



**PEDIATRIC NEWBORN
MEDICINE CLINICAL
PRACTICE GUIDELINES**

Feeding in the Weeks
Leading Up to Discharge





**Clinical Practice Guideline:
Feeding in the Weeks Leading up to Discharge**

Points of emphasis:

This CPG is intended to guide oral (*per os*, PO) feeding practices in the weeks leading up to discharge. Its creation was guided by the principles of evidence-based practice, individualized (cue-based) care, multi-disciplinary collaboration, and family-centered developmental practice.

This guideline was developed to assist in improving consistency of feeding practices amongst staff working with infants who are preparing for discharge to home, with the goal that this will improve patient outcomes, parent confidence and competence in feeding their infant/s, and family satisfaction with their NICU care.

This document is consistent with principles set out in the 10 Steps to Successful Breastfeeding (Baby Friendly Hospital Initiative, WHO and UNICEF) and the SOFFI (Support Of Feeding in Fragile Infants) model.

The working group consisted of representation from nursing (RNs), lactation consultancy (LCs), developmental therapy (SLP, PT, OT), nutrition (RDNs), respiratory therapy (RTs), and medicine (MDs).

In recognition of the primary role of nursing staff in the daily cares of patients, including feeding, this document was circulated within the NICU Nursing Practice Council for feedback and endorsement prior to circulation within the wider NICU.

Questions?

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This is a clinical practice guideline. While the guideline is useful in approaching the feeding of infants in the weeks leading up to discharge, clinical judgment and / or new evidence may favor an alternative plan of care, the rationale for which should be documented in the medical record.

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All CPGs will rely on the [NICU Nursing Standards of Care](#). All relevant nursing PPGs are listed below.

NICU G.1 Gastrostomy Care and Feeding

<https://hospitalpolicies.ellucid.com/documents/view/3205/15783/>

WNH A.1 Alternate Feeding Methods for Infants

<https://hospitalpolicies.ellucid.com/documents/view/3234/15996/>

WNH B.9 Infant Feeding (lists the 10 Baby Friendly Initiative steps and details)

<https://hospitalpolicies.ellucid.com/documents/view/9605/12790/>

1. PROMOTING BREASTFEEDING

The Brigham & Women's Hospital (BWH) supports and promotes breastfeeding as the ideal way to feed babies. BWH endorses **the Baby Friendly Hospital Initiative (BFHI)**

<https://hospitalpolicies.ellucid.com/documents/view/9605/12790/>. As part of this process, our practices are guided by the WHO and UNICEF document "**10 Steps to Successful Breastfeeding**" (<http://www.tensteps.org/>) (1) (see TABLE 1).

It is widely acknowledged that breastfeeding success in the NICU environment may be affected by factors such as infant prematurity and illness, maternal illness, and by separation of mother and infant. As a result, a modified version of the 10 Steps for the NICU environment has been proposed by an international expert group (2) (see TABLE 2). All staff working in the NICU should be familiar with these guidelines. In particular, any staff involved in supporting infant feeding (nursing, medical, allied health professionals) should make themselves aware of each mother's intention to breastfeed and preferences regarding any bottle feeding and formula feeding.

TABLE 1: 10 steps to successful breastfeeding (for healthy full-term infants) (1)

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within one hour of birth.
5. Show mothers how to breastfeed and how to maintain lactation, even if they are separated from their infants.
6. Give infants no food or drink other than breast-milk, unless medically indicated.
7. Practice rooming in - allow mothers and infants to remain together 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no pacifiers or artificial nipples to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or birth center.

**TABLE 2: Modified 10 steps to successful breastfeeding for the NICU (2)**

<p>Guiding principles:</p> <ul style="list-style-type: none"> • The staff attitude toward the mother must focus on the individual mother and her situation. • The faculty must provide family-centered care, supported by the environment. • The health care system must ensure continuity of care, that is, continuity of pre-, peri-, and post-natal care and, post-discharge care.
1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Educate and train all staff in the specific knowledge and skills necessary to implement this policy.
3. Inform all hospitalized pregnant women at risk for preterm delivery or birth of a sick infant about the management of lactation and breastfeeding and benefits of breastfeeding.
4. Encourage early, continuous, and prolonged mother-infant skin-to-skin contact (kangaroo mother care) without unjustified restrictions. Place babies in skin-to-skin contact with their mothers immediately following birth for at least an hour. Encourage mothers to recognize when their babies are ready to breastfeed and offer help if needed.
5. Show mothers how to initiate and maintain lactation and establish early breastfeeding with infant stability the only criterion.
6. Give newborn infants no food or drink other than breast milk, unless medically indicated.
7. Enable mothers and infants to remain together 24hrs a day.
8. Encourage demand feeding or, when needed, semi-demand feeding.
9. Use alternatives to bottle feeding at least until breastfeeding is well established, and use pacifiers and nipple shields only for justifiable reasons.
10. Prepare parents for continued breastfeeding and ensure access to support services/ groups after hospital discharge.

In general, infant feeding plans should be guided by the following principles (2):

1. Provide sufficient fluid and nutrition to meet the infant's requirements for health, growth, and development.
2. Protect the mother's milk supply (teach methods for expressing and storing milk, if breastfeeding at the breast is not possible at that time).
3. Work to address any obstacles to breastfeeding and/or breast milk feeding.
4. Where possible, provide support to have the infant feed at their mother's breast.
5. Where breastfeeding isn't possible, support the infant to receive breast milk where possible (own mother's milk is the first preference; with parent consent, donor milk is the next preference; formula is the last preference).

However, while breastfeeding is generally the best method for infants to feed, all mothers and infants should be supported by NICU staff in establishing successful feeding, regardless of their choice or ability to breastfeed.

See Appendix A: Breastfeeding Decision Tree for high-risk infants

**Nutritive sucking:**

Wherever possible, offer breastfeeding as the first PO feed.

Non-nutritive sucking (NNS):

NNS while on tube feeds has been shown to have benefits for the infant, such as improved transition from tube to PO feeds and better PO feeding performance (3). NNS on a fully pumped breast may be an option for some infants while they are on tube feeds. Mothers intending to use this technique should be taught to recognize:

- Signs of fully pumped breast (e.g. unable to pump any additional milk, soft breast).
- Signs of an additional let down (as sucking stimulation often triggers more milk production).
- Infant indicators that they are not managing any flow (e.g. change in physiological status, coughing, or stress cues).

However, if an infant is NPO due to aspiration risk, they should not be offered the breast at that time, as there is always a potential for milk transfer.

For all infants whose mothers intend to breastfeed, a referral to a lactation consultant (LC) should ideally be made within 24hrs of birth. Education provided by the LC includes:

- Education for pumping strategies to initiate and maintain milk supply.
- Education to help facilitate appropriate positioning and effective latch.
- Use of breastfeeding equipment: Breast pumps, nipple shields, supplemental nursing systems (line feeders), and safe use of oral syringe to deliver small volumes of breast milk when nursing at the breast isn't possible.

Other education that is provided by the lactation consultant, in association with other members of staff includes:

- Education regarding kangaroo care (skin-to-skin contact) (Note: RNs often assist in providing this information and training).
- Education for assessing infant feeding readiness cues (RNs and feeding/ developmental therapists often assist in providing this information and training also).
- Discussion regarding offering 'empty' breast for NNS practice during gavage feeding (this decision should involve medical and feeding therapy staff, in addition to LC and RN staff, if concerns regarding aspiration or apnea exist).
- Discussion of potential need for supplementation, with test weights and feeding assessment (this decision should involve medical and nutrition staff, in addition to LC and RN staff, if concerns regarding growth exist).
- Discussion regarding number of breastfeeds per day vs bottles in infants who need to be supplemented (this decision should involve medical and nutrition staff, in addition to LC and RN staff, if concerns regarding growth exist).



2. STANDARDIZED FEEDING ASSESSMENT TOOLS

Standardized feeding assessments should ideally be performed at standard time points to allow comparison of infants' progress against available norms and analysis of trends. Examples of published, standardized feeding development tools available include:

- Early Feeding Skills Assessment Scale (4)
- Neonatal Oral Motor Assessment Scale (5)

Assessments will be performed by feeding/ developmental therapists or RNs trained in using these tools.

- Results should be recorded in the infant's electronic medical records using standardized templates.
- Results may be used for research studies, with IRB approval.

3. GENERAL BOTTLE FEEDING APPROACH IN LOW-RISK INFANTS

A useful approach to feeding preterm infants at low risk of feeding difficulties is based on the SOFFI algorithm (6, 7) (TABLE 4).

For the general preterm population, staff may consider offering first bottle feed with standard newborn bottle nipple (level 1, such as disposable slow flow nipples) and holding the infant in a standard feeding position (i.e. traditional cradle hold). Then, if needed (i.e. if the infant shows any decline in physiological stability or engagement, or liquid loss), staff should implement the following **compensations**, ideally in the following order, until a suitable option is found:

- **Slower flowing bottle nipple** (i.e. slower than a standard newborn level 1 bottle nipple)
- **Horizontal milk flow** (i.e. bottle horizontal, parallel to floor). This is easiest achieved in either:
 - **Side-lying position** (like when being nursed, with the infant on their side, with their ear, shoulder, and hip in line and facing up towards the ceiling).
 - **Semi-upright position** (supported upright position, with the infant's head above their chest and hips, with the infant's neck supported, such as by the inside of feeder's elbow).
 - Avoid holding the infant in a **reclined/ supine position**.
- **External pacing** (i.e. tipping the bottle down to slow milk flow and/or removing the bottle from the infant's mouth to impose a break in sucking).

NOTE: The rationale for the order of changes is based on gradually increasing demands on the parent/ feeder. Changing the bottle nipple puts the least amount of burden on the parent/ feeder, whereas implementing horizontal milk flow (and associated positioning changes) and external pacing require more active effort, skill, and critical thinking from the parent/ feeder, and there is a greater potential for variation between feeders.

4. FEEDING INFANTS AT HIGH-RISK OF ADVERSE RESPIRATORY EVENTS DURING FEEDS

Some preterm infants (such as those listed in TABLE 3) are at increased risk of **apnea** and/or **aspiration** during PO feeds. Aspiration often presents as '**silent aspiration**' in this group (i.e.



no overt clinical signs of aspiration (e.g. coughing)). Often suspicion is raised via subtle cues (e.g. changes in state during PO feeds) or by symptoms (i.e. otherwise unexplained worsening of respiratory condition).

TABLE 3: Infants at high risk of swallowing difficulties and impaired airway protection during PO feeds (8, 9)

- Born at <28 weeks GA
- Bronchopulmonary dysplasia (BPD)*
- Congenital heart disease (CHD), including patent ductus arteriosus (PDA)
- Airway malformation (e.g. laryngomalacia, laryngeal cleft, micrognathia)
- Neurological injury or altered neurological state: (e.g. intra-ventricular hemorrhage (IVH) 3 or 4, hypoxic-ischemic encephalopathy (HIE), seizures; those on anti-epileptic drugs or sedatives)
- Genetic syndromes (e.g. Down syndrome)

For these infants, given the high risk of **aspiration** (which can contribute to or prolong recovery from lung disease, as well as prolonging transition to full PO feeds and length of stay) and/or **apnea events** during PO feeds (which are potentially life-threatening), a **conservative approach** to the introduction of PO feed is encouraged (TABLE 4). This involves:

- Commencement of any PO feeding with **full compensations**:
 - **slow milk flow** (half emptied breast or slower therapeutic bottle nipple)
 - **side lying position** and **horizontal milk flow**
 - **external pacing as required**
- Breastfeeding only if possible:
 - Flow of milk from the breast is more responsive to the infant's sucking than milk flow from the bottle, which generally occurs passively whether the infant is actively sucking or not.
 - In addition, breastfeeding is infant driven, unlike bottle feeding, which can be feeder-driven if the infant is 'encouraged' to feed by holding the bottle nipple in the infant's mouth, twisting or jiggling the bottle nipple to stimulate sucking, or holding the infant's mouth closed around the nipple in the form of chin and cheek support.

There should be a low threshold for discontinuation of PO feeds in this population if **any concerns regarding airway protection** arise (e.g. change in physiological stability and vital signs, cough, choke, transmitted airway sounds, increased work of breathing, changes in state or motor functioning).

If PO feeds are slow to progress, respiratory support needs increase, or if the patient is unable to wean from respiratory support, an instrumental assessment of swallowing (e.g. **modified barium swallow study, MBS** or **fiberoptic endoscopic evaluation of feeding, FEES**) may be warranted to objectively evaluate swallow function and determine aspiration risk. Some patients who are unable to feed safely with one feed plan, may be able to feed safely with other plans (i.e. change of feeding equipment, feed consistency, position, and/or external pacing).



While, in general, staff should encourage and support **cue-based feeding**, if there is a concern regarding silent aspiration during feeding (i.e. aspiration with no overt clinical signs), it is recommended to use a very conservative approach. In these cases, staff should work to provide developmental and bonding opportunities through other means (e.g. non-nutritive sucking, swaddling and holding during tube feeds). In addition to safety issues, staff should actively work to avoid adverse patient experiences (e.g. aspiration) likely to cause long-term feed aversion.

Table 4: EVIDENCE-BASED BOTTLE FEEDING STRATEGY based on the SOFFI algorithm (6, 7).

LOW-RISK INFANTS	HIGH-RISK INFANTS
Start with: <ul style="list-style-type: none"> • Level 1 bottle nipple • Standard cradle hold 	Start with: <ul style="list-style-type: none"> • Ultra Preemie bottle nipple (slowest bottle nipple available) • Side-lying position with horizontal milk flow • External pacing
As needed (i.e. if the infant displays any decline in physiological stability or engagement during PO feeds) implement the following compensations, in the following order, until a suitable option is found: <ol style="list-style-type: none"> 1. Slower flowing bottle nipple <ul style="list-style-type: none"> • Preemie (first) • Ultra Preemie (second) 2. Horizontal milk flow <ul style="list-style-type: none"> • Side-lying position OR • Semi-upright position • Avoid holding the infant in a reclined/ supine position. 3. External pacing 	As able (i.e. provided infant is showing no decline in physiological stability or engagement during PO feeds), consider trialing the following (one at a time): <ul style="list-style-type: none"> • Remove external pacing • Transition to standard cradle hold • Gradually increase flow <ul style="list-style-type: none"> • Preemie nipple (first) • Level 1 nipple (second)

Feeding an infant on CPAP/ HFNC:

Given the potential for adverse respiratory events related to the underlying respiratory disease, as well as from the effect of positive pressure flow delivered through the pharynx and larynx, staff should adhere to the following guidelines:

- **Infants will not be fed PO while on CPAP or HFNC.**
- **For infants with chronic respiratory support needs on LFNC, the infant should be stable on this flow for ≥ 12 hours prior to any initiation of PO feeding.**

Note:

- PO feeding includes any fluids given by mouth that are swallowed (e.g. medication, breast milk, formula, sucrose solutions) given via any device.



- Oral cares (≤ 1 mL liquid used to moisten and clean mouth) and gels applied to the oral mucosa may be used with caution, as needed. Any liquids delivered to infant's mouth should be broken down into 0.1- 0.2 mL boluses to replicate the size of a typical infant swallow.
- Note:
 - Full-term infants swallow an average of 0.2 mL per swallow.
 - In a fast infant feed, it takes at least 10 sec to swallow 1 mL (90 mL in 15 mins = 1 mL per 10 sec, where most infant would do 5-10 sucks).

Feeding infants who demonstrate increased work of breathing and/or tachypnea (regardless of degree of respiratory support):

Given the potential for adverse respiratory events related to the underlying respiratory disease, as well as from the effect of mis-timing of swallows during inspiration, staff should adhere to the following guidelines:

- Infants who display increased **work of breathing** (e.g. nostril flaring, head bobbing, subcostal retractions, tracheal tug) and/or who are tachypneic should not be fed PO at that time.

Infants with severe neurological impairment or altered neurological state:

- Infants who display altered neurological state should not be fed PO at that time due to increased risk of aspiration.
- Infants with severe IVH (grade 3 or 4) or HIE (including those who have received therapeutic hypothermia) should be considered at risk of silent aspiration and any PO intake should proceed with caution.

Any staff involved in feeding patients at risk of adverse respiratory events during PO feeding should be alert for **signs and symptoms suggestive of swallowing incoordination**. See TABLE 5.

TABLE 5: Signs and symptoms suggestive of possible swallowing incoordination (10, 11)

- Apnea (+/- bradycardia) during PO feeds
- SpO₂ desaturation events during PO feeds
- Increased work of breathing during or after PO feeds
- Cough during or after PO feeds
- Increased congestion or fremitus during or after PO feeds
- Unexplained respiratory infection
- Unexplained inability to wean from O₂ support
- Delayed PO feeding milestones
- Requiring compensations during PO feeds (e.g. modified feeding equipment, modified positioning, or external pacing)



5. THERAPEUTIC FEEDING COMPENSATIONS (see sections 6-8 below)

For all therapeutic feeding compensations:

- If a staff member (RN or feeding/ developmental therapist) assesses that therapeutic compensation is useful for an infant, this should be documented in the infant's medical record.
- Other staff members should continue use of therapeutic compensation unless they assess that this is no longer useful. If so, the reason for this change should be documented in the infant's medical record.
- Staff should avoid making frequent changes to feeding plans, as inconsistencies in feeding practices may contribute to infant feeding difficulties.
- Parent training will be required when using any therapeutic compensations, as these are special strategies that are often not intuitive to parents or other care-givers who may be feeding the infant. Feeding/ developmental therapists and RNs may be involved in performing parent training.

6. THERAPEUTIC FEEDING POSITIONING:

Given that fluids flow more slowly when a bottle is held horizontally vs vertically, the use of horizontal milk flow may be used to assist the infant to regulate milk flow (reducing bolus size) and assist with suck-swallow-breath coordination (12-14).

- It is easiest to achieve horizontal milk flow if the infant is positioned in a **side-lying position** (FIGURE 1) or in a **supported upright position** for PO feeds. Avoid feeding infants in a reclined/ supine position.
- The transition to standard cradle hold (semi-reclined) position should be made when tolerated by the infant.
- In addition, given that most infants are held in a side-lying position when breastfeeding, the use of a side-lying position when bottle feeding may assist with transition to breastfeeding.

Note: Regardless of the position that the infant is held in (cradle hold, side-lying, upright), preterm infants generally benefit from additional postural support during PO feeds, given that many have immature/ altered tone. Supportive positioning can assist in facilitating a flexed position, which is most conducive to effective sucking.

- For breastfed infants, support is provided by the mother's torso and arms. It is suggested that the infant is unwrapped to allow skin to skin contact and assist the infant to latch effectively without extending their neck or stretching their mother's nipple.
- For bottle fed infants, some level of support is provided by the feeder's torso and arms. However, given that the presence of the bottle obstructs the closeness of the infant and feeder, many preterm infants benefit from being firmly **swaddled** during bottle feeds. This can make handling easier for the feeder and less stressful for the infant.

FIGURE 1: Side-lying (a-c) and upright (d) positioning for feeding**7. THERAPEUTIC FEEDING STRATEGIES:**

External pacing (FIGURE 2) is a strategy that may be used if an infant is having difficulty self-coordinating sucking, swallowing, and breathing (14, 15).

- External pacing involves either/ both:
 - Tipping the bottle down, to reduce the amount of milk in the nipple and slow milk flow
 - Removing the nipple from the infant's mouth, to impose a break in sucking to allow the infant to catch their breath.
- External pacing may be performed on a schedule (e.g. every 3 sucks) or on demand (i.e. cue-based).

FIGURE 2: External pacing for feeding (bottle is tipped down to slow liquid flow)**8. THERAPEUTIC FEEDING EQUIPMENT:**

Slower flow bottle nipples (nipples that are slower than a standard newborn bottle nipple (Level 1), such as very slow flow and ultra slow flow nipples):

- Slower flowing bottle nipples may be used to assist the infant to regulate milk flow and assist with suck-swallow-breath coordination.
- In addition, given that milk flow from the breast is generally not as fast as many bottle nipples, the use of slower flowing bottle nipples when bottle feeding may assist with transition to breastfeeding.
- Summary of information from a recent study by Pados et al (16):
 - **Disposable bottle nipples labeled 'slow flow'**
 - On average, these nipples are equivalent to standard commercial newborn nipples (Level 1)
 - There is often variable flow rate between nipples (poor quality control)



- These nipples are made to be single use (i.e. it is not safe to re-use them)
- These nipples are not available to families after discharge from the hospital
- **Commercial bottle nipples labeled ‘preemie’ or ‘ultra preemie’:**
 - These nipples are considered VERY slow flow or ULTRA slow flow
 - They have a more consistent flow rate than disposable nipples (due to stricter quality control in the manufacturing process)
 - These nipples are made to be re-usable (i.e. they can be kept, cleaned, and re-used).

Rationale and considerations when recommending a bottle nipple with a slower flow rate:

Suck- swallow- breath coordination:

- Difficulty with suck-swallow-breath coordination often presents as:
 - Physiological changes: Apnea, bradycardia, SpO₂ desaturations
 - Anterior milk spillage
 - A change to weaker or slower sucking patterns, or a non-nutritive sucking pattern
 - Frequent self-imposed rest breaks
 - Requiring external pacing to impose rest breaks
- If slower flow rate is effective, there should be less of these events.

Time to finish feedings:

- Typical infant feedings last 20-25 minutes (17).
- Slower flow rate may have the potential to extend feeding times. However, in clinical practice, slower flow often does not push infant feed times outside normal limits, as the slower flow generally improves suck-swallow-breath coordination, so the infant spends less time pulling away from the nipple and/or requiring breaks to catch breath.
- It should be noted that infants do not need to complete feedings in 10-15 minutes. This is not physiologic, and may possibly contribute to increased reflux and/or a preference for bottle feeding over breastfeeding.

Faster-flowing bottle nipples:

- Many NICUs stock fast flowing bottle nipples, with the thought that faster milk flow may make sucking easier.
- However, in infants with poor suck-swallow-breath coordination, it is known that faster milk flow generally does not help, and can make feeding harder. Concerns include airway compromise (aspiration, apnea, increased work of breathing), reduced patient enjoyment of feeding (reduced engagement with feeder and potential development of aversion to feeds), and possible flow confusion if moving between breastfeeds and bottle feeds.
- Infants who may benefit from a somewhat faster flow include those with true oral-phase feeding difficulties (versus pharyngeal-phase), such as infants with cleft lip/ palate. In these cases, an assessment must be made to determine the flow rate which is fast enough to assist with effective milk transfer, without being so fast as to interfere with swallowing safety.



9. LOGISTICS OF MANAGING THERAPEUTIC FEEDING EQUIPMENT

Who recommends feeding equipment and how is it supplied:

- The BWH NICU is not currently funded to supply reusable feeding equipment to all infants. Hence, an assessment of clinical need is required to support use, and a record of demand and supply should be kept.
- Feeding/ developmental therapists will supply therapeutic feeding equipment, as required, based on assessment.
- If therapeutic feeding equipment required, several sets of necessary equipment should be supplied to allow time between cleaning.

When to discontinue therapeutic feeding equipment:

- Slower flowing bottle nipples are often used as infants are establishing suck-swallow-breath coordination.
- Collaboration is needed between the feeding/ developmental therapist and RN in determining an infant's readiness to transition to faster flow.
- Some infants will require therapeutic feeding equipment beyond discharge.
- Once an infant is managing with Level 1 nipple, they will often be able to manage with standard newborn Level 1 nipple from most commercial brands.

Family preference for feeding equipment:

In preparation for home, once the discharge date has been identified, staff should recommend the family brings in home bottle system at least 3 days before identified discharge date to ensure nipple flow is appropriate and feedings are successful:

- Disposable feeding equipment available on the floor for inpatient use are manufactured to be single use. They are also not available in the community, and should not be given to parents to take home with them.
- If the re-usable system brought in by the infant's family is not appropriate, staff should provide guidance on this (note: this usually applies to nipple flow rate, and a slower flowing nipple for the same bottle may be available).
- If it has been determined a specialized bottle system is required, the family should be provided with at least 4 full sets to take home, and be guided on where and how to obtain additional sets.

Cleaning feeding equipment

See existing Nursing Guidelines.

<https://hospitalpolicies.ellucid.com/documents/view/3234/15996/>

10. FEEDING PROGRESSION

A MD/ NP/ PA order is generally required for all feeding types (PN, PG, PO). Other staff should be aware of orders that are in place, and discuss with the provider if they believe a patient is ready to commence PO feeding, or if clinical assessment suggests they should remain NPO.

**Commencing PO feeds:**

An order to start PO feeds should only be placed when the infant is physiologically stable (e.g. not requiring positive pressure respiratory support, tachypneic, or displaying increased work of breathing) and presenting with **feeding readiness cues** (i.e. alert, sucking on pacifier, waking for feeds).

Feeding progression for low-risk infants:

Research shows most healthy preterm infants follow a feeding progression, typically achieving full PO feedings between 36-37 weeks GA (18, 19).

Feeding progression for high-risk infants:

It should be acknowledged from the onset that infants who are at risk of feeding and swallowing difficulties may require a longer amount of time to show feeding readiness and to progress to full PO feeding (18, 19).

In general:

Literature suggests that progressing PO feeds based on a cue-based approach may shorten the transition time to full PO feeding by up to a week (20).

Cue-based feeding involves:

- Offering PO feeds when the infant displays **engagement cues** (e.g. physiological stability, flexed position, quiet alert state).
- Discontinuing PO feeds when the infant displays **disengagement cues** (e.g. physiological instability, extension patterns, loss of tone, sleepy, irritable, or hyper-vigilant state).
- **Semi-demand feeding** involves offering the infant the opportunity to PO feed on a schedule (e.g. every 3 hours, q3hr). An assigned volume is provided at each feed (whatever is not taken PO is given PG). A PO feed only progresses when the infant shows feeding readiness cues before the feed and engagement cues during the feed, and it is discontinued based on disengagement cues. Progression of the number of PO feeds and the amount offered is determined by the infant's cues and physiological stability.
- **Demand (ad lib) feeding** involves offering PO feeds based entirely on the infant's cues. Infants are fed PO as much (or as little) as they want, and as often as they demand, provided they meet minimal daily fluid and energy quotas.

Cautions regarding the transition to demand feeding:

- A discussion regarding an infant's suitability to transition to demand feeding is required between medical, nutrition, nursing, and feeding/ developmental therapy staff.
- When an infant is transitioned to demand feeds, a minimum amount of daily fluid and energy intake needs to be agreed on by the team (usually 120 mL/kg/day or 100kCal/kg/day as a minimum).



- A gavage tube will generally need to remain in situ until the patient has achieved PO intake equivalent to 75% of the total energy goal, but not less than 120 mL/kg/day.
- Close management is required by all disciplines to ensure the infant is medically stable and obtaining all fluids, energy, and nutrients required for appropriate growth and development.
- Infants should not go more than 5 hours (and not more than once in a 24 hour period) in between feedings. There should continue to be close monitoring of hydration status, weight gain, and blood glucose.
- In general, the length of a demand feeding trial should be no longer than 48 hours. If an infant is not meeting their fluid and energy minimum, they should be transitioned back to a semi-demand schedule (which often involves re-insertion of a gavage tube).

11. FEEDING ASSESSMENT

Feeding readiness

The first step in a feeding assessment is to establish the infant’s **readiness to feed**.

- Observations are first made across the four areas of functioning, as outlined in the Synactive Theory (21), both at rest and during activity, such as handling:
 - Physiological stability
 - Motor organization
 - State control and attention
 - Self-regulation

See TABLES 6 and 7 for indicators of stress across different areas of functioning, as well as common physiological descriptors.

TABLE 6: Indicators of stress across different areas of functioning

Physiological/ autonomic stability: Changes in HR, RR, SpO ₂ ; yawning, hiccupping, coughing, gagging; color changes (e.g. red, pale, or blue)
Motor organization: Extension patterns (arching, finger splaying), increase or decrease in tone
State control and attention/ interaction: Extremes of state: hyper-vigilance, irritability or shut down; rapid changes in state
Self-regulation: inability to calm, requiring high levels of co-regulation

TABLE 7: Common terms related to physiological functioning

Bradycardia: Reduced heart rate (HR)
Tachycardia: Increased heart rate
Tachypnea: Increased respiratory rate (RR) (>60BPM)
Apnea: Cessation of breathing. An apnea event is the cessation of breathing for >20 seconds or >10 seconds with oxygen desaturation or bradycardia
Typical vital signs in neonates and young infants: <ul style="list-style-type: none"> • Respiratory rate: 30-50 breaths per minute • Heart rate: 110-160 beats per minute
Hypoxemia: Reduced oxygen (O ₂) in the blood <ul style="list-style-type: none"> • Usually, hypoxemia is defined as an O₂ saturation <95%. • Note: Refer to unit guidelines for optimal target saturation levels
Cyanosis: Blue tinge to skin or mucous membranes associated with hypoxemia

**TABLE 7: Common terms related to physiological functioning (con't)**

Increased work of breathing (WOB): Physical presentation of respiratory distress. Signs include: nostril flaring, neck extension, head bobbing, tracheal tug, subcostal recession, accessory chest muscle use, and grunting
Stridor: High-pitched sound originating in the larynx, trachea, or bronchi, caused by a narrow or obstructed airway. Can be inspiratory, expiratory, or biphasic
Stertor: Course sound originating in the pharynx by a narrow or obstructed airway
Fremitus: Vibration caused by partial airway obstruction (often secretions) that can be felt from outside the body

Clinical feeding examination

If it is determined that an infant is showing readiness to feed, the infant undergoes a direct feeding assessment to allow an assessment of the infant's nutritive sucking and suck-swallow-breath coordination is performed. Staff involved in performing feeding assessments include RNs and feeding/ developmental therapists.

In general, an assessment of feeding in the NICU setting will involve a description of how the infant was fed (feeder, infant position, equipment used, and any strategies used), as well as a rating of the following:

- Sucking (lip seal, tongue cupping, sucking strength, sucking rhythm)
- Suck-swallow-breath coordination (beginner/ intermediate/ mature pattern, see TABLE 8)
- Physiological status (any changes in HR, RR, SPO₂, or WOB during feed)
- Stress cues (any changes in motor organization, state control and attention/ interaction), and self-regulation ability (ability to return to an optimal state of functioning after a stressful event).

Infants may also be rated on a scale of feeding ability (see TABLES 8 and 9, as examples).

TABLE 8: Stages of preterm suck-swallow-breath coordination (22)

Mature	Integrated suck-swallow-breath pattern (i.e. cycles of suck-swallow-breathe in a 1:1:1 pattern)
Intermediate	Bursts of multiple suck-swallows followed by a self-imposed break to catch breath (e.g. suck, swallow, suck, swallow, suck, swallow, breathe, breathe, breathe)
Beginner	Bursts of multiple suck-swallows without a break to catch breath; the feeder needs to assist the infant to take breaks to catch their breath or an adverse event (SpO ₂ desaturation, apnea, bradycardia event, or aspiration) may occur

**TABLE 9: Boston Infant Feeding Scale (22)**

Overall PO feeding status:	
1	Competent feeder
2	Functional feeder with therapeutic compensations (any or all of the following): <ul style="list-style-type: none"> • Slower flowing bottle nipple (i.e. slower than a standard newborn bottle nipple, level 1) • Altered positioning (e.g. side-lying position with horizontal milk flow) • External pacing (i.e. tipping the bottle down and/or removing from the infant's mouth to slow milk flow and impose break in sucking for them to catch breath)
3	Struggling/ beginner feeder despite compensations
4	Not ready for PO feeds
Current route for feeds:	
A	PO
B	PO with close monitoring
C	PO with PG top-up as required
D	NPO with conservative PO trials
E	NPO

12. WHEN TO REFER TO FEEDING THERAPY

NICU feeding therapists provide services to the following populations:

- All infants who fall in the high-risk category for aspiration/ apnea during PO feeds (see TABLE 3)
- Infants with:
 - Craniofacial malformation (e.g. cleft lip/ palate, Pierre Robin sequence)
 - Gastro-esophageal reflux disease (GERD)
 - GA at birth <28/40 weeks
- Any infant where there is a concern regarding aspiration or apnea during PO feeds
- Infants 36 weeks GA who do not show readiness to feed PO
- Infants 40 weeks GA who are not fully PO feeding
- If physiological instability is observed with PO feeding despite compensation strategies (therapeutic feeding equipment, positioning, strategies)

NICU MD/ NP/ PAs can request feeding therapy services for any other NICU patients, on a case-by-case basis.

13. SUB-SPECIALTY CONSULTS AND SPECIALIZED ASSESSMENTS RELATIVE TO FEEDING

NICU MD/ NP/ PAs may consider referral to the following sub-specialities, as needed:

- **Pediatric Gastroenterology (GI)**
 - For infant with prolonged NG/ NJ tube feedings, and anticipated need for long term gavage or surgical tube feedings (G or GJ) upon discharge to home
 - In cases of presumed GERD or milk intolerance



- **Pediatric Otorhinolaryngology (ORL)**
 - Where there is concern for palate or airway anomalies
 - In cases of presumed vocal cord dysfunction
- **Radiology for Modified Barium Swallow (MBS) assessment**
 - Where there is concern regarding aspiration during swallowing
 - Eligible infants should ideally be assessed by a NICU feeding therapist first, who will make a recommendation and facilitate the study
 - Currently, studies are conducted at an outside facility (Boston Children's Hospital) that has access to pediatric radiologists. It is recommended that the NICU feeding therapist and RN attend the study, to guide testing conditions, and to facilitate the integration of findings into the infant's care plan

14. WHEN TO CONSIDER FRENULECTOMY

Effective milk transfer from the breast or bottle requires the infant to use their tongue to express milk from the breast or bottle nipple. For fully functional suckling, the tongue tip should be able to extend beyond the lower gum line and be able to move backwards along the roof of the mouth in a stripping action. A lingual frenulum that attaches close to the tip of the tongue, or that is thick and immobile, may prevent normal tongue movement during sucking.

Criteria for frenulectomy:

1. Infant beginning to PO feed,
2. Tongue tie (ankyloglossia) noted on clinical exam, and
3. Clinical signs of tongue-tie noted:
 - Difficulty latching effectively at the breast
 - Painful breastfeeding (e.g. blisters, other nipple trauma, mastitis)
 - Poor extraction of fluids from a bottle (e.g. poor latch, tongue clicking).

Steps to follow:

1. LC and feeding therapist consult
2. If it is assessed that infant meets any of the criteria above, and the attending MD agrees, ORL or a qualified NP is consulted to perform the procedure
3. Parental consent is obtained for procedure
4. Perform frenulectomy
5. LC/ feeding therapist re-evaluates feeding



15. GROWTH, DEVELOPMENT, AND DISCHARGE PLANNING MEETINGS

In keeping with currently recommended family-centered developmental care practices, there should be a weekly encounter of allied health disciplines (developmental therapy – PT, OT, SLP, as well as registered dietitian-nutritionists (RDN), social work, case coordination) along with MD and RN staff to assess patient progress and review readiness for discharge.

- Goals should include:
 - (1) to flag active neurodevelopmental and growth issues, and
 - (2) to identify infants likely to be discharged home in next 1-2 weeks in order to allow sufficient time for coordination of outpatient follow-up care.
- When meetings cannot occur at the bedside, MDs and NP representatives can bring any concerns that various RN staff have raised in morning rounds regarding each baby to this meeting, and then feedback the information from the meeting to RNs and other team members at the next morning rounds and/or sooner as required.
- Following the meeting, a multidisciplinary team note should be placed in the infant's medical record.

16. WHEN TO CONSIDER TRANSITIONING TO NUTRITION FEEDING REGIMEN FOR DISCHARGE

See **Appendix B**: Guidelines for Nutrition Feeding Regimen for Discharge flow diagram

The suggested duration of calorically enhanced feedings is dependent upon the infant's overall NICU course, any estimated remaining cumulative nutrient deficits, and the infant's ongoing postnatal growth trajectory.

- Infants considered at **low nutrition risk** at and/or approaching the time of discharge from the NICU are those who have:
 - 1) no known nutrition deficits,
 - 2) received <2 weeks duration of parenteral nutrition, and
 - 3) have achieved an appropriate growth trajectory
 - Note: Appropriate growth trajectory is defined as equal to 15 percentiles (or 0.5 Z-scores) below birth weight percentile (or Z-score) or better, along with proportional length and head circumference growth. The Z-score is the standard deviation above or below the mean. Therefore, a Z-score of "0" would equate to the 50th percentile.
- Infants considered at **high nutrition risk** at and/or approaching the time of discharge from the NICU are those who have:
 - 1) known nutrition deficits,
 - 2) received parenteral nutrition for ≥ 2 weeks,
 - 3) have a documented sub-optimal growth trajectory, and/or
 - 4) a weight of <2 kg at discharge.
 - Note: Additional considerations include known steroid and/or diuretic course. Another consideration is MRI findings, such as white matter injury and/or increased extra-axial space.



Adjustments to the discharge feeding regimen will be made by the outpatient primary care provider, in conjunction with an outpatient RDN when indicated, based on the infant's ongoing growth trajectory.

A Neonatal Nutrition Discharge Summary may be completed by the RDN (with input from the LC, as appropriate) based on determination of risk and forwarded to the appropriate outpatient care provider/s.

17. NEONATAL NUTRITION DISCHARGE SUMMARY

See Appendix C: Neonatal Nutrition Discharge Summary

Infants considered **high nutrition risk** and/or those being discharged on preterm infant feeding products or any other complex feeding regimens may benefit from a Neonatal Nutrition Discharge Summary.

The Neonatal Nutrition Discharge Summary includes:

- Birth and discharge anthropometrics (Olsen and/or WHO growth charts)
- Change in weight, length and head circumference percentiles and Z-scores from birth to discharge
- Brief NICU nutrition growth summary
- Recommended discharge regimen (including recipe)
- Vitamins/mineral needs and supplementation
- Suggested duration of recommended regimen
- Suggested growth/laboratory monitoring
- NICU Phone number for health care providers to contact RDN for any questions

NICU RDNs should be made aware of pending discharges several days prior to discharge via growth, development and discharge planning meetings and/or via alternate communication from primary care team.

Target audience includes parents, primary pediatrician, and receiving RDN (for example, as part of a multi-disciplinary clinic). The intention is to provide review of discharge nutrition feeding regimen at discharge, as well as a summary of the patient's growth while in the NICU.

The Neonatal Nutrition Discharge Summary will be entered as part of patient's overall discharge summary and/or as a progress note in the chart by the RDN. It will be electronically available to any eCare using facility, and/or faxed to the pediatrician, along with other discharge summary documents. It can also be faxed to other health care providers, as deemed appropriate.

18. DISCHARGE ON ENTERAL TUBE FEEDS AND/OR SUPPLEMENTAL OXYGEN

Discharge from the NICU is dependent on physiological stability and adequate growth. Historically many NICUs would not consider discharging an infant who continued to require enteral tube feeds or supplemental oxygen to meet their nutritional and respiratory requirements.



However, more recently, an increasing number of NICUs have begun to allow infants to be discharged with a feeding tube in situ and/ or with nasal cannula, provided that:

- (a) the infant is physiologically stable,
- (b) the parents are willing and trained in how to use these support systems, and
- (c) appropriate support and follow-up is in place.

With regards to enteral tube feeds, a decision often has to be made prior to discharge regarding whether to continue with a temporary gavage tube (e.g. NG tube) or whether to transition to a surgical feeding tube (e.g. gastrostomy). Different facilities use different guidelines to determine when to transition to a surgical feeding tube. In the BWH NICU, we consider the expected need for tube feeding for greater than 3 months post-term age to justify transitioning to a surgical feeding tube.

See Appendix D: NG feeding guidelines, and existing G tube feeding guidelines

<https://hospitalpolicies.ellucid.com/documents/view/3205/15783/>

19. WHEN TO REFER FOR POST DISCHARGE FOLLOW-UP

Most infants with ongoing feeding difficulties at term age would benefit from monitoring beyond discharge.

The NICU medical team may consider outpatient referral to the following health professionals:

- **Feeding therapist:** If the infant has demonstrated difficulties achieving full PO feeds, aspiration risk, and/or feeding aversive behaviors at any point during their hospital stay, and/or if the infant is discharged home on therapeutic feeding equipment (e.g. Ultra Preemie nipple), special feeds (e.g. thickened feeds), or tube feeds.
- **Dietitian (RDN):** If the infant has demonstrated difficulties gaining weight, and is discharged home on: 1) tube feeds, 2) preterm feedings, and/or 3) is discharged home at <10%ile for weight.
- **Gastroenterology specialist:** If the infant has growth faltering, need for any kind of tube feedings, severe GERD or any other GI-related medical diagnosis that requires follow-up.
- **Pulmonology specialist** if the infant has a history of severe lung disease and those who are on any supplemental oxygen therapy at discharge.
- **Otorhinolaryngology specialist:** if the infant has suspected or confirmed vocal fold dysfunction or structural airway issues.

Of note, infants may be referred separately to feeding, dietetics, or medical programs. However, for medically complex babies with multiple challenges, a multidisciplinary clinic (where available) is likely to best meet their needs and provide a comprehensive and consistent plan for the family.

For all eligible babies, referrals to other outpatient programs (e.g. infant developmental follow-up) should be made in addition, as clinically indicated.



20. DOCUMENTATION IN ELECTRONIC MEDICAL RECORDS

Ideally, feeding assessment and therapy templates should be available to allow consistent reporting. Other efforts should also be made between the various health professionals involved in infant feeding to facilitate consistent reporting.

- At a minimum, infants should be rated as being either a:
 - Competent feeder
 - Functional feeder with compensations
 - Beginner feeder/ struggling feeder despite compensations
- Any compensations required (e.g. ultra/ very slow flowing bottle nipple, side-lying, and external pacing) should be documented.
- The occurrence of, and rationale for, any deviations from agreed plan should also be documented.

21. PARENT EDUCATION MATERIALS

It is important that parents of infants within the NICU receive accurate and consistent feeding information from NICU staff. Ideally, parents should be provided with hard copies of evidence-based feeding information to complement discussions and education provided by NICU staff. Staff should be considerate of potential differences in parent education levels, experience, and adult learning styles. Staff should also be aware of the need for repetition of important information to assist with parent understanding and retention of information. Parent education materials may be provided in the format of handouts, bedside posters, videos, or in other formats.

Feeding topics that should be addressed in parent education materials include:

- Recognizing infant cues (e.g. feeding readiness, engagement, disengagement)
- Breastfeeding (e.g. supporting supply, positioning, latch)
- Bottle feeding (e.g. equipment, positions, external pacing, cleaning)
- Tube feeding (e.g. indications for use, tube options, tube placement)
- Oral stimulation for the non-oral feeder

Nutrition topics include:

- Feeding recipes, including tips for safe preparation and storage
- How to prepare formula for bottle-feeding at home
- How to obtain specialized preterm infant formula products at/after discharge
- WIC Information



22. STAFF TRAINING

It is important that staff within the NICU provide accurate and consistent feeding information. Staff should undergo regular training and self-education in this area. Training may take the form of written material, seminars, courses/ conferences, or case discussions.

Feeding topics that staff should have a current evidence-based awareness of include:

- Recognizing infant cues (e.g. feeding readiness, engagement, disengagement)
- Breastfeeding (e.g. supporting supply, positioning, latch)
- Bottle feeding (e.g. equipment, positions, external pacing, cleaning)
- Tube feeding (e.g. indications for use, tube options, tube placement)
- Oral stimulation for the non-oral feeder

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