Basics of Breastfeeding Support for the NICU or PICU Dyad

Lecture Notes

IABLE
Institute for the Advancement of Breastfeeding & Lactation Education

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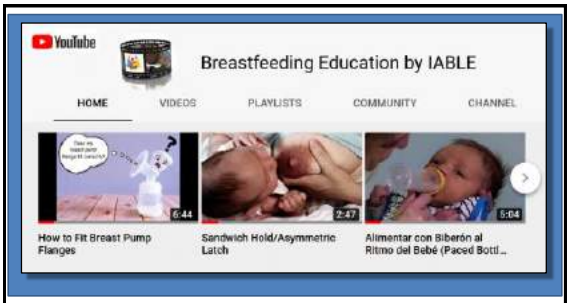
What is The Institute for the Advancement of Breastfeeding and Lactation Education (IABLE)?

- Non-profit 501c3 membership organization of breastfeeding medicine and lactation educators
- Mission
  - Create breastfeeding-knowledgeable health care institutions and community support systems in the outpatient sector
    - Provide a safety net for families, reduce risks, increase rates
- Provision of evidence-based educational resources
  - Breastfeeding medicine for physicians and other providers
  - Lactation education for allied health professionals
  - Educational tools for families- handouts, videos

www.lacted.org

Clinical Questions/LactFacts

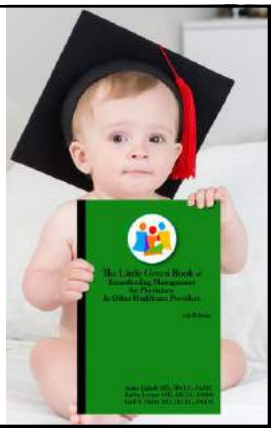
A biweekly blog highlighting recent important policies, research, consensus statements
Lacted.org/questions/



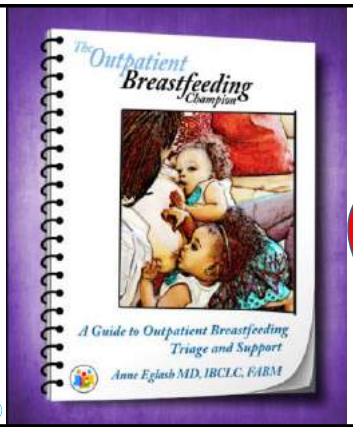
FREE

The IABLE Breastfeeding Medicine Podcast

The Little Green Book of Breastfeeding Management For Physicians and other Providers
7th Edition 2020
Pocket-sized



Need Help with Triage and Patient Education?
Train Your Team!!
Outpatient Breastfeeding Champion Course



The Outpatient Breastfeeding Champion Guide is Available for Anyone

Perfect for your nurse or medical assistant!

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- Image collection

Mother's Own Milk: What is it and why does it matter?

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IABLE Building Breastfeeding-Knowledgeable Medical Systems & Communities

Objectives

- Review professional recommendations for breastfeeding
- Identify special properties of human milk
- Describe the risks of not breastfeeding for the mother and infant
- Identify the risk of just 1 bottle
- Explain health benefits of mother's own milk for premature infants
- Describe the differences between pasteurized donor and MOM
- Describe relative contraindications and special considerations for breastfeeding

World Health Organization, American Academy of Family Physicians	• Exclusive bfeeding until 6 mo • Add solids at 6 mo • Nurse at least until 2 yrs
American Academy of Pediatrics	• Exclusive bfeeding until about 6 mo • Add solids at around 6 mo • Continue for at least 1 year or as long as desired
American College of Obstetrics and Gynecology	• Exclusive bfeeding for 6 mo • Continue for 1 year or longer

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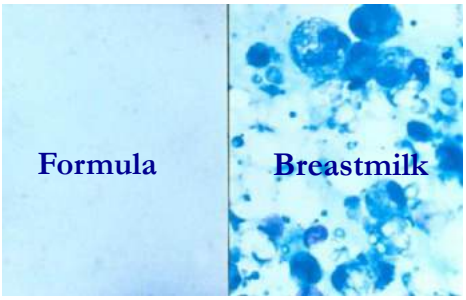
What's In the Milk?

Under the Microscope



4000 cells/cubic mm

Human Milk

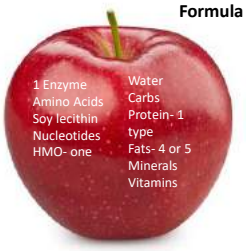
PLUS:

Hormones
Antibodies
Active white cells
Enzymes
Anti-viral proteins
Antibacterial agents

++Oligosaccharides
Anti-allergy factors
Carotenoids
Protaglandins
Cytokines
Peptides
Etc!!!

Comparing Breastmilk and Formula = Comparing Apples and Oranges

Formula



Stages of Human Milk

- Colostrum- More trophic than nutritional: rich in secretory IgA, lactoferrin, leukocytes, and developmental factors such as epidermal growth factor, low levels of lactose. Higher Na, Cl, Mg, lower K and Ca. High in anti-oxidants e.g. Beta carotene
- Transitional milk- from day 5 to 2 weeks, gradual decline in protein as it transitions to mature milk, lower in carotenoids, increase in water, lactose, fat
- Mature milk- after 2-3 weeks, reaches a steady state of protein, fat, lactose, bioactive factors, enzymes, antioxidants, etc.
  - After 1 year, decrease in water and carbs, higher in protein and fat
- Preterm milk- higher in protein during the first month as compared to term milk

Maternal Risks of Less Breastfeeding

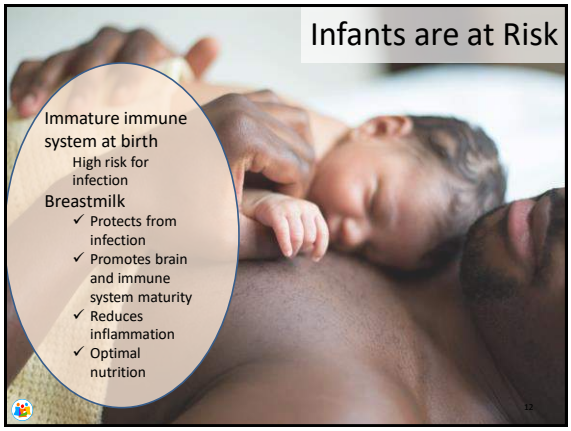
% protection by exclusive breastfeeding

- Postpartum bleeding
- Child spacing (lactation amenorrhea)
- Post partum depression
- Breast cancer ↓ 22%
  - ↓ 6 % for every 12 months
- Ovarian cancer ↓ 30%
- Metabolic syndrome
- Type 2 diabetes ↓ 47%
- Cardiovascular disease

AAP 2012, *Lancet* 2016
AJOG 2013, *JAMA Int Med* 2018

Breastfeeding Reduces Risk of Vascular Disease and Abd Fat

- Menopause transition increases abdominal obesity
  - Increased abd fat increases risk of insulin resistance
    - Increased insulin resistance => increased risk of HBP, CVA, MI
- Breastfeeding found to:
  - Lower risk of visceral fat in a dose-related manner (Asian Nurs Res 2020 Aug;14(3))
  - Lower risk of CVA in a dose-response relationship (J Am Heart Assoc 2018;7)
  - Lower risk of postmenopausal HBP (Breastfeeding Med 2018 Nov 13(9))
  - Lower risk of perimenopausal metabolic syndrome in a dose- related manner (Nutrients 2020, 12, 2691)



Short Term Risks of Less Breastfeeding for Children
% protection by exclusive breastfeeding

- Infection ↓ 50%
  - Hospital admission ↓ 70%
- NEC ↓ 58%
- SIDS ↓ 73%
- Vaccine response

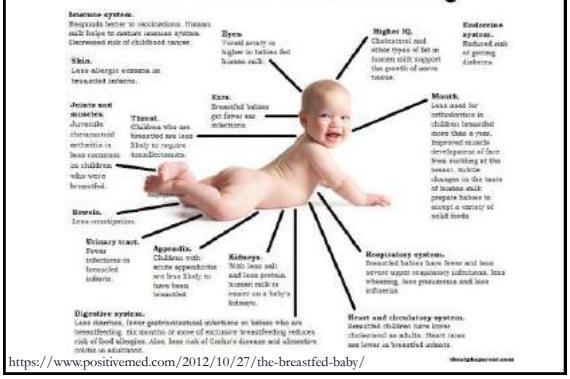
Lancet Victora January 30, 2016

Long Term Risks of Less Breastfeeding for Children
% protection by exclusive breastfeeding

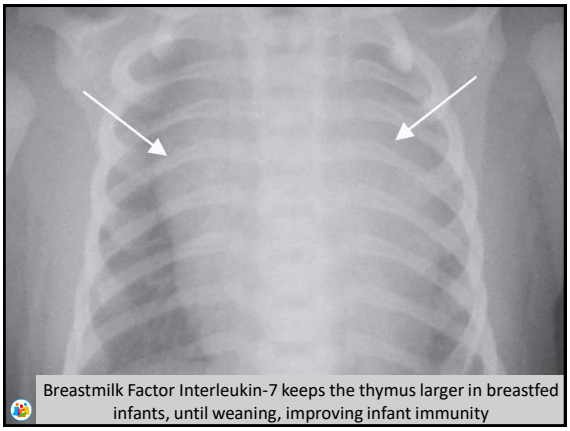
- Malignancy (ALL) ↓ 50%
- Child Abuse ↓ 62%
- Dental malocclusion
- Metabolic
  - Obesity ↓ 26%
  - DM ↓ 30%
    - Type I ↓ 50%
- Cognition (IQ) ↑ 3-4

Lancet Victora January 30, 2016

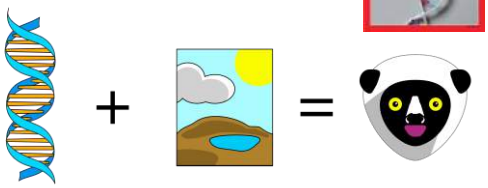
The Breastfed Baby



https://www.positivemed.com/2012/10/27/the-breastfed-baby/



Epigenetics



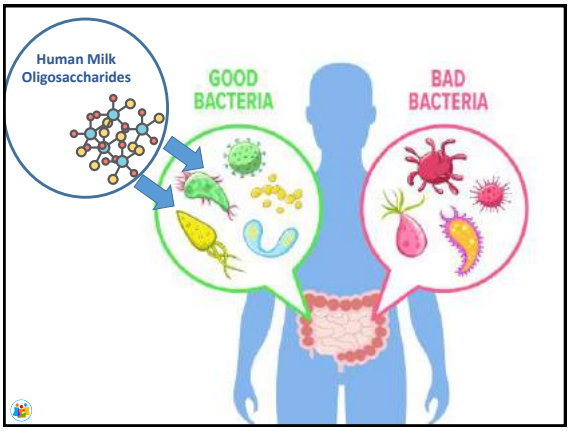
Genotype + Environment = Phenotype

Obesity in Adolescents

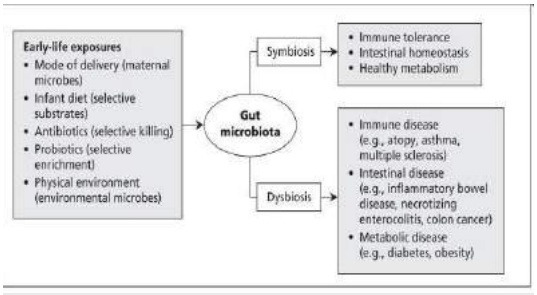
- Breastfeeding prevents obesity genes from turning on
- **Personalized medicine**

Health imprinting for life!

Diabetes Care 2010 Jan; 33(1): 190-196



Development of the Human Microbiome



CMAJ 185,5 (2013)

Just one bottle; the push for exclusive breastfeeding.

Is it really that big of a deal?

After just one formula bottle…

Formula exposure changes the gut microbiome, leading to microbial imbalance (dysbiosis), impaired innate immunity and aberrant development of tolerance.

**** Changes occur within 24 hours and can take weeks to change back. ****

Courtesy Dana Silver

Andersson, et al. J Immunol. 2009 Oct 1;183(7):4322-8

Risk of Early Supplementation with Cows Milk Protein Formula

Risk of cows milk allergy higher when supplemented with cows milk based formula in the first 3 days, and then exclusively bfed

- 1.75x risk of CMA- (Meta-analysis Brit J Midwifery 20(5) 2012)
- 7x increased risk of CMA- study of 55 CMA children (Pediatr Allergy Immunol 2019 July)
- Higher risk of CMA among bfed infants if given cow milk based formula in the first 3 days vs hydrolyzed formula- Japan, 312 infants – (JAMA Pediatrics Oct 2019)

Health impact of breastfeeding for the United States

Changing from rates of... ...to rates of	Initiation 82.5 90	Exclusive in hospital 69.7 90	3 mo exclusive 46.6 90	6 mo exclusive 24.9 90	6 mo any 56.3 90	12 mo any 33.7 90

would prevent...

Medical Costs
$2,405,023,438
($1,507,415,042 to $3,435,992,657)

Non Medical Costs
$1,093,681,596
($890,235,488 to $1,330,166,686)

Death Costs
$10,798,725,299
($1,158,363,092 to $21,568,947,064)

Maternal deaths
2,057
(-788, 5,271)

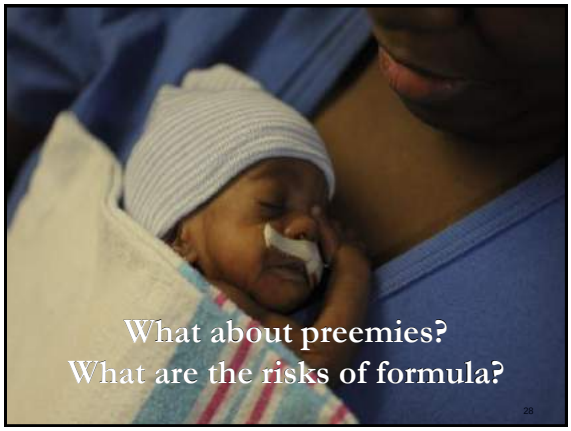
Child deaths
543
(-9, 1,161)

Usbreastfeeding.org

Conclusions

"Human breastmilk is therefore not only a perfectly adapted nutritional supply for the infant, but probably the most specific personalized medicine that he or she is likely to receive, given at a time when gene expression is being fine-tuned for life. This is an opportunity for health imprinting that should not be missed."

Cesar Victora, The Lancet, vol 387, Jan 2016



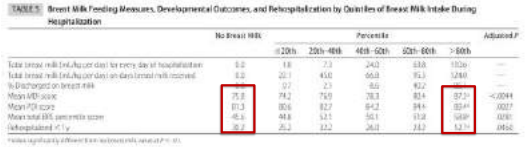
For Preemies, Formula Increases…

- Necrotizing enterocolitis (O'Shea 2007)
  - >half of feeds as formula = 6x risk of NEC
- Retinopathy of Prematurity (Collins, 2018)
  - Exclusive HM = 7.6% less risk ROP
- Sepsis (Patel, 2013)
  - ~20% less risk LOS for every 10cc/kg/d HM

Food for Thought

For every 10cc/kg/d MOM vs formula:

- Rehospitalization decreases 6%
- Neurodevelopment increases by ~0.5 pt



(Vohr, 2006)

Does the Colostrum Matter?

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Benefit of Colostrum for Preterm

Image source: Lee, 2015

- Higher secretory IgA in preterm colostrum (Araujo, 2005)
- Higher urinary lactoferrin and urinary and serum sIgA (non statistically significant)
- Protective effect for sepsis
- Shorter time to reach full enteral diet
- Higher mean weight at 36 weeks of life
- Better breastfeeding rates at hospital discharge

Demetra; 2018; 13(2); 463-476

Does Donor Human Milk Have the Same Benefits?

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Pasteurized Donor Human Milk
Human Milk Banking Association of North America

- Member banks distributed 6.5 million ounces in 2018
- 74% increase in number of maternity hospitals providing donor milk from 2011 to 2015 (Perrin, 2018)

US Level 3 NICU DHM Use in 2015

US Level 4 NICU DHM Use in 2015

(Perrin, 2018)

Benefits of Donor HM (vs Formula)

- Half the risk of NEC ! (Quigley, 2019)
  - NNT = 33
- May help prevent BPD (Villamor-Martinez, 2018)
- May improve long-term cardiovascular risk factors (Singhal, 2001 and 2004)

Benefits of Mother's Own Milk (vs Donor)

- Decreased sepsis (1% vs 9%) (Schanler, 2005)
  - 29% vs 44% pathogens isolated
- Decreased BPD (Patel, 2019)
  - 10% decrease in BPD for every 10% increase in MOM
- Increased growth (de Halleux, 2019)

MOM is Far Superior to Donor Milk

Outcomes	Donor Milk (N=110)	Mother's Own Milk (N=68)	P value
Z-score for Weight at Discharge, Mean (SD)	-1.30 (0.98)	-0.88 (1.76)	0.06
ROP Requiring Treatment	22 (21%)	7 (10%)	0.075
Cognitive BSID Score	81.8 (11.2)	86.7 (11.2)	**0.023**
Language BSID Score	76.4 (13.7)	82.4 (16.1)	**0.041**
Motor BSID Score	79.9 (14.9)	83.5 (11.6)	0.17

- Donor milk is associated with:
  - Five point decrease in Bayley (BSID) cognition score
  - Six point decrease in language
  - Trend toward worsened growth and ROP

(Jordan-Crowe, 2020)

Why is Donor Human Milk Different than Mothers' Own Milk?

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Banked Pasteurized Donor Milk

- Pasteurization Process
  - Holder method: 62.5°C for 5 min then rapid cooling
  - Destroys heat-labile microorganisms
  - Reduces hormones, growth factors, immunoglobulins, milk lipase (de Halleux, 2019) DHA and HMOs

Sterilized Donor Milk

- Sterilized (shelf-stable) donor milk
  - Retort processing: 121°C for 5 min at 15lbs/in^2 above atm
  - Destroys all microorganisms (including spores)
  - Reduced nutrients: thymine and lysine (Lima, 2017)
  - Reduced Bioactive components: lysozyme and sIgA (Meredith-Dennis, 2018)
  - Reduced Protein and human milk oligosaccharides (HMO) (Meredith-Dennis, 2018)

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Comparison of Infants Fed DHM

- Babies fed pasteurized DHM had improved weight change and head circumference.
- Trend toward decreased BPD

Outcomes	Pasteurized DHM (n=19)	Sterilized DHM (n=40)	p-value
Change in Weight Z-score from Birth to Discharge	-0.78 (0.8)	-1.29 (0.58)	0.01
Change in HC/Week (cm)	0.8 (0.09)	0.72 (0.12)	0.04
Oxygen at 28 days	14 (74%)	37 (93%)	0.097
Severe ROP	2 (11%)	7 (18%)	0.70
Poor Intestinal Outcome	0	2 (5%)	>0.99
Sepsis (CNS)	2 (11%)	5 (13%)	>0.99

Z-score change 0.8-1.2 = mild malnutrition
1.2-2 = moderate
>2 = severe

Mean (SD) for continuous variables.
Number (%) for counts.

(Jordan-Crowe, 2020)

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Conclusions for Preemies

- Donor human milk should be used to supplement any baby less than 1500g because it halves the rate of NEC
- **Mother's Own Milk** provides protection against sepsis, BPD, ROP, growth failure, and neurodevelopmental impairment that donor milk may lack, especially sterilized shelf-stable products

Racial Disparities

- Fewer black women are providing MOM (not Donor Human Milk) at time of discharge
- In US, black women give birth to VLBW infants 2.6 x more than non-Hispanic white women
- **This is despite a goal to continue providing MOM after discharge**

Table 1

Cohort characteristics by racial/ethnic subgroups

Characteristic n(%) or M(SD)	Cohort (N=415)	White/Asian (n=90)	Black (n=212)	Hispanic (n=113)
MOM Provision				
Ever provided MOM	405 (97.6%)	89 (98.9%)	204 (96.2%)	112 (99.1%)
MOM feeding at NICU discharge	130 (32.8%)	38 (42.2%)	49 (23.1%)	48 (43.4%)

(Patel, 2019)

Mediators of Racial Disparity

If we support black mothers in pumping just 1.17 more times per day we would increase likelihood baby is still receiving breastmilk at discharge by 40% and eliminate its contribution to racial disparities in the poor neurodevelopmental outcomes of our VLBW babies.

Table 3

Mediation Analyses

Race/Ethnicity Mediator	Race/Ethnicity → Candidate mediator		Candidate mediator → MOM Feeding at NICU Discharge		Indirect Effect	
	b	95% CI	b	95% CI	b	95% CI
White						
Maternal Age	3.06	1.61 : 4.54	0.04	0.02 : 0.06	0.13	0.06 : 0.23
Low SES	−1.35	−1.70 : −1.01	−0.51	−0.65 : −0.34	0.68	0.44 : 0.96
Mean daily pumping frequency	1.17	0.87 : 1.48	0.34	0.25 : 0.42	0.40	0.26 : 0.57

(Patel, 2019)

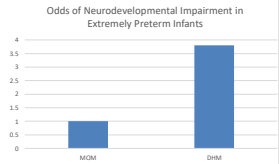
Improving Outcomes by Addressing Disparities

Best fit logistic regression model of neurodevelopmental impairment in extremely preterm infants

Risk Factor	Parameter Estimate	Odds Ratio (95% CI)	P value
Donor Milk	0.66 (0.25)	**3.8 (1.4-10.1)**	**0.0086**
Poverty	0.17 (0.26)	1.4 (0.5-4.0)	0.51
Multiples	0.30 (0.28)	1.8 (0.6-5.4)	0.28

Neurodevelopmental Impairment: Bayley Scales of Infant and Toddler Development Cognitive Score < 85.

Infants fed donor HM almost 4x as likely to have neurodevelopmental impairment, *controlling for SES*



How?

"These findings indicate that evidence-based lactation care should be **concentrated in the first two weeks postpartum** for mothers of VLBW infants with a **primary focus on frequency of pumping and the MOM volume target** ≥500mL/day. Given the complexity of pumping in mothers of VLBW infants, specific strategies and **close monitoring are required**. **Intensive communication in the first 2 weeks** may be our best intervention. **Daily maternal follow-up** of breastfeeding by peer counselors, lactation consultants, or nursing in-person or via phone **to monitor changes in pumped MOM volume, actual (not theoretical) pumping frequency, and practical challenges** such as nipple discomfort that affect pumping can provide real-time advice and targeted support."

(Patel, 2019)

Peer Counselors

- RCT showed NICU moms w/ peer counselling almost 3 times as likely to be providing milk 12 weeks out
- Effect even stronger in African American moms

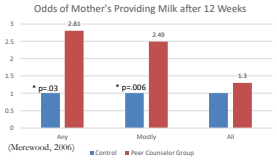


Table 3. Odds of African American Mothers Giving Different Amounts of Breast Milk at Each Observation Point at 12 Weeks' Follow-up

Breast Milk Category	Control Group (n = 29)	Intervention Group, OR (95% CI) (n = 30)	P Value
Any	1.00	3.53 (1.16-11.03)	.03
Mostly	1.00	1.94 (0.54-5.86)	.24
All	1.00	0.23 (0.02-2.26)	.21

Abbreviations: CI, confidence interval; OR, odds ratio.

What Maternal or Infant Conditions Preclude Mothers' Own Milk Use?

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Infant Illnesses Requiring More Evaluation Before Providing Human Milk

- Galactosemia type 1- cannot breastfeed
- Other metabolic illnesses infants can receive a partial human milk diet, e.g.
  - PKU
  - Maple syrup urine disease

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Maternal Relative Contraindications to Breastfeeding/Providing MOM

- HIV/HTLV I
- Ebola Virus
- Brucellosis
- Herpes simplex or zoster (shingles) on nipple/breast
  - Keep covered, pump and dump until lesions dry up
- A few meds, mainly chemotherapy
- Substance Use

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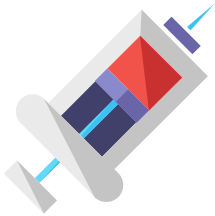
Contraindications to Feeding at Breast Expressed Breast Milk OK

- Untreated, active tuberculosis
  - May feed at the breast after 2 weeks of treatment
- Active Varicella 5 days prior or 2 days following delivery
  - May resume once no longer infectious

CDC.gov

Vaccinations Contraindicated During Lactation

- Small pox
- Yellow fever



All others are OK!

Conclusions

- Fewer Black women and some groups of Latina women are providing MOM at discharge
  - Due in part to age, SES, and pumping frequency
- Receiving DHM instead of MOM puts these VLBW infants at 4x risk of neurodevelopmental impairment
- Resources like peer counselors can improve MOM rates
- Most maternal and infant conditions are compatible with mom's milk

Lactation Basics for the Neonatal and Pediatric Intensive Care Units

IABLE
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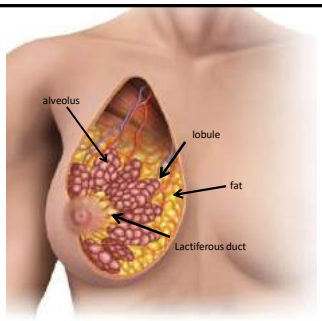
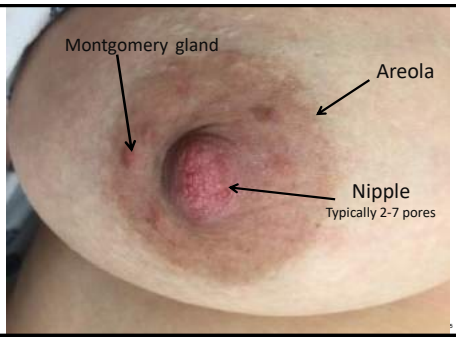
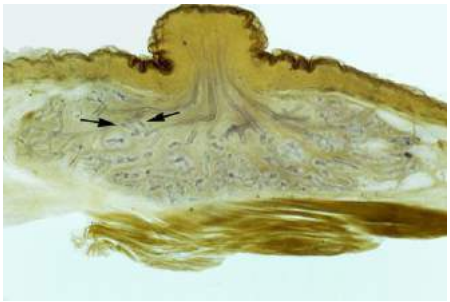
IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

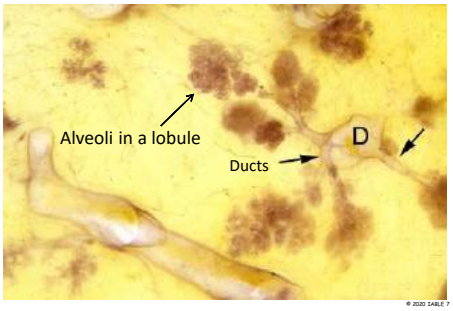
Objectives

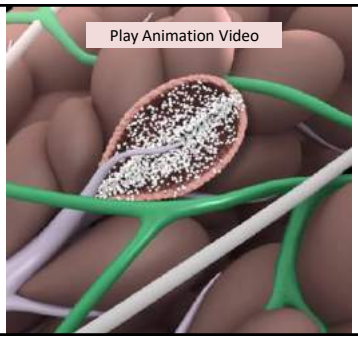
- Describe breast anatomy and hormones of milk production and release.
- Identify maternal risk factors for insufficient milk production.
- Explain the physiologic process of secretory activation.
- Describe key factors in the establishment and maintenance of milk production.

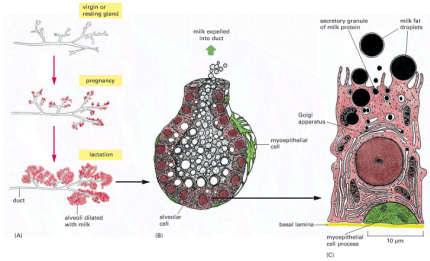






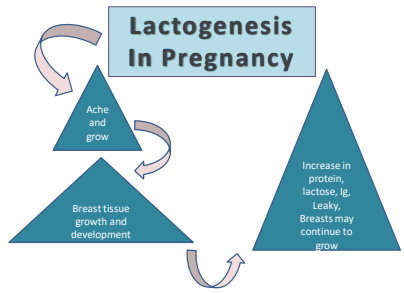




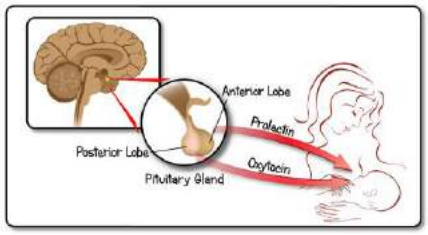


Hormones Affecting Breast Growth

- Thyroid hormone
- Estrogen
- Progesterone
- Parathyroid hormone related protein
- Insulin
- Human Placental Lactogen
- Insulin-like Growth Factor
- Prolactin
- Fibroblast Growth Factor
- Growth Hormone



Placenta is delivered → Placental hormones diminish → Pituitary & Breast tissue seize control



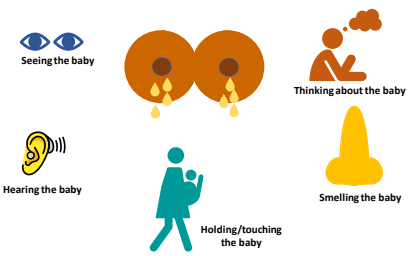
Prolactin

- Released from anterior pituitary
- Stimulates breasts to produce milk
- Requires **nipple stimulation**
- Prolactin level ≠ Amount of milk

Oxytocin

- Released by posterior pituitary
- Stimulates milk ejection
- Several let-downs occur during a nursing session
- Tingly/tight sensation

The Multiple Triggers of Milk Letdown by Oxytocin

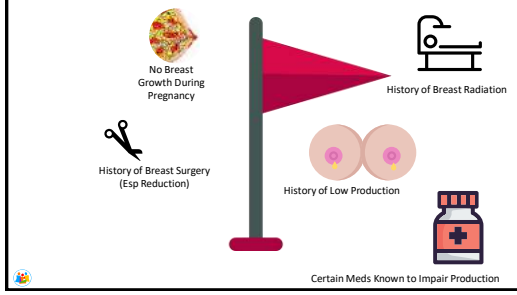


Premature Birth Introduces Challenges to Lactation

Most lactating parents have the ability to make sufficient milk
= 600ml-1000ml/day

- Premature birth increases risk of low production due to
  - Insufficient hormone responses
    - Stress, not feeding directly at the breast
  - Lack of time to pump at optimal rates
  - Possible lack of full breast growth
  - Multiple births (needing higher volumes)

Red Flags for Low Production Problems

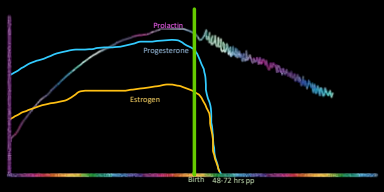


Prolactin Remains Elevated

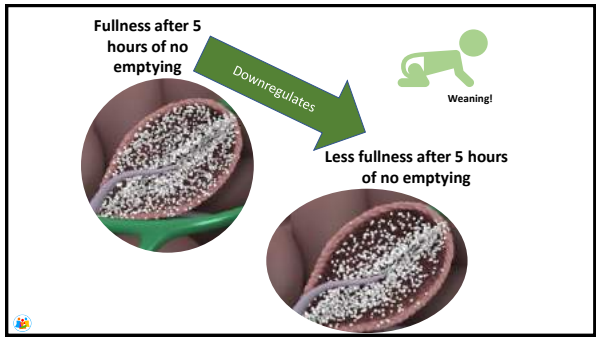
2 Principles with Establishing and Maintaining Lactation

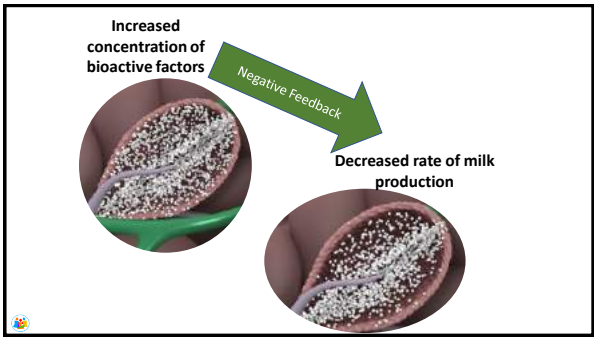
Breast is Emptied Often

Prolactin Levels are Highest During Pregnancy and Lactation



Lactation Depends on Drop in Estrogen/Progesterone and Sustained Elevated Prolactin Over Time





Galactagogues

- Occasionally medications that increase the prolactin level are helpful
  - Domperidone- not available in the USA
    - Has the most data to support its use for premies
  - Metoclopramide- can cause neurologic side effects
- Herbal galactogogues
  - At least 30 different herbs can increase the supply
  - Variable response to them
  - Do not take the place of frequent and effective milk expression

Why Might Some Galactogogues Work?

- Many galactogogues improve insulin resistance
- Diabetes in pregnancy is a known risk factor for low milk production
  Riddle SW, Mommsen-Rivers LA Breastfeeding Med 11(2) 2016
- Mammary gland tissue is very sensitive to Insulin-like Growth Factors I and II during pregnancy, and after delivery becomes very sensitive to insulin during lactation.
  Berlato C, Doppler W. Endocrinology 2009;150

Plant-Based Galactogogues that Decrease Blood Sugar/Improve Insulin Sensitivity

- Black Seed
- Fenugreek
- Fennel
- Shatavari
- Goats rue
- Milk Thistle (Silymarin)
- Turmeric
- Ginger
- Dill
- Garlic
- Coriander
- Cumin
- Alfalfa

Common Foods Believed to Increase Supply Based on Culture, Little Research

- Herbs and Spices
  - Garlic, ginger, basil, onions, caraway, anise, coriander, dill, cumin
- Hops
- Chamomile, marshmallow
- Green Leafy Vegetables and sprouts
- Grains- oats, quinoa, barley, rice
- Nuts and nut butters
- Brewers yeast

Mother-food.com

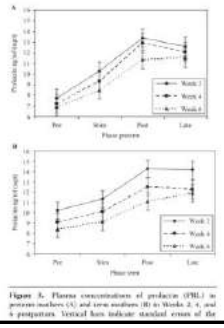
Considerations in Galactogogue Use

- Parents with high milk production will have a greater response
- Studies on galactogogues do not typically include women with low production
- No 'one-size fits all'
  - People respond differently to different herbs
- Research is generally low quality. Best evidence is cultural experience
- No data on how long to take herbs for effectiveness

Lactating Parents with Premies at Risk for Lower PRL levels and Lower Milk Production

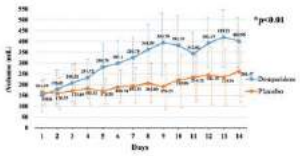
Biol Res for Nursing 10(4) April 2009 340-349

Baseline and Late PRL Levels Lower in Preterm Group
Milk production also lower in Preterm Group



Domperidone Use for Mothers with Premature Infants

- Randomized controlled trial- 47/166 women of premies in a Thai NICU were unable to increase milk volume with routine management
  - 24/47 in treatment group- domperidone 20mg 3x/day
  - 23/47 in placebo group



Breastfeeding Med J Nov 17th 2020

Change in Prolactin Levels with Domperidone

TABLE 2. PROLACTIN HORMONE LEVELS.

	Prolactin level, ng/mL		
Day of treatment	Domperidone (N = 20)	Placebo (N = 21)	p
0	72.85 (22.2–167.15)	42.33 (14.02–93.54)	0.348[a]
7	223.4 (49.75–280.2)	60.08 (14.31–132.14)	0.015a
p	0.008[b]	0.212[c]	

95% of the mothers in the treatment group were providing exclusively human milk at discharge
vs
52% of the mothers in the placebo group

Breastfeeding Med J Nov 17th 2020

Conclusions

- Milk producing tissue develops in the breasts during pregnancy.
- Milk production begins after the delivery of the placenta.
- Prolactin and oxytocin are the major hormones of lactation.
- Establishment and maintenance of lactation rely on frequent nursing/pumping to keep the prolactin level elevated and to empty the breasts as often as possible.
- Mothers of premature infants are at risk for lower prolactin levels.
- Galactogogues have a varied effect on lactation. They do not take the place of freq and effective milk expression.

Lactation Basics for the Neonatal and Pediatric Intensive Care Units
The Immediate Postpartum Period

IABLE
Institute for the Advancement of Breastfeeding & Lactation Education

- The Instructor and members of the planning committee have no conflicts of interest to disclose
- CMEs for providers, continuing education recognition points (CERPs) for IBCLE, or CPEUs for registered dietitians, are awarded commensurate with participation and complete/submission of the evaluation form.

IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

Topic Overview

- Talking with mothers about providing breast milk to premature or sick infants using scripting
- Initiating milk expression immediately after birth
- Oral Immune Therapy
- Delayed Lactogenesis
- Engorgement
- Breast massage and Nipple Stimulation
- Skin to Skin/Kangaroo Care
- Postpartum Mood Disorder Screening in the NICU/PICU

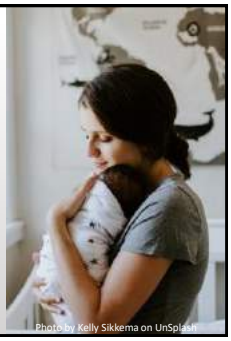


Photo by Kelly Sikkema on UnSplash

Objectives

1. Describe how to counsel the parent of a premature/ill infant on the importance of a human milk diet
2. Identify risks of delay in lactation
3. Explain the importance and technique of oral immune therapy for the preterm infant
4. Recognize key management strategies during engorgement
5. Describe skin to skin and the importance for a premature dyad
6. Discuss screening for Postpartum Depression in NICU/PICU mothers

Talking with Families Who Will Deliver Early, Have Delivered Early, or Those Expecting a High-Risk Baby

5

Talking with Mothers Who Will or Have Delivered Early or Those Anticipating an At-Risk Newborn

1. Importance of deciding to provide milk vs. whether to breastfeed.
"Perhaps you have not been able to think about how you will feed your baby because he/she will be born early, but would you be willing to provide milk for your baby while the baby is in the NICU/PICU? Only you can provide this life saving substance to your baby."

2. Protectiveness and uniqueness of her milk for her baby.
"Colostrum is like a vaccine for your baby, providing protection for your baby. It is so much more than food."
"Your milk is specifically designed for your baby and is constantly changing to meet your baby's needs. It has living cells, immunoglobulins, enzymes, and hormones."

Discuss with Mothers:

3. **Importance of early and frequent milk expression after delivery.**
   "You should express milk as often as a baby would be nursing. You can express your milk by hand immediately following delivery, use a pump within 3 hours of delivery, and you should continue to express at least 8-10 times in a 24 hour period. This would be every 2-3 hours. There should never be more than a 4 hour break from expression."
4. **Realistic goals for milk expression and expectations.**
   "This frequent stimulation is like placing an order for the amount of milk you will need later on. There may not be a lot of volume at times, but over time the volumes will be increased to provide milk for your baby long term."
5. **Any amount of breastmilk is helpful for your baby.**

Scripting

- We encourage all of our mothers who have even a small chance of delivering prematurely to learn about the life-saving importance of breastmilk for small and sick babies. Because there is so much to learn, would you be willing to watch a video at firstdroplets.com?
- When you give birth, we would like to help you collect your babies "first immunization" (your colostrum) in the delivery room, just after your baby is born (mention 1 hour). Just as a healthy baby breastfeeds right after birth, your colostrum can then be taken straight to the NICU for your baby. Once you're back to your room, we'll help you start pumping and recording each session in a diary.

https://med.stanford.edu/newborns/professional-education/breastfeeding/babies-at-risk.html

7 Best Practices by the California Perinatal Quality of Care Collaborative

- Inform the mother of the rational to pump early and pump often.
- Providing equipment, staff and logistics to pump early (within 6 hours of birth), pump often (8 times/24 hours with no more than a 5 hour interval at night.
- Provide a diary/log and begin recording every pumping and hand expression session.
- Teach about manual stimulation: breast massage and hand expression 8 times/day
- Facilitate early colostrum feeds.
- Provide skin-to-skin contact, whenever the mother is with her baby or as soon as the baby is stable enough to be transferred to and from his bed.
- Maternal discharge planning.

https://www.cpqcc.org/resources/nutritional-support-vlbw-infant

Best Practices: at the Beginning

- Initiation and Coming to Volume
  - Start early expression, < 1 hour, with hand and pump
  - Express as often as baby would nurse, > 8 times / 24 hours
  - Pumping every 2-3 hours during the day and no more than 4 hour break overnight
  - Pump approximately 15 min or until milk stops flowing
  - Use a double electric pump
  - Use hands on expression techniques

Best Practices: at the Beginning

- Milk as a vital sign
  - To be tracked and trended
  - Pumping sessions should be visualized regularly

Previous Studies Not Adequately Powered RCTs

180 mothers with infants < 1500g, < 32 weeks

Timing of Milk Expression

N=58 Early
Within 60 Min

N=62 Intermediate
Within 61-180 Min

N=60 Late
Within 181-360 Min

Parker, Sullivan, et al J Perinatology 2020 40: 1236-1245

Outcomes	Initiation			p value*
	Early (n = 52)	Intermediate (n = 61)	Late (n = 55)	
Lactation and MOM consumption				
Onset of secretory activation (hours)	140.5 ± 144.7	94.7 ± 65.0	109.4 ± 98.4	0.08
Days lactated	45.3 ± 31.8	48.7 ± 28.2	48.2 ± 28.3	0.82
Lactating at day 42	52% (27/52)	53% (32/61)	60% (33/55)	0.64
Ceased lactating before infant's discharge	58% (30/52)	48% (29/60)	55% (30/55)	0.60
Percent MOM consumed by infant				
Day 7	71.7 ± 42.1	69.2 ± 43.4	81.9 ± 36.3	0.22
Day 14	65.7 ± 45.3	66.7 ± 44.1	70.2 ± 45.6	0.87
Day 21	55.7 ± 48.5	59.6 ± 48.7	70.2 ± 45.1	0.27
Day 28	57.5 ± 48.0	62.3 ± 46.4	64.3 ± 47.7	0.77
Day 35	51.3 ± 49.0	54.3 ± 48.1	65.6 ± 46.5	0.31
Day 42	51.1 ± 48.9	53.9 ± 49.7	56.0 ± 48.6	0.90

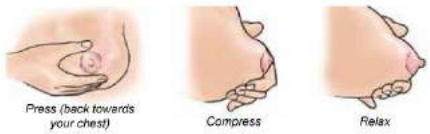
- Mothers who initiated at 181-360 min produced more MOM in the first 3 days and over the first 6 weeks; Overall P values are not significant
- **The late group had 14% more expression sessions vs other groups**
- **Higher # of expressions may be more important than exact timing of first expression if within the first 6 hours**
  - **Frequent expressions keep prolactin up and prevent prolonged fullness**

Milk Expression is Still Recommended in the First Hour After Birth

- Milk is needed immediately for infant
- Expression in the first hour increases # of expressions in the first 24 hours
- Milk expression in the first hour capitalizes on the oxytocin surge from labor and delivery

The Golden Hour of Prolactin and Oxytocin

Hormonal milieu after birth is perfect for expression of colostrum



At no time -ever- is prolactin ("PRO-lactate" – get it!?) higher than in the hour after birth

Manual Expression of the Breast

© IABLE 17

Manual Expression for the NICU/PICU Parent

- The first week postpartum
- Engorgement
- Low milk production
- Before latching to soften areola

Manual Expression Video

© IABLE 18

Milk Expression For the NICU/PICU Parent

Empowerment

The way in which milk expression is discussed can empower mothers to feel how important her milk is for her baby

Control

Gives women a sense of control in a situation that is very much out of her control

Focus

Gives mom something to focus on that provides for her newborn. Makes her feel like she is "mothering" by providing food

Delay in Milk Production vs Low Milk Production

NICU Mothers are at Risk for Both Delay and Low Production

- Delivered early due to high risk pregnancy
  - Pre-eclampsia/eclampsia
    - Magnesium sulfate
- Gestational hypertension
  - Anti-hypertensives
- Gestational diabetes
  - Insulin resistance
- Placental conditions that could lead to PPH
- STRESS

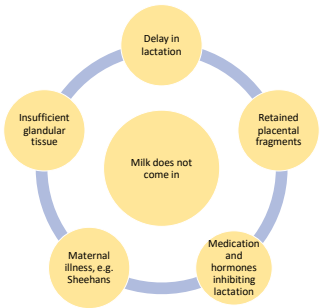
Dx of Delayed Lactation

- Milk is not 'in' by:
  - Day 2-3 for those who've previously lactated
  - Day 2-5 for first baby

- No breast fullness
- No increase in pumping volumes despite optimal pumping technique and pumping 8-10 times per day

Delayed Lactogenesis What to do?

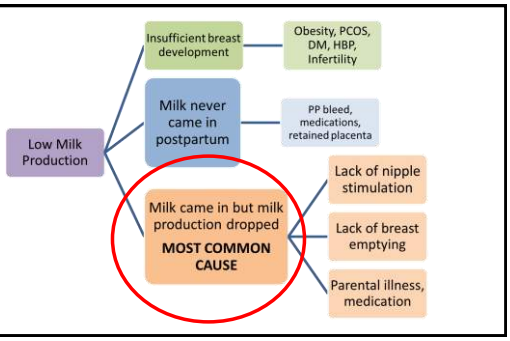
- Pump at least 8-10 times a day
- Optimize pumping technique
- Promote skin to skin
- Daily follow up
- Rule out other causes of low production



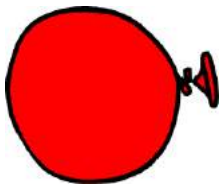
If Minimal/No Milk by 7-8 Days, Refer to a Knowledgeable Physician/Provider

Labs and eval needed for:
- Pituitary function
  - Cortisol, TSH/T3/T4, Prolactin
- Uterus for retained placenta
  - HCG, ultrasound
  - Ask about bleeding
- Other hormone problems
  - Testosterone
- Medication side effects
  - Pseudoephedrine
  - LARC
  - Aripiprazole

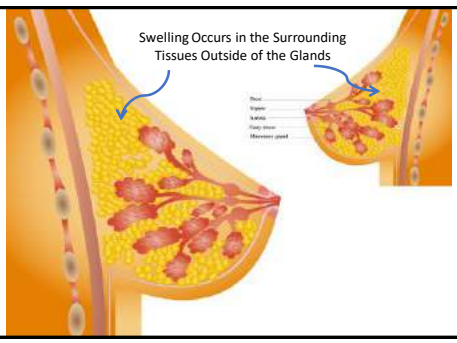
Postpartum Complications Leading to Low Milk Production



Engorgement



- Days 3-5 pp
- Increased blood flow
- Edema (swelling)
- Not the same as 'too much milk'



Effects of Engorgement

- Sore nipples
- Breast discomfort
- Reduction in milk production
  - Monitor for pathologic engorgement

Treatment for Engorgement

- Heat before pumping/nursing
- Lymphatic massage before pumping/nursing
- Express 1-3 tsp of milk to soften areola before nursing/pumping
- Apply cool compresses after pumping/nursing
- Best Treatment is FREQUENT PUMPING/NURSING

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Lymphatic Massage



- Technique
  - Ten small circles above clavicle near neck
  - Ten small circles in axilla
  - Continue with light touch massage from nipple towards clavicle, axilla
  - "Very gentle touch/traction of skin - "like petting a cat"
- Lifts skin so excess fluid/swelling in breast can drain more easily to lymph nodes
- Start during pregnancy if experiencing painful rapid breast growth, and use as needed postpartum for engorgement

Oral Immune Therapy with Colostrum

Decreased risk of neonatal infection

Improves long term immunity for infant

Empowering to parents

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Oral Therapy and Long Term Immunity for Babies

- ✓Moreno-Fernandez , et. al., 2019 - neonates who had received oral therapy with colostrum have more lactoferrin, IgA and IgM
- ✓Gephart and Weller, 2014 found that oral therapy with colostrum stimulates the lymphoid tissue in the **oral** mucosal lining of the mouth
  - ✓ thus causing the release of sIgA, an antibody that plays a crucial role in **immune** function
  - ✓ lactoferrin, a protein of the **immune** system with antimicrobial activity, to promote immunity development.
  - ✓ milk sIgA and saliva sIgA harmonize to prevent adherence of bacteria to the gastrointestinal tract and respiratory tract to promote immunity.

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Oral Therapy

- Exposure to protective biofactors of breastmilk
- Theories:
  - administration may mimic the protective effects of amniotic fluid that is normally swallowed during the last trimester
  - intestinal growth factors may be absorbed mucosally and travel to the gut to accelerate intestinal maturation
  - human milk administration will lead to decreased use of parenteral fluids, ventilator associated pneumonia, central line days, and the duration of hospitalization
  - lead to increased maturation of oral feeding skills and enhance breastfeeding outcomes.
- Proven facts:
  - not harmful, alters oral microbiome
  - more parental empowerment, duration of breastmilk
  - increased urine levels of IgA and lactoferrin, decrease in clinical sepsis

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- Oral therapy should be done around the clock with mother's own milk
- Use 0.1 ml per cheek every 3-6 hours with cares
- Place in sterile tuberculin syringes and apply to the baby's cheek, gums and the inside of their lips

►During kangaroo care, a premature infant is dressed in only a diaper and is placed against a parent's bare chest. Then cover both baby and parent with a blanket.

"I believe that the daily kangarooing was really important because if the milk secretion didn't start properly, but during kangarooing it started to flow."… Niela, et.al, 2015

KANGAROO CARE = SKIN TO SKIN

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Skin-to-Skin Contact

- Increased:
  - Breastfeeding duration
  - Temperature regulation
  - Blood sugar control
  - Maternal affection
  - Decreased Infant crying
  - Important for support persons, too

"Yes, we were able to kangaroo with both babies and they really encouraged us to do it! Both nurses and doctors! It was absolutely wonderful."… Niela, et. al, 2015.

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Benefits of Skin to Skin

For Babies

- IMPROVES
  - Breathing and heart rate
  - Weight gain
  - Infection rates
  - Comfort and pain control
  - Low blood sugar
  - Brain development
  - Mortality rates

For Families

- Improved parenting confidence
- Promotes parental attachment
- Reduced stress
- Reduced maternal depression
- Improved rates of breastfeeding

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Impact of Skin to Skin on Breastfeeding

- Skin to skin contact during kangaroo care triggers the release of oxytocin in mothers
- Mothers produce more milk when pumping just after a kangaroo care session
- Having an infant on the mother's skin and near breast, smelling milk, triggers rooting from the infant. This also increases maternal triggers for milk production

When to do Skin to Skin

- Baby needs to be medically stable per unit protocol
- Many units encourage skin to skin even when baby is ventilated or when they have umbilical lines– needs careful monitoring and assistance with positioning
- Should be encouraged as baby's condition allows
- Skin to skin sessions should last at least an hour (as baby's condition allows)

Tips for Skin to Skin

- Make it part of routine cares
- Plan for SSC when parents can be in the unit – be flexible!
- Consider a handout for parents emphasizing the importance of skin to skin for the baby
- Make sure mom has pumped and has used the restroom
- Adjust the temperature in the room.
- Encourage skin to skin to be special time for parents and their baby – No phones, No TV, just baby time.

How to do Skin to Skin

- Use a comfortable chair that reclines and has arms and has a footstool to prevent thrombophlebitis during the first 6 weeks postpartum. A hospital bed could be used as well.
- Mom should wear a shirt with an open front – many units will use a clean scrub jacket for mom. Mom should be bare chested – bra off.
- Baby should be in a diaper only. Baby should be placed between mother's breasts in a vertical position. Baby can wear a hat and use a warm blanket to cover the infant.
- Consider a mirror for the person providing SSC so they can see their baby's face while he/she is skin to skin.
- Support persons should also be encouraged to hold their babies skin to skin.

Sudden Unexpected Postnatal Collapse (SUPC)

- CDC- Healthy infants born at > 35 weeks, 10 min APGAR >6, who collapse suddenly and unexpectedly within the first postnatal week
- 2.6-19/100,000 live births
  - 36% in the first 2 hours of life
  - 29% between 2-24 hours of life
  - 24% between 24-72 hrs
  - 9% days 4-7
- Associated with
  - Unsafe skin-to-skin practices
    - Airway obstruction
      - Exhausted mother with inadequate supervision
      - Maternal mobile phone use

J Ped 2018;196:104-8 & Early Human Development 126 (2018) 28-31

COMPONENTS OF SAFE POSITIONING FOR THE NEWBORN WHILE SKIN-TO-SKIN

- Infant's face can be seen
- Infant's head is in "sniffing" position
- Infant's nose and mouth are not covered
- Infant's head is turned to one side
- Infant's neck is straight, not bent
- Infant's shoulders and chest face mother
- Infant's legs are flexed
- Infant's back is covered with blankets
- Mother-infant dyad is monitored continuously by staff in the delivery environ and regularly on the postpartum unit
- When mother wants to sleep, infant is placed in bassinet or with another support person who is awake and alert

AAP Pediatrics 138(3) Sept 2016

Postpartum Mood and Anxiety Disorders in the ICU

"My first thought was: I did something wrong, I failed! I felt ashamed and scared." Gonçalves, et al, 2020

"My baby was taken away immediately by the neonatal team. Obviously, words can't actually explain what goes through your head at that time. It's just ridiculous in regards to the shock and the trauma and how upset you actually feel." Fowler, et al, 2019

"There was a point where I had to remove myself from social media and group conversations, because it's very hard looking at people who are living very happy lives, worrying about the smallest things, when your day-to-day involves multiple heel pricks, watching your baby's heart rate drop, one cannula after the next, invasive eye checks. It's a very, very intense traumatic environment. It's very hard to look at everyone else making plans with their life, when you can't even make plans for the next day, really, because you don't know what the next day is going to hold." Fowler, et al, 2019

Mothers of ICU Infants are at Higher Risk for Postpartum Mood and Anxiety Disorders

- Parents are unprepared to see their critically ill newborns. New sights, sounds and medical terminology
- Maternal postpartum recovery following a high risk pregnancy, maternal illness
- Psychological reactions to having their newborns unexpectedly admitted to the ICU
- Mothers can also suffer from loss of the maternal role
- Feelings of helplessness and guilt
- Parents may worry about the survival of their critically ill child
- Deep sadness due to separation from the baby
- Loss of their expected experience of having this baby

Wyatt., Shreffler., & Ciciolla., 2019.

Other Issues That Contribute to PP Mood and Anxiety Disorders

- History of mood and anxiety disorder
- Returning to work sooner than anticipated
- Partner may be working and mother feels isolated and alone
  - Alone in the ICU
    - Lack of support system/group
  - Separated from friends/family
- Pandemic
- Share your thoughts!

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Signs of PP Mood and Anxiety Disorders

- Quiet, reserved
- Excessively worried about the baby
- Don't answer the phone
- Not visiting
- Change in affect, presence
- Not connecting with infant
- Cultural sensitivity is needed when interpreting changes in behaviors
  - Recognize one's own implicit bias

Assess for Postpartum Mood and Anxiety Disorders in the ICU

- Mothers who deliver prematurely or those with a baby who is ill should be assessed for PPD upon discharge from the postpartum unit
- Reassess at 2 weeks postpartum and 2 months
  - Screening with OB
- Plan referral process
  - Social services
  - Primary care provider
  - Other local behavioralist program
  - Community
    - Postpartum International- postpartum.net
    - https://www.acog.org/womens-health/faqs/postpartum-depression
    - National Alliance on Mental Illness- nami.org (free 24/7 support)

ACOG Committee Opinion #757: Screening for Postpartum Depression Obstet Gyn 2018; 132(5)

Table 1. Depression Screening Tools

Screening Tool	Number of Items	Time to Complete (Minutes)	Sensitivity and Specificity	Spanish Available
Edinburgh Postnatal Depression Scale	10	Less than 5	Sensitivity 59–100% Specificity 49–100%	Yes
Postpartum Depression Screening Scale	35	5–10	Sensitivity 91–94% Specificity 72–98%	Yes
Patient Health Questionnaire 9	9	Less than 5	Sensitivity 75% Specificity 90%	Yes
Beck Depression Inventory	21	5–10	Sensitivity 47.6–82% Specificity 88.9–89%	Yes
Beck Depression Inventory-II	21	5–10	Sensitivity 56–57% Specificity 97–100%	Yes
Center for Epidemiologic Studies Depression Scale	20	5–10	Sensitivity 60% Specificity 92%	Yes
Zung Self-rating Depression Scale	20	5–10	Sensitivity 45–88% Specificity 77–88%	No

https://www.acog.org/Womens-Health/Depression-and-Postpartum-Depression

Conclusions

- Use scripting to help guide mothers toward providing breastmilk for her sick or premature infant.
- Express early and often. Consistency is key.
- Oral therapy with colostrum should be done with all cares.
- Mothers of sick or premature babies are at risk for delayed lactogenesis.
- Engorgement should be avoided or managed appropriately if it occurs.
- Skin to skin is amazing and should be done as often as possible.
- Postpartum depression rates are higher for mothers with sick or premature babies. They should be screened, monitored and referred as needed.

Milk Preparation for Feeding

Stephanie Attarian, MD, IBCLC, FABM

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- The Instructor and members of the planning committee have no conflicts of interest to disclose
- CMEs for providers, continuing education recognition points (CERPs) for IBCLE, or CPEUs for registered dietitians, are awarded commensurate with participation and complete/submission of the evaluation form.

IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

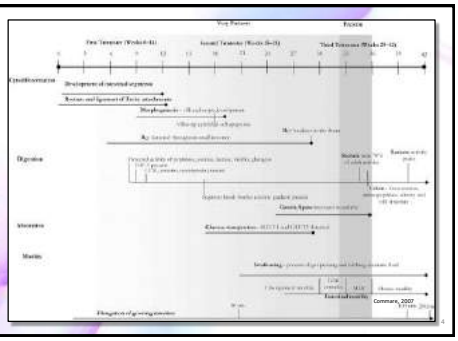
Objectives

1. Explain how fresh mother's own milk is superior to older, frozen expressed milk.
2. Describe how bolus and continuous feedings differ in terms of quality.
3. Describe basic principles of fortifying mother's own milk.

Gut Maturation by Gestational Age

Gut maturation factors:

Nerve GF
Insulin like GF
Insulin
Cortisol
Thyroxine
Nucleotides
Taurine
Glutamine
Lactose
Cytokines



Does Your Unit Emphasize Feeding of Colostrum First?

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Feed Me the Butter!

Table 2. *Influence of maturity on the concentration of anti-infective proteins in colostrum*

Group	Total proteins (g/l)	IgA	IgG	IgM	Lysozyme	Lactoferrin
Preterm						
Mean ± SD	0.41 ± 0.13	310.5 ± 69.8*	7.4 ± 3.9*	39.6 ± 23.1*	1.3 ± 0.5*	165 ± 74.7*
Range (n=25)	0.23–0.74	171.9–481.5	3.4–20.9	14.3–106	0.5–3	52–242
		13.5 ± 5.5†	0.52 ± 0.19†	1.48 ± 1.3†	0.06 ± 0.01†	6.7 ± 1.3†
		6.6–21.9	0.18–0.89	0.44–4.1	0.04–0.09	4.6–9.4
Fullterm						
Mean ± SD	0.31 ± 0.09	198.2 ± 28*	8.4 ± 1*	36.1 ± 16.1*	1.1 ± 0.32*	116.7 ± 23.2*
Range (n=30)	0.2–2.4	100.0–283.3	4.5–10.3	13.6–60	0.89–1.46	77.7–150
		5.2 ± 1.3†	0.26 ± 0.07†	1.22 ± 1.1†	0.34 ± 0.068†	9.1 ± 0.9†
		3.5–7.5	0.16–0.41	0.5–2.8	0.01–0.65	1.9–4
t-test	p<0.001	p<0.001*			p<0.05	p<0.001
		p<0.001†			p<0.001	p<0.001

* mg/g of protein. † g/l of colostrum. Acta Paediatr Scand 79: 1039-1044, 1990

- **Colostrum helps to prime the gut as it has the same factors as amniotic fluid**
- **Fresh milk before frozen milk**

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Nutrient Changes in Freezer

- Decline in lactoferrin by 3 mo
  - Major protein that fights infection
    - J Perinatol 2016 36, 207-209
- Decline in IgA, lysozyme, but not leptin
  - Pediatr Neonatol 2013 Dec; 54(6) 360
- Decrease in vit C and E
- Decrease in fat and total calories over 3 mo
  - Breastfeeding Med 7(4)2-12 p. 295
- Decrease in overall antimicrobial activity
  - JPGN 51(3) Sept 2010 p. 347
- Overall fresh frozen milk has more active properties than pasteurized milk
- Fresh milk has better energy and cell preservation compared to frozen milk

Fresh Milk

- Place fresh, unfortified milk in refrigerator for up to 96 hours
  - No significant changes for osmolality, total and Gram-negative bacterial counts or concentrations of sIgA, lactoferrin, and fat
  - Gram-positive colony counts decreased, pH decreased, WBC decreased, and total protein decreased as storage duration increased
  - FFA concentrations increased
- Fresh milk has more current antibodies

Inpatient Fortification

- Preterm human milk is higher is both protein and energy content
- Use of unfortified human milk alone beyond the second and third weeks in preterm infants may provide insufficient amounts of protein, Ca, Phos, Cu, Zn, and Na
- Mature milk can range from 18-26 kcal/oz
- Fortification criteria: <32-34 weeks gestation at birth and <1500 g at birth
- Modest evidence to support fortification for short term growth but evidence insufficient if any evidence for long term effects on growth and development
- Otherwise healthy preterm infants can tolerate volumes up to 200 ml/kg/day with no increase in adverse outcomes (Travers, JPeds, 2020)
- Per CDC guidelines and due to risk of contamination, fortification should be sterile (not powdered infant formula)

1.5kg 225 mls	Kcals/kg	Protein, g/kg	Carb, g	Fat, gms/kg	Ca, mg	Phos, mg	Mag, mg	Fe, mg	Vit A IU	Na mEq/kg
Term Breast Milk	100	1.60	16.2	8.8	150	63	32	7.9	0.0	506	1.2
EBM+Prolact 4	120	2.85	17.1	10.4	150	277	144	16.2	0.3	839	3.3
EBM+Prolact 6	130	3.60	17.6	11.7	150	277	144	16.2	0.3	821	3.3
EBM+Prolact 8	140	4.35	17.8	12.8	150	277	143	16.2	0.4	801	3.5
EBM+SHMF 22	110	2.80	17.8	8.8	150	180	99	15.8	0.3	1267	1.7
EBM+SHMF 24	120	3.80	19.1	8.9	150	277	155	22.3	0.6	1899	2.0
EBM+Enfamil 22	110	1.50	19.6	8.6	150	63	16	0	0.3	401	0.0

Continuous Feeds Deprive Infants of Calories

Comparison of human milk macronutrient concentrations (mg/L) throughout the studied treatment and offer processes – analysis of associated effects on slowly-thawed and quickly-thawed human milk (ANOVA for repeated measurements).

Treatment and offer processes	Lactose	Fat	Protein
Raw	6.51 ± 0.51	2.17 ± 1.46	1.03 ± 0.39
Post-pasteurization	6.28 ± 0.54	2.05 ± 1.46	0.90 ± 0.42
Slow-thawed-gavage offered	6.33 ± 0.57	1.91 ± 1.21	0.96 ± 0.41
Slow-thawed-continuous infusion offered	6.38 ± 0.56	0.89 ± 0.59	0.50 ± 0.39
Quickly-thawed-gavage offered	6.32 ± 0.54	1.88 ± 1.22	0.94 ± 0.38
Quickly-thawed-continuous infusion offered	6.36 ± 0.56	1.00 ± 0.69	0.80 ± 0.41
F	0.58	26.77	1.90
P	0.629	< 0.001	0.046

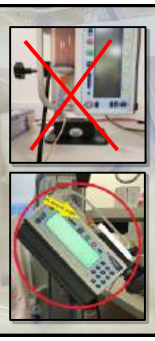
Vieira, 2011

Warming the Milk in the Hospital

- Warming milk leads to less caloric loss
- In preterm infants, feeding intolerance is reduced when feeds are warmed to body temperature
- Pseudomonas and other biofilm producing bacteria are a known contaminant of hospital tap water
- Waterless milk warmers can provide a safe and consistent way to warm milk in the hospital

Prepping the Syringe

- Consider syringe feeds by gravity with goal feed delivered over 20-30 minutes
- If using pump feedings, invert feeding syringe upward or at a 45 degree angle and prime with at least 2 ml of air
  - Fat floats to the top of syringe
  - Fortifier sinks to bottom of syringe
  - Priming with air prevents milk left behind
- Use syringes (vs bags) when possible to avoid milk loss with priming tubing



Conclusions

- Colostrum helps the gut mature and all colostrum should be fed first before transitional and mature milk.
- Fresh is best! Use fresh milk over frozen when possible.
- Fortification supports short term growth but strong evidence for long term benefits is lacking.
- Warming milk is beneficial for the infant but must be done safely.

Milk Expression

IABLE
Institute for the Advancement of Breastfeeding & Lactation Education

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IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

Objectives

- Understand basic principles of operating breast pumps.
- Counsel parents on proper breast shield size.
- Explain key techniques of breastmilk expression and milk storage.
- Identify problems that can occur among parents who exclusive pump milk.

Expressing Breastmilk

- Most important determinant of exclusivity and duration of breastfeeding is VOLUME of milk produced
- Maximize milk production while minimizing minutes of expression
  - Optimal frequency is 8-10 expressions in 24 hours
  - Customize for each individual
    - High storage capacity- can pump less often
- Night time expression is important to maintain prolactin level
  - Duration of night time break depends on storage capacity
- Hands on pumping may improve milk production

CPQCC.org Nutritional Support of the VLBW Toolkit 2018

Using a Hand Pump

Battery or Electric Powered Breast Pumps

Easier than a clothes washing machine!

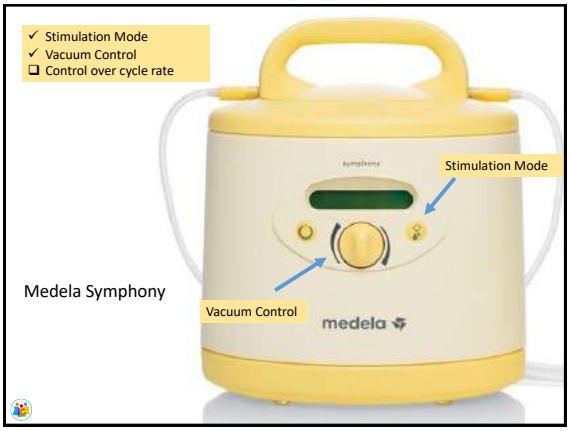
Proper use imperative to protect milk production

Proper fit needed to prevent injury!

Control Options for Electric or Battery Operated Breast Pumps

- Stimulation/massage mode
  - Stimulates let down w/fast, light suction
  - Not all pumps
  - Some pumps automatically start on them, others don't
- Amount of vacuum (suction)
  - Most if not all pumps allow vacuum control
  - Ideal vacuum at -150 to -200mmHg during expression mode
- Rate of cycles
  - Some allow fast vs slow rate of pumping
- Single or double pumping

✓ Stimulation Mode
✓ Vacuum Control
❑ Control over cycle rate

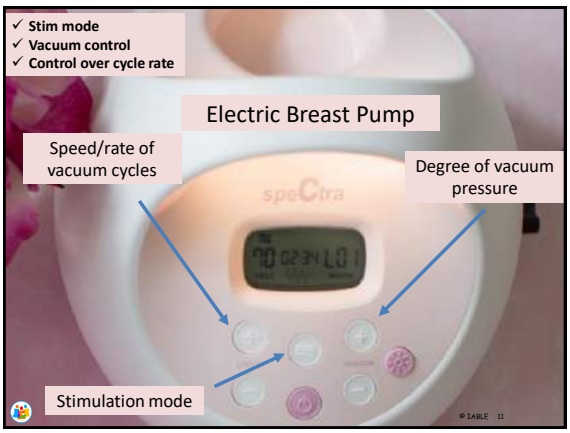


❑Stimulation Mode
✓ Vacuum Control
✓ Control over cycle rate

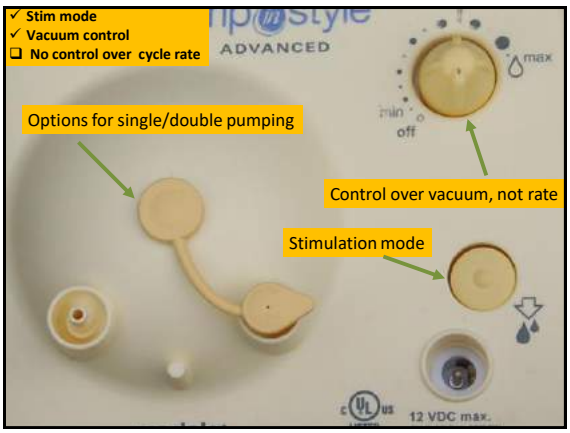
Ameda Elite

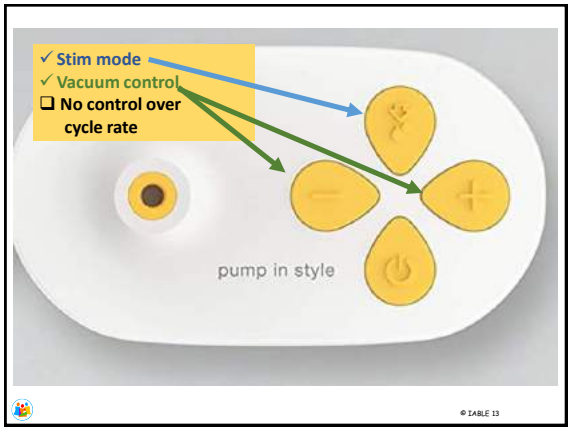
❑Stimulation Mode
✓ Vacuum Control
✓ Control over cycle rate

✓ **Stim mode**
✓ **Vacuum control**
✓ **Control over cycle rate**

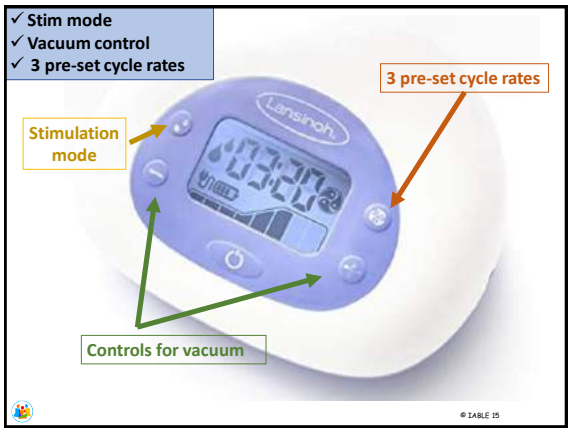


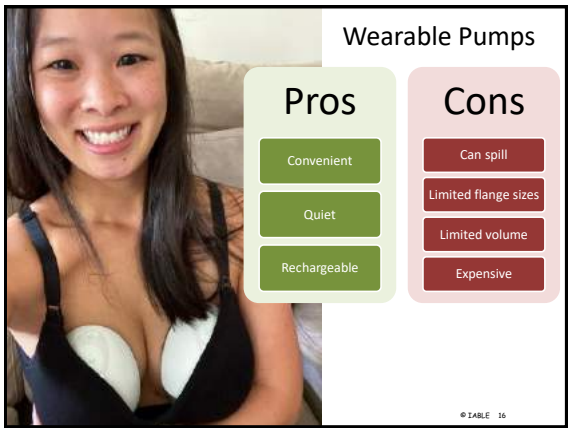
✓ **Stim mode**
✓ **Vacuum control**
❑ **No control over cycle rate**



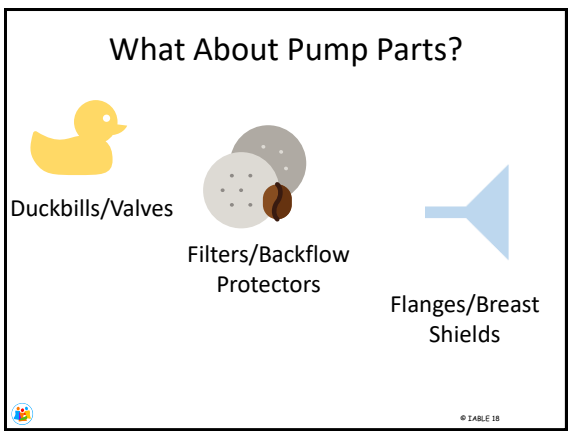

✓ Stim mode
✓ Vacuum control
❑ No control over cycle rate
pump in style
© IABLE 13


❑ No Stim mode
✓ Vacuum control
✓ Control over cycle rate
© IABLE 14


✓ Stim mode
✓ Vacuum control
✓ 3 pre-set cycle rates
3 pre-set cycle rates
Stimulation mode
Controls for vacuum
© IABLE 15

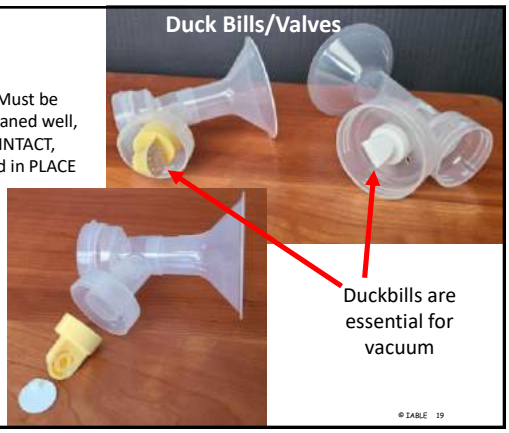

Wearable Pumps
Pros
Convenient
Quiet
Rechargeable
Cons
Can spill
Limited flange sizes
Limited volume
Expensive
© IABLE 16


✓ Stim mode
✓ Vaccuum control
❑ No control over cycle rate
elvie
© IABLE 17


What About Pump Parts?
Duckbills/Valves
Filters/Backflow Protectors
Flanges/Breast Shields
© IABLE 18

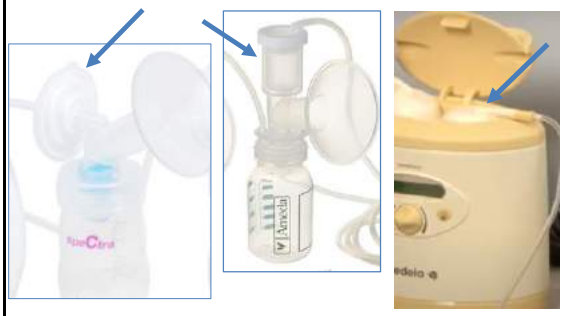
Duck Bills/Valves

Must be Cleaned well, INTACT, and in PLACE



Duckbills are essential for vacuum

Backflow Protectors/Filters
Prevent Milk From Entering Pump/Tubing (Closed System)

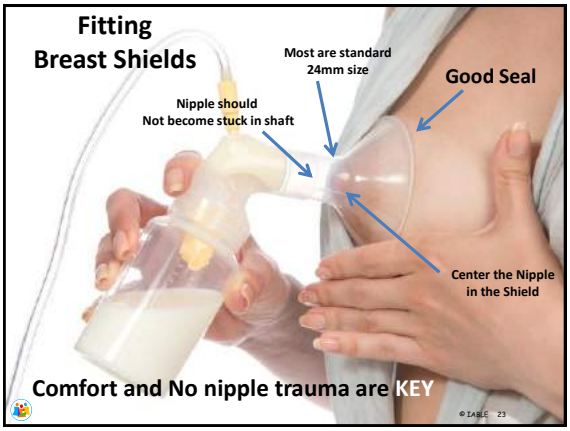


Setting Up a Symphony Pump

Symphony Plus Program Card

- Card has 2 pump programs
  - Initiation Program PLUS Maintain Program
- Start with Initiation program
  - Turn on pump and press Let-Down button
    - Should see 'Initiate' running
    - Use until 20 ml/pump, or thru day 5
- Switch to Maintain program
  - Turn on pump and don't push Let-Down
    - Within 10 sec will see 'Maintain' running

Fitting Breast Shields



Comfort and No nipple trauma are KEY

Flange Video

Steps When Using a Pump

- Wash hands with soap and water
  - Usually no need to wash breast
  - Use clean pump parts
- Assemble pump parts
- Find a comfortable place to pump

© IABLE 25

Hands Free Pumping




© IABLE 26

Lithium Battery to Make Pump Portable

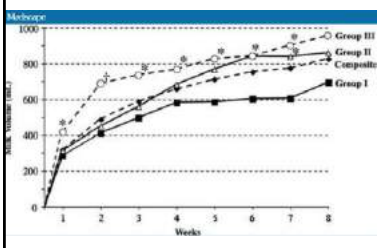
© IABLE 27

Other Pumping Tips

- Start w/low vacuum or stimulation phase
  - Gradually increase to comfortable & ideal vacuum
- Manual expression during or after pumping as needed
  - With ideal pump use, ME should not be needed

© IABLE 28

Combining hand techniques *with electric pumping increases milk production in mothers of preterm infants. J Perinatol* 2009



Grp 1= **2 x/day** n=15
Grp 2= **2-5 x/day** n=18
Grp 3= **>5 x/day** n=16

**Mean daily pumping for*
Day 1-14 = 6x in all groups

Mean daily volumes (MDV) of expressed milk over the course of the 8-week study of three groups as defined by frequency of hand expression during ***the first three postpartum days***. Statistical comparisons using analysis of variance were performed only between Groups I, II and III. *P*<0.05 *vs Group I, vs Groups I and II. (Morton J, et al)

© IABLE 29

Promoting a Letdown

'Experience' the baby
- Photos/video
- Article of clothing/blanket
- Audio of the baby

- Massage/tickle breasts
- Rub nipples
- Warm packs

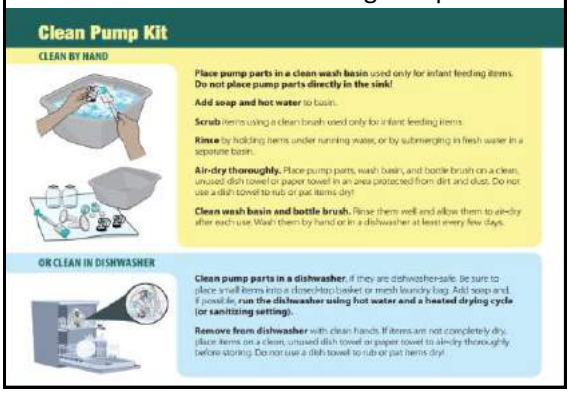
Get Comfy!
- Music
- Eat/drink
- Distract
- Feel safe

© IABLE 30

Freq/Duration of Pumping

- Pump every 3 hours with no more than a 5 hour break at night
- Average duration = 12-20 minutes
  - Pump until empty, unless overproduction
- Average session = 2-3 let-downs
- High production
  - limit volume expressed

CDC Guidelines for Cleaning Pump Parts



CDC Guidelines for Sanitizing Once a Day For Infants Who are Premature, Ill, or < 3 months

- Boil for 5 minutes, remove with tong
- Steam in a microwave bag or plug-in steam system
- Dishwasher on sanitize cycle
- Bleach
  - 1 tsp of bleach in 16 cups of water
    - Submerge completely and soak for 2 minutes
  - Do not rinse, to avoid re-contamination
    - Bleach will break down as it dries and is safe
  - Dry on a clean paper towel or unused dish towel

Milk Storage Containers

- Hard plastic bottles
  - BPA- free
- Wash bottles in hot soapy water or dishwasher

Human Milk Storage Guidelines

Additional Principles of Human Milk Storage

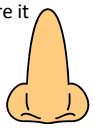
- Fresh is best!
- Freeze in 50-60 ml volumes
- New milk (chilled) can be added to older milk
- Preprinted label with name and MR #

Toss or Donate Stored Milk?

- Reasons to not use stored milk:
  - Baby is allergic to a substance in parent's milk, e.g. food or medication
- Milk can be donated
- Very rare need to toss milk from a yeast or bacterial infection

All Stored Breastmilk has a Smell

- Due to an enzyme lipase breaking up the fat in the milk.
  - Not due to excessive lipase
  - Keep the bottle/bag airtight to decrease odor
- The longer it is stored in frig or freezer, the more it smells
  - Fresh milk is the least smelly
- Scalding milk is NOT recommended
  - Scalding destroys milk properties
- Most babies don't care about the smell
  - We eat stinky foods- cheese, fish, eggs, cooked broccoli/cauliflower



Colored Milk Do Not Toss!!

- Medications
  - Rifamycin (e.g. rifampin) – pink
  - Iron – green
  - Minocycline- black
  - Propofol-blue/green
- Blood
  - 'Rusty pipe'- brown/red
- Serratia marcescens
  - Produces a pink pigment, will coat pump parts
- Foods
  - Kelp, algae, spirulina- green
- Food & med dyes
  - Candy
  - Pill coatings

Bfmed 13(3) 2018

Source: US Breastfeeding Committee

Return to Work

- Discuss lactation needs with employer
  - Pump breaks
  - Part time work
    - First few weeks or longer?
  - Encourage return after establishing production
    - 600ml-1000ml+

The Break Time for Nursing Mothers US Fair Labor Standards Act

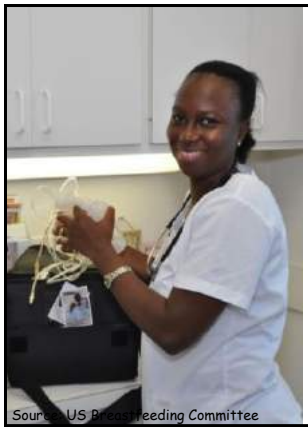
- No defined frequency for breaks
- Break time must be 'reasonable' in duration

- Allowed for 1 year

- Not in bathroom
- Sink not required
- 'Functional space'
- Shielded from view
- Free from intrusion from others
- Available when needed

- Employer not required to pay for uncompensated breaks
- Mainly applies to hourly workers

https://www.dol.gov/sites/dolgov/files/WHD/legacy/files/whdfs73.pdf



Source: US Breastfeeding Committee

Return to Work

- Learn tips from coworkers
- Pump every 3 hours at work
- Store in 50-60 ml increments for NICU

The Pump Won't Work! The Basics

Ensure Pump is charged/plugged in

Check for Break in Seal

Dial to Adequate Vacuum!

If single pumping, close other port

Trouble Shooting Problems Among People Exclusive Pumping

- Nipple/Breast Pain
- Low Milk Production
- Over Production
- Slow Flow
- Recurrent Plugging

Nipple/Breast Pain

Ill-Fitting Flanges
- If too big, areola/breast tissue is drawn into shaft
- If too small, nipple is squeezed by shaft
- Solution => evaluate size

Vacuum too high
- No need to go beyond -150 to -200mm Hg
- Insufficient vacuum limits milk flow
- Don't blame vacuum until ensuring flange fit

Nipple Vasospasm
- Nipple turns purple during pumping, pain throughout
- Check flange fit and proper vacuum
- Refer for treatment

Still Pain? Evaluate for Breast Infection/Dermatitis/Nipple Lesions!

Low Milk Production

- Infrequent Pump Schedule
- Low Vacuum
- Pain with Pumping
- Meds Substances

Management of Over-Production

Stop galactogogues

Reduce frequency of pumping
- Gradually!

Decrease volume taken out during milk expression
- Gradually!

If difficulty decreasing production, refer to lactation specialist

Slow Milk Flow

- Optimize Vacuum
- Check Flange size (May be too large or small)
- Oxytocin Release (Need to Relax!!)
- Check hands-free bra (ensure flanges are not drifting)

Conclusions

- Manual expression early postpartum helps to express colostrum.
- Manual expression may help to increase fat in expressed breastmilk.
- Understanding basic principles of operating breast pumps allows healthcare providers to teach a parent how to use any pump.
- Parents need guidance on proper breast shield size.
- Parents need counseling on techniques on breastmilk expression and milk storage.
- Several problems can occur with milk expression, such as low production, high production, vasospasm, infections and trauma.

Maintenance of Mother's Own Milk Production for the NICU and PICU Mom

Eliza Myers, MD, IBCLC

IABLE
Institute for the Advancement of Breastfeeding & Lactation Education

- The Instructor and members of the planning committee have no conflicts of interest to disclose
- CMEs for providers, continuing education recognition points (CERPs) for IBCLE, or CPEUs for registered dietitians, are awarded commensurate with participation and complete/submission of the evaluation form.

IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

Overview

- Why the Physiology of the Best Practices matters
- Biases and obligations
- Maternal diet
- Milk as a vital sign
- Disparities in BFing
- Support

- ….and sprinkled throughout, Ideas for Change

Best Practices for **Maintenance** Start at the Beginning:

- **Early**: Stimulate nipples early: early skin-to-skin, early feeding or **early expressing**
  - Programming prolactin receptors
- **Often**: Express milk every 2-3 hours
  - **Keep prolactin levels high**
- **Well**: Breasts must be emptied
  - **Avoid downregulation**

Early! Prenatal Consult: Informed Decision

- **Informed Decision is Step 1** in Diane Spatz "10 steps"
- Mothers who intended to formula feed do not feel offended or guilty when asked to provide breastmilk
  - *On the contrary:*
- Mothers who were not given appropriate early information (or not given a breast pump or taught to hand express) ***do*** feel angry that their later breastfeeding goals were not met

Miracle, D. et al Mothers' decisions to change from formula to breastmilk for very low birthweight infants, JOGNN, 2004

What is Our Ethical Obligation?

- Human milk is the normative standard for infant feeding and nutrition.
- **Breastfeeding should be considered a public health issue, not a lifestyle choice-AAP.**
- It is our duty as pediatric healthcare workers to set mothers and infants up for success.
- When a woman is educated on the detriments of formula in the premature population, most will choose to breastfeed.
- WHO recommendations: Infants be exclusively breastfed for the first 6 months after birth to achieve optimal growth, development, and health. After the first 6 months, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods while breastfeeding continues for up to 2 years of age or beyond.
- AAP recommendations: Infants should be fed breast milk exclusively for the first 6 months after birth until at least 1 year old.

Idea: Support Hand Expression

- Firstdroplets.com
- Emphasizes the role of hands on expression
- De-emphasizes excessive hygiene or rigorous schedules
- "The more the better, wherever you are; try practicing in the shower!"
- On this website, pathways for **term** babies and **preterm** babies – advise NICU admission moms to look at preterm babies regardless of gestational age!

Jane Morton at ABM 2018 and Firstdroplets.com

Idea: Antenatal Hand Expression

DAME study (Diabetes and Antenatal Milk Expressing), Lancet 2017
- Multicenter 2 group unblinded RCT, 635 women enrolled
- Singletons 34-37 wks gestation, low risk diabetic population
- **Hand expression 2x/day starting at 36 wks compared to usual care**
- Primary outcome was NICU admission
- Each arm had 3 admissions
- Expression group: respiratory indication
- Control group: encephalopathy indication

Outcomes
- **No harm in antenatal expression. SAFE**
- **Increased EBF at 24 hrs and through hospital stay**
- Effect was not sustained to 3 months

Ideas…

- Have First Droplets video play on Newborn Channel, iPads, QR code
  - Use as a prenatal resource – has information for term and preemie babies
- Send an Early Milk Expression care package out on transport:
  - Hand pump, log, cooler bag for milk transport
- Incorporate antenatal expression as a multidisciplinary process
- Have "Is there a breast pump available in the PACU?" added to pre-op list for cesarean birth patients

Here's What Does NOT Affect Milk Production:

Poor nutrition
Fluid intake
Sleep

PD Hill 2005; A Kurpad 2005

Maternal Diet Pointers

- **Drink water to thirst**
  - Urine should appear clear or pale yellow
  - Dark urine can indicate insufficient fluid intake (unless colored by supplements)
- Foods with essential fatty acids (DHA), particularly **fish**, should be eaten 2-3 times a week
- If dietary restriction or malabsorption, check with physician on supplements
  - Vegan/vegetarian
  - Gastric bypass surgery
- Balance of carbs/protein/fats won't change the breastmilk - junk food won't either!
- Remember WIC supplemental food program for BFing moms

Maternal Foods/Supplements That Can Create Infant Symptoms

- Most foods do not cause GI symptoms in the infant
- Dairy *can* increase gastroesophageal reflux (GER) symptoms
  - No need to stop all dairy- reduce # of servings
- Coffee, tea, chocolate: watch for infant GER
- **Avoid foods that can inadvertently decrease milk production: mint, sage, parsley, rosemary, thyme**

Milk: a Vital Sign

- We have to treat milk production and maintenance **like a vital sign**
- **Milk production should be monitored**
- **Discuss on rounds**
- **Track volume**
  - Goal of 500+ mls by day 10-14
  - "Coming to Volume"
  - Maintain over 500 ml

Tracking Milk Production

- Logs (can help with figuring out low production)
- Apps
- Milk Management Systems

- Pump with maximum vacuum comfortable for you
- Pump for 15 minutes or until 2 minutes after milk stops flowing until coming to volume
- Pump at least once between midnight and 7 AM

Tracking Milk Production: Apps

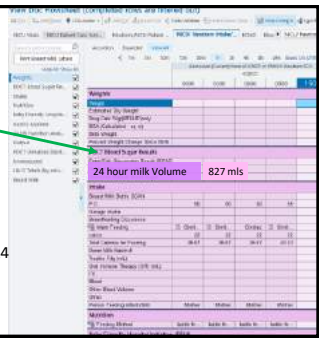
- Logs
- Apps
- Milk Management Systems

Tracking Milk Production

- Logs
- Apps
- Milk Management Systems

Milk: A Vital Sign

- Discussing Milk Production on Rounds:
- Mother's goals for feeding at discharge include: _Breastfeeding _
- Today, 5/8, DOL _16_ Mother reports _ 827_ ml pumped in 24 hours

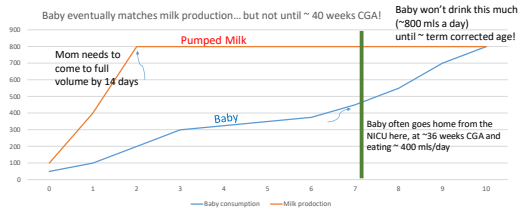


How Much Milk?

- A full term baby takes an average of 20-30 ounces, or 600-900 mls per day from ages 1-6 months.
- **"Coming to Volume"** indicates achieving this full milk volume of 600+ mls / 24 hours
- **Mothers of preemies who achieve > 500 mls by day 14 are three times more likely to be providing breastmilk at discharge than those who don't meet this goal [Milk: a Vital Sign!]**

Patel AL. Barriers to continued provision of human milk for mothers of VLBW infants. Sep 6 2016

Preemie Baby Consumption / Milk Production **Mismatch**



That's A Lot Of Milk!

- 24 week baby
- If mom achieves > 600 mls by day 14, Mom will pump ~ 2500 oz during the hospitalization, of which the convalescing preemie may drink ~ 600 oz
- **1900 ounces = 15 gallons**

Consider freezer space!

Storage Guidelines: Magnets!

Milk Storage

Milk Storage

- The freshest milk is best.
  - Refrigerated and frozen milk loses fat, calories, and immune properties
- Milk can be stored for at least 6 months in a freezer.
- Keep milk away from the walls of self-defrosting freezers.

$180

Also $180…

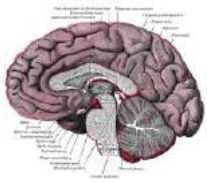
Emotional Support

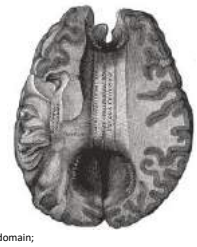
Two Parallel Paths of Work and Research

NICU and Neonatology Professionals	Breastfeeding and Lactation Professionals
Severely ill vulnerable infants	Healthy mothers and babies
Life-saving interventions	Family support
Feeding = nutrition	Feeding > beyond nutrition
Long hospital stays, separation	

Right Brain Versus Left Brain

Left and right communicate
Don't really work alone





Images in the public domain;
from 1918 Gray's Anatomy

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Health care providers?

Right brain back seat

Own motions suppressed/ignored

Listens to words but may miss emotional content

May not notice own tone of voice, body language

Can misinterpret her responses

Mothers

Right brain *ACTIVE*

Emotional

Remembers words associated with strong emotion

Attends to body language

Focused on emotional meaning of your words

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Health care providers

Left Brain *strong*

Wants information, facts.

When and how often did baby feed?

How many wet diapers yesterday?

How many stools yesterday?

How long does the baby sleep?

Explains with details.
Gives specific instructions.
Plans for next week, month.

Mothers?

Left brain back seat

Has trouble with memory for facts and numbers

Might try to compensate:

- Watch the clock
- Keep a (confusing) log
- Write down what you say

Confused by long explanations.

Confused by instructions

Next week seems far away

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Identify How the NICU Effects Emotions:

- Palmquist, et al. **"It was all taken away:"** Lactation, embodiment and resistance among mothers caring for their very-low-birth-weight infants in the neonatal intensive care unit
- Themes included:
  - **Mothers experience being marginalized in their infant's NICU care**
  - Mothers practice **"embodied forms of resistance"** to cope with both trauma and marginalization
  - **Skilled support** is central to positive lactation experience
- **Among the solutions: minimize barriers, include parents, provide skilled support**

Palmquist et al 2019

"It was all taken away"

- "I couldn't spend as much time doing her cares and talking to her nurse and just being in the room involved, because you know, I was sitting in the pumping room, and that frustrated me. So, I had to make a choice. Do I spend more time with her and be involved? Or do I really, really, really, really try to make this work?"

Palmquist et al 2019

Including Parent in Care:

- Oral Immune Therapy / Colostrum Therapy
- Pumps at bedside
  - Pump bundle initiative
  - More milk at day 14 in post-initiative group
  - More exclusive breastfeeding at discharge
    - (from 26-76%!)
  - Hospital savings in donor milk paid for the increased collection kits and containers given out!

Statistically Significant!

- Porta et al, A Breast Milk Pump at the Bedside: A Project to Increase Milk Production in Mothers of Very Low Birth Weight Infants, Breastfeeding Med 2020

Where to find Emotional Support Outside of Family, Friends and Partner?

- Social Media Support
- Peer Support
- Social Work
  - Relaxation techniques, referral to mental health providers

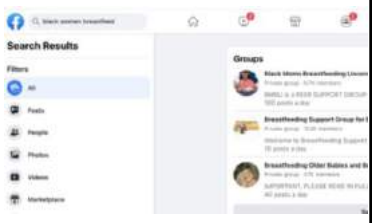
Social Media Support

- Facebook and Instagram
- Exclusive Pumping Mums
- Black Women Do Breastfeed
- Pumping Mamas
- Pump_Momma_Pump
- Dr. Milk

Social Media Support

Social Media: Facebook

- Qualitative Research Study of breastfeeding Black mothers:
- Facebook
  - Improved confidence
  - Prolonged initial BFing goals
- Choose a group with moderators who are lactation specialists
- Robinsinon et al "It Takes an E-Village" 2019



Peer Counselor Support

- Since 2005, Rush Mothers' Milk Club at RUMC
- Breastfeeding Peer Counselors employed as Lactation Providers
  - "Mother helping Mother" model, "Shared Experience" model
  - Addressing very specific barriers:
    - Unsupportive family, inability to use breastpump at work because of work logistics, fears about BFing after discharge
  - First paid BPC was a former NICU mom – had a 25 weeker at age 17

Meier et al, Breastfeeding Peer Counselors as Direct Lactation care Providers in the Neonatal Intensive Care Unit, 2014

Social Work

- Referral to Mental Health Providers
- Sounding board for stress
  - Be a non-medical ear
- Relaxation Techniques
  - Listening to music while pumping lowers salivary cortisol

Varisoglu Y et al. The Effects of Listening to Music on Breast Milk Production by Mothers of Premature Newborns in the Neonatal Intensive Care Unit, 2020

More Support Ideas

Breast Pump loaner
Insurance assistance

Letters of necessity

Support groups:
Local LLL
Mom-baby groups
Baby cafe

Travel support*
Parking vouchers

Order meals in ICU
Meal vouchers

Goody bags:
Hands-free bras
Insulated bags
Scent cloths

*Riley et al 2016: Study at Rush University in Chicago with 430 dyads, trend in less human milk feeding at discharge in Black mothers without access to a car.

Equity Lens

Disparities in Breastfeeding: Equity Lens

- In the US, 25% of all infants are exclusively BFing at 6 months
  - And only 17% of Black infants are exclusively BFing at 6 months
- Qualitative Study through Equity Lens
  - Cultural
  - Sociological
  - Health Dimensions
- Black Mothers perspective: while Black women stand to benefit *most* from BFing, they are breastfeeding the *least*.

Gyamfi et al. Black/African American Breastfeeding Experience: Cultural, Sociological and Health Dimensions Through an Equity Lens, 2021.

Disparities in Breastfeeding: NICU Care

NICU care also demonstrates disparities

- VLBW Black babies born in predominantly Black population hospitals have poorer outcomes than Black babies born in not predominantly Black population hospitals
- Nurse understaffing, lower resources in general
- Poorer Outcomes = More infections, Less breastmilk at discharge
- Black babies cared for by Black doctors may have lower mortality

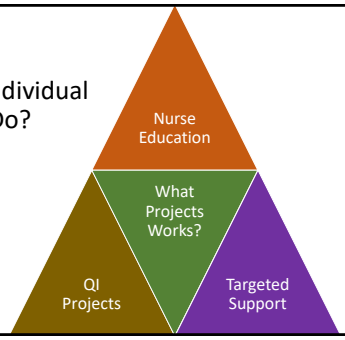
Lake et al. Disparities in Perinatal Quality Outcomes for Very Low Birthweight Infants in the Neonatal Intensive Care Unit, 2020.
Greenwood et al. Physician-patient concordance and disparities in birthing mortality for newborns

Disparities in Breastfeeding: Language Barriers

- Materials in Spanish and other languages
- Resources specific to your hospital
- Query the interpreter service
  - NICU Parent Language Line in languages comprising 95% of calls from system NICUs
- Cultural barriers
  - Concepts of numbers, time. measurements
  - Interactions with healthcare
    - How decisions are made

Photo by Kyle Glenn on Unsplash

What Can Individual Units Do?



Rick Frausto, artist

Nursing Practices Drive Exclusive Bfing Rates

- Change in bfing at discharge rate changed from 58 to 66%
- In 420 preemie-mother dyads over 2 years in all the NICUs in Denmark
- 6 Bfing-supportive clinical practices, driven by Nurses:

1. Encouraging Early (< 6 hours) Milk Expression
2. Advocating for rooming in when possible
3. Limiting pacifier use
4. Test-weighing babies (pre- and post-)
5. Emphasizing Daily skin-to-skin
6. Prioritizing extra attention to at-risk groups

Maastrup R. et al, Improved exclusive breastfeeding rates in preterm infants after a neonatal nurse training program focusing on six breastfeeding-supportive clinical practices. 2021

More Ideas! At Johns Hopkins!

Forget a pump part? Vending machine solves breastfeeding mothers' dilemma

More Ideas!

- Breastmilk Phone Line
- "Pro-text-ing your Milk Supply"
  - ABM poster
- Staff texts messages out
- Patients text info in
- ?

Multidisciplinary QI Project Drives Change

- Team: Attending, Resident, RN charge, RN bedside, LC
- Interventions (The 'Dos') included:
  - Telephone reminders before each feed (during *and* after discharge)
  - Standardization of Kangaroo Care
  - Daily counseling to family
  - Nonnutritive Sucking Protocols

- Bagga et al 2020

Multidisciplinary QI Project Drives Change

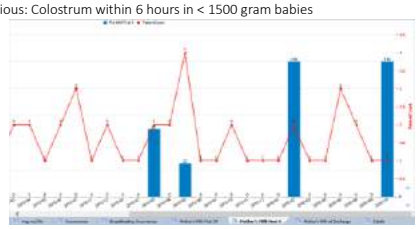
- ~100 Preemie dyads
- Outcomes (the 'Studies')
  - Receiving MOM in 24 hours: 24 to 82%
  - Amount of MOM on DOL 1 0-3 ml
  - Amount of MOM on DOL 3 6-20 ml
  - Amount of MOM on DOL 6 60-100 ml
  - Discharge on MOM from 48-77%

All statistically significant!

- Bagga et al 2020

As an Example of a Small, Doable Project:

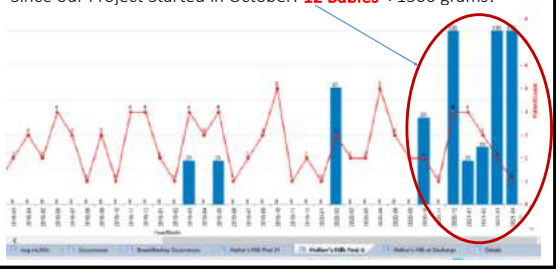
Previous: Colostrum within 6 hours in < 1500 gram babies



Since the beginning of 2018, we had successfully administered Colostrum (as OIT) within 6 hours to 5 babies weighing less than 1500 grams.

Colostrum within 6 hours in < 1500 gram babies

Since our Project Started in October: 12 Babies < 1500 grams!



Colostrum Within 6 hours to ALL Babies!

Since the initiation of the project, we have increased our early colostrum administration to ALL birthweight babies!

Best Things to Remember

- **Milk is a vital sign**: talk about it on rounds
- **Breastmilk disparity is real:** address it
- Ideas you might bring to your unit: **small changes add up!**

Transitioning the ICU Infant to Direct Breastfeeding

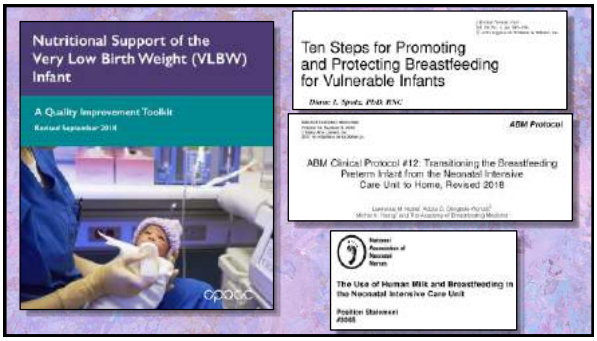
Stephanie Attarian, MD, IBCLC

IABLE
Institute for the Advancement of Breastfeeding & Lactation Education

- To earn continuing education recognition points (CERPS) for IBCLE, attendance for the entire course and completion of an evaluation is required.
- For CMEs, please keep track of the hours you have attended, and completion of an evaluation is required.

Objectives

1. Identify readiness cues for feeding at the breast.
2. Explain the risk of introducing bottle feeding before first having the premature infant feed at the breast.
3. Identify the differences in bottle feeding vs breastfeeding on physiologic factors such as heart rate, pulse, and hormone levels.
4. Counsel families on latch and positioning the premature infant at the breast.



Spatz 10 Steps to Promoting Breastfeeding in the Vulnerable Infant

1. Informed decision
2. Establish and maintain milk supply
3. Breast milk management
4. Feeding the infant the milk
5. Skin to skin care
6. Non-nutritive sucking
7. Transition to breast
8. Measuring milk transfer
9. Preparation for discharge
10. Appropriate follow-up

Spatz, 2004

Develop a Feeding Plan

- "The goal of the feeding plan recommendations for preterm infants is to enable the mother to exclusively breastfeed or provide as much human milk as possible while protecting and supporting the mothers' decisions."
- Shared decision-making by the mother, the infant's clinician, and any others involved in feeding support (nursing, lactation consultant, and dietitian).

Develop a Feeding Plan

- The food: what and how?
- Understand mother's home feeding goals.
- Teach mother how to assess good transfer.
- Encourage rooming-in when able.
- Expectation setting.

Preterm Breastfeeding Stages

- Tube-feeding, skin-to-skin contact, and frequent milk expression
- Breastfeeding begins-Rooting, licking, mouthing
- Single sucks, short bursts, long pauses, some milk intake
- Longer suckling bursts, stays fixed longer, more milk more often, supplements gradually reduced
- Milk intake increases, occasional larger volumes
- Milk intake varies, immature suckling pattern, can fully breastfeed with semi-demand feeding
- Vigorous, mature suckling, long bursts, breastfeeds on demand

Nyqvist, In Supporting Sucking Skills in Breastfeeding Infants 2017,

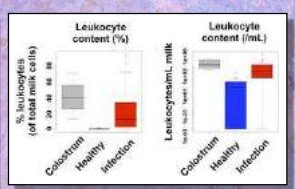
Direct Breastfeeding

- Increases milk supply during the first few weeks.
- Increases duration of lactation - exclusive pumping leads to early cessation.
- May reduce workload: mothers who are pump dependent do not provide milk for as long as those who pump by choice.
- Provides convenience – mothers don't have to "take care of the pump and take care of the baby."
- Help with emotional healing – may be the only "normal" experience they have.

Direct Breastfeeding

- Milk is alive— with immune cells, stem cells, and microbes of maternal and infant origin.
- When breastmilk mixes with baby saliva a chemical reaction produces hydrogen peroxide which inhibits growth of bacteria. (Al-Shehriet al. 2015)
- Immune changes in milk happen when baby is sick even if mother is not sick.
- Mother specifically tailors milk to her infants needs – how does this happen?

Retrograde Ductal Flow



Transfer of antigen, antibodies and leukocytes

Clin Trans Immunology. 2013;2(4):e3

Barriers to Transition

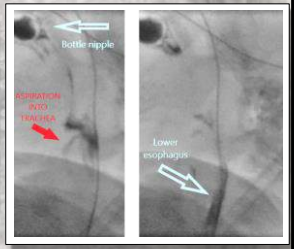
- Physical: tubes, lines, incisions and machinery
- Emotional: lack of confidence, maternal depression, trauma history, cultural aspects
- Support: lack of support or knowledge of how to help mom
- Maternal and professional misinformation
- Illness severity
- "Bottlefeeding as a goal for discharge" - early bottlefeeding does NOT shorten time to discharge!
- 'Need' to know accurate measurements of intake
- Mother's availability to breastfeed

Umbilical Catheters

- High risk neonates commonly receive enteral feedings even with the presence of an umbilical arterial catheter (UAC)
  - Little effect on pre/postprandial blood flow
  - No increased risk of feeding problems
- Skin to skin should be promoted even with umbilical catheters in situ
  - Check catheter placement
  - Make sure bedside RN and frontline provider are comfortable
  - No increased risk of infection

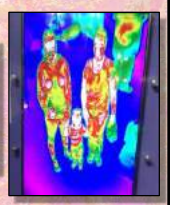
Is Going to Breast Safe?

- Nonnutritive sucking is safe
- Different mechanism with bottle vs breastfeeding
- FEES study may be helpful if available
- Breastfeeding is the physiologic norm and is physiologically easier



First Steps to Transition

- For separated dyads, includes initiation of expression
- Oral Immune Therapy creates a positive oral experience and may contain oral maturation factors
- Skin to skin
- What's next?



Non-Nutritive Sucking at a Pumped Breast

- "Nuzzling (non-nutritive sucking) at the emptied breast during tube feeds can be initiated as soon as the infant is no longer ventilator dependent." NANN #3065
- Suck, swallow, breath is needed for both breast and bottle but can occur first in infants feeding at breast and they remain more physiologically stable.
- Begin putting baby's face near nipple.
- Anticipate rooting, licking, nuzzling
- This can begin much earlier than "PO readiness"

Transitioning to Breast – Tools & Tricks

- Compressions during feed to keep infant interested.
- Supplementing systems.
- Feed when awakens before baby starts to cry- ideally a sleepy state.
- Paced bottle feeding and sliding scale.
- Continue to pump after feeds which means mother is "triple feeding".
- Breast before bottle – consider defining length of time.
- It takes time – good things in the NICU happen slowly!

Cue Based Feeding/ Semi Demand

- Cue based feeding in the NICU is essential to promote breastfeeding
- Baby can now fully breastfeed
- At ~35-36 weeks, approaching discharge
- Feeding cues are subtle, and mother must offer breast Q1-3 during day and Q3-4 at night, until term corrected age
- Mother must also protect milk supply
- Full supply is 600-900 mls/day, but a 2kg baby taking TF 160 is taking 300-400; remainder must be pumped and stored

"You've Have to Tuck to Suck"

© IABLE 23

Latch Is More Manageable Before Infant is Crying!

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Watch for Signs of Satiation

Measuring Milk Transfer

- An electronic breastfeeding scale should be used to measure pre- and post-weights to determine milk transfer volume.
- Initially assume minimal milk transfer.
- As transfer of milk improves, perform pre- and post-breastfeeding test weight.
- Pre- and post-weights are the only method that allow for direct measurement of milk transfer and are reliable.
- Gavage remainder of feed.
- Do this every few days, until milk transfer matches goal.
- Use post pump residuals as an estimate.

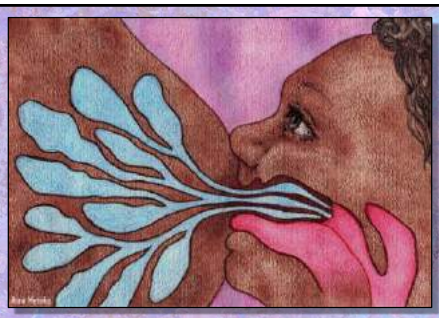
What Happens When Things are Not Working?

© IABLE 24

Positioning at the Breast is KEY for:

- Deep Latch
- Maternal Comfort
- Effective Milk Transfer

Image: United States Breastfeeding Committee



Positioning Tips for Optimal Latch

- Firm, Secure Hold
- Maternal Comfort and Support
- Nose to Breast
- Proper Alignment
- Mouth Wide Open

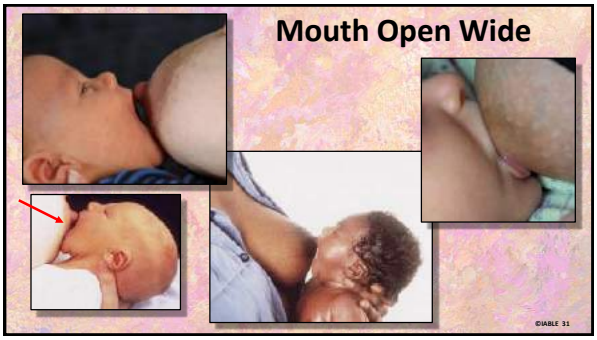
Firm Secure Hold

Proper Alignment

Source: USBC

Maternal Comfort & Support

Mouth Open Wide



Nose to Breast

Sitting in Lap Facing Mom

Mom is using a C-Hold

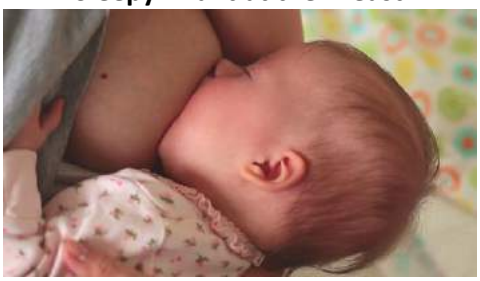
Semi-Reclined (laid back) Positioning

Asymmetric Latch

Click for Video

Awake and Effective Infant at the Breast

Sleepy Infant at the Breast



Young Infant at the Breast

Why Not a Nipple Shield?

- **Don't assume a premie needs this**
  - Not great evidence that it increases transfer
  - If used, avoid long term
- **Nipple shields might decrease prolactin**
  - Risk of decrease in milk supply
- **Risk of insufficient milk transfer**
- **Need to pump after nursing**
- **Does not teach nursing**
  - May increase nursing challenges

Always Pace Bottle Feeds!

- **Pacing is not just for premies!**
- **Decreasing hydrostatic pressure in bottle slows flow**
- **Slower flow associated with**
  - ++ Infant control
  - Decreased risk of overfeeding
  - Less GERD/vomiting
    - Fewer prescriptions!
  - Less choking/coughing
  - Lower risk of bottle preference for nursing infants

Keep the bottle horizonal

Infant on their side until good head control

Energy Expenditure

Energy Expenditure for Breastfeeding and Bottle-Feeding Preterm Infants

Tips for Weaning Supplementation

- Watching for subtle feeding cues.
- Pre/ post feed weights.
- Pre/ post pump residuals.
- Watching for satiation.
- Breast softness.
- Growth!

US News and World Report Rankings

- Outcomes and Experience (44.1% of score)
- Better survival odds and fewer complications.
- % of discharged infants receiving at least some nutrition from breast milk when leaving NICU.
- Ability to prevent infections in NICU
- Keeping breathing tube in place
- Dedicated milk room
- NICU BF committee
- Donor milk program
- Cohort of NICU RNs specially trained in lactation counseling
- Matching breast milk with correct infants: Success in insuring that newborns receive breast milk from the correct source.
- Tracking of growth metrics for treated patients: Success in tracking growth metrics for treated patients prior to discharge or transfer.

Conclusions

- Preparing for transition to breast happens throughout the entire ICU admission
- Developing a feeding plan can serve as a roadmap for the infant's family and ICU staff
- There are many benefits of direct breastfeeding for the mother infant dyad
- Tips for optimal latch include ensuring a secure hold with maternal comfort and placing the infant's nose to breast in proper alignment with the infant's mouth wide open.

Medications During Lactation

IABLE

Institute for the Advancement of Breastfeeding & Lactation Education

1

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- CMEs for providers, continuing education recognition points (CERPs) for IBCLE, or CPEUs for registered dietitians, are awarded commensurate with participation and complete/submission of the evaluation form.

IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

Objectives

- Describe pharmacologic properties of medications that determine their transmission into breastmilk.
- Identify unsafe medications during lactation.
- Explain how to counsel the lactating parent on the use of marijuana, cigarettes, and alcohol during lactation.
- Identify evidence-based resources for medications during lactation.

3

4

Basic Principles of Meds and Human Milk

- Volume of distribution
- Half-life of drug- how long it hangs around
- Infant absorption
- Effect on milk production

5

Volume of Distribution

- Meds move from the parent's blood into bmilk
- More likely to go into breastmilk if:
  - Absorbed from the parent's gut
  - Drug is fat soluble
  - Little protein binding
  - Small molecule

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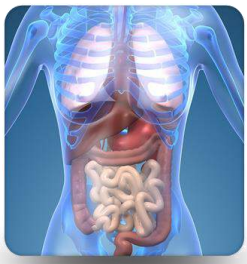
Half-Life of Drug

- How long does it hang around?
  - –Choose meds that are short-acting
    - Antidepressants
      - –fluoxetine vs sertraline
    - Anti-anxiety meds
      - – clonazepam vs alprazolam

Infant Absorption

Choose medications that are not well absorbed from the infant gut



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General Guidelines on Medications During Lactation

- Most medications that are OK during pregnancy are fine during lactation
  - Decongestants are an exception
- Usually meds that are OK for infants are OK for lactation
- Choose the best med in a category
  - Shortest acting
  - Best evidence for use
  - Less likely to cause side effects
    - aripiprazole vs risperidone

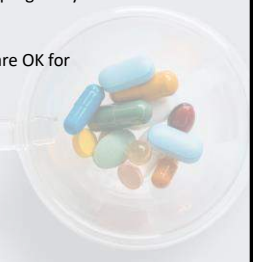

Photo by Adam Niescioruk on Unsplash

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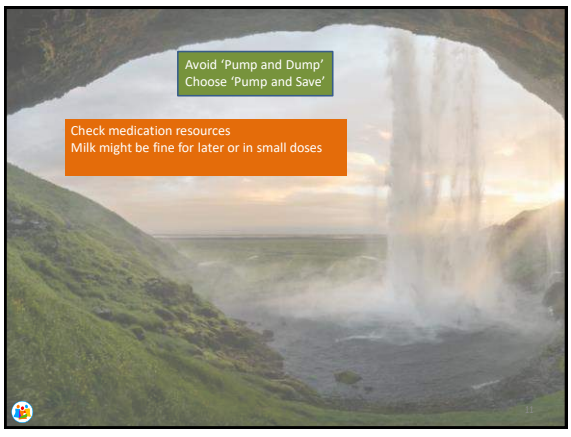
Radiology and Nuclear Medicine Academy of Breastfeeding Med Protocol

(BF Med 14(5) 2019)

TABLE 1. COMMON NUCLEAR MEDICINE IMAGING AGENTS AND RECOMMENDATIONS FOR BREASTFEEDING

Imaging agent	*Breastfeeding interruption*
Noncontrast radiographs	No
Nonvascular administration of iodinated contrast	No
CT with iodinated intravenous contrast	No
MRI with gadolinium-based intravenous contrast	No
Nuclear medicine imaging	
PET	No
Bone scan	No
Thyroid imaging	
I-131	Cessation for this infant
I-123	Recommendations vary, up to 3 weeks
Technetium-99m pertechnetate	Up to 24 hours, depending on dose
Renal imaging	
Tc-99m DTPA	No[a]
Tc-99m MAG3	No[a]
Tc-99m DMSA	No[a]
Tc-99m glucoheptonate	No[a]
Cardiac imaging	
Tc-99m Sestamibi	No[a]
Tc-99m Tetrofosmin	No[a]
MUGA	
Tc-99m RBCs in vitro	No[a]
Tc-99m RBCs in vivo	Up to 12 hours, depending on dose
VQ scan	
Tc-99m MAA	12 hours
Breast imaging	
Screening or diagnostic mammography	No
Ultrasound	No
MRI with gadolinium-based intravenous contrast	No

10



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Use Evidence-Based Resources for Medications During Lactation

- Lactmed- National Library of Medicine- https://www.ncbi.nlm.nih.gov/books/NBK501922/
- Medications in Mothers' Milk by Tom Hale
- Infant Risk Center - infantrisk.com
- Mother To Baby - mothertobaby.org
- E-lactancia.org (English and Spanish)

Photo by Markus Spiske on Unsplash

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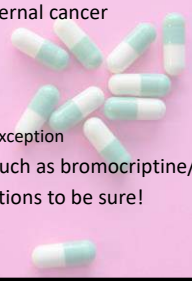
The List of Unsafe Medications is Short

- Chemotherapy for maternal cancer
- Radioactive meds
- Codeine, tramadol
- Recreational drugs
  - Occas marijuana is an exception
- Prolactin-lower meds such as bromocriptine/cabergoline
- Always look up medications to be sure!



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Substances that May Decrease Milk Production

- Bromocriptine, cabergoline
- Estrogen-containing birth control pills
- Progesterone birth control, esp in the first 6 weeks
- Decongestants- pseudoephedrine
- Aripiprazole (Abilify)
- Nicotine
- Alcohol
- High dose steroids
- Epinephrine
- Antihistamines, especially frequent use
- Herbal teas/supplements
- Placenta encapsulation

Alcohol During Breastfeeding

- Breastmilk level=blood level
- Alcohol in BM decreases infant's intake
- Safe Rules:
  - No more than 2 drinks a day, avoid daily use
  - Each drink over 1-2 hours
  - Eat food when drinking
- 5 drinks can decrease let-down and drop milk production
- Several infant meds are in an alcohol base

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Smoking During Breastfeeding

- Smokers can breastfeed
- Increased risk of SIDS
- Decreased milk production
  - Dec'd blood flow to breast
- Possible decreased fat in breastmilk
- Reduce exposure by smoking right after feeding, not before
- Low dose nicotine replacement is preferred

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Narcotics During Lactation Naive Newborns

- Newborns who are narcotic naïve
  - At risk for decreased respirations, sleepiness
  - Decreased metabolism
  - Metabolism of codeine and tramadol too variable to assume safety in infant
- Limit round-the-clock maternal opiates to 2-3 days for pain control

Narcotics During Lactation Exposed During Pregnancy

- Infants exposed to methadone and buprenorphine during pregnancy
  - Ok to continue during breastfeeding
  - Less NAS
  - Monitor infants closely over time

Marijuana During Lactation

- Marijuana (THC) is stored in fat
  - Baby's brain and breastmilk are high in fat
  - THC found in newborn meconium/stool
- Estimated transfer into breastmilk is 0.8% of maternal dose
  - Milk/plasma ratio = 7.0
- Daily infant exposure may delay motor development
- Long term effects of intermittent marijuana exposure unknown
- Evidence for a decrease in PRL in marijuana smokers
- AAP and ACOG recommends breastfeeding continuation but avoid marijuana

AAP 2018, ACOG 2017

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Conclusions

- Most medications during lactation are safe.
- Several pharmacologic properties of a medication determine its passage into breastmilk.
- Use evidence-based resources to determine the best medication during lactation.

The ICU Infant Who Can Feed At The Breast

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IABLE
Building Breastfeeding-Knowledgeable Medical Systems & Communities

Objectives

- Describe the typical feeding pattern of a newborn who is able to feed at the breast.
- Identify early feeding cues.
- Describe risks and indications of a pacifier.
- Describe the risks of nipple shield use.
- Explain the nutritional support needed for late preterm and early term infants who are feeding at the breast.

3

Typical Scenarios of Infants in the ICU Feeding at the Breast

- Jaundice
- Hypoglycemia
- Hypothermia/sepsis rule out
- Mild respiratory distress
- Possible coarctation
- Other possible cardiac concerns
  - Fetal SVT, heart block
- Late preterm

First Feeding as Soon as Possible After Birth

- Baby Friendly Hospital Initiative Step 4
  - *Facilitate* immediate and uninterrupted skin-to-skin contact and support individuals to initiate breastfeeding as soon as possible after birth
- Newborn awake & alert first 1-2 hours
  - Decreases risk of low blood sugars
    - Low blood sugar leads to early bottle supplementation
  - Parental confidence

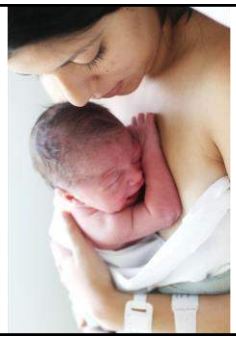
5

Term Infants Benefit From Early Skin-to-Skin Contact

- Increased:
  - Breastfeeding duration
  - Temperature regulation
  - Blood sugar control
- Less infant crying
- Enhanced maternal affection

AAP Pediatrics 138(3) Sept 2016

6



Skin-to-Skin and Self-Led Latch

- Awakens infant feeding reflex
- Organizes route to feeding
  - Search->feel->root
  - Baby finds the nipple/areola and latches

7

Colostrum

Early colostrum feeds are small

First 24 hrs
2-10ml/feed

24-48 hrs
5-15ml/feed

Small, freq feeds are appropriate for newborn size

Every 1-3 hr feeds are expected

8-12 times/24 hours

May seem like snacking!

8

Early Pacifier Use

- Pacifier use on days 2-5 postpartum for non-ICU babies:
  - 2.5 times risk of not breastfeeding exclusively in the first 6 mo if a pacifier is used
  - Use of a pacifier might signal that dyad has breastfeeding problems
- All feeding cues should be met with food first, not the pacifier

Matern Child Nutr 2017 Jul;13(3)

9

When Are Pacifiers OK for Non-ICU infants?

- Baby is latching & nursing well
- Back to birth weight
- Good weight gain
- Painful procedures or separations when mom cannot be present

Medical Indications for Supplement

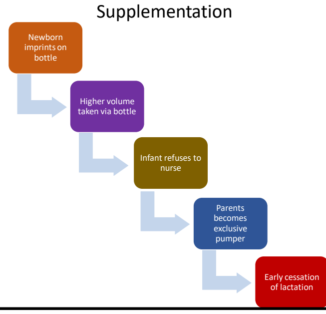
- Hypoglycemia
- Dehydration
- Delayed lactogenesis
  - Day 5, >10% weight loss
- Severe hyperbilirubinemia
- Infant not latching
- Known maternal insufficient production
  - Breast reduction
  - Breast radiation
  - Insufficient glandular tissue

Academy of Breastfeeding Med Protocol #3 bfmed.org

Late Preterm Infant (35-37 weeks)

- Limit length of feeds to 30 min
- Demand feeds fine BUT not > 4 hr gap
- Avoid excess wt loss: >3% by 24 hrs, >7% by 48 hrs
- Supplement using expressed colostrum/milk w/5-10 cc/feed day 1, then 10-30 cc/feed thereafter if needed

Aim for Non-Bottle Means of Supplementation



Colostrum Feeds via Cup


Globalhealthmedia.org

Cochrane Review of Cup Feeding 2016:
- No difference in weight gain or gestation age at discharge between infants supplemented via cup or bottle at discharge
- Infants who received supplemental feeds by cup were more likely to be exclusively breastfed at discharge
  - More likely to breastfeed at 3 and 6 months of age

Early Feeds via Spoon

J Perinatol (2010) 30

- 79 babies >32 weeks gest randomized to NG vs spoon feeding
  - No significant differences in weight gain
  - Time to bfeeding was similar


Globalhealthmedia.org

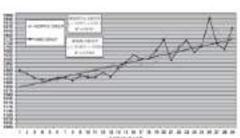


Table 4 Time period for transition to breast feeding

S.No.	Variables	Trial 1: NG feeding in hospital [illegible]	Trial 1: Spoon feeding in hospital [illegible]
1	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]
3	[illegible]	[illegible]	[illegible]
4	[illegible]	[illegible]	[illegible]

Finger Feeding vs Syringe Feeding

- 70 babies on room air at 30-35 weeks gest
  - Randomized to finger vs syringe feeding
    - 4 times a day for 20 min
    - Feeding finished via NG

TABLE 2. COMPARISON OF TWO GROUPS ACCORDING TO STUDY OUTCOMES

	Group 1 (finger feeding) (n=35) Mean±SD	Group 2 (syringe feeding) (n=35) Mean±SD	p
Transition time to full enteral feeding (days)	7.7±5.0	9.0±6.1	0.436
Starting time to specified oral feeding method (days)	14.1±13.9	11.7±6.9	0.773
The amount of remaining milk given through orogastric tube after feeds (cc)	15.3±6.5	15.9±3.0	0.203
Transition time to fully breastfeeding (days)	19.4±15.0	29.7±10.2	0.000
Duration of hospitalization (days)	25.8±17.4	35.9±13.0	0.001
Weight gain at 10th day of study (g)	322.1±82.3	252±108.4	0.004

SD, standard deviation.

Buldur, Baltaci et al Breastfeeding Med 15(11) 2020

Supplementing at the Breast

Advantages:
- Decreases risk of bottle preference
- May increase breast emptying
  - Esp for low milk production
- Adds breast stim, increasing PRL

Tips:
- Does not need to be done for each feeding
- Ideal for infants who are effective nursers
  - Not for sleepy, weak infants
- Practice makes perfect
  - May take several tries to become efficient
- Can be used for small (syringe) or large (bottle) volumes

Always Pace Bottle Feeds!

- Pacing is not just for premies!
- Decreasing hydrostatic pressure in bottle slows flow
- Slower flow associated with
  - ++ Infant control
  - Decreased risk of overfeeding
  - Less GERD/vomiting
    - Fewer prescriptions!
  - Less choking/coughing
  - Lower risk of bottle preference for nursing infants

Keep the bottle horizonal

Infant on their side until good head control

Hypoglycemia Requiring IV Dextrose

- Infants on IV dextrose should be allowed to nurse or take colostrum
  - Reduces duration of IV therapy
  - Reduces maximum IV glucose infusion rates
- Protect milk production
  - Pump after each feeding or at least every 3 hours in lieu of feeding

Why Not a Nipple Shield?

- An easy fix
- Nipple shields might decrease prolactin
  - Risk of decrease in milk production
- Risk of insufficient milk transfer
- Need to pump after nursing
- Does not teach nursing
  - ? Increase nursing challenges

Newborns on Phototherapy can be Taken Out for Feedings at the Breast

- Intermittent vs continuous phototherapy
  - Intermittent = less than 12/24 hours
    - E.g. 3-5 hours, stop for 2-4 hours
  - Continuous = more than 12/24 hours (1 off-period at most in 24 hours)
- Intermittent associated with
  - As effective in reducing TSB
  - Shorter phototherapy duration
  - Fewer side effects
    - Fever, rash, bottle feeding
- Rationale
  - Photoreaction takes minutes
  - It takes hours for bili to come to the skin surface

J Adv Nurs 2021;77:12-22

Conclusions

- Infants who are well enough to breastfeed need to nurse often to prevent excessive weight loss and establish milk production.
- Early skin to skin promotes successful feedings at the breast.
- Avoid pacifiers unless needed for procedures or maternal infant separation.
- Late preterm infants need nutritional support with small volumes after nursing at least every 3 hours.
- Nipple shields increase the risk of insufficient milk transfer and low milk production.
- Alternative forms of supplementation, rather than bottles are ideal for transition to breastfeeding
- Always pace bottle feedings.