

Nutritional Support of the Very Low Birth Weight Infant: Part I



Quality Improvement Toolkit California Perinatal Quality Care Collaborative

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Nutritional Support of the VLBW Infant Toolkit

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Nutritional Support of the VLBW Infant

SECTION 1: IMPROVING VLBW INFANT NUTRITION: A PERINATAL/NEONATAL TEAM APPROACH

Introduction/Background

The Need and Potential to Improve VLBW Infant Nutrition

As survival rates for preterm infants and all NICU patients improve, more attention is being focused on improving the quality of survival through optimal nutritional management. Increasingly, both researchers and clinicians are recognizing that nutrition during critical periods in early life may permanently affect the structure and/or function of organs and tissues (Lucas 1992). There are good animal data and some evidence now in humans that early diet can influence long-term health (e.g. brain development, obesity, bone mineralization, blood pressure) and the risk of certain diseases (e.g. diabetes, chronic digestive diseases, some cancers) (AAP 2004, Lucas 1992).

Timing is crucial! Suboptimal nutrition, starting early in the neonatal period, contributes to the accumulation of growth deficits early in postnatal life (Olsen 2002). Infants provided only glucose solutions as nutrition in the first few days rapidly develop large protein and essential fatty acid deficits, with the smallest, most immature infants suffering the worst postnatal malnutrition (Thureen 1999). Likewise, postnatal gut luminal starvation, after active GI activity *in utero*, results in nutritional deficits, morphological and developmental changes in the gut, and reduced host resistance to infections (La Gamma 1994, Cochrane 1997). On the other hand, excessive growth acceleration may lead to adverse health effects including obesity, elevated blood pressure, diabetes, and cardiovascular disease via recently reported long-term effects on insulin and leptin metabolism (Singhal 2003, Singhal 2002).

The more immediate goals of nutrition are the provision of adequate energy stores and nutrients for optimal growth. Growth of premature babies in the NICU setting usually falls far short of that compared to comparable gestation fetuses, with approximately 90% of VLBW infants falling below the 10th percentile

of expected intrauterine growth by 36 weeks gestational age (Dusick 2003). Thirty to forty percent of these infants are still considered growth-retarded by 18 to 22 months of age.

During the VLBW infant's neonatal period, nutrition will have profound effects on:

- Organ development – especially the lungs and brain, which are undergoing the most pronounced developmental differentiation. Retinol has been shown to accelerate healing of injured fetal lamb cells (Stahlman 1988). More recently, prospective trials have proven that Vitamin A administration reduces the incidence of chronic lung disease in premature humans (Darlow 2002, Tyson 1999). Similarly, fatty acid supplementation improves neuro-developmental outcomes in the VLBW infant (O'Connor 2001).
- Immune status – with antibody production dependent on adequacy of protein production and susceptibility to infection significantly related to nutritional status (Brumberg 2003).
- Gastrointestinal integrity and the incidence of necrotizing enterocolitis - feeding practices have long been implicated as risk factors that affect NEC rates; conversely, the presence of NEC markedly compromises the provision of nutrition and affects metabolic demands.

Infections other than NEC will likely affect the nutritional status of premature newborns, either by compromising the ability to give enteral or parenteral feeds, or by altering other organ functions and overall metabolism. Environmental support mechanisms in the NICU, including the type of bed (warmer vs. incubator) and ventilator support will also impact metabolic and nutritional needs of the VLBW infant.

The goals of nutrition are straightforward: achieving a standard of short-term growth; preventing feeding-related morbidities; and optimizing long-term outcome. Achieving these goals is not simple in the NICU population. The first step is to understand the short-term and life-long importance of nutrition for

premature newborns. Only then, with assessment of current practices, outcomes and beliefs, can opportunities for practice improvements be developed and implemented locally.

Human Milk

The benefits of human milk for term infants are well recognized (AAP 1997, Cunningham 1995, Blueprint 2000). Human milk provides not only optimal nutrition for term infants (AAP 1997, AAP Yellow Book 1998), but also key digestive enzymes, direct immunologic protective factors, immunomodulators, anti-inflammatory factors, anti-oxidants, growth factors, hormones and other bioactive factors, with new components and interactions being discovered regularly (Lawrence 1999). Breastfeeding has been rediscovered by modern science as a means to save lives, reduce illness, and foster optimal development. Policy makers are increasingly recognizing that breastfeeding promotion efforts can reduce healthcare costs and enhance maternal and infant well-being (Ball 1999, Weimer 2001).

Breastfeeding promotes healthy children by providing optimal nutrition, growth and developmental hormones, and infection fighting factors to decrease risk for a large number of both acute and chronic diseases (AAP 1997).

Breastfeeding is associated with reduced risks of acute infections including:

- Otitis media – with a reduction in the frequency and duration of ear infections in breastmilk versus formula fed newborns
- Respiratory tract illnesses including respiratory syncytial virus infection
- Gastrointestinal illness
- Urinary tract infections
- Infant botulism – with increased severity and mortality seen in formula fed babies

Several chronic diseases appear to be affected by breastfeeding including:

- Allergies/atopy
- Type 1 juvenile onset diabetes
- Crohn's disease
- Lymphoma

Breastfeeding also promotes strong families by improving the health of the mother, establishing a close bond between mother and infant, and fostering communication and emotional development. Breastfeeding provides significant economic benefits to the family (and the community) by reducing unnecessary expenditures for infant formula, reducing health care costs, reducing employee absenteeism to care for a sick child, and decreasing resource use and waste. Breastfeeding cost effectiveness studies reveal that as little as three months of exclusive breastfeeding can save \$200 - \$400 per child in health care costs during the first year of life (Ball 1999). The American Academy of Pediatrics, American Academy of Family Physicians, the American College of Obstetricians and Gynecologists, the American Dietetic Association, the US Surgeon General, the WHO/UNICEF and many other organizations recognize that the promotion and support of breastfeeding is a key public health issue (AAP 1997, ACOG 2000, AAFP 2002, ADA 2001, USDHHS 2000, WHO/UNICEF 1989, WHO 1998).

The Importance of Human Milk for the VLBW Infant

Research to date supports, and the consensus opinion is growing, that human milk (with appropriate fortification for the very low birth weight infant) is the standard of care for preterm nutrition, as well as term infant nutrition (Schanler 1999c). Benefits of human milk for VLBW infants include:

- Breastmilk empties from the stomach faster (Ewer 1994, Cavell 1981), and reduces intestinal permeability faster (Catassi 1995).
- The use of breastmilk results in less residuals and faster realization of full enteral feedings (Schanler 1999b, Lucas 1990, Uraizee 1989).
- Many factors in human milk may stimulate gastrointestinal growth, motility and maturation (Sheard 1988, Groer 1996, Bartlaw 1974).
- Enzymes in breastmilk help immature infants absorb and utilize nutrients more efficiently (Hamosh 1994) and may also improve absorption of nutrients when breastmilk and artificial milks are combined (Alemi 1981).
- Reaching full feedings faster with the use of breastmilk means fewer days of IV's, less side effects from TPN, less infections and infiltrations from IV's, and less costly and fewer hospital days (Shanler 1999c).
- Breastmilk-fed infants have a reduced incidence of necrotizing enterocolitis, (Schanler 1999c, Lucas 1990, Bartlaw 1974, Pitt 1977, Bleusher 1994, Schanler 1985, Narayanan 1980, Narayanan 1984, Eibl 1988, Yu 1981),
- Breastmilk use leads to reduced episodes of bacteremia and sepsis (Schanler 1999c, Narayanan 1980, Narayanan 1981, El-Mohandes 1997, Hylander 1998);
- Breastmilk use is associated with fewer urinary tract infections (Goldblum 1989, Marild 1990, Pisacane 1992).
- VLBW infants fed breastmilk tend to have higher IQ scores (Lucas 1992, Anderson 1999, Hagan 1996).
- VLBW infants receiving breastmilk have improved visual development (Uauy 1990, Faldella 1996, Carlson 1989) and less retinopathy of prematurity (Hallman 1992, Hylander 1995).

While there are occasional medical contraindications to the use of a mother's breast milk, the most likely reason given for not providing human milk to VLBW infants is lack of availability. It stands to reason that mothers of VLBW infants should be directed and supported as much as possible to ensure that their milk is available for their baby. A mother's successful commitment to supplying her milk is likely to have significant medical benefit for her VLBW infant in both the short and long-term. If a mother's breastmilk is not available, by her choice or medical contraindications, the alternative of banked human milk should lead to the realization of most, but not all, of the benefits of human milk for the VLBW population.

Nutritional Outcomes in VLBW Infants: Assessments, Variations and Intervention.

Growth is an important health outcome measure in the NICU. Satisfactory weight gain is associated with shortened lengths of hospital stay (Schanler 1999), reduced health care costs (Wight 2001), and later growth and cognitive development (Lucas 1998). Despite this, most NICUs turn AGA VLBW infants at birth into SGA infants at discharge. NICHD data reveal that over 90% of infants who are < 1500 gm at birth are discharged weighing less than the 10th percentile for corrected gestational age (Dusick 1988). The term “extrauterine growth restriction” has been used to describe this phenomenon (Clark 2003).

Optimal nutritional outcomes of VLBW are hard to define for lack of ideal targets and benchmark data. Recently, normative growth data has been published for this population, adjusted by birthweight (Ehrenkranz 1999). Simply following mean growth velocity of this population in a NICU could be misleading as this measure may confound those patients with excessive growth (and its attendant health risks) with babies who are growth-retarded. It may be more helpful to track the variability of gestational age corrected weights close to discharge, as well as the percentage of VLBW infants who remain below the 10th percentile for predicted growth. Head circumference growth may also be an important marker of nutrition given its association with later neurodevelopmental outcomes; however, database analyses should exclude outliers with post-hemorrhagic hydrocephalus and ventriculomegaly.

Multicenter studies have found that mean growth varies significantly among NICUs. (Rubin 1997, Bloom 2003, Clark 2003). In one study, variations in nutritional intake had the largest impact on explaining growth differences among sites (Olsen 2002). Use of breastmilk and breastfeeding is also extremely variable across sites (Powers 2003). As few evidence-based standards of care are available for complex nutritional practices, these differences in nutritional practices are understandable, but not desirable.

Recent studies have demonstrated the effectiveness of quality improvement measures directed towards the nutrition of VLBW infants.

Consistent and comprehensive monitoring of growth, nutritional status, and nutritional outcome measures were part of the approach that led to markedly improved and more cost-effective nutritional outcomes for VLBW infants (Kuzma-O'Reilly 2003). By evaluating and sharing the nutritional practices of several best performing NICUs, Bloom demonstrated improvement in nutritional outcomes of over 75% of NICUs where process improvements were implemented along with evaluation of site-specific weight-gain performance (Bloom 2003). These interventions leading to a 20% increase in average daily growth of VLBW infants with no change found in the incidence of NEC, IVH or ROP.

An initial step towards assessing and improving the nutrition of prematures is determining who is going to be held responsible for evaluating and tracking nutritional outcomes. There are data documenting the benefit of including a nutritionist and having a team approach to this clinical challenge. (Valentine 1993, Elsaesser 1998, Rubin 1997, Kuzma-O'Reilly 2003). Potential participants include nutritionists, physicians/nurse practitioners, nursing staff, discharge planners, pharmacy staff, developmental specialists and occupational therapists (who may have expertise and interest in oral feeding practices). An individualized database should facilitate the nutritional care of a particular patient, but more collective analyses of nutritional processes and outcomes are needed for global NICU QI interventions.

Best Practice #1 – Consistent and comprehensive monitoring of nutritional status and outcomes of VLBW infants.

Rationale. – See prior section.

Implementation Strategies.

- A. Define nutritional team composition. Consider including nutritionists, physicians/nurse practitioners, nursing staff, lactation consultants, discharge planners, pharmacy staff, developmental specialists and occupational therapists.
- B. Determine the mission of the nutritional assessment team. There may be a pressing need to re-evaluate what current practices are a) thought to be and b) actually are. There may be a significant disconnect between a) and b). Decisions should be made about the following:
 - a. what nutritional data (individual and population-based, e.g. < 1500 gm. birthweight) will be tracked
 - b. how (format and frequency) individual patient data will be available to the bedside caregivers
 - c. how nutritional recommendations for an individual patient will be given
 - d. consensus about nutritional practices including parental and enteral nutrition
 - e. how to track deviations from these consensus practices
- C. Develop a database - Relevant stakeholders, presumably based in the Nutritional Team that has developed within a NICU, should compare data forms in use to other models (see Appendix S for examples of Nutritional Database). Some forms may need to be completed daily, others may contain data elements that are stable or trended over time. Data elements to be considered for inclusion in data forms should include:

- prenatal education and parental decision-making, especially regarding breastfeeding
- growth trends (compared to norms, see Appendix S), incl. weight, head circumference
- date/time of initiation of TPN, enteral feeding, discontinuation of TPN, ultimate volume and caloric density of enteral feedings
- initial, interval and ultimate composition of enteral feeds (all, some or no breastmilk)
- timing of skin-to-skin breast contact, non-nutritive breastfeeding
- relative contribution of gavage vs. nipple vs. breastfeeding intake
- maternal milk production
- nutritional discharge planning

Daily information can include

- daily caloric intake, incl. protein, dextrose, fat calories and ratios
- when appropriate, electrolyte, vitamin and trace element intake
- weight change and overall fluid balance

(See example in Appendix S)

Barriers. Challenges for nutritional QI efforts include shortage of time and staff to address this issue, lack of data collection and analysis capability, territorial or “control” issues surrounding nutritional decisions and feeding practices, and a lack of appreciation about the importance of nutrition on short and long-term outcomes in VLBW infants.

Measurements. There should be a regular assessment of the nutritional team’s structure and function as a quality improvement body. A center’s outcomes may be compared to normative data on VLBW infant growth adjusted for birthweight. As reported benchmarks become available regarding breastfeeding practices, it will be increasingly important to track use of breastmilk as the preferred nutritional source of VLBW infants.

Summary

CPQCC Nutrition Toolkits are being developed to promote rapid assessment of current practices, outline evidence-based best practices, and enable rapid multidisciplinary improvement cycles to improve nutritional outcomes for premature newborns. This first Toolkit, Nutritional Support for the VLBW Infant: Part I (2004) is designed to provide background information regarding the importance of nutrition and human milk in the VLBW population, and to optimize human milk production and utilization. The next Nutrition Toolkit, to be released in 2005, will focus on practices to optimize parenteral nutrition and the numerous transitions of enteral feedings, from their introduction through discharge.

Nutritional Support of the VLBW Infant

SECTION 2: SETTING THE STAGE FOR LACTATION SUPPORT

I. Introduction/Background

A barrier to the initiation and continuation of breastfeeding beyond the immediate neonatal period is the lack of consistent breastfeeding knowledge and skills among the providers of healthcare to mothers and infants (US DHHS, 1984 and 1985; DHHS OWH Blueprint 2000; Freed 1995a-d). All perinatal care providers should be knowledgeable about the basics of lactation and their role in encouraging and managing breastfeeding (AAP 1997; AAFP 2002; ACOG Bulletin 2000). Unfortunately, some may not have had the opportunity during training to gain the knowledge and skills needed to assess, support, and assist women reach their breastfeeding goals (Freed 1995).

“Teaching the pregnant woman and her partner about childbirth and breastfeeding is an integral part of good prenatal care.The advice and encouragement of the obstetrician-gynecologist are critical in making the decision to breastfeed. The health benefits of breastfeeding warrant efforts in professional cooperation and coordination among all health care workers to educate and encourage women and their families to choose breastfeeding.”
(ACOG 2000)

Provider encouragement significantly increases breastfeeding initiation among women of all social and ethnic backgrounds (Lu 2001, Miracle 2002, Meier 2000, Sikorski 2003a,b). Obstetricians, pediatricians, family practitioners and hospital staffs often unintentionally undermine breastfeeding by providing formula company access to patients via commercial literature and formula marketing strategies such as baby clubs, gift bags and free formula (Howard 1997, Howard 1993, Howard 1994, Donnelly 2003).

As important as breastmilk is to the preterm and ill NICU patient, prenatal, perinatal and postnatal care providers must be aware of possible contraindications and cautions regarding use of an individual mother's breastmilk for her infant (Lawrence 1997, Lawrence 2001, AAP 2001, Hale 2003).

Best practices will be discussed in three settings: prenatal, perinatal/labor & delivery, and postnatal. Overarching issues of staff knowledge, skill and attitudes will also be examined.

II. Settings for Improvement: Prenatal

Best Practice #1. Obstetric and perinatal professionals should actively advocate breastmilk and breastfeeding during prenatal patient contacts.

Rationale. The decision to breastfeed is usually made early in the pregnancy if not before (Ekwo 1983, Hill 1988, Noble 2003). Provider encouragement significantly increases breastfeeding initiation and duration among women of all social and ethnic backgrounds. (Kuan 1999, Lu 2001, Miracle 2002, Meier 2000, Sikorski 2003a,b, Taveras 2003). Obstetric and family practice physicians, nurses and other staff are especially well placed to begin education, risk screening and anticipatory guidance regarding lactation (ACOG 2000, AAFP 2002). Counseling allows patients to become familiar with the fact that breastfeeding is best from a medical perspective (Berens 2001). Prenatal intention to breastfeed is one of the strongest predictors of initiation and duration of breastfeeding (Coreil 1988, Donath 2003, Dennis 2001; de Oliveira 2001). As breastfeeding is even more important for preterm/NICU patients than for term infants, physicians and other healthcare providers have a responsibility to provide accurate information of the consequences of a mother's decision, just as we do with recommendations regarding immunizations, car-seats, bicycle helmets, fencing around pools, etc.

Implementation Strategies.

- Patient education should begin during routine pre-pregnancy obstetric/gynecologic visits.
- Specific encouragement or reinforcement of the decision to breastfeed should occur at the first obstetric visit. If a mother indicates a choice not to breastfeed, the reasons for that decision should be explored, as they are often based on misunderstanding of the value and challenges of breastfeeding.
- Continued education should occur during prenatal visits, especially if the pregnancy is complicated and early delivery anticipated.
- Specific anticipatory guidance should be provided if problems are discovered.
- Mothers hospitalized with preterm labor or other complications should receive intensive additional encouragement and education about breastfeeding.
- Patients should be referred to appropriate, culturally competent, breastfeeding resources: breastfeeding classes; lactation consultants; mother-to-mother support groups.
- Toward the latter part of pregnancy, patients should be instructed regarding potential barriers to breastfeeding that routine hospital care may place in their path, and suggested ways to resolve these barriers.

Barriers. Despite evidence to the contrary (see Section 1), breastfeeding is still perceived by some as a lifestyle choice, not a healthcare issue. Health care providers are afraid to “push” breastfeeding for fear of making mothers feel “guilty” if they do not breastfeed (Osiki 1995, Wight 2001).

Measurement. Measurement should focus on the timing, frequency, quality and extent of education given patients regarding breastfeeding.

- Does the prenatal record have a specific check box or blank regarding intention to breastfeed and education given?
- Patient survey re when breastfeeding first mentioned and how many times during pregnancy was it mentioned by physician and support staff.
- Survey of staff regarding attitudes towards breastfeeding as a health care issue.
(See Appendix A)

Best Practice #2. Obstetric and perinatal professionals should screen for risk factors for insufficient lactation or breastfeeding problems prenatally.

Rationale. Both general medical, social, psychological and environmental and breast-specific factors play a role in successful lactation. As with any physiologic process, historical or physical findings may signal potential or actual barriers to breastfeeding success (Neifert 2001, Berens 2001).

Implementation Strategies.

- Women should be screened for risk factors at the first prenatal visit by history and physical exam using a standardized format. (See Appendix B)
- Continued risk screening (history and physical exam) should occur as appropriate during prenatal visits, especially if the pregnancy becomes complicated and early delivery is anticipated.
- Risk factors for insufficient lactation or other breastfeeding problems should be communicated to the perinatal and postpartum staff as well as the infant's physician.

Barriers. Adding another risk screen takes time. Standardized prenatal records may need to be amended to record feeding choice and risk factors. Physicians, nurses and other staff may not be aware of resources available when risk factors are encountered (See Appendix C).

Measurement. Process measures may help assure appropriate attention is being devoted to breastfeeding anticipatory guidance.

- Is there a risk-screening tool in the prenatal record?
- Patient survey regarding questions about breast surgery, breast enlargement during pregnancy and previous breastfeeding history taken.

Best Practice #3: Obstetric and perinatal professionals should promote breastmilk and breastfeeding by having a breastfeeding supportive office or organization.

Rationale. Obstetricians, pediatricians, family practitioners and hospital staffs may unintentionally undermine breastfeeding by providing formula company access to patients via commercial literature and formula marketing strategies such as baby clubs, gift bags and free formula (Howard 1997, Howard 1993, Howard 1994, Donnelly 2003).

Implementation Strategies.

- No donation or sale of patient lists/contact information to formula or marketing companies (HIPPA).
- Use non-formula company materials.
- Remove formula “baby-club” materials in office.
- Provide visual cues (artwork, posters, calendars) that actively support breastfeeding
 - AAP Breastfeeding Welcome Here posters (www.aap.org/advocacy/hcca/hccaposters.htm)
- Support breastfeeding patients and staff by providing space and supplies for pumping and breastfeeding.

Barriers. Patient education materials and “gifts” are attractive and perceived as “free”. In reality, formula prices include the costs of those materials and gifts in their pricing. Because marketing clearly influences physician choice (Wazana 2000), the AMA, ACOG, AAP and other professional societies have developed ethical guidelines that recognize and advise how to mitigate the influence of pharmaceutical company marketing messages and gifts (AMA ACP-ASIM, 2002a,b, Wazana 2000, Lexchin 1993, nofreelunch.org). The AAP's policy statement “Breastfeeding and the Use of Human Milk” asks physicians “to work actively toward eliminating hospital practices that discourage breastfeeding (e.g. infant formula discharge packs and separation of mother and infant)” (AAP 1997).

Measurement. Measurement methods should call attention to the presence or absence of appropriate and inappropriate, direct and indirect, messages about breastfeeding.

- Have a plan to regularly inventory your educational materials, artwork calendars in the environment and office/hospital surroundings
 - Office and hospital scavenger hunt (See Appendix D).
- Review of policies and procedures regarding vendors and vendor materials in the environment.
- Survey staff awareness of office and hospital policies regarding vendors.

III. Settings for Improvement: Perinatal/Labor and Delivery

Best Practice #4: Perinatal professionals should seek out opportunities to educate and support the breastfeeding family.

Rationale. Antepartum hospital stays are opportunities for dispelling myths (e.g. “I can’t breastfeed because I have a premature infant.”) and for providing anticipatory guidance regarding procedures to ensure a full milk supply and safe storage and use of pumped milk. After controlling for mother’s prenatal breastfeeding intentions, father’s feeding preference, and demographic and psychosocial variables, a recent study by the CDC concluded that the mother’s perceptions of her prenatal physician’s and hospital staff’s attitudes on infant feeding was a strong predictor variable of later breastfeeding. Adjusted analyses indicated that “no preference” regarding infant feeding by hospital staff was a significant risk factor for failure to breastfeed after 6 weeks (DiGirolamo 2003).

A recent meta-analysis of the impact of education on breastfeeding success states:

To identify trials and review articles, the task force conducted a search of MEDLINE (1996-2001), HealthSTAR, the Cochrane Database of Systematic Reviews, the National Health Service Centre for Reviews and Dissemination Databases, and bibliographies. They identified 30 randomized and nonrandomized controlled trials and 5 systematic reviews of breastfeeding counseling. Based on the review of evidence and meta-analysis, the task force found that:

- * Overall, programs with key educational components (i.e., sessions that review the benefits of breastfeeding, principles of lactation, myths, common problems, solutions, and skills training) increased breastfeeding initiation and short-term duration up to 3 months. Education did not have a significant impact on long-term duration up to 6 months.
- * Overall, support alone significantly increased short- and long-term breastfeeding duration but did not have a significant effect on initiation.
- * The impact of education and support combined was not substantially different from that of education alone.
- * There was insufficient data to determine the effectiveness of peer counselor programs.
- * Written materials were not effective in increasing breastfeeding initiation or duration.
- * Commercial discharge packs, often containing samples and coupons for formula, were associated with reducing the rates of exclusive breastfeeding (Guise, Palda, Westhoff et al. 2003).

Implementation Strategies.

- Nurses, physicians and other staff caring for either hospitalized or outpatient high-risk antepartum mothers should communicate the importance of breastfeeding to the mother and infant.
- Hospitals should have videotapes, DVDs or closed circuit television programs delineating the “why” and “how” of providing breastmilk for preterm or ill NICU infants. (See Appendix E).
- Inventory all current educational materials (written, audio, video, DVD, etc.) for content and bias. Establish a mechanism for periodic review.
- Neonatal prenatal consults should include discussion of the importance of a mother’s own milk and the steps to be taken to assure a good milk supply.
- Prenatal lactation consults should be available for both inpatient and outpatient high-risk patients.

Barriers. Communication about neonatal nutrition is not perceived as important or urgent as other acute care concerns, such as lung maturity or fetal malformation. There maybe a lack of understanding of the importance of breastmilk for short and longterm outcomes of the VLBW infant. Providing access to relevant videotapes and DVDs maybe a challenge.

Measurement. Periodic scheduled evaluation of these process variables will assist in identifying opportunities to educate and support the breastfeeding family.

- Presence or absence of appropriate audio-visual materials and written materials on breastmilk and breastfeeding for antepartum patients.
- Chart audit of 10 antepartum consults by neonatal service to determine if breastmilk use was discussed
- Is a Lactation Consult routinely ordered on antepartum high-risk patients?
- Chart audit of breastfeeding education for mothers during the antepartum period.

Best Practice #5: Labor and delivery/neonatal staff should allow as much maternal contact with the infant before transfer to the NICU as the infant's medical condition allows.

Rationale. Visual and tactile contact with her infant allows the mother to recognize the “reality” of the birth and the need for provision of breastmilk. Early maternal-infant contact (<1 hour) is associated with increased initiation and duration of breastfeeding (Righard 1990, DeChateau 1977, Salariya 1978). Skin-to-skin care is associated with increased amounts of milk, longer duration of breastfeeding, and breastfeeding “success” (Furman 2002, Kirsten 2001, Hurst 1997, Blaymore-Bier 1996, Anderson 1991).

Implementation Strategies.

- Those infants without immediate problems (e.g. borderline preemie, Infant of a Diabetic Mother, asymptomatic congenital anomalies) should be allowed skin-to-skin care and immediate post-partum breastfeeding, before being removed to the NICU for diagnostic or therapeutic procedures.
- All awake mothers should be given the opportunity to see, and if possible, touch, their ill infants prior to transfer to the NICU.
- Peripartum caretakers should begin a discussion, as appropriate, of provision of breastmilk as something only the mother can do.

Barriers. Perinatal caretakers are appropriately anxious to begin definitive care for each ill infant. The risks and benefits of allowing a mother a few moments to bond with her infant should be evaluated on an individual basis.

Measurement. Awareness of the benefits of early maternal contact on breastfeeding should lead to additional opportunities for breastfeeding support.

- Is maternal-infant contact documented in nursing or medical record?
- What is the time interval from a VLBW infant's admission to the NICU and its first maternal visit?

IV. Settings for Improvement: Post-Partum

Best Practice #6: Postpartum and NICU policies and practice should support breastfeeding in a coordinated, consistent manner.

Rationale. Mothers of VLBW infants are less likely to breastfeed than mothers of healthy, term infants (Ehrenkranz 1985, Lefebvre 1989, Meier 1993, Yip 1996, Bell 1997, Hill 1997, Furman 1998). Family members and health care professionals sometimes discourage these mothers from initiating lactation as they think that providing milk will be an added stress (Meier 2001). Mothers may be advised, in error, that their medications preclude the use of their milk. Similarly, mothers may be inappropriately advised that their high-risk conditions may interfere with adequate volumes or composition of milk. Mothers of VLBW infants often feel a loss of control of their lives and a loss of role as a mother. The infant is in the hands of strangers and she is the outsider. Several studies indicate that providing milk for their infants helps mothers cope with the emotional stresses surrounding the NICU experience and gives them a tangible claim on their infants. Providing breastmilk is something only SHE can do (Kavanaugh 1997, Spanier-Mingolelli 1998). One of the most consistent complaints of mothers is the often confusing, contradictory advice they receive regarding lactation.

Implementation Strategies:

- All post-partum and NICU nurses should have a basic level of knowledge re lactation physiology and breastfeeding support, as evidenced by “competencies”. (See Appendix F)
- Breastfeeding supportive postpartum and nursery breastmilk policies and procedures should be in place for:
 - Collection, storage and handling of mothers’ own milk for hospitalized infants (See Appendix G)
 - Accidental feeding of the wrong mother’s milk to an infant
 - Use of fresh and pasteurized donor human milk, as appropriate (See Appendix G)
 - Skin-to-skin (kangaroo care) (See Appendix G)
- An NICU breastfeeding support committee or task force should be multidisciplinary, including physicians, nurses, dieticians, occupational therapists, pharmacists, lactation consultants, and, if appropriate, breastfeeding mothers.

Barriers:

- Misinformation on the part of families and staff regarding the efforts and rewards of breastfeeding an NICU infant
- Lack of nursing time
- Overspecialization of breastfeeding responsibilities

Measurement: Regular review of policies, procedures and competencies will assist in focusing attention toward areas for possible improvement.

- Do appropriate policies exist?

- Are all caregivers competent to provide needed education and support?
- Regular review of policies mentioned above in strategies.
- Education of staff on competencies
- Assessment and measurement of competencies

Best Practice #7: Every mother of an infant admitted to the NICU should be provided with an appropriate breast pump and the support to use it effectively.

Rationale: Because of lactation physiology a full milk supply must be established for the tiny preterm infant, just as it is for a full term healthy infant (Hartmann 2003). Just “keeping up” with the VLBW infant’s needs is not sufficient, as the mother will be unable to call upon a larger milk supply when the infant’s needs increase. Although the mother of a term NICU infant may be able to establish and maintain her milk supply with a combination of her infant nursing and a hand or mini-electric pump, a mother who must establish her milk supply without her infant, and who needs to maintain it for more than a week, will require a full-size automatic cycling electric pump capable of pumping both breasts at one time.

Implementation Strategies:

- Nursing staff should determine who will be responsible for assisting the mother to initiate pumping (post-partum RN? NICU RN?)
- Nursing staff should determine who will be consistently be available to assist a newly delivered mother with pumping (NICU RN, postpartum RN?)
- Provision should be made for every mother separated from her infant to have access to an appropriate breast pump both at home and in the NICU post maternal discharge. An auto-cycling electric breast pump capable of pumping both breasts at one time has been shown to be more efficient and effective in establishing and maintaining a mothers milk supply for a VLBW infant (Hill 1997).
- Hospital staff should be trained in acquiring pumps for women. (For a draft letter to justify insurance coverage see Appendix I.)
- Develop a breast pump loan program for the first few weeks for those mothers with no other resources (Philipp 2000).

Barriers: Buying or renting an effective breast pump may be beyond the means of some families and many insurance companies still will not cover breast pumps for mothers. Breast pumps readily available in discount stores may be low cost and are typically ineffective. A loner/transitional pump may not be available.

Measurement: Both the availability of appropriate pumps and supplies and maternal knowledge of optimal pumping schedules and techniques should be regularly evaluated.

- Regular review of availability of appropriate pumps and supplies (including loaner pumps)
- Is there a facility in or near the NICU for mothers to use for pumping when they are visiting or is provision made for mothers to pump at their infant’s bedside?
- Survey moms regarding availability and use of appropriate pumps (See Section 3 and Appendix J)

Best Practice #8: Specific lactation assistance should be available to mothers of NICU infants.

Rationale. Although healthcare professionals who care for mothers and infants should have a general knowledge of lactation physiology and breastfeeding management, supporting the mother of a NICU infant often requires special knowledge, skill and experience. International Board Certified Lactation Consultants (IBCLC) are one method to assist in increasing breastfeeding rates in the NICU through staff and mother education, clinical consultation and support (Baker 1997, Gonzalez 2003, Merewood 2003, Kuzma-O'Reilly 2003). In some units, well-trained NICU RNs may have the knowledge and experience to counsel and manage complicated NICU breastfeeding issues.

Implementation Strategies:

- Hire or contract with an appropriately experienced IBCLC.
- Train an existing NICU RN or RD to be an IBCLC or lactation resource person.
- Train all NICU personnel to manage complicated lactation problems and issues.
- Develop guidelines for IBCLC/lactation resource person interaction as part of the multidisciplinary care team
 - Participation in multidisciplinary rounds and teaching rounds
 - Consultations and systematic follow-up
 - Creation and evaluation of patient literature
 - Education for other NICU staff
 - NICU breastfeeding support committee or program
 - Research as appropriate
 - Key lactation facts as part of RN “Kardex” or separate lactation “Kardex”
- If lactation consultants (LC) are used, LC’s should “bill” (i.e. keep records of services performed) even if their services are not directly reimbursed at present.

Barriers: NICU-experienced lactation consultants (LC) are difficult to find in some areas. Given current NICU reimbursement methods, LC time may not be compensated. Tendency to abdicate all lactation support to LCs, rather than appropriate training for all NICU staff.

Measurement: Although the percentage of mothers providing milk to their own infants at any given time, and the percentage of infants receiving any breastmilk at the time of discharge are key outcome measures, other short-term measures may be valuable.

- Hours of availability of lactation support in the NICU and for mothers of NICU infants on the post-partum unit.
- Reimbursement for LC services
- Survey of mothers re lactation support
- Presence and utilization of a lactation documentation tool

Best Practice #9: Physicians involved in mothers' postpartum and in infants' NICU care should advocate for breastfeeding.

Rationale: Physician advocacy for breastfeeding can have tremendous impact (Lu 2001, Miracle 2002, Meier 2000, Sikorski 2003a,b). If the doctor tells the mother that her milk is best for the baby's health, the mother will probably attempt to provide it (Philipp 2001). ANY breastmilk is better than none, especially for the VLBW infant (Furman 2003).

Implementation Strategies.

- The physician(s) in charge of the mother's care should reinforce the importance of breastmilk by inquiring about the mother's pumping or breastfeeding progress during routine post-partum care.
- The first visit in the NICU with the neonatologist or pediatrician should include discussion of the value and benefits of human milk for the VLBW infant (with documentation in the medical record). Care should be taken to separate the decision to provide a few weeks of pumped breastmilk from the commitment to long-term, exclusive breastfeeding.
- Physicians should find opportunities to praise mother's efforts to provide this "liquid gold" for their VLBW infant.
- Preprinted or standing admission orders should include "Lactation Consultation for all VLBW infants."

Barriers.

- Physicians are not in the habit of discussing infant nutrition in the immediate post-partum period.
- Assumption that someone else is responsible.
- Lack of awareness of potential impact.

Measurement. Advocacy and facilitation are difficult to measure directly, but attention must be placed on increasing opportunities to discuss human milk for VLBW infants and documenting these interventions.

- Documentation of such discussions in the medical record by chart review.
- Presence of LC order on standing postpartum or NICU admission orders.

V. Settings for Improvement: Staff Knowledge, Skills and Attitudes

Best Practice #10: Perinatal and neonatal professionals should have the knowledge, skills and attitudes necessary to successfully support provision of breastmilk to the VLBW infant.

Rationale. With the Office of Women’s Health, DHHS, CDC, AAP, AAFP, ACOG, NMA, ADA, NANN, ICEA, AWHONN, NAPNAP, NPA and many other organizations actively promoting and supporting breastfeeding, our families are becoming more knowledgeable about breastfeeding issues. They depend on us, the members of the healthcare team, for accurate, consistent information. Inconsistent, inaccurate information and lack of support by health care professionals have been cited as reasons for breastfeeding failure among many groups of mothers (Ellis 1983; Winikoff 1986; Winikoff 1987, Raisler 1993, Humenick 1998). Unfortunately, many healthcare providers have not had the education and training to support breastfeeding families (US DHHS 1984 and 1985; DHHS OWH Blueprint 2000, Freed 1995a-d). Existing studies also suggest that nursing knowledge or attitudes can influence mothers’ breastfeeding decisions in the NICU (Jaeger 1997, Bernaix 2000, Wheeler 1999, Kavanaugh 1997, Kavanaugh 1995). Significant increases in knowledge are possible with nursing education, but attitudes are more difficult to change (Siddell 2003). Despite adjustment for other significant variables, the site of care significantly influences breastmilk use at the time of discharge (Powers 2003). High breastmilk use sites tended to have physicians who openly expressed support for breastmilk use, nurses who facilitated breastmilk use and helped maximize breastmilk supply, and maternity nurses who conveyed the need for and expectation of breastmilk production while guiding mothers through the process. Low breastmilk use sites had physicians who had no position or were silent on breastmilk use, had nurses who did not facilitate breastmilk use or help maintain maternal milk supply, and maternity nurses who avoided breastmilk issues and provided no guidance regarding breastmilk production (Powers 2202).

Implementation Strategies.

- Hold regular CME, CEU and other inservices, both multidisciplinary and physician-only, re lactation issues.
- Designate a Director of Lactation as a resource person. The advantage to having a physician in this position is the added medical knowledge base, prescriptive ability and credibility of physician-to-physician communication.
- Make key resources (e.g. drugs & breastfeeding information, basic text or handbook) available in all care areas (hard copy and/or digital).
- Develop/test for competencies regarding breastfeeding knowledge and skills.
- Subsidize utilization of on-line breastfeeding management courses (www.umdnj.edu/lactweb, www.breastfeedingbasics.org, <http://breastfeeding1.com>, www.breasted.com.au).
- Utilize existing self instructional materials (e.g. Wellstart Lactation Management Self Study Modules- www.wellstart.org)
- Develop “scripts” for common or difficult situations (See Appendix M).

Barriers. Education alone will not change professional behavior (Davis1995). Attitudes of perinatal and neonatal staff should be addressed. The development, training and implementation of policies and procedures take time to become implemented and to become part of NICU culture.

Measurement. Knowledge, clinical skills and attitudes must all be addressed.

- Use nursing /physicians surveys of lactation knowledge, skills and attitudes to guide incremental program planning.
- Is there a Director of Lactation?
- Are key resources immediately available to physicians and nursing staff?

Best Practice #11: Obstetric, perinatal, and neonatal professionals should counsel mothers when breastfeeding may be of concern or contraindicated.

Rationale. As important as breastmilk is to the VLBW infant, prenatal, perinatal, and neonatal care providers should be aware there are cautions and contraindications regarding use of an individual mother's breastmilk for her infant (Lawrence 1997, Lawrence 2001, AAP 2001, AAP Red Book 2003, Hale 2003). The physician will need to weigh the risks of using breastmilk from a mother with potentially transmittable diseases or medications against both the short-term and long-term risks of withholding breastmilk from the VLBW infant. Pharmaceutical manufacturers' inserts typically discourage breastmilk use, often due to lack of safety data. Similarly, discontinuing breastfeeding for a self-limited or treatable maternal illness deprives the infant of the maternal antibodies after having been exposed to that illness (2003 Red Book, Pg. 117). A drug that is not compatible with breastfeeding can often be changed to another drug that is compatible (Anderson 2003).

Implementation Strategies for Special Situations.

- A current, reliable reference for drugs and breastfeeding should be immediately available in the NICU and post-partum areas. The PDR is NOT a reliable reference. The recommended references are Medications and Mother's Milk by Thomas Hale R.Ph, PhD (updated every 1-2 years) and Lawrence and Lawrence, Breastfeeding: A Guide for the Medical Profession 5th Ed 1999. Other resources: UCSD Breastfeeding & Drugs Hotline 1-900-288-8273; Breastfeeding and Human Lactation Study Center, Univ. of Rochester (585) 275-0088; <http://www.iBreastfeeding.com>.
- Infants with galactosemia should not receive breastmilk.
- Contraindications to breastfeed in the USA:
 - Maternal Illnesses (AAP Red Book 2003)
 - HIV/AIDS
 - Human T-Lymphotropic Virus Type I & II
 - Active tuberculosis in mother prior to treatment
 - Maternal medications (AAP 2001, Hale 2002, Hale 2003)
 - Anti-metabolite or cytotoxic medications (e.g. anti-cancer)
 - ¹³¹I
 - Drugs of abuse: heroin, cocaine, amphetamine, marijuana, and phencyclidine. (AAP 2001) (See below for discussion of methadone, smoking, alcohol)
- Women with the following need special consideration for breastfeeding:
 - **Cytomegalovirus (CMV).** "Infants born to CMV-seronegative women who seroconvert during lactation and premature infants with low concentrations of transplacentally acquired maternal antibodies to CMV can develop symptomatic disease with sequelae from acquiring CMV through breastfeeding. Decisions about breastfeeding of premature infants by mothers known to be CMV seropositive should include consideration of the potential benefits of human milk and the risk of CMV transmission. Pasteurization of milk seems to inactivate CMV; freezing milk at -20°C (-

- 4°F) will decrease viral titers but does not reliably eliminate CMV” (AAP 2003 Red Book, pgs 118-9).
- Infants of women with **Hepatitis B Virus** (HBV) should receive HBIG and HB Vaccine within the recommended time period. The medications do not need to be given before breastfeeding is initiated (AAP Red Book 2003).
 - “Mothers infected with **Hepatitis C Virus** (HCV) should be counseled that transmission of HCV by breastfeeding theoretically is possible but has not been documented. According to current guidelines of the US Public Health Service, maternal HCV infection is not a contraindication to breastfeeding. The decision to breastfeed should be based on informed discussion between a mother and her health care professional” (AAP Red Book 2003).
 - Infants of mothers with active **Varicella-Zoster Virus** (VZV) may breastfeed after mothers are no longer infectious. The infant may require VZIG. Expressed breastmilk may be given to the infant if no skin lesions involve the breasts and the infant has received VZIG. (For details please see Lawrence 1999 pgs 585-588 and AAP Red Book 2003). Milk supply should be established and maintained while mother and infant are isolated.
 - Infants of mothers with **measles** should be given IG and may breastfeed when the mother is no longer infectious (72 hrs after onset of the rash). The breastmilk may be pumped and given to the infant (Lawrence 1999, AAP Red Book 2003).
 - **Herpes Simplex Type 1**. Women with herpetic lesions on their breasts should refrain from breastfeeding or feeding expressed breastmilk from the affected breast until the lesions have healed. Active lesions elsewhere should be covered during breastfeeding, and careful hand hygiene should be used. Women should be encouraged to pump until lesions are clear, so milk supply is not interrupted.
 - Mothers receiving **radioactive diagnostic agents** need to pump and discard their milk for varying periods of time. (Hale 2002, AAP 2001)
 - Most common maternal **post-partum medications** are not contraindications to breastfeeding or providing expressed breast milk to VLBW infants (e.g. magnesium sulfate, tocolytics, antihypertensives, pain medications, antibiotics). However, some medications may be preferred over others due to decreased excretion into milk, or experience with preterm infants (Hale 2002, Hale 2003, AAP 2001).
 - **Methadone** is listed by the AAP as “usually compatible with breastfeeding” (AAP 2001).
 - **Smoking**. Milk yield is significantly decreased in smoking mothers of premature infants who initiated lactation by pump. (Hopkinson 1992) Nicotine is present in human milk of women who smoke, but there is no evidence whether the nicotine presents a health risk to the nursing infant (AAP 2001). Mothers of VLBW infants should be advised (as with all mothers) to minimize or eliminate smoking.

- **Alcohol.** Although the AAP lists alcohol as “usually compatible with breastfeeding” (AAP 2001), the consumption of alcohol during lactation deserves careful consideration because of potential effects on the VLBW infant and a wide range of intakes. More than occasional consumption should be discouraged.
- **Immunizations.** “Lactating women may be immunized as recommended for other adults to protect against measles, mumps, rubella, tetanus, diphtheria, influenza, Streptococcus pneumonia infection, Hepatitis A, Hepatitis B, and Varicella. If previously unimmunized or if traveling to a highly endemic area, a lactating mother may be given inactivated poliovirus vaccine. Rubella seronegative mothers Should be immunized during the postpartum period” (AAP 2003 Red Book, pg 117).
- **Psychotropic Drugs** are not contraindicated for breastfeeding mothers. They are listed by the AAP as “drugs for which the effect on nursing infants is unknown but may be of concern”, but most have “none” listed as a reported or possible side effect (AAP 2001). Because concentrations in breastmilk differ, some medications are preferred over others. For a current, evidence-based discussion of various types of psychotropic drugs, see Hale 2003.

Barriers. It is often easier to proscribe breastmilk than to research current recommendations. Physician knowledge in this area is often outdated. There is a lack of familiarity of where to turn for resources. There is inadequate documentation of safety for newer drugs.

Measurement. Measurement should focus on efforts to use mothers’ milk safely for the VLBW infant.

- Inventory of availability of resources: Are appropriate references available in key post-partum and NICU areas?
- Survey staff to assess their awareness of resources.
- Are infectious disease/isolation policies consistent with current breastfeeding policies, and up to date with current references?
- Is there a consistent policy as to when breastmilk is allowed to be discarded and those reasons are documented?

SUMMARY:

As noted above, many individuals, policies, and practices can impact breastfeeding success. The very definition of “success” will also vary; for example, having expressed breastmilk be the first feeding for every VLBW infant, to full, exclusive breastfeeding for several months post-discharge. Assess your own institution using the tools provided, put together a multidisciplinary team, and pick one small area to improve, then another.

A recent meta-analysis of the impact of various interventions to promote breastfeeding aimed at patients concluded that breastfeeding “success” depended on the outcome you were looking at: initiation, short-term duration, long-term duration, exclusivity, etc. Overall, face-to-face education seemed to be more effective than written materials (Guise 2003). Unfortunately, there are few studies, and no meta-analysis of what are effective interventions for health care professionals in the area of breastfeeding education and support. While you are working on general education, attitudes, hospital policies, etc., perhaps the two most immediate and simplest interventions are to have appropriate patient education available and used (e.g. Morton video or DVD; See Appendix E) and basic reference materials, to include drugs and breastfeeding information, immediately available for all healthcare providers.

The provision of breastmilk for the VLBW infant is a medical treatment, not just a social choice. Encouraging mothers of VLBW infants to provide breastmilk and supporting their efforts is a multifaceted endeavor, involving knowledge, attitude and action. We must both advocate and facilitate to improve nutritional outcomes in the NICU.

Nutritional Support of the VLBW Infant

SECTION 3: ESTABLISHING LACTATION: THE FIRST 100 HOURS

I. Introduction/Background

How to avoid: *too few doing too little too late*:

There are two major misconceptions that undermine successful lactation management in the NICU for the VLBW baby. The first is that management of lactation can be postponed until the mother has recovered and the baby is deemed stable. The other is the prevalent attitude that the responsibility for lactation support rests with a small number of specialized care providers and/or the mother vs. a collaborative team that includes physicians (Powers 2002). To overcome these barriers specific guidelines need to be in place to avoid unnecessary delays and to enlist a collaborative team. One approach would be to develop an effective multidisciplinary clinical pathway recognizing that different nurseries will need to tailor this pathway to capture their individual strengths and weaknesses. Best practices, which may be incorporated into differing models, are discussed, followed by a template, which may serve as a starting point for each NICU's planning strategy

II. Best Practices

Best Practice #12. Pump early, pump often: Informing the Mother

Rationale. The single-most important factor determining the exclusivity and duration of breastfeeding for the mother-infant dyad is the volume of milk produced, which typically plateaus by two weeks postpartum. Initiating early pumping (within the first day) is associated with higher levels of milk production (Wooldridge 2003, Hill 1999, Flacking 2003, Smith 2003, Furman 2002, Bier 2002). Yet, mothers who deliver prematurely are often unprepared and perhaps too medically compromised themselves to assume primary responsibility for acquiring the information and equipment to manage timely initiation of pumping. Pumping and providing milk contributes to the physical and emotional recovery of the mother (Kavanaugh 1997). Therefore, the hospital staff is integral to the initiation of pumping and establishment of a regular pumping schedule. An organized care system needs to automatically provide assistance with, and remove obstacles to, establishing a consistent pumping routine.

For a mother, the decision to provide milk for a VLBW infant is quite different from the decision to breastfeed a healthy, term infant. First, the decision is usually made based on health-related issues (i.e. The vulnerability of the infant puts him at greater risk of diseases from which breastmilk may protect him.) Second, mothers who did not intend to breastfeed, often decide to pump, while not planning to feed at the breast (Meier 2000). Third, mothers are highly influenced by the advice of professionals who care for the infant, feeling thankful for (not coerced by) their guidance and even resentful if misinformed about formula being equally acceptable (Miracle 2002).

Implementation Strategies.

Antepartum education:

As previously stated, obstetrician and pediatricians may be the first individuals to have the opportunity to discuss the importance of human milk for the VLBW infant. Mothers may be more influenced when practitioners with whom they have an established relationship discuss such factors. In addition, the hospital staff dealing with high-risk mothers in the obstetrical clinic or antepartum ward may also seek out opportunities to present the importance of breastmilk. Ideally, these discussions should occur prior to delivery, when a mother's attention is not compromised by the condition of her infant.

Postpartum education:

The first post-delivery encounter with the neonatologist should include discussion of human milk; its role in the VLBW infants care and the urgency to begin pumping. A cohesive nursing support system will determine who will consistently be available and responsible to assist a newly delivered mother with pumping.

Barriers.

- Misconception that pumping can be delayed without adverse consequences
- Misconception that the mother is too sick
- Misconception that mothers of VLBW infants can't produce as much milk as a mother of full term infants
- Unfounded concerns about perinatal maternal complications and medications related to the safety of breastmilk for the infant and pumping for the mother.
- Misconception that lactation management is the responsibility of a small number of specialized providers (e.g. lactation consultants) or even the mother herself.
- Lack of knowledge about lactation physiology (e.g. milk production peaks at 2 weeks)
- Uncertainty of neonatal survival
- Inappropriate delay in focusing on nutrition until VLBW infant is stabilized
- Language barriers
- Lack of a care plan

Measurement. Awareness of the benefits of early maternal contact on breastfeeding should lead to additional opportunities for breastfeeding support.

- When and who informed your mothers of the benefits of breastmilk? (See Appendices J and M)
- What percent of informed mothers initiated pumping?
- What educational seminars or clinical consensus workshops are available to format a plan of action?

Best Practice #2, Pump Early, Pump Often: Providing Equipment, Staff and Logistics

Rationale: A rental grade “double”, electrical pump, enabling a mother to pump both breasts simultaneously should be consistently available to the mother during her hospital stay and at discharge. In addition, staff should be available and committed to establishing a regular pumping schedule with this equipment. In contrast to sequential pumping, the double pump results in higher milk yield, reduced time, and a higher prolactin level (Hill 1996).

Frequent pumping (8 times every 24 hours) with a hospital grade pump should begin within the first day, as soon after delivery as the mother is stable (not “recovered”). Early initiation of pumping (within the first 8 postnatal hours) results in higher prolactin levels and is more likely to yield the targeted goal of 20 ounces/day by 7-10 days (Furman 2002). The aim is to mimic the optimal breastfeeding stimulation provided by a healthy full term infant (Neville 1991). Augmenting the effect of electric pumping with manual expression may be an additive technique for some women.

Implementation Strategies.

- Adjust the postpartum nurse/patient ratio to support breastfeeding care and to physically assist with pumping whenever needed.
- Secure sufficient number of pumps to ensure access

Barriers.

- Financial
- Lack of available staffing
- Lack of adequate equipment
- Time constraints
- Distance (mother in ICU or referral hospital)
- Staff misconceptions
 - Failure to view pumping as integral to the mother’s recovery and infant’s outcome
 - Failure to recognize urgency

Measurement. It is unclear whether all mothers who deliver prematurely have the potential to produce a full milk supply, even under ideal conditions. Therefore, milk production may not be an accurate index of a mother’s pumping history. Both the availability of appropriate pumps and supplies and maternal knowledge of optimal pumping schedules and techniques should be regularly evaluated.

- Audits to make certain that every mother who delivers a VLBW has a pump available, both in the hospital and for home use on the day of discharge. (See Appendix N, question 11.)
- Time of first pumping and frequency (Appendix N, questions 2 and 3)
- Audits of maternal records for implementation of breast pump use.
- Largest amount pumped in a 24 hour period during first 2 weeks (Appendix J, question 5)

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- Comparisons to normal milk production curve in mothers of term infants: (Appendix K).

Best Practice #3. Keeping Score

Rationale. Keeping a pumping diary of milk production is the equivalent to charting lactation vital signs in the mother of the VLBW infant. In centers with successful implementation of lactation support, a NICU-designed diary-log for mothers to record their pumping history cues mothers to visit, pump and hold their infants frequently (Rush-Presbyterian-St. Luke's Medical Center 1999, Meier 2001). Such charting, if regularly recognized by the NICU staff, may encourage pumping and skin-to-skin care.

Implementation Strategies.

- Develop a diary-log, specific for the hospital NICU (see Appendix P; email address)
- Identify responsible care providers to assist mother with initiation and maintenance of pumping record
- Periodic NICU RN documentation of milk production volumes

Barriers.

- Not having a diary/log
- Lack of knowledge of, or value for log maintenance and completion
- Time constraints

Measurement. Periodic assessments must target both the adequacy of provisions and services as well as the effectiveness (outcome) of these services. (Appendix O).

- Availability of a personalized diary-log for mother
- Assess whether mother was taught how to log in diary (Appendix N, question 4)
- Request periodic copy of log for infant's record
- Review infant's chart for notation of milk production

Best Practice #4. Non-pharmacological means to optimize early milk production: Breast massage and manual expression.

Rationale: There are numerous benefits to breast massage and manual expression. Breast massage has been shown to improve milk production both in mothers who double pump (both breasts simultaneously) as well as those who pump sequentially. Presumably, massage detects poorly emptied glandular tissue and facilitates milk removal. Effective emptying is critical to maximizing milk production and preventing engorgement and mastitis. (Note: simultaneous pumping has been shown to be more effective at producing milk than sequential pumping, Jones 2001). Massage of the areolar-nipple area, immediately prior to pumping, may help stimulate a let-down reflex, a prerequisite to effective emptying. Manual expression, used in conjunction with electric pumping, may facilitate the collection of small volumes of colostrum and help initiate milk flow when the breasts are engorged. Later, manual expression, when practiced synchronously with breastfeeding, may improve milk transfer from the breast to the baby.

Implementation Strategies.

- Identify skilled staff to demonstrate this technique to mothers
- Utilize available handouts or videos which demonstrate this technique (e.g. A Premie Needs His Mother, J. Morton: see Appendix E for published reviews and ordering information).

Barriers.

- Lack of time and skilled staff
- Issues related to modesty
- Lack of appreciation for the difficulty in achieving consistent, effective emptying with a pump, and the relationship between incomplete emptying and compromised production and/or mastitis

Measurement. Regular review of competencies (both mothers' and staff's) will assist in focusing attention toward areas for possible improvement.

- Maternal education on manual expression, breast massage and colostrum collection (Appendix N questions 5 and 9).

Best Practice #5. Non-pharmacologic means to optimize early milk production: Early colostrum feeds.

Rationale. Aside from the health advantages for the infant of initiating early feedings with colostrum, there are benefits for the mother and staff as well. The use of human milk for trophic feeds in VLBW infants is associated with improved milk production. The authors of this study suggest that this maybe related to a subtle psychological benefit mothers experience in knowing their own milk is being utilized. (Schanler 1999.) In addition, the use of human milk for the first feedings sends the important message to staff that preterm formula is not equivalent to human milk for this vulnerable population.

Implementation Strategies

- Have equipment to collect small volumes
- Teach mother the adjunctive skill of manual expression
- Identify tools and methods of assuring complete collection and transport of small volumes of colostrum
- Improve staff and MD awareness of the importance of the numerous gastrointestinal and immunological effects of the use of colostrums.
- Establish policies and ordering practices that limit early feeds to colostrum/human milk. (Avoid orders such as: “maternal breastmilk or preterm formula...”)

Barriers.

- Maternal disappointment over small expressed volumes
- Staff lack of appreciation for the importance of small volumes
- The desire to initiate trophic feeds regardless of breastmilk availability
- Difficulty with collection and labeling of small expressed volumes

Measurement. Knowledge, clinical skills, attitudes and outcomes must all be addressed.

- Documentation of utilization of colostrum for first feeds
- Maternal education on manual expression, breast massage and colostrum collection (Appendix N, questions 5 and 9.)
- Are post-partum providers competent in helping mothers collect colostrum?
- Are NICU staff encouraging and willing to use even small volumes?
- If colostrum is not available in the NICU, is there an effort to contact the mother before providing alternatives?

Best Practice # 6. Non-pharmacologic means to optimize early milk production: Skin-to-skin contact

Rationale. Early non-pharmacological means to stimulate milk production include expressing milk while relaxed at the bedside (or in proximity to the infant) (Meier 2001, Fehrer 1989) skin-to-skin care (Hurst 1997, Fewtrell 2001) and non-nutritive tasting at the breast (Narayanan 1990). In many nurseries skin to skin care in VLBW infant maybe practiced when the infant is stable on or off the ventilator (Kirsten 2001). Non-nutritive tasting may be accomplished while the baby is on nasal-CPAP (Pinelli 2001).

These interventions may stimulate both prolactin and oxytocin as mothers become conditioned to readily let down with psychological and tactile stimulants. Psychological inhibitors of the neuroendocrine let-down reflex include fear, pain and embarrassment, while positive stimuli include the sight, sound or feel of the infant (Newton 1967). The average pumped milk yield without letdown is less than 4% of available milk (Mitoulas 2002, Kent 2003) The key to milk production is milk removal, which is dependent on the let-down reflex. "Hind-milk", the fat-rich milk available with a let-down at the end of expression, contributes to the caloric and lipoprotein composition.

There are benefits for both mother and infant from skin-to-skin care.

- Mothers have increased milk production (Hurst 1997).
- Infants have improved physiologic stability and feeding tolerance (Kirsten 1997).
- Contact with her infant stimulates the maternal entero-mammary system. Antigens (e.g. viruses, bacteria, fungi) stimulate lymphocytes in a mother's intestine, which then "home" to her breasts and there stimulate the production of specific antibodies, targeted against those antigens. (Kleinman 1979, Hanson 1985).
- Contact may facilitate bonding and attachment (Kirsten 2001).

Implementation Strategies.

- Develop practices and policies to encourage skin-to-skin contact. Such contact should be an expectation for the development of the parental-VLBW baby relationship
- Identify knowledgeable personnel who can assist positioning and supporting mother and baby
- Provide chairs (semi-reclining), space, and screens for privacy as requested
- Offer uninterrupted time (Head phones, ear plugs for mother may offer a way to address privacy concerns when rounds are conducted.)
- Educate staff re the physiological and psychological benefits of skin-to-skin care

Barriers.

- Privacy issues
- Lack of space
- Lack of uninterrupted time for maternal contact
- Lack of chairs
- Mother viewed by staff as a "visitor" vs. a member of the health care team

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- Under-appreciation of the physiological benefits of skin-to-skin care
- Unwarranted anxiety of the physiologic stability of the infant during transfer to skin-to-skin care, diminishing the frequency and duration of sessions

Measurement. Advocacy and facilitation are difficult to measure directly, but attention must be placed on increasing opportunities to discuss the importance of skin-to-skin care for both the mother and her VLBW infant and to document these interventions.

- Review policies for visitation, skin-to-skin care, etc.
- Assess adequacy of bedside pumping equipment and appropriate chairs
- Chart audits of initiation and frequency of skin-to-skin contact

Best Practice #7. Maternal Discharge Planning: A Team Approach

Rationale. By the time of the mother's discharge, the list of preparatory education issues and equipment needs is extensive and does not fall neatly into the purview of any one specialist. Therefore, a collaborative team approach is needed.

Maternal discharge from the hospital may coincide with the onset of copious milk production (lactogenesis II or milk "coming in"). Any break in the frequency of effective milk removal at this most vulnerable time may seriously compromise the potential to maximize milk production (Neville 2001). A pro-active plan to provide a rental pump at discharge, (especially in the under-insured), is more likely to support an uninterrupted pumping schedule. Similarly, a proactive plan, to teach each mother the building blocks of required skills to establish and maintain lactation must occur in a logical, step-wise fashion, to enable a smooth transition home.

Establishing a full milk supply (over 20 oz /day) is the key to enabling long-term breastfeeding for these infants (Woodridge 2003). When a mother produces less than this volume, she is unlikely to succeed in transitioning the infant from breastmilk feeds to breastfeeding (Woodridge 2003). These initial steps to support milk production will influence outcomes, as many of the early and long-term benefits of human milk are dose related (Schanler 1999, Mortensen 2002).

Implementation Strategies.

- A team plan: Implementation involves structuring a collaborative support system, composed of consistently available individuals with the skills and motivation to assume the "acute care" of lactation during this critical window of opportunity. Assuming responsibility and accountability for these tasks is more likely if assignments dovetail with the strengths of the individual care providers. (See Appendix M- the *Clinical Pathway* designed to complement the skills of four specialists who typically care for the mother-infant dyad: the neonatologist, the postpartum nurse, the NICU nurse and the lactation specialist).
- Pump rental plan: A policy that permits the hospital to loan an underinsured mother a rental-grade hospital pump may be cost-effective and pragmatic.
- Maternal education checklist: During the course of hospitalization, a series of skills and educational goals need to be accomplished. A mother may place her initials by each of the listed tasks upon completion. Such a monitor will assess maternal preparation and provide a tool for measuring the strengths and weaknesses of the team's plan. Such a checklist should assess a wide array of issues, including maternal education, maternal assessment and discharge provisions (See Appendix N).

Barriers.

- Ill defined roles and responsibilities

- Need for other d/c teaching
- Failure to anticipate discharge
- Lack of coordination between postpartum and NICU regarding maternal education and discharge plans
- Language barriers
- Equipment barriers (No loaner pump policy)
- No lactation follow up plans/lack of contact/referral information

Measurement. Regular review of policies, procedures and competencies will assist in focusing attention toward areas for possible improvement (See Appendices: K.

- An education checklist, to be initialed by the mother with each intervention and signed by the discharge nurse, provides a means to audit implementation (Appendix J).
- Continuous appraisal of a written multidisciplinary collaborative plan.
- An educational quiz for NICU staff (Appendices P and Q)
- What are the policies regarding pumping provisions for the under-insured mother?
- What follow-up services are in place for mothers after discharge (Appendix N)?

Tools:

- Establishing Lactation in the Mother of the Preterm Infant: A Care Plan for the first 100 Hours (Appendix M)
- Maternal Discharge Check List (Appendix N)
- Rush Mothers' Milk Club Diary (Appendix O)
- Staff Questionnaire and Staff Questionnaire Answers (Appendix P & Q)
- Video: A Premie Needs His Mother, First Steps to Breastfeeding Your Premature Baby & Published Reviews and Awards (Appendix E)

Nutritional Support of the VLBW Infant References

1

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