The Journey to Successful Breastfeeding Part V: To Pump or Not to Pump? Why, When, How, With What, How Long, or...Not At All?

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Faculty Disclosure Information

In the past 12 months, I have not had a significant financial interest or other relationship with the manufacturer(s) of the product(s) or provider(s) of the service(s) that will be discussed in my presentation.

This presentation will not include discussion of pharmaceuticals or devices that have not been approved by the FDA and I will not be discussing unapproved or “off-label” uses of pharmaceuticals or devices.

Any photos of breast pumps included in this lecture are for illustration only and do not imply endorsement.

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Participants will be able to:

- Briefly review the physiology of milk production;
- Describe the differences between breastfeeding and breast milk feeding;
- Discuss how to manually express milk;
- Discuss the different types of breast pumps available;
- Understand when pumps should and should not be used through the use of case studies.
Anatomy of the Breast

- Non-breastfeeding structures
  - ribs, muscle, fatty tissue
- Breastfeeding structures
  - alveoli
  - ductules
  - ducts
  - lactiferous sinuses?
  - areola
Lactogenesis I, II, and III

- Lactogenesis I (21 weeks - 4 days pp)—differentiation of alveolar epithelial cells into lactocytes that secrete colostrum, with ~100mL available to infant on day one postpartum
- Lactogenesis II – onset of copious milk secretion occurring between 32 and 96 hours postpartum
- Lactogenesis III – maintenance of milk production (mature milk)
Early: Endocrine Control of Milk Production

- Changes in estrogen and progesterone levels
  - Increases in prolactin levels after delivery
  - Secreted by anterior pituitary
  - Roll in development of breast anatomy
- Development of prolactin receptors
Physiology of Lactation

- Prolactin Receptor Theory:
  - Sucking stimulates the development of receptors to prolactin
  - Number of receptors per cell increases in early lactation and remain constant
  - Multiparas had lower serum prolactin levels than primiparas but significantly higher levels (Zuppa 1988)
Later: Autocrine Control of Milk Production

- Nipple stimulation and milk removal inhibit dopamine release
- Feedback inhibition
  - Suppressor peptides (FIP)
- Ability of prolactin to get into milk gland cells
Oxytocin

- Posterior pituitary hormone
- Causes milk ejection reflex (MER)
- Stimulates uterine contractions
- Dilates peripheral vascular beds
- Sensitive to adrenaline/ noradrenaline
Infant suckles at the breast.

Stimulation of nerve endings in mother’s nipple/areola sends signal to mother’s hypothalamus/pituitary.

Pituitary releases
Prolactin (ant. Pit.) and oxytocin (post. Pit)

Hormones travel via bloodstream to mammary gland to stimulate milk production and milk ejection reflex (let-down).

{Brain, uterus}

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Indicators of Lactogenesis II

- Changes in colostrum/milk composition (biomarkers)
  - Decrease in sodium and chloride
  - Increase in citrate and lactose
- These changes precede the onset of the large increase in milk volume by 24 hours
- Maternal perception of onset of lactation is a valid proxy for lactogenesis II
Maternal indicators of onset of lactation

- Breast swelling
- Milk leakage
- Physical appearance of milk
- Infant cues
- Breast fullness
- Breast heaviness, hardness

- Breast tingling
- Wide range of when this occurs 1-148 hours post birth
Mean Milk Volume of Fully Breastfeeding US Women During the First Week Postpartum

**Figure 8.** Mean milk volume produced by American women fully breastfeeding their infants during the first week postpartum. (From Neville MC: Lactogenesis in women. In Jensen RG: Handbook of Milk Composition. San Diego, Academic Press, 1995, p 88; with permission.)
Are breastfeeding and breast milk feeding equals?

- Hormonal release with milk ejection reflex
  - Stress reduction
  - Relaxation
  - Hormone of love
- Baby must be held close to mother to breastfeed; bottle can be propped
- Breastmilk content changes over course of a feed—more fat toward end of feed
  - Satiety issues
It is widely held—there is more to breastfeeding than “just” the milk....
Prevalence of Pumping

- 2005 to 2007 Infant Feeding Practices Study II (FDA and CDC)
- Of mothers of infants < 4 ½ months:
  - 85% had expressed milk at some time since birth;
  - 43% have done so occasionally;
  - 25% on a regular schedule;
  - Higher among first-time mothers;
  - Slowly decline as infant becomes older

Pediatrics 2008;122:S63-S68
Figure 21-1 Percentage of breastfeeding mothers who had successfully expressed milk, according to method of milk expression and infant age-group. The 1.5- to 4.5-month sample is based on breastfeeding mothers who responded about methods used to successfully express milk since their infant was born; the >4.5- to 6.5-month sample is based on mothers who responded in the previous 3 months; and the >6.5- to 9.5-month sample is based on mothers reporting about methods used in the previous 2 months. Samples are smaller than the total of those who had successfully expressed milk during a given period (1315, 845, and 653, respectively, for the successive age-groups) as a result of question non-response. Respondents could mark all answers that applied; therefore percentages in each age group do not sum to 100%. Combination pumps were defined as both electric and battery operated.
Breastfeeding mothers’ prevalence of breast milk expression in the previous 2 weeks, according to infant age-group.

Lawrence & Lawrence 2011

Figure 21-2 Breastfeeding mothers’ prevalence of breast milk expression in the previous 2 weeks, according to infant age-group.
Reasons to express breastmilk

- Maintain milk supply while separated from the infant
  - Hospitalization (mother or baby)
  - Return to work
- Feeding multiple infants
- Relieving engorgement or plugged ducts
- Maintain or increase milk supply
- Evert flat or inverted nipples
- Women with poor body image; past trauma
Is milk expression important?

- Survey of breastfeeding women
- After first 3 weeks of breastfeeding, women who reported expressing milk as well as breastfeeding were 75% MORE likely to still be breastfeeding at 12 weeks pp than women who did not express breast milk
- Remember grains of salt.....and association versus causality...

Manual Expression of Breastmilk

- All breastfeeding women should be taught to manually express milk
  - to express in the first few days for an ill baby
  - to tempt your baby to attach and feed
  - to help your baby attach to a full breast
  - it may be more effective than a breast pump
  - it doesn’t cost anything
  - it’s more convenient
  - you are in full control
  - it helps you learn how your breasts work
  - in case of emergency
Manual (Hand)-expression

- Wash your hands.
- Start the milk flowing by relaxing and massaging your breasts gently
- Place your thumb above and index finger one to two inches back from the areola in a C-shape
- Press your thumb and finger together, squeezing your breast between thumb and finger
  - As you bring your fingers together, bring your hand backward and inward toward your chest, instead of outward toward your nipple.
Bring the pads of the thumb and index finger together as you **pull in** towards your chest, **not pulling out** towards your nipple. Repeat the motion rhythmically until the drops appear.

http://newborns.stanford.edu/Breastfeeding/ABCs.html

Manual (Hand)-expression

- Keep in mind that you are applying pressure in back of the pools of milk that lie beneath the areola.
- Your milk will take a minute or so before it begins dripping
- Release and repeat in a rhythmic action.
  - Milk will start to drip and then may squirt out in a spray
- To get as much milk as possible, rotate your fingers around the breast to empty all the breast segments.
Breastfeeding, A Guide to Getting Started

- Excellent video by Dr. Jane Morton, Stanford, on teaching hand expression
- Web site has video you can watch or show patients; full video for sale

http://newborns.stanford.edu/Breastfeeding/HandExpression.html
What is a breast pump?

- Believe it or not, breast pumps are medical devices regulated by the FDA.
- Breast pumps are frequently used by lactating women to extract (or express) their breast milk.
- As of 2/10/11—cost of breast pumps considered tax-deductible medical expenses by IRS:
  - flexible spending accounts
  - If no flexible spending accounts, tax deductible if their total medical costs exceed 7.5% adjusted gross income
Types of Breast Pumps

- There are three basic types of breast pumps
  - Manual pumps
  - Battery-powered pumps
  - Electric pumps
- Extracts milk from breasts by creating a vacuum around the nipple pulling air into the breast-shield, applying & releasing suction.
- Each suction & release combination is a cycle.
What does a breast pump look like?

- Three main types of breast pumps:
  - manual
  - battery-powered
  - electric.

http://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/HomeHealthandConsumer/ConsumerProducts/BreastPumps/ucm061584.htm
Basic Parts of a Breast Pump

- A cone-shaped cup, called a breast-shield, fits over the nipple and the areola.
- A pump to create the gentle vacuum that expresses milk.
  - The pump may be attached to the breast-shield or have plastic tubing to connect the pump to the breast-shield.
- A detachable milk collection container that fits below the breast-shield.
  - The container is typically a disposable bag or a reusable bottle that can be used to store the milk, or attached to a rubber nipple and used for feeding a baby.
FDA Regulates Breast Pumps

- FDA regulates breast pumps as medical devices
  - a passive surveillance system that receives reports on adverse events and product problems
  - 37 reports for breast pumps between 1992 and 2003

Most commonly reported patient problems

- Electric breast pumps
  - pain, soreness, or discomfort;
  - need for medical intervention;
  - tissue damage
  - Injuries to the breast including 1 case each of reddening and blister formation; a tear in the nipple; bleeding

- Manual breast pumps
  - tissue damage and infection

Most commonly reported device problems

- Electric/battery-operated pumps
  - high suction and inadequate suction
  - leakage or aspiration into the motor in some breast pumps

- Manual pumps
  - Device design or structure function problem
  - high suction,
  - Leaking
  - device mis-assembly.

How to report pump malfunction or injury to FDA

- FDA’s toll-free number at 1-888-463-6332
- The goal of reporting is to identify and intervene when there are problems with medical devices.
  - Thus, reporting adverse events is an important component of patient safety.
Manual Pumps

- Breast-shield is placed over the nipple and areola
  - a small cylinder-shaped tube is pumped in and out of a larger cylinder to create a vacuum that expresses milk
  - handle or lever that is squeezed to create suction
  - bicycle horn pump
Battery Powered and Electric Pumps

- Small motor that creates suction
- One or more long plastic tubes connect the breast-shield to the motor
- Some adjustable to create different patterns of suction
- Back-up method, such as a manual breast pump or manual expression in case of power failure
Showing a pump does not imply endorsement. K. Marinelli
<table>
<thead>
<tr>
<th>Pumping Type</th>
<th>How it Works</th>
<th>Types of Breast Pumps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single</td>
<td>Extracts milk from one breast at a time.</td>
<td>Most manual breast pumps are single pumps. Battery-powered pumps are commonly single pumps, perhaps because the single pumping action drains the battery at a slower rate than other pumping types.</td>
</tr>
<tr>
<td>Double</td>
<td>Can be used to extract milk from both breasts at the same time.</td>
<td>Some electric pumps are double pumps. Some women find that the dual suction decreases the amount of time it takes to empty their breasts.</td>
</tr>
<tr>
<td>Double-Alternating</td>
<td>Can be used to extract milk from both breasts at the same time.</td>
<td>Electric pumps are commonly double-alternating pumps.</td>
</tr>
<tr>
<td></td>
<td>Unlike the double pump, the double-alternating pump releases suction from one breast before applying suction to the other breast.</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>Ameda Purely Yours w/Backpack</td>
<td>Ameda Purely Yours w/CarryAll</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-------------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>Price</td>
<td>$229.95</td>
<td>$199.95</td>
</tr>
<tr>
<td>Suction Settings</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Suction Strength</td>
<td>100-220 mm Hg in 1 second</td>
<td>100-220 mm Hg in 1 second</td>
</tr>
<tr>
<td>Cycles Times Per Minute</td>
<td>30-60 times per minute</td>
<td>30-60 times per minute</td>
</tr>
<tr>
<td>Compression</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Automatic Suck Release Cycling</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Built-in Bottle Holders</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

http://www.healthchecksystems.com/breastpumps_compare.htm
<table>
<thead>
<tr>
<th>Feature</th>
<th>Ameda Purely Yours w/Backpack</th>
<th>Ameda Purely Yours w/CarryAll</th>
<th>Medela Pump In Style Original</th>
<th>Medela Pump In Style Advanced with Backpack</th>
<th>Medela Pump In Style Advanced</th>
<th>Whisper Wear Hands Free Breast Pump</th>
</tr>
</thead>
<tbody>
<tr>
<td>Works With AC Adapter</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Works With Car Adapter</td>
<td>Yes - Included</td>
<td>Yes - Optional</td>
<td>Yes - Optional</td>
<td>Yes - Optional</td>
<td>Yes - Optional</td>
<td>Yes - Optional</td>
</tr>
<tr>
<td>Works With AA Batteries</td>
<td>Yes - Internal</td>
<td>Yes - Internal</td>
<td>Yes - Separate Battery Pak</td>
<td>Yes - Separate Battery Pak</td>
<td>Yes - Separate Battery Pak</td>
<td>Yes</td>
</tr>
<tr>
<td>Warranty</td>
<td>1 yr. on pump motor</td>
<td>1 yr. on pump motor</td>
<td>1 yr. on pump motor</td>
<td>1 yr. on pump motor</td>
<td>1 yr. on pump motor</td>
<td>1 year</td>
</tr>
<tr>
<td>Closed Pumping System to prevent milk back-up</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Single and Double Pumping</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Pump Removable From Tote Bag</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Number of Bottles Stored and Cooled</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Model</td>
<td>Ameda Purely Yours w/Backpack</td>
<td>Ameda Purely Yours w/CarryAll</td>
<td>Medela Pump In Style Original</td>
<td>Medela Pump In Style Advanced with Backpack</td>
<td>Medela Pump In Style Advanced</td>
<td>Whisper Wear Hands Free Breast Pump</td>
</tr>
</tbody>
</table>
Figure 1  65% of glandular tissue within 30 mm of nipple

Journal of Neonatal Nursing (2009) 15, 14–17
The shield is too small

the shield is too large

the shield too large

Journal of Neonatal Nursing (2009) 15, 14–17
Figure 2   Nipple not aligned centrally within the breast shield tunnel.

Correct alignment
Correctly fitted shield

- Is it rubbing or sticking against the side? Does the base of the nipple blanche during the expression session?
- Does it feel painful?
- Can you see a ring of skin flakes on the inside of the shield when the shield is removed?
- Does the nipple move in and out of the tunnel freely?
Connecticut WIC Program

BREAST PUMP FACT SHEET
Guidelines for Breast Milk Storage

<table>
<thead>
<tr>
<th>If milk is stored...</th>
<th>Keep no more than...</th>
</tr>
</thead>
<tbody>
<tr>
<td>At room temperature (75 degrees or lower)</td>
<td>4 hours</td>
</tr>
<tr>
<td>In refrigerator</td>
<td>3-5 days</td>
</tr>
<tr>
<td>In freezer section of refrigerator</td>
<td>3 months</td>
</tr>
<tr>
<td>In deep freeze (0 degrees or lower)</td>
<td>6 months</td>
</tr>
<tr>
<td>In refrigerator after thawing</td>
<td>24 hours</td>
</tr>
</tbody>
</table>

Guidelines for Thawing and Warming Breast Milk

<table>
<thead>
<tr>
<th>If the milk needs to be...</th>
<th>Then ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thawed</td>
<td>Put the container in the refrigerator -OR- Hold the container under cool running water Do not use microwave or stove.</td>
</tr>
<tr>
<td>Warmed</td>
<td>Put the container in a bowl of warm tap water -OR- Hold the container under cool running water and gradually increase temperature of the running water Do not use microwave or stove.</td>
</tr>
</tbody>
</table>
**Sanitation/Hygiene Related to Breast Pump Use**

<table>
<thead>
<tr>
<th>Before Initial Use …</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Boil for 20 minutes all parts of collection kit except tubing, white adapter cap, white pump connector.</td>
<td></td>
</tr>
<tr>
<td>Completely air-dry before assembly and first use.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Before and After each use …</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Wash hands with warm water and soap.</td>
<td></td>
</tr>
<tr>
<td>Take collection kit apart.</td>
<td></td>
</tr>
<tr>
<td>Wash everything from collection kit except tubing, white adapter cap, white pump connector.</td>
<td></td>
</tr>
<tr>
<td>DO NOT use abrasives – Rinse with hot clean water.</td>
<td></td>
</tr>
<tr>
<td>Completely air-dry the parts on a clean towel or drying rack.</td>
<td></td>
</tr>
</tbody>
</table>
Coverage for pumps

- WIC: assistance obtaining a breast pump is available
- HUSKY: breast pumps
- Breastfeeding: Heritage and Pride Peer Counselor Program
- Private insurers: variable
- What can physicians do?
When is the use of pumps appropriate? Some cases...
Case 1: Hypoglycemic baby

Baby K is a 6 hour old FT 8lb 7oz baby girl to a 25 year old G₁ by SVD. Pregnancy complicated by gestational diabetes. Baby remained with mom skin to skin post delivery, latched 30 min after birth, and has maintained her temperature. Glucose was >40 as per routine. Baby K is now very sleepy, glu 35, asymptomatic, but will not awaken to latch. What should mom and staff do?
Case 2: I need sleep and dad should have the joy of feeding junior!

Mrs. M is a 28 year old G₁ with her 5 day old FT baby in your office for their first visit after D/C. Baby looks great, nursing well, mom’s milk is “in” (i.e. lactogenesis II); stools mustard yellow. Mom tells you she got 2 breast pumps for her baby shower, one a battery and one a plug-in, and she is going to start pumping extra during the day so she can sleep through the night (she is exhausted!!!) Dad is going to get up to fix breastmilk bottles and feed junior. Which pump should she use? What do you say?
Case 3: Hospitalization with Jaundice

Baby A is a 7#14oz 37 week male born to a 34 yo G₂P₁ obese mom with uncomplicated pregnancy by SVD. D/C home at 48 hours with bili 7. Seen in Pedi office at 96 hours. Only 2 stools at home—black. ? How many wet diapers. Bili 19; no ABO or RH, hemolysis w/u neg. Wt. 7#1.4oz (↓10%). You admit him to hospital for jaundice protocol. Mom says he has been sleepy, and so far, she does not think her milk has “come in”. What do you do for mom? What do you feed baby?
Clues:

- Obese mom: delayed lactogenesis II
  - Now at 96 hours
- Baby
  - Late preterm;
  - 10% weight loss;
  - 4 day old;
  - Still passing meconium; ? Urine output
  - No hemolysis
- Likely early-onset breast “non-”feeding jaundice
Notes Case 3

- Mom needs maximal stimulation
  - Hospital grade pump
  - Double-pumping
  - Start immediately on admission or in ER while waiting
  - Under one month of age:
    - every 3 hours or after every feeding
  - Over one month of age but has a history of poor feeding:
    - every 3 hours or after every feeding
  - Over one month of age and has been feeding well:
    - whenever a feeding is missed or infant has a poor feeding
Notes Case 3

- If milk has not “come in” yet: 10 - 15 minutes
- If milk has “come in” but mother is pumping only drops: 10 - 15 minutes
- If milk has “come in” and mother has adequate supply: pump until “empty”
- Eliciting MER
  - warm compresses
  - Massage
  - Relaxation
  - Massage while pumping
Notes Case 3

- Once supply is established?
- Preferably, mom weans off pumping and fully breastfeeds except when separated from her baby
Case 4: Back to work

Mrs. B is a 3<sup>rd</sup> grade teacher. Due to financial circumstances she can only take 8 weeks off after the birth of her first baby, a FT girl. She can use the nurse’s office to express milk, but it has to fit the children’s schedule. This means she has 20 minutes for morning recess and 30 minutes when they are in “special” in the afternoon. All other times she must be with them. She asks for your advice.
Return to the Workplace or School

- Continued breastfeeding is feasible and desirable for mother and infant.
- Prepare ahead by discussing with the employer or school personnel.
- Delay introduction of bottles until milk supply well established at >3–4 weeks if possible
AN ACT CONCERNING BREASTFEEDING IN THE WORKPLACE.

Be it enacted by the Senate and House of Representatives in General Assembly convened:

(NEW) (a) Any employee may, at her discretion, express breast milk or breastfeed on site at her workplace during her meal or break period.

(b) An employer shall make reasonable efforts to provide a room or other location, in close proximity to the work area, other than a toilet stall, where the employee can express her milk in private.

(c) An employer shall not discriminate against, discipline or take any adverse employment action against any employee because such employee has elected to exercise her rights under subsection (a) of this section.

(d) As used in this section, "employer" means a person engaged in business who has one or more employees, including the state and any political subdivision of the state; "employee" means any person engaged in service to an employer in the business of the employer; "reasonable efforts" means any effort that would not impose an undue hardship on the operation of the employer's business; and "undue hardship" means any action that requires significant difficulty or expense when considered in relation to factors such as the size of the business, its financial resources and the nature and structure of its operation.

Approved July 6, 2001
The Business Case for Breastfeeding

The Business Case for Breastfeeding brochure
Easy Steps for Supporting Employees, an educational booklet
Tool Kit: Resources for Building a Lactation Support Program
Employee’s Guide to Breastfeeding and Working
Materials for lactation specialists and health professionals

CT Breastfeeding Coalition:
http://www.breastfeedingct.org/

US Dept Health and Human Services
What advice do you give?

- Explain risks of switching to formula for baby and for her.

- Advice on expressing milk:
  - Given her situation, what type of pump would be best?
  - How can she store milk?
  - When should she start to express and store her milk?
  - How much time does a woman need to express milk at work?
    - time to "commute"; set up; clean up; actual time to relax and pump
Case 5 Maternal Illness and Medication Use

- Mrs. W has mastitis. Her baby is 2 months old, and she has had a history of plugged ducts with previous pregnancies. She goes to her doctor and she sees this:
  - Bilateral mastitis
- Does she feed the baby or pump?
- She is put on antibiotics & ibuprophen. Does that change you mind?

Case 5 Maternal Illness and Medication Use

Now what?????
Case 5 Maternal Illness and Medication Use
Case 5 Maternal Illness and Medication Use: MRSA
Breastfeeding and Maternal Illness

- Most maternal acute minor illnesses and infections are compatible with breastfeeding.
  - Breastfed infant receives protective components from mother’s breastmilk.
  - Interruption of nursing may predispose an infant to an upper respiratory or gastrointestinal tract infection or may increase the risk of severity if an infection occurs.
- If need to stop breastfeeding on one side (or both) need to express with an efficient pump (depending on duration) to maintain milk supply.
Support—for you!

- Academy of Breastfeeding Medicine: http://www.bfmed.org/
  - Awesome clinical protocols!
- AAP SOBr http://www.aap.org/breastfeeding/
- CDC http://www.cdc.gov/breastfeeding/
- ILCA http://www.ilca.org
- LLLI http://www.llli.org/
- CT Breastfeeding Coalition http://www.breastfeedingct.org/
- CT AAP Chapter Breastfeeding Coordinator—me!
  - Kathleen.marinelli@cox.net
Join the AAP Section on Breastfeeding! Membership is $35 per year for fellows or $10 per year for residents. Visit www.aap.org/breastfeeding or contact us at lactation@aap.org or call 847/434-4784 for assistance.
Thank you!!

kathleen.marinelli@cox.net