Long Term Outcomes of Late Preterm Infants

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Definition

- Late preterm birth: 34 0/7 to 36 6/7 completed weeks gestation

Late Preterm Birth Rate:
Singleton birth rates at 34-36 weeks’ gestation overall and by week, US 1990-2006

Indications for late preterm delivery

- Multiple gestations
- PPROM
- Spontaneous preterm labor
- Increased surveillance
- Medically indicated births
- Pregnancy related conditions
- An obstetrical culture of intervention?

Holland, AJOG 2009

- When is an indicated LPB really indicated?
  - 36.2% spontaneous preterm birth
  - 17.7% PPROM
  - 8.2% Elective
  - 37.9% Medically Indicated:
    - Indicated: severe
      - Severe preeclampsia
      - HELLP
      - Abnormal testing
      - Previa/accreta and bleeding
      - Medical condition
  - 17% Potentially Avoidable
  - Indicated: mild
    - IUGR, normal testing
    - Mild preeclampsia
    - Prior classical
    - Prior myomectomy
    - Medical Condition
    - Prior Stillbirth

ACOG Committee Opinion # 404

Late preterm infants often are mistakenly believed to be as physiologically and metabolically mature as term infants. Late Preterm delivery should occur only when an accepted maternal or fetal indication for delivery exists. Collaborative counseling by both obstetric and neonatal clinicians about the outcomes of late preterm births is warranted unless precluded by emergent conditions.

Statement developed jointly with AAP Committee on Fetus & Newborn
Late Preterm Birth Rate:
Singleton birth rates at 34-36 completed weeks’ gestation overall and by week, US 2007-2008


Late preterm birth rates: United States, selected years final 1990–2009 and preliminary 2010


Late Preterm Birth: What’s the big deal?
Short-term adverse outcomes of late preterm delivery

- Temperature instability
- Hypothermia
- Hypoglycemia
- Hyperbilirubinemia
- Re-hospitalization
- Respiratory distress
- Mortality

Mortality

- Infant death in the first year of life occurs 4 times more among children born late preterm than those born at term

Percent distribution of infant deaths, by gestational age: United States, 2000 and 2007

### Mortality Rates

<table>
<thead>
<tr>
<th>Gestational Age, Weeks</th>
<th>Neonatal Mortality Rate</th>
<th>RR (95% CI)</th>
<th>Infant Mortality Rate</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>34</td>
<td>7.1</td>
<td>9.5 (8.4-10.8)</td>
<td>11.8</td>
<td>5.4 (4.9-5.9)</td>
</tr>
<tr>
<td>35</td>
<td>4.8</td>
<td>6.4 (5.6-7.2)</td>
<td>8.6</td>
<td>3.9 (3.6-4.3)</td>
</tr>
<tr>
<td>36</td>
<td>2.8</td>
<td>3.7 (3.3-4.2)</td>
<td>5.7</td>
<td>2.6 (2.4-2.8)</td>
</tr>
<tr>
<td>37</td>
<td>1.7</td>
<td>2.3 (2.1-2.6)</td>
<td>4.1</td>
<td>1.9 (1.8-2.0)</td>
</tr>
<tr>
<td>38</td>
<td>1</td>
<td>1.4 (1.3-1.5)</td>
<td>2.7</td>
<td>1.2 (1.2-1.3)</td>
</tr>
<tr>
<td>39</td>
<td>0.8</td>
<td>reference</td>
<td>2.2</td>
<td>reference</td>
</tr>
<tr>
<td>40</td>
<td>0.8</td>
<td>1.0 (0.9-1.1)</td>
<td>2.1</td>
<td>0.9 (0.9-1.0)</td>
</tr>
</tbody>
</table>

Adapted from Reddy et al., Delivery indications at late-preterm gestations and infant mortality rates in the United States. Pediatrics 124:234-240, 2009

### Long-term outcomes

- School-age outcomes:
  - Developmental delay
  - Lower reading scores
  - Poorer teacher evaluations
  - Higher rate of special education

- Behavioral issues
- Emotional issues
- Neuropsychiatric disease

![Long-term outcomes](http://www.dreamstime.com)
Chyi et al, 2008

- Examined 970 preterm infants and 13671 full term control subjects
- From public dataset from Department of Education
- Neonatal data collected retrospectively from parental report (including gestational age of delivery)

Morse et al, Pediatrics 2009

- Examined 161, 804 singleton infants born in Florida
  - 01/01/1996-08/31/1997
  - LOS <72 hours
  - Gestational age 34-42 weeks
  - Excluded if major congenital anomalies

Chyi et al, 2008

- Late preterm infants had lower reading scores than full term infants in K to first grade
- K through 5th grade math scores were worse for late preterm infants
- Special education was higher for LP infants
Morse el al, Pediatrics 2009

- 36% elevated risk of developmental delay
- 19% increased risk suspension in Kindergarten
- Increased risk (10 to 13%) disability in prekindergarten and retention in kindergarten

Other Outcomes

- Increased risk of cerebral palsy
- Increased risk of an IQ score < 85
- Less likely to finish high school and college
- More likely to develop schizophrenia
- Increased risk of a medical disability

If your pregnancy is healthy, it's best to stay pregnant for at least 39 weeks.

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

- Study conducted using the Longitudinal Study of Early Development (LSED) database
  - >200,000 children with outcomes

- LSED links children across the following New York City administrative databases or registries:
  - Birth certificate
  - Death certificate
  - Early Intervention Program
  - Lead Poisoning Prevention Program
  - Department of Education

Inclusion criteria

- Delivered from 1994-1998 in NYC
- Non-anomalous singleton infants
- 32 0/7 - 42 0/7 weeks’ gestation
- Enrolled in Grade 3 by NYC DOE
Study groups

- Preterm: 32 0/7 - 33 6/7 weeks
- Late Preterm: 34 0/7 - 36 6/7 weeks
- Full term: 37 0/7 - 42 0/7 weeks

Covariates

- Maternal characteristics: age, race/ethnicity, birth place, educational attainment, health insurance status, parity
- Pregnancy characteristics: mode of delivery, medical risk factors, complications of labor and delivery
- Birth characteristics: NICU admission, 5 minute Apgar <7, SGA <10th percentile
- DOE: Days absent in 3rd grade

Covariates

- Medical risk factors: anemia, renal disease, cardiac disease, lung disease, gestational diabetes, chronic diabetes, chronic hypertension, previous preterm or small for gestational age infant
- Labor complications: preeclampsia, eclampsia, placenta previa, cord prolapse, placental abruption, and/or fetal distress
School age outcomes

- Need for special education (SE):
  - Enrolled in a SE school, or
  - Individualized education plan in 3rd grade, or
  - Educational disability

- Third grade scores*
  - Math
  - English Language Arts (ELA)

* Test scores were Z transformed by year of birth

RESULTS

<table>
<thead>
<tr>
<th>Study Population</th>
<th>N=215,138</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm</td>
<td>n=2332</td>
</tr>
<tr>
<td>Late Preterm</td>
<td>n=13,207</td>
</tr>
<tr>
<td>Full Term</td>
<td>n=199,599</td>
</tr>
</tbody>
</table>
## RESULTS:
 School Age Outcomes

### Adjusted school age outcomes*

<table>
<thead>
<tr>
<th>Need for Special Education</th>
<th>AOR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preterm versus full term:</td>
<td>1.53 (1.30 to 1.69)</td>
</tr>
<tr>
<td>Late preterm versus full term:</td>
<td>1.34 (1.29 to 1.40)</td>
</tr>
<tr>
<td>Preterm versus late preterm:</td>
<td>1.14 (1.03-1.27)</td>
</tr>
</tbody>
</table>

*Adjusting for infant gender, maternal age, race/ethnicity, payer, low Apgar, NICU admission, medical risk factors, labor complications, SGA, days absent 3rd grade

### Adjusted school age outcomes*

<table>
<thead>
<tr>
<th></th>
<th>Adjusted Math Z score Effect (95% CI)</th>
<th>Adjusted ELA Z score Effect (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT versus FT:</td>
<td>-10% (-14 to -7)</td>
<td>-6% (-10 to -2)</td>
</tr>
<tr>
<td>Late PT versus FT:</td>
<td>-7% (-9 to -5)</td>
<td>-4% (-6 to -2)</td>
</tr>
<tr>
<td>PT versus Late PT:</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

*Adjusting for infant gender, maternal age, race/ethnicity, payer, low Apgar, NICU admission, medical risk factors, labor complications, SGA, days absent 3rd grade
Adjusted mean Z scores for math and ELA standardized tests in 3rd grade by weeks gestational age at birth

*Adjusting for infant gender, maternal age, race/ethnicity, payer, low Apgar, NICU admission, Medical risk factors, labor complications, SGA, days absent 3rd grade

What is Preterm?

- Why is gestational age a benchmark?
- Optimal outcomes occurs at 39-40 weeks
- Rethink preterm as <39 weeks
- Increasing data about “Early Term” Birth
  - Tita et al NEJM, 2009
    - Early term associated with adverse respiratory outcomes, sepsis, prolonged hospitalization, NICU admission

Toolkit

Elimination of Non-medically Indicated Elective Deliveries Before 39 Weeks Gestational Age
Making Progress??

Trends in late preterm birth, stillbirth and infant mortality, United States, 1990-2004

Stillbirth Death Versus MORBIDITY

Committed Opinion

Medically Indicated Late-Preterm and Early-Term Deliveries

April 2013, Number 560
Committee Opinion

- Delivery may be warranted for either maternal or newborn benefit or both
- Dependent on accurate determination of gestational age
- Recommendations do not include antenatal corticosteroids administration before delivery at or after 34 0/7 weeks of gestation

Committee Opinion

Amniocentesis for the determination of fetal lung maturity in well-dated pregnancies generally should not be used to guide the timing of delivery

Placental/Uterine Issues

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Placenta previa</td>
<td>Late preterm/early term</td>
<td>36 0/7–37 6/7 weeks</td>
</tr>
<tr>
<td>Placenta previa with suspected accreta, increta, or percreta</td>
<td>Late preterm</td>
<td>34 0/7–35 6/7 weeks</td>
</tr>
<tr>
<td>Prior classical cesarean</td>
<td>Late preterm/early term</td>
<td>36 0/7–37 6/7 weeks</td>
</tr>
<tr>
<td>Prior myomectomy</td>
<td>Early term/term (individualize)</td>
<td>37 0/7–38 6/7 weeks</td>
</tr>
</tbody>
</table>
### Growth restriction (singleton)

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otherwise uncomplicated, no concurrent findings</td>
<td>Early term/term</td>
<td>38 0/7–39 6/7 weeks</td>
</tr>
<tr>
<td>Concurrent conditions (oligohydramnios, abnormal Doppler studies, maternal co-morbidity (eg, preeclampsia, chronic hypertension))</td>
<td>Late preterm/early term</td>
<td>34 0/7–37 6/7 weeks</td>
</tr>
</tbody>
</table>

### Maternal Issues-HTN

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension: Controlled no medications</td>
<td>Early term/term</td>
<td>38 0/7–39 6/7 weeks</td>
</tr>
<tr>
<td>Chronic hypertension: Controlled on medications</td>
<td>Early term/term</td>
<td>37 0/7–39 6/7 week</td>
</tr>
<tr>
<td>Chronic hypertension: Difficult to control</td>
<td>Late preterm/early term</td>
<td>36 0/7–37 6/7 weeks</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>Early term/term</td>
<td>37 0/7–38 6/7 weeks</td>
</tr>
<tr>
<td>Preeclampsia—severe</td>
<td>Late preterm</td>
<td>At diagnosis after 34 0/7 weeks of gestation</td>
</tr>
<tr>
<td>Preeclampsia—mild</td>
<td>Early term</td>
<td>At diagnosis after 37 0/7 weeks of gestation</td>
</tr>
</tbody>
</table>

### Maternal Issues: Diabetes

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregestational well-controlled</td>
<td>Late preterm, early term birth not indicated</td>
<td>Not Indicated</td>
</tr>
<tr>
<td>Pregestational with vascular complications</td>
<td>Early term/term</td>
<td>37 0/7–39 6/7 weeks</td>
</tr>
<tr>
<td>Pregestational, poorly controlled</td>
<td>Late preterm/early term</td>
<td>Individualized</td>
</tr>
<tr>
<td>Gestational—well controlled on diet or medications</td>
<td>Late preterm, early term birth not indicated</td>
<td>Not Indicated</td>
</tr>
<tr>
<td>Gestational—poorly controlled</td>
<td>Late preterm or early term Individualized</td>
<td>Individualized</td>
</tr>
</tbody>
</table>
### Other Issues

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligohydramnios</td>
<td>Late preterm/early term</td>
<td>36 0/7–37 6/7 weeks</td>
</tr>
<tr>
<td>Di–Di twins</td>
<td>Early term</td>
<td>38 0/7–38 6/7 weeks</td>
</tr>
<tr>
<td>Mo–Di twins</td>
<td>Late preterm/early term</td>
<td>34 0/7–37 6/7 weeks</td>
</tr>
<tr>
<td>PPROM</td>
<td>Late preterm</td>
<td>34 0/7 weeks</td>
</tr>
</tbody>
</table>

### Not mentioned

- Cholestasis of pregnancy
- Women with a history of stillbirth
- Chronic abruptio placentae
- Congenital anomalies
- Augmentation of labor or repeat cesarean delivery because the patient presents with contractions

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