



## Breastfeeding the Late Preterm Infant (34-37 Weeks)

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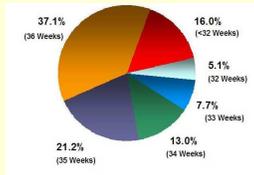
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## Stats for Late Preterm Infants

- 12.3% of births in the US are preterm
- 72% of these are late preterm
- 500,000 preterm births annually in the US
- 350,000 of which are late preterm
- Another 700,000 births each year occur at 37 and 38 weeks of gestation that are called early term infants

**Distribution of Preterm Births, All Live Births, United States, 2003**



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## Nomenclature

- <34 weeks = preterm
- 34 0/7 to 36 6/7 weeks = late preterm
- 37 0/7 to 38 6/7 weeks = early term
- 39 0/7 to 41 6/7 weeks = term
- 42+ weeks = post term

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## Not out of the woods yet

- Babies born between 37 weeks and 39 weeks are not exempt from the problems of prematurity
  - 2 to 4-fold risk of complications such as respiratory distress, NICU admission, sepsis, or hospitalization for more than 5 days (Tita et al, 2008).

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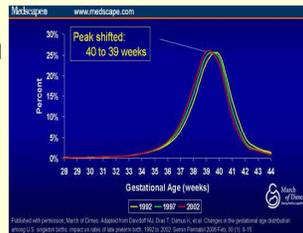
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## Falling gestational ages

- Between 1992 and 2002, the most common gestational age of singleton babies born in the United States dropped an entire week, from 40 to 39 weeks (Davidoff et al, 2006).



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## Late Preterm Infants

- Weight ranges from 3lb 5oz (10<sup>th</sup> percentile at 34 weeks) to 7lb 13oz (90<sup>th</sup> percentile at 38 weeks)
- Late preterm babies may look mature but are often functionally immature
- LPI, especially breastfed ones, are 2.2x more likely to be readmitted, especially for jaundice and infection



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### A population at risk

(Adamkin, 2006; Engle et al, 2007).

- airway instability
- apnea
- bradycardia
- excessive sleepiness
- large weight loss
- dehydration
- feeding difficulties
- weak sucking
- jaundice
- hypoglycemia
- hypothermia
- immature self regulation
- respiratory distress,
- sepsis,
- prolonged formula supplementation,
- hospital readmission,
- breastfeeding failure
- Newborn morbidity rate doubles in infants for each gestational week earlier than 38 weeks

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### Increased morbidity and mortality

- Newborn morbidity rate doubled in infants for each gestational week earlier than 38 weeks with the risk intensified when an infant was exposed to maternal hypertensive disorders of pregnancy (Shapiro-Mendoza et al (2008)
- Each weekly increase in gestational age is associated with a decreasing risk of death, with infants born at 37, 38, and 42 weeks showing an increase in mortality rates compared with babies born at 40 weeks. (Young et al, 2007).
- LPIs are at a twofold higher risk for sudden infant death syndrome
  - 1.4 cases per 1000 at 33-36 weeks gestation compared with 0.7 per 1000 at >37 weeks gestation (Kramer et al, 2000; Malloy & Freeman, 2000).

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### Clinical Outcomes of Near Term Infants Wang et al. Pediatrics 2004; 114:372-376

- Compared 90 late preterm (35-37 weeks) and 95 term infants
- Temperature instability
  - 10% in near term, 0% full term
- Respiratory distress
  - 28.9% in near term, 4.2% full term
- Clinically jaundiced
  - 54.4% in near term, 37.9% full term
- Hypoglycemia
  - Seen 3 times as often in near term cohort

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## Breastmilk protection

- Provision of human milk is important to infants born preterm as these babies have a lower antioxidant capacity.
- May be why they are so vulnerable to diseases and conditions associated with oxidative stress such as necrotizing enterocolitis, chronic lung disease, retinopathy of prematurity, periventricular leukomalacia, and intraventricular hemorrhage.
- Breastmilk is much higher in antioxidant capacity than infant formula and helps neutralize oxidative stress on young babies (Ezaki et al, 2008).

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## Importance of the last 6 weeks

- Brain weights at 34 and 36 weeks are 65% and 80% of brain weights at term affecting such functions as arousal, sleep-wake behavior, and the coordination of feeding with breathing.
- The immature brainstem adversely impacts upper airway and lung volume control, laryngeal reflexes, and the chemical control of breathing and sleep mechanisms, with 10% of these infants experiencing significant apnea of prematurity (Darnall et al, 2006).

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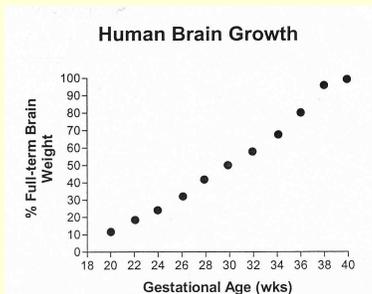
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### Human Brain Growth



Brain weight at different ages from 20-40 wks gestation. At 34 weeks, the overall brain weight is 65% of term weight.

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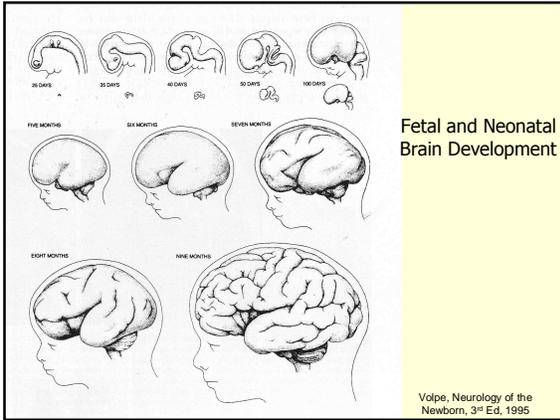
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### Breastmilk as brain food

- Myelination is markedly underdeveloped, and neuronal connections and synaptic junctions are not at their full complement
- Breastmilk is a rich source of components designed specifically to promote myelination and increased development of brain synapses such as sialic acid-containing oligosaccharides
- Formula-fed babies receive only 20% of the sialic acid that a breastfed baby receives and do not synthesize the difference

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### For every 10-mL/kg per day increase in breast milk ingestion:

- Mental Development Index increased by 0.53 points
- Psychomotor Development Index increased by 0.63 points
- Behavior Rating Scale percentile score increased by 0.82 points
- Likelihood of rehospitalization decreased by 6%
- Infants receiving the most breastmilk would enjoy a 5 point elevation in IQ or conversely, infants fed no breastmilk could experience a 5 point IQ deficit. (Vohr et al (2006))

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### Immature behaviors

- Diminished muscle tone makes LPIs more prone to positional apnea due to airway obstruction.
- Immature autonomic system may demonstrate exaggerated responses to stressful stimuli with rapid or lower heart rates, abnormal breathing, skin mottling, frequent startling, regurgitation, or simply shutting down.
- Ability to self regulate may be limited and they be irritable, difficult to console, or not very responsive to their parents' overtures.

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### Neurologic Immaturity

- Immature state regulation
- Difficulty achieving the "latchable" state
- Low tone = poor latch, reduced intake per suck, inadequate milk transfer
- May require more support and positioning adjustments at breast
- Less mature suck pattern

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### Cardiorespiratory Instability

- Reduced clearance of normal lung fluid (TTN)
  - Especially in elective repeat cesarean without labor
- Large head + decreased tone = positional respiratory instability in some breastfeeding positions and in a car seat
- Increased risk for centrally mediated apnea as central nervous systems are developmentally immature with fewer sulci and gyri in the brain and less myelin.

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## Temperature Instability

- Poor temperature regulation
- Skin-to-skin care
  - Newborns placed skin-to-skin remain warmer during the first 3 hours following birth compared with newborns swaddled in mother's arms or receiving nursery care (Bystrova et al, 2003)
  - achieve thermoregulation and do so more rapidly than newborns placed under a radiant warmer



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## Metabolic Instability

- Reduced glycogen and brown fat stores
- Hyperinsulinism may be encountered in infants of diabetic mothers and babies whose mothers are obese and insulin-resistant
- Reduced ketone body compensatory mechanisms especially if given formula which blunts ketone response
- Little energy reserve
- Reduced ability to conjugate and excrete bilirubin
- The more preterm the baby, the longer and more prolonged is meconium passage

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## Heading off hypoglycemia

- Especially if the mother is diabetic, breastfeeding attempts should occur:
  - within 1 hour after birth
  - once every hour for the next 3 to 4 hours
  - every 2 to 3 hours until 12 hours of age
  - at least 8 times each 24 hours in hospital stay
- Frequent breastfeeding is important for late preterm infants who lack stamina and demonstrate inefficient feeding skills.
- Unless swallowing takes place and is documented during these feeding sessions, late preterm infants may actually receive little colostrum, exacerbating hypoglycemia

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## Delayed lactogenesis II

- Compromises the availability of milk
  - Ineffective suckling further down-regulates milk volume
- Diabetes
- Obesity
- Cesarean delivery
- May see prolonged colostrals phase

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## Feeding Problems

- Feeding problems are the predominant reason for delay in discharge
  - Discharge home for near term infants was delayed by suboptimal feeding in nearly 25% of these infants
  - Close attention crucial in avoiding readmission for jaundice and dehydration
  - Ineffective breastfeeding can cause jaundice and jaundice can be a sign of ineffective breastfeeding

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## Inadequate Milk Intake

- Depressed sucking pressures
  - Baby uses suction to draw nipple into mouth
  - Needs -50 to -60 mm Hg during pauses to keep nipple in mouth; can explain why baby keeps slipping off breast
  - Depends on expression to extract milk
- Tire easily at breast/reduced endurance
- Reduced intake per feed
- Insufficient feeds per 24 hours
- Reduced maternal milk supply
- Disorganized suck
- Long periods of sleep
- Maternal health problems/separation
- Babies do not consume milk from the breast simply because it is there

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Geddes et al. Tongue movement and intra-oral vacuum in breastfeeding infants.

*Early Human Development, 84, 471-477.*

- Vacuum plays a major role in removing milk from the breast with milk flowing only when vacuum is applied
- Intraoral pressure was lower in younger babies
- LPs may encounter difficulty with sufficient milk transfer as their ability to generate high enough vacuum levels may be compromised by
  - low muscle tone
  - rapid decrease in tone during a feeding
  - poor seal on the breast
  - difficulty in maintaining the nipple in an optimal position.

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### General breastfeeding plan for LPI

- Place baby skin to skin on your chest
- Watch for rapid eye movements under the eyelids (the baby will wake easily)
- Feed your baby frequently
  - within 1 hour after birth
  - once every hour for the next 3 to 4 hours
  - every 2 to 3 hours until 12 hours of age
  - at least 8 times each 24 hours during the hospital stay

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### Utilize behavioral feeding cues

- Move baby to breast when baby shows feeding cues
  - Sucking movements of the mouth and tongue
  - Rapid eye movements under the eyelids
  - Hand-to-mouth movements
  - Body movements
  - Small sounds

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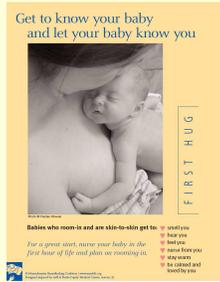
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## Immediate Postpartum Care

- Skin-to-skin contact
  - Physiologic stability
  - Provides warmth
  - Proximity to breasts
  - Improves oxygenation
  - Decreases crying
  - Does not interrupt initial breast-seeking behaviors
  - Avoids hypoglycemia



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## Decrease stressors

- Gentle handling, suctioning only if necessary
- Dim lights
- Reduce noise
- Limit visitors
- Avoid separation for routine procedures



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## Interruptions

Morrison et al. JOGNN 2006; 35:709-716

- Averaged 54 interruptions over a 12 hour period
- Interruptions were frequent, erratic
- Mothers reported feeling rushed when breastfeeding because they were unsure when the next person would enter the room
- Interruptions took precedence over breastfeeding
- Mothers would cease breastfeeding immediately when interruptions occurred
- Mothers had little time to rest, take care of themselves, or feed the infant

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## Positioning Late Preterm Infants

- Position infant for maximal lung expansion, head slightly flexed for open airway
- Assure that the head is stable, in straight alignment with neck and hips



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## Biological Nurturing-Suzanne Colson

- Any mother/baby behavior at the breast where the baby is in close chest contact with the mother's body contours.
- For the baby, biological nurturing means:
  - Mouthing, licking, smelling, nuzzling, and nesting at the breast
  - Sleeping at the breast
  - Groping and rooting at the breast
  - Latching onto the breast
  - Sucking, swallowing, glugging breast milk through active feeding
- For the mother, biological nurturing means:
  - Holding the baby so that baby's chest is in close contact with a maternal body contour
  - Offering unrestricted access to the breast with as much skin-to-skin contact as mother desires

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## Biological Nurturing



- Extended holding in postures where mother leans back, babies lie prone in close frontal apposition with maternal body contours
- Release primitive neonatal reflex-like movements
- Release of these reflexes aids in breastfeeding
- Primitive neonatal reflexes is a collective name given to >50 unconditioned reflex responses, spontaneous behaviors to environmental stimuli
  - Rooting, sucking, swallowing
  - Head, cheek, tongue, lip reflexes
  - Hand-to-mouth, stepping, crawling

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This first time mother has not been taught to breastfeed. Mother and baby are lightly dressed. Mimicking the ventral suspension hold used by neurologists to assess PNRs, she places her 13 day old baby on her body.

The mother has arms and hands free, her body slope contains her baby providing a safe environment. There is a pause during which the mother spontaneously triggers foot PNRs. Baby's fingers grasp, flex and extend.

The baby places and crawls but steps sideways; the mother brings her baby back to her own body midline. In positions of ventral suspension, chest pressure and brushing release head righting and nodding.

The mother opens her body to accommodate these innate PNR movements. The baby head nods again, grasps, places, crawls and steps up the maternal body.

**Baby in Full BN position  
Mother in full BN posture**

The mother spontaneously places the baby as necessary, stroking the baby's foot releasing hand-to-mouth and head nodding which in turn trigger mouth gape, tongue dart and rooting.

Breaking all the rules, the baby self attaches coming from above the breast.

Sustained step and Babinski PNRs aid the baby to remain in situ during milk transfer. The mother says: "Breastfeeding is so easy, I wish more of my friends were doing it".

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### Tilted position

- Tilted position results in better oxygenation, decreased bradycardia and hypoxic episodes, and reduced stomach residuals




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### Biological Nurturing Effects

- The higher the dose of oxytocin infusion during labor epidurals the lower the oxytocin levels during breastfeeding on day 2 (Jonas et al, 2009)
- Biological nurturing in the 1<sup>st</sup> 72 h may trigger ↑ peak concentrations of oxytocin earlier




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### Ineffective Latch

- Low tone
- Does not draw nipple/areola deep into mouth
- Younger infants exert lower vacuum
- Vacuum is primary force used to remove milk from the breast




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## Helping with Latch

- Skin-to-skin
- Behavioral feeding cues
- Encouraging wide open mouth
- Incentives at the breast
- Nipple tug
- Finger feeding



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## Helping with Latch

- Nipple shield
  - 20mm size
  - 16mm may be too small and 24mm may be too large
  - Teat height should not exceed distance from infants lips to juncture of hard and soft palate
- Compensates for relatively weak suck
- Properly fitted
- Reverse pressure softening for edematous areola



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### Alternate Massage/ Breast Compressions

- Breast is massaged and compressed during pauses between sucking bursts
- Creates improved pressure gradient between breast and baby's mouth
- Can increase volume and fat content of feeds



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### In-hospital feeding plan

- Place baby skin to skin on your chest  
Watch for rapid eye movements under the eyelids  
Feed your baby frequently
- within 1 hour after birth
  - once every hour for the next 3 to 4 hours
  - every 2 to 3 hours until 12 hours of age
  - at least 8 times each 24 hours during the hospital stay
- Move baby to breast when baby shows feeding cues
- Sucking movements of the mouth and tongue
  - Rapid eye movements under the eyelids
  - Hand-to-mouth movements
  - Body movements
  - Small sounds

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Make sure you know how to tell when your baby is swallowing

- baby's jaw drops and holds for a second
- you hear a "ca" sound
- you feel a drawing action on the areola and see it move towards your baby's mouth
- you hear the baby swallow
- you feel the swallow when you place a finger on the baby's throat
- your nurse hears the swallow when a stethoscope is placed on the baby's throat

Use alternate massage if your baby doesn't swallow after every 1 to 3 sucks.

Massage and squeeze the breast each time she stops between sucks. This helps get more colostrum into her and keeps her sucking longer.

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If your baby does not swallow when at the breast, hand express colostrum into a teaspoon and spoon feed 2 teaspoons to your baby using the above guidelines



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## Maternal Milk Production

- 8-12 breastfeeding attempts/24 hours
- Alternate massage
- Pumping q3 hours if baby is not transferring milk
- Begin pumping within first 6 hours
- Hospital grade electric breast pump with double collection kit
- Pump after feedings
- Mother should have an electric pump available in the home before discharge

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## Properly fitted pump flange

- Nipples swell during pumping
- Standard pump kits provide flanges whose nipple tunnel opening is 24mm to 25mm, but many mothers benefit from a larger opening of 27mm to 30mm




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## Power Pumping

- First milk ejection releases up to 45% of total volume expressed
- elicit multiple "first" let-downs
  - double pump for 10 minutes, 5-15 minute break, then double pump another 10 minutes
- Tricks the breast into performing several "first" milk ejections
- Mothers who are exclusively or predominantly pumping should target an output of 3500mL/week (500mL/day) by the end of the second week

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Figure 1

**Sample crib card for LPI care plan**

My name is \_\_\_\_\_

Help me stay warm by

- Keeping my hat on at all times
- Holding me skin-to-skin OR
- Snuggling me in several dry blankets
- Checking my temperature before each feeding

My feeding plan

- Breastfeed me every 2 to 3 hrs. for \_\_\_\_\_ min on each breast. I need at least 8 to 10 feedings in 24 hours!
- My mom pumps after feed.
- Pump both breasts at the same time for \_\_\_\_\_ min
- Also give me breast milk and/or \_\_\_\_\_ mL every \_\_\_\_\_ hours

By:  tube at breast  tube with finger

- No pacifiers please!
- My mother prefers to bottle feed me \_\_\_\_\_

Feed me \_\_\_\_\_ mL every \_\_\_\_\_ hours

Completed by \_\_\_\_\_ Date \_\_\_\_\_

Stellwagen LM, Hubbard E, Wolf A. The late preterm infant: a little baby with big needs. Contemporary Pediatrics November 1, 2007

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## Breastfeeding Teaching

- Jaw support/Dancer hand position
- Sublingual pressure
- Signs of swallowing
- Monitoring of wet diapers and stooling
- Pre- and post breastfeeding weights
- Criteria for supplementation
- What to supplement
- How to supplement
- How much to supplement
  - 3-5ml/kg/feeding, or
  - 5-10ml per feeding on day 1
  - 10ml-20ml day 2
  - 20ml-30ml day3

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## Supplementation

- Hand express colostrum into a spoon and spoon feed baby
  - Teaspoon is 5ml
- If using a pump, place the Ameda diaphragm between valve and collection bottle




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Figures 2a-c

### Methods of supplementation to breastfeeding



Figure a: A 5- or 10-ml syringe containing expressed human milk or/and formula can be attached to a 5 Ft feeding tube. The end of which should be inserted along the infant's palate after she/he has latched properly onto the breast. The syringe should be slowly pushed when the infant sucks.



Figure b: During "cup feeding," the infant is supported in a slightly upright position. A small cup containing supplement is placed at the bottom of its attainable mouth opening. The cup is then tilted so that the baby can slowly sip.



Figure c: For "finger feeding," supplement is drawn into a 5- or 10-ml syringe which is then attached to a 5 Ft feeding tube. The end of the tube should be supported by a gloved finger when introduced into the infant's mouth. As the infant sucks on the finger, the syringe plunger can be slowly pushed.

Stellwagen LM, Hubbard E, Wolf A. The late preterm infant: a little baby with big needs. Contemporary Pediatrics November 1, 2007

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## Commercial tube feeding devices



Medela



Maternal Concepts



LactAid



Hazelbaker Finger Feeder

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## Supplementing with a Bottle

- Bottles weaken the masseter muscle and the suck
- Preterm infants frequently remove milk from a bottle, not by exerting vacuum, but by compressing the nipple
- Orthodontic nipples compromise central grooving of the tongue



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## If using a bottle to supplement

- Infant may not be able to generate the force necessary to compress and extend an artificial nipple, which forces the tongue down, hindering its movements
- Nipple should be soft, pliable, short, rounded
  - GerberComfortLatch
  - Evenflo Ultra, Elite
  - Playtex NaturaLatch
- Flow rate should not overwhelm baby
- Orthodontic nipple can produce forward tongue movement

- Paced bottle-feeding
- Adiri bottle



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## Supplementing without stress

- If the infant is holding his breath, looking distressed, sputtering or coughing then the flow needs to be slowed such that a comfortable ratio of sucking to swallowing is seen and the baby inhibits breathing only when swallowing (Wolf & Glass, 2008)

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## Triple Feeding

- Feed baby at breast
- Supplement with previously pumped milk
  - at breast with tube feeding device
- Pump to remove residual milk
- Baby may not be able to maintain mother's milk supply alone
- Inadequately drained breasts result in
  - Reduced milk supply
  - Milk stasis
  - Engorgement
  - Mastitis

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## Discharge Criteria

- Temperature stability in an open crib
- Bilirubin stable or decreasing
- Weight stable or increasing
- Evidence of effective milk transfer
- Mother's milk supply initiated
- Anticipatory guidance regarding nipple soreness, lactogenesis II, effective milk transfer, normal weight patterns
- Sleepy non-demanding baby does not indicate that baby is getting enough

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## Discharge plan

- May do well in hospital but be unable to sustain adequate intake post discharge
- May not have the stamina to engage in complete feedings
- Frequent weight checks
  - May rent scale for in-home use
  - Calculate necessary intake
- Referral to lactation consultant
- Mother decreases pumping after:
- Infant wakes predictably to feed
- Stays awake longer at breast
- Draws nipple further into shield or mouth
- Gains appropriate weight from feeds at breast
- Discontinue nipple shield
- Weight q3 days after each change

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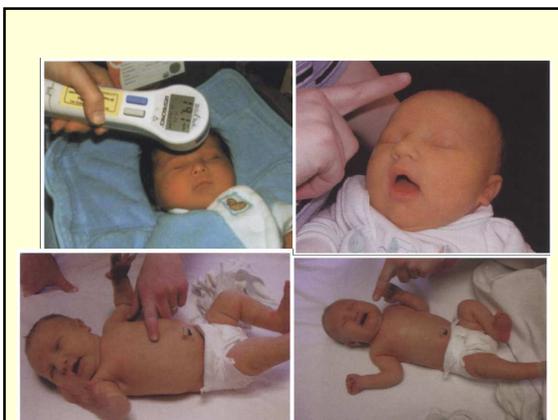
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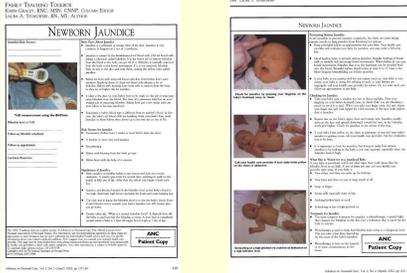
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Stokowski LA. Newborn jaundice.  
Adv Neonatal Care 2002; 2:115-116



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Resources

- CPQCC Care and Management of the Late Preterm Infant Toolkit  
– <http://www.cpqcc.org/LPT.htm>
- Protocol #10: Breastfeeding the near-term infant (35 to 37 weeks gestation)  
– [http://www.bfmed.org/acefiles/protocol/near\\_term.pdf](http://www.bfmed.org/acefiles/protocol/near_term.pdf)

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Helpful handouts for parents

- Contemporary Pediatrics. Guide for parents going home with your late preterm infant  
<http://www.modernmedicine.com/modernmedicine/Parent+Guides/Parent-Guide-Going-home-with-your-late-preterm-inf/ArticleStandard/Article/detail/473739?contextCategoryId=6465>
- Late Preterm (Near-Term) Infant: What Parents Need to Know  
[http://www.awhonn.org/awhonn/content.do?name=02\\_PracticeResources/2C3\\_Focus\\_NearTermInfant.htm](http://www.awhonn.org/awhonn/content.do?name=02_PracticeResources/2C3_Focus_NearTermInfant.htm)
- Stokowski LA. Newborn jaundice. Advances in Neonatal Care 2002; 2:115
- The Diaper Diary (for keeping track of output) and Pumping Milk for Your Premature Baby <http://www.lactnews.com/>

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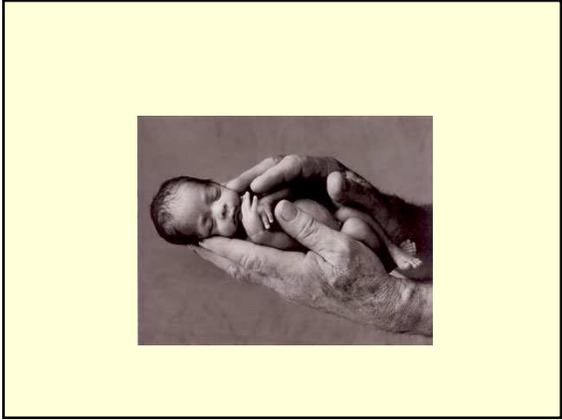
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