

## ANMC Guideline on Preterm Infant Nutrition through 2 Years Old

Preterm infants <37 weeks gestation need careful monitoring of their growth through the first two years of life.

The following information is included in this guideline:

- Recommended periodicity for monitoring growth
- Goal growth parameters
- Fortification of feeds
- Introduction of Solid Foods
- Vitamin D and iron supplementation recommendations
- Nipple progression using the Dr. Brown bottle system

The information below is a guideline created with the goal to help providers make informed decisions about their patients. However, the recommendations below may not apply to all infants and cases should be continue to be considered on an individual basis.

### Recommended Periodicity for Monitoring Growth

- Measurements
  - Weight in grams
  - Length in centimeters, ideally measured on a length board to ensure accuracy
  - Head circumference
- Monitoring growth in the month after NICU discharge
  - After NICU discharge, infant should be seen every week for 2-3 weeks for growth assessments.
  - Growth should be reviewed by primary care provider or member of regional center provider team to confirm appropriate trend. See below for goal growth reference.
  - If any changes are made to feeding regimen, consider more frequent growth assessments.
- Monitoring growth through 12 months corrected gestational age:
  - If growth is reassuring in the month after NICU discharge, infant should continue to have growth assessments at all well child checks (6-8 weeks old, 4 months old, 6 months old, 9 months old, 12 months old, 15 months old, 18 months old, 24 months old)
  - Growth should be reviewed by primary care provider or member of regional center provider team to confirm appropriate trend. See below for goal growth reference.
  - If any changes are made to feeding regimen, consider more frequent growth assessments.

## Goal Growth Parameters

Monitor growth on growth charts appropriate for prematurity to assure infant's growth is tracking appropriately.

- The Fenton growth chart can be used up to 50 weeks corrected gestational age.
- The CDC/WHO growth charts should be corrected for gestational age until infant is two years old.

Goal growth for corrected gestational age (CGA):

	Weight	Length	Head Circumference
0-4mo CGA	25-35g/day	0.8-0.93cm/week	0.38-0.48cm/week
4-8mo CGA	10-15g/day	0.37-0.47cm/week	0.16-0.2cm/week
8-12mo CGA	6-11g/day	0.28-0.37cm/week	0.08-0.11cm/week
12-16mo CGA	5-9g/day	0.24-0.33cm/week	0.04cm-0.08cm/week
16-20mo CGA	4-9g/day	0.21-0.29cm/week	0.03-0.06cm/week
20-24mo CGA	4-9g/day	0.19-0.26cm/week	0.02-0.04cm/week

## Fortification of Feeds

Both breast and formula fed infants may be discharged from the NICU on higher calorie feeds to support post-natal growth. See Appendix B for mixing instructions.

- Continue fortification of feeds\* as prescribed at NICU discharge until approximately 6 month corrected gestational age at which point infant may transition to exclusive breast feeding or unfortified term formula (ex. Similac Advance 20kcal/oz)
  - **If weight gain is inadequate (below goal weight gain) or excessive (far above goal weight gain over many weeks), readdress feeding plan earlier**
  - If weight gain is on the low end of the desired range, consider prolonging fortification in discussion with dietitian
- Considerations for breastfed infants
  - Breastfed infants may be discharged from the NICU with a feeding plan of direct breastfeeding in addition to supplemental feeds with fortified expressed breast milk (EBM) and/or preterm formula.
  - Options for fortification of breast fed infants:
    - Some formula feeds: Unfortified breast milk for most feedings with three feedings per day of EBM fortified to 22kcal/oz. (If poor growth increase number of fortified feeds per day and/or increase to 24kcal/oz or higher.)
    - Enriching feeds: Add powdered formula to fortify EBM to 22kcal/oz for all feeds. (If poor growth, increase fortification to 24kcal/oz or higher.)
    - Nursing supplementation: Direct breastfeeding for all feedings while supplementing at the breast with 15mL of preterm formula. (If poor growth increase the amount of supplementation with each feed.)

\* Higher calorie formula powders are obtained through WIC prescription or home health care (ex. Procure) prescription if not WIC eligible

### Transition from Formula to Cow's Milk

- Transition to whole cow's milk at 12mo corrected gestational age
  - If child's growth continues to be poor consider transition to pediatric formula
- Transition to 2% cow's milk at 2yo corrected gestational age

### Introduction of Solid Foods

The American Academy of Pediatrics recommends starting solid foods at around six months of age. Preterm infants will start solid foods later than this. They need to show they are developmentally ready to start solid foods.

Signs an infant is ready to start solid foods:

- Can sit in a high chair, feeding seat, or infant seat with little or no support
- Good head control
- Opens mouth and leans forward when food is offered

### Vitamin D and Iron Supplementation

- Vitamin D (cholecalciferol): All infants in Alaska should be supplemented with vitamin D through one year of age, preterm infants should continue supplementation through at least one year old corrected gestational age.
  - Supplement with cholecalciferol 800 IU/day for breastfed infants (partial or exclusive)
  - Supplement with cholecalciferol 400 IU/day for exclusively formula fed infants
  - Preparations
    - Cholecalciferol drops: 400IU/1 drop (0.028mL)
    - Poly-Vi-Sol with Iron: 400IU cholecalciferol/1mL
  - Consider continuing supplementation after one year old if infant is not getting recommended daily intake (600IU/day) from foods.
- Iron: preterm infants continue supplementation through one year old corrected gestational age. Iron supplementation is especially important for Alaska Native children as they are at increased risk for iron deficiency in childhood.
  - Supplementation with elemental iron 2-3mg/kg/day
    - Infant will be discharged from the ANMC NICU on 3mg/kg/day
    - **Update dose to reflect weight changes at each well child check**
    - May divide dose BID if issues with spitting up
  - Preparations
    - Iron polysaccharide: 15mg elemental iron/1mL (improved tolerance/better taste)
    - Ferrous sulfate: 15mg elemental iron/1mL
    - Poly-Vi-Sol with Iron: 11mg elemental iron/1mL
  - CBC should be checked at 12mo well child check to assess for iron deficiency anemia. If CBC unable to be obtained, POC Hgb can be considered however this is a less reliable test.

Dr. Brown’s Bottle System Nipple Progression

Many bottle fed infants in the NICU use the Dr. Brown’s bottle system as it is the most consistently manufactured nipple product currently available, resulting in the least variability in flow rate from nipple to nipple. The Dr. Brown’s system has a series of nipples with progressively faster flow rates. As an infant ages and becomes more skilled with feeding they are able to advance to a faster flowing nipple. Most infants are discharged from the NICU using the Dr. Brown’s premie nipple.

- Dr. Brown’s Ultra Premie Flow Nipple – Slowest of the slow flow nipples. Often used with very premature or medically fragile infants.
- Dr. Brown’s Premie Flow Nipple – Slow flow nipple that is used if infant are showing stress signals with faster flow nipples. Often a good choice for newborns and infants who feed at the breast and are receiving supplemental bottle feedings. (Flow rate: 35% Faster than ultra-premie)
- Dr. Brown’s Newborn Nipple – Used for infants who require a slower flow nipple than level 1 or needing to transition from the premie level nipple to a higher flow nipple. (Flow rate: 25% faster than premie, 15% slower than level 1)
- Dr. Brown’s Level 1 Nipple – Used when infants are beginning to show consistent feeding skill and starting to take larger feedings. (Flow rate: 60% faster than premie)
- Dr. Brown’s Level 2 Nipple – Used when infants are taking a long time feeding from the Level 1 nipple, showing they are ready for a faster flow. May be best with infant is sitting up with assistance or without support. (Flow rate: 60% faster than level 1)
- Dr. Brown’s Level 3 Nipple – Used in infants with established feeding skills. May be best for infants who can sit up with assistance or without support. Consider this nipple in infants who are developmentally taking solid foods from a spoon. (Flow rate: 50% faster than level 2)
- Dr. Brown’s Level 4 Nipple –Used in infants with advanced feeding skills. Consider this nipple in infants transitioning to finger foods and drinking from a cup. (Flow rate: 50% faster than level 3)

Note: The American Academy of Pediatrics recommends introducing cups at 6 months old, transitioning to a cup at 12 months old, and discontinuing bottle feeding by 24 months old. For preterm infants these recommendations can be adjusted based on corrected gestational age and developmental progress.

Stress cues that a nipple flow rate is <i>too fast</i> :	Signs that a nipple flow rate is <i>too slow</i> :
<ul style="list-style-type: none"> <li>• Change in alertness (looks like: falling asleep during feed)</li> <li>• Change in postural control or tone and movement patterns</li> <li>• Change in cardiorespiratory behavior:               <ul style="list-style-type: none"> <li>○ Color change, respiratory fatigue, tachypnea, nasal flaring and/or blanching, chin tugging, shallow short breaths instead of a series of deep breaths, unstable saturations, bradycardia, apnea</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Infant consistently finishes bottle with no observed stress cues/requires no external pacing</li> <li>• Infant maintains quiet-alert state before/during/after feeding</li> <li>• Infant becomes fussy during feed (may pull off nipple out of frustration) when s/he was previously quiet-alert for duration of feed(s)</li> </ul>

<ul style="list-style-type: none"><li>• Uncoupling of swallowing and breathing resulting in:<ul style="list-style-type: none"><li>○ Gulping</li><li>○ Hard sounding swallowing</li><li>○ Coughing/</li><li>○ Choking</li><li>○ Fluid loss (spilling) from mouth</li></ul></li></ul>	
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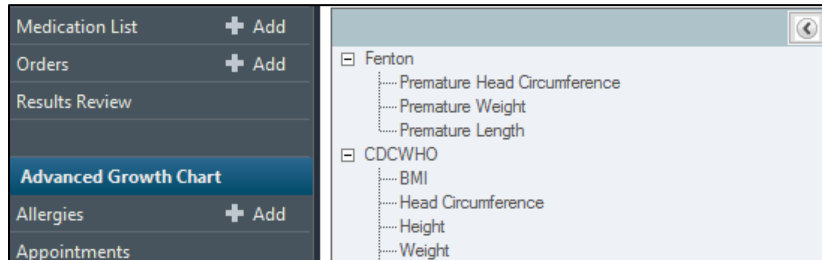
If stress cues go unnoticed and unmanaged (looks like: the infant is not paced when s/he is experiencing stress during feeding), disengagement can happen as a means to help themselves. This can lead to the creation of negative neuropathways which can result in oral aversion and feeding disorders in the months/years following discharge from the NICU.

Signs of disengagement during feeding:

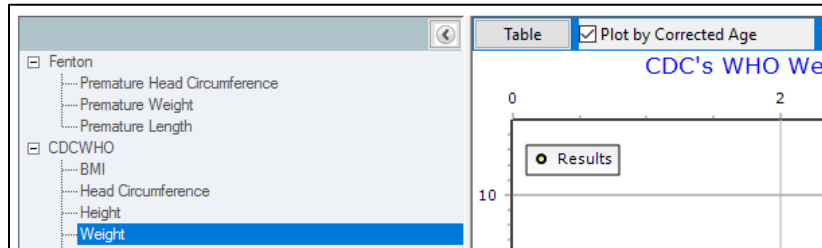
- No active rooting/sucking
- Inability to re-alert, passivity
- Pulling off nipple, pushing nipple out (looks like: bottle refusal)
- Purposeful use of a weak or “compression-only” suck to signal a preference for return to only pacifier sucking instead of nutritive sucking (looks like: taking a very long time to eat small amounts)

Appendix A

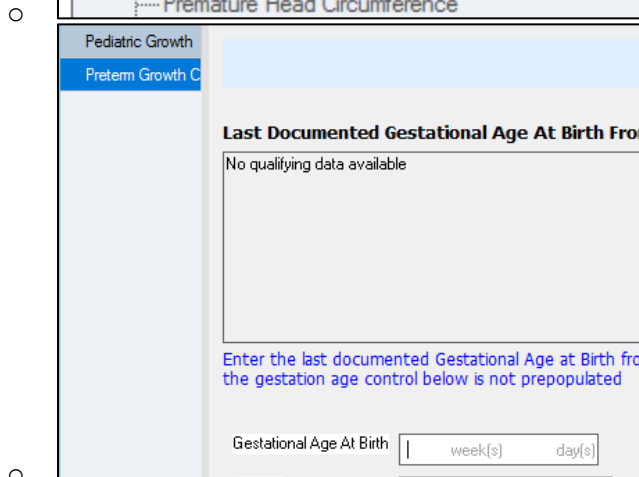
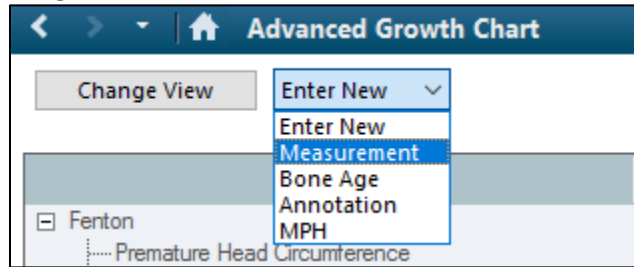
- Using other health records systems (not Cerner): There are multiple online tools to calculate corrected gestational age such as PediTools: <https://peditools.org/growthwho/>
- In Cerner:
  - Up to 50 weeks corrected gestational age, use the Fenton Preterm growth charts (available in the Advanced Growth Chart section)



- To use the CDC/WHO charts, check the box on the upper left hand corner of the growth chart that says "Plot by corrected gestational age"



- If infant does not have corrected gestational age entered in Cerner, this can be added in the growth chart section



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## Appendix B

Unfortified breast milk is ~20kcal/oz.

Larger volumes of fortified feeds may be mixed up and kept in a covered container in the refrigerator for 24 hours.

### Fortified Feed Mixing Instructions for 22kcal/oz Formula Powder (Neosure)

Making fortified breast milk with 22kcal/oz Formula Powder

Calories per ounce	Breast milk	Formula powder (unpacked, level)
22	3oz	½ teaspoon
	8oz (1 cup)	1 teaspoon + ½ teaspoon
	10oz (1 ¼ cup)	2 teaspoons
	16oz (2 cups)	1 tablespoon
	24oz (3 cups)	1 scoop
24	3oz	1 teaspoon + ¼ teaspoon
	8oz (1 cup)	1 tablespoon
	10oz (1 ¼ cup)	1 scoop
	12oz (1 ½ cups)	1 tablespoon + 2 teaspoons
	18oz (2 ¼ cups)	2 tablespoons + 1 teaspoon
	24oz (3 cups)	3 tablespoons
26	2oz (¼ cup)	1 teaspoon + ¼ teaspoon
	5oz	1 tablespoon
	7oz	1 scoop
	18oz (2 ¼ cups)	¼ cup
	21oz	3 scoops
	24oz (3 cups)	1/3 cup
27	3oz	2 teaspoons
	4oz (½ cup)	1 tablespoon
	6oz (¾ cup)	1 scoop
	16oz (2 cups)	¼ cup
	21oz	1/3 cup
	24oz (3 cups)	4 scoops

Making fortified formula with water and 22kcal/oz Formula Powder

Calories per ounce	Water	Formula powder (unpacked, level)
22	Follow package mixing instructions (60mL water + 1 scoop)	
24	3oz	2 tablespoons + 1 teaspoon
	5½oz	3 scoops
	9oz	5 scoops
	14oz (1 ¾ cups)	½ cup + ¼ cup
	19oz	1 cup
	24oz (3 cups)	1 cup + ¼ cup

26	2½oz	1 tablespoons + ½ teaspoon
	3½oz	3 tablespoons
	5oz	3 scoops
	13oz	½ cup + ¼ cup
	17oz	1 cup
	23oz	1 cup + 1/3 cup
27	3oz	1 tablespoons + 2 teaspoons
	8oz (1 cup)	5 scoops
	11oz	2/3 cup
	16 ½oz	1 cup
	21oz	1 cup + ¼ cup
	25oz	1 cup + ½ cup

**Fortified Feed Mixing Instructions for 20kcal/oz formula (ex. Similac Advance, Similac Sensitive, Alimentum)**

Making fortified breast milk with 20kcal/oz Formula Powder

Calories per ounce	Breast milk	Formula powder (unpacked, level)
22	4oz (½ cup)	¾ teaspoon
	6oz (¾ cup)	1 teaspoon
	8oz (1 cup)	1 ½ teaspoons
	16oz (2 cups)	1 tablespoon
	18oz (2 ¼ cups)	1 scoop
24	3oz	1 teaspoon
	6oz (¾ cup)	2 teaspoon
	10oz (1 ¼ cup)	1 scoop
	20oz (2 ½ cups)	2 scoops
26	6oz (¾ cup)	1 scoop
	11oz	2 tablespoons
	24oz (3 cups)	2 scoops
27	5 ½oz	1 scoop
	10oz (1 ¼ cups)	2 tablespoons
	22oz (2 ¾ cups)	4 scoops

Making fortified formula with water and 20kcal/oz Formula Powder

Calories per ounce	Water	Formula powder (unpacked, level)
22	5 ½oz	3 scoops
	9oz	5 scoops
	18oz (2 ¼ cups)	10 scoops
	24oz (3 cups)	13 scoops
24	5oz	3 scoops
	8oz (1 cup)	5 scoops



	10oz (1 ¼ cup)	6 scoops
	16oz (2 cups)	10 scoops
	21oz	13 scoops
26	3oz	2 scoops
	9oz	6 scoops
	15oz	10 scoops
	24oz (3 cups)	16 scoops
27	8 ½oz	6 scoops
	13oz	9 scoops
	19oz	13 scoops

#### Contributors to this document included

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