Breastfeeding the Preterm Infant

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Breastfeeding the Premie

- **Introduction**
  - Early nutritional management
  - Goals of nutrition & opportunities
- Human Milk in the NICU
  - Benefits of human milk for preterm infants
  - Concerns re human milk for preterm infants
  - Pasteurized donor human milk
  - Fortification of human milk
- Establishing & Maintaining Moms' Milk Supply
  - EBM Storage and Handling
- Strategies to Facilitate Breastfeeding in the NICU
  - The Breastfeeding-Supportive NICU
- Post-Discharge Nutrition
  - Benefits and concerns of human milk post-discharge
  - Monitoring nutritional adequacy
- The late preterm infant
- Conclusions/ Q & A

Definitions

LBW (low birth weight)	<2500 grams	< 5 lb 8 oz
VLBW (very low birth weight)	<1500 grams	< 3 lb 5 oz
ELBW (extremely low birth weight)	<1000 grams	< 2 lb 3oz

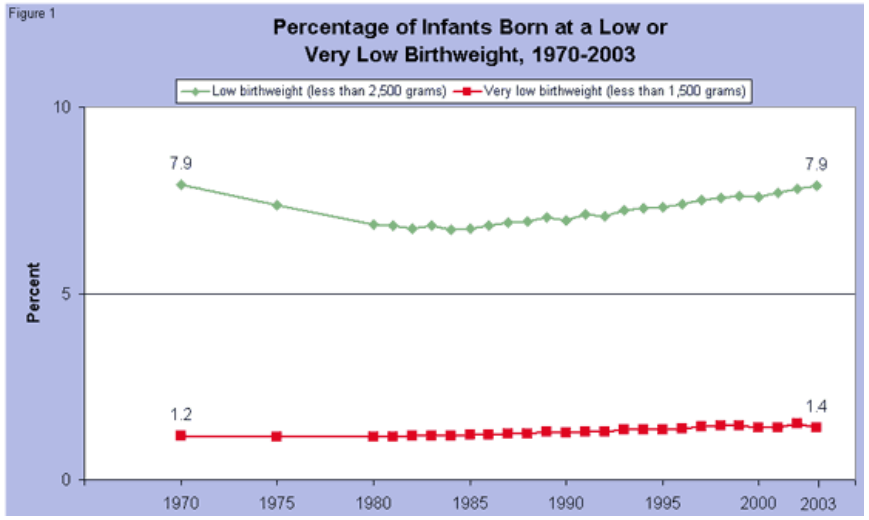
Small for gestational age (SGA)	Wt < 10%tile
Appropriate for gestational age (AGA)	Wt 10-90%tile
Large for gestational age (LGA)	Wt > 90%tile

Premature	≤ 37 6/7 wks
Term	38-42 wks
Post-term	> 42 wks

Preterm M & M: 2003 Number of Infants/Year

US (4.1M)	LBW (7.9%)	~ 324,000/yr
	VLBW (1.4%)	~ 58,000
	ELBW (0.7%)	~ 29,000
World (200M)	LBW (15%)	30,000,000
	VLBW (3%)	6,000,000
	ELBW (1.5%)	3,000,000

NCHS, 2003:
www.cdc.gov/nchs/fastats/birthwt.htm



Child Trends Data Bank

Improved Survival:
Weight at 50% Survival (in USA)

1970	**.....**	**1500 g**
1980	**.....**	**1000 g**
1990	**.....**	**750 g**
1995	**.....**	**600 g**
2000	**.....**	**500 g**
2005	**-------**	**500 g**

Factors Affecting Growth Outcome at 18 Months in ELBW Infants

Dusick A et al. (NICHD Network), Pediatric Res 1998; 43:213A, Abstr # 1243

BW (g)	n	Birth Wt ≤ 10%	36 wks Wt ≤ 10%	18 mo Wt ≤ 10%	18 mo L ≤ 10%	18 mo HC ≤ 10%
401-500	15	71%	100%	77%	69%	92%
501-600	94	35%	100%	73%	63%	92%
601-700	208	15%	99%	52%	52%	57%
701-800	237	16%	100%	47%	42%	46%
801-900	290	15%	99%	43%	41%	37%
901-1000	307	17%	98%	35%	33%	31%

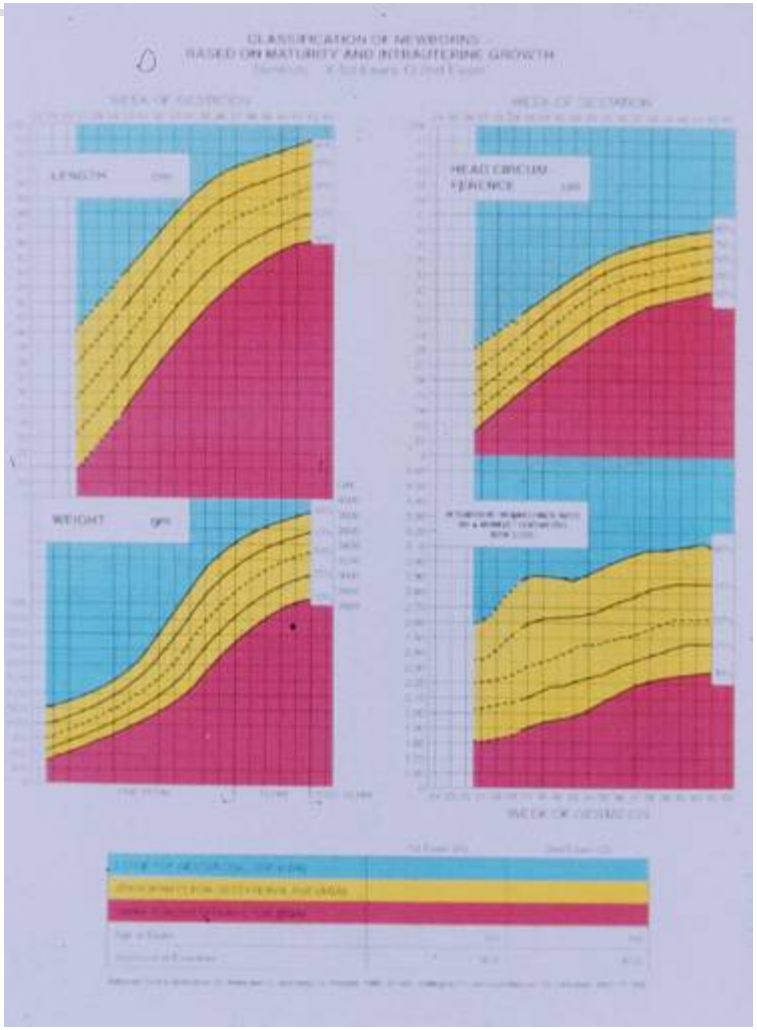
56
Please be super
at my beside !!!
I can only handle
Minimal Stimulation

GOALS OF NUTRITION

- Defining and achieving a standard of short-term growth
- Meeting the unique nutritional needs of prematurity
- Preventing feeding-related morbidities
- Optimizing long term outcome

Current Standard of Growth

- To approximate the in utero growth of a normal fetus of the same postconceptional age.
  - Body weight
  - Body composition



- AAP Committee on Nutrition: Nutritional needs of low birth weight infants. Pediatrics 1985;75:976
- AAP Committee on Nutrition: Nutritional needs of the preterm infant, in Kleinman RE (ed): Pediatric Nutrition Handbook, ed 4, Elk Grove Village, IL, AAP, 1998, p55-87

Unique Aspects of Nutrition for the VLBW Infant

- Higher organ:muscle mass ratio
- Higher rate of protein synthesis and turnover
- Greater oxygen consumption during growth
- Higher energy cost due to transepidermal water loss
- Higher rate of fat deposition
- Prone to hyperglycemia
- Higher total body water content

Preventing Feeding-Related Morbidities

- NEC
- Osteoporosis
- Vitamin and mineral deficiencies
- Feeding intolerance
- Prolonged TPN
- Prolonged hospitalization
- Lack of full physical and intellectual potential

Optimizing Long Term Outcome

Nutritional Programming:

(The Barker Hypothesis)

Nutrition during critical periods in early life may permanently affect the structure and/or function of organs or tissues.

Alan Lucas, 1990

David Barker 1992

Early Diet Influences Long-term Health and Disease

Breastfeeding leads to reduction in diastolic blood pressure in later years of 3.2 mmHg, a greater impact that seen by other public health measures including:

- Weight loss (-2.8 mmHg)
- Alcohol reduction (-2.1 mmHg)
- Salt restriction (-1.3)
- Exercise (-0.2 mmHg)

Ebrahim S, Smith GD. J Public Health Med 1998; 20:441-48

Compilation of Research: Atul Singhal MRCP, Dec 2003

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Rise and Fall and Rise of Human Milk

- 1950-60's: EBM (MOM & Fresh Donor) for almost all infants
- 1970s: PTF "better growth"
- 1980s: HIV / BM Bank closures
- 1990s: Increased use of MOM
- 2000+: MOM standard of care
  Pasteurized Donor milk when MOM not available

Benefits of Human Milk for Preterm Infants

- Host Defense
- Gastrointestinal Development
- Special Nutrition
- Neurodevelopmental Outcome
- Physically & Psychologically Healthier Mother
- Economic & Environmental

Host Defense:
(Each element has multiple functions)

- **Cellular elements**
  - Lymphocytes, PMN & Macrophages
- **Immunoglobulins & other direct anti-infective factors**
  - IgA, Secretory IgA
  - Lactoferrin
  - Lysozyme
  - Casein
  - Mucin
- **Anti-inflammatory factors**
  - Vitamin A, C, E
  - Catalase
  - Glutathione peroxidase
  - PAF acetylhydrolase
  - Prostaglandins
- **Immunomodulators**
  - Prolactin
  - Cytokines
  - Cortisol, thyroxine, insulin & growth factors
  - Interleukins
  - Interferon
  - TNF & TGF
- **Other bioactive factors**
  - Oligosaccharides
  - FFA
  - Nucleotides
  - Glutamine, Taurine
  - EGF

Incidence of Necrotizing Enterocolitis by Type of Feed

	Necrotizing Enterocolitis	
Type of feed	Incidence	Proportion
EBM	1.2 %	3/253
EBM + PTF	2.5 %	11/437
PTF	7.2 %	17/236

Statistical Comparison:

PTF v. PTF + EBM $p < .005$

PTF v. EBM $p < .001$

Lucas & Cole, Lancet 1990;336:1519

Human Milk Provides Protection from Infection

Sepsis rate	Breastmilk	Formula
Day 0 - 10	5% (2/38)	10% (10/107)
Day 11-24	9% (4/43)	20% (18/94)
Day 25-38	0% (0/19)	15% (11/72)

El Mohandes et al. Use of Human Milk in the Intensive Care Nursery Decreases the Incidence of Nosocomial Sepsis. **J Perinatology** 1997;17(2):130-134

The effect of maternal milk on neonatal morbidity of very low-birth-weight infants

Furman L et al. Arch Pediatr Adolesc Med 2003; 157(1):66-71

- Prospective observational study
  - 119 singleton VLBW infants
    - Mean B Wt 1056 g
    - Mean gest age 28 wks
  - Effect on neonatal outcomes of graded doses of MOM
- Results:
  - **Threshold amount of at least 50 ml/kg/d of maternal milk through week 4 of life needed to decrease rate of sepsis in VLBW infants**
    - Rate of sepsis lower by factor of 0.27

Benefits of Human Milk for the Preterm Infant

- Gastrointestinal Development
  - Reduces intestinal permeability faster
  - Induces lactase activity
  - Multiple factors to stimulate growth, motility and maturation of the intestine
  - Human milk empties from the stomach faster than artificial milks
  - Less residuals and faster realization of full enteral feedings

Factors in Breastmilk That May Promote Gastrointestinal Maturation

- Epidermal growth factors
- Nerve growth factors
- Somatomedin-C
- Insulin-like growth factors
- Insulin
- Cortisol
- Thyroxine
- Nucleotides
- Taurine
- Glutamine
- Lactose
- Amino sugars
- Cytokines

Groer & Walker. Advances in Pediatrics 1996; 43:335-358

Time needed to establish full enteral feeds in 95 % of infants

Type of feed	Number of days
Expressed breastmilk (EBM)	20
Standard formula (SF)	45
Preterm formula (PTF)	48

Lucas & Cole. Lancet 1990;336:1519

Benefits of Human Milk for the Preterm Infant

- Special Nutrition
  - Different quantity and quality of proteins
  - Lipid profile: Cholesterol, DHA, ARA
  - Carbohydrates designed for human infants
  - Antioxidants
  - Lower Osmolality/Renal solute load
  - Other factors: eg. Erythropoietin, EGF

Composition of Milk on Day 7 Postpartum

Gross et al. J Pediatr 1980; 96:641

Component	Preterm Milk	Term Milk
Calories (kcal/100 ml)	67.4	60.6
Protein (gm/100 ml)	2.44	1.87
Fat (gm/100 ml)	3.81	3.06
Sodium (mEq/l)	21.8	16.9
Chloride (mEq/l)	25.3	21.3
Lactose (gm/100 ml)	6.05	6.52
Phosphorus (mg/100 ml)	14.2	15.1
Calcium (mg/100 ml)	24.7	25.4

Benefits of Human Milk for the Preterm Infant

- Neurodevelopmental Outcome
  - Higher IQ scores (especially for males)
  - Improved visual development
  - Less, and less severe ROP
  - Development of taste and smell

Long Term Outcome: Cognitive Development

- 20 studies compared cognitive development
- Breastfeeding was associated with significantly higher scores than artificial feeding
- **Benefit was strongest for children of low birth weight**
- Developmental achievements persisted at least through adolescence.

Anderson et al. Breast-feeding and cognitive development: A meta-analysis. Am J Clin Nutr 1999; 70:525-535

Breastmilk and Subsequent Intellectual Performance in Premature Infants at 8 yr

Factor Affecting IQ	IQ Points
Breastmilk	+ 8.3
Social Class	- 3.5/class
Mother's Education	+ 2.0/group
Female Gender	+ 4.2
Mechanical Ventilation	- 2.6/week

Lucas et al, Lancet 1992; 339:261

THE NATION'S NEWSPAPER 50 CENTS

USA TODAY

No. 1 IN THE USA . . . 6.6 MILLION READERS A DAY

TOGETHER IN THE LIMELIGHT

WEEKEND EDITION

ROCKERS, MODELS DYNAMIC DUOS, 1D

FREQUENT TRAVELERS CHECK IN 1B

'ROAD WARRIORS' RESPOND TO CALL BY HUNDREDS

Celebrity Photo
DAVID BOWIE AND IMAN: Betrothed

Mother's milk: Food for smarter kids

By Mike Snider
USA TODAY

Children who got mother's milk as premature infants score higher on IQ tests than children who didn't, a new study finds.

Other studies have suggested breast feeding boosts development and IQ, but some researchers have attributed that to having a nurturing mother.

This new study of 300 preemies — fed by tube — offers "strong evidence . . . that receiving breast milk was associated with the IQ advantage, rather than the process of breast feeding," says Alan Lucas of the Medical Research Council, Cambridge, England.

He and others studied the preemies in two groups: those who got milk from their natural mothers and those who didn't. Infants in both groups may also have been fed infant formula and milk from a woman other than their mother.

Preemies who got milk from their mothers during the first four to five weeks of life averaged 8.3 points higher on IQ tests at age 7½-8, show findings in the British medical journal *Lancet*, out Saturday.

"We've produced strong evidence that breast milk may be beneficial for long-term development," Lucas says.

Researchers did not identify a specific amount of mother's milk needed for the IQ advantage, but the more mother's milk they got, the better the children seemed to do.

He says new formulas — with a better supplement of hormones, growth factors and certain fats found in mother's milk, coupled with at least some milk from the natural mother — could give preemies "a double advantage."

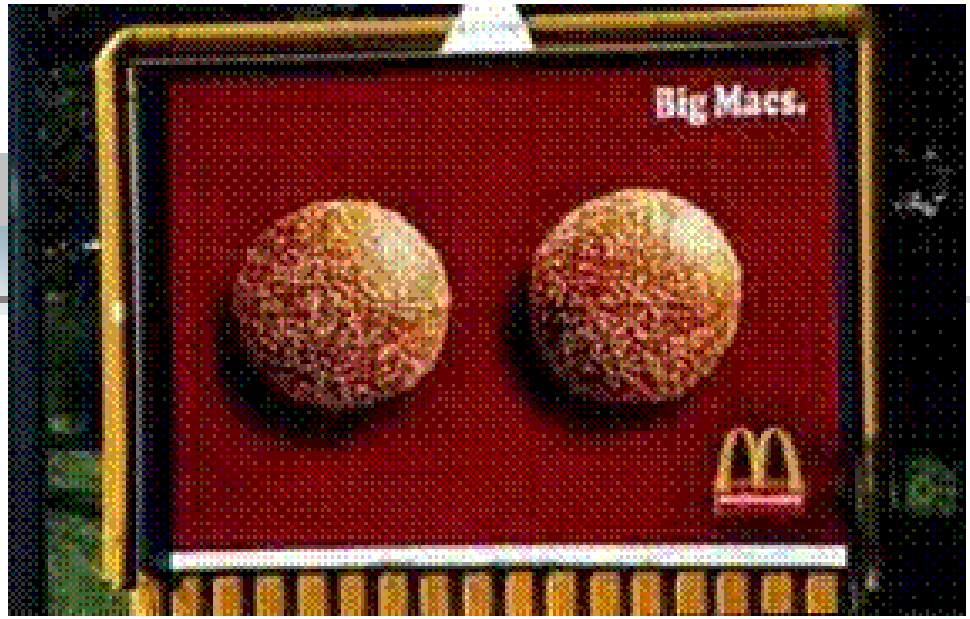
"I forgot to say I was breast-fed."

Benefits of Human Milk for the Preterm Infant

- Physically Healthier Mother
  - (Weight loss ↑)
  - Breast cancer/ovarian cancer ↓
  - Osteoporosis ↓
  - Child spacing via LAM
- Psychologically Healthier Mother
  - Alternate focus
  - Sense of control & Claim on infant
  - Guilt issue (D. Miracle/Rush study)

Benefits of Human Milk for the Preterm Infant & Society

- Decreased Healthcare Costs
  - Less acute illness
  - Less chronic illness
- Decreased Societal Costs
  - Loss of time and income from work
  - Less waste
  - Less use of resources


Big Macs.

Possible Concerns re Human Milk for Preterm Infants

- **Nutritional**
  - Insufficient Pro, Ca, Phos, Na,, vitamins
  - Variability of composition
  - Loss of nutrients during storage/feeding
- Infectious
  - Bacterial contamination during expression, storage and feeding
  - Viral transmission: CMV, HIV

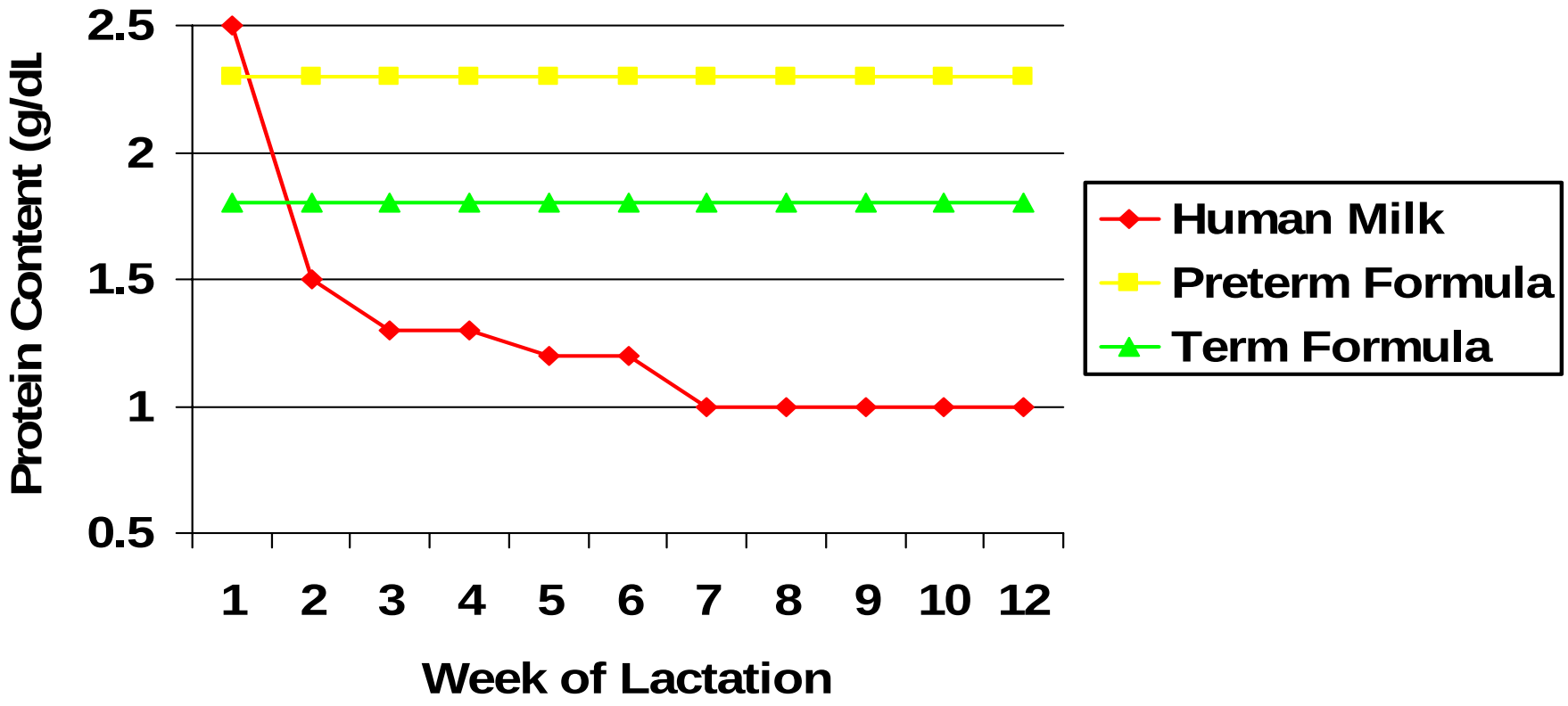
Preterm vs Term Milk over Time

Schanler & Atkinson. Effects of Nutrients in Human Milk on the Recipient Premature Infant. J Mam Gland Biol Neoplasia 1999;4(3):297

	Preterm Mother's Milk			Term Mature
Milk Component	Colostrum	Transit.	Mature	
Total Pro, g/dL	30	24	15	12
IgA, mg/g protein	109	92	64	83
NPN. % total N	15	18	17	24
Na, mmol/L	22.2	11.6	8.8	9.0
Ca, mmol/L	6.8	8	7.2	6.5

Protein Content of Human Milk vs term and Preterm Formula

Schanler & Oh. J Pediatr 1980;96:679



Higher Protein Intake Improves Growth in VLBW Infants Fed Fortified Breastmilk

Carlson Abstr 1638, SPR 5/1/00

	Fortified HM		Formula	
	Lactose (n=13)	Protein (n=13)	Lactose (n=9)	Protein (n=11)
Cal intake (kcal/kg/d)	120.7	113.7	117.0	114.4
Wt gain (g/d)	22.7	26.7	28.5	29.4
Wt gain (g/kg/d)	14.9	17.3	18.4	19.1
Wt gain (g/100 kcal)	13.0	16.0	16.4	16.9

66 Infants <1250 gm. Suppl started when enteral feeds reached 50 ml/kg/d

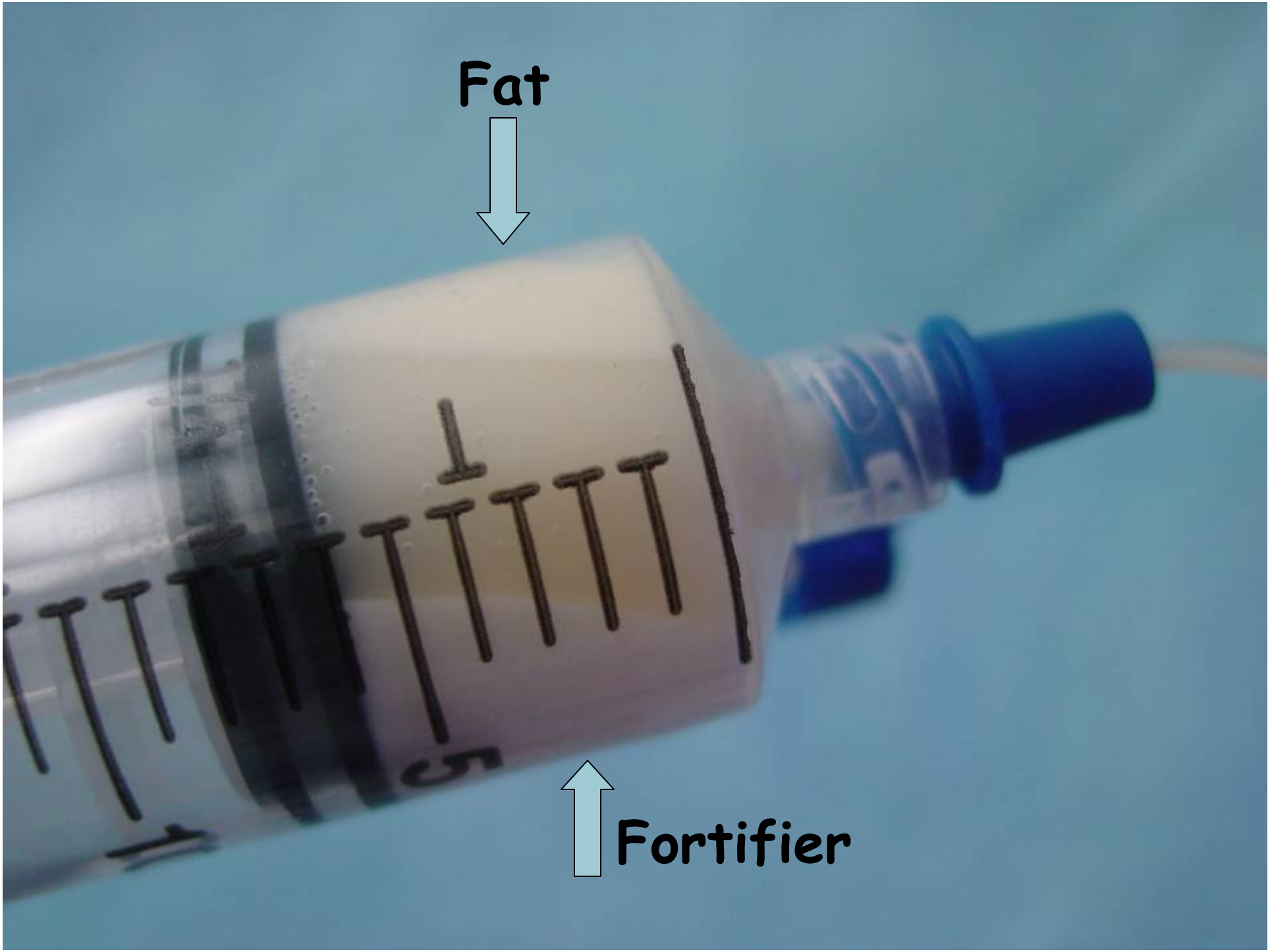
Nutrients in Human Milk

Schanler & Atkinson. J Mam Gland Biol Neoplasia 1999; 4(3):297

Nutrient	Prem Recom Nutr Intake	Volume of MOM to meet Recom
Energy, kcal	105-135	145-185
Protein, g	3.0-3.6	180-210
Potassium, mmol	2.5-3.5	155-220
Zinc, umol	7.7-12.3	120-190
Copper, umol	0.1-1.9	115-200
Vitamin E, mg	0.5-0.9	120-200

Na, Ca, Phos recommended intakes only met with clinically impossible volumes of milk.

Baxter
RUN
STANDBY
LOCK SYSTEM
STOP
CLR
PLUS
TOT
LOCK
ALERT
BATTERY
ON CHARGE
START
28
200
228


Fat
Fortifier

Concerns re Human Milk for Preterm Infants

- **Nutritional**
  - Insufficient Pro, Ca, Phos, Na,, Vitamins
  - Variability of composition
  - Loss of nutrients during storage/feeding
- **Infectious**
  - Bacterial contamination during expression, storage and feeding
  - Viral transmission: CMV, HIV

AAP 2003 RED BOOK,
26th Ed, pg 118

- NICU gram neg outbreaks occasionally attributed to contaminated human milk specimens that have been collected or stored improperly.
- Milk from other than biologic mother should be treated according to HMBANA guidelines.
- Routine culturing or heat treatment of mothers' own milk has not been demonstrated to be necessary or cost-effective.

Clinical Uses of Donor Human Milk

- **Preterm Infants**
- **Other infants, children and adults:**
  - allergies or sensitivities to formulas
  - failure to thrive (FTT)
  - immune deficiencies
  - malabsorption syndromes
  - post-surgical nutrition
  - short gut syndrome
  - solid organ transplants (including adults)
  - cancer chemotherapy patients / apoptosis
  - renal failure (replenish IgA)

Special Benefits of Heat-Treated Human Milk

- All WBC destroyed (no GVHD)
- All bacteria, viruses and other pathogens destroyed
- Removes inhibitory cytokines, facilitating the action of epidermal growth factor (EGF) and lysozyme
- Most enzymes, vitamins and minerals are unchanged or minimally decreased
- Many immunoglobulins and other infection-fighting factors are unchanged or minimally decreased

Human Milk Banks in North America

Research Milk Bank:
Cincinnati Children's Hospital

In Development:

Indiana Mothers' Milk Bank, Inc.
Mothers' Milk Bank of Ohio
Bronson Methodist Hospital, MI
Medical University of South Carolina

Mothers' Milk Bank at WakeMed, Raleigh, NC
Mothers' Milk Bank, Denver, CO
Mothers' Milk Bank, San Jose, CA
Mothers' Milk Bank, Newark, DE
Mothers' Milk Bank at Austin, Austin, TX
Mother's Milk Bank of Iowa, Iowa City, IA
C&W Milk Bank, Vancouver, BC, Canada

California Neonatologist Survey

Although 97% of **California** neonatologists in this survey always or usually recommend human milk for their NICU patients, there is little familiarity with the use of pasteurized donor human milk. It is likely that there is even **less** familiarity and usage of PDHM in many areas of the United States.

Some key areas of neonatologists' concern identified were:

- ➔ Accessibility and logistics of obtaining milk
- ➔ Safety and infection control issues
- ➔ Social acceptability and legal issues
- ➔ Nutritional adequacy and efficacy questions

One comment summarized it very nicely: "Great idea if disease-free, adequate quantities available in a timely manner, and appropriate studies done."

Concerns re **Donor** Human Milk for Preterm Infants

- Nutritional
  - Insufficient Pro, Ca, Phos, Na,, Vitamins
  - Variability of composition - donors usually term+
  - Alteration of nutrients with processing
  - Loss of nutrients during storage/feeding
- Infectious
  - Bacterial contamination during storage and feeding
  - Bacterial contamination with processing
  - (Viral transmission: CMV, HIV)

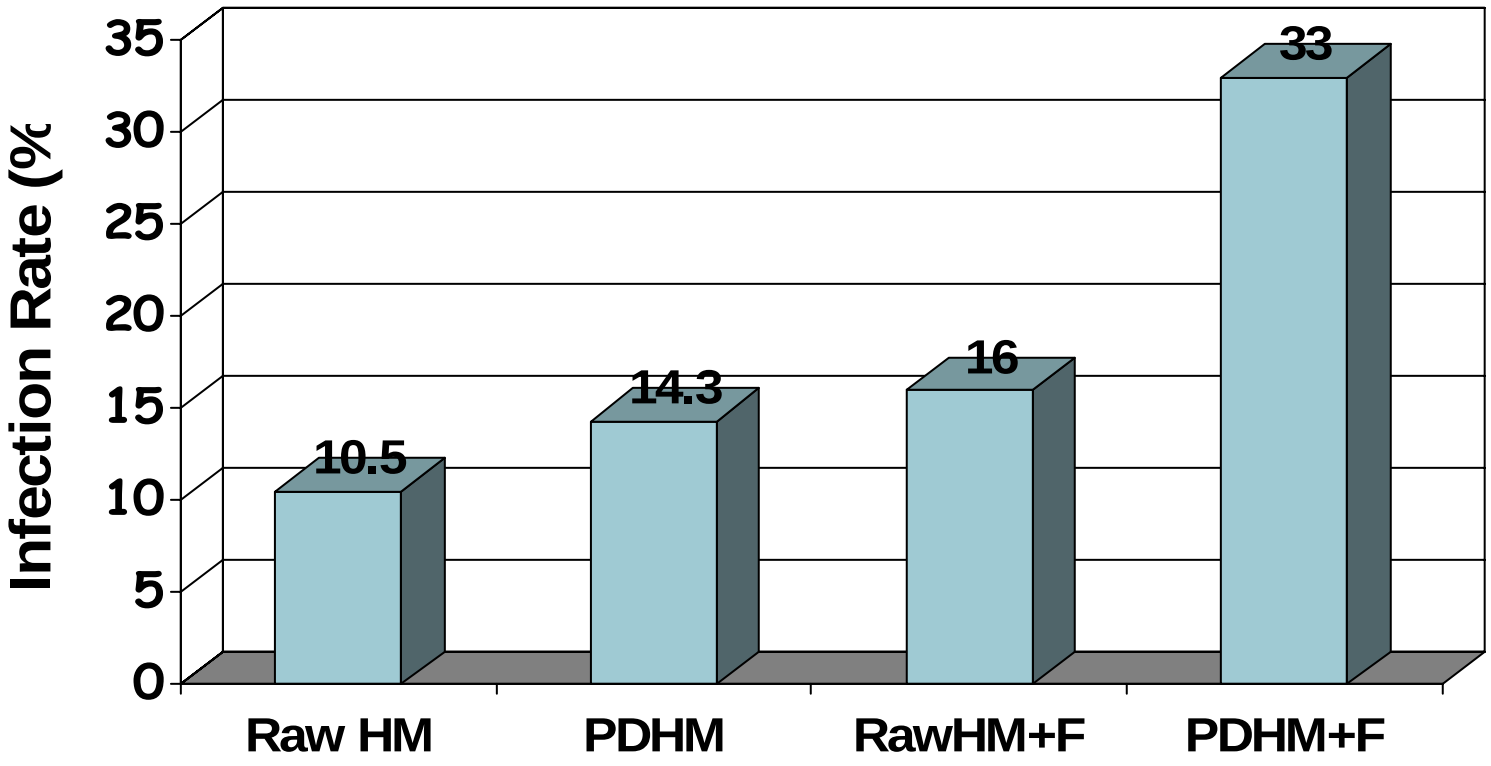
Pooled Pasteurized Breast Milk and Untreated Own Mother's Milk in the Feeding of VLBW Babies: A RCT

Stein et al. JPGN 1986; 5:242

	MOM	Pooled Term	P Value
Days to regain Birth Wt	11.5	17.2	<0.0001
Days from regained B Wt to 1800 gm	32	44	<0.0001
Growth (gm/d)	16	12	<0.0001
Increase in Head Circ (cm/wk)	0.77	0.74	0.8
Increase in Length (cm/wk)	0.77	0.76	0.5

Infection Rates in High Risk Infants

Narayanan et al. Lancet 1984;II:1111-1113



HM = Human Milk; PDHM = Pasteurized donor human milk; F = Formula

Donor human milk versus formula for preventing necrotizing enterocolitis in preterm infants: systematic review

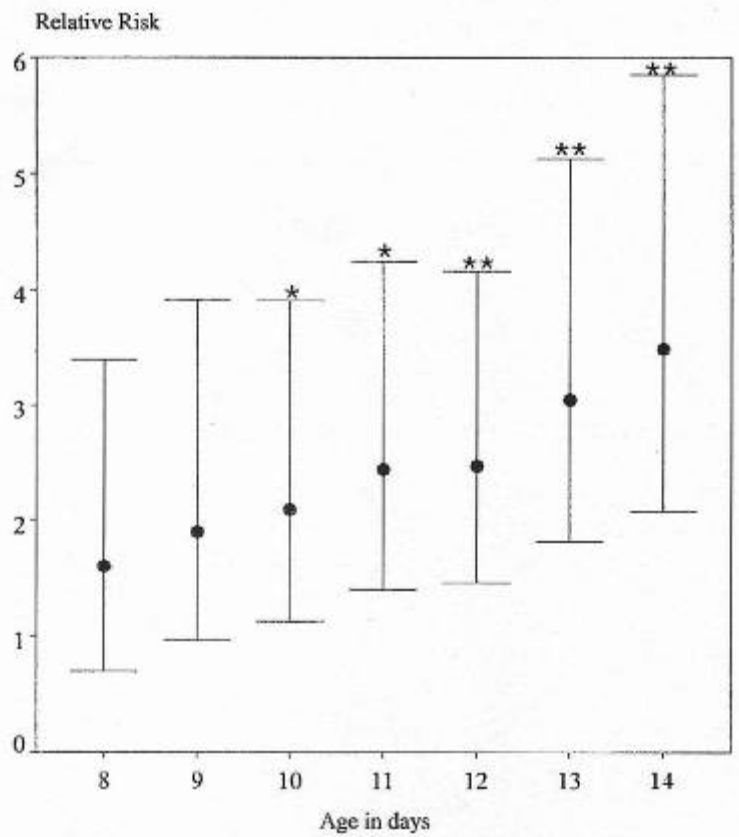
McGuire W, Anthony MY. Arch Dis Child Fetal neonatal Ed 2003 Jan; 88(1):137-138

- Meta-analysis: Only 4 small trials, all > 20 years old
- Infants who received donor human milk:
  - 3 times less likely to develop NEC (RR 0.34; CI 0.12-0.99)
  - 4 times less likely to have confirmed NEC (RR 0.25; CI 0.06-0.98)

Late-Onset Septicemia in a Norwegian National Cohort of Extremely Premature Infants Receiving Very Early Full Human Milk Feeding

Ronnestad A et al. Pediatrics 2005; 115(3):e269-276

- Prospective study of all infants born in Norway 1999 & 2000
  - EGA < 28 wks or B Wt. < 1000g
  - Of 464 eligible infants, 462 (99.6%) enrolled
  - 405 (87.7%) survived until day 7
- Enteral feeding with human milk (mothers' own and **donor**) initiated by:
  - Day 1 – 61%
  - Day 2 – 92%
  - Day 3 – 96%
- Most influential risk factor for late-onset sepsis (LOS) was the number of days without establishment of full enteral feeds with human milk



*; p < .05 and **; p < .001 versus full enteral feeding established on given day. Circles represent relative risk (RR), bars represent 95 % confidence interval for RR

Fig 3. RR of future LOS if FEF with human milk is not established within a given age (in days) among extremely premature infants in Norway, 1999–2000.

Conclusions:

Schanler et al. Pediatrics 2005; 116:400-406

- Mother's own milk is best and should be supported in the NICU
  - Less NEC, Late-onset sepsis, length of stay, ROP
- Through no fault of the authors, the sample size was inadequate to detect a difference in NEC or LOS
  - Incidence < half of predicted
- Both mothers' own and donor milk groups had a significant reduction in CLD
- Giving ALL groups ~ 50% of enteral intake as mothers' own milk may not be the best way to see an effect of donor milk
- Kangaroo care is highly correlated with mothers ability to produce milk
  - And NOT correlated with any increase in infection
- Rapid catch-up growth may not be the ideal for VLBW infants
  - Long term outcomes not studied

TEAR OPEN
Powder
Ⓤ-D
Similac®
Human Milk Fortifier
ROSS
PEDIATRICS
NOT FOR INDIVIDUAL SALE
0.031 OZ (0.90 g)

RCTs of Fortified vs Unfortified Human Milk

Kuschel & Harding 1998, http://silk.nih.gov/silk/cochrane/kuschel/kuschel.htm

- 13 studies, 596 infants
- Growth
  - Weight gain +3.7 g/kg/d
  - Length +0.13 cm/wk
  - FOC +0.12 cm/wk
- Bone mineral content +8.3 mg/cm
- Nitrogen balance +66 mg/kg/d
- BUN +5.8 mg/dL
- Blood pH - 0.01 units
- NEC No significant difference
- Feeding tolerance No significant difference

Comparison of Selected Human Milk Fortifiers (per 100 ml)

Schanler. Ped Clin NA 2001; 48(1):207-219

Nutrient	PreT HM	SNC 1:1	EHMF	SHMF
Energy (kcal)	71	76	85	85
Fat (g)	3.6	4.0	3.6*	4.0
CHO (g)	7.0	7.8	9.7	8.8
Protein (g)	1.8	2.0	2.5	2.8
Calcium (mg)	22	97	112	139
Phosphorus (mg)	14	50	59	81
Magnesium (mg)	2.5	6.3	3.5	9.5
Sodium (mEq)	0.7	1.1	1.0	1.35
Zinc (μg)	320	760	1030	1320
Copper (μg)	60	1045	122	230
Vitamins	Yes	Multi	Multi	Multi

Hindmilk Fortification

Valentine, JPGN 1994; 18:474

(unit/L)	Foremilk	Hindmilk
Energy (kcal)	629	825
Fat (g)	28.6	47.8
Protein (g)	13.1	13.1
Calcium (mg)	272	273
Sodium (mEq)	3.3	3.1
Zinc (mg)	2.9	2.8

Hindmilk Feeding in VLBW Infants

Dayanikli P et al. PAS 2004, San Francisco, Abstr # 2526 & #2194

- 26 VLBW infants included in study
  - Entered at 100 ml/kg/day enteral feeds &
  - Mothers' milk supply at least 20% more than infants' needs
  - 13 fortified hindmilk (HM)
  - 13 fortified mother's milk (Control-matched for BWt.)
- No significant differences in:
  - Gest age at birth (29.5 weeks)
  - Birth weight
  - COC, weight, height at study entry
- Milk analyzed for
  - Fat content: ($p<0.05$)
    - 2.0 ± 1.1 g/100g Control
    - 3.1 ± 1.1 g/100g Hindmilk
  - Total calories: ($p<0.05$)
    - 53.8 ± 13.1 Control
    - 65.1 ± 9.7 Hindmilk
- Results after 28 days:
  - No differences in weight, length, FOC, Mid-arm circ, Skin fold thickness
  - No adverse effects on lab values
    - Ca, Phos, Alp, T Pro, Alb, BUN
  - No change in Cholesterol, TG, LDL levels

Fortification and Immune Competency of Human Milk

- Fortification does not significantly alter bacterial counts if used within 24 hrs. (Jocson)
- IgA content not affected by fortification, storage temp, duration of storage (Jocson)
- E coli-specific IgA decreased with fortification (Quan)
- Microwave destroys IgA

Gastric emptying in pre-term infants: the effect of BM fortifier

- 11 infants studied on 22 occasions
- Median gestation 28 wk (25-31)
- Median birth weight 1090 gm (714-1360)
- Median postnatal study age 44 days (15-83)
- Nestle fortifier FM-85
- Mean (+/-SEM) half emptying time
  - unfortified BM 21 min (+/- 3.6)
  - fortified BM 48 min (+/- 4.0)

Ewer & Yu. Acta Paediatr 1996: 85:1112-5

Early Diet Influences Long-term Health and Disease

Adverse effects of growth acceleration in humans include:

- Obesity
- Elevated blood pressure
- Insulin resistance and diabetes
- IGF-1 concentrations
- Cardiovascular mortality

Eriksson JG et al. BMJ 1999; 318:427-31
Fewtrell M et al. Diabetologia 200; 43:714-717
Law CM et al. Circulation 2002; 105:1088-1092
Compilation of Research: Atul Singhal MRCP, Dec 2003

Breastfeeding the Premie

- Introduction
  - Early nutritional management
  - Goals of nutrition & opportunities
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  - Benefits of human milk for preterm infants
  - Concerns re human milk for preterm infants
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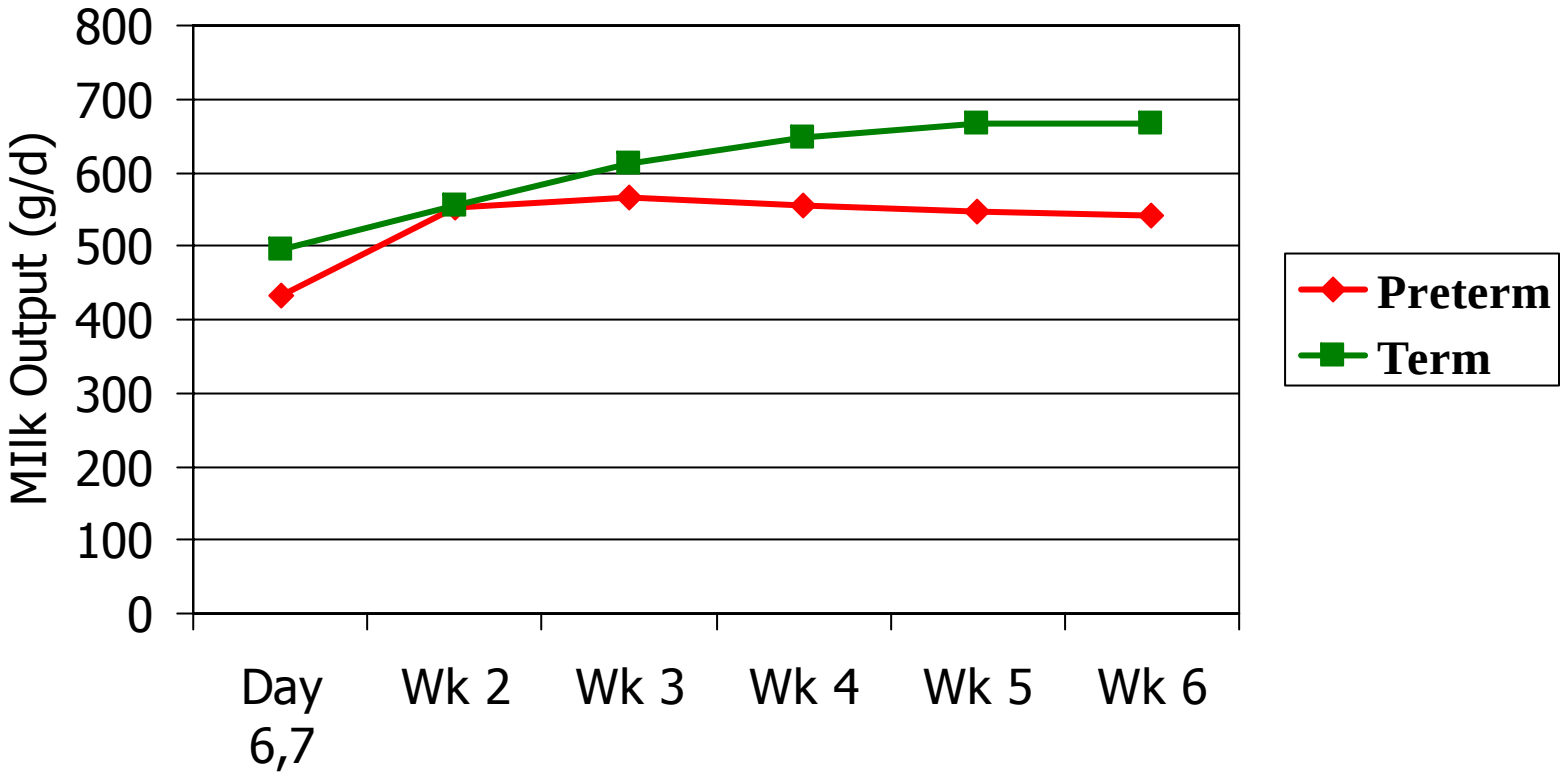
- **Establishing & Maintaining Moms' Milk Supply**
- Strategies to Facilitate Breastfeeding in the NICU
- Post-Discharge Nutrition
  - Benefits and concerns of human milk post-discharge
  - Monitoring nutritional adequacy
- The late preterm infant
- Conclusions/ Q & A

Comparison of Milk Output Between Mothers of Preterm and Term Infants

Hill PD et al. J Hum Lact 2005; 21(1):22-30



Establishing and Maintaining a Mother's Milk Supply

- **Anticipatory Guidance**
  - Prenatal assessment and counseling (Neo & LC)
  - Breast pump rental and supplies
  - Continued monitoring and support
  - Recommended milk volumes by 7-10 days pp
    - Abundant: >600 mL/day
    - Marginal: 350-600 mL/day
    - Low: <350 mL/day
- **Pumping Initiation and Frequency**
  - Pump early: within first 24 hours
  - Pump often: 8-10 times/24 hours
  - Round the clock to start, and when notice decrease in supply (never longer than 5-6 hours between pumpings)
  - Mimic normal term newborn feeding pattern

Automatic cycling, "double" pump:

-increased prolactin levels

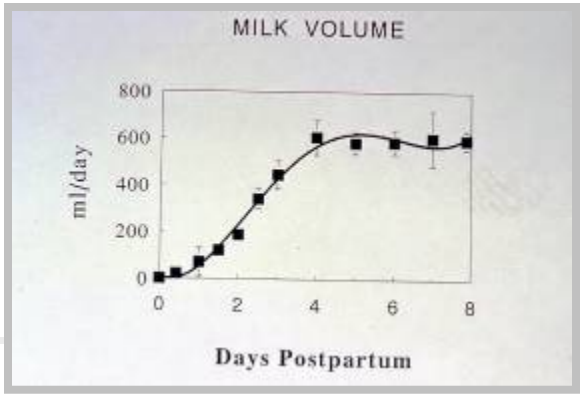
-increased efficiency

Correlates of Lactation in Mothers of Very Low Birth Weight Infants

Furman L, Minich N, Hack M. Pediatrics 2002; 109(4): e57
URL: www.pediatrics.org/cgi/content/full/109/4/e57

- Prospective observational study of 87 mothers who intended to breastfeed their preterm infants
  - Mean B Wt: 1056 g and mean Gestational Age: 28 wks
  - Interviews at 3 wks after delivery, 35 wks CA, 40 wks CA, 4 mo CA
- Results:
  - At Corrected Age (CA) of 40 wks: 34% still lactating
  - At CA 4 months: 16% still lactating and 14 % breastfeeding
  - After controlling for maternal age, race, marital status, maternal education,
  - **5 factors associated with lactation beyond term:**
    - **Initiation of breast pumping before 6 hrs postpartum**
    - **Pumping milk $\geq$ 5 times per day**
    - **Kangaroo care**
    - **Higher mean vol. of milk pumped at initial interview and 35 wks**
    - **Putting the infant to breast by 35 wks CA**

Establishing the milk supply

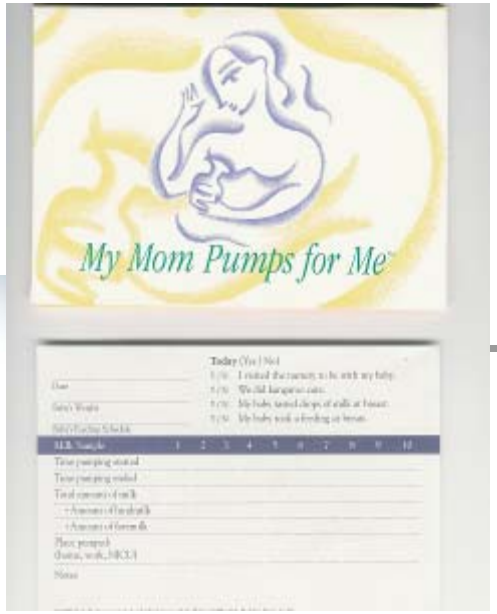


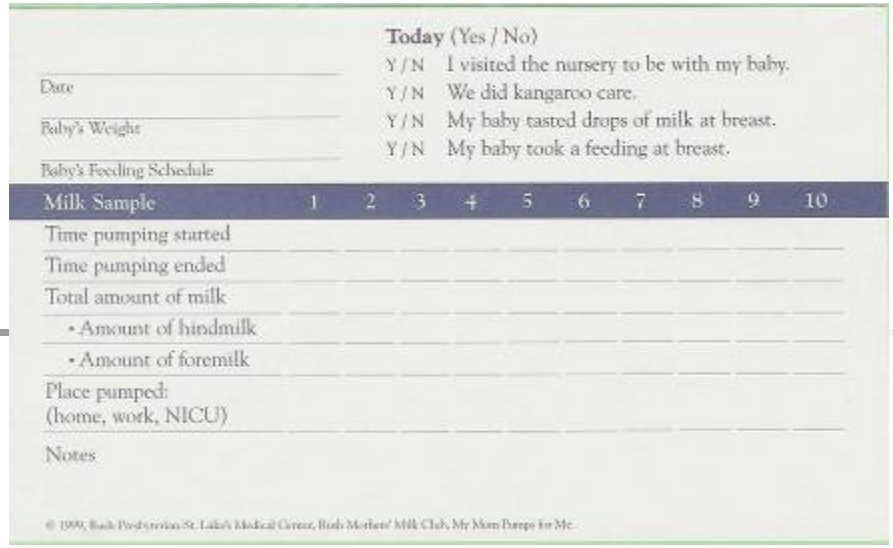
- Outcome depends on milk volume
- Milk volume plateaus by two weeks
  - 20 oz (600mL) by 7-10 days
- Early initiating of pumping (within 6 hours) is associated with higher volume
- Mothers who deliver prematurely are often:
  - unprepared
  - too medically compromised to assume primary responsibility for pumping
- Pumping and providing milk contributes to the physical and emotional recovery of the mother.

The "GUILT" Issue

- "The medical profession has been hesitant to take anything but a neutral position in such discussions for fear of pressuring the mother. The evidence is stronger than ever that there are distinct advantages to the mother and the infant in breastfeeding. Parents have the right to hear the data. They can make their own choice. **Fear of instilling guilt is a poor reason to deprive a mother of an informed choice."** R A Lawrence, 1990

- "All 21 women denied feeling coerced to provide milk or made to feel guilty about their initial feeding plans. On the contrary, **mothers expressed anger and frustration** about health care providers from referral institutions who had told them that human milk and formula were the same or that method of feeding was their choice, without offering a professional opinion." P P Meier, Ped Annals, May 2003





Today (Yes / No)

Y / N I visited the nursery to be with my baby.
Y / N We did kangaroo care.
Y / N My baby tasted drops of milk at breast.
Y / N My baby took a feeding at breast.

Date

Baby's Weight

Baby's Feeding Schedule

Milk Sample	1	2	3	4	5	6	7	8	9	10
Time pumping started										
Time pumping ended										
Total amount of milk										
• Amount of hindmilk										
• Amount of foremilk										
Place pumped: (home, work, NICU)										
Notes										

© 1999, Rush Presbyterian-St. Luke's Medical Center, Rush Mothers' Milk Club, My Mom Pumps for Me.

Rush Mothers' Milk Club

Lucile Packard Children's Hospital AT STANFORD

Maintaining a pumping diary-log cues mothers to visit, pump and hold their infants frequently.

Breast Expression	1	2	3	4	5	6	7	8	9	10	MILK TOTALS	
Time pumping started												
mls of milk pumped from left breast											TOTAL LEFT	
mls of milk pumped from right breast											TOTAL RIGHT	
Baby weight before nursing at breast												
Baby weight after nursing at breast												
Total milk swallowed by my baby during nursing											TOTAL SWALLOWED	
TOTAL DAILY PRODUCTION (Add Total Left, Total Right and Total Swallowed)												

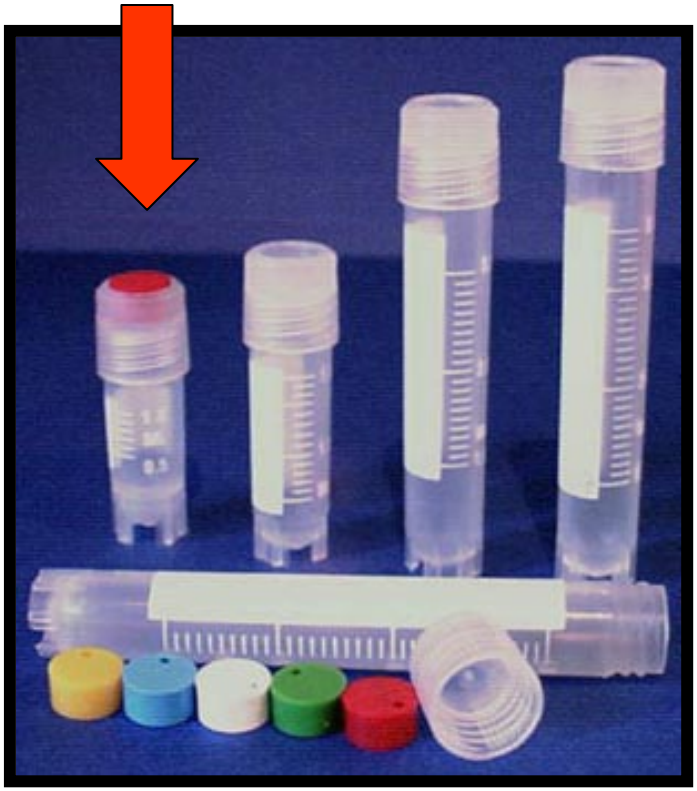
Mother's Medications: _____

Questions: _____

Recording maternal milk production in the infant's chart cues staff to promote behaviors demonstrated to improve production.

Teach hand expression and provide containers

1.2 mL



http://www.simport.com/products/77/T310

A RCT to compare methods of milk expression after preterm delivery

Jones E et al. Arch Dis Child Fetal Neonatal Ed 2001; 85:F91-F95

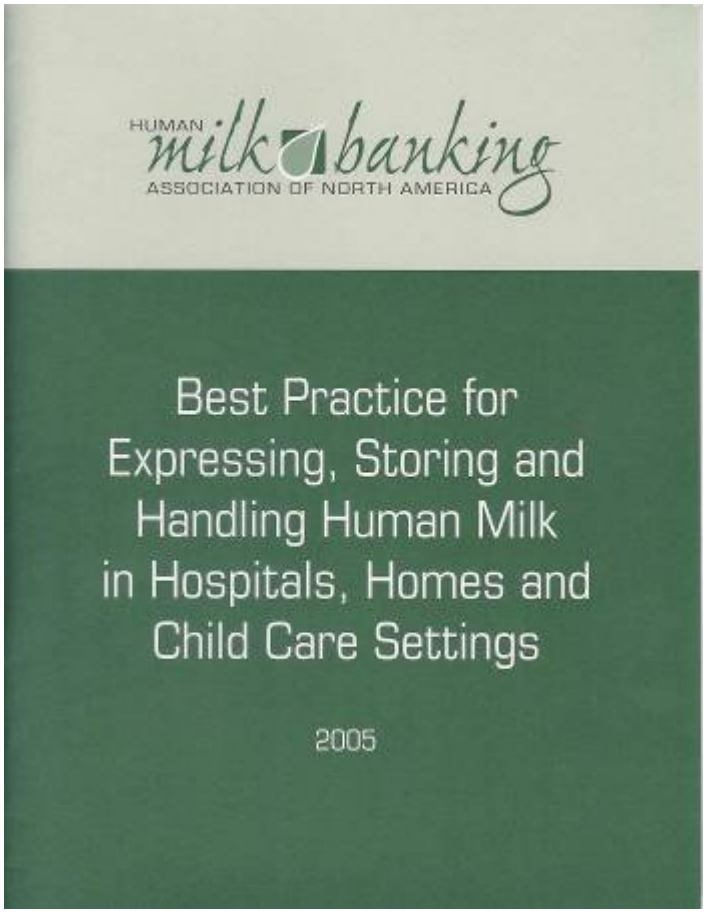
Output from a single expression for milk weight and for fat for 4 different combinations of pump modality & breast massage.				
	Sequential, non-massage	Sequential, massage	Simultaneous, non-massage	Simultaneous, massage
Weight (g)	51	79	88	125
Fat Conc (g/l)	7.1	6.7	7.0	6.8
Total fat (g)	3.1	4.2	6.0	8.0

Key messages:

1. **Frequent and efficient milk removal is essential for the continued production of milk.**
2. **Breast massage and simultaneous pumping increase the volume of milk expressed in the immediate period after preterm delivery.**
3. **Fat content is also higher when simultaneous pumping is used.**
4. **Creamatocrit surveillance provides a positive tool to ensure effective milk expression.**

Handling Human Milk

- Human Milk Banking Association of North America
  www.hmbana.org
  - "Guidelines for the Establishment and Operation of a Donor Human Milk Bank" at $40.00/copy ($45.00/copy outside the U.S.)
  - "Best Practice for Expressing, Storing and Handling of Human Milk in Hospitals, Homes and Child Care Settings" at $40.00/copy ($45.00/copy outside the U.S.)



ATTENTION

- "Whereas **universal precautions DO NOT APPLY** to human breast milk, gloves may be worn by health care workers in situations where exposures to breast milk might be frequent, for example in breast milk banking."
  - Centers for Disease Control. MMWR 1988; 37:377-82
- "Contact with breast milk **does not constitute on occupational exposure** risk as defined by OSHA standards."
  - Committee on Pediatric AIDS, AAP. Pediatrics 1995; 96:977-79

Misadministration of Human Milk

(For protocol see www.cpqcc.org, Toolkit 2)

- Prevention
  - Color-coding
  - 2 RN medication verification
  - Warming at bedside
  - Individual refrigerator/freezers at bedside
- Management
  - Informing parents
  - Laboratory work-up
  - Paperwork
  - Follow-up
- **DON'T PANIC !!!!!**

Establishing and Maintaining a Mother's Milk Supply

- Maintaining Milk Volume
  - Monitoring: desired milk volume at 1-2 weeks 600-800 ml/day
  - Increasing milk volume
  - Stress and lactation
- Galactogogues
  - Metoclopramide (Reglan)
  - Domperidone (Motilium) *
  - Fenugreek
  - Sulpiride*
  - TSH (not used clinically)

* Not available in US

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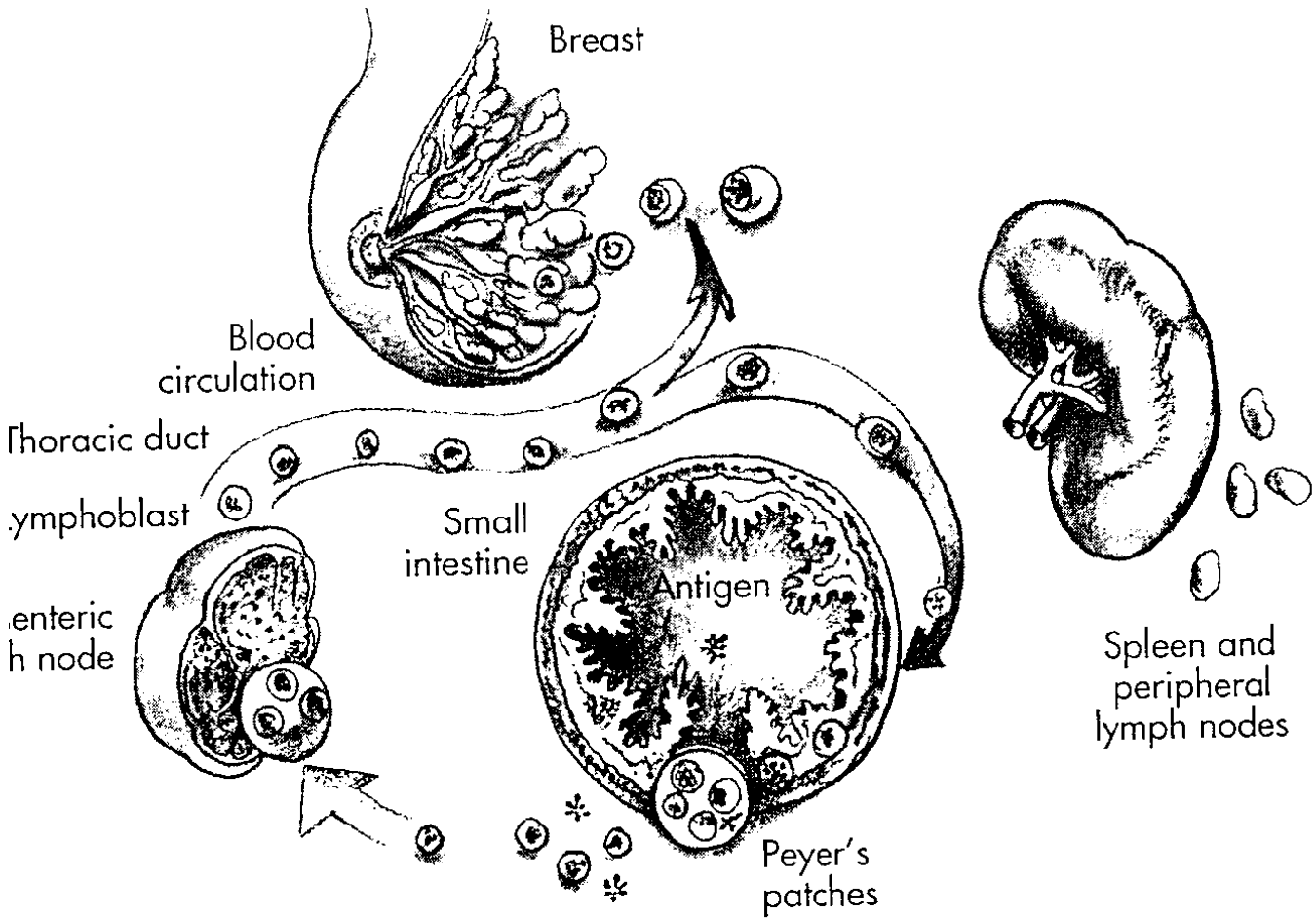
Kangaroo Care = Skin-to-Skin Care

- Kangaroo Care
  - Improves breastmilk production
  - Lengthens time nursing after discharge
  - Enhances entero-mammary immune system
  - Stabilizes vital signs

Enteromammary Immune System

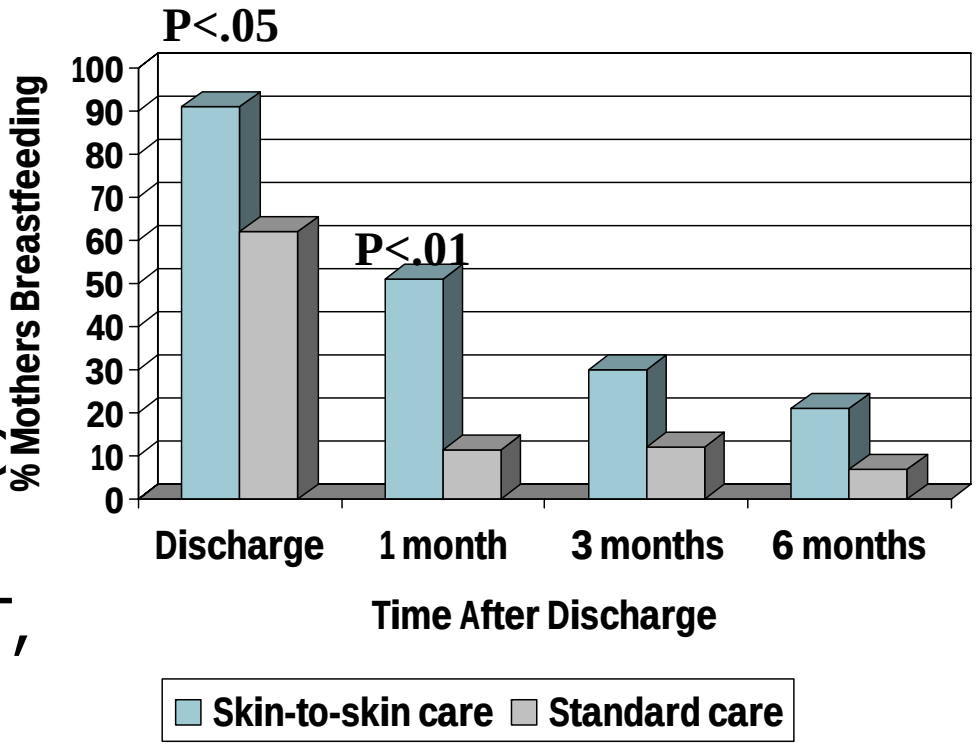
Lawrence & Lawrence, 5th ed, 1999, pg 166



Comparison of Skin-to-Skin Contact with Standard Contact in Low-Birth-Weight Infants Who Are Breast-fed

Blaymore Bier et al. Arch Pediatr Adolesc Med 1996; 150:1265-1269

- 50 VLBW infants
- O2 sats higher during SSC than SC (p<.001)
- More stable milk production in SSC group
- No difference in T, HR, RR



"Dry" Breastfeeding = Empty Breast Nursing = Non-nutritive Nursing

- Pump, then breastfeed + gavage feed measured amount
- Empty-breast nursing
  - Promotes milk production
  - Provides suckling experience without worrying about caloric intake or suck/swallow coordination
  - Extended times of exclusive and total breastfeeding post discharge

Sucking on the "emptied" breast: non-nutritive sucking with a difference Narayanan et al. **Arch Dis Child** 1991; 66(2):241-244	Intervention Group	Control Group	P
Mean (SD) duration of exclusive BF (mo)	3.7 (±1.3) n=13	1.9 (±0.6) n=10	< 0.001
Mean (SD) duration of total lactation (mo)	5.1 (±2.2) n=16	3.3 (±1.9) n=14	< 0.05

Initiating Breastfeeding

- Infant Readiness
  - NO weight or gestational age criteria
    - Accelerated neurologic maturity
    - Breastfeeding less stressful than bottle
  - When sucking well on finger, fist, pacifier or "dry breast" and handling own secretions
  - When medically stable
    - Can be on O_2

Matthew, 750 grams at 14 days, s/p 26 week

Feeding Techniques

- Can go from gavage to breast without bottles
- If Mom not available, consider alternative feeding techniques
- Can use supplemental nursing system as a transition
- Test-weighing
- Cue-based feedings (Nyqvist/Meier)
- Nipple shields

The development of preterm infants' breastfeeding behavior

Nyqvist et al. Early Human Dev 1999; 55(3):247-264

- "Opportunities for preterm infants to breastfeed should be made based on cardiorespiratory stability rather than current maturity, age, or weight."
- "Infants born at 28 weeks were able to efficiently root, grasp, and latch onto the breast, with nutritive suckling achieved from 30.6 weeks, and full breastfeeding for most of these infants at 36.0 weeks."

Assessment of Infant Feeding: The Validity of Measuring Milk Intake

Scanlon KS, Alexander MP, Serdula MK et al. Nutrition Reviews 2002; 60(8):235-251

- Review of 32 studies
  - Direct observation
  - Test weighing
  - Doubly-labeled water
- Correlations with actual intake were the highest with test weighing and doubly-labeled water
- "Regardless of whether the clinical assessments were performed by nurses, mothers, or lactation educators, **the differences between the clinical estimates and the test weight estimates of milk intake were large and random**."

Current Alternative Feeding Techniques

- Most common techniques:
  - Underdeveloped countries: CUP
  - Developed countries: BOTTLE
- Other techniques:
  - Finger-feeding
  - Dropper, spoon
  - Syringe
  - SNS

Nipple Shields and Milk Transfer

Meier PP. J Hum Lact 2000; 16(2):106-114

- Retrospective analysis of 34 preterm infants
  - Gestational age: 25-37 wks
  - Birth weights: 770-2820 gm
  - Wt at 1st breastfeeding; 1080-2820
- Indications for nipple shield use:
  - Infant not achieving/maintaining effective attachment to breast (62 %)
  - Infant falling asleep at breast quickly (29%)
  - Other (9%)
- **Mean milk transfer significantly greater for feedings with nipple shield in place**
  - **18.4 ml vs. 3.9 ml (p=.0001)**
- Mean duration of nipple shield use 32.5 days
- Mean duration of breastfeeding 169.4 days
- **No significant association between duration of nipple shield use and duration of breastfeeding.**

Posthospitalization Breastfeeding Patterns of Moderately Preterm Infants

Wooldridge J, Hall WA. J Perinat Neonat Nurs 2003; 17(1):50-64

- Conclusions:
  - Most of the infants were discharged from the hospital primarily bottle-feeding breastmilk.
  - The increase in direct breastfeeding was gradual over the 4-week period.
  - The increase in direct breastfeeding was slower/less for twins vs. singletons
  - **"Adequacy of the milk supply was a key factor in the successful transition from primarily bottle-feeding at hospital discharge to primarily breast-feeding at home."**

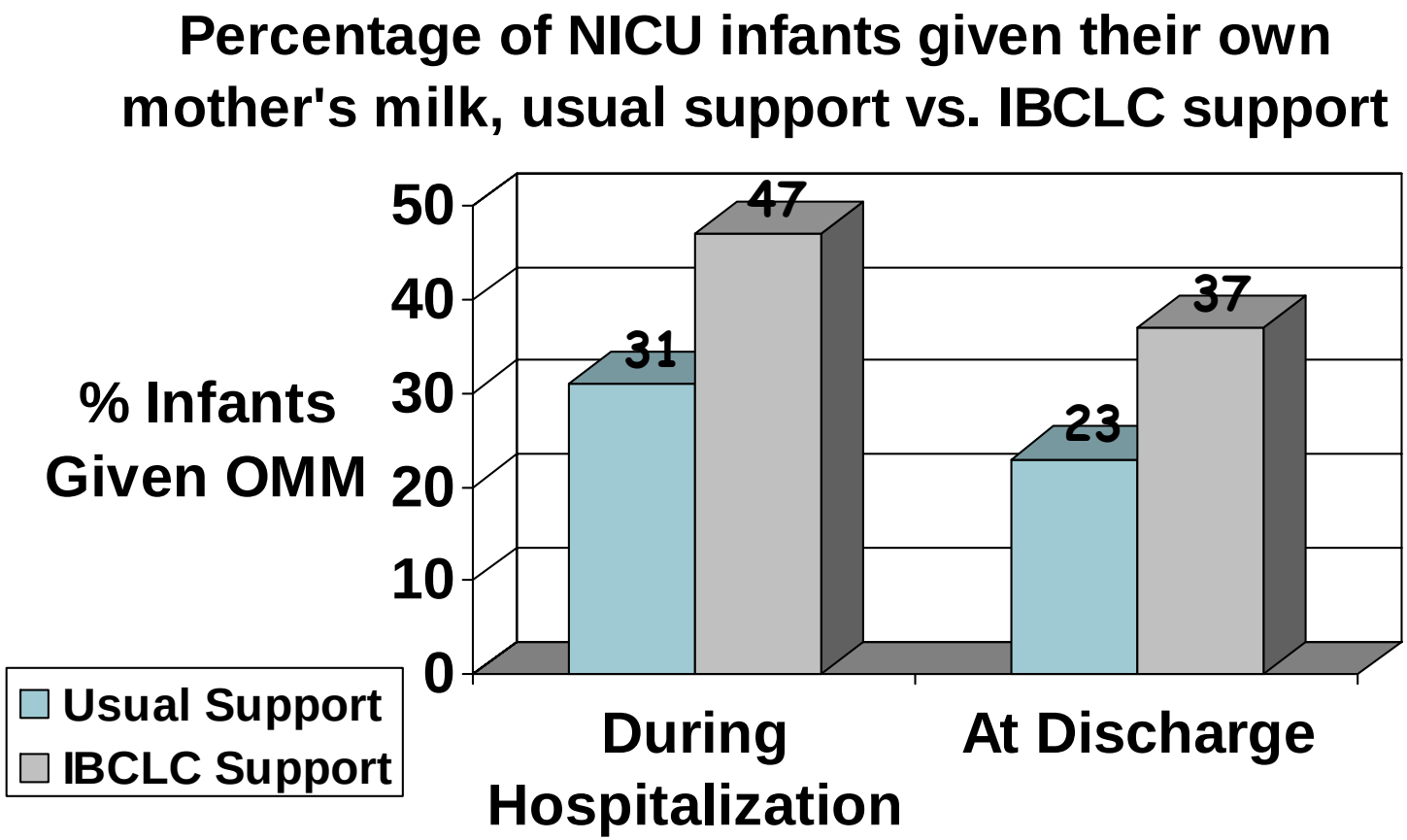
Lactation Support Services

- Patient education
  - prenatal
  - perinatal
- Consultation
  - prenatal outpatient/inpatient
  - inpatient perinatal
  - postnatal outpatient clinic
  - postnatal home health
- Durable Medical Equipment
  - breast pump rental
  - breast pump purchase
- Supplies
  - pump kits
  - mother supplies (pads, shields, shells)
  - infant supplies (SNS, feeders)
- Donor Milk
  - pasteurized donor human milk
  - (fresh donor milk)
- Support
  - support groups
  - telephone hotlines/warmlines
  - peer counselors

Other Services

- Coordination of Care
- Education
  - lactation consultants
  - healthcare providers (MD/RN/RD/etc)
  - public
- Staff Support
- Advocacy
- Program Evaluation/ CQI

Specific lactation assistance should be available to mothers of NICU infants.



Gonzalez et al. J Hum Lact 2003; 19(3):286-292

Lactation Counseling for Mothers of VLBW Infants: Effect on Maternal Anxiety and Infant Intake of Human Milk

Sisk, P. M. et al. Pediatrics 2006;117:e67-e75

- Sample:
  - All VLBW (700-1500g) infants' mothers
  - Approached within 3 days of delivery
  - Intention to breastfed group (IBG, N=115)
  - Intention to formula feed group (IFG, N=81)
- Counseling on:
  - Infant health benefits
  - Collection & storage of breast milk
  - Breast pump procurement
- Outcome measures:
  - State-Trait Anxiety Inventory
  - Parental Stressor Scale: NICU
  - Exit interview questionnaire
  - Infant breastmilk intake (% of total enteral intake)
- Results:
  - Initiated milk expression
    - IBG:100%
    - IFG: 84%
  - **Lactation counseling did NOT increase anxiety regardless of mothers' original feeding plan**
  - **Maternal anxiety trait scores were inversely correlated with infant breastmilk intake, suggesting that more anxious mothers had more difficulty maintaining lactation**
  - **More likely to express milk if infant smaller, more immature**
  - Breastmilk intake (mL/kg/day) was greater for infants of IBG v. IFG group
  - Most common reasons for stopping milk expression:
    - Low milk supply
    - Returning to work or school
    - Inability to pump as needed

Dietician Involvement in the NICU: More is Better

Olsen IE et al. May 2004 PAS, Abstr 2209

- 411/812 (51%) NICUs completed surveys
- 10 key survey questions: NC Score (nutrition care score)
  - In 168 (41%) NICUs had full or part-time RDs
  - Additional 143 (35%) NICUs used RD on consultant basis.
  - 99 (24%) had no formal RD inpu
- Full or part-time RD NICUs provided less TPN kcalories and more protein, and more enteral kcal and protein (consistent with best current practice)
- Mean NC Score increased with RD involvement:
  - No RD 4.6 ± 1.7
  - Consulting RD 4.7 ± 1.5
  - Part-time/full time RD 5.2 ± 1.7 ($p<0.01$)

Effect of NICU-based Peer Counselors on Breastfeeding Duration Among Premature Infants

Philipp BL, May 2004 PAS; Abstr # 201

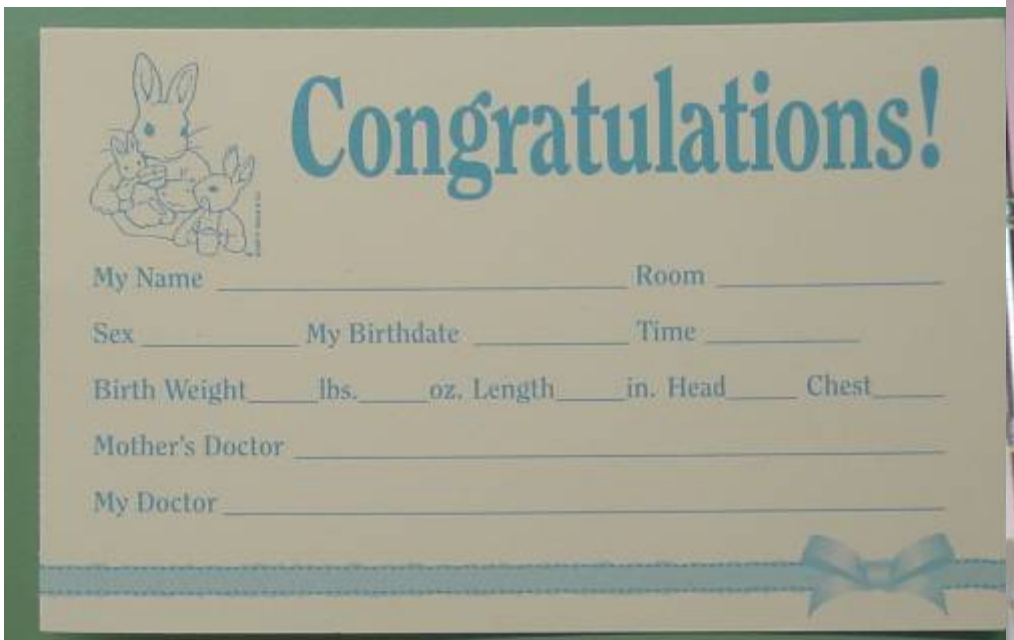
- Premature (26-37 week)
  - 38 mother/infant pairs (control)
  - 38 mother/infant pairs (intervention)
- Intervention
  - Breastfeeding peer support within 72 hrs of birth, then weekly for 6 wks
    - Showed mothers the NICU & Kangaroo care video
    - Reviewed benefits of breastfeeding
    - Helped with set-up and use of breast pump
    - Continued support at each meeting
  - Feeding status at 2, 4, 8, 12 weeks
    - All breastmilk
    - Mostly breastmilk with some formula
    - Mostly formula with some breastmilk
    - All formula
- **Intervention group mothers had odds of breastfeeding 5.3 times as great as control group mothers at any contact point.**

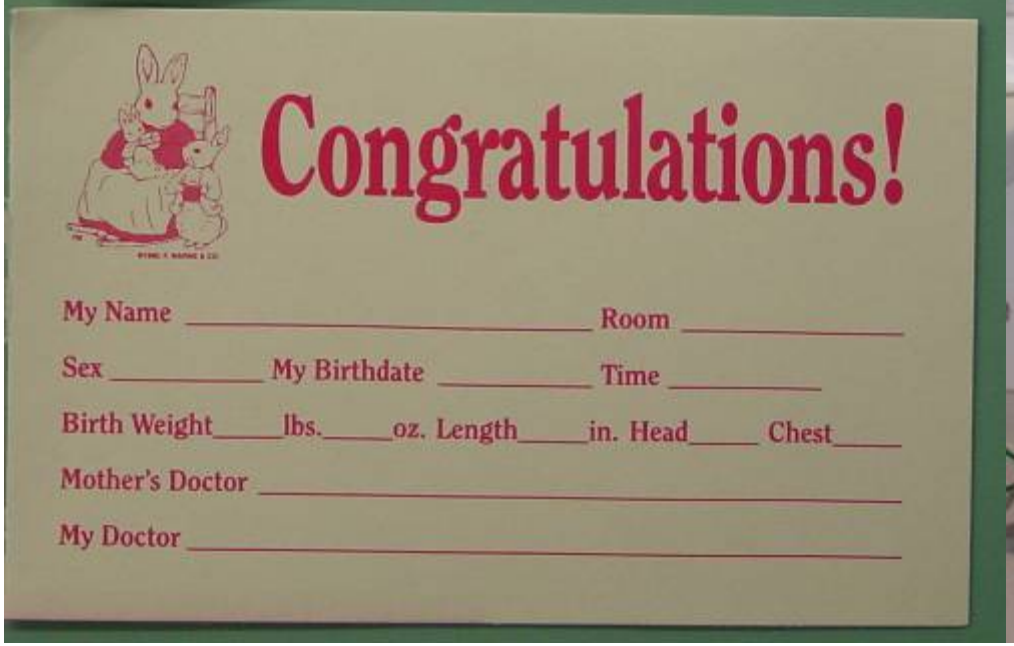
Lactation Policy and Procedure

- Basic Hospital Breastfeeding Policy
- NICU Breastmilk Policies
  - Basic policy/principles
  - Collection, storage and handling of MOM for hospitalized infants
  - Use of fresh and processed donor human milk
  - "Oops" policy
- Ancillary Policies
  - Trophic feeding
  - Kangaroo care
  - Co-bedding twins
  - Visitation
  - Pre-discharge rooming in
  - Outpatient follow-up
  - **Vendors/Gifts**

ISOMIL

ISOMIL


Congratulations!
My Name
Room
Sex
My Birthdate
Time
Birth Weight
lbs.
oz. Length
in. Head
Chest
Mother's Doctor
My Doctor


Congratulations!
My Name
Room
Sex
My Birthdate
Time
Birth Weight
lbs.
oz. Length
in. Head
Chest
Mother's Doctor
My Doctor

NO !

BABIES
SIMIL
Enfamil
Nurses Shape The Future
Similac
Enfamil

GOOD HEALTH BEGINS WITH BREASTFEEDING
GOOD HEALTH BEGINS WITH BREASTFEEDING
GOOD HEALTH BEGINS WITH BREASTFEEDING
YES !

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  - EBM Storage and Handling
- Strategies to Facilitate Breastfeeding in the NICU
  - The Breastfeeding-Supportive NICU
- **Post-Discharge Nutrition**
  - Benefits and concerns of human milk post-discharge
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Diets Available for the Preterm Infant – Post Discharge

- Human Milk
  - Mothers' Own Milk (MOM)
  - Donor Breastmilk (DBM)
    - Drip Milk
    - Expressed Milk
- Standard Formulas
- "Enriched" Formulas
- Preterm Formulas
- Fortified Diets
  - Human Milk plus Multinutrient Fortifier
  - Lactoengineering

Comparison of Milks Used Post-Discharge

Per 100 ml	Preterm formula	Enriched Formula	Term Formula	Human Milk
Energy (kcal)	81	73	67	67
Protein (g)	2.2-2.4	1.9-2.1	1.4	1.0
Fat (g)	4.1-4.4	3.9-4.1	3.6	3.5
CHO (g)	8.6-9.0	7.7-8.0	7.3	7.0
Calcium (mg)	133-145	78-90	53	26
Phosphorus (mg)	67-81	46-50	28-36	14
Sodium (mEq)	1.4-1.5	1.1	0.7-0.8	0.9
Chloride (mEq)	1.8-1.9	1.6-1.7	1.2	1.6
Zinc (μg)	1210	900	500-675	320
Vitamin A (IU)	1000	340	203	223

Post-Discharge Nutrition

- VLBW infants grow faster and have higher bone mineral content up to 1 year, if provided additional nutrients, especially:
  - Protein
  - Calcium
  - Phosphorus
- However, exclusively breastfed former preterm infants tend to "catch up" if given sufficient time (2-8 years).
- The optimal growth rate (reference target) has not been established for post-discharge preterm infants.
- Select the population for enriched diet.
- Encourage breastfeeding.
- Monitor growth and nutritional status.

Measuring/Monitoring Nutritional Adequacy

- Growth Parameters
- Chemical Indicators
  - Albumin
  - Pre-albumin (transthyretin)
  - BUN
  - Calcium
  - Phosphorus
  - Alkaline phosphatase
  - CBC, Retic Ct
- Bone Mineral Content
- Long Term Health & Development =

Gold Standard!

Discharge Planning: Breastfeeding

- Discharge planning starts on admission !
- Pre-discharge nutritional assessment
  - Growth
  - Laboratory
- Mother-Infant Dyad Breastfeeding Assessment
  - Cardio-respiratory stability
  - Adequate volume transferred in "reasonable time"
- Nutritional Follow-Up Plan
  - Primary MD
  - Lactation
  - RD
- Pre-discharge rooming in
- Individualized plan for transition to full breastfeeding at home
  - Mother's goals & preferences
  - Social & financial concerns
  - Share plan with follow-up Peds/FP/NNP
- Equipment
  - Keep breast pump until term + 4-8 weeks
  - Home scale if appropriate
- Outpatient follow-up & support
  - Lactation
  - Mother-to-mother support group
  - WIC/RD

Criteria for Hospital Discharge of the High Risk Neonate

Adapted from: AAP COFN, Pediatrics 1998; 102(2 Pt 1): 411-7

- Sustained pattern of weight gain of sufficient duration
- Competent oral feeding (breast or bottle)
  - Without cardiopulmonary compromise
- Nutritional risks assessed and treated
- Temperature stability in open crib/normal environment
- Mature cardiopulmonary function
- Unresolved medical conditions identified, treated
- Screening completed
  - Metabolic (newborn) screen
  - Hearing and Ophthalmologic
  - Immunizations
- Parents and home environment assessed as capable of safe and adequate infant care
- Appropriate follow-up arranged

Include Nutrition in Discharge Planning

ABM Protocol # 12, www.bfmed.org

- Can baby consume volume > 180 ml/kg/d ?
- Is wt gain adequate ?
- Are nutritional indices appropriate ?
  - Albumin
  - Alkaline phosphatase
  - Phosphorus
- If ALL responses YES:
  - Exclusive breastfeeding
    - At the breast
    - Expressed BM
    - Combination
  - Term formula
- If any responses NO:
  - Combination BF /EBM + enriched formula
  - Enriched formula

Post-Discharge Nutritional Monitoring

Ehrenkranz RA. Clin Perinatol 2000; 27(2):325-45

- Consider nutritional screening assessment
  - 1 week after discharge
  - 4-6 weeks after discharge
- If infant growing slowly or assessment is abnormal, provide nutritional supplementation
- Continue breastfeeding with the addition of the supplement
- Continue to monitor

Post-Discharge Nutritional Monitoring

Modified from Hall RT, Carroll RE. Ped in Review 2000; 21(6):191-200

- Nutritional assessment
  - Growth

	Action Values
Weight gain	< 20 g/day
Length growth	< 0.5 cm/wk
Head Circumference	< o.5 cm/wk

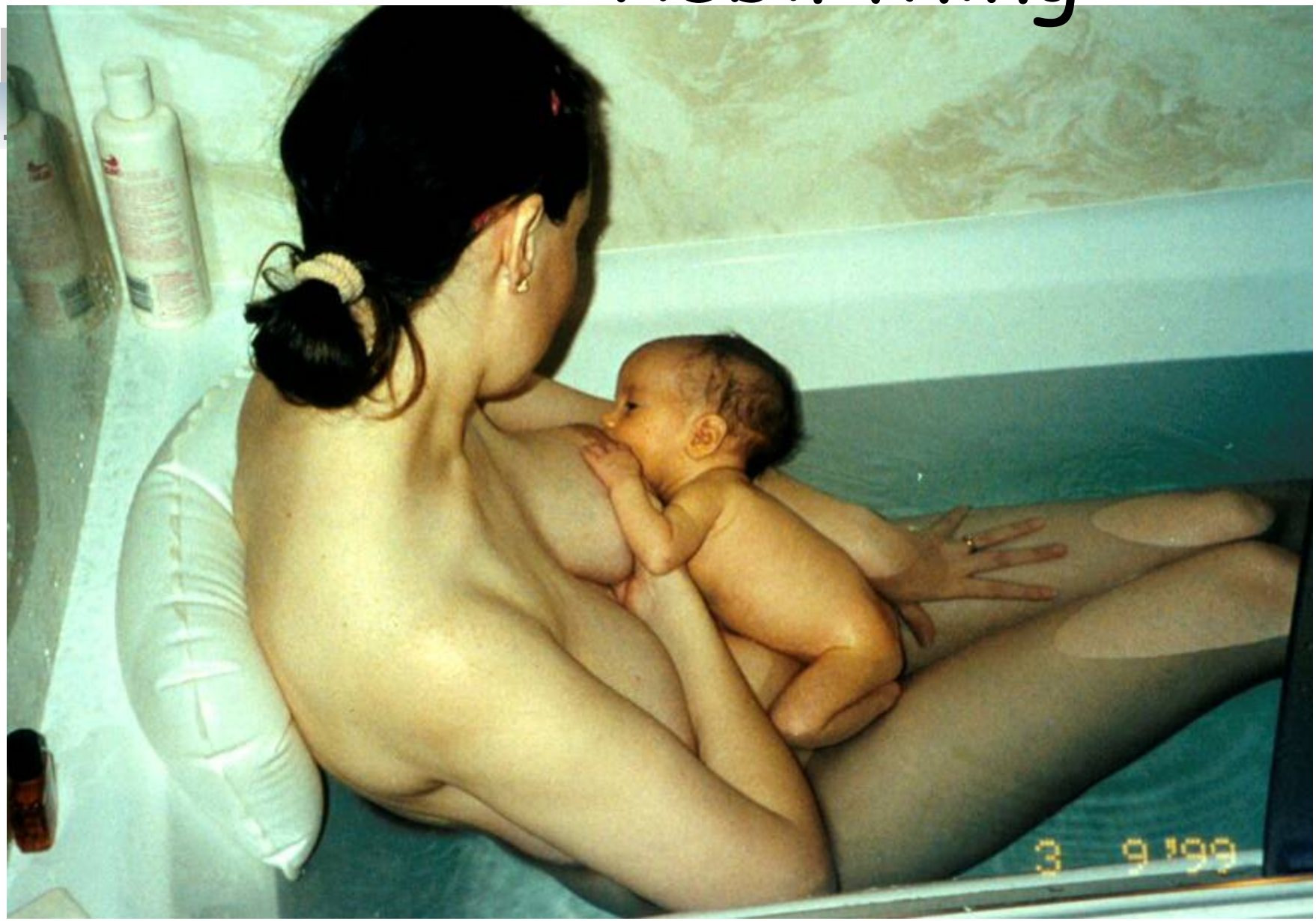
  - Biochemical Test

Phosphorus	< 4.5 mg/dL
Alkaline phosphatase	> 450 IU/L
BUN	< 5 mg/dL
Pre-albumin/transthyretin	< 10 mg/dL

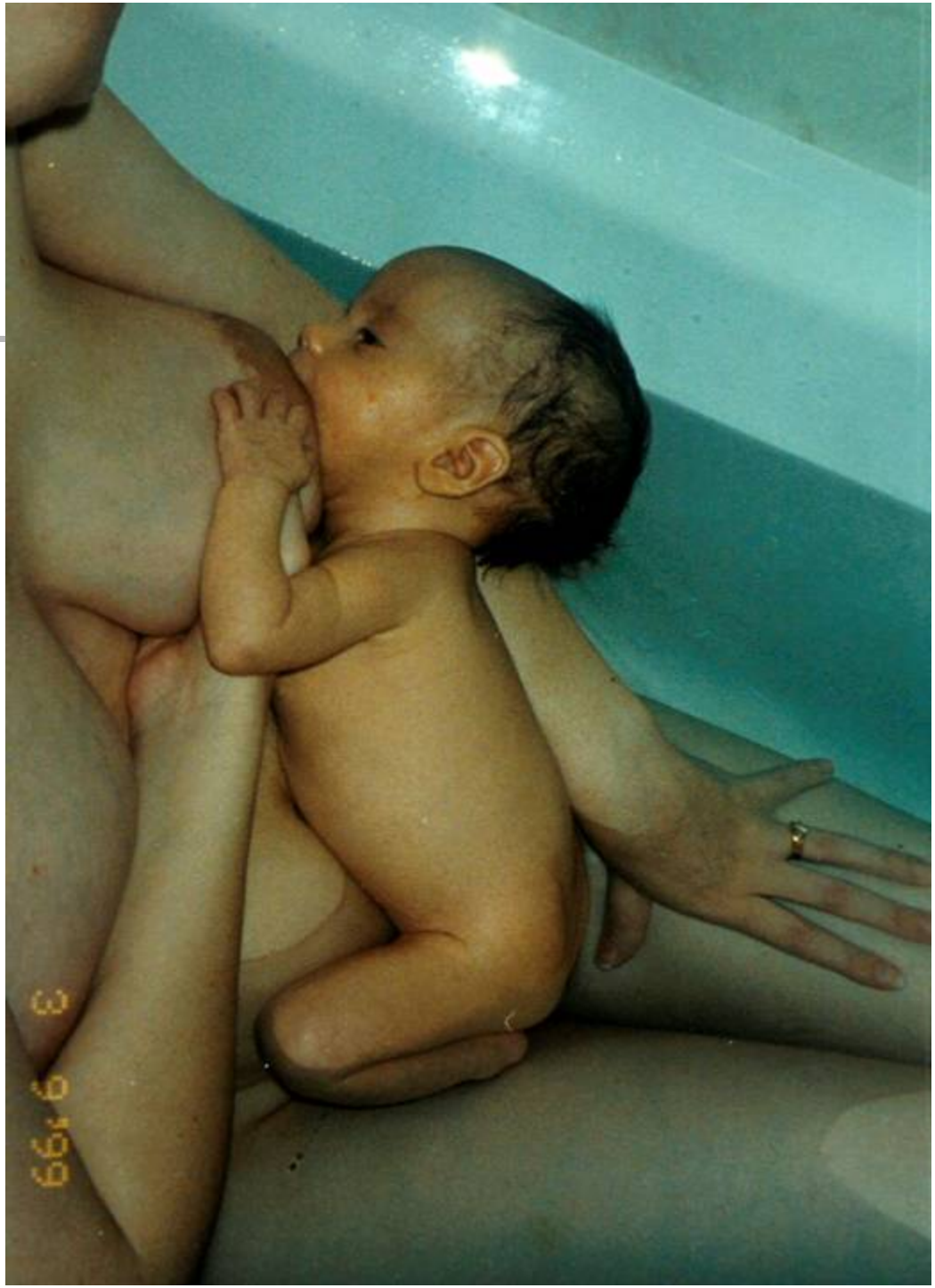
Transitioning to Direct Breastfeeding

- Preterm Birth does not usually limit milk production capacity.
- Preterm infants are vulnerable to under consumption until term + corrected age.
- Adequacy of milk supply is a key factor in successful transition to full direct breastfeeding.
- Mothers should continue to pump to maintain milk supply for at least 1 month post-discharge.

"Rebirthing"



“Rebirthing”



Breastfeeding the Premie

- Introduction
  - Early nutritional management
  - Goals of nutrition & opportunities
- Human Milk in the NICU
  - Benefits of human milk for preterm infants
  - Concerns re human milk for preterm infants
  - Pasteurized donor human milk
  - Fortification of human milk
- Establishing & Maintaining Moms' Milk Supply
  - EBM Storage and Handling
- Strategies to Facilitate Breastfeeding in the NICU
  - The Breastfeeding-Supportive NICU
- Post-Discharge Nutrition
- **The late preterm infant**
- Conclusions/ Q & A

Definitions

- Near-Term: 35 $^{0/7}$ to 36 $^{6/7}$ wks gestation [1, 2]
- Borderline Term: 37 $^{0/7}$ to 37 $^{6/7}$ wks gestation [2]
- Borderline Pre-Term: 34 $^{0/7}$ to 34 $^{6/7}$ wks gestation [2]
- Late Preterm: 34 $^{0/7}$ to 36 $^{6/7}$wks gestation [3]

1.Wang ML et al. Clinical Outcomes of Near-Term Infants. Pediatrics 2004; 114(2):372-376

2.Boies EG, Vaucher YE. Betwixt and Between: Breastfeeding the Near-Term Infant, Aug 21, 2004, San Diego, CA

3. Engle WA. A rRecommendation for the Definition of "Late Preterm" (Near-Term) and the Birth Weight-Gestational Age Classification System. Semin Perinatol 2006; 30:2-7

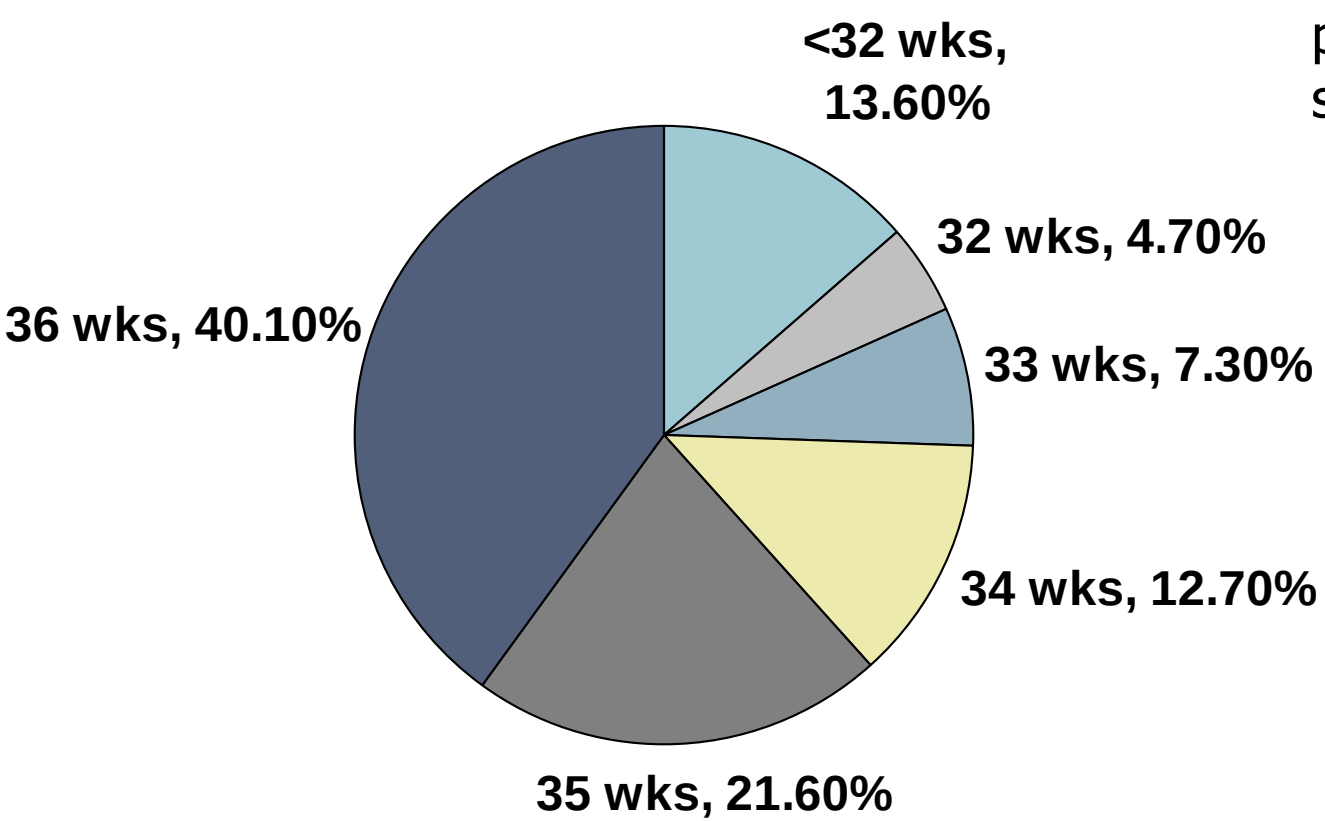
For this lecture: 34 $^{0/7}$ to 37 $^{6/7}$ wks gestation

(although some 38-39 wk infants may have problems as well!)

Gestational age distribution of singleton preterm births, US 2002

Davidoff MJ et al. Semin Perinatol 2006; 30:8-16

N= 394,996 preterm singletons



Gestational Age at Delivery, US, 1990-2003

NVSR: Births, Final Data for 2003, Vol 54, #2, 9/8/2005

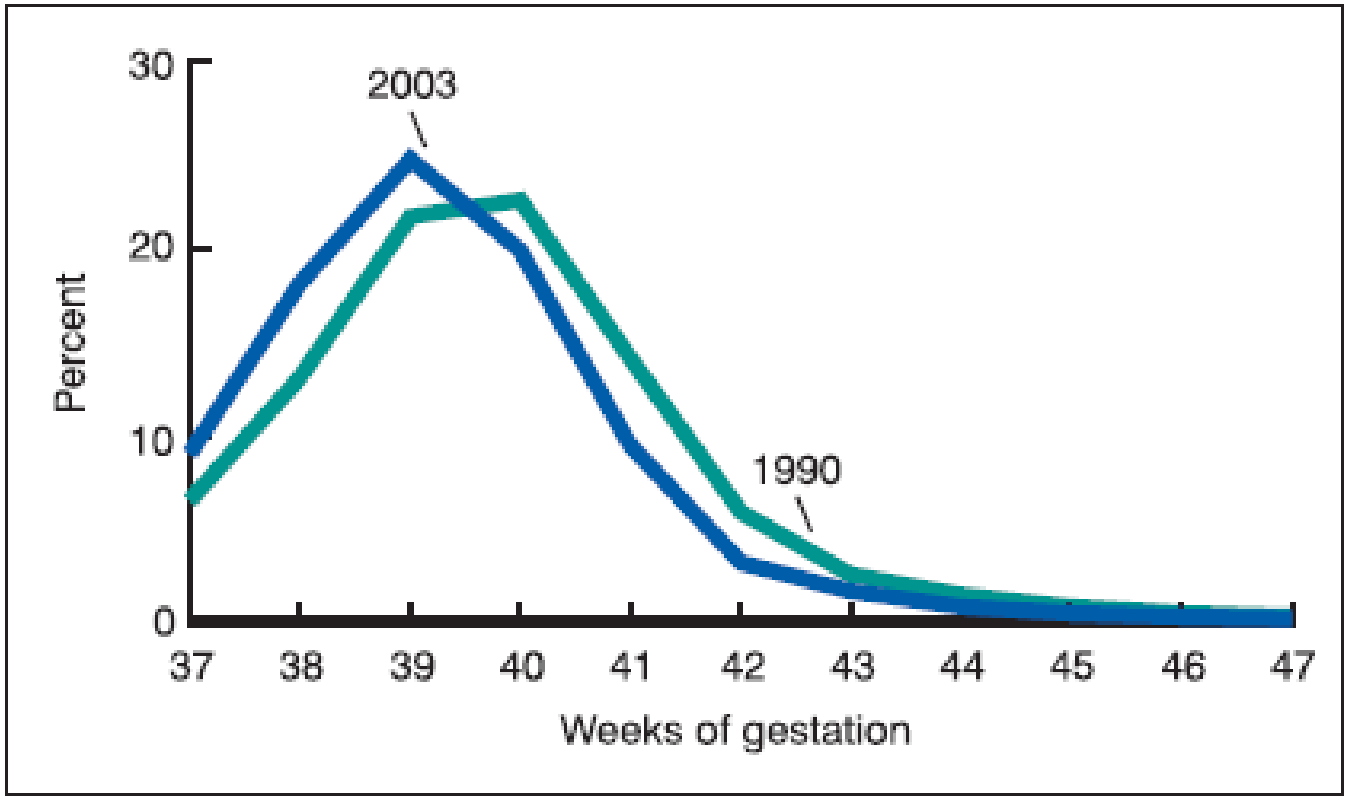


Figure 10. Percent distribution of births 37–47 weeks of gestation: United States, 1990 and 2003

Early Discharge Studies

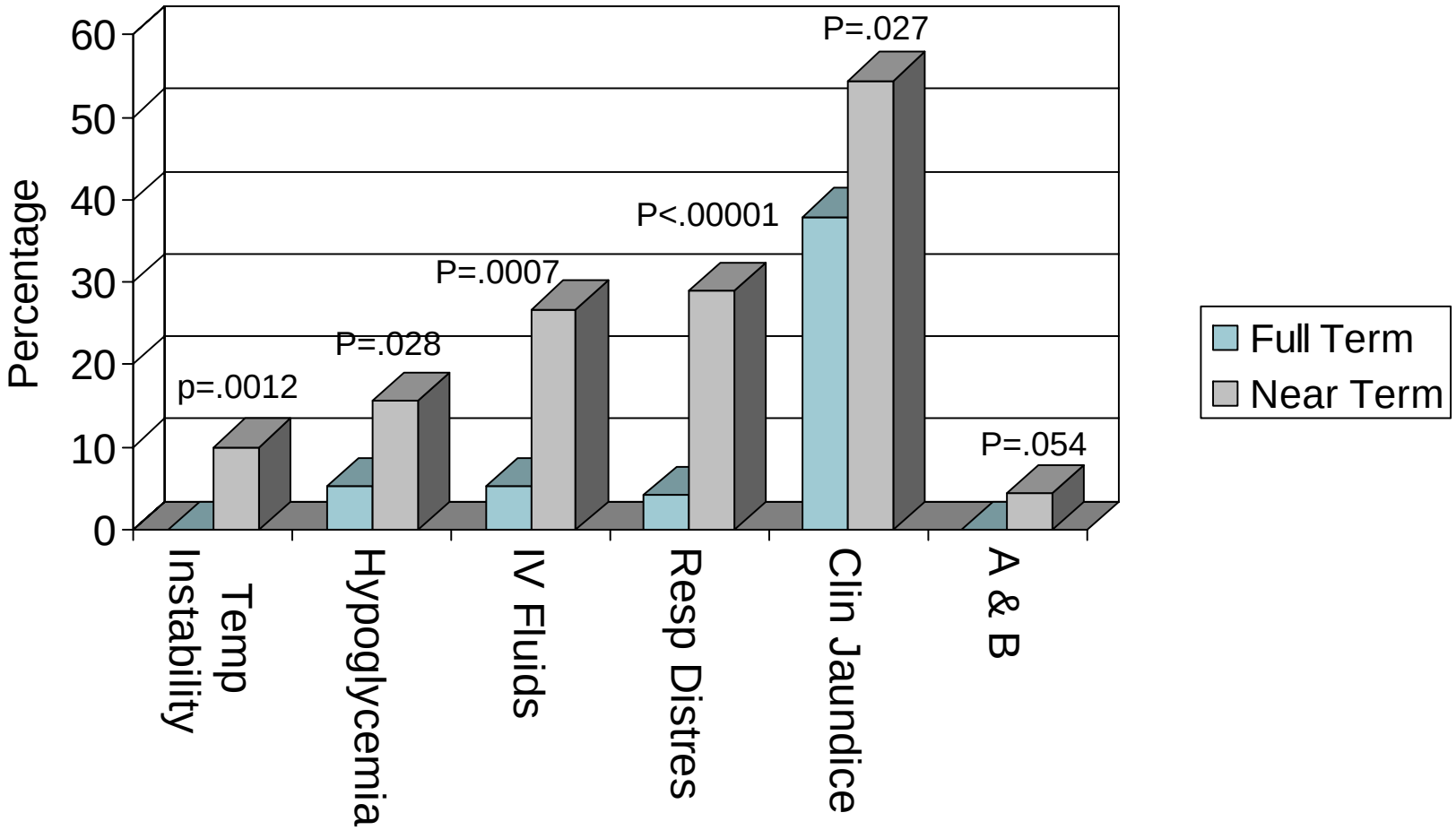
- Infants between 35-37 weeks have 5-10 times the risk of readmission due to poor feeding with resultant:
  - weight loss
  - jaundice

Edmonson MB, Stoddard JJ, Owens LM.. JAMA 1997; 278: 299-303

Soskolne EI, Schumacher R, Fyock C et al. Arch Pediatr Adolesc Med 1996; 150:373-379

Clinical Outcomes of Near-term Infants

Wang, Dorer, Fleming, Catlin. Pediatrics 2004; 114(2):372-376



Common Post-Partum Problems of Near-term Infants

- Hypothermia
- Hypoglycemia
- Jaundice
- Dehydration
- Slow weight gain
- Failure to thrive
- Hospital readmission

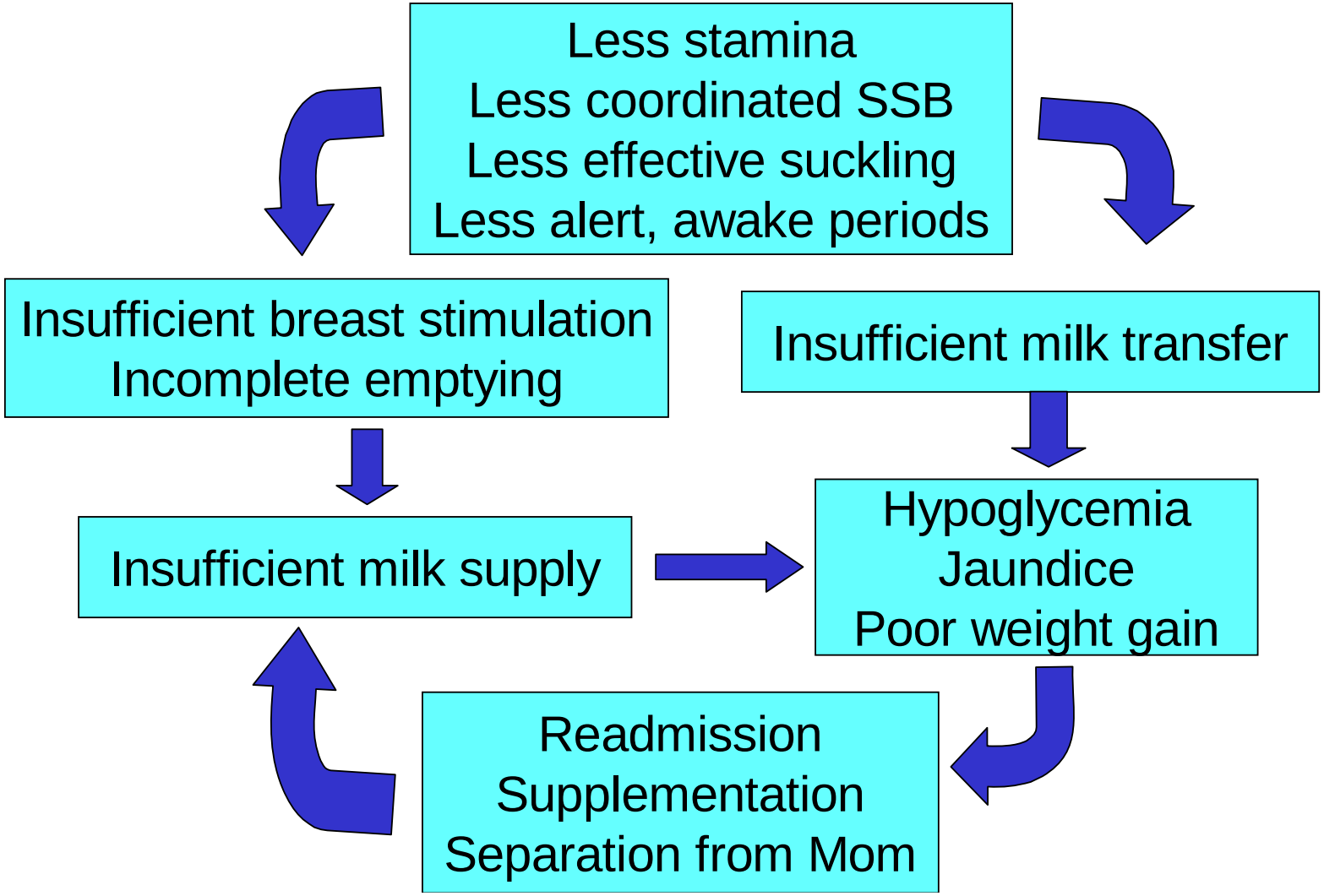
Edmonson MB, Stoddard JJ, Owens LM. Hospital readmission with feeding related problems after early postpartum discharge of normal newborns. *JAMA*. 1997;278:299-303.

Soskolne EI, Schumacher R, Fyock C et al. The effect of early discharge and other factors on readmission rates of newborns. *Arch Pediatr Adolesc Med*. 1996;150:373-379.

Neifert MR. Prevention of Breastfeeding Tragedies. *Pediatr Clin NA*. 2001;48(2):273-297

Wang ML, Dorer DJ, Fleming MP, Catlin EA. Clinical Outcomes of Near-term Infants *Pediatrics* 2004; 114(2):372-376

Near-Term Infant Breastfeeding Cascade



Near-Term Infant: Principles of Care

ABM, Clin Protocol #10, Breastfeeding the Near-Term Infant (35-37wks Gest), 2004

- Principles of Care
  - Optimal communication
  - Assessment/reassessment
  - Timely lactation support in both inpatient & outpatient settings
  - Avoid separation of mother & infant
  - Anticipate & prevent frequently encountered problems
  - Education
  - Discharge/Follow-up

Miss Piggy

Wardrobe malfunction

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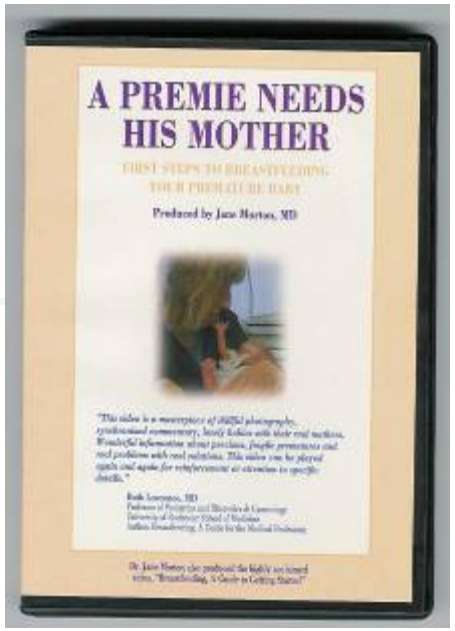
CONCLUSIONS

- Human milk is the **standard of care** for preterm or ill infants
- Human milk is **necessary**, but may not be sufficient, for optimal growth and development of the VLBW infant
- Establishing and maintaining a mother's **milk supply** is a key factor in transitioning to direct breastfeeding
  - Unequivocal message from all that MOM is best for baby
  - Begin milk expression with pump NOW and make choice about breastfeeding LATER
- **Kangaroo care** and **non-nutritive suckling** at the breast facilitate transition to full breastfeeding
- **NICU breastfeeding support** can improve patient outcomes in a cost-effective manner.
- **Outpatient follow-up and support** is crucial for transition to full breastfeeding at home

Resources



- A Premie Needs His Mother: First Steps to Breastfeeding Your Premature Baby
  - Produced by: Jane Morton MD, Stanford, 2002
  - Aimed at mothers, but excellent for staff
  - In 2 parts, total 50 minutes, video or DVD
  - www.breastmilksolutions.com
- Breastfeeding the Premature Infant
  - Produced by: Children's Hospital, Columbus Ohio, 2002
  - Aimed at staff, but OK for parents
  - 20 minutes, CEUs ($10) from Children's Hospital
  - Funded with an unrestricted grant from Ross Products Division
  - Paula Meier & Richard Schanler

www.cpqcc.org

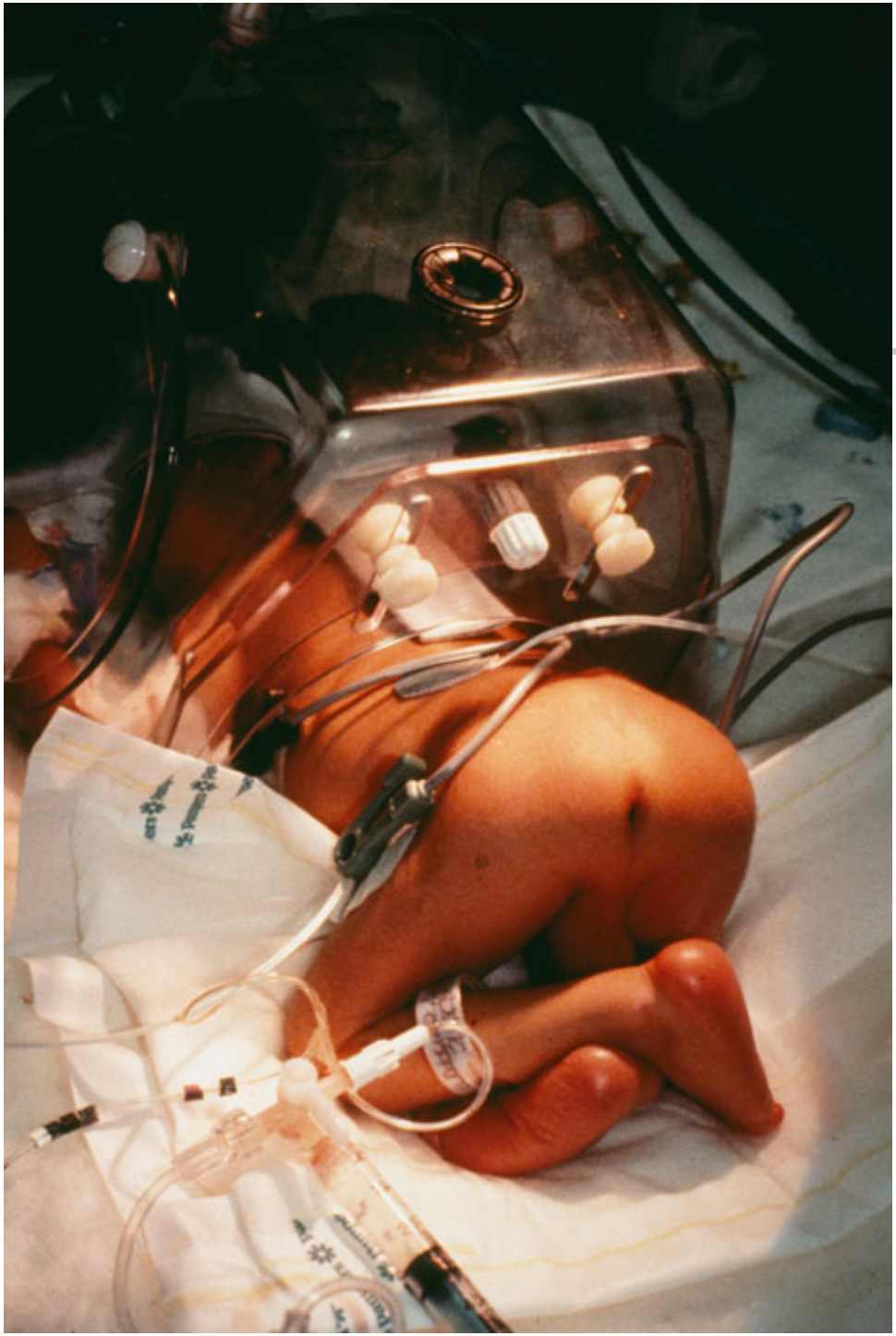
Download **CPQCC's** newest
Quality Improvement Toolkit!

Nutritional Support of the Very Low Birth Weight Infant: Part I & Part 2

CPQCC's other Quality Improvement Toolkits, Postnatal Steroid Administration, and Nosocomial Infection Prevention: Neonatal Perspectives, Practices and Priorities are also available. Download them today!

Cost-Effective NICU Therapies

Therapy	Availability	Rel Cost	# Pts/Yr
Liquid Vent	Experim	$$$$	50
ECMO	25 yrs	$$$$	200
iNO	10 yrs	$$$	6000
HIFI Vent	25 yrs	$$	10,000
Surfactant	20 yrs	$$	20,000
Breastmilk	60,000+ yrs	0	4+ Million



The End

Questions ?