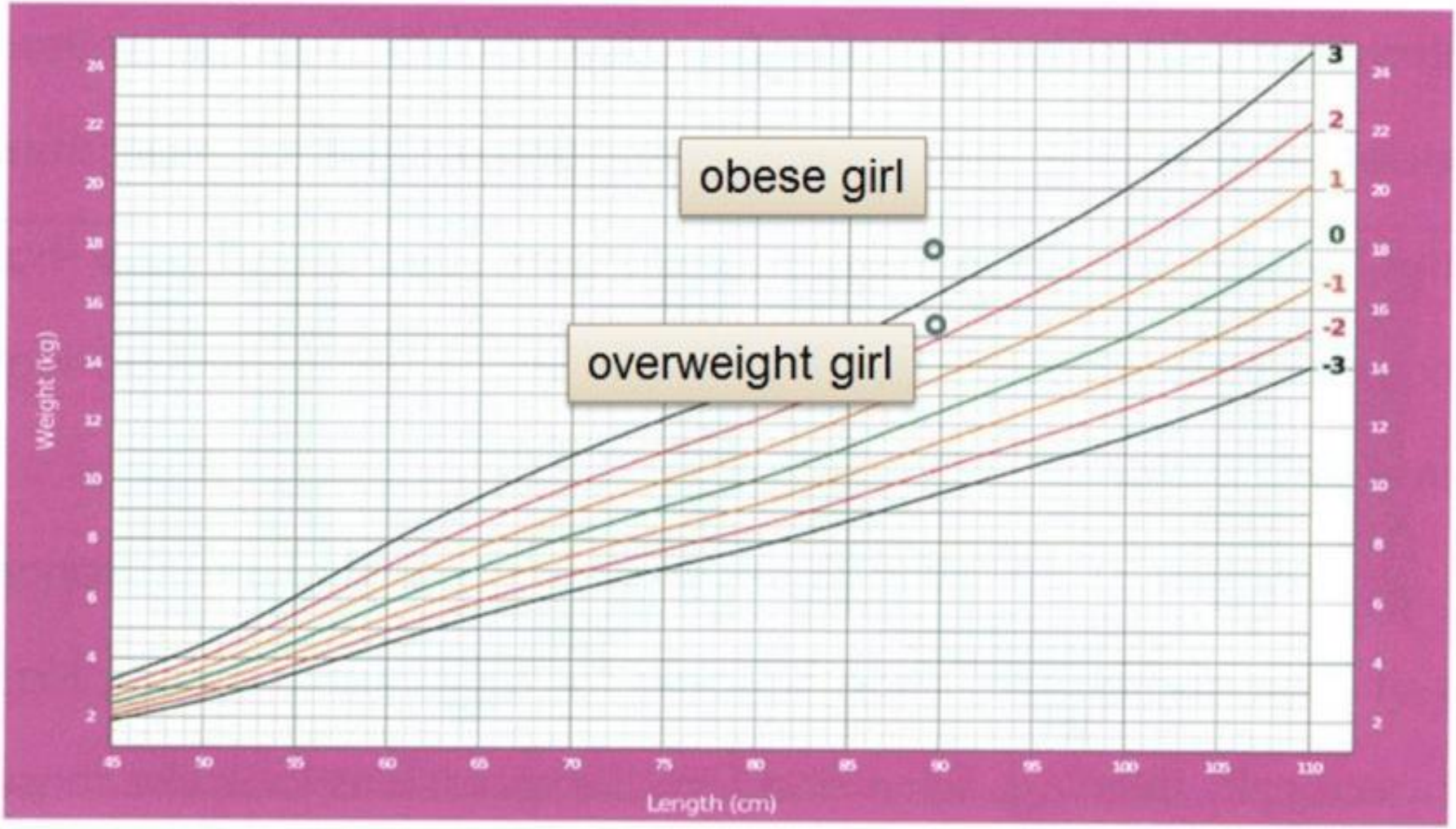
Measuring and Plotting



Weight-for-length GIRLS

Birth to 2 years (z-scores)

World Health Organization

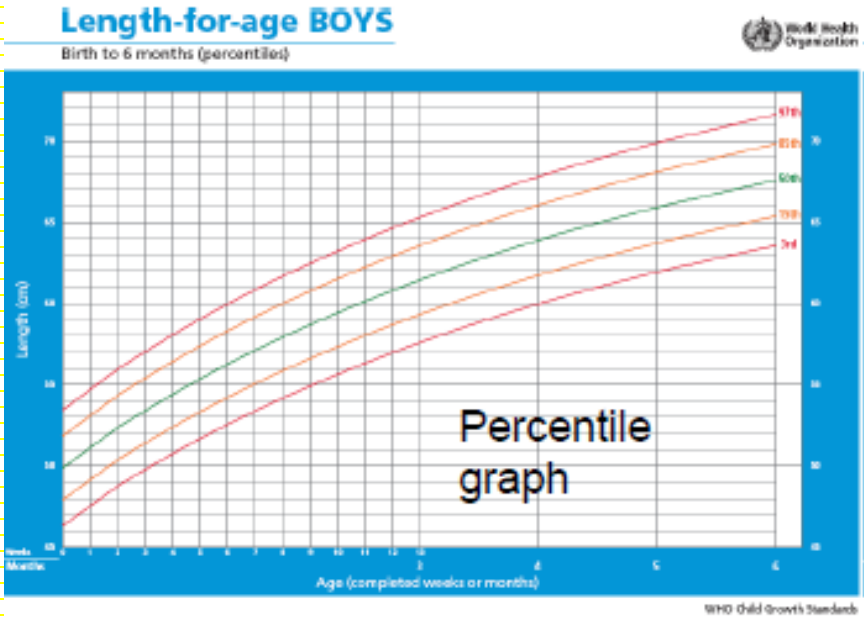


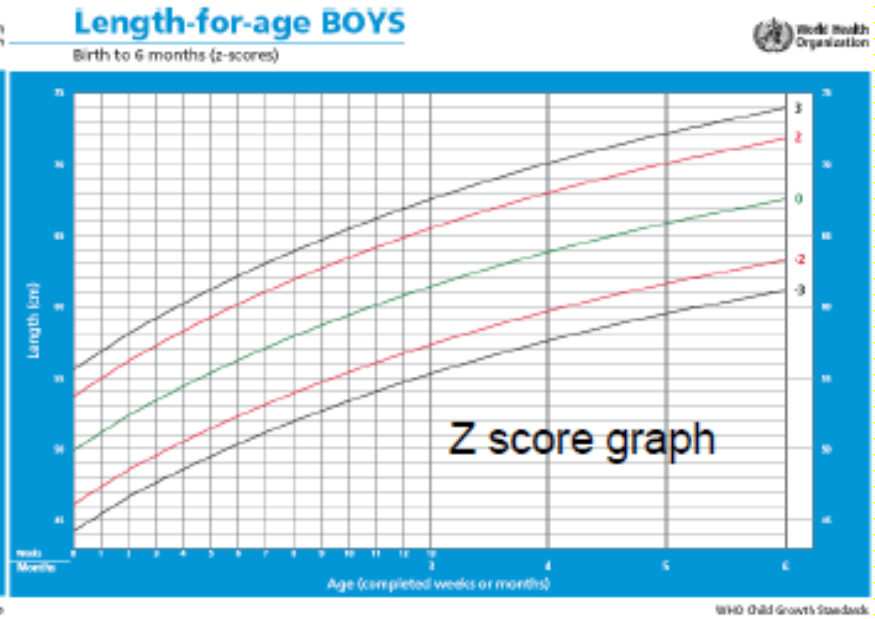
WHO Child Growth Standards

Z-score graphs

- **0** correspond to the mean and median
- **Z-scores or SD scores** are used to describe mathematically how far a measurement is from the median (average).
- **Z score=x` ± SD**
- The mean (median) is the same in both types of graph

Comparison of growth charts

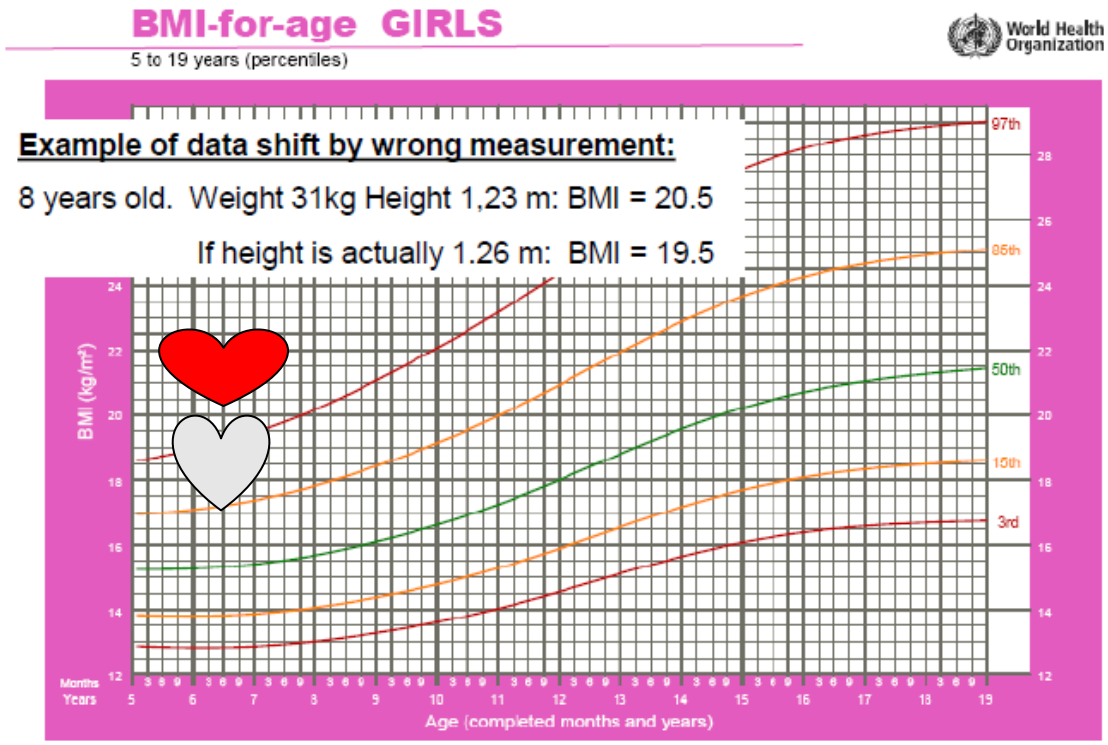




Percentile graphs have a narrower range, because the 97th centile corresponds approximately to a Z score +2

A Z-score of +3 or -3 is more likely to be definitely abnormal

Measuring and Plotting



Remember influence of measurement on derived numbers

After measurement, what next?

- •Measurement does not improve growth
- •Interpret the graph
- •Action must follow:

- Any child with Z score < -3
- Any child crossing the lines
- Weight/height discrepancy
- Consider wasting

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.

High concern :

- **Any sharp decline in growth line:**
  - This is a very significant change in the child's growth.
  - A sharp decline in a normal or undernourished child indicates a growth disturbance.
  - Changes in weight or length should be investigated before a child crosses two major percentile lines.

High concern :

- **A flat growth line:**
  - Child is not growing consistently.
  - When growth rate is rapid during first six months of life, even a one month flat line in growth represents a possible concern.

High concern :

- **Any sharp incline in the growth line:**
  - This is a very significant change in the child's growth.
  - Changes in weight or length should be investigated **before** a child crosses two major percentile lines.
  - An unexplained sharp incline may signal a change in feeding practices - may lead to overweight/obesity.
  - A sharp incline in a previously ill or undernourished child may be "catch-up" growth expected in the re-feeding period.

Measuring and Plotting

It is important to correct for various factors in plotting and interpreting growth charts.

For premature infants, over diagnosis of growth failure can be avoided by using growth charts developed specifically for this population.

A cruder method, subtracting the weeks of prematurity from the postnatal age when plotting growth parameters.

Measuring and Plotting

While VLBW infants may continue to show catch-up growth through early school age, most achieve weight catch-up during the 2nd yr and height catch-up by 2.5 yr.

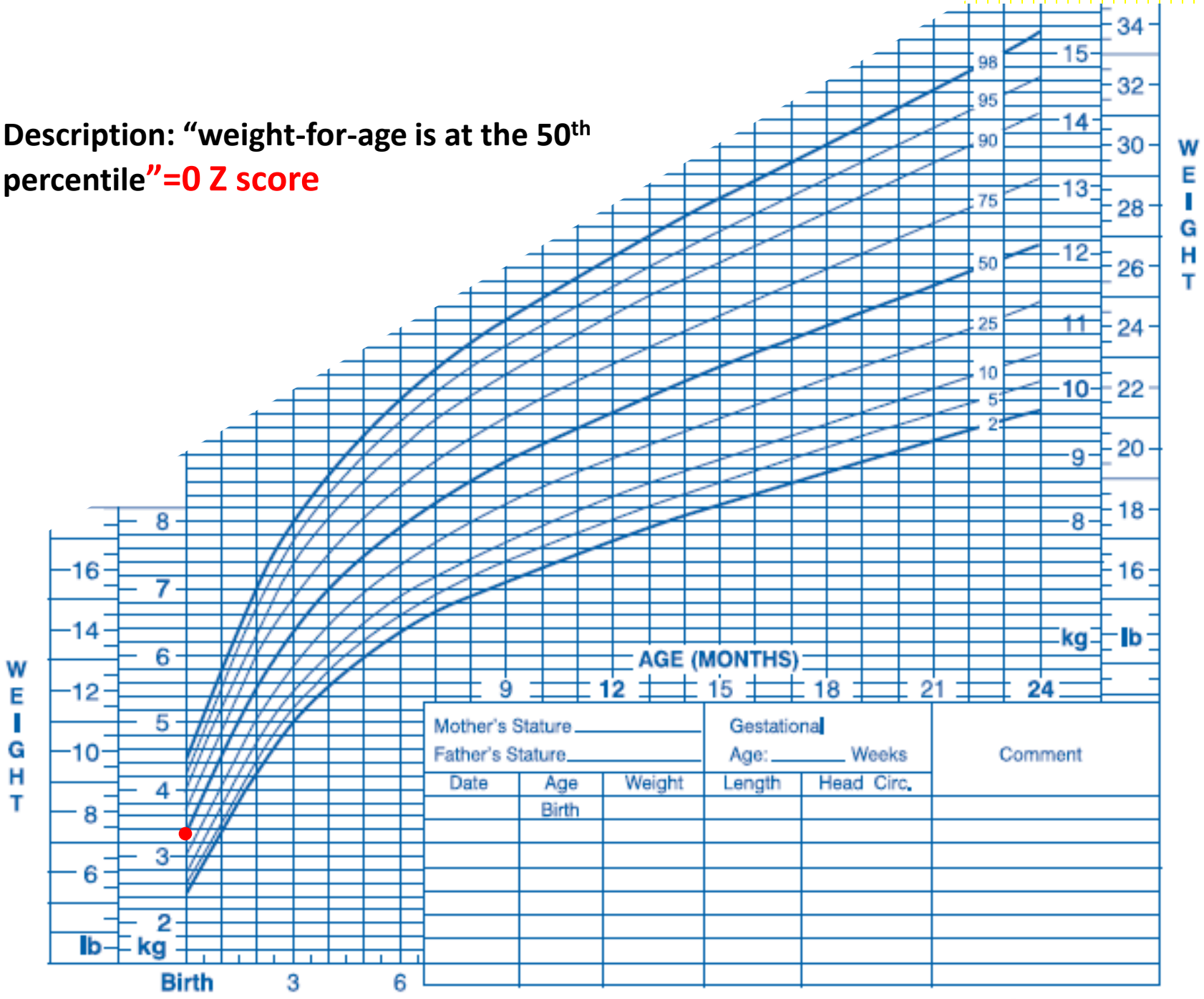
For children with particularly tall or short parents, there is a risk of over diagnosing growth disorders if parental height is not taken into account.

Measuring and Plotting

Practice Scenario - Birth

- **Omar is a 1 day old breastfed male infant:**
  - **Birth date: 15 APR 2023**
  - **Birth weight: 3.41 kg**
  - **Gestational age: 38 weeks**
- Plot the point and describe his weight-for-age percentile

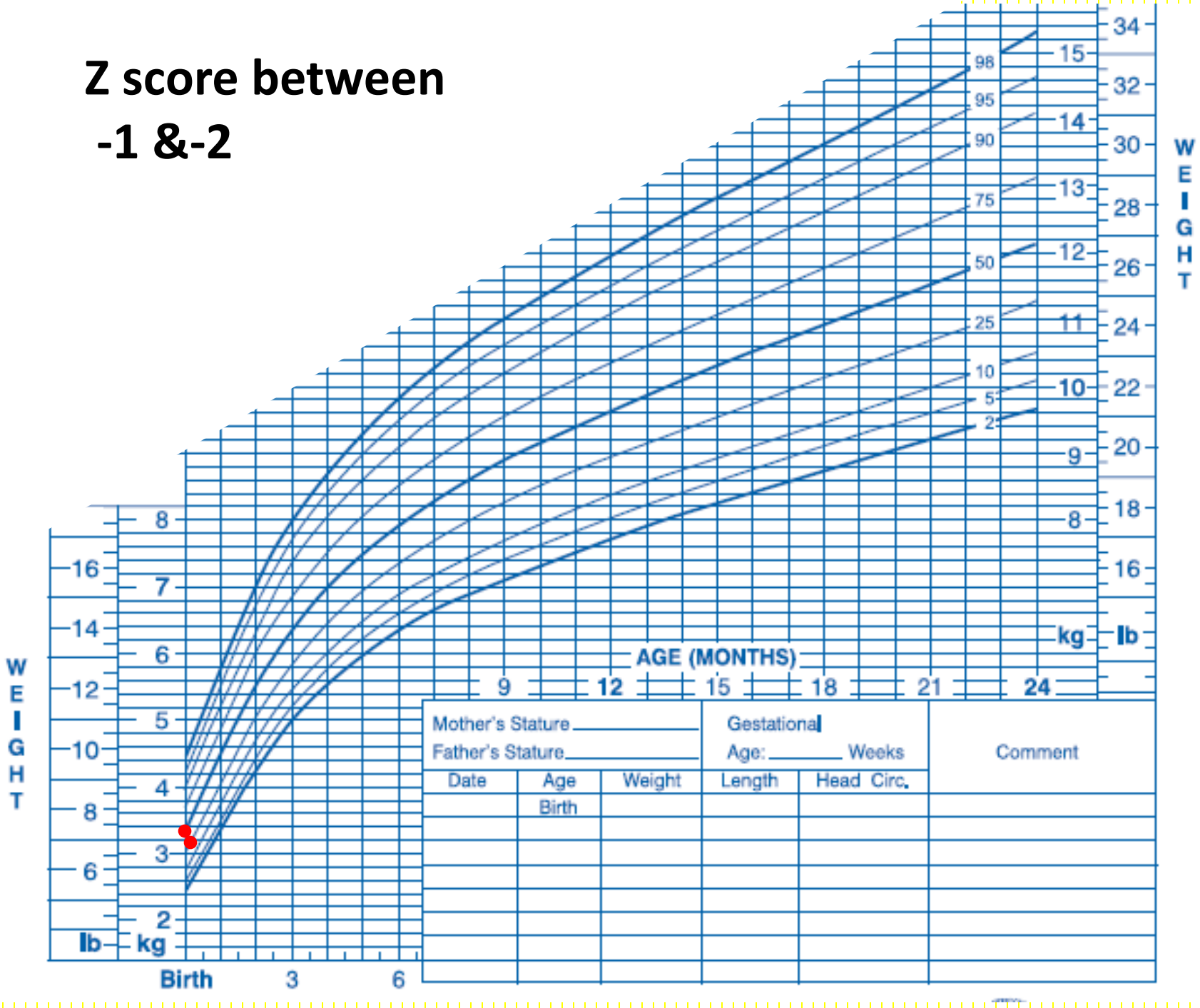
Description: "weight-for-age is at the 50th percentile"=0 Z score



Practice Scenario – Week 1 Visit

- **At Omar's first study visit his mother is concerned that she does not have enough breast milk.**
  - **Visit date: 24 APR 2023**
  - **Visit weight: 3.21 kg**
  - **Age: 9 days**
- Plot the point and describe his weight-for-age percentile
- Is this expected?
- What else would you do at this visit?

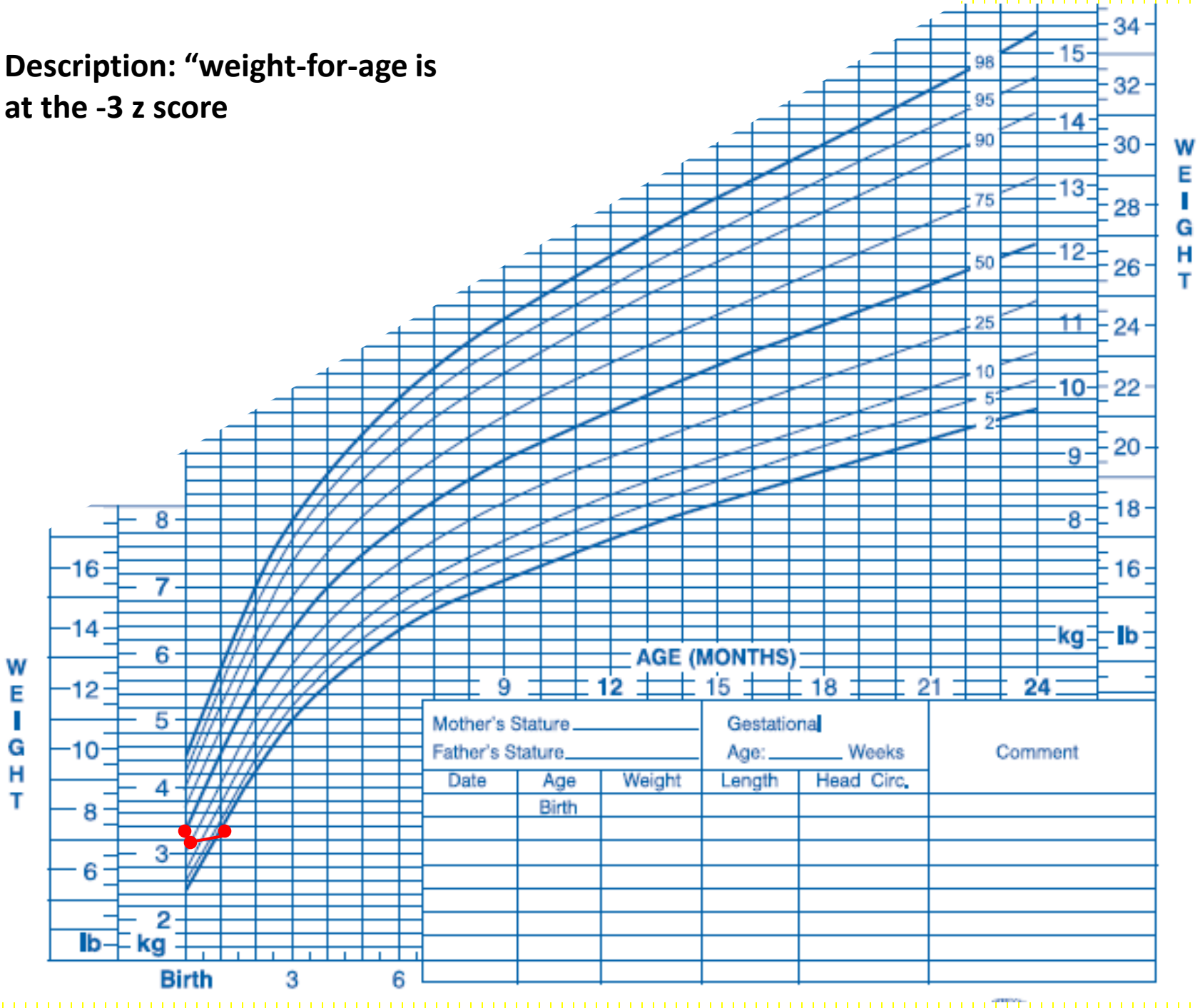
Z score between -1 &-2

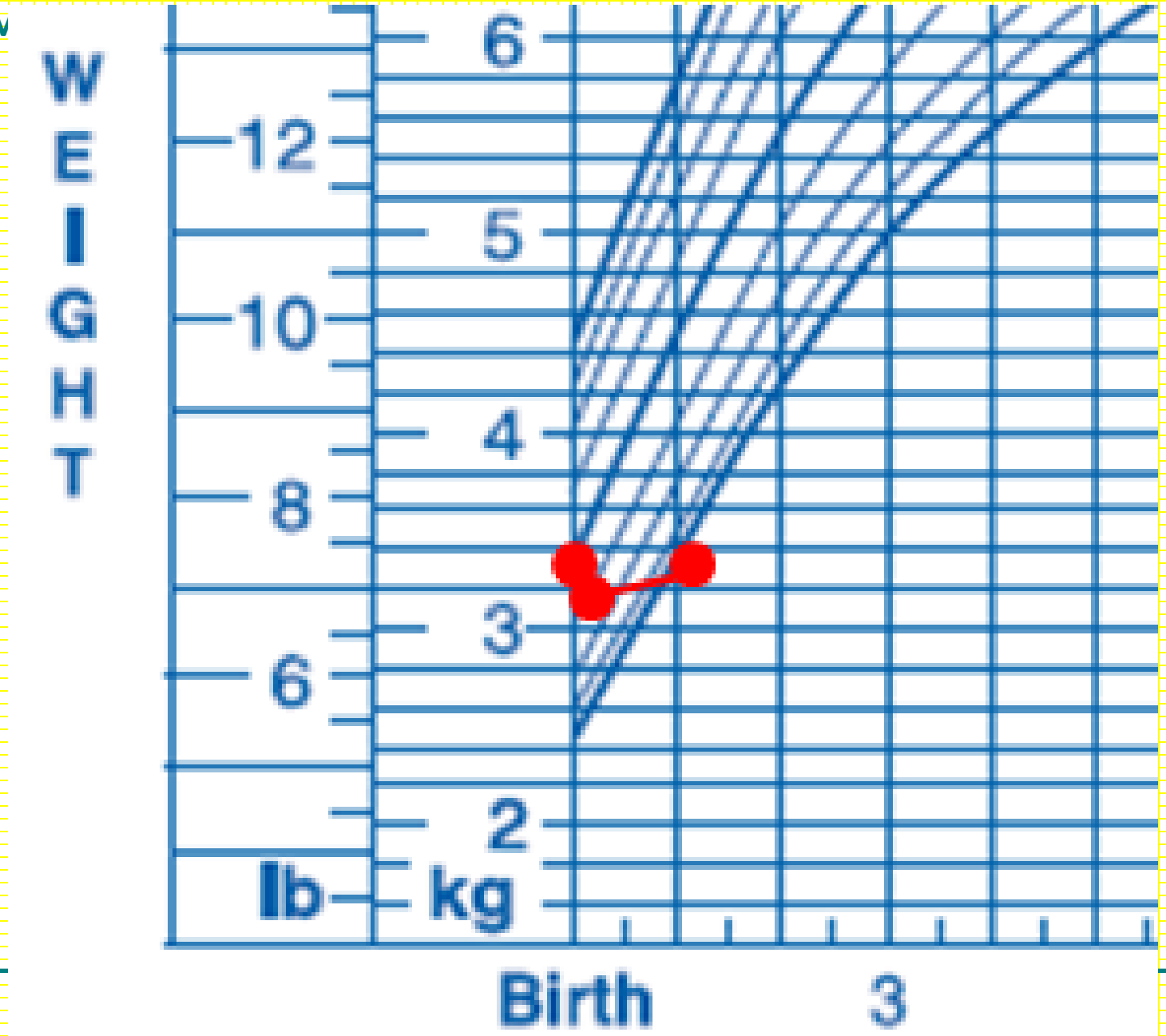


Practice Scenario – Month 1 visit

- At the Month 1 visit, Omar has not yet regained his birth weight:
  - **Visit date: 15 May 2023**
  - **Visit weight: 3.35 kg**
  - **Age: 1 month**
- Plot the point and describe his weight-for-age percentile
- Is this expected?
- What else would you do at this visit?

Description: “weight-for-age is at the -3 z score

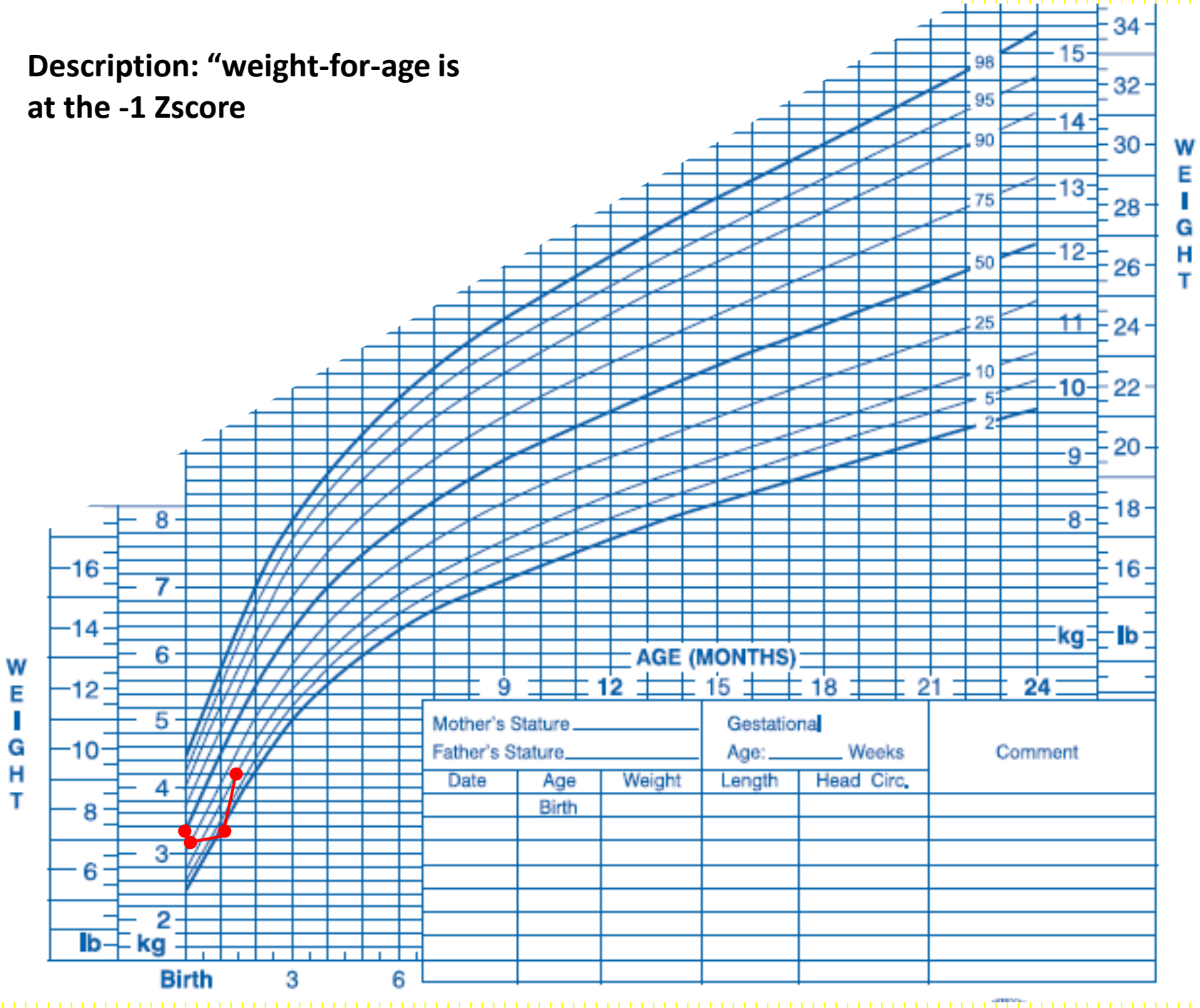



WEIGHT
12
10
8
6
lb
6
5
4
3
2
kg
Birth
3

Practice Scenario – Interim visit 1

- Omar returns for an interim weight check two weeks after his Month 1 visit:
  - **Visit date: 30 May 2023**
  - **Visit weight: 4.21 kg**
  - **Age: 1.5 months**
- Plot the point and describe his weight-for-age percentile
- Is this expected?
- What else would you do at this visit?

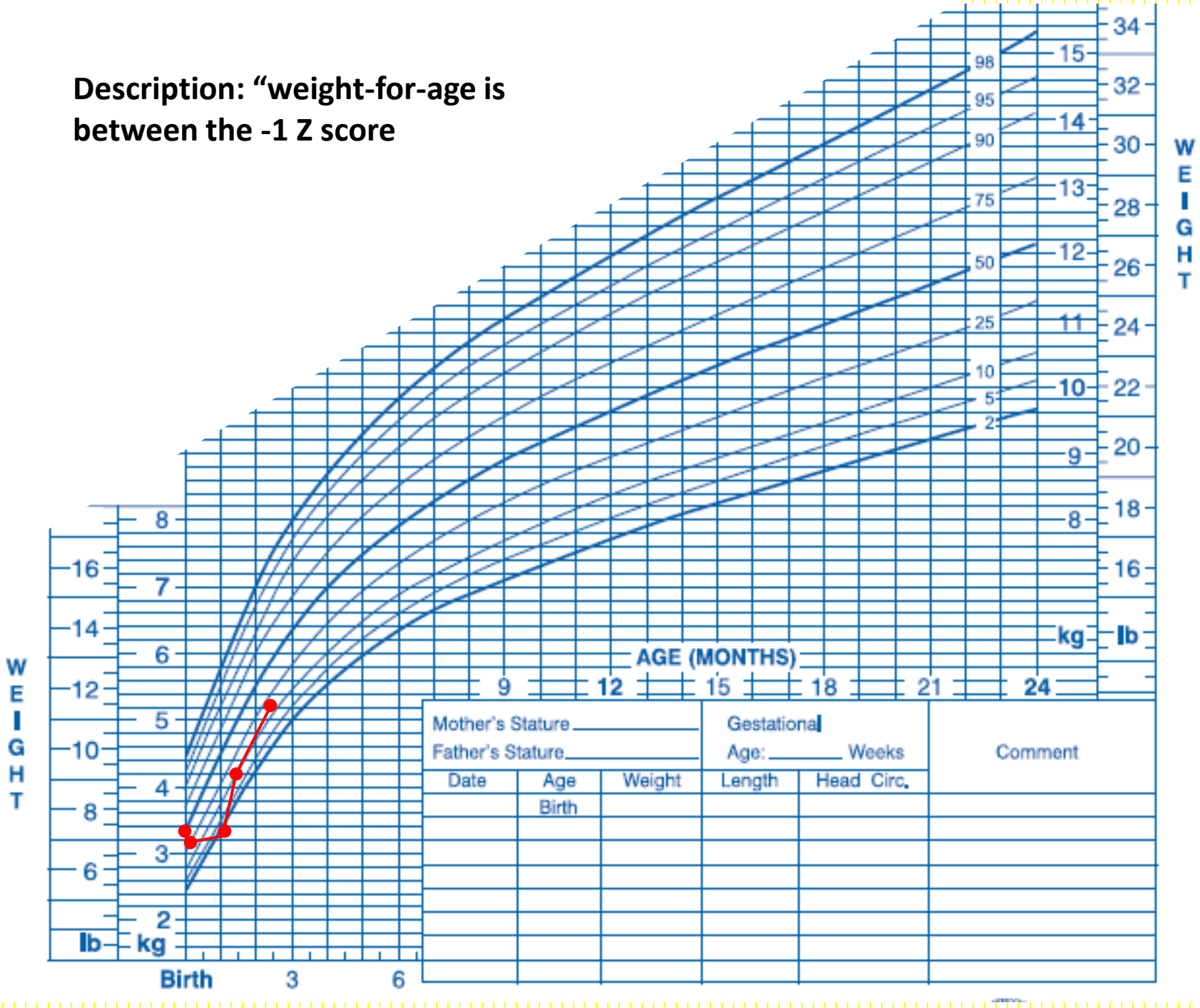
Description: “weight-for-age is at the -1 Zscore



Practice Scenario – Interim visit 2

- Omar returns for an interim weight check one month after his last interim visit:
  - **Visit date: 01 July 2023**
  - **Visit weight: 5.23 kg**
  - **Age: 2.5 months**
- Plot the point and describe his weight-for-age percentile
- Is this expected?
- What else would you do at this visit?

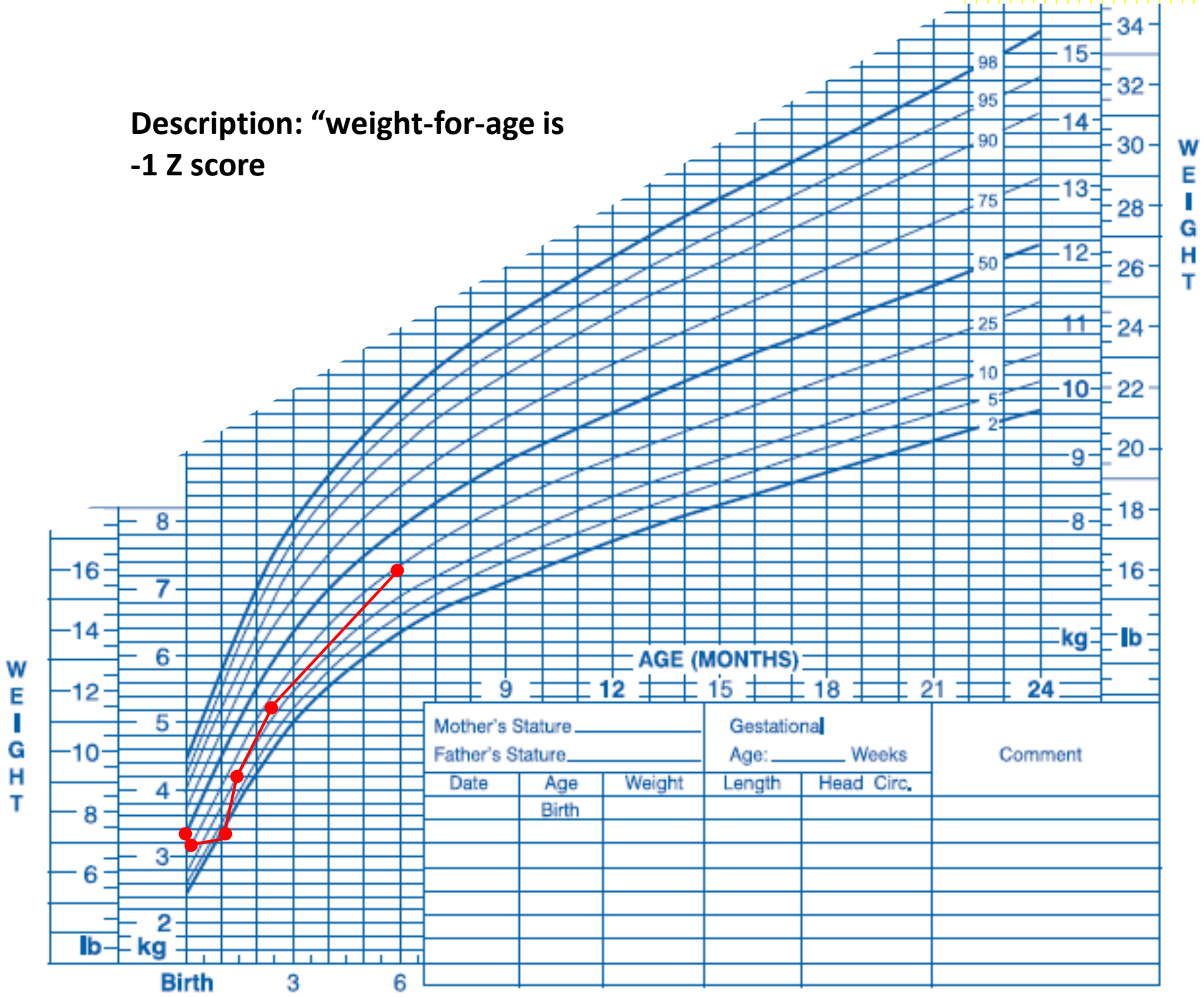
Description: “weight-for-age is between the -1 Z score



Practice Scenario – Month 6 visit

- Omar returns for his Month 6 visit:
  - **Visit date: 12 OCT 2018**
  - **Visit weight: 7.26 kg**
  - **Age: 6 months**
- Plot the point and describe his weight-for-age percentile
- Is this expected?
- What else would you do at this visit?

Description: “weight-for-age is -1 Z score



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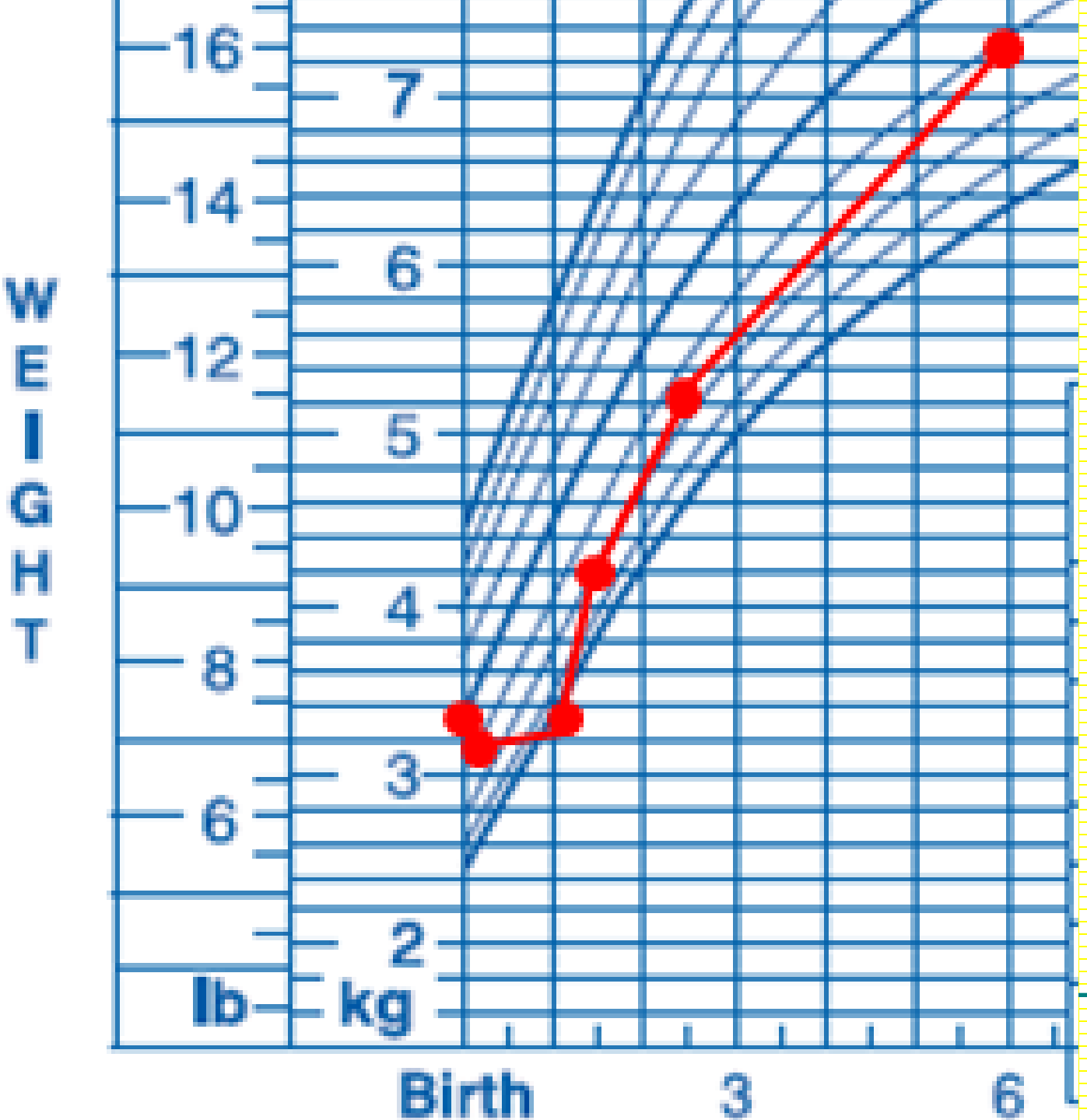

THANK YOU