

Hot or Cold? It's Not a Game: Care of the Late Preterm Infant

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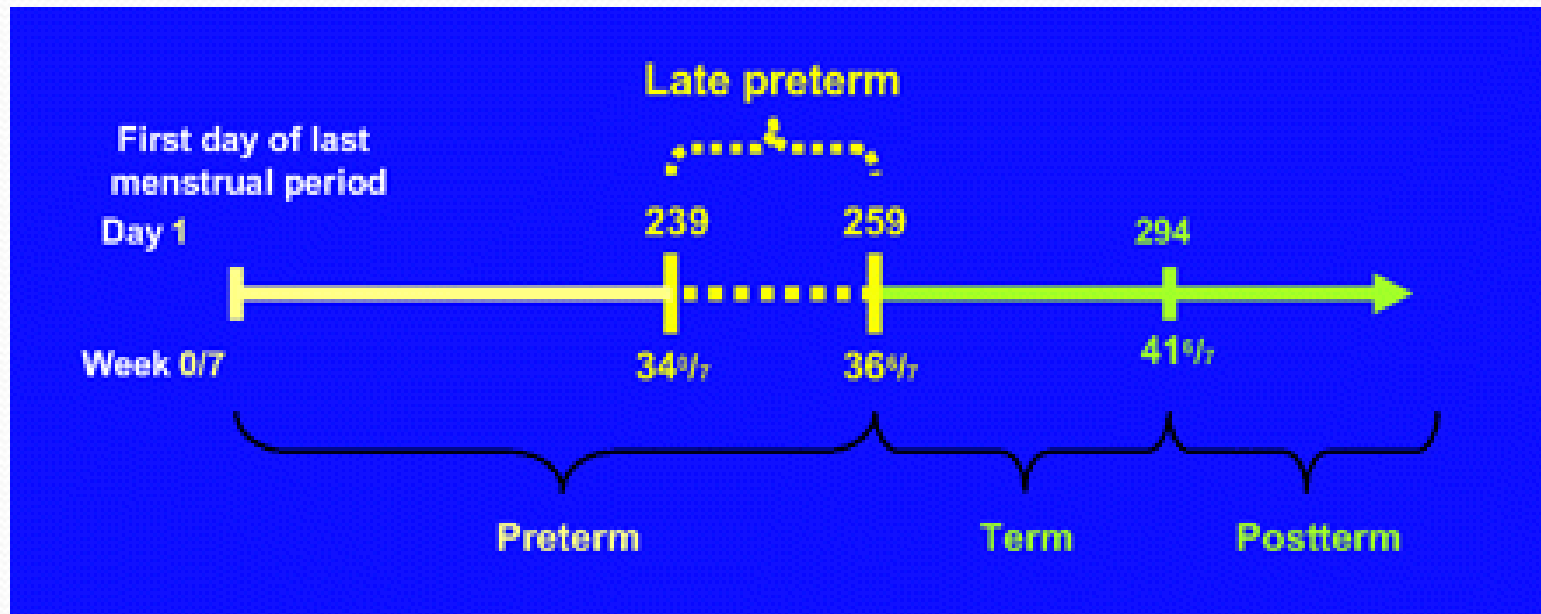
Disclosures

I have no financial disclosures.

Defining “late preterm” infant (LPI)

The World Health Organization (WHO), the American Academy of Pediatrics (AAP), and the American College of Obstetricians and Gynecologists (ACOG) define preterm birth as the delivery of an infant before completion of 37 weeks gestation. This occurs on or before the 259th day after the first day of the last menstrual period (LMP) of the mother.

Defining “late preterm” infant (LPI)



Name Change: Near-Term→Late Preterm

NICHD Workshop, July 2005; (34 0/7-36 6/7 weeks)

Raju TNK et al. Pediatr 2006; 118(3): 12-7-1214

- “Near-term” suggests that these infants are *almost term* and therefore *almost mature*.
- “Late Preterm” suggests these infant are *still premature* and therefore *more vulnerable*.

Major Advances in Late Preterm Birth

- 2006 Introduction of the phrase *late preterm* to replace *near-term*
- 2007 Practice guidelines issued by AAP Committee on Fetus and Newborn, and the Committee on Obstetrics Practice of the ACOG
- 2007 NCHS begins tracking late preterm birth statistics; the March of Dimes begins research support and educational activities to prevent non-medically indicated deliveries at late preterm gestations
- 2011 Guidelines to manage “indicated late preterm and early term deliveries” published after and NICHD and SMFM workshop
- 2012 Additional classifications published by defining and refining the definition of *term birth* at a working group convened by NICHD, in collaboration with ACOG, the AAP, SMFM, the March of Dimes, the WHO, and the NCHS.

Major Advances in Late Preterm Birth, continued

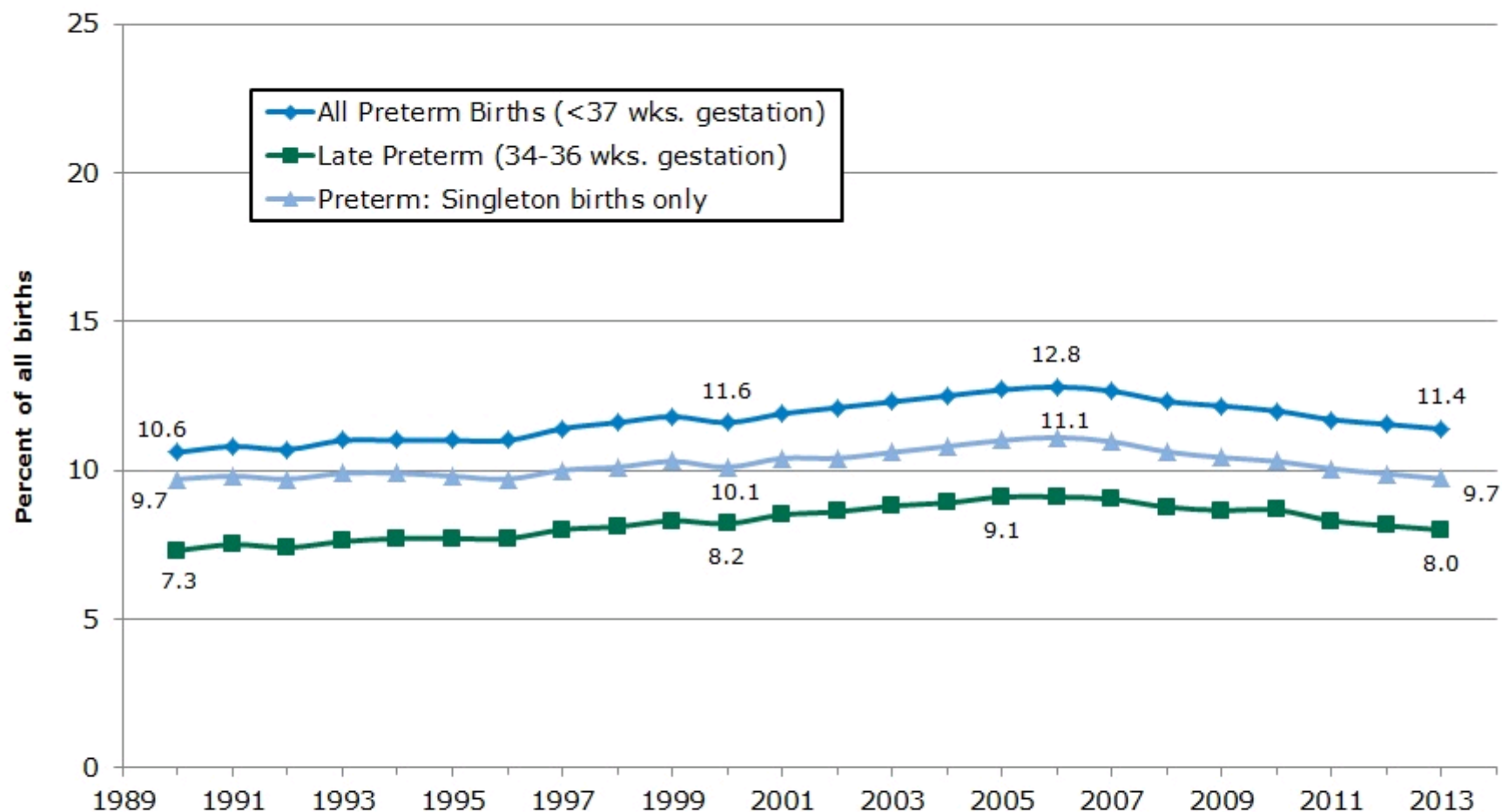
- 2014 NCHS continues to note decreases in US singleton preterm and late preterm birth rates beginning in 2007
- 2016 From 2007 through Oct 2016 >500 publications and review articles confirm that late preterm infants are at higher risk for pulmonary, metabolic, and neurologic disorders; feeding difficulties during the neonatal period; elevated risk for hospital readmissions for jaundice and bilirubin-induced brain injury; RSV and other pulmonary infections during infancy and childhood; cognitive deficits and learning issues at school age, and small but measurable negative effects in adult age groups.
- 2016 Decreasing rates of inductions at late preterm and early term pregnancies in 6 high-income countries in North America and Europe.

Major Advances in Late Preterm Birth, continued

Most recently in 2016, attempts to improve fetal pulmonary maturity in late preterm, early term gestations for elective CS birth and in other clinical settings. Publication of a large trial to increase fetal lung maturation with antenatal betamethasone therapy in late preterm pregnancy and endorsement of the practice by the SMFM and ACOG.

Figure 1

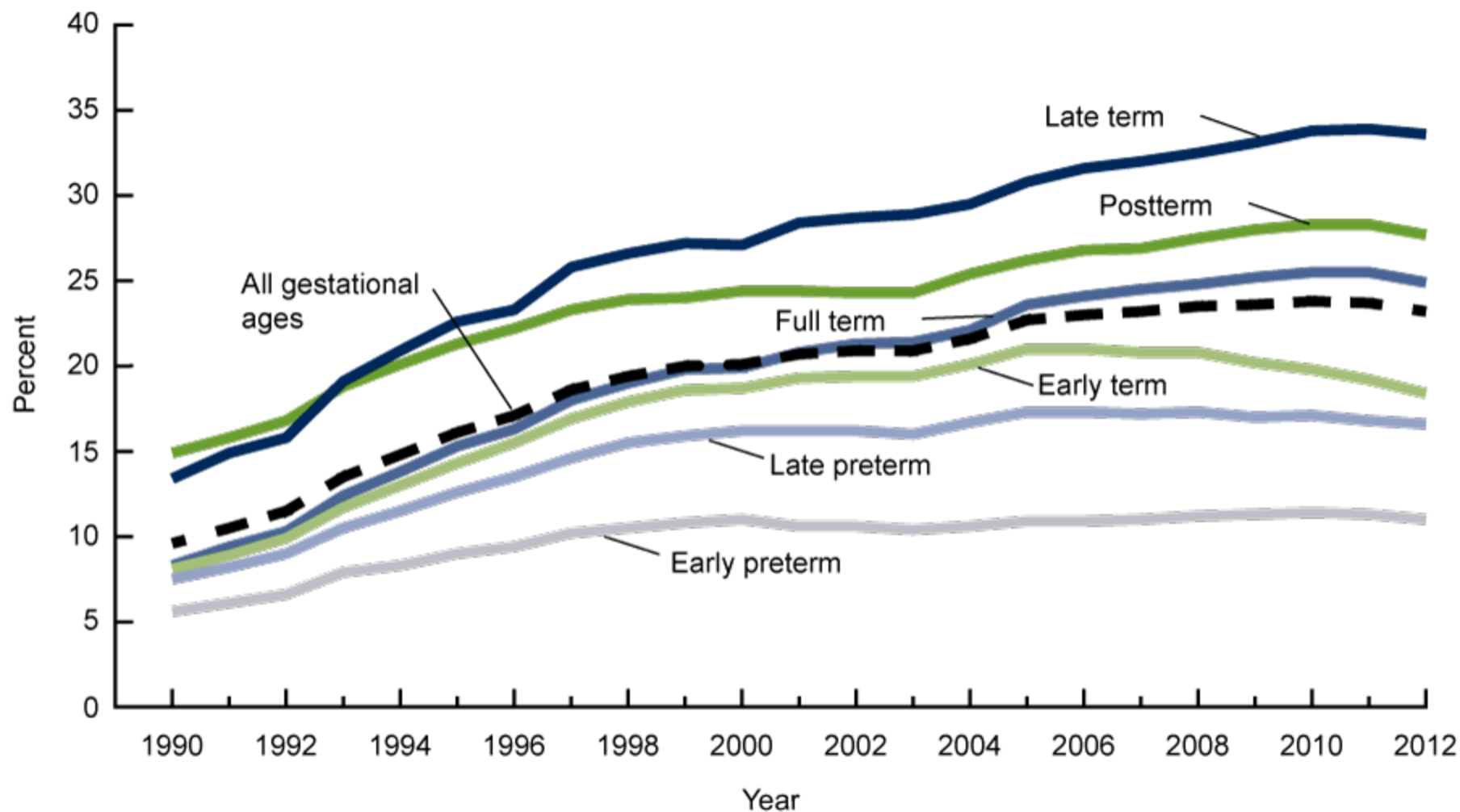
All Preterm and Late Preterm Births, as Percentage of All Births, 1990-2013



Note: Percentage calculations exclude records missing gestation period data.

Data for 1990-1995: Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System. *VitalStats* online tool. Available at www.cdc.gov/nchs/data_access/vitalstats/VitalStats_Births.htm. Data for 1995-2013: Centers for Disease Control and Prevention, National Center for Health Statistics, CDC Wonder online database. Available at: <http://wonder.cdc.gov/nativity.html>

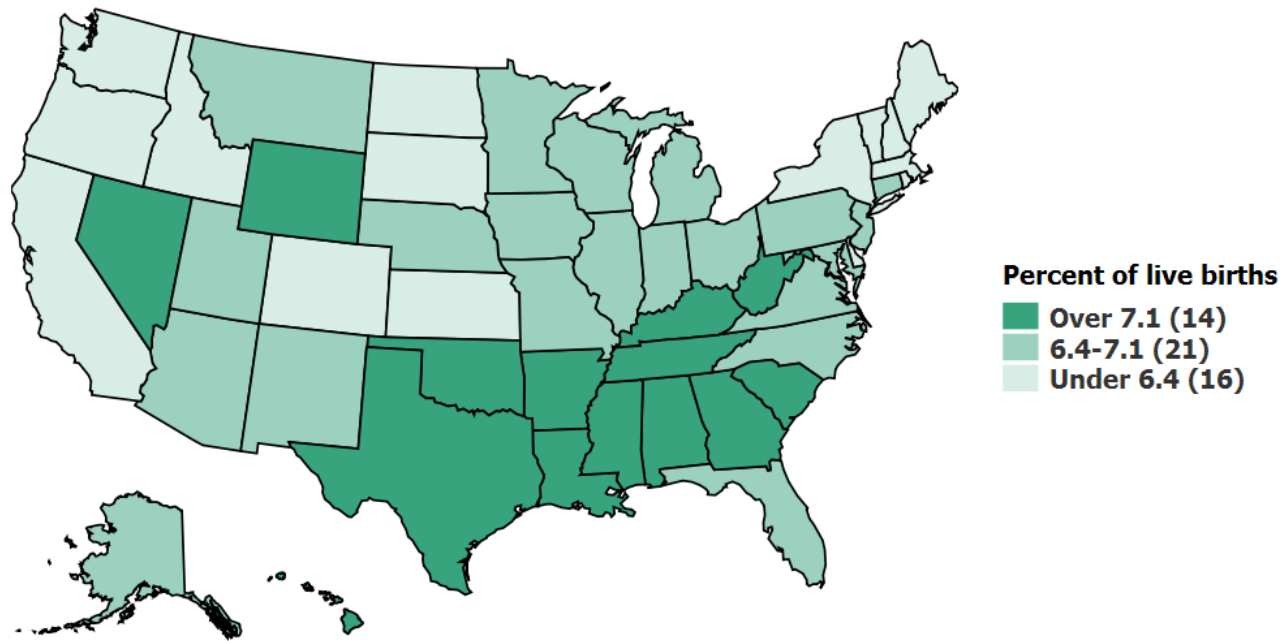
Figure 1. Induction of labor, by gestational age: United States, 1990–2012



NOTES: Singletons only. Early preterm is less than 34 weeks of gestation; late preterm is 34–36 weeks; early term is 37–38 weeks; full term is 39–40 weeks; late term is 41 weeks; postterm is 42 weeks or more. Access data table for Figure 1 at: http://www.cdc.gov/nchs/data/databriefs/db155_table.pdf#1.
SOURCE: CDC/NCHS, National Vital Statistics System.

Late Preterm Births

United States 2014



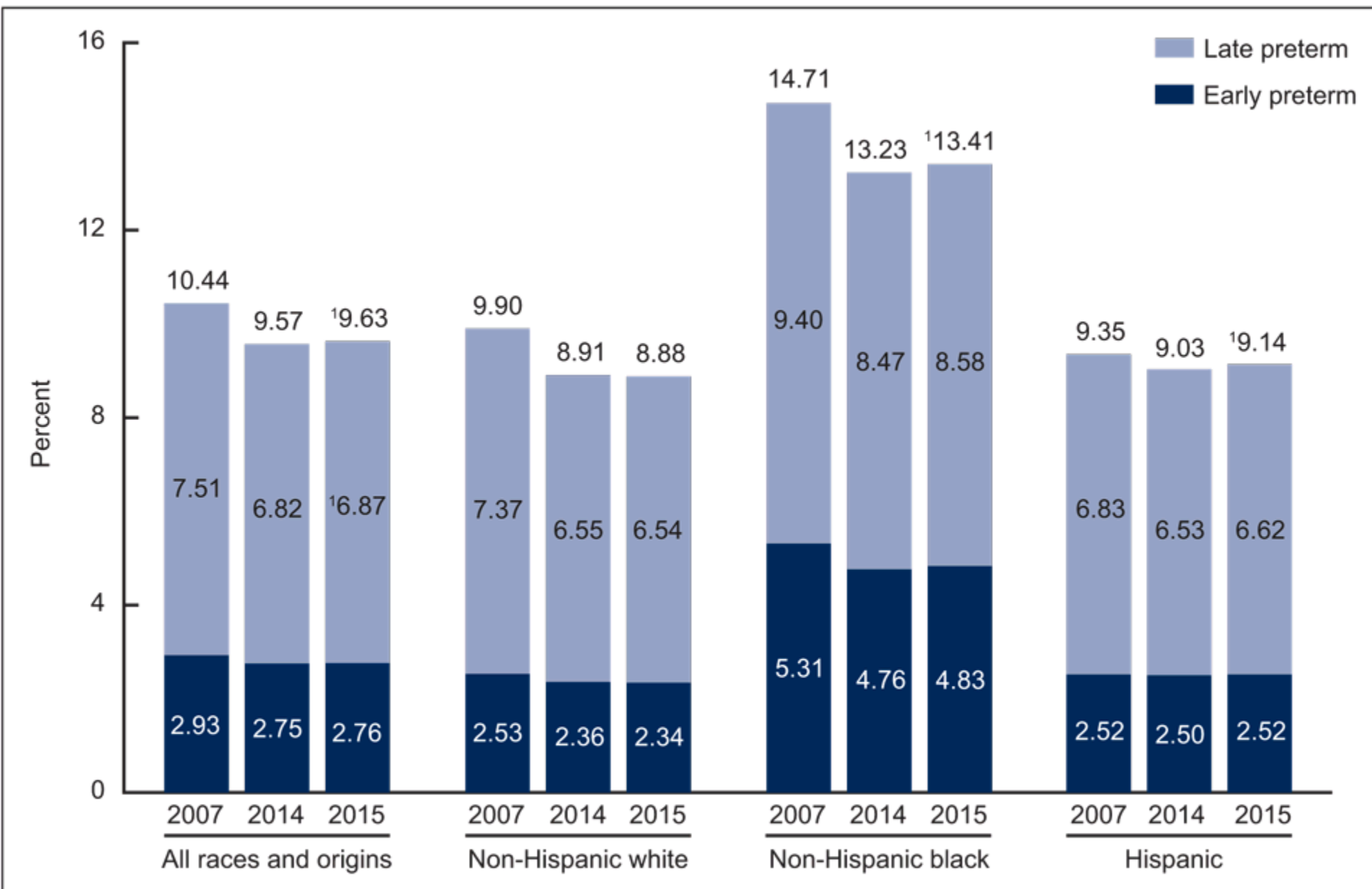
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Late preterm is between 34 and 36 weeks gestation.

Source: National Center for Health Statistics, final natality data.

Retrieved September 11, 2017, from www.marchofdimes.org/peristats.

Figure 4. Preterm birth rates, by race and Hispanic origin of mother: United States, 2007, 2014, and 2015



¹Significantly higher than rate for 2014 ($p < 0.05$).

NOTES: For all births and for each race and Hispanic origin group, the difference in rates from 2007 to 2015 is significant ($p < 0.05$). Gestational age is based on the obstetric estimate of gestation. Access data table for Figure 4 at: http://www.cdc.gov/nchs/data/databriefs/db258_table.pdf#4.

SOURCE: NCHS, National Vital Statistics System, Natality.

Morbidity Rates of Late Preterm Infants

FACTS:

- *“Late Preterm Infants are more likely to be re-hospitalized within the first 2 weeks of discharge.”*
- **“The morbidity rate approximately doubles for every week below 38 weeks gestation age that a baby is born.”**
 - 38 weeks: 3.3%
 - 37 weeks: 5.9%
 - 36 weeks: 12.4%
 - 35 weeks: 25%
 - 34 weeks: 51.2%

Phillips, R. M. (2013). Multidisciplinary Guidelines for the Care of Late Preterm Infants. *Journal of Perinatology*, 33(Suppl 2), S3–S4.
<http://doi.org/10.1038/jp.2013.52>

Odds of Health Complications Decrease with Advancing Gestational Age through the Late Preterm Period (34-36 ⁶/₇ weeks)

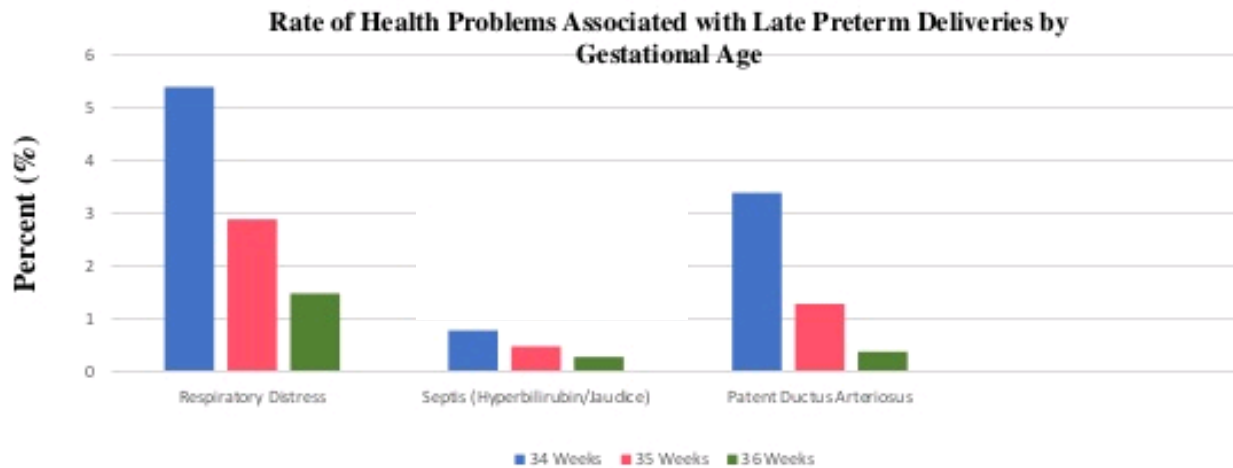


Figure 1. Rate of respiratory distress, sepsis, and patent ductus arteriosus (PDA) by gestational age (Loftin, Habli, Snyder, Comier, Lewis, & DeFranco, 2010, p.14).

Significant Outcome Variables by gestational age (34-37wks)

Completed Weeks

Outcome (X1000)	34 n=4633	35 n=8042	36 n=13588	37 n=28963
Neonatal death	7 (1.5)	14 (1.7)	8 (.6)	16 (.6) ¹
Respiratory distress syndrome	153 (33)	145 (18)	106 (8)	144 (5) ²
Intracranial hemorrhage (grade 3 or 4)	0	1 (.1)	1 (.1)	2 (.1) ³
Necrotizing enterocolitis	4 (.9)	1 (.1)	1 (.1)	1 (.03) ⁴
Bronchopulmonary dysplasia	1 (.2)	1 (.1)	3 (.2)	2 (.1) ⁵

¹p = .006 for 37 weeks compared to 35 weeks but not significant when compared to 34 or 36 weeks

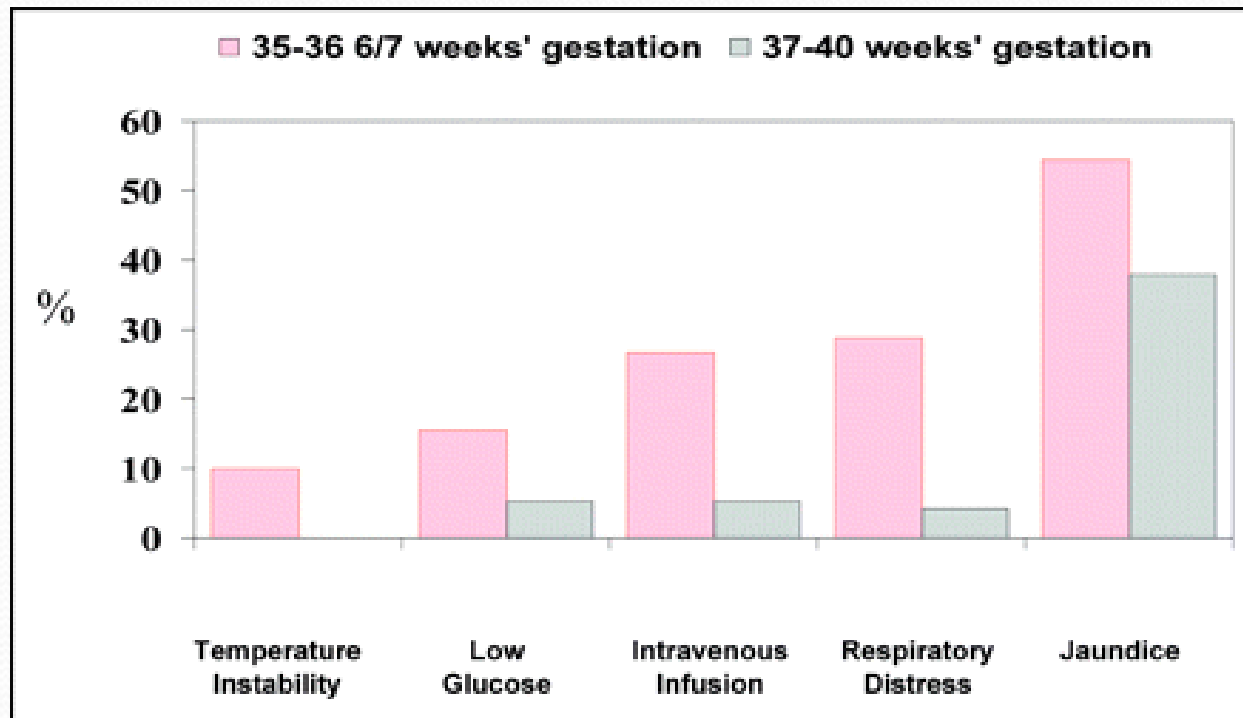
²p = <.001 for 37 weeks versus 34, 35 or 36 weeks respectively

³p = not significant

⁴p = < .001 for 37 weeks compared to 34 weeks; 37 weeks not significant versus 35 or 36 weeks

⁵p = not significant

Morbidity during birth hospitalization among late preterm and term.



Adapted from Wang ML. *Pediatrics*. 2004;114:372–376

TABLE 2 Late-Preterm Infants and the Most Frequent Complications of Prematurity During the Birth Hospitalization

Outcome During Initial Birth Hospitalization	Late-Preterm Morbidity		Term Morbidity		OR (95% CI)	P
	No.	%	No.	%		
Feeding difficulties						
Wang et al ² (35–36 ⁶ / ₇ wk)	29	32.2	7	7.4	—	—
Hypoglycemia						
Wang et al ² (35–36 ⁶ / ₇ wk)	14	15.6	5	5.3	3.30 (1.1–12.2)	.028
Jaundice						
Wang et al ² (35–36 ⁶ / ₇ wk)	49	54.4	36	37.9	1.95 (1.04–3.67)	.027
Temperature instability						
Wang et al ² (35–36 ⁶ / ₇ wk)	9	10.0	0	0.0	Infinite	.0012
Apnea						
Henderson-Smart ³⁸ (34–35 ⁶ / ₇ wk)	—	7.0	—	<0.1	—	—
Merchant et al ⁴² (35–36 ⁶ / ₇ wk)	6	12.0	0	0.0	12.0 (4.5–24.3)	.0267
Wang et al ² (35–36 ⁶ / ₇ wk)	4	4.0	0	0.0	—	.054
Respiratory distress						
Escobar et al ²⁴ (34–36 ⁶ / ₇ wk)	345	10.7	975	2.7	—	—
Gilbert et al ⁷⁰ (34–36 ⁶ / ₇ wk)	1167	3.6	843	0.8	—	—
Rubaltelli et al ³³ (34–36 ⁶ / ₇ wk)	314	9.6	359	0.6	—	—
Wang et al ² (35–36 ⁶ / ₇ wk)	26	28.9	4	4.2	9.14 (2.9–37.8)	.00001
Received intravenous infusion						
Wang et al ² (35–36 ⁶ / ₇ wk)	24	26.7	5	5.3	6.48 (2.3–22.9)	.0007
Underwent sepsis evaluation						
Wang et al ² (35–36 ⁶ / ₇ wk)	33	36.7	12	12.6	3.97 (1.8–9.2)	.00015
Received mechanical ventilation						
Gilbert et al ⁷⁰ (34–36 ⁶ / ₇ wk)	1103	3.4	950	0.9	—	—

OR indicates odds ratio; CI, confidence interval; —, data not reported.

TABLE 3 Late-Preterm Infants and Rates of Readmission to the Hospital After the Birth Hospitalization

Description of Comparison Groups by Study	Readmitted to Hospital ^a		Required Hospital Care ^b		Adjusted OR (95% CI)
	No.	%	No.	%	
All NICU survivors from 6 Kaiser Permanente hospitals, <i>N</i> = 6054 (Escobar et al ⁶⁶)					
<33 wk, all LOS	20	3.4	—	—	1.88 (1.10–3.21)
33–36 wk, LOS < 96 h	31	5.7	—	—	2.94 (1.87–4.62)
33–36 wk, LOS ≥ 96 h	26	2.2	—	—	1.13 (0.69–1.84)
Term, LOS ≥ 96 h	32	2.8	—	—	1.31 (0.83–2.05)
Term, LOS < 96 h	56	2.2	—	—	Reference
One half of all births >34 wk born in UK northern region, <i>N</i> = 11406 (Oddie et al ⁴)					
35–37 wk	37	6.3	—	—	1.72 (1.15–2.57)
>40 wk	57	2.4	—	—	0.70 (0.51–0.95)
38–40 wk	178	3.4	—	—	Reference
All newborns surviving to discharge at 7 Kaiser Permanente hospitals, <i>N</i> = 33 276 (Escobar et al ³)					
<34 wk (100% in NICU)	26	3.0	—	—	0.96 (0.57–1.62)
34–36 wk, in NICU ≥ 24 h					0.89 (0.54–1.46)
34–36 wk, in NICU < 24 h					1.31 (0.41–4.21)
34–36 wk, never in NICU					3.10 (2.38–4.02)
All 34- to 36-wk infants	94	4.4	—	—	
≥37 wk, in NICU ≥ 24 h					0.79 (0.52–1.21)
≥37 wk, in NICU < 24 h					1.43 (0.73–2.81)
≥37 wk, never in NICU					Reference
All ≥37-wk infants	618	2.0	—	—	
All Massachusetts newborns discharged early after vaginal delivery, <i>N</i> = 25 324 (Tomashek et al ⁸)					
34–36 wk	35	3.5	—	—	1.8 (1.3, 2.5) ^c
37–41 wk	489	2.0	—	—	Reference
34–36 wk	—	—	43	4.3	1.5 (1.1, 2.0) ^c
37–41 wk	—	—	648	2.7	Reference

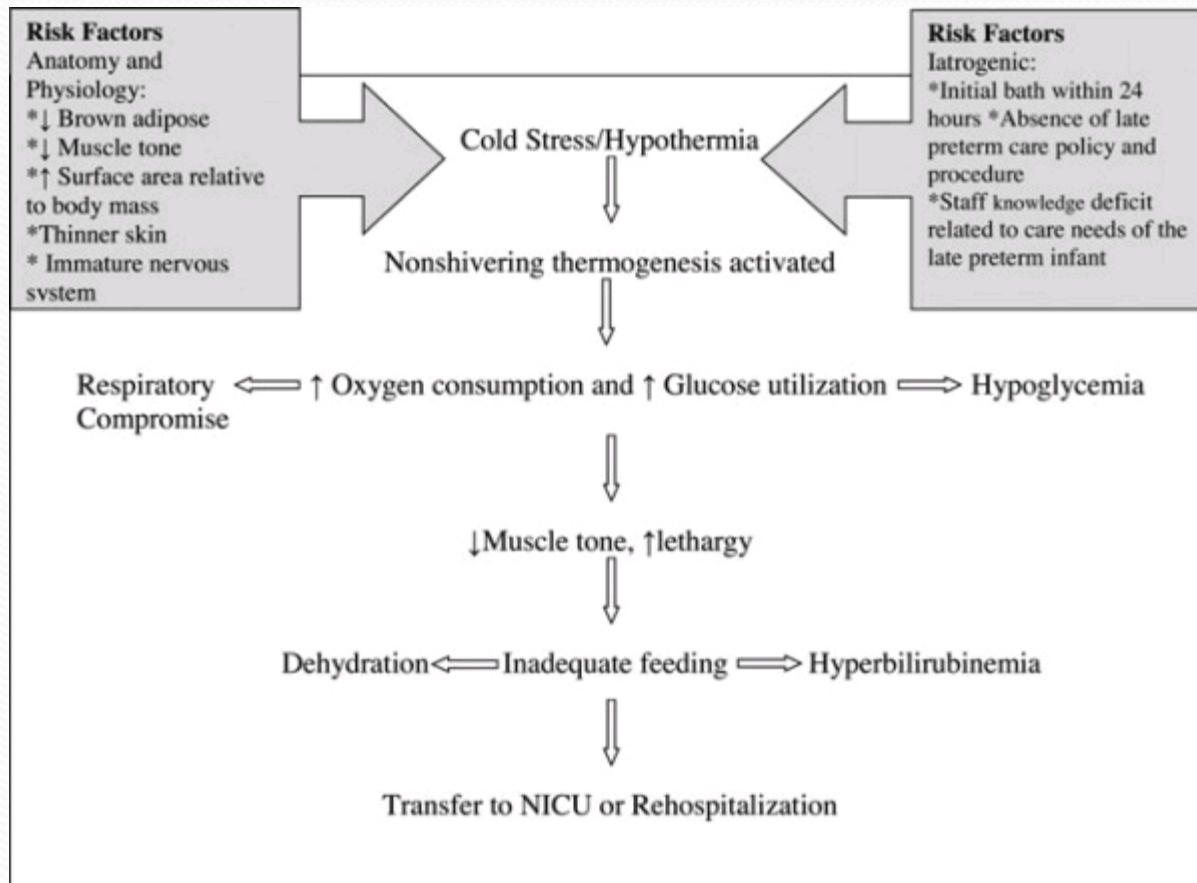
OR, odds ratio; CI, confidence interval; LOS, length of stay; UK, United Kingdom; —, data not reported.

^a Readmitted to hospital within 2 weeks after birth hospitalization discharge (Escobar et al⁶⁶) and within first 28 days of life (Oddie et al⁴ and Tomashek et al⁸).

^b Required hospital care includes hospital inpatient readmission and observational stay visit during neonatal period.

^c Shown are relative risks with confidence limits.

Risk Factors of the Late Preterm Infant



Risk Factors of the Late Preterm Infant

Brain Development

- Brainstem Vital Functions

- Respiration, rhythmic
- Heart rate variability
- Homeostatic mechanisms
- Sleep
- Coordination of suck/swallow/breathe

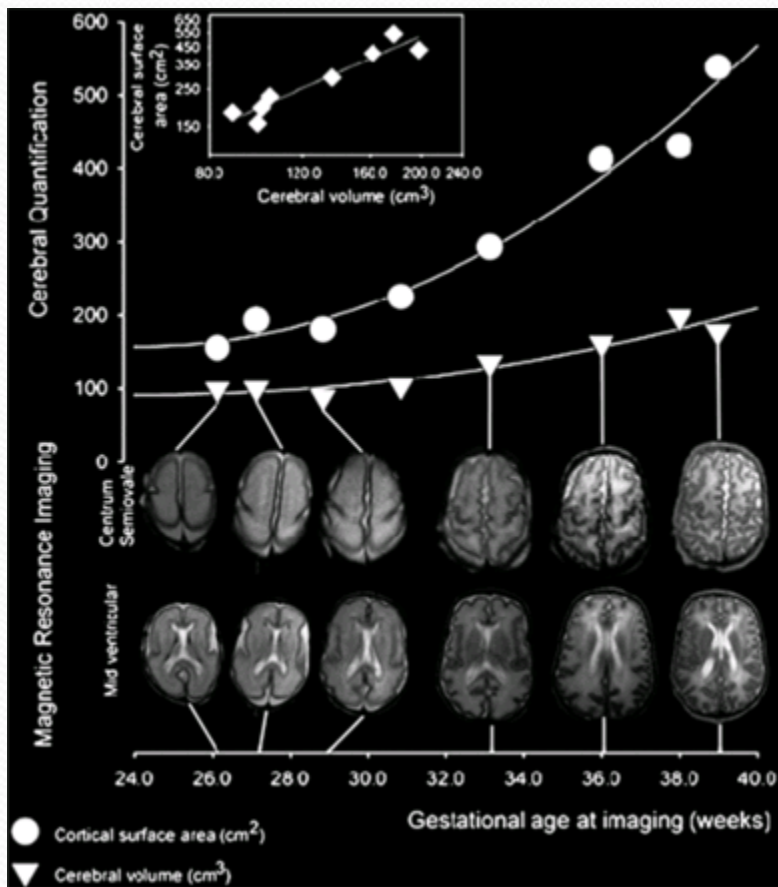


- Immature Control in LPT Infant

- Periodic Breathing and/or Apnea
- Decreased HR variability
- Immature response to hypoxia, CO₂
- REM sleep
- Feeding difficulties

Risk Factors of the Late Preterm Infant

Brain Development



It's best to stay pregnant for at least **39 weeks**.

Lots of important things are happening to your baby in the last few weeks of pregnancy:



- 1 Important organs, like your baby's brain, lungs and liver, are still developing and growing.

A baby's brain at 35 weeks weighs only two-thirds of what it will weigh at 39 to 40 weeks.



35 weeks



39 to 40 weeks

39 weeks give your baby all the time he needs to grow before he's born. Talk to your provider about things you can do to help you and your baby get to 39 weeks. Births scheduled before 39 weeks should only be for medical reasons.

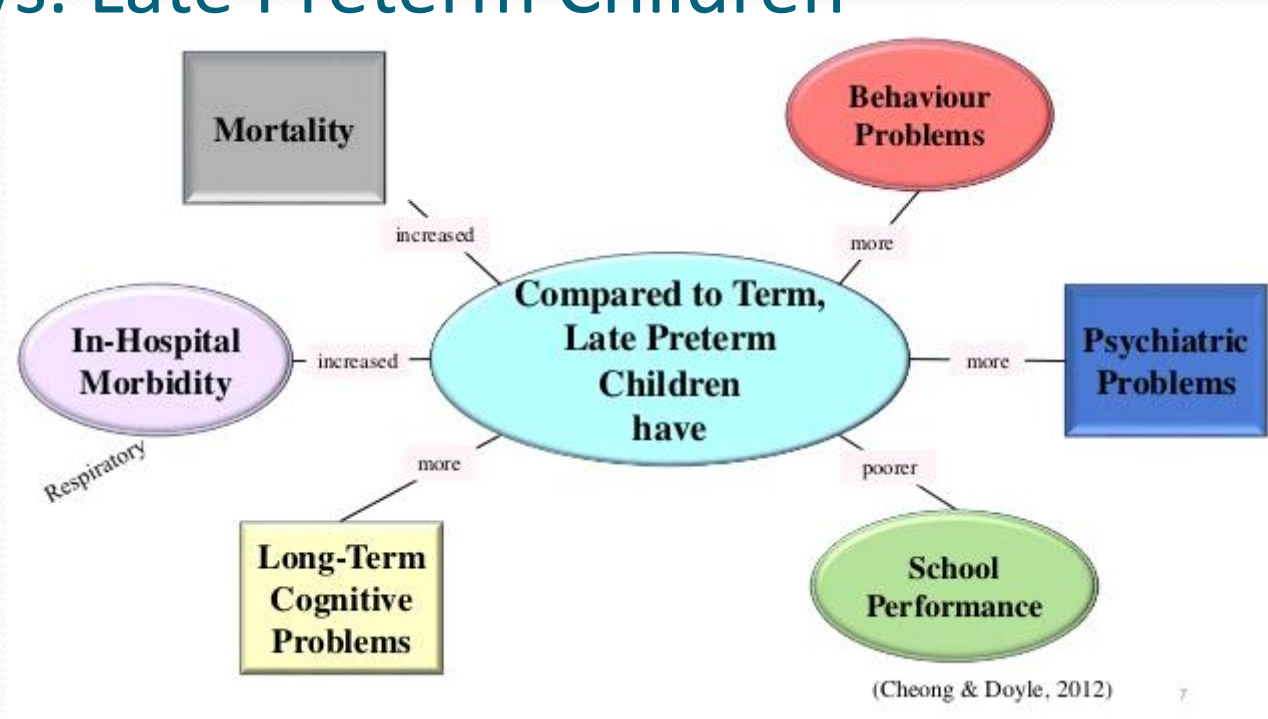
- 2 Your baby's eyes and ears are still developing, too. Babies born too early are more likely to have vision and hearing problems later in life.
- 3 Your baby is still learning to suck and swallow. Babies born early sometimes can't do these things.

Table 1.
Potential Postnatal Risks to Late-Preterm Infants and the Primary Care Interventions

Postnatal Risk	Primary Care Interventions
General recommendations	<p>Conduct frequent assessment and evaluation of infant in newborn nursery.</p> <p>Discourage early discharge from birth hospital.</p> <p>Evaluate late-preterm infants 24 to 48 hours post-discharge.</p> <p>Evaluate late-preterm infants at 2 weeks and 4 weeks of life.</p>
Hyperbilirubinemia	<p>Evaluate maternal and birth history for indications of increased risk for jaundice.</p> <p>Determine ABO compatibility.</p> <p>Perform bilirubin screen prior to discharge.</p> <p>Monitor urine and stool output.</p> <p>Assess for jaundice and monitor direct and indirect serum bilirubin levels if assessment warrants intervention.</p> <p>Initiate phototherapy when necessary.</p>
Respiratory compromise	<p>Monitor for respiratory difficulties.</p> <p>Educate parents on the signs of increased work of breathing and when to call the primary care provider.</p>
Poor feeding/ Hypoglycemia	<p>Monitor weight gain and feeding practices closely.</p> <p>Offer lactation support, if appropriate. Educate parents on feeding cues and proper feeding techniques and anticipated intake at each feeding.</p> <p>Monitor and review with parents the signs of dehydration and hypoglycemia.</p>
Temperature instability	<p>Educate parents on proper dressing of infant for temperature regulation.</p> <p>Educate parents on proper technique of taking a temperature.</p> <p>Review signs of cold stress with parent.</p>
Infection	<p>Educate parents to call if temperature above 100.4° F (38.6° C) or below 97° F (36.1° C).</p> <p>Evaluate maternal and infant risk factors for infection.</p> <p>Monitor for and review with parents the signs of infection and home infection control.</p>

Note: Adapted from Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN), 2010.

Term vs. Late Preterm Children



**So...What
Can We
Do??**



In 2010, the National Perinatal Association hosted a Summit, entitled Multidisciplinary Guidelines for the Care of Late Preterm Infants. The Summit was attended by 29 multidisciplinary experts representing 20 different organizations involved in the care of late preterm infants.

A Steering Committee continued the work begun during the Summit to synthesize the existing guidelines into a multidisciplinary, consensus, and evidence-based set of guidelines to increase uniformity of care for the late preterm infants.



“Multidisciplinary Guidelines for the Care of Late Preterm Infants”

<http://www.nationalperinatal.org/Resources/LatePretermGuidelinesNPA.pdf>

- 1) In-Hospital Assessment and Care
- 2) Transition to Out-Patient Care
- 3) Short-Term Follow-Up Care
- 4) Long-Term Follow-Up Care.

Within each section, the guidelines are further divided into four subsections:

- 1) Stability
- 2) Screening
- 3) Safety
- 4) Support.

Each guideline includes recommendations for the Healthcare Team and for Family Education are provided for each guideline included.

In-Hospital Assessment and Care

	HEALTHCARE TEAM	FAMILY EDUCATION*
STABILITY		
<p>Initial Assessment</p> <p><i>References:</i> 2, 7, 9, 10, 11, 12, 13, 14, 15</p>	<ul style="list-style-type: none"> • Establish gestational age (GA) prior to delivery, if possible. • Keep warm and dry, and stimulate per Neonatal Resuscitation Protocol (NRP) guidelines. • Place stable infants skin to skin with mother as soon as possible after delivery and cover with a warm blanket. • Do initial assessment and Apgar scores during infant's skin-to-skin contact with mother if infant remains stable. • After initial stabilization, assess newborn q 30 min until condition has been stable for 2 h, then q 4 h for first 24 h, then q shift until transition/discharge. <ul style="list-style-type: none"> » Assess respiratory rate (RR), type of respirations, and work of breathing. » Assess heart rate (HR) and rhythm, presence of murmur, distal pulses, and perfusion. » Assess axillary temperature. » Assess tone and activity. » Assess cord stump. • Support uninterrupted skin-to-skin contact by delaying Vitamin K, eye care, and foot and hand prints until after the first breastfeeding or until 1–2 h after birth (Vitamin K and eye prophylaxis can be delayed up to maximum time allowed by hospital protocol if there are no specific risk factors.) • Obtain weight, length, and head circumference after first breastfeeding unless needed to adjust care. <ul style="list-style-type: none"> » Plot measurements on appropriate preterm growth curve. » Determine if Small for Gestational Age (SGA), Appropriate for Gestational Age (AGA), 	<ul style="list-style-type: none"> • Communicate risks of late preterm birth (prior to delivery, if possible), explaining that immature organ systems and brain of LPI may lead to complications in the immediate postpartum period (and beyond) that will require close monitoring, including: <ul style="list-style-type: none"> » Respiratory distress » Hypothermia » Sepsis » Hypoglycemia » Feeding difficulties and dehydration » Hyperbilirubinemia » Developmental, learning, and behavioral challenges • Stress importance of immediate postpartum skin-to-skin contact with mother to: <ul style="list-style-type: none"> » Stabilize infant and support optimal transition after birth » Promote physiological stability in HR, RR, oxygen saturation, temperature, and glucose levels » Facilitate infant's first breastfeeding

In Hospital Assessment and Care

STABILITY

- Initial Assessment
- Reducing Risks of Respiratory Distress
- Reducing Risks of Sepsis
- Reducing Risks of Hypoglycemia
- Reducing Risks of Feeding Difficulties
- First Breastfeeding
- Continued Breastfeeding
- Monitoring Breastfeeding Success
- Supplementation
- Breast Pumping
- Reducing Risks of Hyperbilirubinemia
- Optimizing Neurologic Development

SCREENING

- Newborn Screening
- Hearing
- Anomalies
- Maternal Screening

SAFETY

- In Hospital Safety

SUPPORT

- Staff Support
- Family Support

Transition to Outpatient Care

STABILITY

- General
- Feeding
- Hyperbilirubinemia
- Circumcision
- Newborn Care
- Developmental Care

SCREENING

- Newborn Screening
- Hearing Screening
- Anomalies
- Maternal Screening
- Parent-Infant Bonding

SAFETY

- Family Risk Factors
- Home Environment
- Safe Sleep
- Infection & Immunizations
- Car Seat Safety
- Shaken Baby Prevention Education
- When to Call 911 or Local Emergency Number
- When to Call Primary Care Provider

SUPPORT

- Staff Support
- Family and Social Support

TRANSFER OF CARE

- Primary Care Provider
- Discharge Summary & Checklist

Short-Term Follow-Up Care

STABILITY

- Respiratory Distress
- Sepsis
- Weight Loss
- Feeding
- Hyperbilirubinemia
- Circumcision
- Newborn Care
- Developmental Care

SCREENING

- Newborn Screening
- Hearing Screening
- Anomalies
- Maternal Screening
- Parent-Infant Bonding

SAFETY

- Family Risk Factors
- Home Environment
- Safe Sleep
- Immunizations
- Car Seat Safety
- Shaken Baby Prevention Education
- When to Call 911 or Local Emergency Number
- When to Call Primary Care Provider

SUPPORT

- Family and Social Support



Long-Term Follow-Up Care

STABILITY

- Growth
- Respiratory Illness

SCREENING

- Sensory Screening
- Developmental Screening
- Behavioral Screening
- Maternal Screening

SAFETY

- Family Risk Factors
- Developmental Risk Factors

SUPPORT

- Infant Support
- Family Support

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