



Published in final edited form as:

Clin Perinatol. 2013 December ; 40(4): 689–705. doi:10.1016/j.clp.2013.07.014.

Management of Breastfeeding During and After the Maternity Hospitalization for Late Preterm Infants

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Keywords

late preterm infant; moderately preterm infant; early term infant; lactation; breastfeeding; lactation technologies

Human milk reduces the risk of short- and long- term morbidities in recipient infants through a combination of nutritional, anti-infective, anti-inflammatory, anti-oxidative, epigenetic and gut colonizing substances. [1–6] These substances function synergistically to downregulate inflammatory and oxidative stress processes that manifest in lifelong health problems, including infections, atopic disease, neurocognitive and neurodevelopmental delay, and many chronic diseases. [1, 7–9] Late and moderately preterm infants, and even those infants delivered early term, are born prior to the maturation of many body organs and systems, [10–16] and are especially protected by the bioactive components in human milk. In contrast, several lines of inquiry indicate that the components in commercial formulas may be separately detrimental in that they upregulate inflammatory and oxidative stress processes by a variety of mechanisms, including increased intestinal permeability and toxicity to immature gut epithelial cells. [17–26] Thus, while human milk is important for all infants, it is especially important for infants who are born early and have a compromised immunomodulatory response, and with immature organs, including the brain, that are susceptible to inflammatory injury and oxidative stress.

Among the infants born moderately and late preterm or early term, the greatest challenge for breastfeeding management is the late preterm infant (LPI) who is cared for with the mother in the maternity setting. [27] The lack of management strategies is underscored by the fact

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that exclusive breastfeeding at the time of hospital discharge is a major risk factor for rehospitalization in LPIs due to dehydration, hyperbilirubinemia, and suspected sepsis. [27–31] In less severe situations, LPIs who are exclusively breastfed tend to gain weight slowly and have protracted jaundice. These and other complications can be termed “lactation-associated morbidities”, in that human milk does not cause the morbidity, but inadequate milk intake during breastfeeding contributes to its severity. [27] It is well documented that LPIs demonstrate ineffective breastfeeding behaviors such as sleepiness and slipping off the mother's nipple during feeding that translate into compromised milk transfer during breastfeeding. [27, 32] Whether or not rehospitalization is required, common outcomes in this population include routine formula supplementation and early cessation of breastfeeding. [27, 32]

Although breastfeeding for LPIs and their mothers is commonly managed according to practices designed for healthy term infants, LPIs are much more like premature infants being discharged from the NICU with respect to consuming an adequate volume of milk during feedings at the breast. [27] However, unlike mothers of NICU infants who have used a breast pump to establish their milk supply by the time of NICU discharge, mothers of LPIs must rely on the sucking stimulation of the infant to establish the milk supply. Furthermore, delayed onset of lactation is especially common among mothers of LPIs, meaning that despite an effective sucking stimulus from the breast pump or the infant, little milk is available for several days post-birth. [27, 33–37] As a consequence, breastfeeding failure among LPIs and their mothers is high and clinicians need evidence-based strategies to protect infant hydration and growth and maternal milk supply until complete feeding at breast can be established. This article will review the evidence for lactation and breastfeeding risk in LPIs and their mothers, and describe strategies for managing these immaturity-related feeding problems. Application to moderate preterm infants (MPIs) and early term infants (ETIs) will be made throughout.

Late Preterm Infants and Mothers: A Population at Risk for Poor Lactation Outcomes

LPIs and their mothers each bring risk factors to effective breastfeeding that contribute to the high rates of lactation-associated morbidities and shortened duration of breastfeeding in this population. [27] In combination these risk factors predispose infants to inadequate intake during feedings at the breast and predispose mothers to an inadequate milk supply. LPIs have weak suction pressures and immature sleep-wake regulation that place them at risk for underconsumption of milk during breastfeeding. Mothers of LPIs are at risk for delayed onset of lactation, such that the availability of adequate milk occurs later and less predictably than for healthy term births. These maternal and infant risk factors compromise the intricate interplay in lactation hormones and changes in mammary epithelial cells during the transition to lactogenesis II and the establishment of a full milk supply. [38–40] (See figure 1). An understanding of these LPI-mother lactation dynamics is essential for establishing evidence-based practices to prevent, identify and manage these problems.

Suction Pressures and Milk Removal During Breastfeeding in Late Preterm Infants

Suction (e.g., vacuum) occurs during feeding when the infant lowers the mandible, creating negative pressure in the oral cavity. [41–43] In contrast to bottle feedings, strong baseline suction pressures (mean = –64 mm Hg) are essential for breastfeeding because the infant must create the nipple shape by elongating the maternal nipple approximately three times its resting length so that the tip is almost at the juncture of the hard and soft palate. [42, 44, 45] The infant maintains this baseline suction pressure throughout the feeding, even while not actively sucking. [42, 44] Furthermore, even stronger suction pressures are used to transfer the bolus of milk from the maternal breast to the infant during the suction phase. [42, 44–46] In contrast, suction pressures are not really essential to the removal of milk from a standard bottle and nipple unit. [41–43, 47] The bottle nipple shape is already “created” so baseline suction pressures are not required for the infant to maintain a “latch” on the nipple, and the hydrostatic pressure associated with bottle feeding allows milk transfer with minimal or no suction on the part of the infant. [41, 44, 48, 49] Thus, suction pressures are critical to the creating the nipple shape and removing milk from the breast, but not for removing milk from a typical bottle unit.

Suction pressures mature more slowly than expression pressures in premature infants [43, 50] and explain many of the common behaviors associated with breastfeeding problems for MPIs, LPIs and ETIs: inability to latch onto the breast, slipping off of the breast repeatedly during a feeding, and the ability to consume milk more efficiently from a bottle than from the breast. [27] In combination with immature sleep-wake regulation, [11] these weak suction pressures predispose infants to underconsumption of milk directly from the breast until approximately term corrected age. [27] Several studies of test-weighing, in which milk intake during breastfeeding can be accurately and precisely measured, [51–55] are consistent with the fact that MPIs, LPIs and ETIs do not consume adequate amounts of milk directly from the breast, even when the milk is available and can be removed with a breast pump. [27, 56]

Lactation Risk for Mothers of Late Preterm Infants

Delayed onset of lactation (e.g., delayed lactogenesis II), is a temporary problem in which the availability of milk during the early days after birth is extremely limited. [57] During uncomplicated lactogenesis, milk synthesis is triggered by the withdrawal of progesterone with the birth of the placenta. [39] The dramatic decline in serum progesterone removes its inhibiting effect on prolactin, so that milk synthesis can begin. [39, 40, 58] These abrupt hormonal changes are catalyzed by a uniquely human infant sucking rate and rhythm that is applied to the breast when milk flow is limited. [46, 59–65] The combination of hormonal changes and breast stimulation rapidly transition the breast from producing approximately 15 mLs of colostrum during the entire first 24 hours post-birth to 500–600 mLs of milk by days 4–7 post-birth. [59, 66–68]

These early days are conceptualized as a critical period for the mammary gland, which must receive timely and appropriate stimulation from the infant, and during which time the number of secretory cells and the density of prolactin receptors in the mammary epithelial cells increase. [39, 40, 59, 69, 70] Central to this transition is the closure of tight junctions in

the mammary epithelium, an anatomical change that keeps lactose within the mammary gland rather than allowing it to pass into the maternal serum via open paracellular pathways. [39, 40] The osmotic properties of lactose's remaining in the mammary gland result in copious milk output. [69, 70] The transition from lactogenesis I to lactogenesis II normally occurs between 40–72 hours post-birth, but in delayed onset of lactation, a longer duration of very little available milk is typical. [34, 37, 39, 40, 71–73] Risk factors for delayed onset of lactogenesis II are listed in Box 1.

Delayed onset of lactation is prevalent world-wide, and mothers who deliver LPIs often have one or more of the risk factors for delayed onset of lactation. [34, 37, 39, 40, 71–73] These risk factors frequently go unnoticed, especially when infants are considered “healthy” and cared for in the maternity area with their mothers. However, despite the fact that little milk is available, the effective sucking stimulus of the infant (or a breast pump substitute) is necessary to catalyze the hormonal, structural and biochemical processes in the breast. [74] Many LPIs and some ETIs are incapable of providing the stimulation and milk removal necessary to correct delayed onset of lactation, and what should be a temporary problem, segues into a permanent low milk volume that is difficult to correct once the early critical period for mammary stimulation has passed. [27]

Late Preterm Infants Cared for in the Maternity Setting Should Not Be Considered Healthy Term Infants

Most LPIs are cared for in the maternity area with their mothers, where lactation care is guided by policies consistent with the Joint Commission Core Perinatal Measure on exclusive breastfeeding and/or the Baby Friendly Hospital Initiative (BFHI). [75–77] Both of these sets of guidelines are intended to establish effective breastfeeding practices in the hospital setting for healthy term infants and mothers. [78, 79] However, it is often assumed that these guidelines should be generalized to include LPIs as well, especially with respect to the avoidance of formula or donor milk supplements. Whereas routine supplementation of breastfeeding is inappropriate for LPIs, the clinician must be alert to the possibility that supplements may be medically necessary to prevent or treat hypoglycemia, hypothermia, hyperbilirubinemia or other morbidities. Similarly, LPIs and mothers often need to use temporary lactation aids such as breast pumps, nipple shields and bottle units, which are unnecessary for healthy term infants and mothers, and are inconsistent with select steps in the BFHI. [27]

Initiatives that focus on exclusive breastfeeding in the immediate post-birth period have been crafted from a substantial body of evidence about the interplay between infant intake and mammary physiology during this critical period. An understanding of this mother-infant synchrony is necessary to understand the inappropriateness of these guidelines for LPIs. Healthy term infants are born with adequate fat and glycogen stores so that they do not need more milk than the approximately 15mLs they consume during the entire first 24 hours of life. [66, 80] Furthermore, during this time, they breastfeed 10–11 times on average, transferring only about 1.5 mLs of milk each feeding. [66] This frequent, unrestricted feeding in the first 24 hours means the breast is stimulated by the infant so that additional milk is available in the next 24 hours as the infants need additional fluid and calories. [81]

This mother-infant synchrony is imbalanced following LPI birth, in that fat and glycogen stores are added exponentially between 34 weeks and term gestation. [12] This immaturity means that the LPI is at risk not only for metabolic complications as a function of preterm birth, but also because of minimal milk availability in the first 24–48 hours of breastfeeding. [27] Thus, the “supply and demand” explanation that underpins these BFHI and Joint Commission breastfeeding initiatives is inconsistent with the evidence about LPIs and their mothers.

Similarly, strategies used by clinicians to encourage frequent breastfeeding in healthy term infants are often ineffective and can exacerbate morbidities in LPIs. For example, the most consistently reported characteristic of LPIs is sleepy behavior that compromises the frequency and duration of breastfeedings. [27, 32] In healthy term infants who demonstrate sleepy behavior, mothers are encouraged to wake infants frequently and to remove the infant's clothing and blankets because the infant has gotten “too comfortable”. While skin-to-skin care, wherein the unclothed infant is held in immediate contact with the mother's breasts is appropriate for LPIs, removing clothing to stimulate wakefulness exacerbates the risk of metabolic morbidities. Similarly, frequent waking is not only ineffective, it can compromise the infant's energy stores and growth.

New parents frequently have unrealistic expectations for their LPIs, too. There are few resources specifically about breastfeeding LPIs for parents, so they rely upon written materials for uncomplicated breastfeeding situations and the advice of friends and family members that is not specific to LPIs. They fail to recognize excessive sleepiness and short, ineffective breastfeeds in their infants as a sign of immaturity and inadequate intake, and interpret these behaviors to mean that the infants are satiated and sleep well. These parents need information about breastfeeding that is specific to LPIs and includes clear guidelines about adapting basic lactation principles to the needs of their immature infants. One evidence-based booklet, “Breastfeeding Your Late Preterm Infant” is available for new parents, and details reasons why their LPIs do not breastfeed like healthy term infants, as well as specific plans to protect the maternal milk supply and ensure adequate intake for infants. [82] This booklet also includes three real-life case studies of LPIs, so that parents understand that the immaturity-related feeding issues they observe in their own LPIs are common in this population.

Management of Breastfeeding for Late Preterm Infants and Mothers

There are two key objectives in managing breastfeeding for this population: protecting the maternal milk supply and ensuring that the infant is adequately nourished. In healthy term populations, unrestricted and effective feedings at the breast accomplish both objectives. For LPIs, separate strategies for each objective are needed until the infant is able to consume all feedings directly from the breast without the additional stimulation provided by the breast pump. [27] Although there is considerable variability as to when LPIs actually accomplish this outcome, parents can be told that it occurs at approximately the infant's expected birth date. Until this time, the use of evidence-based lactation technologies, such as breast pumps, specialized breast pump suction patterns, nipple shields, in-home test-weights and bottle

units, help the clinician individualize a safe and effective breastfeeding plan with families of LPIs. [27]

The Maternity Hospital Stay

In general, the infant should be able to feed effectively (e.g., awake and feeding eagerly) for at least 15 minutes each of 8 times daily during the maternity stay. Most LPIs, and many ETIs are unable to maintain this regimen consistently. If the LPI cannot provide this stimulation to the mammary gland, then the mother should use a hospital grade electric breast pump. The pump will provide necessary breast stimulation during this critical period for lactogenesis II, and remove available milk that can be fed to the infant. One randomized clinical trial found that the use of a breast pump suction pattern that mimics the uniquely human infant suck during this critical period resulted in mothers' producing significantly more milk in less time spent pumping by day 14 post-birth in breast pump dependent mothers with premature (< 34 weeks of gestation) infants. [59] Thus, when possible, mothers should be encouraged to use this suction pattern in the breast pump until the onset of lactogenesis II, changing to a maintenance suction pattern in the pump thereafter.

Oftentimes mothers are instructed to try to breastfeed their infants prior to each pumping, and become exhausted and discouraged with the extra effort involved. A more effective approach helps the mother understand her LPI's sleepy behavior is normal, and encourages her to breastfeed when the infant is awake, and pump when the infant is unable to awaken and feed eagerly. She can substitute the breastfeeding for skin-to-skin care with her infant prior to or after the pumping session. [32] Many LPIs will require additional milk during the maternity hospitalization due to concerns about hypoglycemia, hypothermia, and hyperbilirubinemia. [12] If the mother is able to remove milk with the breast pump, it can be fed to the infant. If no mother's milk is available, donor milk or formula must be supplemented. In general, the smallest volume of supplement that will prevent or treat morbidity in the LPI is indicated. In animal and human studies, large amounts of milk administered rapidly in the early days post-birth results in a different pattern of feeding-induced hormone release, which may have longer-term implications, and should be avoided if possible. [83]

Preparing for Hospital Discharge

The clinician should work with the family to develop a strategy that permits as much direct feeding at breast as possible, while still ensuring that the maternal milk supply is protected and that the infant receives sufficient hydration and nutrition. Oftentimes, a strategy called "triple feeding" is recommended, which involves attempting to feed the infant at breast followed by use of a breast pump and feeding any expressed milk (or formula supplement) to the infant by bottle. [32] New families are often sent home with these generic instructions, and the resulting fatigue contributes to the high rates of breastfeeding failure for this population. Box 2 summarizes an alternative plan that protects the maternal milk supply with routine breast pump use and ensures the infant receives sufficient milk by substituting some breastfeedings with bottle feedings of the freshly pumped milk. The use of select lactation technologies can help make this plan even more individualized for the family of the

LPI. These interventions are also suitable for MPIs and ETIs as hospital discharge approaches.

Lactation Technologies Suitable for Mothers and LPIs

A number of evidence-based lactation technologies can help mothers transition from a mixture of bottle and breastfeedings to exclusive breastfeeding during the first weeks after hospital discharge. A brief review of each device and a description of the ways in which it protects maternal milk volume or ensures adequate infant intake are summarized here.

Protecting Milk Volume—Without an adequate milk supply, the mother cannot breastfeed exclusively. This fact must guide the clinician's recommendations for securing an effective hospital grade electric breast pump and for using it until the infant is gaining weight consistently on exclusive feedings at the breast without the assistance of a nipple shield or bottle supplements (unless these are a choice of the mother). Although new mothers will want to discontinue routine breast pump use as soon as possible, they must be reminded that the pump is doing the work of maintaining the milk supply because their LPIs are incapable of doing so. Initially, most LPIs will require some bottle supplements of expressed milk in addition to the amount they consume at the breast, because they are unable to remove all of the available milk from the breast. [51, 52] As the infants mature, they progressively consume more milk at the breast and require less supplemented volume. Regular (2–4 times daily) breast pump use is critical to this transition because the pump serves as the entity that “creates and maintains” the extra milk, which flows more readily to the infant despite immature sucking patterns. [51, 52] Thus, the LPI “gets enough” milk partly because the pump is providing extra stimulation to the mother's breasts. Even when the LPI has made the transition to exclusive feedings at the breast and is growing appropriately, the pump must be discontinued slowly, and only after the LPI no longer needs the assistance of the nipple shield to transfer sufficient amounts of milk.

The data in Figure 2 exemplify this progression, and can be used by the clinician to reinforce the importance of continued breast pump use with family members for both LPIs and MPIs. These findings are a secondary analysis of one group of mothers and their premature infants from a randomized clinical trial of in-home measurement of milk intake following NICU discharge. [51, 52] In this study, 24 mothers of premature infants [mean post-conceptual age (PCA) and weight at NICU discharge= 36 ± 2 weeks and 2248 ± 97 grams] measured milk intake during breastfeeding in the home for one month after NICU discharge. [52] All of the mothers had an adequate milk supply and all extra milk consumed by the infants was pumped milk. Although the infants had access to a sufficient amount of milk in the breast, they could not ingest all of the available milk during breastfeedings, and required bottle supplementation of expressed milk until approximately 42 weeks PCA. Breastfeeding progression continued and maternal milk supply was protected because of the mothers' routine breast pump use. Thus, it is critical that the mother not discontinue the extra pumpings too soon.

Facilitating milk intake during breastfeeding—LPIs frequently do not consume an adequate volume of milk during breastfeeding due to weak suction pressures, evidenced by

slipping off of the nipple and falling asleep early in the feeding. Breastfeeding positions that support the head and neck (Figure 3) can be used to facilitate milk intake, but many LPIs will benefit from temporary use of an ultra-thin nipple shield (Figure 4). [84, 85] The nipple shield creates the nipple shape so that suction pressure is not necessary. Similarly once the infant is properly placed on the breast with the shield, strong negative pressure within the tunnel of the shield facilitates milk transfer to the infant, provided that the maternal milk supply is adequate. A study in premature infants of similar post-conceptual ages as LPIs revealed that infants consume significantly more milk with the shield than without it, and that the shield was necessary until approximately the infant's expected birth date. [84]

Ensuring adequate milk intake during breastfeeding—A major safety concern during the early weeks after birth for breastfeeding LPIs is whether they consume an adequate amount of milk at breast to remain hydrated and grow. [28, 30, 31, 86] For this reason, many families are advised to routinely supplement feedings at breast with formula or pumped milk, a practice which is time-consuming and inexact. In contrast, in-home measurement of milk intake is easy, accurate and effective for this population, and helps families achieve their breastfeeding goals with more confidence that their LPIs are consuming an adequate volume of milk. [51, 52] Also referred to as test-weighing, wherein the clothed infant is weighed on an accurate and reliable electronic scale, this technology takes the guess-work out of “getting enough”, providing extra milk only when it is necessary. [53, 55, 87–89] Several studies have shown that commonly used clinical indicators of “breastfeeding effectiveness”, such as audible swallows, visualizing milk in the infant's mouth and post-feed satiety, are not accurate indicators of intake in premature and LPIs. In contrast, the in-home rental scale to measure milk intake during breastfeeding (BabyWeigh, Medela, Inc., McHenry, IL) weighs to the nearest 2 grams, is portable and easy to use, and has been studied extensively. [51–54] Measuring milk intake in the home helps parents learn to recognize a “good” feeding with respect to milk intake, helps them determine when to provide extra milk, and highlights the LPI's progress with consuming more milk at breast each week during the early post-birth period. [51, 52]

Discontinuing Lactation Technologies for Mothers and LPIs

Because there is so little evidence-based information available for parents with respect to breastfeeding their LPIs, they are often told to discontinue all of the technologies and feed their infants as if they were healthy term infants before the LPIs are ready to make this transition. [82] Although the final cessation of lactation technologies will occur between approximately 40–42 weeks post-conceptual age, most LPIs will demonstrate inconsistency in staying awake and feeding eagerly before this time. [51, 52] For example, the LPI may be able to consume some daily feedings without the nipple shield, but require it for others. Other LPIs demonstrate eager feeding and adequate milk transfer for the first 5 minutes of a feeding without the nipple shield, and then fall asleep without completing the feeding. The nipple shield can be introduced midway through the feeding to help the infant take a full feeding.

The pump should be gradually discontinued after the nipple shield is no longer needed and the infant is gaining weight adequately on exclusive feedings at breast. For example, if a

mother is currently pumping 3 times daily at this time, she should decrease the frequency of pumping, with a goal of discontinuing pumping over a 10-day period. This slow cessation of extra pumping is important because the LPI may be consuming sufficient milk during breastfeeding because the pump has created the extra milk volume that flows readily and easily to the infant. [51, 52] In-home measurement of milk intake validates that the infant is transitioning from “milk remover” to “milk maintainer” as pumping is discontinued.

Most families who use lactation technologies to guide the transition to exclusive feedings at breast relinquish the in-home rental scale after breastfeeding is effective and efficient, and the pump is no longer needed to maintain an adequate maternal milk supply. [51, 52] Along this trajectory, the families cease the measurement of milk transfer, and simply measure daily nude weights for a week or two to reassure themselves that milk intake is adequate for infant growth.

Adequacy of Exclusive Human Milk for MPIs, LPIs and ETIs

Although there is some evidence that providing a nutrient-enriched formula supplement of human milk is beneficial for short-term growth in very low birthweight and/or extremely premature infants, there are few data about the safety and efficacy of this practice with more mature preterm infants. [1, 90–92] In the absence of evidencebased guidelines, many clinicians elect to supplement human milk feedings with powdered formulas or to replace some daily breastfeedings with enriched formula “to be on the safe side.” However, there is compelling evidence about the detrimental impact of bovine-based formulas in the early post-birth period with respect to the developing gut microbiota, the upregulation of inflammatory processes and interference with the bioactive components in human milk. [17–26] These practices shorten the lifetime dose of human milk for the recipient infant, increasing the risk of later childhood and adultonset morbidities such as obesity, hypertension, diabetes, inflammatory bowel disease and atopic illness. [7, 8] With this evidence, supplementation of exclusive human milk feedings--whether at the breast or bottle--should not be routine, but based instead on the individual infant's nutritional risk factors and growth rates. [93] All MPIs and LPIs should receive multivitamins with iron. Unless there is a specific indication, ETIs should not be supplemented with iron due to its interference with lactoferrin, which is a potent anti-inflammatory and anti-infective component of human milk. [6, 94–97] All MPIs, LPIs and ETIs who are feeding at the breast should be seen by the pediatrician within two days after hospital discharge, and should be monitored frequently by the primary health care provider until acceptable growth patterns on exclusive breastfeeding are well established. [98]

Key to the decision about replacing or enriching human milk with powdered formulas is knowing the infant's intake of human milk. [93] Only a handful of recent studies about post-discharge nutrition with VLBW infants has actually measured milk intake during breastfeeding using test-weighing techniques. [1, 88, 90–92] Thus, if infants fail to grow properly, it is assumed that the quality rather than the quantity of the milk is inadequate. [53, 54, 88] In-home test-weighing procedures using scales designed for the rental market (BabyWeigh®, Medela, Inc., McHenry, IL) measure milk intake to the nearest 2mLs, are accurate, and are easily performed in the home by caregivers. [53, 55, 87–90]

Summary

Human milk is especially important for infants who are born prior to the final maturation of body organs and systems, including MPIs, LPIs, and ETIs. However, management of lactation and breastfeeding for these populations has not been evidence-based, as reflected in the high rates of breastfeeding failure and lactation-associated morbidities, especially for LPIs who are cared for in the maternity setting with their mothers. LPIs are at risk for underconsumption of milk during feedings at the breast due to immature suction pressures and sleepy behavior, and their mothers are at risk for delayed onset of lactation. In-hospital management strategies should focus on protecting the maternal milk volume and ensuring that the infant is fed appropriately, and may be inconsistent with the BFHI's Ten Steps for Successful Breastfeeding, which were intended for healthy term infants. During and after the maternity hospitalization, breastfeeding management for the LPI and mother should incorporate evidence-based lactation technologies, including the breast pump, in-home test-weighing, and the nipple shield, until the infant approximates term, corrected age, and can remove milk from the breast effectively. Many of the management strategies outlined for the LPI can be adapted to the MPI and ETI.

Acknowledgments

Disclosure: This work was partially supported by a grant from the NIH.

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Box 1: Major Maternal Risk Factors for Delayed Onset of Lactation

- High BMI
- Diabetes
- Pregnancy-Induced Hypertension
- Preterm Labor
- Prolonged Bedrest
- Cesarean Delivery
- Intrapartum Complications, including excessive blood loss
- Medications, including magnesium sulfate and other antepartum/intrapartum medications, SSRIs

Box 2: Alternative to Triple Feeding as Breastfeeding is Advanced

- Separate the day into stretches of time for feedings at the breast and stretches of time for feeding pumped milk by bottle:
 1. Select daytime hours when the mother and infant are rested for breastfeeding and nighttime hours for pumping and feeding milk by bottle
 2. Pump both breasts thoroughly 4–5 times daily during the first week at home
 3. If the infant consumes at least half of the feeding volume at breast, he or she can receive fewer (e.g., 4 or fewer) bottle feedings of pumped milk
 4. If the infant consumes less than one fourth of the feeding volume at breast, as many as 6 bottle feedings of pumped milk may be indicated
- During breastfeeding stretches:
 1. Start the breastfeeding as soon as the infant shows wakeful signs. Do not wait for crying. Do not change clothing or the diaper with the intent of making the baby “more awake”
 2. Use the cross-cradle or football hold to provide head and neck support
 3. Use the nipple shield and test-weights as indicated
 4. If the baby falls asleep early in the feeding, change the diaper and clothing to see if the activity increases wakefulness
 5. Do not routinely offer a bottle after each breastfeeding
 6. Do not routinely pump after each breastfeeding
 7. Feed the baby immediately when he or she awakens again (e.g., “on cue”)
 8. Pump and offer a bottle every 4–6 hours, depending upon infant's intake (e.g., more intake = longer stretch without pumped milk)
- During bottle feeding stretches:
 1. When the infant awakens, the mother can use the breast pump to completely remove available milk while the father or other designated helper changes the infant's clothing (e.g., ensuring breast emptying)
 2. The helper can feed the pumped milk by bottle, allowing the infant to consume as much as he or she is able (e.g., ensuring adequate intake)
 3. Everyone returns to sleep quickly.
 4. Repeat this pattern throughout the nighttime hours, reducing the frequency (and substituting feedings at breast) as the infant matures

Adapted from Meier, P.P. “Breastfeeding Your Late Preterm Infant”. Medela, Inc., McHenry, IL. 2010; with permission.

Key Points

1. Human milk is especially important for infants who are born prior to the final maturation of body organs and systems, including MPIs, LPIs, and ETIs.
2. LPIs are at risk for underconsumption of milk during feedings at the breast due to immature suction pressures and sleepy behavior, and their mothers are at risk for delayed onset of lactation.
3. In-hospital management strategies should focus on protecting the maternal milk volume and ensuring that the infant is fed appropriately, and may be inconsistent with the BFHI's Ten Steps for Successful Breastfeeding, which were intended for healthy term infants.
4. During and after the maternity hospitalization, breastfeeding management for the LPI and mother should incorporate evidence-based lactation technologies, including the breast pump, in-home test-weighing, and the nipple shield, until the infant approximates term, corrected age, and can remove milk from the breast effectively.
5. Many of the management strategies outlined for the LPI can be adapted to the MPI and ETI.

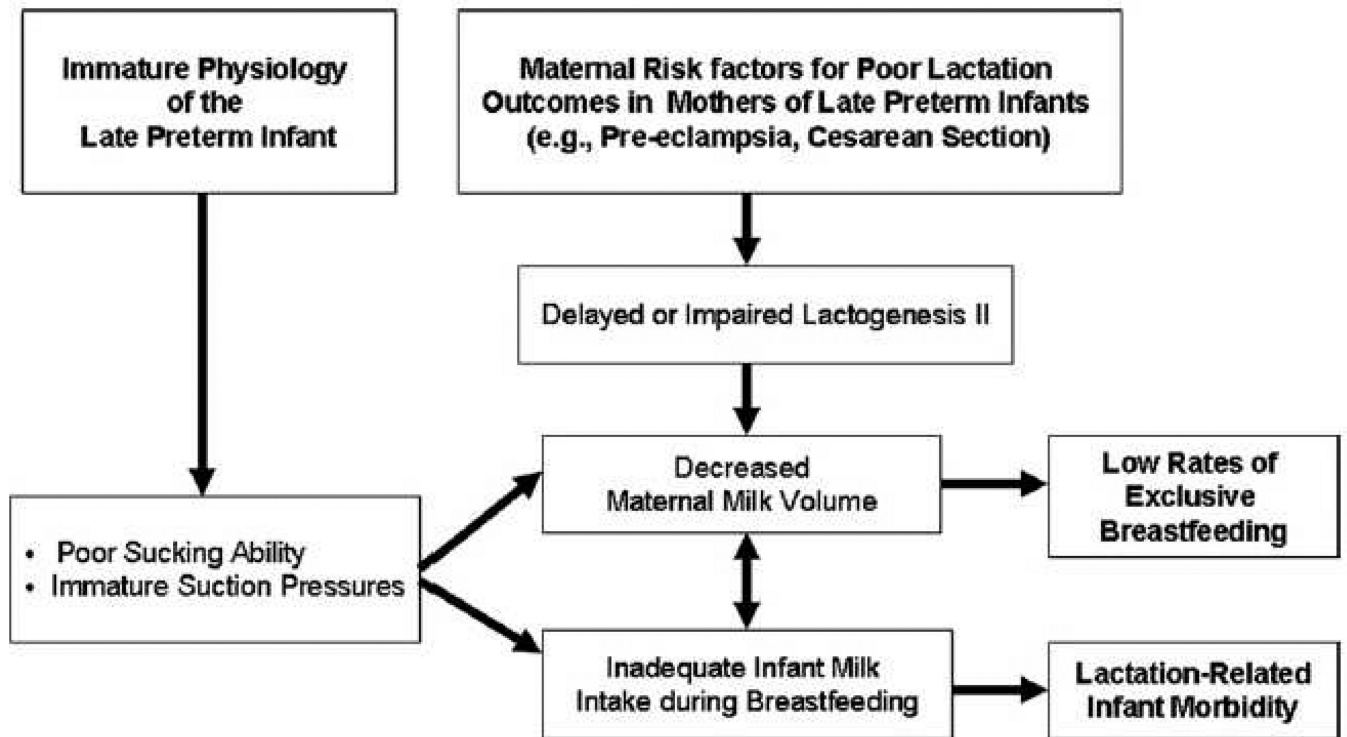


Figure 1. Schematic depicting the interplay of maternal and late preterm infant risk factors for lactation associated morbidities and poor lactation outcomes *Courtesy of* L. Furman, MD, Cleveland, OH and P. Meier, PhD, RN, RAAN, Chicago, III

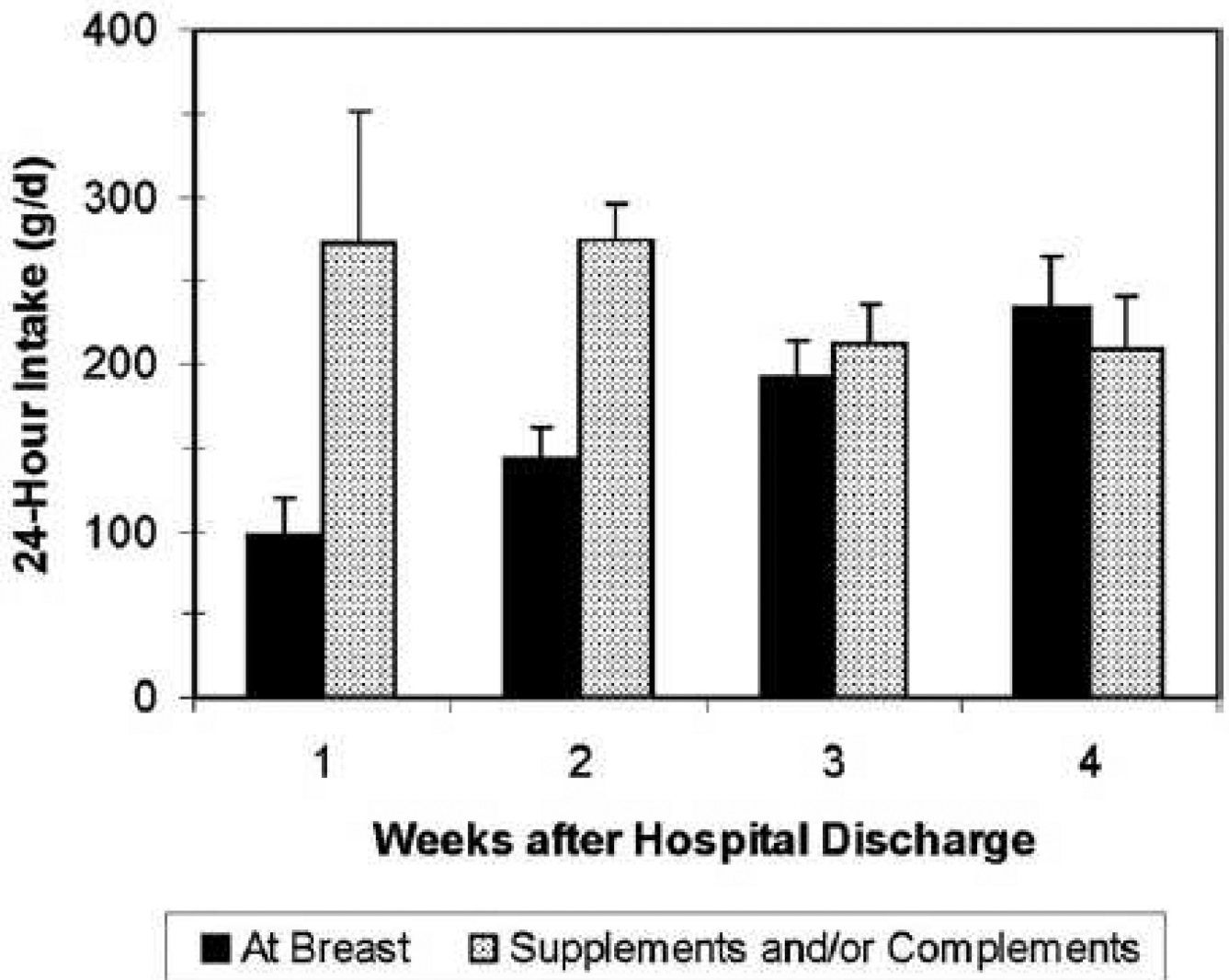


Figure 2. Volume of milk consumed at the breast and as extra milk (supplements and complements of pumped mothers' milk) during the first 4 weeks at home in premature infants discharged from the neonatal intensive care unit. *Courtesy of N.Hurst, PhD, Houston, TX, P.Meier PhD, Chicago, III and J. Engstrom, PhD*



Figure 3. Use of breastfeeding positions that support the head and neck of the LPI (and MPI and ETI) facilitate milk intake during breastfeeding *Courtesy of Medela, Inc., McHenry, III; with permission.*

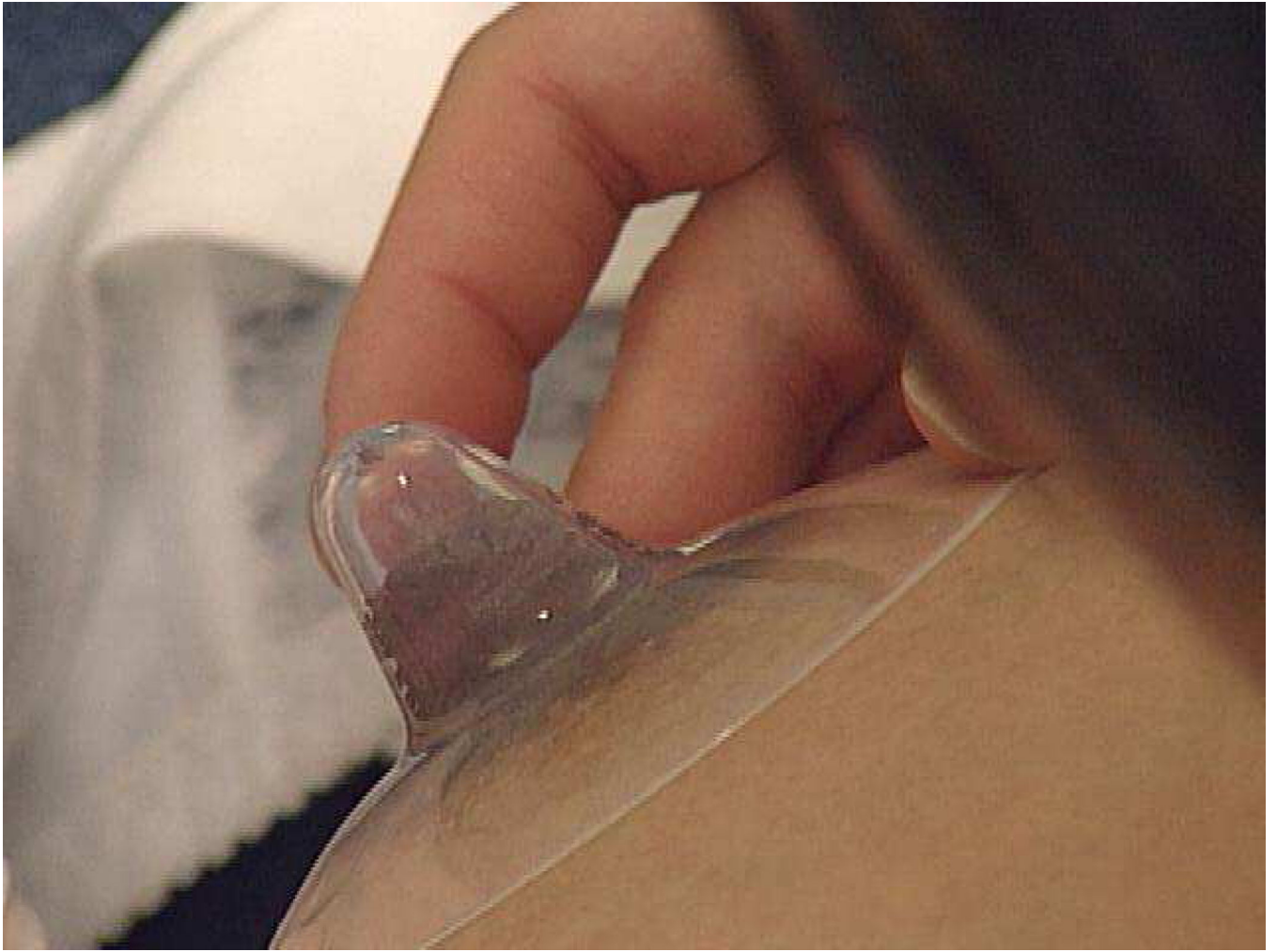




Figure 4. Use of a nipple shield creates the nipple shape for the infant and helps compensate for weak, immature suction pressures that develop with increasing maturity *Courtesy of Medela, Inc., McHenry, III; with permission.*