Human Milk & Breastfeeding for the Vulnerable Infants
Initiation & Maintenance of Milk Supply

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Clinical Coordinator of CHOP’s Mothers’ Milk Bank

Dual Role
- University of Pennsylvania
  - Teach and mentor students across the curricula- BSN, MSN, PhD
  - Entire semester course on human milk & breastfeeding
- Children’s Hospital of Philadelphia
  - Nurse Researcher & Director of the Lactation Program
  - Director of CHOP’s Mothers’ Milk Bank

Nursing 361
- Entire semester course for undergraduate nursing students
  - 28 hours of lecture
  - 14 hours over clinical time
- Over 400 graduates of course who are active with breastfeeding:
  - Research & publications
  - Advocacy
  - Global & political influence
  - Personal and professional
The Children's Hospital of Philadelphia

- 565 bed hospital
- Neonatal Intensive Care Unit
  - 99 bed intensive care nursery
  - Surgical and non-surgical cases
  - Over 400 staff nurses
- Cardiac Intensive Care Unit
  - 26 beds—approximately 2/3rds are infants
  - 14 other inpatient units
- Special Delivery Unit opened in 2008
  - Usually 100-200 infants receiving human milk

CHOP circa 2001
Changing Institutional Culture

- **Strategic initiatives over the past 17 years**
  - 98-99% pumping initiation rate in our Special Delivery Unit for past decade
  - PhD prepared nurse researcher as director of program MSN prepared clinical supervisor
  - 5 (4.0 FTE) IBCLC staff (Monday-Friday coverage only)
  - Over 900 Breastfeeding Resource Nurses
  - Hospital and unit based breastfeeding committees
  - Ongoing CQI and research projects
  - Standards, policies, and patient family education
  - Extensive online internal and external web-based resources
  - Human Milk Management Center including HMBANA Milk Bank since 2015


**Purpose:** To examine the associations between the nurse work environment in the NICU and two measures:
1. Nurse-reported breastfeeding support
2. The practice of VLBW infant discharge on human milk

1. Only 14% of NICU infants in the sample received nurse-reported breastfeeding support.
2. Many NICUs (49%) had no lactation consultants.
3. Parents were present 60% of the time across all shifts. Nurses reported providing breastfeeding support to 1 in 5 parents across all shifts.
4. NICUs with better staffing ratios and more experienced nurses had more parents who received breastfeeding support (p<.05).
5. NICUs with more BSN-prepared nurses had more VLBW infants discharged on human milk (p<.01).

Nurses & the Practice Environment Matter!

- For every 1 SD increase in the Environment Score ➔ human milk at discharge increased by 4% (p < 0.05)
- For every 1 SD increase in BSN nurses ➔ human milk at discharge increased by 3% (p <0.05)
- For every 1 SD increase in breastfeeding support ➔ human milk at discharge increased by 8% (p < 0.001)

- 52% of infants were discharged on formula only
- 42% mixed feeds
- Only 6% exclusive human milk
Role of IBCLC versus Nurse

- United States has only 3 IBCLC’s per 1,000 births
- Breastfeeding Resource Model at CHOP
  - 14 years of published data on outcomes
  - 90% of nurses report providing direct breastfeeding assistance & support

NEW REPORT FROM WHO HAS CONCERNING NEWS ABOUT BFHI

- http://apps.who.int/iris/bitstream/10665/259386/1/9789241550086-eng.pdf?ua=1
- The new guidelines are better, however they only speak to preterm infants
- There are a lot of other vulnerable infants who are separated from their mothers!
Mothers of NICU Infants Need Different Care than BFHI!

Healthy Infants
- Baby Friendly Hospital Initiative
- Focus is only healthy term infants
- http://www.babyfriendlyusa.org/

NICU infants
- Hospitals that care for NICU infants need multiple policies to ensure infants receive human milk & breastfeed
  - Pumping initiation
  - Label & storage
  - Skin to skin
  - Oral care
  - Transition to at breastfeeds
  - Need for technology!

VULNERABLE INFANTS NEED A DIFFERENT MODEL TO ENSURE RECEIPT OF HUMAN MILK

Ten Steps for Promoting and Protecting Breastfeeding for Vulnerable Infants

Diane L. Spatz, PhD, RNC

Human milk is the preferred food for infants, including ill and preterm infants. Nursing skills and competencies for providing support to these vulnerable infants require a specialized approach. The author outlines 10 steps for promoting and providing breastfeeding for vulnerable infants. The steps include: providing information about human milk, including its importance; ensuring the presence of a human milk manager within the healthcare facility; developing policies and procedures for accessing and using milk; implementing milk management strategies that increase the likelihood of successful breastfeeding for all infants; and involving the family in the process.

Ten Steps for Promoting/Protecting Breastfeeding in the Vulnerable Infant

- Step 1: Informed decision
- Step 2: Establishment & maintenance of milk supply
- Step 3: Human milk management
- Step 4: Feeding the infant the milk
- Step 5: Skin-to-skin care
- Step 6: Non-nutritive sucking
- Step 7: Transition to breast
- Step 8: Measuring milk transfer
- Step 9: Preparation for discharge
- Step 10: Appropriate follow-up

*14 years of published outcomes from CHOP & other institutions worldwide

Spatz 10 Steps at TGH

- Increase in number of mothers pumping < 6 hours post-delivery
- Increase in patient satisfaction
- Increase in # of infants receiving human milk as first feed
- Human milk at discharge rate increase 3 fold!

Note: all were statistically significant findings!

Florida State Wide Implementation

- Florida Perinatal Quality Collaborative
  - All NICUs across state
- Extensive resources developed
  - Pre-assessment tool
  - In-person education
  - On-line modules
- Data collection is on-going however to date, human milk rates at discharge are significantly higher!
THAILAND IMPLEMENTATION

Country-wide implementation: Human milk rates at discharge have increased 3 to 6 fold!

Practical Way to Get the Message Out to ALL!

QSNICH Elevators

Spatz 10 Steps, Why Human Milk is Medical Intervention & Establishment of Milk Supply, Labeling & Storage

2016-Implementation of Spatz 10 Steps in NICUs in India

• Delhi and Jaipur NICUs
  • 10 hospitals representing over 100,000 births with a 25% NICU admission rate
  • Units had been closed to families!
Japan - October 2018

- Implementation of Spatz 10 steps at regional perinatal referral center outside Tokyo
- March 2018 → human milk rates at discharge < 20%
  - Focus Steps 1-5 of model
- October 2018 → human milk rates at discharge 46%

Many women do not initiate breastfeeding due to culture, lack of family support, lack of education & exposure to breastfeeding

STEP 1: INFORMED DECISION

Ten Steps for Promoting and Protecting Breastfeeding for Vulnerable Infants

Step 1 - Informed Decision

Pre-Assessment Questions

- Does your institution track pumping initiation rates?
- Does your institution have the ability to implement a prenatal lactation consultation program?
- If infants are transferred to your NICU, can your transport team take out pumping supplies?
  - When transfer call is made, does accepting provider speak to mother about initiating pumping?
- Are all mother’s (and their families) presented with why human milk is essential for the NICU infant?
The Center for Fetal Diagnosis & Treatment & Special Delivery Unit

- All our mothers who deliver with us have infants with congenital anomalies
- Over 50% of our families come from over 100 miles away

Prenatal Consultation & Power of Pumping DVD

- Personalized 1:1 prenatal assessment & education tailored specifically to infant’s diagnosis
- Not all mothers have prenatal intent to breastfeed
- Gift bag of pumping supplies, cooler bag
- Assessment, education & demonstration
  - Create a sense of urgency about pumping within one hour!
- Involvement of partner/support person
- GEMS support group for families
- Teaching the science of human milk
- The Power of Pumping DVD

Ten Steps for Partners/Family Members to Support Mother

- Mother’s only job is to eat, sleep, pump & visit baby!
- Everyone else must do everything for the mother!
Group of Empowered Mothers

- Led by experienced Breastfeeding Resource Nurses who have also taken Certified Breastfeeding Counselor course
  - Mother to mother support with whole family welcome!
  - Empowerment
  - Sharing experiences
  - Food & gifts

Informed Decision: Prenatal Lactation Consultation

- Focus-the provision of human milk
  - Exclusivity
  - Dose & exposure

- In our program, 99% of women initiate pumping for their critically ill infants and 86-96% are discharged on human milk


Human Milk = Medical Intervention

- Protection from:
  - Infections- ear, GI, urinary, LRI, URI, RSV
  - Sepsis
  - NEC
  - BPD
  - ROP
  - Improved feed tolerance & Less number of TPN days
- *Brain development & developmental outcomes*
- Protection from both short & long term health illnesses

Brain Development & Neurodevelopmental Outcomes

- Human milk results in more white matter development
- Improved scores on tests of neurodevelopmental outcomes

Impact of breast milk on IQ, brain size and white matter development

Elizabeth B. Innes, Bruce K. Finni, Brain T. Quinn, Wai K. Chong, David B. Godfrey, and Jon Lyman

New Deoni Study

Early Nutrition Influences Developmental Myelination and Cognition in Infants and Young Children

Sean Deoni1, Douglas Dean 2, Sarah Isachsen 3, Jennifer Elger 3 and Mike Nygren2
The Power of Pumping!

• http://www.chop.edu/service/breastfeeding-and-lactation/home.html

STEP 2: ESTABLISHMENT & MAINTENANCE OF MILK SUPPLY
Step 2 - Initiation & Maintenance of Milk Supply

Pre-Assessment Questions

- Does your institution currently track time to first pumping?
- Does your institution currently assess maternal milk supply daily?
- Does your institution provide mothers with milk supply volume target goal?
- What percent of your mothers sustain milk production of 750 mls/day through discharge?
- Do you track why mothers stop pumping prior to discharge?

Myths About Milk Production

- Mothers who have preterm infants can't establish and maintain a full milk supply through hospital discharge
- Mothers who have cesarean births will have a delay in milk supply or inadequate supply
- It is too stressful for mothers to pump if their infants are in the NICU
- Manual expression is adequate for maternal infant separation

Lactogenesis I - Secretory Differentiation

- Begins at 16 weeks of pregnancy
- Breasts are prepared to make milk!
Lactogenesis I – Secretory Differentiation

- During days 0-4, only small amounts of colostrum are expected to be produced
  - Infants on average only consume 15 ± 11 grams during first 24 hours
  - Per feed intake is only 1.5 ± 1.1 grams


Lactogenesis II – Secretory Activation

- Occurs after the delivery of baby and the placenta
- Postpartum day 2-3 through day 8
  - Critical window to come to volume!
- Copious milk secretion triggered by drop in hormones (endocrine)
- By day 8, milk controlled by supply-and-demand (exocrine)

Milk Production is Vital!


- Milk volume & frequency of expression on day 4 are significant predictors of milk supply at 6 weeks
- Production of less than 500 mls/day by end of week 2 = less than adequate milk production long term
First 3-5 Days Sets the Stage!

- Eight mothers (50%) who came to volume with normal milk volumes and normal biomarkers had more cumulative pumping sessions by day 5 (p = 0.03)
- A dose-response relationship between number of normal biomarkers and milk volume was demonstrated for postpartum days 3 (p = 0.01) and 5 (p = 0.04)

Coming to Volume Data Collection Tool

<table>
<thead>
<tr>
<th>Day after Birth</th>
<th>Date</th>
<th>Number of Expressions per 24 hours</th>
<th>Total daily volume per 24 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery day</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
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<td>Day 2</td>
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<td>Day 3</td>
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<tr>
<td>Day 4</td>
<td></td>
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</tr>
</tbody>
</table>

Lactation Risk Assessment Tool

- First time in labor
- Maternal age over 30 years
- Obesity
- Gestational diabetes/diabetes
- PMH/PE/SE/Aggression - Sulfate/PCOS
- Antenatal steroids
- Retained placenta
- Severe postpartum hemorrhage
- Prolonged labor & delivery/interventions
- Breast surgery
- Granular hypertrophy
- Maternal medications
IF MATERNAL INFANT SEPARATION OR INFANT NOT FEEDING WELL AT THE BREAST: #1 GOAL MUST BE PROTECTION OF MILK SUPPLY

In your NICU how many mothers produce 750 mls of milk per day?

Pumping must be First Priority!

  - Mothers who pumped within 1 hour had (compared to mothers who pumped within 6 hours):
    - Significantly more milk during the first 7 days (P<0.05)
    - Significantly more milk at week 3 (P<0.05)
HOSPITAL GRADE PUMP & EARLY FREQUENT PUMPING ARE ESSENTIAL!

Manual Expression will Not Provide Adequate Vacuum to Establish Normal Milk Volume

- Geddes, D. T. and colleagues (2008) in *Early Human Development*
  - Peak vacuum ($145 \pm 58$ mmHg) occurred with the tongue was at the lowest position
  - Milk flow through the milk ductules was observed at this time
  - Vacuum is likely **key** for milk removal

*Hands only techniques will not result in adequate suction vacuum to establish full milk volume*

Limitations to Morton Studies

- Convenience sample
- 52/67 (78%) completed study
- 48/67 (72%) had complete data
- 42/67 (62%) of data is actually reported
- Intervention was delivered over a wide space of time
  - $20.6 \text{ days} \pm 9.6 \text{ days}$ (Range 11 to 30 days)
- Milk Volume data is skewed
  - $583 \pm 383$ (Range 200-966 mls)
  - $863 \pm 506$ (Range 357-1369 mls)
CHOP Parameters for Pumping

- Symphony® pumps at bedside
  - Every bed spot in labor & delivery
  - Every bed spot in NICU

- Mother initiates expression of milk immediately post delivery
- Instruct mother to pump for goal of 8 or more pumps/24 hours in order to establish milk supply
- Initiation Technology™ used for all mothers regardless of infant’s gestational age at birth

Maximizing Access to Colostrum

- Initiation Technology™ (Symphony® Plus)
  - More milk out at initial pumps and subsequent increase collection of colostrum

ORIGINAL ARTICLE

Breast pump suction patterns that mimic the human infant during breastfeeding: greater milk output in less time spent pumping for breast pump-dependent mothers with premature infants

PP Hsu1,2,3, J. Bogdanski1,*, H. J厅n4, E. Judah1,2 and F. Lancer1

1Department of Women’s Health and Family Nursing, Rush University Medical Center, Chicago, IL, 2Department of Pediatrics, Rush University Medical Center, Chicago, IL, 3Department of Women’s Health and Family Nursing, Rush University Medical Center, Chicago, IL, 4Thatcher School of Law and Family Nursing, Oakland, CA, 5RAV

Figure 3: Cumulative number of efficients and efficiency in 1st cumulative number of pumps at 1h. b) cumulative number of pumps at 2h. c) cumulative number of pumps at 3h. d) cumulative number of pumps at 4h.
Pump Both Breasts at Same Time!


- Simultaneous expression results in:
  - More milk ejection
  - More milk volume
  - Higher fat/energy content of milk

New Research

- Dr. Danielle Prime

- New shield has 105 degree opening
  - Increased comfort
  - Increased Percent Available Milk drained from breast by 11%

- Manuscript under revision Breastfeeding Medicine

CHOP’s Pump Recommendations

- Over 265 Symphony® Plus pumps with Initiation Technology™ at bedside!
  - Mothers are encouraged to spend as much time as possible at CHOP to use our pumps & pump at bedside

- Symphony® Plus pump rental encouraged
  - CHOP rental price $65 per month
  - One year pump rental = $780
  - Versus over $2,000 to feed infant formula for same time frame

- Personal use and other technology not ideal
Special Delivery Unit
Pumping CQI Project

  - Early pumping = long term sustained milk production
  - Majority of our mothers delivering at CHOP make 1,000 mls per day

Continued Refinement of Pump Early, Pump Often

- Monthly meetings & chart audits
- Pumping in operating room after cesarean birth

Every Month-SDU Audits Data

- Monthly chart auditing and review to ensure that mothers are pumping early and often
  - Virtually 100% vaginal birth mothers pump within 1 hour
  - Cesarean births
    - Current research protocol
Is it the Cesarean Delivery or Is it the Management?

- Current research study at CHOP
- Impact of the timing of milk expression on maternal milk supply among women post cesarean delivery

- First year as milk bank - 65 Approved Donors
  - 15 = Bereaved donors (23.1%)
  - 40 = Inpatient (61.5%)
  - 10 = Employees (15.4%)
  - 15 = Care Network (23.1%)

- Early pumping = long term sustained milk production
- *Our SDU mothers make a LOT of milk!
- *Our Special Delivery Unit mothers provided 73% of the volume of milk donated!
Establishment & Maintenance of Milk Supply

- Provide mother with target milk production goal for 24 hour period
  - Normal milk volume 440-1220 mls/24 hour in healthy mother-infant dyads
  - Pump-dependent mothers should be given target goal in this range
  - Consider infant’s diagnoses and length of stay
  - Ideally want mother to produce double the volume that infant will need at discharge

- Mom should be producing ideally 700-800 mls/day
- Tracking milk production is essential

Establishment & Maintenance of Milk Supply

- Teach mother’s the physiology of milk production
  - Prolactin is a diurnal hormone
  - Determine pumping schedule to maximize sleep—yet take advantage of peak prolactin (10 pm to 4 am)
  - Storage capacity and milk production are correlated
    - Smaller storage capacity must always feed/pump more frequently
    - Mothers who are high producers may be able to decrease pumping frequency
  - Longer intervals between feeding/pumping = lower milk synthesis
    - Always assess total daily volume and number of pumps

Assess Nipples Before, During, & After Pumping

- A too large or too small of shield may influence the following:
  - Milk ejection timing and/or pattern
  - Rate of milk flow
  - Percent of available milk drained from breast
Nipple Trauma

- Too small of flange/shield will cause friction
- Too large of flange/shield will also cause trauma

Shield Fit Video-24 mm

Shield Fit Video-27 mm
Step 3 - Human Milk Management

- Refrigerators
  - Individual patient versus separate shelf for each infant
  - Individual bin for each infant
  - STOP sign label on bin
  - Name & MRN on each bin

- Freezers
  - Individual bin with colored paper with name & MRN

Managing Colostrum
Guidance for Mothers

- During days 0-4, only small amounts of colostrum are expected to be produced
  - Infants on average only consume 15 + 11 grams during first 24 hours and per feed intake is only 1.5 + 1.1 grams

  • Even the smallest drops of colostrum are saved

Management of Colostrum

- Instruct mother to number colostrum in order that it is pumped
- Save colostrum separately until at transitional milk (about 20 mls/breast) or 320 mls/day
- Will infant be fed within 96 hours?
- If so, all milk should be kept in refrigerator
- Feed in exact order that mother expressed the milk

  • Colostrum should also be used for oral care if infant is NPO
When milk is frozen components are not as potent
- Lysozyme 32% lower
- IgA 51% lower
- Lactoperoxidase 66% lower
- Frozen milk has increased risk for bacterial proliferation

Akinbi, et al. (2010) Alterations in the host defense properties of human milk... *JPEN*: 51(3)

Management of Frozen Milk
- 28 freezers in NICU alone
- All centrally monitored
  - **Online inventory** so that staff can view exactly where milk is stored and how many bins
- **First in-first out (but ONLY if no fresh milk is available!)**
- Trigger point to set mother up for milk donation

Step 4-Oral Care & Feeding of Human Milk
From Critically Ill to Healthy Toddler

- Human milk not only saves lives but improves the quality of life of those who survive.

Oral Care Video

Do Oral Care/Human Milk Matter?

- O. received human milk for 18 months.
- His mom also donated over 2,000 ounces of milk!
The Remarkable Owen

Oral Care Benefits Family Too!

- Novel findings
  - Human milk oral care translates to feelings of inclusion in the CDH infant’s daily care
  - Empowers mothers and families
    - Motivation
    - Inclusion
    - Bonding
    - Feelings of positive progress

Keep pumping and build supply


Thank You!

- To contact me: spatz@nursing.upenn.edu