

NUTRITION Part II.
BREASTFEEDING THE HEALTHY PRETERM INFANT ≤ 37 Weeks

INTRODUCTION

The purpose of this guideline is to help health care providers facilitate and support breastfeeding the preterm infant from the time of birth until after discharge home. The principles of breastfeeding that apply to the term infant may not necessarily apply to the preterm infant. This guideline has been adapted from the BCRCP guideline Nutrition Part I: Breastfeeding the Healthy Term Infant, and focuses on the special needs of breastfeeding the preterm infant. Unless otherwise clarified, the word “infant” in this guideline refers to the preterm infant.

BENEFITS

Breastfeeding is universally accepted as the best method of feeding term infants,^{1,2,70,71} and the nutritional and immunological superiority of breastmilk is well documented in the literature.¹⁻⁵ Short-term and long-term health benefits associated with feeding breastmilk to preterm infants include:

- Reduced incidence of infections⁶⁻⁸
- Reduced incidence of necrotizing enterocolitis⁹
- Improved feeding tolerance^{10,11}
- Enhanced neurodevelopment¹²
- Decreased number of hospital readmissions¹³
- Enhanced family bonding, maternal involvement and interaction^{14,15}
- Enhanced maternal self-esteem and maternal role attainment^{14,15}

CONTRAINDICATIONS

Contraindications to breastfeeding do not differ between the term infant and the preterm infant. (See BCRCP Guideline: Breastfeeding the Healthy Term Infant for detailed information).

CHALLENGES

- A time commitment from the mother and health care professionals is required (preterm infants require more time to learn breastfeeding than to learn bottle feeding).
- Breastmilk does not provide enough calories, protein and minerals for optimal growth and nutrition of the preterm infant (< 2000 gm),¹⁶⁻¹⁸ therefore supplementation with Human Milk Fortifier (HMF) must be considered for this sub population of preterm infants.
- Ongoing issues for the Very Low Birth Weight (< 1,500 gm) infant often remain until or following discharge, as these infants may still require added nutritional supplementation.

INCIDENCE

Little data exists on breastfeeding rates for mothers of preterm infants. In the United States it is estimated that only 10% to 37%¹⁹ of mothers breastfeed their preterm infants. Of the women who initiate breastfeeding in the NICU (USA), less than 50% are successful at sustaining breastfeeding until their infants are discharged.^{20,21} Generally, evidence suggests that breastfeeding termination in preterm infants is even greater than that of term infants.

PRINCIPLES TO PROMOTE BREASTFEEDING OF THE PRETERM INFANT

I. PROFESSIONAL COMPETENCE

Health care professionals assisting in breastfeeding of preterm infants require knowledge and skills in the following areas:²¹

- Breastfeeding the healthy term infant – see BCRCP Guideline: Breastfeeding the Healthy Term Infant
- Care of preterm infants
- Developmentally supportive care
- Breastfeeding strategies for preterm infants
- Counselling skills to support parent's decisions

II. FAMILY PARTNERSHIPS

Families have a right to be involved in decisions regarding feeding of their infant. It is important that families be provided with the following information so they may make informed choices regarding development of a mutually agreed upon feeding plan.

- Benefits of breastmilk for preterm infants
- Feeding options (from pumping only to full breastfeeding)
- Establishing and maintaining milk supply (pumping)
- Breastfeeding Support Services
- General information about preterm infants and their development.

III. DEVELOPMENTALLY SUPPORTIVE CARE

Developmentally supportive care is based on the synactive theory²⁵ and focuses on fostering neurobehavioral and physiological organization in infants.⁶⁹ Intervention strategies are individualized and based on ongoing assessment of each infant. An assumption underlying this approach is that the high-risk infant is vulnerable to sensory overload and overstimulation and demonstrates this via a variety of physiologic, motoric, state, attentional and regulatory cues. Therefore, the goal is not to focus on achievement of developmental milestones or to offer stimulation to foster specific skills, but rather to help the infant stabilize at each stage of maturation and to support the infant's emerging behaviours and organization while reducing stress.²⁶

- Health care professionals are encouraged to consider developmentally supportive care when assisting preterm infants to breastfeed.

- Developmentally supportive care provides a framework for assisting preterm infants to feed and are woven throughout this guideline.
- See references^{25,27,28} for further information.

IV. INDIVIDUALIZED CARE

- Management strategies should be individualized for each infant and based on ongoing assessment of that infant and family.²⁴
- Care planning should be clearly communicated / documented and reviewed daily. The care plan should include the goals as well as detailed clinical management agreed upon with the family. The care plan should be accessible and visible to all staff and to parents.

V. DISCHARGE PLANNING AND COMMUNITY LIAISON

The preterm infant should be discharged at the earliest opportunity when medically stable, and when discharge is compatible with the family's goals. Many infants at the time of discharge are only partially breastfeeding and therefore mothers require ongoing community support.^{22,23} Discharge follow-up and continuity of care between hospitals and home is imperative (Refer to BCRCP Obstetrical Guideline 16: Planned Maternity Discharge Following Term Birth). Studies have shown that mothers of preterm infants have the following concerns after discharge:²²

- Whether the infant is getting enough milk by breastfeeding
- Whether the composition of milk is adequate
- The mechanics of breastfeeding a preterm infant.

Health care providers should address these concerns prior to and following discharge. This includes liaising with community health resources. See page 16: *Planning for the Transition to Home*.

VI. AGENCY SUPPORT

Health Care facilities and community agencies can support breastfeeding preterm infants by providing the necessary support, education, and resources to ensure that these guidelines can be enacted.

- breastfeeding support services are effective in preventing hospital breastfeeding failures in mothers and preterm infants.²¹
- in-hospital support services and preparation for the post discharge breastfeeding experience enhance success.²²
- specialized support services specific to breastfeeding preterm infants are necessary and should be provided.

CLINICAL MANAGEMENT

I. ASSESSMENT: DETERMINING READINESS TO BREASTFEED

Breastfeeding is a learned behavior that is interactive between the mother and her infant. As with a term infant, breastfeeding a preterm infant is initiated but not perfected in the hospital.

The goals for the infant of *early* breastfeeding sessions are positioning the infant correctly at the breast and maintaining physiologic stability during the feed. The infant may nuzzle or lick the breast during the early feed. This means that the infant is “learning” and it should be interpreted as a successful step in breastfeeding. The goal of *later* breastfeeding sessions is to ensure that the infant consumes adequate volumes of milk in preparation for discharge. The transition from early to later breastfeeding is a gradual one and depends on the infant’s responses to the feeding situation.

Each breastfeeding session (including the first) provides opportunity for the mother to learn about: correct positioning, premature behaviour and ability, hunger cues, and what feeding should look and feel like. Additionally, the mother needs to learn that breastfeeding does take time, patience, and requires collaboration between herself and her infant.

Each infant needs to be evaluated for his/her readiness to breastfeed as well as his/her efforts and successes during the feed. The infant’s first bursts of sucking at the breast may be short, but they will lengthen with practice and maturity. This process may take days and even weeks for very young preterm infants.

To consume an adequate volume of milk, the infant must sustain a sucking pattern that permits milk transfer once milk ejection has occurred. Frequently the infant will suckle for several minutes before milk ejection occurs and then fall asleep shortly after a few nutritive sucks. This maturational phase precedes the infant’s ability to consume larger volumes.⁵

The health care providers’ role in supporting the mother of a preterm infant is to help her to learn the signs that her infant has breastfed well so that she develops greater self-confidence when she takes her infant home.

Management strategies are individualized for each infant and based on ongoing assessment of both infant and mother. Assess the following parameters:

A. Gestational Age

While 32-34 weeks is the most commonly cited gestational age to consider initiating breastfeeding, these parameters are continually decreasing as we learn more about preterm infants.^{20,26,29}

B. Physiologic Stability

- The infant should be physiologically stable prior to, during and following each feed.

- Assess for instability of the autonomic system (tachypnea, pallor, mottling, apnea, bradycardia, O₂ desaturation).
- Premature infants decompensate more quickly than term infants.
- Early recognition of signs of instability prevents decompensation.

C. Sleep/Wake States (Level of Arousal)²⁶

- Assess the infants state:
 - Quiet Sleep
 - Active Sleep
 - Drowsy
 - Quiet Alert
 - Active Alert
 - Crying
- Transitional states occur between each of the above states. Preterm and ill infants are more disorganized in their states, spend more time in transitional and active sleep states, and less time in alert states than well full term infants.
- Infants who are awake and active before a feed pursue the breast more eagerly, organise their nutritive sucking, and engage in more frequent and longer nutritive feeding activities. Infants who are sleeping before a feed but subsequently become alert during the feed demonstrate these behaviours inconsistently, or have few or no sucking bursts.³⁰
- The quiet alert state is optimal for feeding. Timing feeds to occur when the infant is most responsive (quiet alert) enhances feeding success and allows for optimal parent-infant interaction.
- Assist the preterm infant to come to a quiet alert state but do not waken an infant from a deep sleep to feed. Waking from a deep sleep to feed is known to result in a disorganized sucking pattern and unsuccessful feeding session.³¹

D. Mature Vs. Immature Suck Pattern³²

- Assess infant's sucking patterns on a soother and/or at the breast. Preterm and ill infants demonstrate more disorganisation in sucking (poor coordination of sucking, swallowing and breathing) than full term infants. Suck, swallow and breath coordination may occur as early as 32 weeks.³⁰ Maturation of nutritive sucking occurs gradually as infants become increasingly competent at latching onto the breast, staying fixed, and engaging in more efficient sucking.
- Sucking bursts lengthen as infants mature and gain experience at the breast, gradually increasing in sucking vigour and thus allow greater flow of milk expression.

E. Behavioural Cues

Reading an infant's behavioural cues is an important part of assessment. It is also important for parents to learn infant cues so they will be able to respond appropriately to their infant's needs. Infant behavior is affected by a variety of factors e.g. gestational age, level of arousal, environment, illness etc. The same behaviour may have different meanings in different

situations. The behaviour of preterm and ill infants may be subtle and more difficult to interpret due to lack of energy to display behavioural responses. In combination with physiologic parameters, an understanding of infant behaviour enriches assessment and evaluation of interventions and facilitates infant physiologic and behavioural organization.

Table I: Infant Behavioural Cues (Adapted from: Als 1982 & Kenner 1998^{25,26})

Stress Cues	Stability Cues
<p>Autonomic</p> <ul style="list-style-type: none"> - respiratory pauses, tachypnea, gasping - colour changes (dusky, pale, mottled) - tremors, startles, twitches - yawning, sighing - gagging, spitting up - hiccoughing, sneezing, coughing - straining 	<p>Autonomic</p> <ul style="list-style-type: none"> - able to regulate colour and respiration - reduction of tremors, twitches, autonomic stress cues.
<p>Motoric</p> <ul style="list-style-type: none"> - flaccidity (Trunk, extremities, face) - hypertonicity with hyperextension - finger splays - facial grimace - hand on face, fisting - fetal tuck - frantic diffuse activity - planing / bracing 	<p>Motoric</p> <ul style="list-style-type: none"> - smooth well-modulated posture and tone - synchronous smooth movements with - hand and foot clasping - grasping - hand to mouth activity - suck/suck searching - hand holding - tucking with hands to midline
<p>State system</p> <ul style="list-style-type: none"> - disorganized sleep-wake states - fussing or irritability - staring or gaze averting - panic or worried alertness - glassy-eyed alertness - rapid state oscillation - irritability 	<p>State System</p> <ul style="list-style-type: none"> - clear sleep states - rhythmic, robust crying - active self-quieting/consoling - focused, shiny-eyed alertness with intent or animated facial expression - “ooh” face - cooing - attentional smiling

II. BREASTFEEDING PROGRESSION

Depending on the gestational age of the infant, breastfeeding progresses as follows:

- A) Expression and storage of breastmilk
- B) Beginning enteral feeds
- C) Skin to skin cuddling
- D) Non nutritive sucking at the breast (NNS)

- E) Nutritive sucking with supplementary feeds progressing to fully breastfeeding
- F) Fully breastfeeding

The progression of breastfeeding is based upon ongoing assessment of the infant's gestational age, stability cues, and tolerance to handling.

A. Expression and Storage of Breastmilk (See BCRCP guideline: Breastfeeding the Healthy Term Infant)

1) Establishing a Milk Supply

- Assist and encourage mothers of premature infants to pump early (within 6 hours of delivery) and often (6 - 8 times in 24 hours) for a minimum of 100 minutes in 24 hours.^{4,33}
- Ensure premature infants receive all available colostrum (many mothers have more success obtaining colostrum using manual expression than with electric pumps).

2) Maintaining a Milk Supply

- Provide mothers with information regarding the importance of high quality electric breastpumps for long term pumping. Do not use electric hand held pumps that cost under \$70.00 as they are often ineffective.
- Provide information re: pump rentals/purchase and options (e.g. available financial assistance from social workers)
- Mothers will need to pump their breasts after breastfeeding until breastfeeding is fully established.

3) Collection and Storage

- Human Milk Banking Association of North America (HMBANA) recommends that the mother should be supplied with her own pump kit as sharing may be a source of contamination.³⁴ Teach cleaning technique to mothers.
- Store breast milk in aseptic or sterile containers.
- HMBANA recommends that fresh breastmilk can remain at room temperature (27-32 degrees celcius) for 1 hour.³⁴ However, other literature supports breastmilk remaining at room temperature for up to 4 hours.⁷³ (Common clinical practice). If the infant is not going to receive the milk immediately it should be refrigerated or frozen as soon as possible.

B. Beginning Enteral Feeds

Ideally breastmilk will be the first food the infant receives.

- Coat the mouth with colostrum (consider using colostrum for mouth care). Colostrum is vital to the preterm infant because it coats the gastric mucosa with antiinfective agents and protects primarily against necrotizing enterocolitis.^{4,29}
- If the volume of colostrum is small, mix with drops of sterile water.

- Indwelling nasogastric (NG) tubes are generally preferred for providing enteral feeds and may increase success of breastfeeding if used as primary supplementary feeding method.²⁹

C. Skin to Skin Cuddling/Kangaroo Care (See Appendix A – Skin to skin Cuddling Protocol For Incubator Care Preterm Infants)

This refers to placing an infant in a vertical position on the naked chest. Mothers and fathers can both participate in skin to skin cuddling if desired. Infants may skin to skin cuddle for extended periods of the 24 hour day or periodically depending on parental visiting patterns. This gives the infant the opportunity to enjoy the sensory stimuli of the breast and often facilitates increased milk supply. Maximum benefits of skin to skin cuddling occur after the baby and parents have been cuddling for more than 30 minutes.²⁸

- Assist mother/father with skin to skin cuddling
- Give gavage feed while parent is doing skin to skin cuddling
- Infant may start to move towards mother's breast and nuzzle or lick the breast
- Infant criteria for skin to skin cuddling needs to be defined in each nursery
- Continue to encourage skin to skin cuddling in the home. Family members may assist.

D. Non Nutritive Sucking (NNS) (Refer to Appendix C - Preparing to Breastfeed Premature Infants: 32-35 weeks. Non-nutritive Sucking Algorithm)

Non nutritive sucking refers to sucking activity when no fluid or nutrition is delivered to the infant; it is characterized by a repetitive pattern of sucking bursts and pauses. The number of sucks per burst and duration of pauses are stable with approximately two sucks per second.³⁵ The infant can suck on either a soother or an “emptied” breast.

NNS results in more periods of alert wakefulness, pacifying effects, less crying, self soothing behaviors, modulated physiologic responses, including heart rate stability and increased levels of oxygenation, improved behavioral state organization, accelerated maturation of the sucking reflex, increased weight gain, and earlier discharge.^{36,37}

- Provide the preterm infant with many opportunities for non nutritive sucking (e.g. have infant suck on emptied breast or soother during a gavage feed or pre feed).

E. Nutritive Sucking (NS) Progressing to Full Breastfeeding

Like NNS, NS occurs in a regular pattern with sucking bursts and pauses. NS differs from NNS in that the rhythm of NS starts with a continuous sucking burst, then moves to intermittent sucking bursts. These become shorter and the pauses become longer over the course of a feed. While the sucking rate for NNS is approximately two sucks per second, NS has a rate of one suck per second. This is constant over the course of a feed.³⁵ See Appendix D: Introducing Breastfeeding to Premature Infants: 32-35 Weeks.

III. CLINICAL MANAGEMENT & SUPPORT BEFORE AND DURING BREASTFEEDING

A. Environment

It is very important to create a suitable environment that facilitates breastfeeding as the preterm infant is particularly sensitive to his/her surroundings.

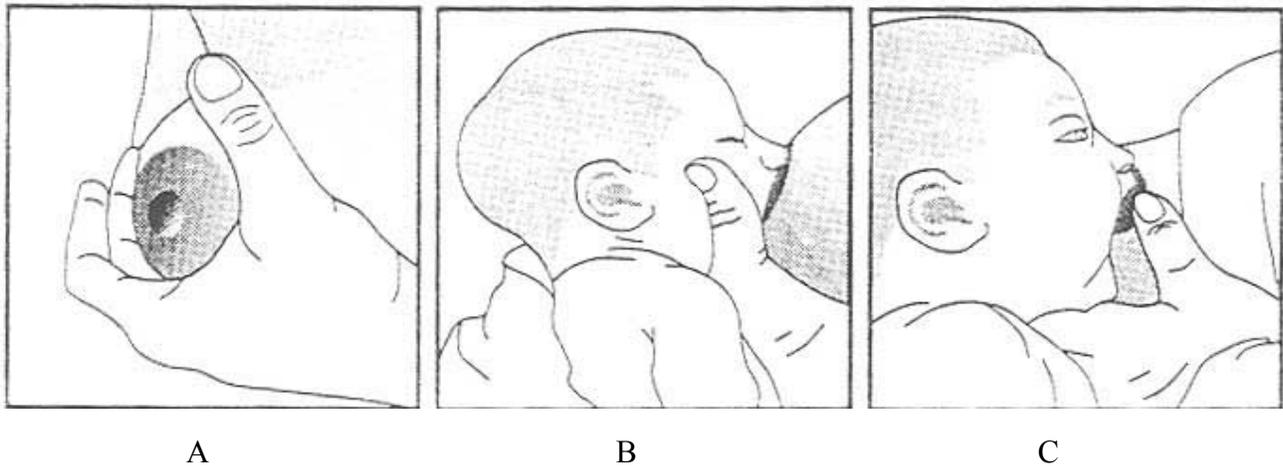
- Provide comfortable upright chair and footstool for mother.
- Provide pillows to position infant at level of breast and for mother's comfort.
- Reduce stimulus and noise to create a quiet relaxing space with dim lighting.
- For the infant who is able to regulate his/her temperature, assist mother to undress and unwrap the infant to encourage a wakeful state.

B. Positioning

Assess mother's positioning of the infant. The following holds may be useful in helping the preterm infant to breastfeed; football hold, modified cradle hold and dancer hand hold (infant's bottom jaw is supported with mother's or helper's hand - see diagram).

Dancer Hand Hold (Adapted from Wolf & Glass, 1992³⁵)

Hand position for providing jaw and cheek support at the breast. A - Cupping the breast in the ulnar portion of the palm. B - Frees the thumb and fingers for cheek support. C - Chin support.



C. Latch

- Obtaining an effective latch with a preterm infant is more difficult than with a full term infant.
- It often takes many attempts and increased gestational maturity to obtain an effective and sustained latch.
- Refer to Guideline 1: Nutrition: Breastfeeding the Healthy Term Infant for signs of an effective latch.

D. Pacing/Duration

- The duration of the breastfeed is determined by the infant - the infant may “come off” the breast, or fall asleep.
- Preterm infants are often able to pace themselves better at the breast than the bottle.
- Assess for stress cues during breastfeeding and respond accordingly. (Refer to Table I: Infant Behavioural Cues on page 6).
- The length of time at the breast will generally lengthen as the infant matures.

E. Cue Based/ Demand Feeds

Many preterm infants are initially fed every 2 - 3 hours. However, healthy preterm infants may be offered cue-based/demand feeds based on the demonstration of hunger cues (waking from sleep, rooting, hand to mouth, sucking, crying). **The maximum time between feeds should not exceed 5 hours from start to start.**

Benefits of cue based feeds include:^{5,30}

- Promotion of parents’ learning - they are able to identify and respond to infant’s cues prior to hospital discharge
- Longer rest periods, fewer feedings per day
- Earlier discharge
- Fewer gavage feeds
- Infants learn to control aspects of their environment
- Parents develop feelings of competence and adequacy in providing care³⁸

Refer to Appendix D - Introducing Breastfeeding to Premature Infants: 32-35 weeks.
Nutritive Sucking Algorithm

F. Adequate Intake/Satiation Cues

The following indicators may be used to help determine intake when breastfeeding (the infant’s cues/signs will become increasingly more obvious/evident as the infant gains maturity and approaches term/discharge):

- Fullness of the mother’s breasts - breasts may feel softer after the infant has breastfed.
- Infant satiation cues: “coming off” the breast, falling asleep (this may also be a sign of fatigue).
- Length of time before infant indicates the desire to feed again.
- Active nutritive sucking for 15 min or more. Frequent swallowing has been audible throughout feed.
- Adequate output
- Daily weight gain
- Test weighing - see section G below.

G. Test Weighing^{33,39-45}

Preterm infant feeding cues are subtler than in the term infant and so some clinicians think

that test weighing can add valuable information to intake. Test weighing is the procedure by which the clothed infant is weighed before and after breastfeeding under identical conditions to estimate the amount of milk intake. The weight gain (in grams) after the feeding is roughly equivalent to the volume (in milliliters) of milk consumed. Test weighing may help identify milk transfer problems and positive findings can be reassuring to mothers and health care professionals.

Test weighing occurs on an individualized basis as follows:

- Use test weighing only after it appears that milk transfer is occurring.
- Use as a teaching tool to recognize effective from ineffective feeding (assess reliability of feeding cues).
- Use to individualize amount of complimentary feeds so that critical 24 hour fluid/caloric requirements can be met.
- Use high quality electronic scale and have it checked for accuracy regularly.
- Test weigh periodically rather than with every feed.
- Support mother as testweighing may undermine confidence, create stress and be discouraging.
- Reduce test weighing prior to discharge to enhance parental confidence.

IV. SUPPLEMENTARY FEEDING OPTIONS

Indications for supplementation include:

- Separation of mother and infant.
- Infant requires medically prescribed supplement of expressed breast milk or requires formula.
- Ineffective milk transfer.
- As a temporary measure during transition to breastfeeding. Many infants may continue to require some supplemental feeding post discharge.^{21,33}
- Mother's choice.

There are many ways to provide supplementary feeds to a preterm infant who is still learning to breastfeed, gaining weight and maturing. Recommended methods are:

- A. Gavage
- B. Cup
- C. Bottle
- D. Lactation aids

There is no evidence to support the use of syringe or finger feeding in the preterm infant population.

A. Gavage Tubes: Nasogastric (NG) size 5 used; Orogastric (OG) size 6-8 generally used

- Used to provide nutrition (breast milk or formula) to an infant whom is unable to take full amount of feed from breast or bottle or when breastfeeding is not possible (mother and infant separated).

- May be used to provide all/most feeds or to provide occasional supplementation .
- Primarily used in the hospital, and are usually discontinued prior to discharge of the infant. Occasionally an infant will go home with an indwelling N/G tube.
- OG tubes are inserted through the infant’s mouth after the breastfeed, and kept in place only for the duration of the supplemental feed.
- NG tubes are inserted through one of the infant’s nares and are “indwelling” for a period of time (common practice is to change the tube every 72 hours). If a silastic feeding tube is used, it is changed every 30 days.

1) Nasogastric tube feeds

Advantages:

- Can easily “top up” infant after breastfeeding (when necessary) when full feed not consumed.
- Can occur during a breastfeed (may help infant learn that breastfeeding provides a “full tummy”).
- Less invasive to infant in terms of replacing tube as the tube is generally only inserted once every 72 hours.
- Provides alternative to bottle feeding which may prevent infant developing preference for bottle nipple.

Limitations

- NG route has been associated with increased work of breathing due to the tube partially occluding the nare (most significant in smaller preterm infants - less than 2 kg).³⁵
- Increases incidence of esophageal reflux.
- Nasal and pharyngeal irritation causes sensitive gag reflex even after discontinued use.
- Stimulates production of nasopharyngeal secretions.

2) Orogastric tube feeds^{26,29,46}

Advantages:

- Tube is not in infant’s nares - may have less impact on breathing
- Infant looks more “normal” without tube in nare and taped to face

Limitations:

- OG route has been associated with vagal responses including decreased heart rate, oxygen desaturations, and regurgitation of any previously ingested feed.
- Insertion of tube may irritate pharynx.
- Repeated insertion may lead to negative conditioning resulting in oral aversion.

B. Cup Feeding (See Appendix B – Cup Feeding Protocol)

- Use a plastic 30 ml medicine cup

- Alternatively, brand names include: Medela Soft Cup 30 ml Plastic medicine Cup, Ameda Egnell cup, Haberman cupfeeder.

Advantages^{47-51,72}

- Method is non-invasive.
- Infant can pace their intake therefore vomiting from overfeeding is unusual.
- Avoids distress from insertion of NG tube.
- Utilizes lingual lipases. Important in digestion of fats and breakdown of dietary glycerides.
- Infant receives taste and tactile stimulation.
- By using the cup, there can be a 'no bottle' policy.
- Method is simple to teach and learn.
- Infant may be fed by someone other than the mother.
- Cups are inexpensive and easy to sterilize when reused.
- Intake of milk can be precisely measured.
- May be used earlier than bottles, usage seen in stable 32 week infants.
- The method seems more temporary thus indicating to the mother that exclusive breastfeeding is expected.
- Cup feeding takes about the same length of time as bottle feeding.

Limitations:

- Dribbling and waste of milk may occur.
- Some infants may show a preference for cup feeding over breastfeeding particularly when breastfeeding opportunities are irregular or limited.
- Incorrect positioning during cup feeding may cause milk to pour into infant's mouth and increase potential for aspiration.
- May take longer than tube feeding and require more staff time in the hospital.
- Very little research available on the effects of cup feeding and comparisons with other methods, particularly with preterm infants.
- Does not provide opportunity to suck, resulting in restlessness.

C. Bottles

- Volu-feeds
- Glass bottles
- Plastic nursers
- Angle neck bottles

Expected Duration of Use

- Sometimes only one or two feeds ranging to all feeds, until infant is weaned or breastfeeding is discontinued.
- May be used intermittently when breastfeeding is well established.

Advantages

- Exact amount of intake is known.
- Other caregivers may share in infant feeding.
- Varying nipple shapes and flow rates may be individualized for the infant e.g. large based nipple encourages wide mouth opening, or firm, straight nipple encourages central grooving of the tongue.
- Infant has the satisfaction and experience of sucking and swallowing.
- Most people are familiar and comfortable with this method.

Limitations

- Infants who bottle feed may require more non-nutritive sucking, therefore are more likely to use soothers which tend to reduce interest in sucking at the breast.
- Ease of bottle feeding may reduce motivation for infant and mother to work towards successful breastfeeding.
- More time and effort required for pumping than bottlefeeding EBM.
- Some infants may show a preference for bottle feeding over breastfeeding, particularly when breastfeeding opportunities are irregular or limited.
- Infant may have apnea and bradycardia or an increase in oxygen requirements during bottle feeding, compared to breastfeeding⁵²
- Bottles require sterilizing between usage.

D. Lactation Aids

1) Supporting Supplementation while Infant is at the Breast

The Supplemental Nursing System™ (SNS) is designed for supplementing at the breast so when the infant latches at the breast, (s)he receives milk from the breast and feeding tube at the same time. The SNS includes a bottle that hangs from the mother's neck and a small gauge feeding tube that is taped to the breast to fit in the infant's mouth when the infant is latched on. Included is a diaphragm that allows milk flow only when the infant sucks.

In hospital, a more economical lactation aid is frequently made by using a #3 or #5 feeding tube. The supplement of expressed breast milk or formula is placed in a bottle or volufeed. The distal end of the feeding tube is inserted into a nipple on a bottle or attached to the volufeed dispensing cap (Ross Labs) on a volufeed. The proximal end of the feeding tube is placed on the areola and taped in place. Gravity controls the flow of milk from bottle to infant. It is more difficult to control the flow with this method compared to the SNS brand.

Advantages

- Keeps infant at the breast which is beneficial to the mother.
- Helps to make each experience at breast a positive, successful one.
- Avoids use of bottles and the theoretical problem of bottle nipple preference.

Limitations

- Infant can use feeding tube like a straw and so it may discourage infant from actively breastfeeding.
- Infant can develop a preference for this feeding method.
- Larger feeding tubes can result in excessive milk flow.
- Some systems are gravity fed and so milk flow can be too fast if bottle is hung too high.
- Infant must be able to latch and suck effectively.
- Awkward and cumbersome to use.

2) Nipple Shields

Commercial brand, thin silicone nipple shields come in two different sizes (regular and small) and can be placed over the nipple for use during a feed. **Bottle nipples or rubber nipples should not be used as a nipple shield, as they do not allow effective latch or milk transfer and may damage the mother's areola.**

Advantages

- Assists infants who prefer bottles to adapt to breastfeeding.
- May assist the infant in suckling on a flat or inverted nipple. (Nipple shields should be used after other solutions have been tried e.g. pumping to evert nipples, timing feeds to infant cues, lactation consultant support).
- Provides the infant with a positive feeding experience at the breast and increases mother's confidence.

Limitations

- Decreases normal nipple stimulation and so may decrease milk supply.^{53,54}
- Continued pumping is required.
- Infant may get lower volume of milk due to decreased surface area suckled.
- Poor breast drainage may result in plugged ducts and mastitis.
- The shield requires cleaning between feeds and sterilizing every 24 hours.
- Inconvenient to place before feeding; may become an issue when feeding in public.
- Weaning infant from the shield is potentially difficult.

PLANNING FOR THE TRANSITION TO HOME

Very little information exists on the post discharge experience of mothers who breastfeed preterm infants. Many mothers pump for extended periods and begin breastfeeding while their infant is in hospital, only to discontinue breastfeeding once home due to one or more of the following reasons:

- Feelings of insecurity about their ability to nourish their infants after discharge.⁵⁵
- Concern about whether their infant is getting enough milk by breastfeeding alone.²²
- Lack of objective data that confirms intake as occurred in hospital e.g. test-weighing, measuring intake, nursing expertise in bottle feeding.
- Lack of clear behavioral cues /immaturity of infant.
- Exhaustion from unrealistic feeding plans.

- A change in support structure from the hospital environment.

The goal should be to prepare parents in advance for discharge, and prevent breastfeeding failure rather than postpone failure until after discharge.

I. FACTORS THAT MAY ENHANCE BREASTFEEDING SUCCESS POST DISCHARGE

- Early initiation and frequent breastfeeding prior to discharge.
- Avoiding drastic changes to feeding plan immediately prior to discharge.
- Moving towards a focus on effectiveness at breast.
- Assisting parents to become competent in:
 - reading infant sleep/wake states and cues
 - assisting infant to achieve quiet alert state
 - assessing effectiveness of feed
- Establishing a breastfeeding plan with the mother and healthcare professionals for the immediate post discharge period.
- Providing the mother with the written breastfeeding plan for her to share with other health care professionals.
- Rooming in (in hospital setting) prior to discharge.
- Providing comprehensive and timely referral to community health care providers.
- Effective communication between all health care professionals.

As discharge approaches, the mother and staff should focus on the following cues rather than clinical measurements that will not be accessible at home. Please see the following chart.

From: Clinical Measurements	To: Cues
Scheduled feeds	⇒ Cue based feeds
Routine supplement	⇒ Supplement individualized to each feed
Measured intake & Test weighing	⇒ { Audible swallowing Soft breast following feed Hydration Voiding/Stooling patterns Signs of satiation
Non Nutritive sucking on soother or emptied breast	⇒ Nutritive sucking at breast
Occasional breastfeeding and frequent supplementary feeds	⇒ Frequent breastfeeding; occasional supplementary feed
Pumping to maintain milk supply	⇒ Breastfeeding to maintain milk supply

II. CRITERIA FOR DISCHARGE

- **Infant is medically well and physiologically stable:**
 - At rest, infant is free of spontaneous apnea, bradycardia, and desaturations <88 requiring intervention, for 4 to 5 days.
 - Apnea & bradycardia during feeds does not preclude discharge. However, parents must be able to manage these situations competently.
- Infant able to feed by breast alone, or breast and an alternative method for 3 days.
- Infant mature (able to maintain normal temperature for 48 hours in an open environment).
- Infant demonstrates a consistent pattern of weight gain (15-30 gms per day) for 3 days on full oral feeds.
- Parents comfortable/competent to care for and feed infant.
- Readiness of family to receive the infant at home, and support systems in place.

III. POST DISCHARGE

Ideally the family should be followed by community resources with expertise in this area (2-3 times/week), until breastfeeding and weight gain are well established. Communities may need to adapt this depending on available resources.

Follow up may be accomplished via the following means:

- referral to appropriate community resources and health care professionals e.g. lactation consultants, breastfeeding drop in centres, community health centres.
- appointment with physician/midwife.
- liaison between the hospital and post discharge visiting nurses.
- phone calls to or visits with family.⁵⁶

POTENTIAL BREASTFEEDING CHALLENGES AND SOLUTIONS UNIQUE TO THE PRETERM INFANT

I. MAINTAINING AN ADEQUATE MILK SUPPLY

Maintaining a sufficient milk supply is frequently a challenge. Stress, separation of mother and infant, late initiation of pumping, fatigue and long term pumping may adversely affect milk volume.

A. Clinical Management / Interventions

- Facilitate skin to skin cuddling.
- Review mother's pumping schedule, pattern and type of pump used. Ensure mother is pumping every 3 hours. Do not omit night pumping as this is when prolactin levels are highest.
- Discuss the need for adequate fluid intake, rest, relaxation techniques.
- Use warm compresses and hand massage breasts prior to pumping.
- Provide counselling and emotional support.

B. Pharmacological Management: domperidone (Motilium™)^{4,57-62}

Motilium has not been approved by the Therapeutic Products Programme (TPP) for use as a galactagogue. The BCRCP therefore, cannot recommend the use of domperidone to stimulate or augment lactation in nursing mothers. Furthermore, there are few data available on the safety and efficacy of domperidone use by nursing mothers to stimulate lactation.

The current (January, 2001) Product Monograph for Motilium states, “Domperidone is excreted in breast milk in very low concentrations. Therefore, nursing is not recommended for mothers taking MOTILIUM Tablets unless the expected benefits outweigh any potential risk.”

However, there are instances when Motilium may be used in clinical practice in the following regime. If milk volume is very low, start with a dosage of 20 mg QID.^{57,60,62} If milk volume is moderate use 10 mg QID. Once full lactation is achieved, Motilium can be weaned gradually by decreasing 10 mg q 3-4 days. If milk volume decreases again, maintain dosage to obtain adequate supply. In some cases the mother may need to continue to take the medication throughout lactation.

C. Herbal Management

Some women report success using herbs to increase their milk supply. However, there is no scientific research on herbs and breastfeeding. Some herbal preparations may contain ingredients not listed on the label as these products are not subject to standard quality control regulations. Some herbs are dangerous to nursing infants and should not be taken while breastfeeding.⁶²

II. SUPPLEMENTATION WHEN ADEQUATE MILK SUPPLY IS NOT POSSIBLE

A. Donor Milk

If additional milk is required beyond what a mother is able to produce, information should be provided on pasteurized donor milk. Fortification of pasteurized donor milk may be needed as more rapid weight gain is seen with mother’s own milk than with pasteurized donor human milk.^{17,63,64} Although further research would be advantageous, current evidence indicates donor milk benefits premature infants.^{12,64-67}

Of concern is the informal “sharing” of human milk among mothers. Information about the risk of this practice and a safe alternative should be offered. Donor milk provided by milk banks is screened and pasteurized. Milk banks in North America are required to follow the Human Milk Banking Association of North America mandatory guidelines (www.hmbana.org). These outline the multi step process for screening of donors and milk. There is only one milk bank in Canada:

Children's and Women's Health Center of British Columbia
Milk Bank
1U30- 4480 Oak Street,
Vancouver BC V6H 3N1
Phone: 604-875-2871
Email: fjones@cw.bc.ca

B. Formula

Preterm infants require special preterm formula. In Canada at the present time, there are two formula manufacturers that provide preterm infant formula: Mead Johnson and Ross Products. Both provide preterm formulas that are 20 kcal/oz. and 24 kcal/oz., as well as iron fortified preterm formulas and non-iron fortified preterm formulas. Contact a formula representative for product information. Most preterm infants will start on 20 calorie formula and move to 24 calorie formula if not gaining weight well.

III. NUTRITIONAL NEEDS UNIQUE TO THE PRETERM INFANT

A. Human Milk Fortifiers

While breastmilk is the perfect food for healthy term infants, smaller preterm infants usually require some additional nutrients.¹⁶ Nutrients of particular concern include protein, calcium and phosphorus.⁶⁴ Fortification with protein, calcium, phosphorus, zinc, copper, vitamins and iron is required by preterm infants:

- whose birth weight is <1800 – 2000 gms and not fully breastfed.⁶⁸

Human milk fortifiers (HMFs) have been clearly demonstrated to improve weight gain and bone mineralization. Commercial HMFs are available as powders or liquids which are then mixed in human milk. The latter results in dilution of the human milk and therefore the powders are generally preferred.

Products available include:

Mead Johnson – Enfamil HMF (powder)

Ross Products – Similac HMF (powder), Similac Natural Care HMF (liquid)

(Contact Children's and Women's Health Centre of BC for the most current protocol on the use of Human Milk Fortifier)

B. Hindmilk

Hindmilk can be used for infants who are growing slowly and whose mothers have an adequate milk supply.⁶⁴

C. Sources of Nutritional Loss for the Preterm Infant

The following table outlines other sources of nutritional loss and recommendations for prevention of these.

Source of Nutritional Loss	Recommendations
1. Collection, storage, and feeding procedures. (Fat absorption is affected by heating human milk)	<ul style="list-style-type: none">• Thaw frozen milk in the fridge.• Use warm water, not hot, when warming milk.
2. Fat is lost by adhering to collection containers, feeding tubes and syringes.	<ul style="list-style-type: none">• Use as short a length of tubing as possible• Keep the syringe upright when on a pump.

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APPENDIX A

BRITISH COLUMBIA'S CHILDREN'S & WOMENS HEALTH CENTRE OF BC SPECIAL CARE NURSERY

Skin-to-skin Cuddling Protocol For Incubator Care Preterm Infants

PURPOSE:

To set guidelines for the infant to be held outside the incubator for skin-to-skin cuddling.

LEVEL: Interdependent.

SUPPORTIVE DATA:

Skin-to-skin cuddling is supported as a safe and effective method of caring for selected parents and their preterm infants. During this care, the infant is held, diapered-only, skin touching skin, upright on the parent's chest.

Research studies have shown that during skin-to-skin cuddling, the infant remains warm, has more deep sleep and quiet alertness, less crying, no increase in infections, fewer episodes of periodic breathing, apnea and bradycardia and greater weight gain. Painful procedures during cuddling produce fewer pain responses.

Lactation is more productive and of greater duration. Skin-to-skin cuddling allows earlier, more frequent opportunities for progression from non-nutritive sucking at the breast to breastfeeding. Participating parents developed confidence in recognizing and responding to their infant's behavioral cues during holding, handling, feeding and general care. Maternal stress levels have been shown to decrease.

STANDARD:

CONTENT:

1. In partnership, an infant will be assessed by parents and the nurse to be suitable for introduction to skin-to-skin cuddling when the following selection criteria are satisfied:
 - 28 weeks post-conceptual age or greater.
 - Stable respiratory support not requiring arterial lines or CT's.
 - Infant has shown **ability to organize physiologic responses**, i.e.:
 - rapid recovery of baseline vital signs after procedures.
 - temperature stability.
 - minimal bradycardia and/or desaturations with handling.
 - Securely taped ETT.
2. When readiness for skin-to-skin cuddling is established:
 - Review with parent(s) the parent handout "Skin-to-skin cuddling: The Magic Touch for Mums and Dads."
 - Provide privacy: mother will remove or open her bra, dad will open his shirt. A front opening cover gown is helpful.

- The infant wearing a diaper and hat (IV allowing) is placed through the parent's front opened clothing, upright and vertically prone, on the chest.
 - Cover the infant's trunk and extremities with a warm blanket and the parent's clothing.
 - Provide infant containment, encouraging the flexion of the arms and legs with the knees tucked; and effectively reducing random motor activity.
 - Support infant's buttocks to prevent sliding using pillow or rolled blankets on parent's lap.
3. To ensure infant tolerates the movement into and out from the incubator, use of the standing transfer by the parent is recommended:
- Have parent place infant supine on open blanket. Swaddle loosely but contain posture. Allow recovery time.
 - Have parent stand in front of open incubator and place hands, with palms up, under the blanket. The bed tray can be pulled out.
 - The nurse supports infant head, IV's etc. while parent lifts infant to their chest. Individualize need for increasing FiO₂ maintain the connection of the ETT to the ventilator.
 - Guide the parent back into a nearby chair to sit while the cables and tubings are supported. Pull out blanket corners around baby for skin-to-skin contact.
 - A footstool, reclining chair and pillow or blanket support will be provided.
 - Ventilator tubings are taped to the parent's clothing for security.
 - The parent will return the infant to the incubator once assisted to standing. The infant will initially be supine. During this time the parent can contain the infant's extremities until the infant is ready to be repositioned.
4. Infants will not be awakened from a deep sleep state to be cuddled by parents. Gentle arousing of the infant can occur from a drowsy state.
5. Infant cuddling will be assessed by the parents and RN to verify the infant's ability to maintain normal body temperature outside the incubator and to provide for airway protection.

Provision for warmth:

- Take infant's baseline axillary temperature prior to cuddling, 10 minutes after transfer to parent and follow up as required.
- Skin temperature monitoring from the incubator can be used. Most infants accept the probe on lateral sites, rather than lying against it.
- Some infants will warm up to a threshold at which they begin to squirm. Take the temperature when this happens and if >37.5, have the parent lighten the infant's coverings. Reassess the temperature after 10 minutes and prn.

Provision for airway protection:

- Maintain cardiorespiratory and/or oximetry monitoring.
- Monitor the infant for neck flexion that may contribute to airway obstruction.
- For the ventilated infant, avoid neck hyper-extension, a position that often contributes to accidental extubation.

6. Parents and the nurse will determine the length of cuddling, allowing a minimum of 30 minutes to let the infant benefit. Many infants fall into a deep sleep during cuddling and parents should be encouraged to let their infant sleep.
7. To optimize the benefits of Kangaroo care for the infant, it is necessary for the nurse to teach and facilitate the parent to recognize and respond to the behavioral cues of their infant while holding.
 - (i) The display of signs of unrest during cuddling, not attributable to hunger, being too warm, etc. and persisting for more than 5 minutes or causing physiologic compromise, in spite of consoling interventions, would indicate the need for the infant to be returned to bed.
 - (ii) Discuss observations with parents and provide reassurance to support the parent's confidence.
 - (iii) Plan the next cuddling occasion with parents to provide follow up for infant's tolerance and management.
8. If a non-ventilated infant shows hunger cues while cuddling, mother can be encouraged to slide her infant into a football hold and allow any attempts to lick or latch at mother's nipple. Initially sucking will be non-nutritive and may require mother to pre-pump her breasts to avoid stressful feeding. An infant's readiness for nutritive sucking at the breast is generally evident at 32 weeks gestation.
9. Visitors and health team members are discouraged from disturbing the parent and infant during cuddling, other than for the purpose of assessing the infant's tolerance.
10. Documentation:

Each cuddling session will be documented until the infant's stability during cuddling is consistently confirmed. Document heart rate, respiratory rate, axilla temperature, oximetry and oxygen management, and predominant behavioral responses.

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Breastfeeding the Preterm Infant

* BCRCP *

Ludington-Hoe, S., Thompson, C., Swinth, J., Hadeed, A.J., and Anderson, G.C. (1994): Kangaroo care: Research results, practice implications and guidelines. Neonatal Network. 13(1): 19-27.

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**APPENDIX B
CHILDREN'S AND WOMEN'S HEALTH CENTRE OF B.C.
NEWBORN CARE PROGRAM**

CUP FEEDING PROTOCOL

PURPOSE:

Cup feeding can be used as an alternative method in healthy preterm infants, ≥ 32 weeks gestational or corrected age, while breastfeeding is being established, and the mother is unavailable to breastfeed.

LEVEL:

Interdependent: in collaboration with the family, and following discussion with the health care team.

SUPPORTIVE DATA:

Cup feeding provides a positive oral experience for the infant. An infant is able to pace his or her own intake during cup-feeding. Cup-feeding strengthens the oral musculature, encourages the coordination of the tongue and muscles of the mouth, and it stimulates lingual lipases aiding in digestion (Lang 1997). Preterm infants demonstrate the greatest physiological stability during breastfeeding compared to both cup feeding (Freer, 1999) and bottle feeding (Meier et al., 1985 & 1987). However, the same literature suggests that cup feeding may require less energy expenditure than bottle feeding. Lang et al. (1994) and Gupta et al. (1999) reported that infants can be safely cup fed from 30 weeks gestational age and older.

CONTENT:

1. Criteria

Cup feedings can be given to an infant starting at 32 weeks gestation who:

- i) is establishing breastfeeding,
- ii) has only enough energy to satisfy part of his nutritional needs at the breast
- iii) has oral aversion, and is unable to bottle feed (ie., chronic lung disease)
- iv) is unable to breast or bottle feed due to neurological problems, but is able to lap or sip.

2. Infant Readiness Cues

The infant should be wide awake and alert at feeding time, demonstrating that he wants to suck: readiness behaviours include hand to mouth activity, sucking on fist or pacifier, rooting, or making smacking noises.

3. Equipment and supplies

- Medicine cup
- Expressed breastmilk
- Bib (or face cloth): weigh cloth pre and post feeding to determine amount of spillage and actual intake.

4. Infant positioning

- Swaddle the infant to provide flexion, containment, and hands to midline.
- Support the infant in an upright sitting position on the lap.
- Place a bib under the chin to collect and measure spillage.

5. Procedure

- Fill medicine cup ½ full.
- Tip the cup so that the milk is just touching the infant's lips. The milk should **NEVER** be poured into the infant's mouth; this is critical to prevent choking, apnea, and bradycardia.
- Direct the rim of the cup towards the corners of the infant's upper lip and gums, with it gently touching/resting on the infant's lower lip. **Avoid applying pressure** to the lower lip.
- Leave the cup in the correct position during feeding. Do not keep removing it when the infant stops drinking (unless he has been gulping and requires a burp).

6. Infant behaviour and cues.

Preterm infants will lap by protruding their tongue and taking an amount of milk onto their tongue. As they mature a sipping action develops. A regular sip-pause-sip (or lap-pause-lap) pattern occurs during cup feeding. Expect some spillage or dribble.

If the infant demonstrates any stress signs such as sneezing, hiccoughing, yawning or head aversion either:

- i) give the infant a rest,
- ii) sit the infant more upright,
- iii) reposition the cup if it is too far forward on the infant's upper lip,
- iv) avoid pressing on the infant's lower lip or gums, or
- v) avoid tipping milk into the infant's mouth causing him to panic.

If stress cues persist, or if there is physiologic instability, ie., color changes and/or oxygen desaturations, discontinue cup feeding and gavage the remaining feed. Try cup feeding again at another feeding or a later date.

Initially a preterm infant may only take a small amount ie., 5-10 mls from the cup. An infant at any GA may want very little milk at one feeding and more at the next. Unless the infant is on fluid restrictions, let him regulate how much milk he takes.

The time required for cup feeding can vary as widely as the time taken for breast, bottle or gavage feeding, but it usually does not take any longer. Although infants usually learn to cup feed successfully in a short time, it may be that cup feeding is not right for every infant; this eventually should always be considered and assessed.

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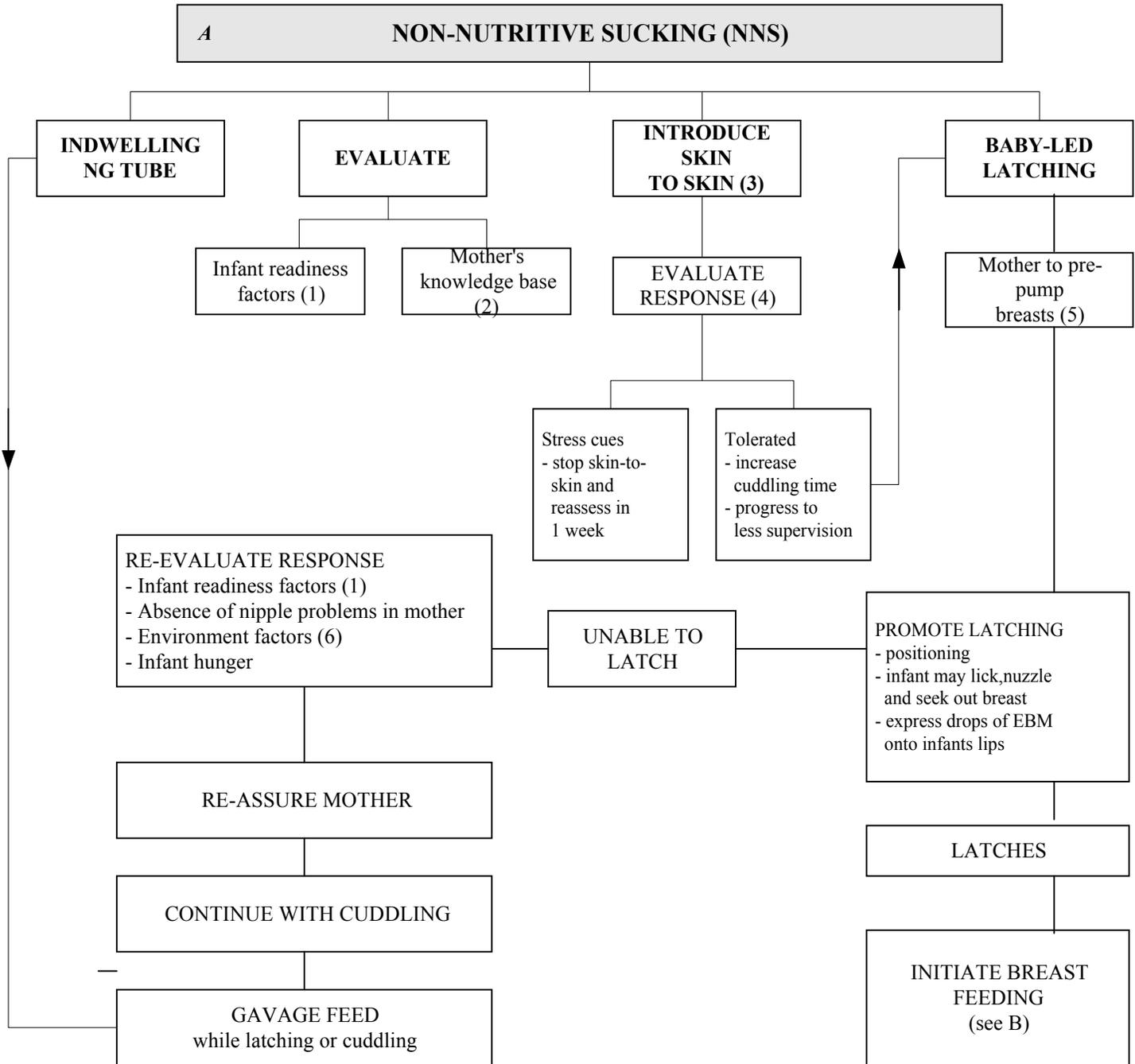
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WRITTEN BY: Newborn Care Program Feeding Practices Committee

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PREPARING TO BREASTFEED PREMATURE INFANTS: 32-35 WEEKS

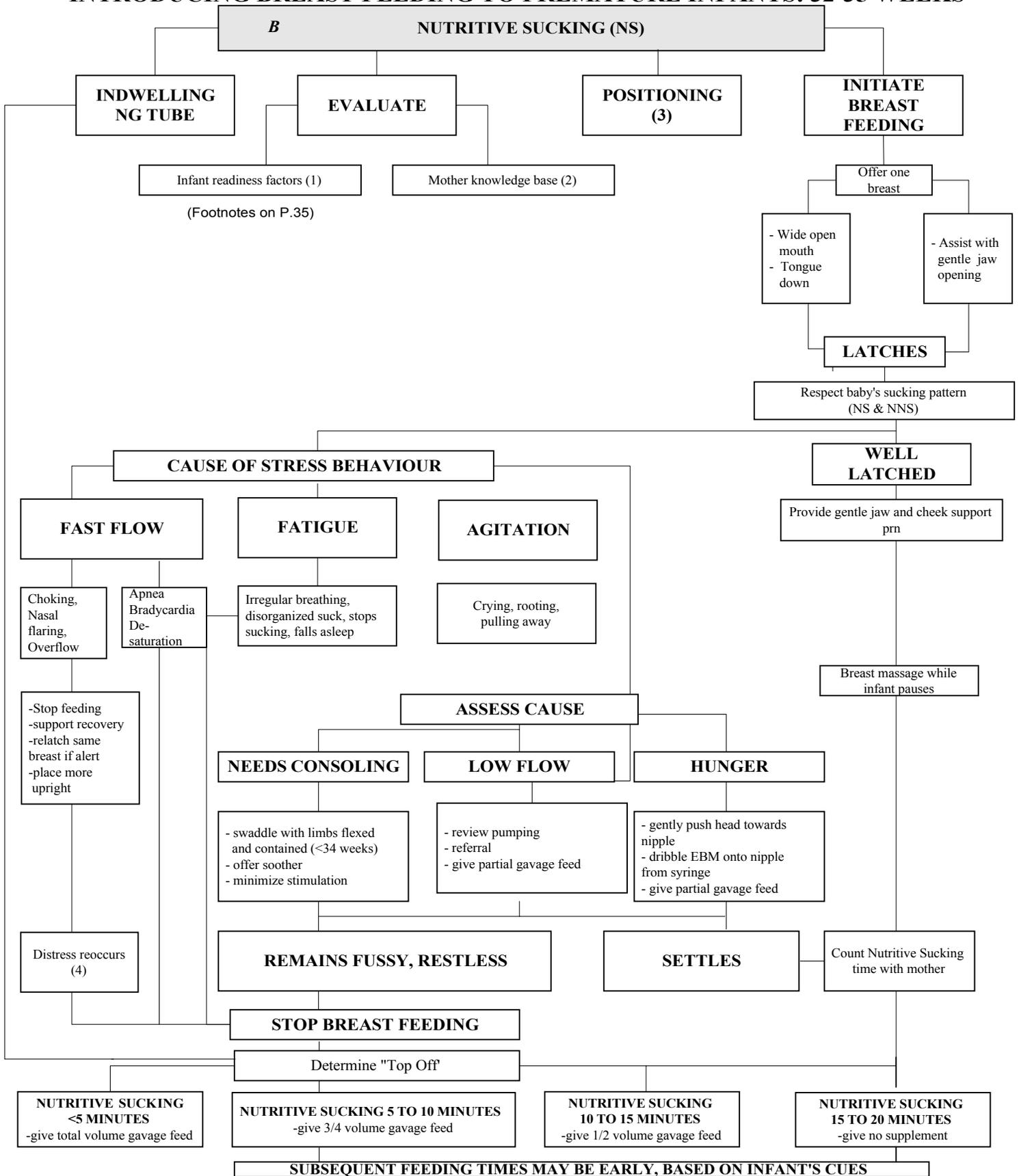


FOOTNOTES: Revised January 2001

1. **Includes:** tolerates increasing gavage feeds, respiratory rate <75/minute and non-laboured, maintains brief wakeful periods, bursts of sucking, reflexes (routine mouthing)
2. **Includes:** expectations, previous experience, pumping and EBM storage, infant behavioral cues and states.
3. Document plan for cuddling visits with mother.
4. May take days for mother and baby to feel comfortable with cuddling.
5. To decrease chance of fast flow and to soften nipples for latching.
6. Provide measures to achieve quiet alert state by reducing stimuli.

APPENDIX D

Children's and Women's Hospital of British Columbia - Special Care Nursery
British Columbia Reproductive Care Program
INTRODUCING BREAST FEEDING TO PREMATURE INFANTS: 32-35 WEEKS



British Columbia Reproductive Care Program

Footnotes to Appendix D

1. Includes: tolerates increasing gavage feeds, respiratory rate < 75 / min. and non-labored, maintains brief wakeful periods.
2. Includes: expectations, previous experience, pumping and EBM storage, infant behavioral cues and states.
3. Position: tummy to tummy, neck in midline, semi-upright, arms either side of breast (not tucked down in front). Try both modified cradle hold and football hold. Football hold may be the optimal position for small babies.
4. Reassess need to partially empty breasts prior to next breast feed.

Revised January 2001

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WORKING COMMITTEE**
January 2000 to August 2001

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