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<th>Title of Guideline:</th>
<th>D14 – Growth Monitoring on NICU</th>
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| If this version supersedes another clinical guideline please be explicit about which version it replaces (not applicable if this is a new guideline, enter below if extensive): | Replaces V3 – main change:  
- Include guidance on recording growth using growth charts in Digital Health Record (DHR)  
Growth charts used – 1 – RCPCH guidance on use of WHO growth charts  
Rest of guideline – 4, 5 & 6 |
| Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues? |  
1. NICE Guidance, Royal College Guideline, SIGN (please state source)  
2a. Meta-analysis of randomised controlled trials  
2b. At least one randomised controlled trial  
3a. At least one well-designed controlled study without randomisation  
3b. At least one other type of well-designed quasi-experimental study  
4. Well-designed non-experimental descriptive studies (i.e. comparative/correlation and case studies)  
5. Expert committee reports or opinions and/or clinical experience of respected authorities  
6. Recommended best practise based on the clinical experience of the guideline developer |
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| A review date of 5 years will be applied by the Trust. Directorates can choose to apply a shorter review date; however this must be managed through directorate Governance processes. |  
This guideline has been registered with NUH Trust. However, clinical guidelines are guidelines only. The interpretation and application of clinical guidelines will remain the responsibility of the individual clinician. If in doubt contact a senior colleague or expert. Caution is advised when using guidelines after the review date or outside of the Trust. |
1 Background

The measurement and documentation of growth using standardised growth charts is an essential part of paediatric and neonatal practice. This is particularly important on the Neonatal Unit because our patients are at high risk of poor growth due to a number of factors including delayed initiation and establishment of enteral feeding and the presence of congenital or acquired pathology. Failure to correctly and accurately document regular growth parameters can result in infants with poor growth patterns not being identified early, placing them at an increased risk of morbidity and mortality.

Until 2009, all growth charts were based on the UK-90 data which used a mixture of longitudinal and cross-sectional data from 7 studies across the UK [1]. Growth charts are now available based on the World Health Organisation (WHO) Child Growth Standards [2]. The WHO data is international longitudinal data from healthy breast fed infants born at term and is considered to be a better indication of optimal growth. Data is currently available from 0-4 years. Beyond that the growth charts continue to use the UK-90 data.

Data for infants born prematurely is purely cross-sectional data from birth – weight, length and head circumference – and was not collected as part of the WHO studies. The data on the 23-42 weeks section of the Newborn Infant Close Monitoring chart is based on reanalysed UK-90 data and represents the measurements of infants born between 23 weeks and term at birth and does not describe how preterm infants grow after birth [3]. However, it offers the best guide to the rate of growth had the infant not been born prematurely.

KEY POINTS:

1) All infants admitted to the neonatal unit who are preterm or are likely to have neonatal or paediatric follow up must have a growth chart completed, kept up to date and filed in the correct place in their notes. Where appropriate a growth chart should be considered for babies on Transitional Care.

2) The growth chart must be ‘prepared’ for the individual baby by completing the date boxes along the bottom of the chart. This should be done by the admitting doctor along with the Badger admission documentation or within 24 hours of admission.

3) Only the Newborn Infant Close Monitoring (NICM) Growth Chart should be used for infants on the neonatal unit.

4) All babies should have the 23w–42w section of the NICM Chart completed weekly with EDD entered to prepare chart in the Digital Health Record (DHR)

2 Selecting a growth chart – paper copy

There are a number of different UK-WHO charts available [4]. For newborn infants there is the UK–WHO Neonatal and Infant Close Monitoring (NICM) Growth Chart 23 weeks gestation to 2 years (Figure 1) designed for infants born prematurely or those born at term where more detailed monitoring is required, and the UK–WHO Growth Chart 0–4 years (Figure 2), designed for healthy term infants. There are separate versions of each of these charts for boys (blue) and girls (pink).
Figure 1. UK-WHO NICM Growth Chart (Girls)  Figure 2. UK-WHO 0-4y Growth Chart (Girls)

Selecting NICM growth chart in DHR

![Screen print from DHR – see section 4.6](image)

- Open record in DHR
- Click EForms - to right Knumber
- Select 23w-42w NICM chart
- Add EDD - will be on Badger centile chart
- Gestational age at birth appears
- Any further data added will be automatically corrected
- Babies born 37-42w will be plotted at Term
Neonatal Infant & Close Monitoring (NICM) charts will be used for all infants on the neonatal unit as the larger scale allows for more detailed monitoring and the method of correcting for prematurity should lead to fewer errors, providing the chart is accurately prepared.

The only exception to this is where a growth chart is available for infants with a condition where growth is known to be different to the background population: the most notable example is the Down’s syndrome charts (updated in 2011 - www.dsmiq.org.uk/publications/growthchart.html). However, the Down’s syndrome’s charts do not include preterm data and so the NICM chart should be used until 42 weeks corrected gestation if the baby was born prematurely.

**Both the UK–WHO NICM Growth Chart (Figure 1) and the UK–WHO 0-4y Chart (Figure 2) mentioned above allow for correction of prematurity, but do so in different ways. The 0-4y charts only include data from 32w gestation and plot at actual age using an ‘arrow-back’ method for showing prematurity (see Appendix 8.2 (Figure 5)) whereas the NICM charts automatically incorporate correction when prepared correctly (See Appendix 8.1 (Figure 4)).**

Growth charts in the Personal Child Health Record (PCHR, commonly called the Red Book) are usually A5 versions of the 0-4 year charts so it is important to be familiar with both. A version of the NICM chart for use in the PCHR is now available and infants admitted to the neonatal unit may have a copy of this chart added to their PCHR by the continuing care team prior to discharge, for use by the community team and in neonatal follow up clinic. The 0-4 year chart will not be removed as it will be required once correction for prematurity is stopped.

Training on the use of charts other than NICM charts is available at www.rcpch.ac.uk/growthcharts

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### 3 Preparation of NICM Growth Charts on Admission

All infants admitted to the neonatal unit who are preterm or are likely to require ongoing neonatal or paediatric follow up should have a growth chart appropriately prepared (see below) and filed in the rear section of their medical notes in front of the results divider.

It is the responsibility of the admitting doctor/ANNP to correctly fill in and file the growth chart. Where this isn’t possible due to time constraints, the responsibility should be handed over to the incoming shift. The admitting doctor/ANNP is defined as the person who completes the Badger admission documentation.

1) Select the correct chart. All infants on the neonatal unit should be plotted on the NICM chart with male infants plotted on the blue (boy) chart and female infants on the pink (girl) chart. If there is any ambiguity about the sex of the infant, a growth chart should be selected once the sex has been determined. If it is necessary to plot the growth before the gender has been determined, this should be clearly documented on the growth chart.

2) Complete the patient identification information on the front of the growth chart. This must include the name (surname, if first name has not yet been decided) date of birth and hospital number as well as the estimated date of delivery (EDD) and gestation. A sticky label can be used if available, but the EDD and gestation must still be filled in by hand.

3) Plot the birth weight, head circumference and length (if available) at the correct gestation.
   a) All infants born between 37 & 42 weeks gestation are counted as term and should be plotted at 40 weeks or term.
   b) Infants born less than 37 weeks should be plotted at their gestational age. In this case draw a straight vertical line with a ruler at their gestational age.
   c) Plot the birth weight and head circumference on this line at the correct point. Each point should be marked only with a dot. Do not use ‘x’, ‘+’, ‘o’, or any other symbol. If a mistake is made, lightly cross out the dot with an ‘x’.

4) Fill in the date boxes. This is an **essential** part of completing the growth chart and must be completed by the person who initiates it. These boxes help to ensure that any further measurements are plotted at the correct date and are particularly useful when the child is followed up in outpatient clinic later on.
Detailed guidance on completing the date boxes is available on the front of the growth charts. If the EDD is known, complete this in the date box at 40 weeks and work backwards to the gestational age using the calendar on the folded column within the chart. Work forwards to complete the other 2 sections. Date boxes are weekly on page 1 (23-42 weeks), fortnightly on page 2 (2 weeks-6 month) with alternate week shading in the calendar provided and monthly on page 3 (6-24 months).

If the EDD is not known, calculate the date of the next completed gestational week and work forward using the calendar provided on the fold-out section of the chart. For instance if the baby is born at 28+5 on 2/May then write 4/5 in the box at 29 weeks.

You will notice that the calendar does not have 31st December due to there not being exactly 52 weeks in a year, or 29th February which only occurs every 4th year. For the purposes of plotting growth these dates should be ignored. If the DOB or EDD is on one of these dates, you should use the preceding date for plotting growth. When you reach the bottom of the calendar you should continue in the same column at the top. Due to this discrepancy the day at 6 months corrected may be up to 2 days out from the EDD. If so, use the day recorded for EDD for all date boxes from 6m-2y. If more than 2 days discrepancy, the chart must have been incorrectly prepared.

4 Measurements and plotting throughout admission

- Growth parameters are used to monitor the progress of individual infants so must be accurate.
- Weight is used as a basis for ongoing management such as monitoring fluid balance, prescribing medication and feeds, etc. so it is extremely important that it is done accurately.
- Staff carrying out measurements should be suitably trained and use appropriate equipment.
- Ideally the baby should have all clothing, etc. removed for accurate measurement.

4.1 Head Circumference (or occipital-frontal circumference, OFC)

The head circumferences should be measured around the widest part of the head. This is usually a line across the eyebrows and to the occiput passing along the top of the ears. Using these landmarks will help to ensure reproducibility and reduce inter-operator variability.

A narrow paper or plastic non-stretchable tape must be used to measure head circumference. Each infant should have their own tape which is kept in their cot or incubator. Tapes should not be shared between infants as this may represent an infection risk.

Head circumferences should be measured on a Monday morning as part of the daily medical review. The actual head circumference should be annotated in the medical records as part of that day’s daily review. The head circumference must be plotted, along with the Sunday weight, on the growth chart and recorded in the notes as part of the daily review. Head circumference will, therefore, usually be plotted on the chart the day after their weight.

It is unusual for an infant to be too unwell to be weighed or have their head circumference measured. If a child is on continuous CPAP or ventilated, a measurement of the head circumference can be made once a week without the hat on except in exceptional circumstances. To do this safely may require a second member of staff to ensure the airway is maintained. Where the doctor or ANNP conducting the daily review is unsure whether it is safe to measure the head circumference in an infant receiving respiratory support this should be confirmed with the Day-time Duty Consultant on the ward round. Special care is required in measuring the head circumference for a child undergoing CFM monitoring and this should be discussed in advance with the NICU Service Registrar or Day-time Duty Consultant.

4.2 Length

Length should be measured using a measuring board or mat, not a tape.

Lengths will be measured on arrival in low dependency and on discharge and plotted on the relevant section of the growth chart. This must only be done by staff who have been specifically trained to use the equipment. It is not anticipated that the length will be used to change management due to the lack of an evidence base on which to make decisions. However, it is recognised that lengths before leaving the unit are often useful for comparison at a later date.
4.3 Weight

Class III electronic scales should be used and the same scale used whenever possible to avoid discrepancies. The scale used can be recorded on the daily weight monitoring chart. Incubator scales should only be used when the infant is not able to tolerate coming out of the incubator.

- Current unit practice is to weigh babies 3x weekly on Sunday, Tuesday and Thursday.
- Some infants, such as the sick newborn, may need more frequent weighing—up to twice a day—for fluid management only. This should not continue beyond the period of stabilisation unless required for fluid management.
- Daily weights must not be used for monitoring of feeds, growth and medication.
- Weights should be recorded on the daily monitoring/feed chart by the nurse who weighs the baby, by crossing out the current weight and noting the new weight.
- An arrow with weight gain/loss since last weight may be recorded alongside.
- The weight must then be recorded by the nurse on the daily weight chart by plotting it on the graph and completing the relevant information.
- Weights should only be recorded to two decimal places even though scales may show to three. For example a weight on the scale of 1.235kg should be recorded as 1.24kg as the scale on the chart isn’t large enough for 3 decimal places.

Recording weight in the nursing documentation

- On all the daily nursing charts, a space is provided to document the current weight. This should be filled in by the nurse caring for the infant over night as part of the preparation for the morning handover. If the infant is not weighed, the same weight will be transferred over.
- When an infant is weighed, the old weight is crossed out and the new weight is written next to it. If the weight is static, the old weight should still be crossed out and rewritten so it is clear that the infant has been weighed.
- The new weight is then plotted on the daily weight chart which forms part of the nursing record.

Recording weight in the daily reviews in the medical records

Recording of weight in the medical notes is part of the daily neonatal medical review along with birth weight. Although current weight is recorded every day it must be clear that the baby wasn’t necessarily weighed on that day. For example:

*Date: 5.7.2011*

  B. Wt. – 1.04kg  Current Wt – 1.33kg today  (↑35g over preceding 2 days)

*Date: 6.7.2011*

  B. Wt – 1.04kg  Current Wt – 1.33kg on 5/7/2011.

It would not be relevant to put in the ‘↑35g since 3/07’ as that is not related to that day.
4.4 **Interpretation**

Growth charts are a tool to allow the user to monitor growth in an individual infant in comparison to standard reference data. Centile lines are used with 50 centile (50°) representing the mean of the population and 2° and 98° being 2 standard deviations (SD) below and above the mean.

UK-WHO growth charts have 9 centile spaces each representing ⅔ SD such that only 1 in 250 optimally growing infants would be expected to fall below 0.4° or above 99.6°. The NICM growth charts also have -3 SD and -4 SD to help with the monitoring of very small infants. Plots that are on, or within, ¼ centile space are described as being ‘on the centile’ and those outside of this as being ‘between’ the centiles on either side.

All babies lose weight after birth and should not necessarily be expected to return to the birth centile. Babies born prematurely will also lose weight and if sick may continue to fall away from the centile lines. Centile lines on growth charts before term are not based on WHO data and are not a guide to how a baby should grow: they are based only on measurements from babies born at each gestation using purely cross-sectional data. However, they give us the best guide available other than studies of longitudinal measurements taken from actual growth of infants born prematurely [5], which do not reflect the optimum growth desired.

4.5 **Plotting on the NICM Chart**

Growth should only be plotted on the chart at weekly intervals in most cases as detailed above.

It has also been necessary to use very different y-axis scales for all three measures, so great care must be taken to check this when plotting. These x-axis scales changes when moving from 23w-2w chart or to 2w-6m chart so again, the user must closely check graph scales when plotting every parameter.

Although the data from all 6 countries involved in the WHO studies showed similar growth rates in healthy infants born at term who were exclusively breastfed to 4-6 months, infants born in the UK had higher birth weights so the charts use the UK-90 birth data and transition to the UK-WHO data at 2 weeks. For this reason, there is a discrepancy when transferring from the 23w-42w chart, over to the 2w-6m chart and infants will look as though they have increased their centile line. Future measurements will give a clearer picture of rate of gain.

On the inside of the fold-out calendar is a section where it is possible to make a record of the growth parameters. This can be filled in if desired, but it is not essential as it is recognised that there is not enough space to record every measurement plotted.

4.6 **Growth Charts for Babies in DHR**

Since this guideline was first written the Trust is working towards electronic notes and the process currently involves scanning the written medical notes. The paper NICM growth chart must not be sent for scanning but kept on the unit until discharge when it will be scanned and therefore available to view on DHR, but no further plotting of growth parameters is possible. However, there is a facility for recording growth in the babies DHR using a NICM growth chart, but this is currently far from ideal as it cannot be accessed on the unit iPads for monitoring growth on ward rounds, can only view weight, length or head circumference on different charts and is separate to the rest of the babies’ record. However, it is essential that a DHR growth chart is started so that there are growth data from the period of admission available to neonatologists and other clinicians in clinic and later during any admissions to hospital.

Ideally these would be started soon after birth selecting the NICM growth chart 23w-42w and preparing the chart by recording the EDD. Thereafter, weekly measurements should be added by selecting the date and inputting the measurements which will be automatically plotted in the correct place on the chart.
5 Discharge
On discharge, key information regarding growth should be transferred from the NICM Growth Chart in the medical records to the Personal Child Health Record (PCHR or Red Book). As a minimum this should include weight and head circumference at birth and discharge and length at discharge. It is often also useful to record when the infant was on their lowest centile. When completing the PCHR Growth Chart it is good practice to check that the Discharge Checklist has been completed. At this stage it is important to check that the growth chart in the babies DHR has been prepared with EDD and weekly growth data completed.

NICM charts for the PCHR are now available and these are useful for all infants requiring neonatal follow up. They will need ‘preparing’ with completion of date boxes by a member of the continuing care team who will add them to the PCHR. The 0-4y chart already in the PCHR should not be removed as it is required for plotting growth from 1 year in infants born ≥32 weeks and 2 years for those born <32 weeks, when gestational correction should stop.

The exception to this is where infants have a specific diagnosis for which there is a separate chart available (e.g. Down syndrome 2011). The Community Paediatric team will provide copies of the appropriate charts for the PCHR and the community medical notes; if the infant is to be followed up by the neonatal team or other hospital based team a copy of the appropriate chart should be placed in the medical notes if not already present.

Growth charts for children with Down syndrome are similar to the UK-WHO 0-4y chart in that they start from 2 weeks so infants with Down syndrome born prematurely should be plotted using the NICM chart until 2 weeks post term.

The standard (UK-WHO 0-4 years) Growth Charts in the PCHR are similar to the ones that may be seen in other paediatric records: they use the WHO data for 0-4 years and the UK-90 data for 4-18 years. These use a different method of correcting for prematurity, referred to as the “arrow back” method: the chart is marked with a dot at the postnatal age with a horizontal arrow drawn back to the corrected age (see Appendix 1).

If you require further information or training about using charts other than NICM charts please see www.rcpch.ac.uk/growthcharts.

6 Audit criteria
a) Growth chart filed in every set of notes and correctly filled in, including date boxes.
b) Weekly head circumferences and weights plotted.
c) Length measurements plotted on transfer to low dependency and on discharge.
d) Growth chart in DHR has been prepared and completed during admission

7 References
8 Appendix - Example Growth Charts

8.1 UK-WHO NICM Chart

In this example a baby girl is born at 32 weeks on 19th April weighing 1.7kg. She has her weight plotted weekly while on the neonatal unit before being discharged at 37 weeks (left hand chart). She is seen in clinic on 23rd August and weighs 5 kg. Instead of needing to calculate her postnatal age (18 weeks) and then subtract her prematurity (8 weeks), the weight is simply plotted against the date as above (right hand chart). For this to work the chart needs to have been completed correctly and this must be done on admission.

8.2 UK-WHO 0-4 years Chart - all babies on the neonatal unit will have a NICM chart as shown above but you may see this type of plotting in clinic in PCHR (Red Book)

In this example a baby boy born 8 weeks early at 32 weeks gestation is reviewed at 18 weeks postnatal age. He weighs 6kg, so a dot is put at the 18w/6kg co-ordinate. An arrow is then drawn back 8 weeks (4 squares) so that the tip of the arrow indicates the corrected age. He is seen again at 24 weeks of age weighing 6.7kg. The process is repeated as shown.

If weighed frequently it is not advisable to "arrow back" every plot as the chart becomes untidy and difficult to read.