How to carry out growth assessment in infants and children under two years old


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Rationale and key points
Measuring and monitoring growth in infants and young children under two years old is an important part of their clinical assessment in hospital and the community. This article outlines the procedure for measuring growth in infants and children under two years old, and discusses the main factors to consider when undertaking this assessment.

» The procedures and some of the data used to monitor the growth of infants and children under two years old differs from those used in older children.

» Obtaining growth information for an infant or child involves measuring and recording their length, weight and head circumference. The process of obtaining this information is not necessarily straightforward and errors may occur while measuring and plotting or interpreting data.

» Correct use of growth measuring equipment and growth charts is essential to obtain accurate results. Nurses should be able to plot weight, length and head circumference data for infants and children under two years old, and to correctly interpret this data to identify malnutrition and faltering growth.

Reflective activity
‘How to’ articles can help you update your practice and ensure it remains evidence-based.
Apply this article to your practice. Reflect on and write a short account of:
1. How you think this article will change your practice when you assess growth in infants and children under two years old.
2. What practical experience you require to consolidate your learning, having read this article.
3. Any learning needs that you have identified that would increase your clinical effectiveness and professional development.

Keywords
child health, faltering growth, growth assessment, growth charts, head circumference, infant health, paediatrics, weight measurement

Definitions in this article
Infants are classified as ‘term’ if they are born at or after 37 weeks’ gestation, and premature if they are born before 37 weeks’ gestation. In this article, ‘infant’ is used to denote a term neonate or child less than one year of age, and ‘child or children’ is used to denote a child between the ages of one and two years.

Preparation and equipment
» The nurse should ensure the clinic room temperature is set at a minimum of 25°C, since infants lose body heat quickly when undressed.

» The nurse should prepare all measuring equipment for use before the infant or child is brought to the clinic room for growth measurement, and ensure it remains in close proximity to minimise
the risk of the infant or child falling.

Equipment includes:

- Weighing scales that measure in kilograms (kg) to the nearest 10g.
- Rigid or non-rigid infantometer, which measures in centimetres (cm) to the nearest millimetre (mm).
- Disposable paper tape measure that measures in cm to the nearest mm.
- Waste bin for nappy disposal.
- Clean changing mat.
- Clean nappies of an appropriate size.
- Sterile wipes.
- Paper towels.
- UK World Health Organization (WHO) 0-4 years growth charts.
- Pencil.
- Pen.
- Calendar, diary or age calculator wheel.

The nurse should first familiarise themselves with the procedure for using the weighing scales, so that they can quickly and effectively read the weight displayed. They should ensure the scales are set to read in kilograms (kg) and/or grams (g), and not in pounds and ounces.

Weighing scales should be calibrated annually, and a sticker will be placed on the scales following calibration, showing when they were last calibrated and when the next check is due. If the date has expired, the scales may not be measuring accurately, so the nurse should check that this date has not passed before using the scales.

The nurse should line the scales with paper towels to keep them clean, and set the scales to zero. This can be done on most scales by pressing the ‘Tare’ button.

The nurse should clean the weighing scales and the infantometer with sterile wipes between each use.

Procedure

1. Obtain verbal consent for the procedure. Explain to the parent or carer that you are going to measure the infant or child’s weight, length and head circumference.
2. Explain that the infant or child should be weighed naked to obtain an accurate weight measurement. Children may be weighed in a vest to reduce heat loss, but should be weighed without a nappy. A medium-sized wet nappy may weigh as much as 350g, which can markedly affect weight measurement.
3. Clarify that the infant or child may find it uncomfortable when you measure their length and/or head circumference, but that the procedure will not hurt them. Confirm that the parent or carer is willing to assist in measuring the infant or child’s length.
4. Confirm that the infant or child is not considered to be at risk of fractures by reviewing their medical notes and asking the parent or carer before measuring length using an infantometer.

Weight measurement

5. Ask the parent or carer to undress the infant or child and remove the nappy. Children may wear a vest or a light top, but the nappy should always be removed and disposed of in a waste bin if it is soiled. A clean changing mat should be available for undressing and dressing the infant or child.
6. Gently place the infant or child in the centre of the weighing scales (Figure 1). Electronic scales are the most accurate and convenient equipment to use.
7. Read and immediately record the reading displayed.
8. Lift the infant or child from the scales.
9. A vest may be put back on the infant or child to prevent heat loss.

Length measurement

10. Remove shoes, socks, baby grows and hats from the infant or child before...
undertaking length measurement, because if worn, they will result in inaccuracies. Ideally, a nappy should not be worn while length measurements are made. However, in practice, a clean nappy is often put on the infant or child to reduce the risk of equipment becoming soiled. Using a clean nappy should have a negligible effect on the length measurement, whereas a wet nappy can distort the infant or child’s body position.

11. Place the infantometer on a firm, clean and level surface such as a worktop or bench. A rigid infantometer, but not a mat, may be used on a bed, with the mattress placed in a horizontal position to minimise the risk of the infant or child sliding down. Place a soft paper towel under the infant or child for hygiene purposes. Lay the infant or child flat on their back on the measuring board.

12. Ask an assistant – a colleague, parent or carer – to hold the top of the infant or child’s head gently but firmly against the headboard at the top end of the measuring board (Figure 2). The infant or child’s eyes should be looking up, with their head positioned so that the bottom of the eye socket is in line with the ear canal, at a right angle to the board. This is known as the Frankfort plane (de Onis et al 2004). The assistant should hold the infant or child’s head gently under their jaw on either side (Figure 2), to prevent them sliding down the board when their legs are extended to obtain the final measurement.

13. Hold both of the infant or child’s legs as straight as possible, gently pressing down on their knees to keep them straight (Figure 2).

14. Move the footplate, the movable end of the infantometer, up to meet their heels.

15. Confirm with your assistant that the top of the infant or child’s head remains in contact with the headboard. If their head has slipped down the infantometer start the measurement again, repositioning the infant or child and ensuring their head is at the top of the board.

16. Read the length from where the footplate edge is in line with the scale at the side of the infantometer (Figure 2). Record the measurement in cm to the nearest mm.

17. The infant or child may now be dressed.

Head circumference measurement

18. Remove any hats, headscarves or hair clips from the infant or child’s head and ensure that their hair is not bunched in a way that might interfere with the tape while it is placed around their head.

19. Arrange the measurement tape horizontally around their head, so that the 0cm mark on the tape is on their forehead. Hold this part of the tape firmly with your thumb or a finger, so that it is held in position on their forehead and not easily moved.

20. Once the tape is held in place, manipulate the rest of the tape around the back of their head to locate where their head is widest and at the maximum circumference.

21. Pull the tape taut around their head and read the measurement, where the section of tape that is wrapped around aligns with the 0cm mark on the tape. Record the reading (Figure 3).

22. Repeat this measurement three times, and take the mean of the three readings. If one reading is markedly different from the others, then repeat the process.
Plotting growth data

**Term infants or young children**

23. Plot growth measurements on an appropriate male or female UK growth chart. It is important to note that the plotted points on the growth chart should not be joined up.

24. Calculate the age of a term infant (born at or after 37 weeks’ gestation) by recording the number of weeks or months that have elapsed since the date of birth until the date of measurement, using a calendar, diary or age calculator wheel. If the day of measurement coincides with the day of the month on which a term infant was born, the date may be used to calculate their exact age in months. The age of a child between one and two years old is usually measured in months.

25. Write the infant or child’s age in weeks or months on the horizontal axis of the chart. Identify where the recorded weight, length and head circumference occur on each of the corresponding vertical axes on the growth chart. Use a pencil initially, rather than a pen to plot where these measurements intersect with the infant or child’s current age and mark the point with a circular dot rather than a cross (Royal College of Paediatrics and Child Health (RCPCH) 2009a). Using a pencil enables any initial errors in plotting to be corrected readily.

26. The weight measurements of breastfed infants should not be plotted on the growth chart in the first two weeks of life.

27. Note the nearest percentile line on the growth chart. A plot may be exactly on a line, very close to a line – either higher or lower – or equidistant between two percentile lines. The gaps between adjacent percentile lines are known as percentile spaces. A plot is ‘on’ a particular percentile line if it is within one quarter of a percentile space of a growth-curve line. If a plot is not on a percentile line, and the gap is greater than one quarter of the distance between two growth-curve lines, it is ‘between’ the two percentiles (Figure 4). The first plot mark in Figure 4 shows the girl’s birth weight of 3.25kg, between the 25th and 50th percentiles. The next three plots can be considered to be on the 25th percentile, while the final three plots can be considered to be between the 25th and 50th percentiles.

**Adjustments for premature infants or children**

28. All growth assessments for premature infants or children under two years old

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**Figure 3. Measuring an infant’s head circumference**

*Consent given by Yeovil District Hospital*

**Figure 4. Plots of seven infant weight measurements**

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who were born premature should be adjusted (Canadian Paediatric Society and Dieticians of Canada 2010). Use the following formula to calculate the adjusted post-gestational age in weeks and days, once the premature neonate has reached their expected date of delivery: corrected post-gestational age = chronological age – number of weeks and days premature.

29. Plot the infant or child’s growth measurements using the adjusted post-gestational age on the growth chart, clearly indicating the adjustment. The adjustment for prematurity continues until the child reaches a chronological age of two years.

Evidence base
An important part of the clinical assessment of infants and young children under two years old is measuring and monitoring growth. The procedures and some of the data used to monitor the growth of infants and children under two years old differ from those used in older children, for example length is measured rather than height.

Length measurement should follow the standard procedures used to formulate the WHO (2006) growth charts. The most up-to-date growth charts for infants or children under two years old are the UK WHO Growth Chart 0-4 Years (boys) and UK WHO Growth Chart 0-4 years (girls) (RCPCH 2009b). These are based on growth measurements obtained from 8,500 healthy infants from six countries who were exclusively breastfed for the first four months and then partially breastfed until 12 months of age, and form the basis for determining how infants and children between zero and four years old should grow (de Onis et al 2004). Length rather than height should be used to measure all infants and young children up to two years old.

Breastfed neonates naturally lose up to 10% of their birth weight, because of the delay in breast milk ‘let down’ following birth, but they should regain their birth weight towards the end of the second postnatal week. Bottle-fed neonates should not lose more than 5% of their birth weight, since there is no delay in milk provision (Lawrence and Lawrence 2011). Premature neonates are born with a greater proportion of body water than term neonates, which is lost in natural diuresis following birth. Therefore, they may take up to 15 days to regain their birth weight. However, it is unusual for any infant to lose more than 10% of their birth weight in their first two weeks of life; losses greater than this may indicate inadequate fluid intake from breast milk or infant formula that should be investigated further (RCPCH 2009a).

Interpreting growth plots and screening for faltering growth
Interpreting an infant or young child’s growth may be based on one of the following:

» The percentiles on which their current measurements lie.

» How their weight and length percentile plots relate to each other, for example where their weight measurement is on a markedly different percentile from their length measurement.

» The trends in their weight and/or length plots over time.

For most infants or young children, their growth parameters, weight, length or head circumference, will lie along or close to percentile lines in the normal range. Any measurements that are above the top percentile (99.6th) or below the bottom percentile line (0.4th) will require close monitoring and/or further investigation. When the child or infant’s weight is >2 percentile spaces below that of their length (Shaw 2015), or if their weight falls by two percentile spaces (Lissauer and Clayden 2012), the child or infant’s weight should be monitored closely, with consideration of referral for further investigations if the discrepancy worsens or persists.

Head circumference measurements of infants or children under two years old in the UK should be plotted in the relevant section of the current UK WHO 0-4 years growth charts (RCPCH 2009b). Infants or young children with head circumference measurements above the top 99.6th percentile or below the bottom 0.4th
percentile require close monitoring. Any head circumference measurements that start to deviate markedly in percentile lines in an upward or downward direction over several weeks warrant further investigation, to exclude hydrocephalus or microcephaly.

A systematic review, which compared data from the WHO’s Multicentre Growth Reference Study (WHO Multicentre Growth Reference Study Group 2006) with data from studies from 1988-2013 performed in 55 countries or ethnic groups, indicated that the use of a single international standard for head circumference is not justified (Natale and Rajagopalan 2014). The differences in mean head circumferences that were observed between national or ethnic groups were sufficiently large to put some healthy infants and young children at risk of a misdiagnosis of macrocephaly or microcephaly (Natale and Rajagopalan 2014). Therefore, head circumference measurements that are outside the normal range may not necessarily be a cause for concern in infants and young children from ethnic minority groups.

Causes of faltering growth
There are two categories of faltering growth: organic causes, which are disease-related and non-organic causes, which may be in part psychological or behavioural, or result from suboptimal parenting. Early identification of malnutrition and nutrition risk through screening is likely to result in the normalisation of growth and the return to health. Specific screening tools for infant and child malnutrition are limited. The Paediatric Yorkhill Malnutrition Score (Gerasimidis et al 2010) is one useful screening tool that may be used to identify children over one year old who are at risk of malnutrition, without resulting in large numbers of false-positive cases.

Common causes of organic faltering growth include (Shields et al 2012):

- Cardiac causes: some defects, such as moderate to large ventricular septal defects, result in increased energy demands and suboptimal feeding.
- Neurological causes: neuro-disability, for example sub-optimal oral-motor skills associated with cerebral palsy.
- Respiratory causes: chronic lung disease, which is often associated with extreme prematurity, and cystic fibrosis. Lung disease increases the energy demands in these children, so their calorie intake needs to be higher.
- Renal failure: may be related to suboptimal intake with high energy requirements or tubular acidosis.
- Gastroenterological causes: gastrooesophageal reflux resulting in inadequate intake, or pancreatic, bile or digestive enzyme insufficiency after gastrointestinal surgery, or as a result of coeliac disease.

References


Weight faltering and failure to thrive in infancy and early childhood. BMI. 346, e5931.
