



# **Block: Child Health**

**Lecture: Growth and Development**

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**Nelson Textbook of Pediatrics, 20th edition.**

**Nelson Essentials of Pediatrics, 7th Edition 2015**

**Pediatric Decision-Making Strategies**

**Illustrated Textbook of Pediatrics**

**Short Atlas in Pediatrics**



# Learning outcomes

Lo1: definitions

Lo2: factors influencing G&D

Lo3: Growth and development age periods

Lo4: growth monitoring

Lo5: growth pattern

Lo6: growth charts



**Growth:** increase of body size over a period of time



**Development:** increase in function of processes related to body and mind.



Hotspot: Being familiar with normal patterns of growth and development allows those practitioners who care for children to recognize and manage abnormal variations.



## Factors influencing growth and development

Lo2

- \* Genetic factors
- \* prenatal factors:
  - maternal nutrition
  - maternal infection
  - maternal illness
  - maternal drug and substance use
  - miscellaneous factors

# Postnatal factors:

**nutrition**

**childhood diseases**

**physical environment**

**psychological environment**

**social environment**

**others**

# Growth and development age periods

Lo3

- **First year**
  - neonatal period birth to 1 month
  - infancy 1 month to 1 year
- **Toddler**
  - 1-3 year
- **Preschool**
  - 3-6year
- **School age**
  - 6-12 year
- **Adolescent**
  - 13-18 year



# Growth monitoring

Lo 4

**growth monitoring** is the regular measurement of a child's size (weight, height or length and head circumference) in order to document growth.

The child's size measurements must then be plotted on a growth chart. This is extremely important as it can detect early changes in a child's growth. Both growing too slowly or too fast may indicate a nutritional or other health problem. Therefore, growth monitoring is an essential part of primary health care in children.



**Hotspot:**

growth is an indicator of nutritional status and general health

The American Academy of Pediatrics recommends routine office visits in the:

- first week of life (depending on timing of nursery discharge)
- at 2 weeks
- at 1, 2, 4, 6, 9, 12, 15, and 18 months
- at 2, 2½, and 3 years
- then annually through adolescence/young adulthood

An accurate measurement of length/height, weight, and head circumference should be obtained at every health supervision visit and compared with statistical norms on growth charts.





# Rules of Thumb for Growth

## WEIGHT

- Average wt at birth: 3.5 kg
- Weight loss in first few days: 5%–10% of birth weight
- Return to birth weight: 7–10 days of age Double birth weight: 4–5 months
- Triple birth weight: 1 year
- Daily weight gain: 20–30 g for first 3–4 months, 15–20 g for rest of the first year

## HEIGHT

- Average length: 50cm (20 in). at birth, 75 cm (30 in). at 1 year
- At age 4 years, the average child is double birth length or 100cm (40 in).

## HEAD CIRCUMFERENCE (HC)

- Average HC: 35 cm at birth (13.5 in.)
- HC increases: 1 cm per month for first year (2 cm per month for first 3mo, then slower)

# Growth patterns

Lo5

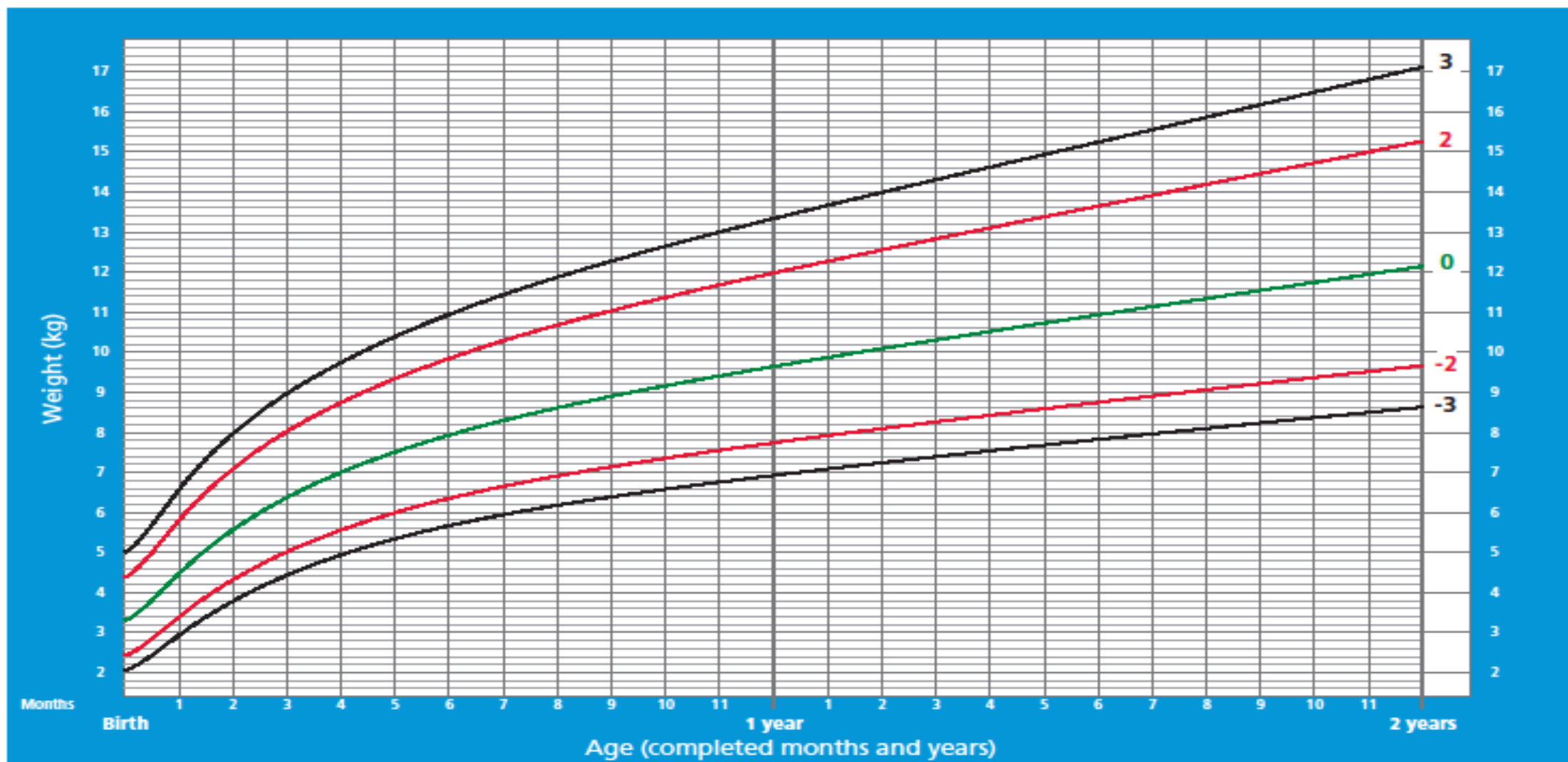
**The growth of healthy children usually follows the growth lines. With increasing age, the growth lines move further and further apart, as some normal children grow faster and others slower than the average. As a result, the normal range becomes wider with age. Boys are slightly larger than girls. Therefore, gender specific charts are used for both boys and girls when routinely plotting size-for-age.**



**HOTSPOT: It is important to identify children who have a growth pattern that differs from the average growth pattern**

# Weight-for-age BOYS

Birth to 2 years (z-scores)



WHO Child Growth Standards

# Growth pattern

One time measurement is not enough, we need series of anthropometric measurements over time

If growth does not follow healthy pattern, consider:

1. parental Ht
2. child's environment
3. nutritional intake
4. chronic illness
5. special conditions e.g Down syndrome, cerebral palsy
- 6. gestational age, birth wt, feeding

# Growth charts

L06

- Growth is assessed by plotting accurate measurements on growth charts and comparing each set of measurements with previous measurements obtained at health visits
- 3 most common measurements: wt first indicator, Lt/ht second, Hc third
- **Growth charts:**
  1. CDC charts
  2. WHO

- \* CDC based on typical growth charts
- \* WHO optimal, based on breast fed infants, prescriptive and more representative of growth pattern

**WHO charts based on age, sex, percentile or Z score.**

- 1. Wt for age**
- 2. Lt/Ht for age**
- 3. HC for age**
- 4. Arm C for age**
- 5. BMI for age**
- 6. Subscapular skin fold for age**
- 7. Triceps skin fold for age**

- **50% of healthy children will fall above and 50% below the 0 line (average) while 3% will fall above the +2 line and 3% below the -2 line. This method enables one to compare the size of any child with the expected size of other children of the same age.**
- **Some growth charts use centile lines rather than z lines. Each centile line indicates the percentage of children expected to fall below that line.**

## Z score:

A **Z score** indicates the number of standard deviations (z) above or below the mean. A z line (or z score line) joins up the z scores at different ages. For example; the +1 Z line indicates one standard deviation above the mean. The 0 line indicated the median.



# A comparison between z lines and centiles:

**Z lines**

**centiles**

+3

99th

+2

97th

+1

85th

0

50th

-1

15th

-2

3rd

-3

1<sup>st</sup>

# Hot spots



- Z score is the best descriptor for malnutrition
- The range of body size between the +2 and -2 lines is regarded as normal and 95% of children should fall in this range.
- A plotted point far from the mean, above or below may indicate growth abnormality

# Z score

wt for ht

>3 obese

>2 over wt

> 1 possible risk

Lt/age

<2

stunted

<3

severe

wt/age

under wt

severe

wt/Lt

wasted

severe

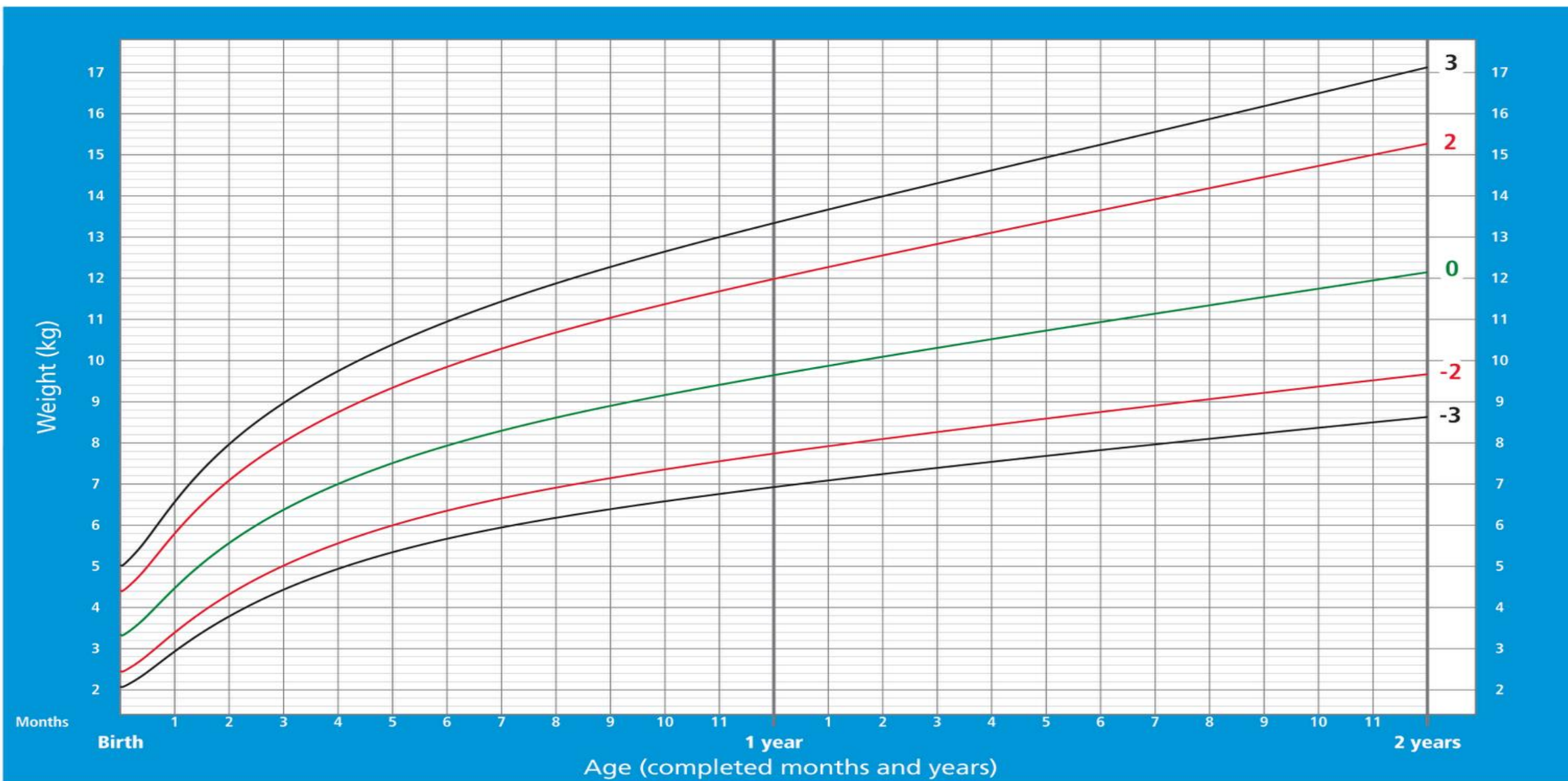
BMI /age

wasted

severe

# Weight-for-age BOYS

Birth to 2 years (z-scores)



# Growth charts- Percentile

percentile: 3rd, 15th , 50th, 85th, 97th

- Children are often change 1-2 percentile curves for Wt and Lt.
- They grow around a centile rather than exactly following a centile path.
- Deviation is due to genetic potential or illness
- Important consideration is whether a child's Wt is proportional to Lt or Ht

wt for age

under- wt

<3<sup>rd</sup>

over wt

>97<sup>th</sup>

Ht for age

stunted

<3<sup>rd</sup>

tall

> 97<sup>th</sup>

Head circumference (HC) for age

(3<sup>rd</sup> .....97<sup>th</sup>)

<3<sup>rd</sup>

microcephaly

>97<sup>th</sup>

macrocephaly

# Wt for Lt chart

Wasted < 3<sup>rd</sup>

Risk over Wt > 85<sup>th</sup>

Over Wt >97<sup>th</sup>

Obese >99.9<sup>th</sup>

# Growth charts percentile

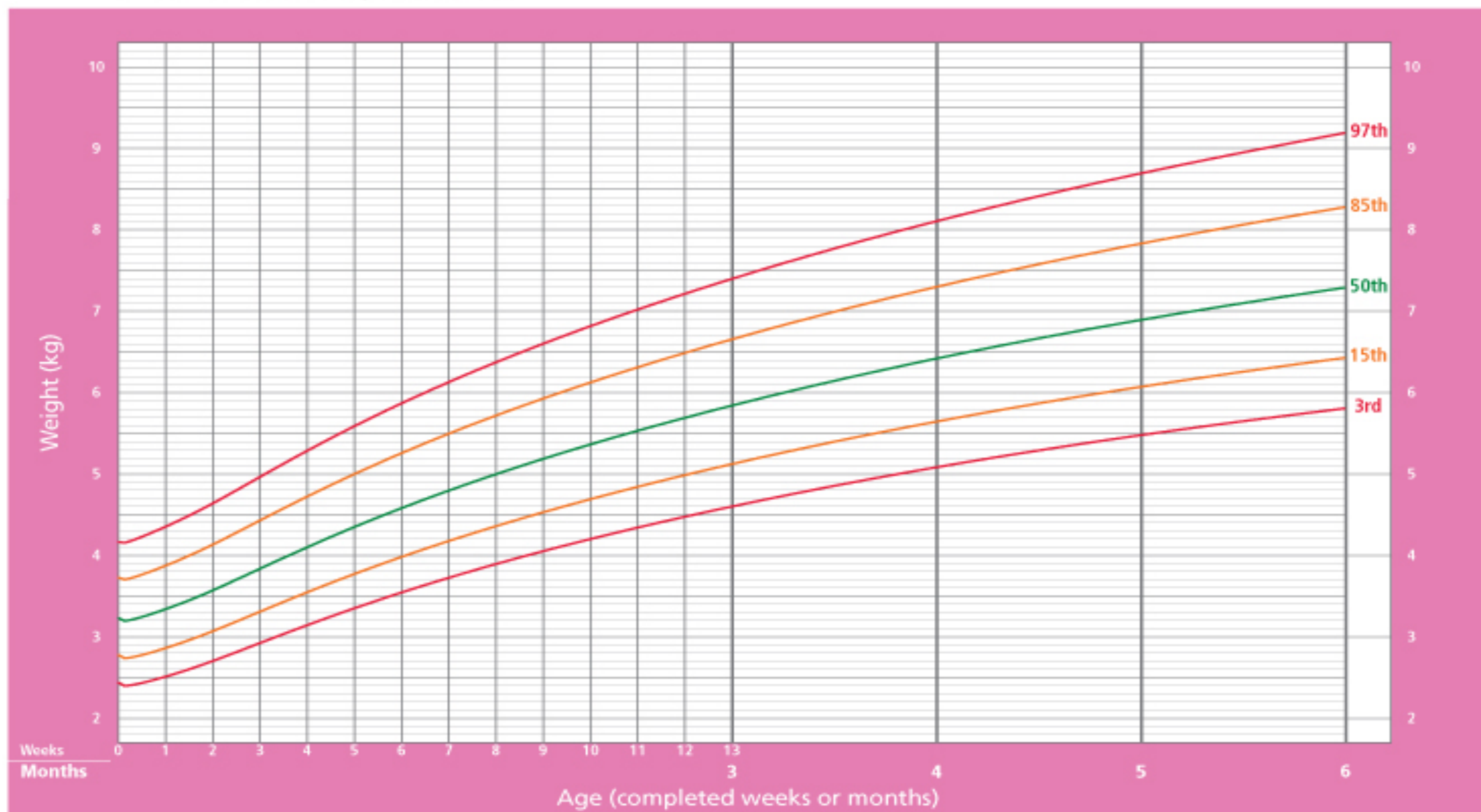
**Normal growth patterns have spurts and plateaus, so some shifting on percentile graphs can be expected.**

**Large shifts in percentiles warrant attention, as do large discrepancies in height, weight, and head circumference percentiles. When caloric intake is inadequate, the weight percentile falls first, then the height, and the head circumference is last**



# Weight-for-age GIRLS

Birth to 6 months (percentiles)



# BMI

**The body mass index is defined as body weight in kilograms divided by height in meters squared; it is used to classify adiposity and is recommended as a screening tool for children and adolescents to identify those overweight or at risk for being overweight**

*Thank you*

