



The Late Preterm Infant: Nursing Care and Management

Tanya Hatfield, MSN, RNC-NIC
Neonatal Outreach Educator



Additional Contributors:

- Jenny Quinn RN, MSN, NNP-BC
- Pamela Wright RN, MS, PNP
- Ana Estrada Yost RNC, BSN
- Cynthia Jensen, MS, BSN



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Objectives

- Provide an overview of the clinical significance of even mild prematurity
- Demonstrate understanding of the unique needs of the Late Preterm Infant (LPI)
- Review guidelines to promote evidence based care for this population

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**Which image do you think of first
when you think of premature
babies?**

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This One?



Or This One?

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What about these ones?



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Impostors!

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“Near Term”

- According to National Institute of Child Health and Human Development (NICHD)
 - “Near Term” can be misleading
 - Suggests that these babies are more like term infants
 - Can result in underestimation of risk
- “Near Term” be treated as developmentally mature and at low risk of morbidity
 - Physiologically and metabolically immature
 - Higher risk of developing medical complications
 - Higher rates of mortality, morbidity, hospital readmission

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Late Preterm Infant defined

- Late Preterm Infant (LPI) is one born between 34 0/7 weeks and 36 6/7 weeks
- 36 6/7 weeks established previously as upper limit of gestational age for prematurity
- LPI often the size and weight of a term infant (>37wks GA)

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“Late Preterm”

- According to National Institute of Child Health and Human Development...
 - No such thing as a “normal” preterm infant
 - “Late preterm” conveys sense of vulnerability

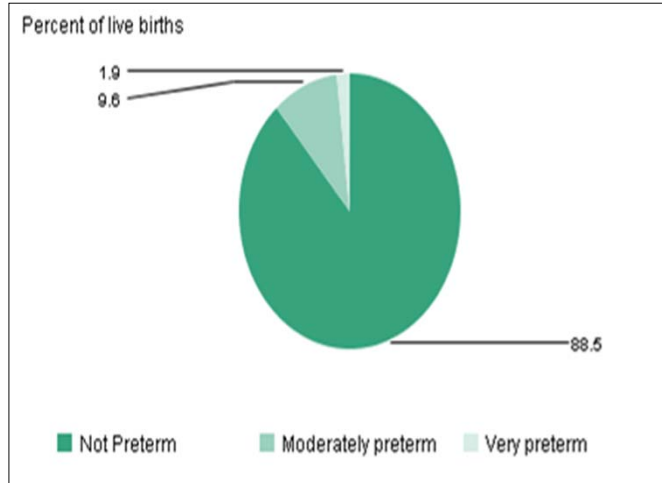
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Round Down

- Optimizing Care and Outcomes for Late Preterm Infants panel suggests:
 - Gestational age should be rounded off to the nearest completed week
 - Therefore a baby at 35 5/7 weeks is 35 weeks, not 36 weeks

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Distribution of gestational age categories United States, 2012



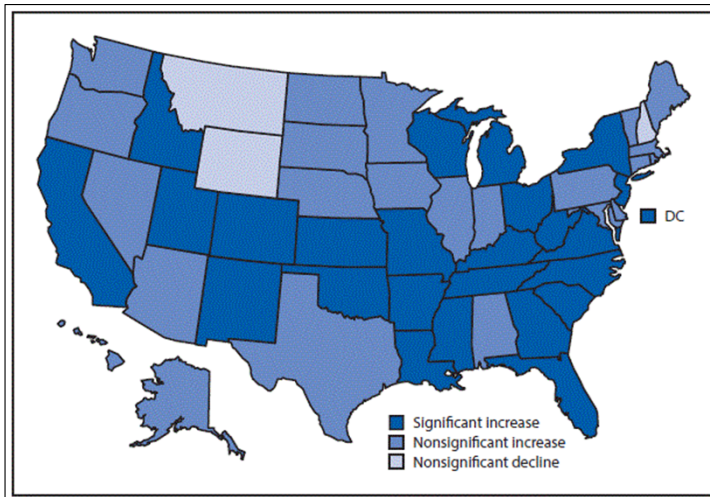
Source: National Center for Health Statistics, final natality data. Retrieved April 21, 2015, from www.marchofdimes.org/peristats.

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10/31/2016



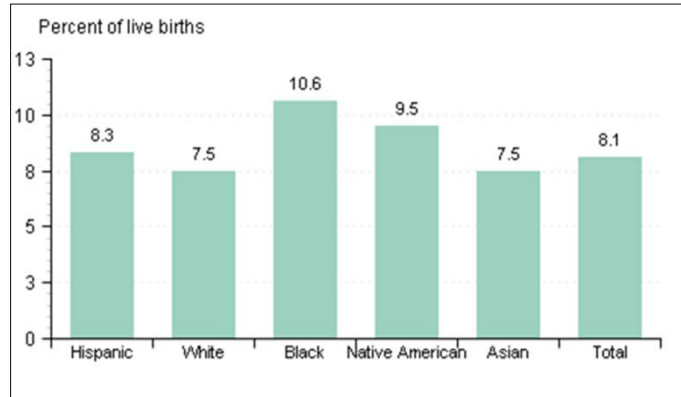
Late preterm births United States, 2014-2016



14 National Vital Statistics System, Natality, 2014 and 2016.
https://www.cdc.gov/nchs/data/nvsr/nvsr64/nvsr64_12.pdf



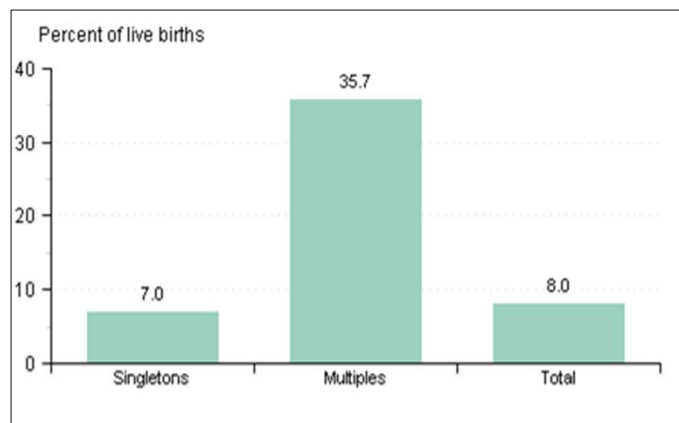
Late preterm births by race/ethnicity United States, 2011-2013 Average



15 All race categories exclude Hispanics. Late preterm is between 34 and 36 weeks gestation.
Source: National Center for Health Statistics, final natality data. Retrieved October 19, 2015, from www.marchofdimes.org/peristats.



Late preterm by plurality United States, 2013



Multiple deliveries include twin, triplet and higher order deliveries. Late preterm is between 34 and 36 weeks gestation.
Source: National Center for Health Statistics, final natality data. Retrieved October 19, 2015, from www.marchofdimes.org/peristats.



The Surge of Late Preterm Births in the 1990's

- Maternal Factors
 - Induction: Increased from 9.5% to 20.6% (25% elective induction in 2003)
 - Stimulation/Augmentation: ↑59% to 16.7% of births in 2003
 - Multifetal pregnancies: ↑ from 2.4% of live births in 1992 to 3.2% in 2002

Martin, JA, et al. National Vital Statistics Reports, Vol. 54, No. 2, 9-8-2005. Births: Final Data for 2003. National Center for Health Statistics, 2005.

17 Davidoff, M.J., et al. (2006). Changes in the Gestational Age Distribution among U.S. Singleton Births: Impact on Rates of Late Preterm Birth, 1992 to 2002. • Seminars in Perinatology, 30 (1):8-15.



Risk Factors for Late Preterm Delivery

- Late or no prenatal care
- Elective induction, augmentation, cesarean
- Premature Rupture of Membranes
- Short inter-pregnancy intervals
- Preeclampsia
- Urinary tract or vaginal infections
- Pre-existing Medical Conditions
 - Hypertension
 - Diabetes
 - Clotting disorders

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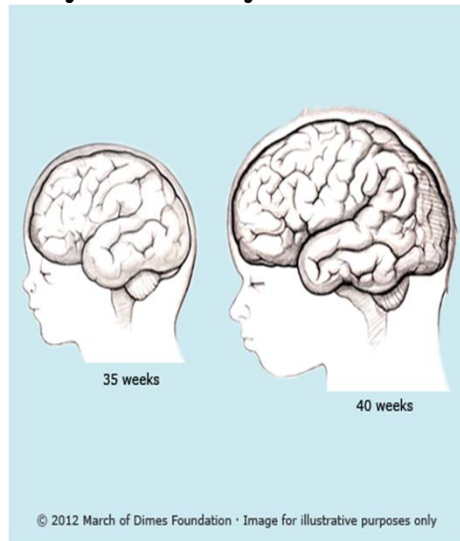
Risk Factors for Late Preterm Delivery

▪ Lifestyle Factors :

- Use of tobacco, alcohol or drugs
- Domestic violence
- Lack of social support
- High levels of stress
- Working long hours, upright
- Low income

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“Don't rush your baby's birth day”



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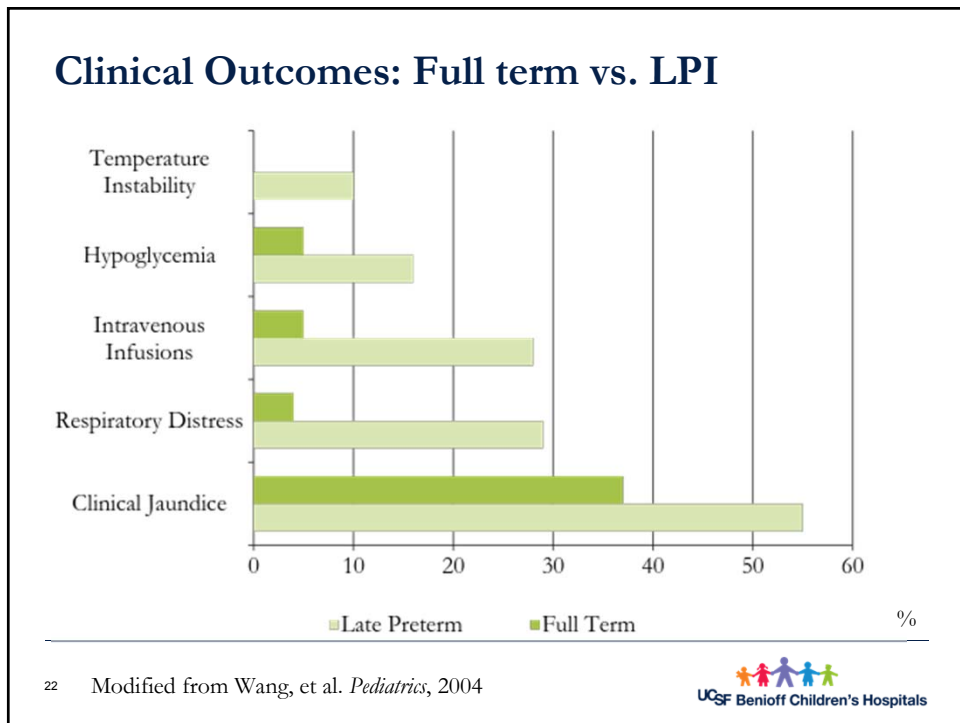
Characteristics of LPI

Characteristics of LPI:

- Low Body Fat
- Excessive weight loss
- Jaundice
- Delay in bilirubin metabolism
- Low Birth Weight
- Feeding difficulties
- hypothermia
- Poor thermoregulation
- Immature suck and swallow
- hypoglycemia
- Low glycogen stores
- Respiratory distress
- Poor state regulation
- sepsis
- Immature Immune system
- Low tone
- Failure to thrive

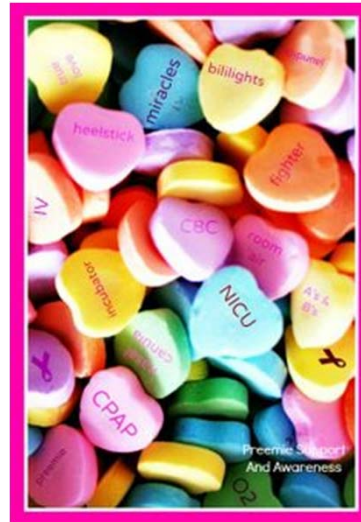
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Outline

- Hypothermia
- Hypoglycemia
- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties



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Temperature Instability



Full Term



Late Preterm

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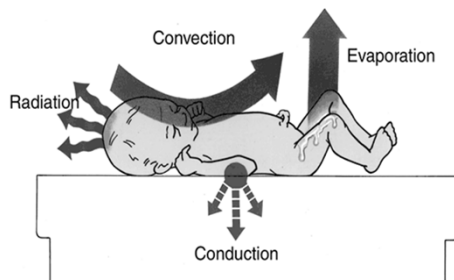
Temperature Instability- Impact

~10-30% of late preterm infants have **persistent temp instability** beyond initial transition (ideal 36.5-37.5)

- **Increased heat loss potential**
- **Impaired ability to produce heat**

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Various Modes of Heat Loss

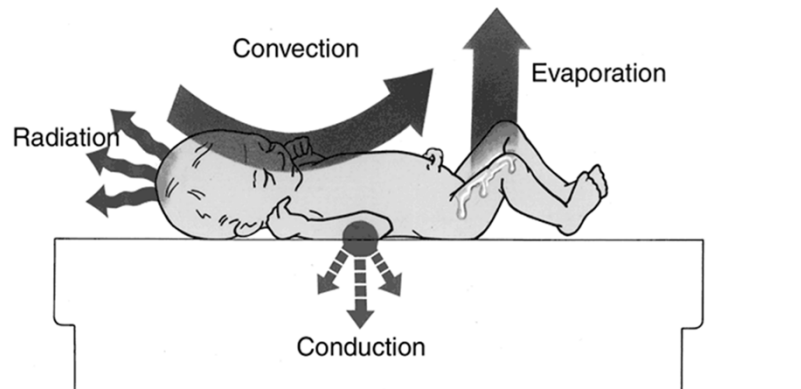


- **Radiation:** transfer of heat to cooler objects (windows)
- **Convection:** heat transferred to the air surrounding infant
- **Evaporation:** wet surfaces exposed to air, then dries (amniotic fluid drying on infant, loss of heat occurs)
- **Conduction:** direct contact with cooler object

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Do you know...???

A naked newborn exposed to an environmental temperature of **23°C (73.4°F)** suffers the same heat loss as a naked adult in **0°C (32°F)**



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Temperature Instability

► Interventions

- Delay interventions at birth that increase heat loss
- Skin to skin care with mother immediately after birth and as frequently as medical condition allows
- Dress infant with hat, double blankets if necessary
- Use servo-control and temp. probe while in warmer/incubator

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Temperature Instability

► Interventions

- Document ambient temperature/clothing necessary to maintain optimal body temp
- Assess carefully for cause of changes in temperature
 - Primary thermo-regulation vs. sepsis, respiratory issues, hypoglycemia
- Warm consistently: incubator, servo-control, monitor NTE, slow transition to OC, additional clothing when in open crib
- Notify provider of episodes of hypothermia

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Temperature Instability

▪ Parent Education

- Importance of temperature regulation
- Avoid over or under dressing infant
- When to call healthcare provider:
 - Temp instability with changes in infant (poor feeding, irritability, lethargy)



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Skin to Skin Safely

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Skin to skin benefits

- Temperature stability (thermal synchrony)
- Higher oxygen saturation
- Improved breastfeeding & milk production
- Increased attachment and bonding
- More mature sleep organization
- Better autonomic regulation
- Effective as pain control
- Increased weight gain
- Shorter hospital stay
- Enhances immune system
- Stimulates digestion



Baley, J. (2015). Skin-to-Skin Care for Term and Preterm Infants in the Neonatal ICU. PEDIATRICS, 136(3), 596-599. <http://dx.doi.org/10.1542/peds.2015-2335>

32 Prematurity.org., (2016). Kangaroo Care Benefits for Premies. Retrieved 12 January 2016, from <http://www.prematurity.org/baby/kangaroo.html>

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Outline

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- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties



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Hypoglycemia



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Hypoglycemia

▪ Definition/Impact

- Serum glucose levels of $<45\text{mg/dl}^*$ in the first 24 hours
- LPI are up to three times more likely to have episodes of hypoglycemia as term infants
- Legal implications

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Hypoglycemia

▪ Etiology

- Inadequate Glycogen Stores
- Increased Glucose Utilization
- Impaired ability to take in adequate nutrition

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Hypoglycemia

- **May Cause:**

- Repeated lab testing or screening
- Alterations in normal feeding patterns and choices including:
 - Exposure to artificial baby milk (foreign proteins, change in gut pH/permeability)
 - Impaired milk production and transfer
- Increased risk of separation and admission to NICU

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Glucose Gel!!

- Inexpensive, non-invasive and easy to administer
- Applied to buccal mucosa for rapid correction
- Absorption rate is similar to IV administration
- Dosing is weight based ($0.2\text{g/kg} = 0.5\text{mL/kg}$)
- Promotes continued breastfeeding and maternal bonding
- Decreases ICN admissions



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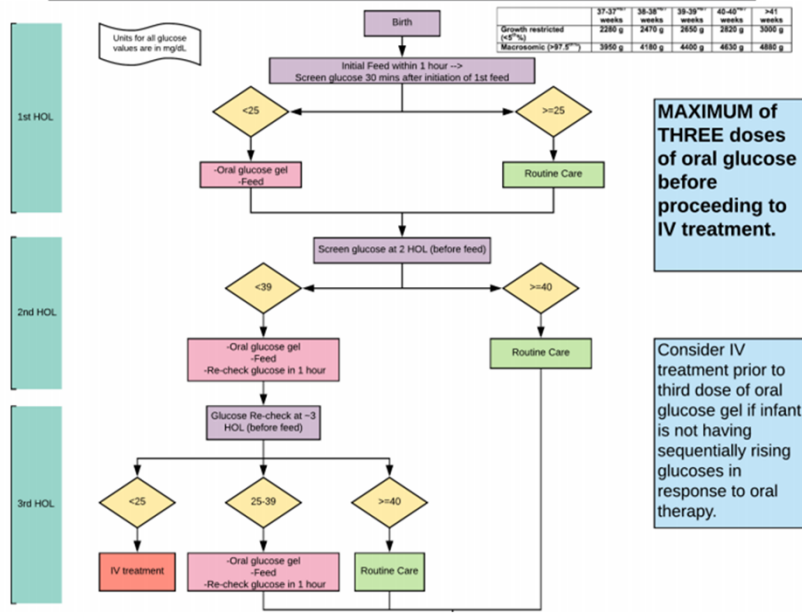
How to Administer?

- Wipe inside of infant's cheek to dry area with a 2x2
- Apply 0.5 ml of gel to (gloved) finger and massage into infant's cheek for ~5 seconds
- Repeat procedure in other cheek; alternating in 0.5mL increments until entire dose is administered.

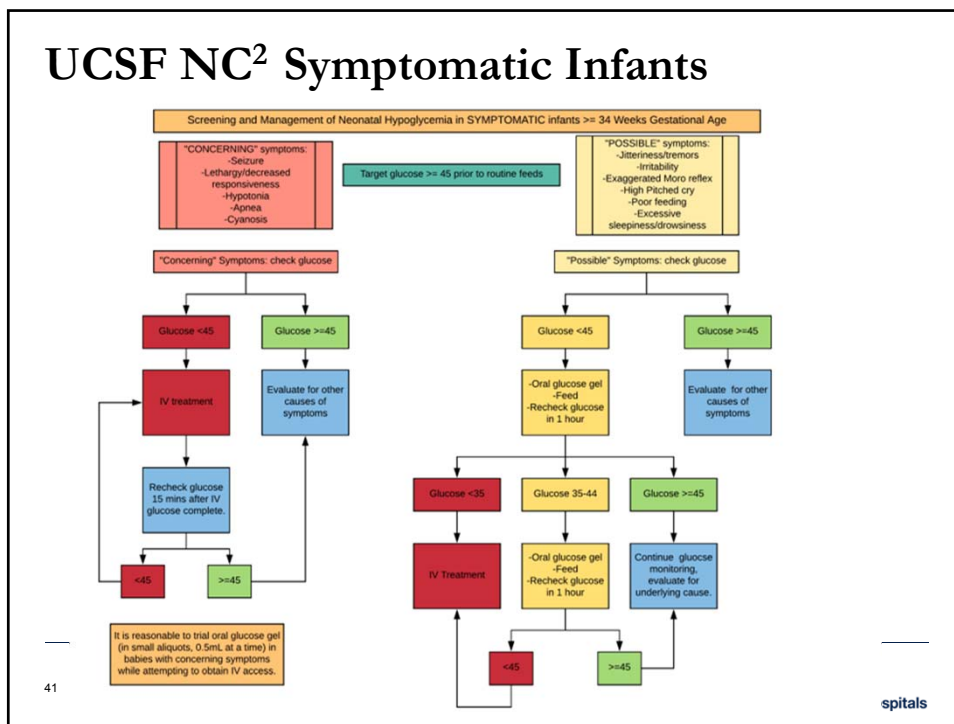
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UCSF NC² Asymptomatic Infants-at risk



UCSF NC² Symptomatic Infants



UCSF Neonatal Hypoglycemia in the Critical and Transitional Care Setting

Patient Population	Blood Glucose mg/dL	Symptomatic	Asymptomatic	Intervention
All (Including NICN)	<25 mg/dL	✓	✓	Notify MD/NNP Place IV Obtain order for: • D ₁₀ W bolus – 2 mL/kg • D ₁₀ W @ 80 mL/kg/day
NICN Patients with: Encephalopathy • HIE • Perinatal stroke • Seizures	<60 mg/dL	✓	✓	Notify MD/NNP Place IV Obtain order for: • D ₁₀ W bolus – 2 mL/kg • D ₁₀ W @ 80 mL/kg/day
All Infants Identified as "at Risk" (Except NICN)	<50 mg/dL	✓		Notify MD/NNP IV Dextrose per order <i>AND/OR</i> Feeding per order
All Infants Identified as "at Risk" (Except NICN)	<50 mg/dL		✓	Notify MD/NNP Feeding per order <i>AND/OR</i> IV Dextrose per order

Blood Glucose testing tips

- For heel sticks:
 - Warm heels to improve circulation
 - Wipe away first drop
- Accuracy in low range depends on manufacturer
- Low or high hematocrit can affect value
- Confirm low levels with iSTAT or stat blood sample sent to laboratory
- **Do not delay treatment**



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Hypoglycemia-Interventions

- Maximize energy intake
 - Encourage early, frequent, effective BF
 - Supplement as clinically indicated (not as routine) following evidence-based guidelines

Methods of supplementation to breastfeeding



Figure a: A 5- or 10-mL syringe containing expressed human milk and/or formula can be attached to a 5 Fr 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 lip to stimulate mouth opening. The cup is then tilted so that the baby can slowly sip.

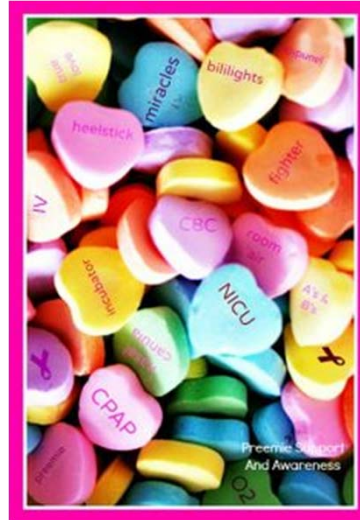


Figure c: For "finger feeding," supplement is drawn into a 5- or 10-mL syringe, which is then attached to a 5 Fr feeding tube. The end of the tube should be supported by a gloved finger when introduced into the infant's mouth. As the infant sucks on the finger, the syringe plunger can be slowly pushed.

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Outline

- Hypothermia
- Hypoglycemia
- **Respiratory Distress**
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties
- Car seat safety & Discharge



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Respiratory Distress



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Respiratory Distress

▪ Definition/Impact

- Respiratory distress requiring intervention is approximately 30% more common in LPI
- Rates are inversely proportional to gestational age
- Rates of any respiratory distress are increased by 4-20+ times

Respiratory Distress Syndrome (RDS) is not the same as Respiratory Distress

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Respiratory Distress

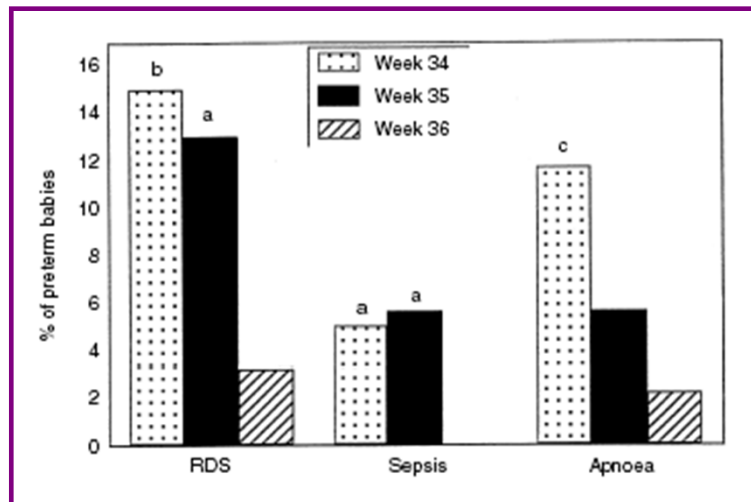
▪ Etiology

- Surfactant deficiency
- Retained fetal lung fluid
- Bacterial infection causing pneumonia
- Inability to meet physiologic demands
- Patent Ductus Arteriosus or Congenital Heart Disease

Respiratory distress is one of the most common indications for transfer to NICU or delayed discharge

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Frequency of RDS, Sepsis and Apnea at 34-36 Weeks



Arnon, et al. *Paediatr Perinat Epidemiol*, 2001

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Respiratory Distress

Interventions

- Closely monitor for first hour of life
- Minimize oxygen requirements or demands
- **DELAY BATH**
- Maintain NTE
- Minimize procedures/hands-on; provide developmental support
- Positioning, skin-to-skin
- Supplemental oxygen if indicated
- Evaluate need for continuous airway pressure

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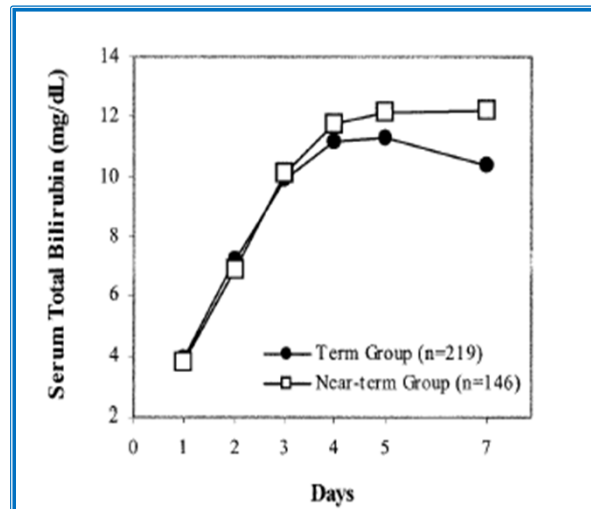
Hyperbilirubinemia- definition

- Hyperbilirubinemia is defined as an elevated serum total bilirubin (TB) level
 - > 10-12 mg/dl in term
 - > 4-5 mg/dl in preterm infants
 - Usually peaks around 5-7 days
 - Later peak in preterm infants
- Values vary depending on the infant's age in hours, gestational age, and pathology
 - <http://phototherapyguidelines.com/>



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Hyperbilirubinemia and the LPI



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Incidence of Jaundice

- Jaundice as a cause for discharge delay
 - 16.3% at 35-36 weeks
 - 0.03% at term
- Bilirubin-induced brain injury
 - Late preterm infants represent a large fraction of infants in kernicterus registries
 - LPIs are twice as likely as term infants to be treated for jaundice

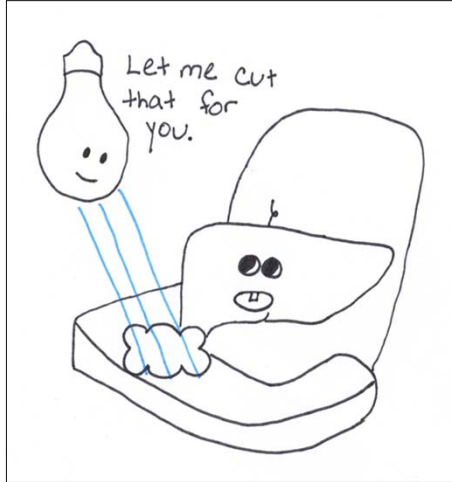
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Recommendations for Prevention (AAP, 2004)

- **Assess risk factors every shift:**
 - Measure levels in all infants with jaundice in first 24 hours
 - Recognize that visual estimation is inaccurate
 - Promote & support BF
 - Establish protocols for identifying and evaluating
 - Perform thorough risk assessment
 - Race, cephalhematoma, blood type, etc
 - Interpret levels according to age in hours
 - Plan for repeat level if d/c'd before 72 hours

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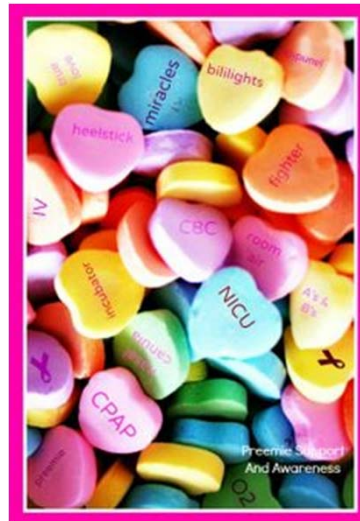
Phototherapy



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Sepsis



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Sepsis

- Evaluation and treatment are inversely proportional to gestational age
- LPI are 3 times more likely to have sepsis evaluation
- LPI 30% more likely to be treated
- Most commonly sited organism of concern is Group B Strep (GBS)
- Most commonly noted site of infection in early sepsis is lungs (pneumonia)

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Sepsis-Etiology

- Maternal infection or colonization (cold, flu, chorio, prolonged ROM)
- Cause of preterm delivery (PIH/HELLP) may confuse or mask evaluation for sepsis
- LPI are more likely to have impaired immune response
- LPI are less likely to tolerate the physiologic stress of sepsis

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Sepsis-Assessment and Screening

- Assess cause of PTL and delivery
- Consider placental examination
- Assess maternal GBS status and treatment in labor

Early-onset sepsis is defined as infection occurring \leq 72 hours of birth

Late-onset sepsis is defined as infection occurring $>$ 72 hours of birth

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Early-onset sepsis

Risk factors

- Maternal infection (e.g. chorioamnionitis/ fever/antibiotics)
- Prolonged rupture of membranes (>24h)
- Maternal GBS colonisation or infection in current pregnancy/confirmed invasive GBS infection in a previous baby
- Spontaneous preterm labour



Late-onset sepsis >72 hours

- Babies become colonized after birth and then develop invasive infection
- Organisms are acquired after birth ('nosocomial' or 'healthcare-acquired infection' – so potentially avoidable)



Sepsis-Interventions

- Vigilance: any abnormal finding may indicate sepsis
- Careful assessment and full treatment of mother in labor with GBS, other infections or PROM
- Careful and prolonged clinical assessment for signs of sepsis
- Obtain Neonatology consultation
- Early intervention with broad spectrum antibiotics if indicated
- Follow blood culture and clinical signs

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Rules of the “Rule Out”

- All preterm infants with the possible exception of a delivery after an induction for maternal reasons
- All infants with any respiratory symptoms, feeding intolerance or changes in neurologic status
- Any baby that just “doesn’t look quite right”

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Baby W

- Baby boy born to a G3-P2 by scheduled C/S at 1100 @ 36 6/7 weeks
- GBS positive... but not ruptured... so not treated
- At 1 hour of life (1200) dusky spell during bath, blow by oxygen given then recovered
- 2nd episode of being “spitty” with another dusky spell
- Moved to nursery, placed on warmer, oxygen cannula placed
- Sepsis work up ordered (CBC and Blood Culture)

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Baby W

- CBC sent, but unable to obtain blood culture
- Vital signs significant for temp 100.4, nurse replaced temp probe
- Pediatrician went home, left orders for lab draws
- Multiple pokes for lab draws, bruising noted at tourniquet sites
- MD called back in to place line for blood culture
- Umbilical line placed, culture sent

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Baby W... the story continues

- PIV infiltrated during Ampicillin admin, Gent given through UAC
- MD went home, told RN to call at 0400 with blood gas results
- Respiratory distress with irritability during the night, more “spits”
- **Emergent intubation required at 0500, baby critically ill, transferred to tertiary facility**
- **Blood culture positive at 20 hours of life for Streptococcus**

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Take Aways

- Babies show non-specific signs of sepsis, trust your instincts
- Do not normalize the abnormal
- Look at the whole picture
- Communicate your findings
- Give a thorough handoff
- Dusky spell
- Required blow by
- “spitty”
- 2nd dusky spell
- Increased oxygen need
- Temp instability
- Bruising
- Increased respiratory distress
- Irritability
- More “spits”

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Early Identification... A New Approach: The Probability of Neonatal Early Onset Infection

- Based on the work by Drs Gabriel Escobar and Karen Puopolo, et al. (2014)
- Goal: To define a quantitative stratification algorithm for the **risk** of EOS in newborns greater than or equal to 34 weeks gestation
- The question: Is there a way to use maternal OBJECTIVE data with OBJECTIVE neonatal clinical findings to define more efficient strategies for the evaluation and treatment of EOS in term and late preterm infants?
- The potential result: Decreased antibiotic treatment in newborns



How?

- Escobar, Puopolo, et al. looked at over 600,000 live births with a gestational age greater than or equal to 34 weeks at 14 hospitals between the years of 1993 and 2007
- Identified ALL 350 EOS cases that occurred at less than 72 hours of age
- These cases were matched by birth year and birth hospital to 1063 controls
- The model uses 5 predictors to compute a potential risk of sepsis at birth
- The risk is then adjusted based on infant-specific data to guide evaluation and treatment decision (Bayesian approach)



“The Calculator” – Let’s try it!

- <http://www.dor.kaiser.org/external/DORExternal/research/infectionprobabilitycalculator.aspx>
- CASE: 39 1/7 week G3P1 presents with c/o labor. Contractions every 3 - 5 minutes. Cervical exam at 1.5 cm. BOW intact. Labors to complete in 1.5 hours. Ruptures 20 min prior to delivery. GBS negative, no antibiotics administered. Last temperature prior to delivery 98.9 degrees F.
- Based on the calculator, what is the baseline risk of EOS?
- What if the gestational is 35 1/7 weeks?



Equivocal Signs

- In the first 12 hours of life, the baby experiences either:
 - Two (2) of the following abnormalities that persist for 2 hours, or
 - One (1) abnormality that persists for 4 hours
 - Heart rate ≥ 160
 - Respiratory rate ≥ 60
 - Temperature $\geq 100.4F$ or $< 97.5F$
 - Respiratory distress (grunting, flaring or retracting)
- (Escobar, et al. 2014)



- 39 1/7 week
- 98.9 F
- BOW intact
- GBS neg


- 35 1/7 week
- 98.9 F
- ROM 1 hour
- GBS neg

- 35 1/7 week
- 100.5 F
- ROM 4 hour
- GBS neg

Which baby gets antibiotics?

- 35 1/7 week
- 101.6 F
- ROM 14 hour
- GBS pos w/abx


- 35 1/7 week
- 102.1 F
- ROM 19 hours
- GBS pos w/abx



Which baby gets antibiotics?

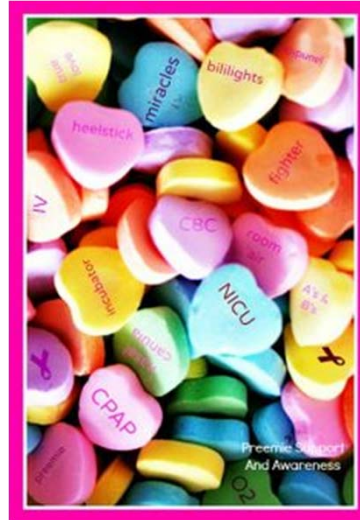
Risk per 1000/births			
EOS Risk @ Birth	0.30		
EOS Risk after Clinical Exam	Risk per 1000/births	Clinical Recommendation	Vitals
Well Appearing	0.12	No culture, no antibiotics	Routine Vitals
Equivocal	1.49	Blood culture	Vitals every 4 hours for 24 hours
Clinical Illness	6.29	Empiric antibiotics	Vitals per NICU

Classification of Infant's Clinical Presentation [Clinical Illness](#) [Equivocal](#) [Well Appearing](#)



Outline

- Hypothermia
- Hypoglycemia
- Respiratory Distress
- Hyperbilirubinemia
- Sepsis
- Excessive Weight Loss
- Failure to thrive
- Feeding Difficulties
- Car seat safety & Discharge



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Feeding Issues



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Feeding Issues

- Definition/Impact
 - Up to 25% of LPI have delayed discharge due to feeding difficulties
 - Excess weight loss (>3% first 24 hours, >7% at 72 hours)
 - Physiologic changes during feedings (desaturations)
 - Inability to take adequate nutrition by mouth,
 - Feeding difficulties can lead to sepsis evaluations, separation of mother and infant, admission to NICU

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Feeding Issues- Etiology

- Difficulty coordinating suck, swallow and breathing
- Easily exhausted
- Increased need for calories
- Mild hypotonia
- Less alert awake periods
- GI tract less mature



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Interventions

- Identify maternal risk factors that may affect successful feeding
- Ensure adequate feeding frequency
- **Facilitate immediate, uninterrupted, and extended skin-to-skin for stable infants until after the first breastfeeding**

UCSF Breastfeeding Policy for LPI

- Skin to skin as much & as early as possible
- Early colostrum expression
- Formal lactation consult within 24 hours
- Pumping initiated 24 hours for 10-20 mins after feeding LPI
- Weight loss >3% in first 24 hours or >7% at 72 hours of life requires further eval and monitoring
- Prevent thermal stress during breastfeeding
- **Do not supplement unless medically indicated, ordered and consented to by mother**

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Support for Breastfeeding (N2 consortium)

- Skin to skin
- Lactation Consultation
 - Should be offered to ALL mothers of late preterm
- Milk Expression/Hand expression
 - Initiate within 4 hours from birth
- Assessment of Breast Milk Transfer
 - LATCH scoring
 - Consider weighing after DOL 3
- Assessment of hydration status
 - daily weights, weighing/counting diapers
- Duration of Supplementation
 - Until infant can feed effectively

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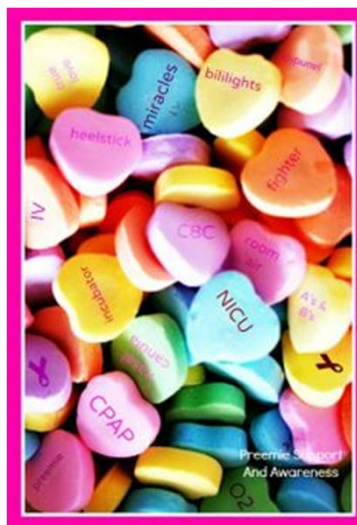
Supplementing

- Supplement with, expressed breast milk, donor breast milk, hydrolyzed formula, formula
- Supplement no more than recommended volumes
 - First 24 hours- 2-10mL per feed
 - 24-48 hours- 5-15mL per feed
 - 48-72 hours- 15-30mL per feed
 - 72-96 hours- 30-60mL per feed
- **Do not supplement unless medically indicated, ordered and consented to by mother**

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Car Seat Safety

- We're no longer doing Car Seat Testing!!

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ORIGINAL
ARTICLES

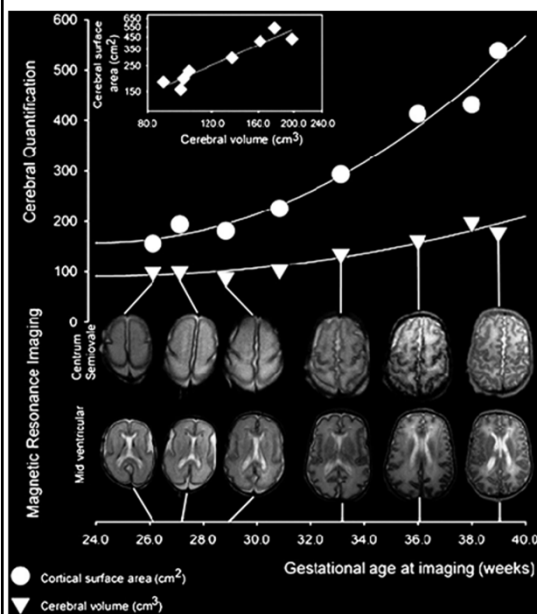
Car Seat Tolerance Screening in the Neonatal Intensive Care Unit: Failure Rates, Risk Factors, and Adverse Outcomes

Erik A. Jensen, MD MSCE¹, Elizabeth E. Foglia, MD MSCE¹, Kevin C. Dysart, MD¹, Zubair H. Aghai, MD², Alison Cook, DO³, Jay S. Greenspan, MD MBA², and Sara B. DeMauro, MD MSCE¹

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Take home points...



- Late Preterm Infants are not just smaller versions of term infants
- Increased risk of:
 - Morbidity and mortality
 - Resuscitation
 - Jaundice
 - Hypoglycemia
 - Temperature instability
 - Apnea
 - Respiratory distress
 - IV fluid administration
 - Ventilatory support
 - Length of stay
 - Rehospitalization

Born in a critical developmental time period



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