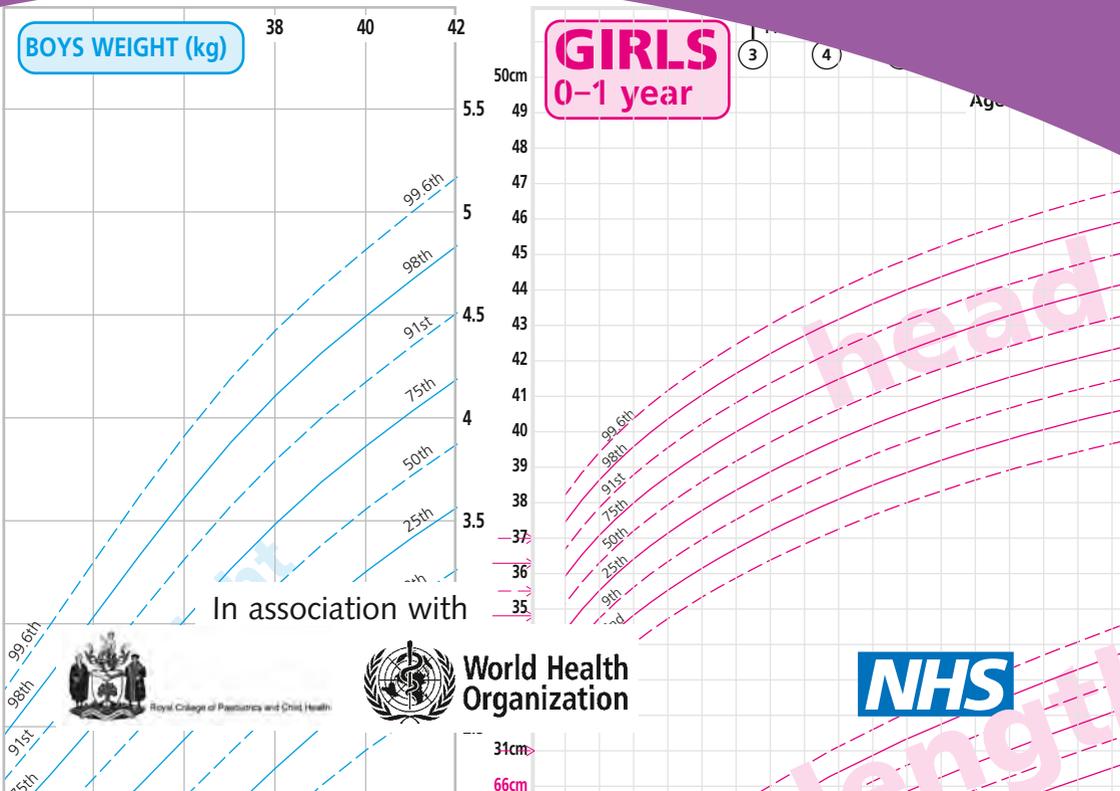


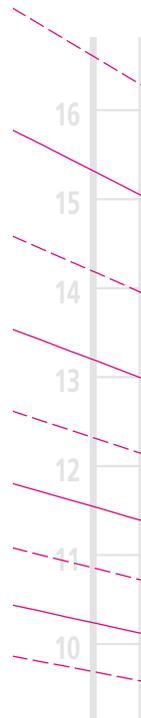
# Using the new UK–World Health Organization 0–4 years growth charts

Information for healthcare professionals about  
the use and interpretation of growth charts



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## Introduction

New UK–World Health Organization (WHO) 0–4 years growth charts have been introduced in England for all new births from May 2009. The charts, which have been developed for the Department of Health by the Royal College of Paediatrics and Child Health, are based on the growth of breastfed infants and replace previous charts that were based on the growth of predominantly formula-fed babies.

The new charts have been constructed using the WHO standards for infants aged 2 weeks to 4 years. These used data from healthy children from around the world with no known health or environmental constraints to growth who were breastfed exclusively for at least 4 months and partially for one year. For the first time, they provide a description of optimal growth which will help to establish breastfeeding as the norm. The WHO found that infants worldwide have very similar patterns of linear growth; and the new charts describe the ideal patterns of growth that we should aspire to for all UK children, whatever their ethnic origin and however they are fed in infancy. These have been combined with birth data for gestations 23 to 42 weeks from the UK 1990 growth reference, as the WHO dataset did not include preterm infants.

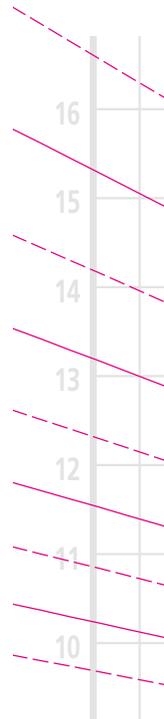
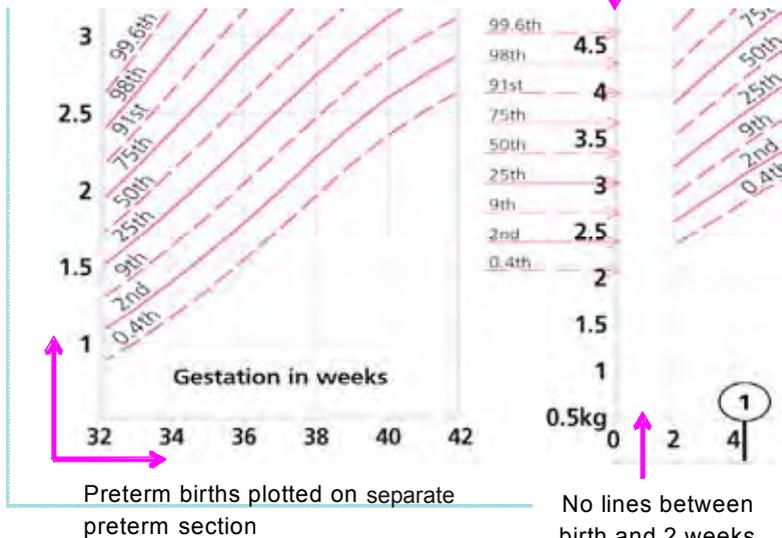
The new charts will have an impact on the interpretation of weight patterns in children. UK children match the charts well for length and height at all ages and for weight in the early weeks, but after the age of 6 months roughly twice as many children will be above the 98th centile for weight compared with the UK 1990 charts, and only about 1 in 200 children will be below the 2nd centile.

This leaflet provides instructions particularly for users of the personal child health record (PCHR) charts; a shorter version of these instructions can also be found on the A4 chart.

## Key new features of the new UK-WHO growth charts:

- ✓ A separate preterm section for infants of 32 to 36 weeks' gestation.
- ✓ A new low birthweight chart available for preterm infants born before 32 weeks' gestation.
- ✓ No centile lines between 0 and 2 weeks.
- ✓ The 50th centile has been de-emphasised.

Term birth measurements plotted at age 0



## Weighing and measuring

### Weighing and measuring

**Weight:** use only class III clinical electronic scales in metric setting. For children up to 2 years, remove all clothes and nappy; children older than 2 years should wear minimal clothing only. Always remove shoes.

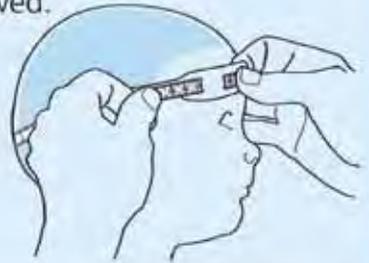
**Length:** (before 2 years of age): proper equipment is essential (length board or mat). Measurers should be trained. The child's shoes and nappy should be removed.



**Height:** (from 2 years): use a rigid rule with T piece, or stadiometer; the child's shoes should be removed.



**Head circumference:** use a narrow plastic or paper tape to measure where the head circumference is greatest. Any hat or bonnet should be removed.



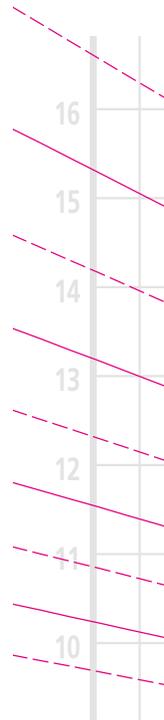
## When to weigh and measure length

- › Babies should be weighed in the first week as part of the assessment of feeding and thereafter as needed.
- › Length or height should be measured whenever there are any worries about a child's weight gain, growth or general health.
- › If parents wish, or if there is professional concern, babies can be weighed at 6–8 weeks, 12 and 16 weeks. Babies should usually be weighed at 12–13 months at the time of routine immunisations. Measurements need to be interpreted in relation to length, growth potential and any earlier measurements of the baby.
- › If there is concern, weigh more often; however, weights measured too closely together are often misleading, so babies should be weighed no more than:
  - once a month from 2 weeks to 6 months of age
  - once every two months from 6 to 12 months of age
  - once every three months over the age of 1 year.

However, most children do not need to be weighed this often; families should be reassured that they can attend for advice without having their baby weighed.

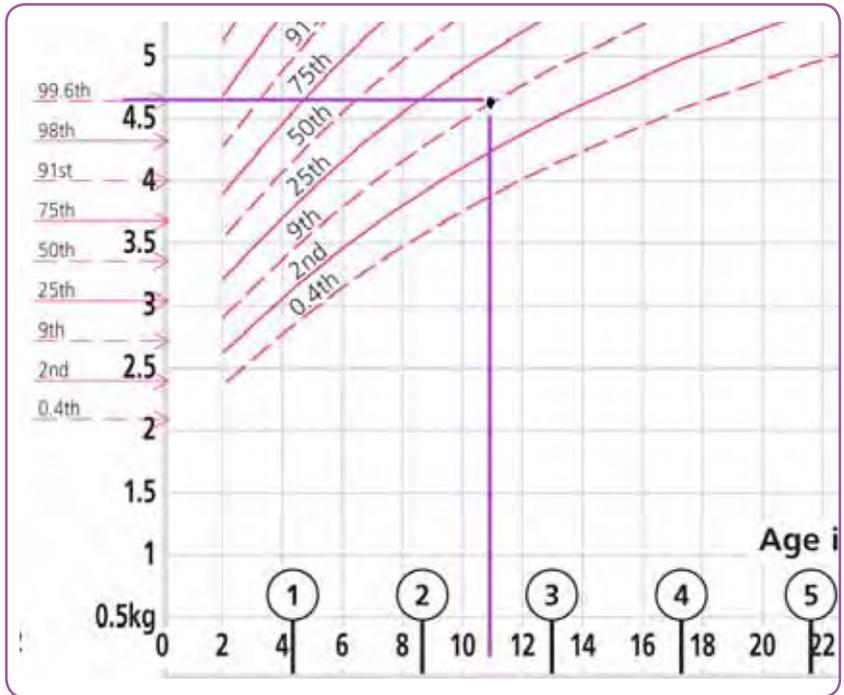
## When to measure head circumference

Head circumference should be measured around birth, at the 6–8 week check and at any time after that if there are any worries about the child's head growth or development.



## Plotting measurements

- Plot each measurement on the relevant chart by drawing a small dot in pencil where a vertical line through the child's age crosses a horizontal line through the measured value.



- The lettering on the charts ('weight', 'length', etc.) sits on the 50th centile, providing orientation for ease of plotting (see page 2).

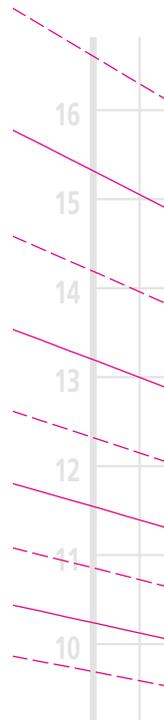
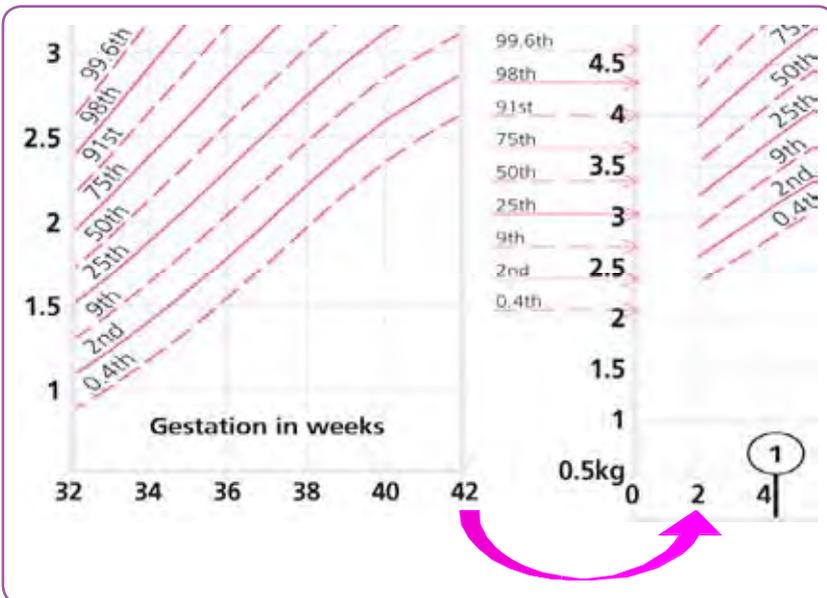
### For babies born at term (37 weeks or later)

- Plot birthweight (and, if measured, length and head circumference) at age 0 on the 0–1 year chart. The coloured arrows at age 0 represent UK birthweight data and show the child's birth centile.

- Weight gain in the early days varies a lot from baby to baby, so there are no lines on the chart between 0 and 2 weeks. Weight collected in this period should still be plotted but for interpretation should be compared with birth weight (see page 11).

## For preterm infants

- A separate low birthweight chart is available for infants of less than 32 weeks' gestation and any other hospitalised neonate or infant requiring detailed assessment.
- For healthy infants born after 32 weeks and before 37 weeks, plot all measurements in the preterm section (to the left of the main 0–1 year chart) until 42 weeks' gestation, then plot on the 0–1 year chart using gestational correction.
- The preterm section can also be used to assess the relative size of infants at the margin of 'term' (e.g. 37 weeks' gestation), but these measurements should also be plotted at age 0 on the 0–1 year chart.



## Gestational correction

- › This should only be used for infants born before 37 weeks.
- › Plot measurements at the child's actual age and then draw a line back the number of weeks the infant was preterm. Mark the spot with an arrow (see diagram below): this is the child's gestationally corrected centile.
- › Gestational correction should continue until at least 1 year of age and until 2 years for infants born before 32 weeks.

### Centile terminology

If the point is within 1/4 of a space of the line they are on the centile: e.g. 91st.

If not they should be described as being between the two centiles: e.g. 75th-91st.

A centile space is the distance between two of the centile lines, or equivalent distance if midway between centiles.

### Plotting for preterm infants (less than 37 weeks gestation):

Draw a line back the number of weeks preterm and mark spot with arrow.

Gestational age  
(7 weeks preterm)

Actual age

# Interpreting the new growth chart

## Assessing weight loss after birth

Some degree of weight loss is common in the first week but 80% of infants will have regained this by 2 weeks of age. Recovery of birthweight by 2 weeks suggests that feeding is effective and that the child is well.

Fewer than 5% of babies lose more than 10% of their weight at any stage, and only 1 in 50 are 10% or more lighter than birthweight at 2 weeks. A weight loss of 10% or more at any stage therefore needs careful assessment.

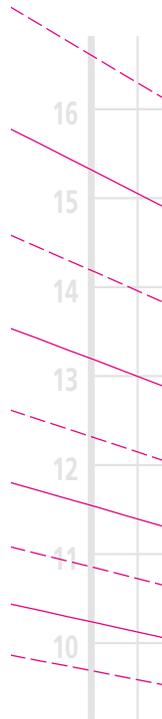
Percentage weight loss can be calculated as follows:

**Weight loss** = difference between current weight and birthweight

**Percentage weight loss** =  
 $\text{weight loss} \div \text{birthweight} \times 100\%$

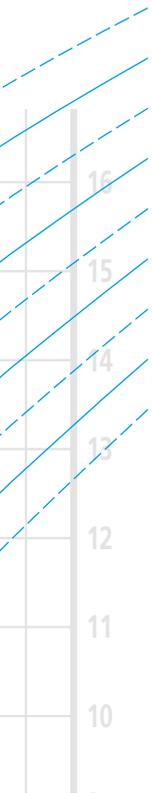
For example:

- › A child born at 3.500kg who drops to 3.150kg at 5 days has lost 350g or 10% ( $0.35 \div 3.5 \times 100$ ).
- › In a baby born at 3.000kg, a 150g loss is 5% ( $0.15 \div 3.0 \times 100$ ).



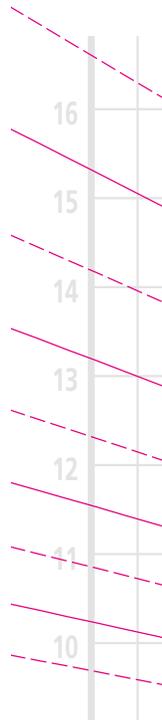
## What do the centiles mean?

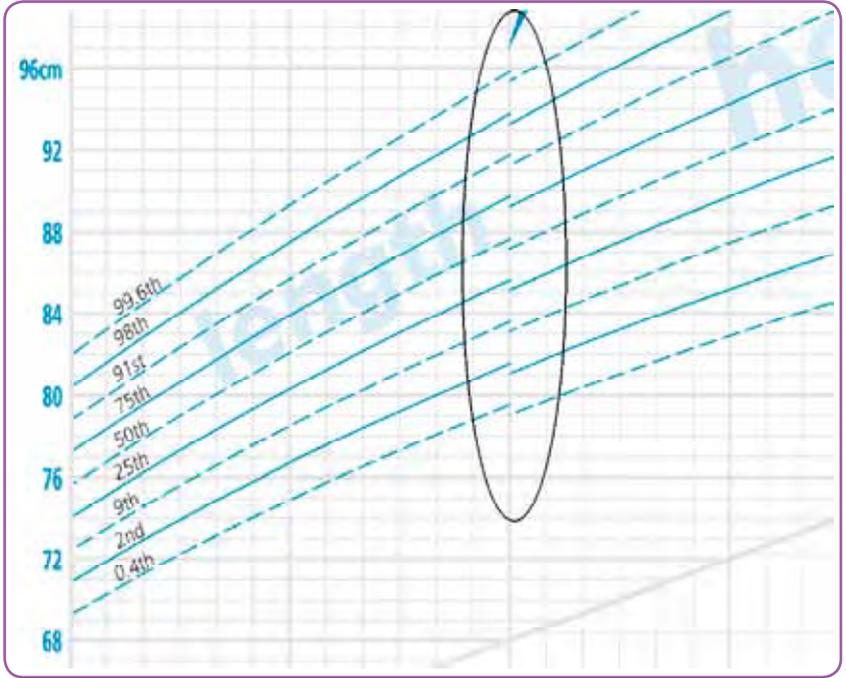
- › The new charts indicate a child's size compared with children of the same age and maturity who have shown optimum growth. The chart also shows how quickly a child is growing.
- › The centile lines on the chart show the expected range of weights and heights (or lengths); each describes the number of children expected to be below that line, e.g. 50% below the 50th, 91% below the 91st.
- › Children come in all shapes and sizes, but 99 out of 100 children who are growing optimally will be between the two outer lines (0.4th and 99.6th centiles); half will lie between the 25th and 75th centile lines.
- › Being very small or very big can sometimes be associated with underlying illness. There is no single threshold below which a child's weight or height is definitely abnormal, but only 4 out of 1000 children who are growing optimally are below the **0.4th centile**, so these children should be assessed to exclude any problems. Those above the **99.6th centile** for height are almost always healthy. If weight is above the 99.6th centile, calculate body mass index (BMI) (see page 17). Also calculate the BMI if the weight and height centiles appear very different.



## What is a normal rate of weight gain and growth?

- › Babies do not all grow at the same rate, so a baby's weight often does not follow a particular centile line, especially in the first year. Weight is most likely to track within one centile space (the gap between two centile lines – see the diagram on page 10). In infancy, acute illness can lead to sudden weight loss and a weight centile fall, but on recovery the child's weight usually returns to its normal centile within two to three weeks. However, a sustained drop through two or more weight centile spaces is unusual (fewer than 2% of infants) and should be carefully assessed by the primary care team, including measuring length/height.
- › Because it is difficult to measure length and height accurately in pre-school children, successive measurements commonly show wide variation. If there are worries about growth, it is useful to measure length or height on a few occasions over time; if there is a stable average position over time this suggests that growth is normal.
- › Head circumference centiles usually track within a range of one centile space. After the first few weeks a drop or rise through two or more centile spaces is unusual (fewer than 1% of infants) and should be carefully assessed.





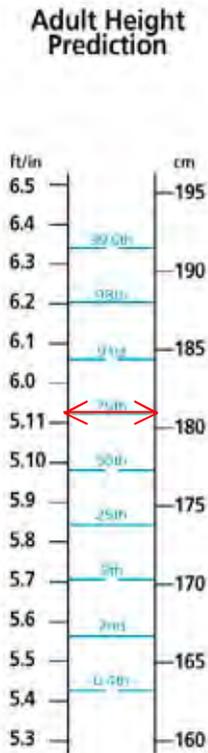
## Why do the length/height centiles change at 2 years?

The growth standards show length data up to 2 years of age, and height from age 2 onwards. When a child is measured standing up, the spine is squashed a little, so their height is slightly less than their length; the centile lines shift down slightly at age 2 to allow for this. It is important that this difference does not worry parents; what matters is whether the child continues to follow the same centile after the transition.

## Predicting adult height

Parents like to know how tall their child will be as an adult. The child's most recent height centile (aged 2–4 years) gives a good idea of this for healthy children. Plot this centile on the adult height predictor to the right of the height chart to find the average adult height for children on this centile. Four out of five children will have adult heights that are within 6cm above or below this value.

For example: if this boy is on the 75th centile for height, the adult height predictor suggests that he may reach an adult height of 181cm  $\pm$  6cm



## Weight–height to BMI conversion chart

BMI indicates how heavy a child is relative to their height and is the simplest measure of thinness and fatness from the age of 2, when height can be measured fairly accurately.

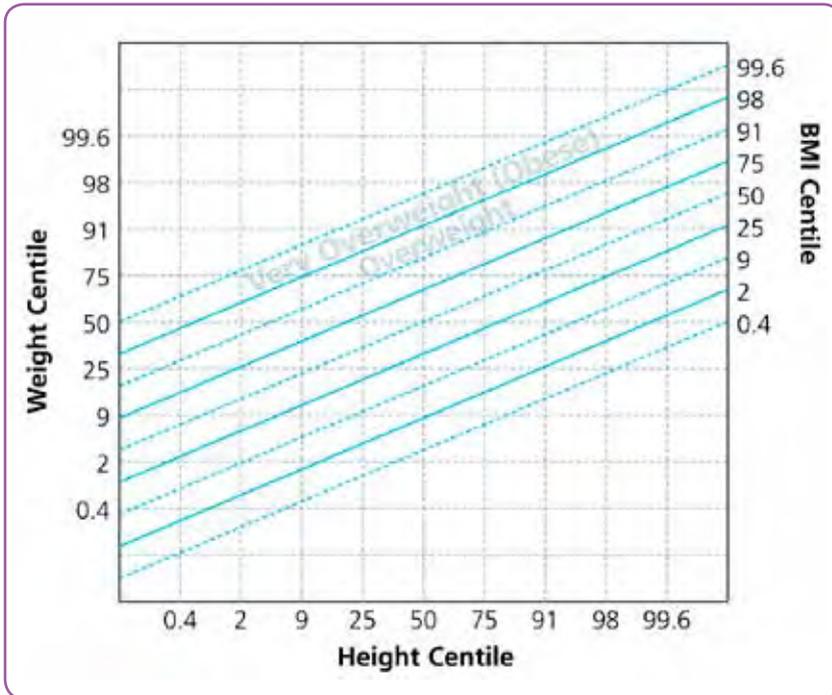
In a child over 2 years of age, the BMI centile is a better indicator of overweight or underweight than the weight centile. The chart on page 18 provides an approximate BMI centile, accurate to a quarter of a centile space.

### Instructions for use of the weight–height to BMI conversion chart

1. Read off the weight and height centiles from the growth chart.
2. Plot the weight centile (left axis) against the height centile (bottom axis) on the chart.
3. If between centiles, read across in this position.
4. Read off the corresponding BMI centile from the slanting lines.
5. Record the centile with the date and the child's age in the data box.

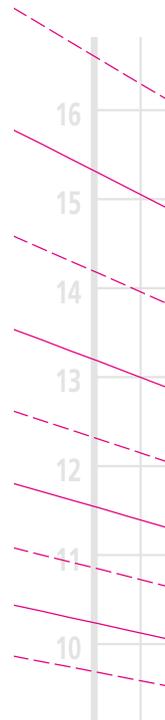
$$\text{BMI} = \text{weight in kg} \div (\text{height in m} \times \text{height in m})$$





## Interpretation

- A child whose weight is average for their height will have a BMI between the 25th and 75th centiles, whatever their height centile.
- BMI above the 91st centile suggests that the child is overweight; a child above the 98th centile is very overweight (clinically obese).
- BMI below the 2nd centile is unusual and may reflect under-nutrition.



## Training and education from the Royal College of Paediatrics and Child Health

The Department of Health and the Royal College of Paediatrics and Child Health recommend the following:

- › Anyone who measures a child or plots or interprets charts should be suitably trained or be supervised by someone qualified to do so.
- › All users need training with the new UK–WHO growth charts in order to familiarise themselves with the changes:
  - Health professionals who occasionally use the new charts will need to complete an introductory training session of 30–60 minutes.
  - Those who use the new charts regularly will be required to complete a further two to three hours of training.
- › The growth chart educational materials can be downloaded from the Royal College of Paediatrics and Child Health website at: [www.growthcharts.rcpch.ac.uk](http://www.growthcharts.rcpch.ac.uk). They include PowerPoint® slides, video clips, notes for tutors and growth chart plotting exercises.



## Useful websites

[www.growthcharts.rcpch.ac.uk](http://www.growthcharts.rcpch.ac.uk)

[www.sacn.gov.uk/reports\\_position\\_statements/index.html](http://www.sacn.gov.uk/reports_position_statements/index.html)

[www.who.int/childgrowth/en](http://www.who.int/childgrowth/en)

## Further reading

Cole TJ (1997). Growth monitoring with the British 1990 growth reference. *Archives of Disease in Childhood* 76:47–49

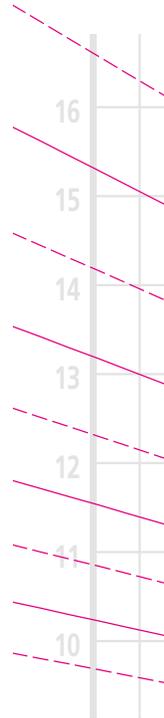
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Macdonald PD, Ross SR, Grant Let al. 2003. Neonatal weight loss in breast and formula fed infants. *Arch Dis Child Fetal Neonatal Ed* 88(6):F472–F476

McKie A, Young D, Macdonald PD (2006). Does monitoring newborn weight discourage breast feeding? *Arch Dis Child* 91(1):44–46



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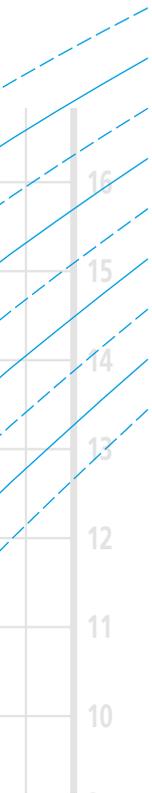
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Wright CM, Waterston A, Matthews JNS et al. (1994). What is the normal rate of weight gain in infancy? *Acta Paediatrica* 83:351–56

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Wright CM, Parkinson KN (2004). Postnatal weight loss in term infants: what is 'normal' and do growth charts allow for it? *Arch Dis Child Fetal Neonatal Ed* 89(3):F254–F257





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