

RDs IN Practice

Optimizing the Nutrition Journey for the < 1500 Gram Infant



A Steadfast Nutrition Journey



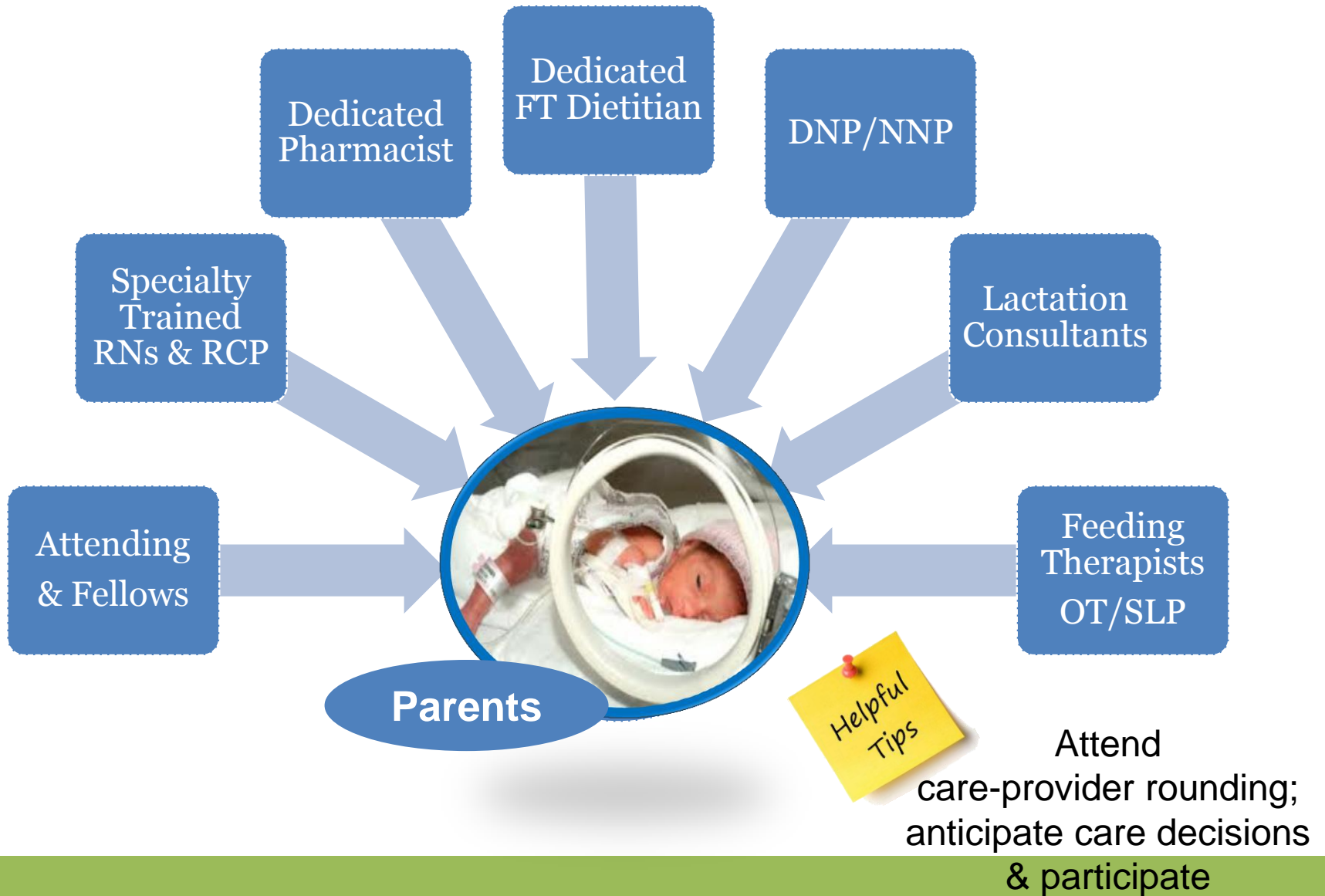
Objectives



1. Review current nutrition support practices identifying key elements of support- “The Journey.”
2. Review the science of human milk feedings in premature infants.
3. Identify strategies to assist pump dependent mothers reach and sustain target milk volumes.

No conflict of interest exists for this presentation

Team Effort



Our United GOALS

Mitigate Risks of....

Intraventricular Hemorrhage

Feeding Intolerance =
Interrupted nutrition support

Chronic Lung Disease =
Growth restriction/High energy needs

Developmental Delays =
Poor PO feeding
→ Need for PEG

Osteopenia =
Metabolic Bone Disease



Infection =
Interrupted nutrition support

Anemia =
Need for PRBCs

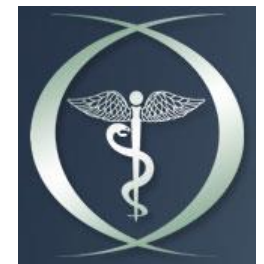
Retinopathy

NEC =
Interruption in support w/
potential for high morbidities

Finding the Evidence to Influence our Practice.....



1. AAP
2. ESPGHAN
3. CPQCC
4. VON
5. Best Practice/Conferences
6. Academy of Breastfeeding Medicine
7. Team collaboration
8. Research
9. Institutional goals
10. Industry drivers



Potential Best Practices

Nutritional Support of the Very Low Birth Weight Infant



Quality Improvement Toolkit California Perinatal Quality Care Collaborative

(rev 2008)

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CPQCC Toolkit Rev. 2008

Section 2: Parenteral Nutrition

- **Best Practice # 2.1:**
Parenteral amino acids within the first 24 hrs

Parenteral nutrition, including protein and lipids, should be started within the first 24 hours of life.

Parenteral nutrition should be increased rapidly so infants receive adequate amino acids (3.0-4.0 g/kg/d) and non-protein calories (80-100 kcal/kg/d) as quickly as possible.

Nutrition Care Map



A Strong Beginning



Δ NICU Feeding Guideline/Schedule A
Birth Weight ≥ 750 grams

Date	Line/Day	Weight (kg)	ml/kg/day	#Feeds	ml Fed/Q3
	1	X	10	- 8	=
	2	X	10	- 8	=
	3	X	10	- 8	=
	4	X	10	- 8	=
	5	X	10	- 8	=
	6	X	20	- 8	=
	7	X	30	- 8	=
	8	X	40	- 8	=
	9	X	50	- 8	=
	10	X	60	22cal #	=
	11	X	70 Intake both over 1 hr	- 8	=
	12	X	80	24cal #	=
	13	X	90	- 8	=
	14	X	100	- 8	=
	15	X	110 Remove Central Line	- 8	=
	16	X	120	- 8	=
	17	X	130	- 8	=
	18	X	140	- 8	=
	19	X	150	- 8	=

- * Use birth weight for first two weeks of life, then daily weight
- # Update CUBS orders to reflect increased calories
- Δ Recommend changing caffeine to oral route
- Ideally, feedings are initiated with breast milk (maternal or banked)
- Cautiously start feedings in infants with: hypotension, thrombocytopenia, hypovolemia, PHH
- Feeding advance occurs with ongoing assessment and clinical judgment
- Feeding volume should be increased in CUBS by night shift unless contraindicated
- Round up/down feeding volume to the nearest 10ml
- 1 vial of HMF to 50ml breast milk = 22cal oz, 1 vial to 25ml = 24cal oz

CHOC Children's
1201 W. La Veta Avenue
Orange, CA 92668
998454 (Rev. 4/2013)

Na ⁺	Cl ⁻	BUN	glucose
K ⁺	HCO ₃ ⁻	creatinine	

Minerals/Lytes:

- Adjust Na- serum Na may ↓ due to losses/diuretics-
- Correct hypophosphatemia
- Monitor for acidosis

RTBW by DOL 14

Growth: 15-20 gms/kg/day

- Advance fluids
- Advance feedings
- Taper TPN when HMF added
- D/C line at ~110-120 ml/kg/d
- Combined Caloric Goal 100-120/kg/d as early as feasible



Target Goal MBM 16-24oz/d

- Promote daily skin to skin
- Ensure HG Pump
- Pump 8-10x/d
- Identify lactation issues early



The RD involvement in TPN Orders



- Adjust additives in “baby steps”
- Calculate GIR frequently
- Incrementally advance Ca^{++} and Phos to ensure adequacy
- Embrace IV Lipids
- Consider tapering when HMF is added or at 80 ml/kg/d volumes
- Minimize lab draws: Anticipate direction of nutrition support & what requires monitoring
- Be another set of “eyes” police for potential errors

Nutrition Care Map

Enteral Nutrition

- Permissive underfeeding when PICC line removed
- Total enteral fluid volume to support growth: 150-170 ml/kg/d
- Nutrition goal**: 120-130 Cal/kg/d & 4.0-4.2 gm protein/kg/d
- Trend nutrition related labs q 2 wks (less if stable)
- Begin vitamin & Iron after TPN supplementation based on HMF (Fe total 2-4 mg/kg/d)

**ELBW infants may need up to 150 Cal/kg/d & 4.4 g Pro/kg/d



My Mama Pumps for Me

- **Cheerleading**
- Teach the science of lactation...

Milk = Medicine

- Skin to skin
- Non-nutritive → nutritive BF
- Anticipate return to work hurdles
- IBCLC
- SLP & OT



Nutrition Care Map

Enteral Nutrition

- Adjust feeding volume for growth 2-3x/week
- Target (Infants <2.0 kg)
Weight gain 15-20 gms/kg/d
OFC ~ 0.9 cm/wk
- Assess need for electrolyte supplementation based on labs and diuretic use
- Adjust iron dose for weight gain
- **Custom fortification of MBM:**
- Nutrition goal: 120-130 Cal/kg/d & 4.0-4.2 gm protein/kg/d



Oral Feedings

- Lead by developmental therapists and nursing staff
- Score infant's developmental readiness
- Monitor growth with progressive oral feedings
- Anticipate D/C care plan



A Set up for Success

What is your breast milk I.Q.?



Teaching the Science...

Human Milk is a uniquely designed,
dynamic & bioactive human food



Stages...

Colostrum

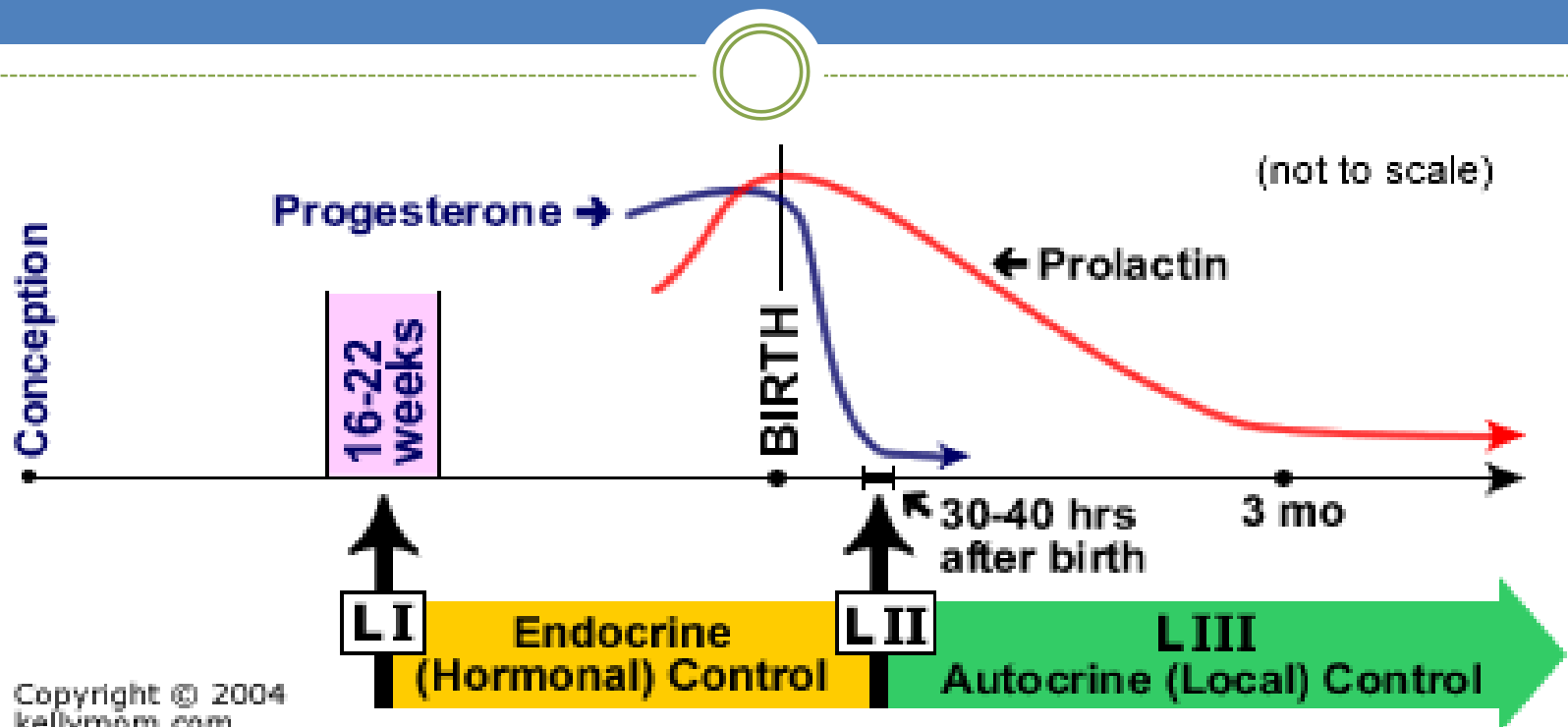
Transitional

500-600 ml/d
by DOL 4-7

Mature

A healthy term
breastfeeding infant
removes approximately
15 mL of colostrum in
10 breastfeedings
during the first 24 hours
after birth

The Physiology & Practicalities of Milk Supply...



Un-removed milk allows for feedback inhibitor of lactation (FIL)
Down-regulation of milk supply (can permanently affect milk volume)

LI-III- Stages of Lactogenesis; LII is anecdotally referred to as “milk coming in”.

Lactogenesis II **SUCKING** **HUNGER**

High Suck Need

Baby Goal:

Clean out meconium

Mother's Goal:

Prolactin Receptor Sites

Sucking

Milk Volume

For mothers of preterm infants, sucking is replaced by breast pump stimulation & milk removal

Low Milk Volume

Baby born full (meconium)
Prolactin levels ↓ over time

Milk Volume

Sucking



The First Critical Exposure Period: Colostrum



- Transition from intrauterine to extrauterine nutrition
- Produced by mom at 14-16 wks gestation
- More like amniotic fluid in composition and bioactivity than human milk
- Open paracellular pathways in the infant's gut permit entry of large antibodies from the colostrum to promote **growth, maturation & protection** of the epithelial cells.



- Ensure First pump = First feeding/swab
- Utilize **fresh** colostrum for oral swabbing for immune properties whenever possible

The Importance of Hands

Dr. Jane Morton

*J Hum Lact
2012 28: 276*



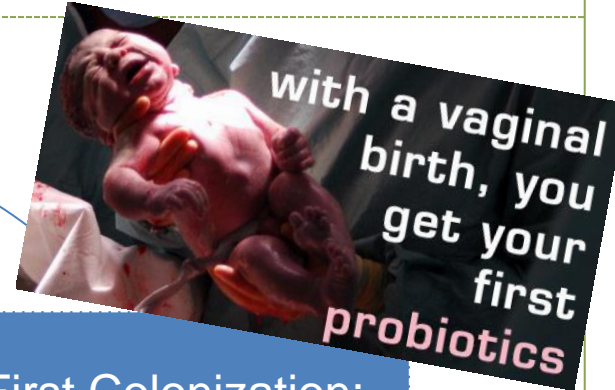
- Although breast pumps are a critical tool in lactation management for many mothers, I would favor more selectivity in recommending pumps and consistently offering instruction on the value of combining pumping with manual techniques (hand expression of colostrum and hands-on pumping of mature milk).

~ Dr. J Morton

Reference: <http://newborns.stanford.edu/Breastfeeding/HandExpression.html>
<http://newborns.stanford.edu/Breastfeeding/MaxProduction.html>

Neonatal Intestinal Microbiota is highly variable in its composition & depends on factors related to:

Birth & Gestational Age:
Infant leaves sterile environment



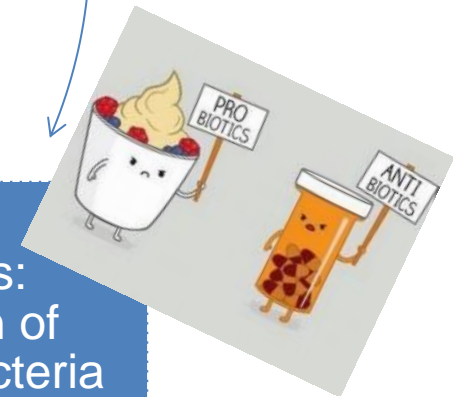
First Colonization:
Vaginal/C-Section Delivery

Establish Healthy Bacterial Colonization

Introduction of breast milk (Pro & prebiotics) or formula feedings



Antibiotics:
Destruction of beneficial bacteria



Medical therapies including Surgery

Harmful Bacteria

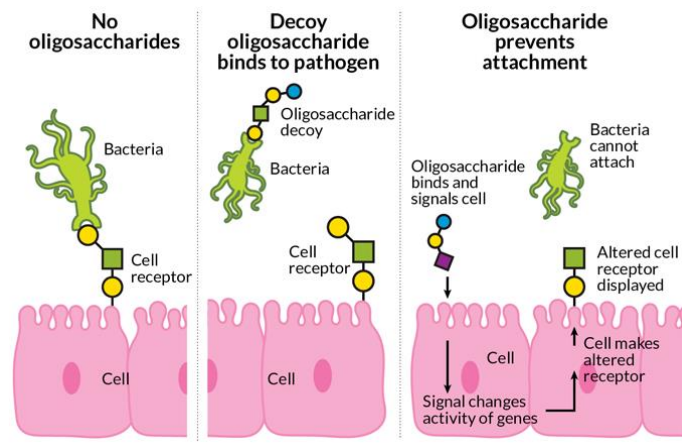
Inflammation

Second Critical Exposure Period



HM Oligosaccharides (HMOS) serve as “food”

- 15-13 grams/L (24 grams/L- colostrum)
- Non-nutritive biofactors
- Pass through the small bowel into the colon undigested
- Fermented by Bifidobacterium & Lactobacillus
- Decoys to prevent attachment of pathogens
 - Excreted in stool



HMOS protect the gut and ↓ risk of inflammation-based mortalities



Commensal Bacteria

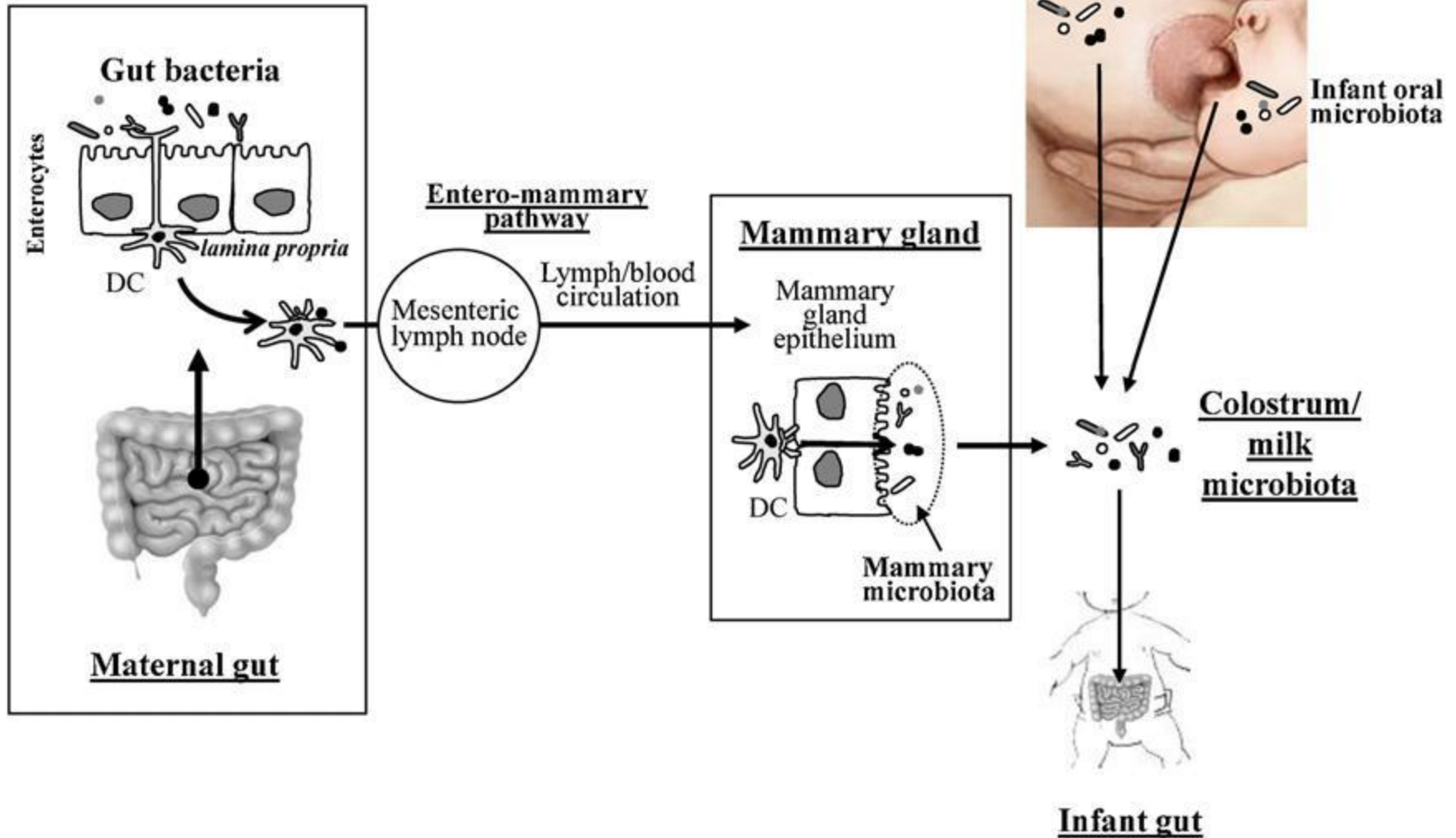
- Anti-inflammatory
- Protect gut epithelial border (bifido bilayer)

Pathogenic Bacteria

- Increase intestinal permeability
- Up-regulate Inflammation
 - Associated with NEC, CLD, ROP
- Infant formula ↑ intestinal permeability
 - Undigested cow's milk casein attracts neutrophils which separate junctions

Human Milk provides Probiotics

Bacteria from maternal gut translocate to the breast via enteromammary pathway



Fortification: We need to be mindful of.....

Safety & accuracy of preparation

Feeding Intolerance

Infection Prevention

Anemia

Osmolality & renal solute load

Over-under Nutrition



Necrotizing Enterocolitis (NEC) w/potential for bowel injury & surgery

Electrolyte imbalance

Osteopenia-Metabolic Bone Disease

Human milk Fortifiers (Cow Milk Based)

- Designed to mix well with expressed human milk
- 4 packets/vials added to 100 ml of EBM yields 24 cal/oz
- Provides needed minerals- calcium, phos, zinc, Na
- Provides additional vitamins
- Provides additional protein- Liquid hydrolyzed protein vs. intact whey protein
- Some are iron & DHA fortified
- Available in liquid and powder



Prolacta® Bioscience (Human Milk Based)

- Prolact+ H²MF® is the first and only commercially available human milk fortifier made from concentrated 100% human milk.
- These formulations are fortified with essential minerals and offer protein delivery up to 3.7/100mL of fortified milk¹ and 24 to 30 Cal/fl oz.

* Nutritional values are based on the assumption that mother's own milk provides 1.4g of protein per 100mL and 20 Cal/fl oz (Abbott)

Prolact+4®



Reference: <http://www.prolacta.com/human-milk-fortifier/>

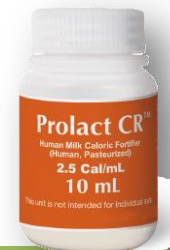
Custom Fortification...What to use???



- Increase volume whenever possible
- Maternal hind milk if available

Tools of Our Trade.....

- Premature formula: 30cal/oz liquid concentrate
 - Mixed ratios w/HM
- Post Discharge formula powder-
EnfaCare/NeoSure/Nourish
- Carbohydrate and/or fat modulars
- Protein- Liquid hydrolyzed protein vs. intact whey protein
- Prolacta products...



Insufficient or Absent Maternal Milk



Considerations for Practice...



Donor Breast Milk

J. Perinat. Med. 38 (2010) 347–351



Recommendations regarding the use of donor human milk in the feeding of preterm infants.

- Growing clinical evidence has placed human milk (HM) feeding as a basic right for preterm infants.
- Mother's own milk is the first choice in preterm infant feeding and strong efforts should be made to promote lactation.
- When mother's milk is not available, fortified donor human milk is the recommended alternative for this group of infants.
- Concerns regarding the nutritional and immunological quality of donor milk and slow growth of preterm infants fed HM should not be a barrier to its use.





Donor Breast Milk

J. Perinat. Med. 38 (2010) 347–351



- Optimization of donor HM processing (particularly pasteurization) and of fortification are required.
- Recent developments in pasteurization techniques appear to retain the bioactivity of human milk, and individualized fortification of HM provides improved protein intakes and growth.
- Thus, implementation of these techniques in human milk banks and utilization of individualized fortification are recommended.
- Donor milk banking should be protected, promoted, and supported as an extension of national breastfeeding policies.

Human Milk Banking

O'Hare, et.al. Neonatal Network 2013,32:175-183

TABLE 1 ■ Breast Milk Components Present After Freezing and Pasteurization^{12,17}

Immunoglobulin IgA and sIgA	60–100% present	Prevent passage of microbes by binding to them in the GI tract
IgG	66–70% present	Creates antibodies against pathogens the mother has been exposed to
Lactoferrin	27–43% present	Assists in binding to iron and retarding bacterial growth
Lysozyme	70% present	Destroys bacterial cell walls
Monoglycerides/ free fatty acids	100% present	Disrupt the membranes of viruses
Linoleic acid/alpha- linoleic acid	100% present	Essential fatty acids that act as precursors for prostaglandins and leukotrienes
Docosahexaenoic acid	100% present	Necessary for eye and brain development in infants

So what can we do for our Pump Dependent Moms



- Maternal self care basics
- Team messaging & encouragement
- Identify & try to remove obstacles
- Increase time with baby at the breast
- Empathize

"I Have Faith in My Milk": The Meaning of Milk for Mothers of Very Low Birth Weight Infants Hospitalized in NICU

Rossmann, et. Al. *J Hum Lact* 2013 29: 359



Table 2. Themes for Faith in the Healing Properties of My Milk

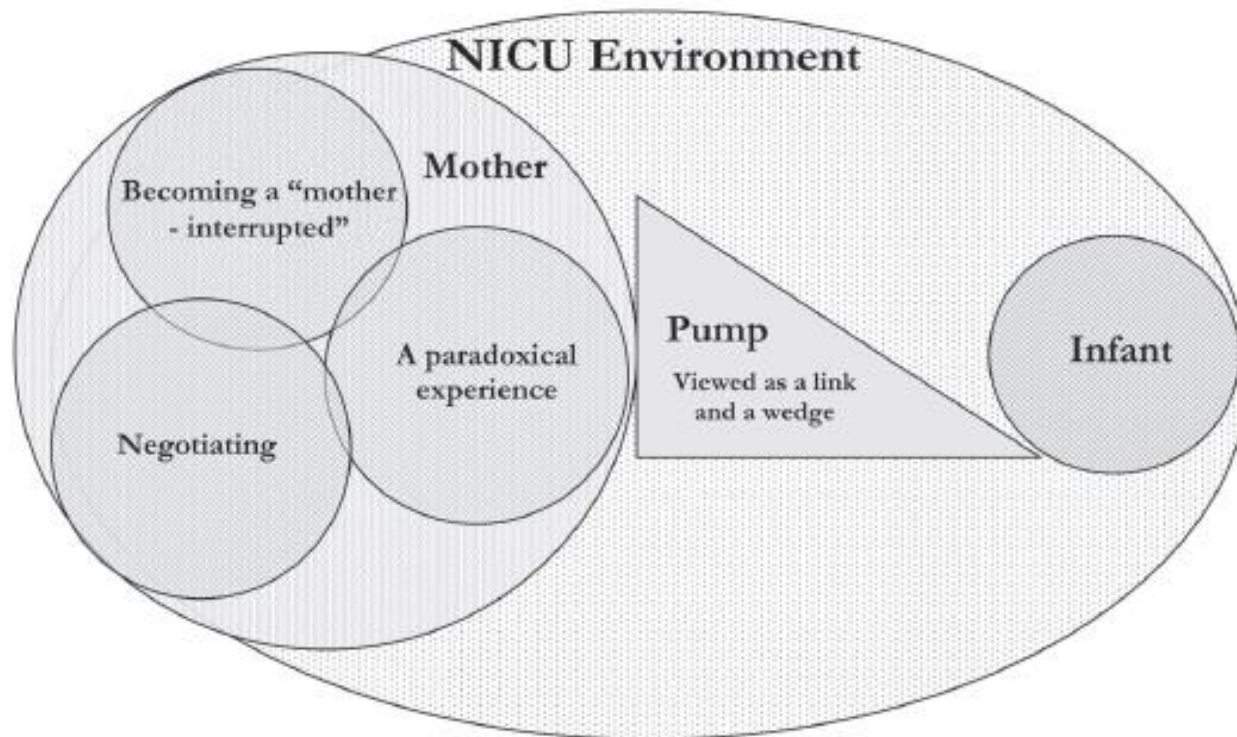
Theme	Subtheme
The healing properties of milk related to the infant	The healing power of milk Mitigating complications The paradox of providing milk and pumping
The healing properties of milk related to the mother	The maternal healing process Bonding/connecting through the ritual of providing milk Rewards and motivation

Providing Mother's Own Milk in the Context of the NICU: A Paradoxical Experience

Hurst, et.al. *J Hum Lact* 2013 29: 366



Figure 1. Conceptual Framework of Providing Mother's Own Milk in the Neonatal Intensive Care Unit



The Galactagogue Bandwagon

Anderson, P J Hum Lact 2013 29: 7



- Galactagogues should be used only after all modifiable factors that affect milk production have been addressed.
- Herbals and foods used as galactagogues have little or no scientific evidence of efficacy, which does not mean they are all ineffective, but they may be serving as placebos in many cases.
- Based on the minimal literature available, **domperidone** likely has galactagogue activity at a dosage of 10 mg 3 times daily for 7-14 days, although the population that will benefit is poorly defined.
- Starting dosage should not exceed 30 mg/d higher dosages and longer durations of administration have not been scientifically demonstrated to be safe or more effective, nor has increasing the dosage in nonresponders been shown to be more effective than 30 mg/d.

The Galactagogue Bandwagon

Anderson, P J Hum Lact 2013 29: 7



- **Domperidone.** High dosages, concurrent use of some common drugs, and preexisting cardiac disease may increase the risk, so mothers should be warned of possible cardiac side effects.
- **Domperidone** is not likely to be commercially available in the United States in the near future, if ever, and potential safety hazards are associated with purchasing drugs on the Internet.
- **Metoclopramide (Reglan)** might have efficacy similar to that of domperidone, but maternal depression and tardive dyskinesia are concerns with prolonged use. Metoclopramide also results in greater infant drug exposure and risk of side effects than domperidone.



Efficacy of Herbal Galactagogues

Mortel, M & Mehta, S J Hum Lact 2013 29: 154



- PubMed was searched from inception to October 2012. Only experimental studies with objective outcome measures were included. Six trials met our search criteria.
- Shatavari, torbangun, fenugreek, milk thistle, and a Japanese herbal medication were the 5 herbal preparations studied.
- Five trials found an increase in breast milk production. Several limitations exist that affect the validity of the trial results, including small sample size, insufficient randomization methods, poorly defined eligibility criteria, use of poly-herbal interventions, and variable breastfeeding practices among enrolled subjects
- Given the insufficiency of evidence from these trials, **no recommendation is made for the use of herbs as galactagogues.** Well-designed and well-conducted clinical trials that address the above limitations are necessary to generate a body of evidence as a basis for recommendations regarding herbal galactagogues.



BREASTFEEDING MEDICINE
Volume 6, Number 1, 2011
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DOI: 10.1089/bfm.2011.9998

ABM Protocol

ABM Clinical Protocol #9: Use of Galactagogues in Initiating or Augmenting the Rate of Maternal Milk Secretion (First Revision January 2011)



The Academy of Breastfeeding Medicine Protocol Committee



Upcoming Best Practice...



**PROMOTE A CULTURE OF
EXCLUSIVE HUMAN MILK FEEDINGS WITH
DEVELOPMENTALLY
APPROPRIATE MILESTONES
TOWARDS ORAL FEEDINGS OF BREAST MILK
MITIGATING RISK OF AVERSIONS
AND OTHER
CO-MORBIDITIES OF
PREMATURITY.**

NICQ Next- Optimizing Nutrition & Decreasing NEC

Nutrition workgroup from the VON Collaborative



PBP 1. Increase the dose of human milk (HM; milk from the infant's own mother) received by the infant during the first 28 days post-birth, using donor human milk (DHM) as a supplement until HM is available.

PBP 2. Develop feeding guidelines that include early intense parenteral (PN) and enteral nutrition (EN) strategies and that address advancement to full enteral nutrition and maintenance of growth.

PBP 3. Integrate knowledge about the variability in HM composition into routine nutritional practice in the NICU.

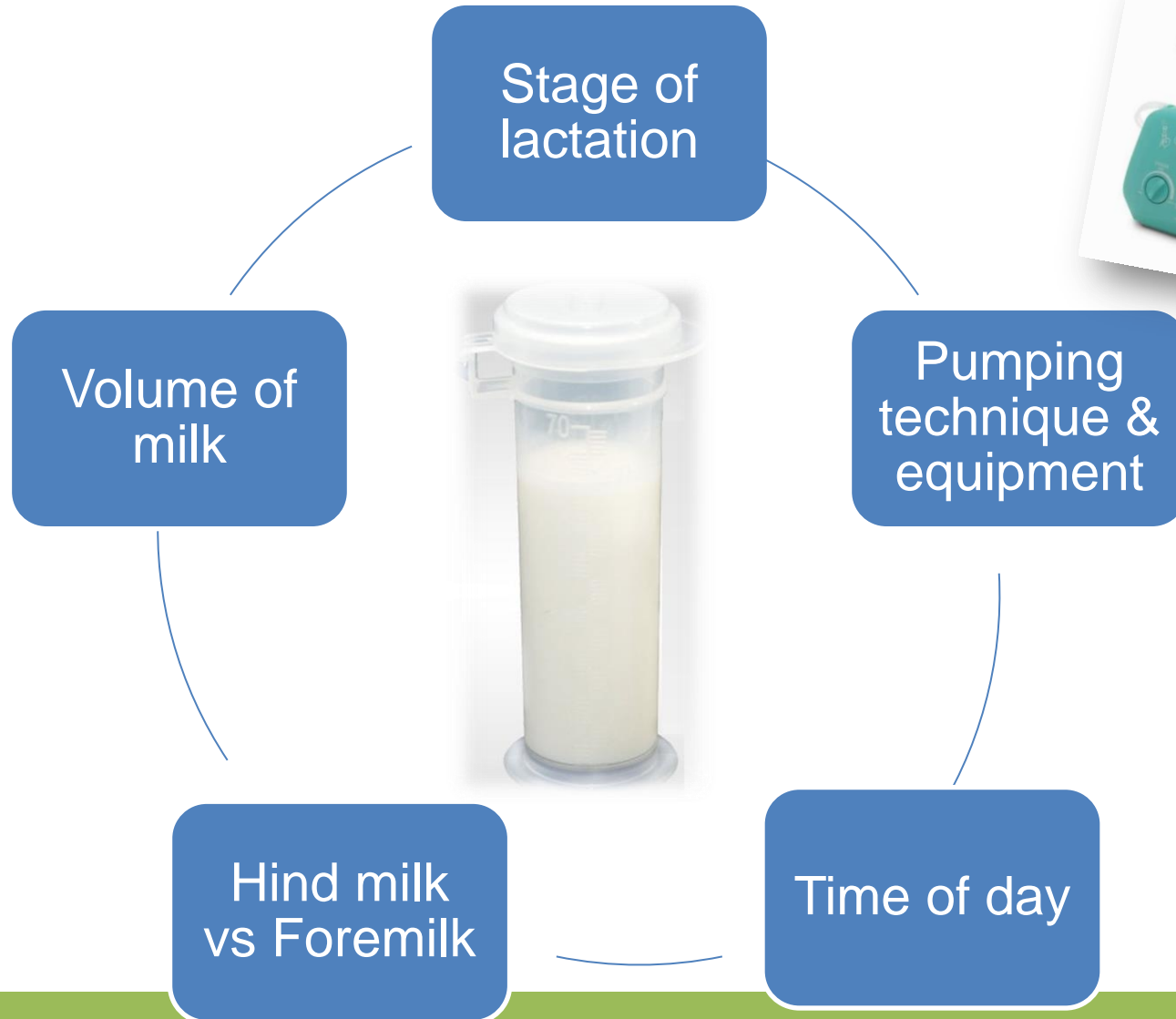
PBP 4. Limit use of medications that facilitate the development of NEC

PBP 5. Initiate an “approved” probiotic that contains at least 2 organisms (Lactobacillus and Bifidobacteria) on day of life 1 and continue until about 36 weeks PMA.



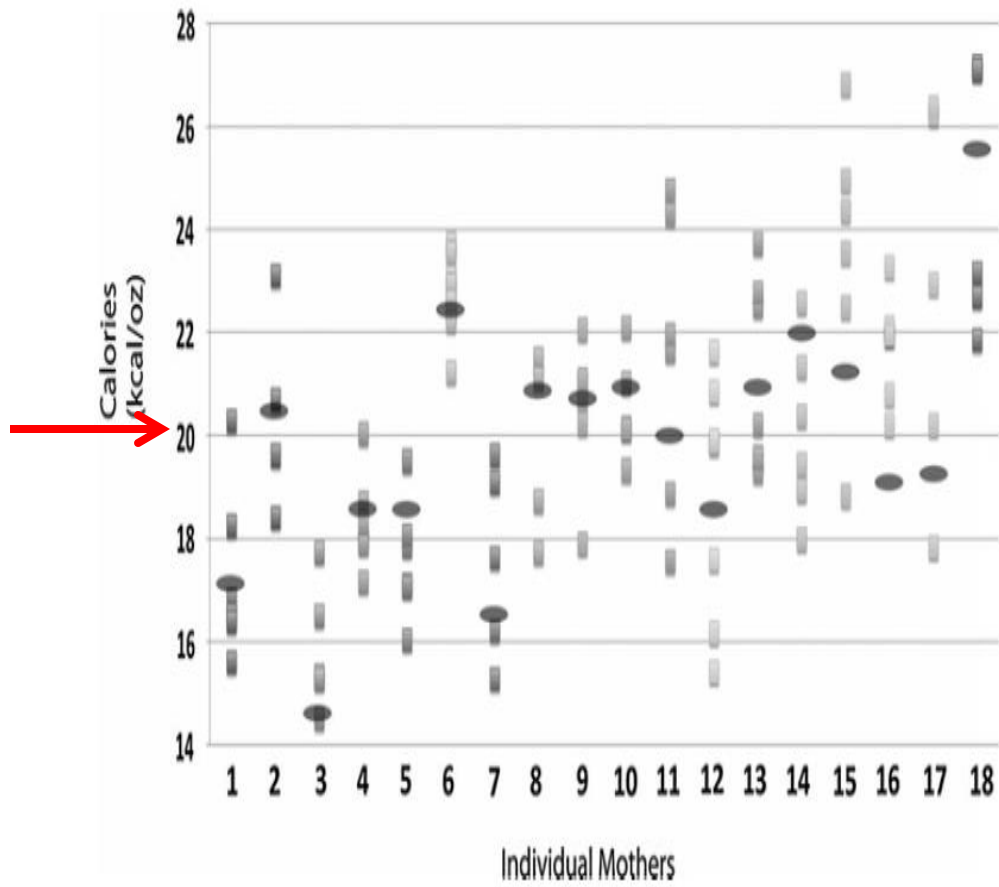
PBP= Potential Best Practice

Expressed Human Milk: Variability in Composition





POOLING EXPRESSED BREASTMILK



Ellipses=
pooled
milk



Squares=
individual
pumps

FIG. 1. Caloric content of 18 mothers' individual and pooled milk collections. A single set for each mother is shown. The pooled and individual collections are represented by ellipses and squares, respectively.

Target Fortification of Breast Milk with Fat, Protein, and Carbohydrates for Preterm Infants

Niels Rochow, MD, Gerhard Fusch, PhD, Arum Choi, HBSc, Lorraine Chessell, BSc,
LouAnn Elliott, RN, Kimberley McDonald, RN, IBCLC, Elizabeth Kuiper, RN, IBCLC, Margaret Purcha, RN,
Steve Turner, MSc, Emily Chan, HBHSc, Meng Yang Xia, and Christoph Fusch, MD, PhD, FRCPC

Human Milk Analyzer Study IRB #130320



Pump & collect milk for 24 hours.
We suggest Sunday.

Refrigerate milk-
DO NOT FREEZE

Bring your milk to CHOC the next day

Our nutrition lab will POOL & analyze a sample and freeze the rest of the milk

The results will be given to your medical team

Nutrition plan changed as needed & medical team updated on the plan of care



“Footsteps for the Future” include:



- Antenatal consultation for milk expression to begin in the delivery room/post partum recovery.
- Exclusive human milk exposure for critical periods of life- ideal birth to 28 days
- Human milk analysis for improved custom fortification and optimal growth.
- Human milk “Scent Cloths” for positive sensory input.
- Human milk “tastes” in developmental treatment.

Resources

Suggested clinicians to follow in the literature

Adamkin, D

Anderson, Diane

Ehrenkranz, R

Groh-Wargo, Sharon

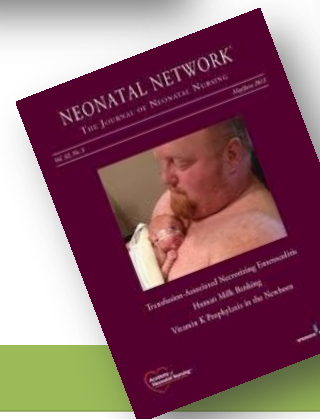
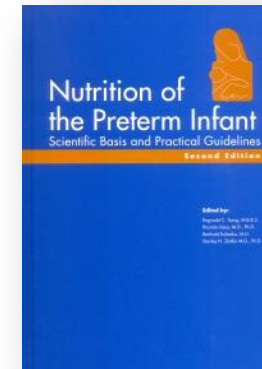
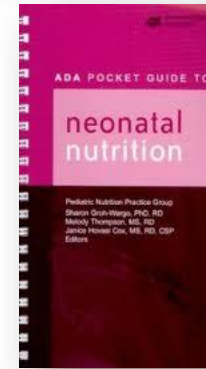
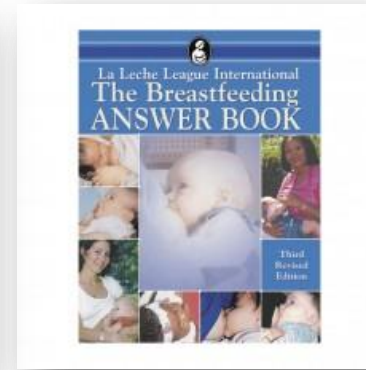
Kim, Jae

Meier, P

Schanler, R

Valentine, C

Zeigler, E





Breastfeeding, it's as good as it gets!

**Thank you for your attention.
Questions?**