Discharge Timing, Outpatient Follow-up, and Home Care of Late-Preterm and Early-Term Infants

OBJECTIVE: To compare the timing of hospital discharge, time to outpatient follow-up, and home care practices (breastfeeding initiation and continuation, tobacco smoke exposure, supine sleep position) for late-preterm (LPT; 34 0/7–36 6/7 weeks) and early-term (ET; 37 0/7–38/6/7 weeks) infants with term infants.

METHODS: We analyzed 2000–2008 data from the Centers for Disease Control and Prevention’s Pregnancy Risk Assessment Monitoring System. χ² Analyses were used to measure differences in maternal and infant characteristics, hospital discharge, outpatient care, and home care among LPT, ET, and term infants. We calculated adjusted risk ratios for the risk of adverse care outcomes among LPT and ET infants compared with term infants.

RESULTS: In the adjusted analysis, LPT infants were less likely to be discharged early compared with term infants, whereas there was no difference for ET infants (odds ratio [OR; 95% confidence interval (CI)]: 0.65 [0.54–0.79]; 0.95 [0.88–1.02]). LPT and ET infants were more likely to have timely outpatient follow-up (1.07 [1.06–1.08]; 1.02 [1.02–1.03]), more likely to experience maternal tobacco smoke exposure (1.09 [1.05–1.14]; 1.08 [1.06–1.11]), less likely to be initially breastfed (0.95 [0.94–0.97]; 0.98 [0.97–0.98]), less likely to be breastfed for ≥10 weeks (0.88 [0.86–0.90]; 0.94 [0.93–0.96]), and less likely to be placed in a supine sleep position (0.95 [0.93–0.97]; 0.97 [0.96–0.98]).

CONCLUSIONS: Given that LPT and ET infants bear an increased risk of morbidity and mortality, greater efforts are needed to ensure safe and healthy posthospitalization and home care practices for these vulnerable infants. Pediatrics 2013;132:1–8
Late-preterm (LPT) birth, defined as delivery at 34 0/7 to 36 6/7 weeks’ gestation, accounted for 8.7% of all US births in 2009 and comprised 70% of all preterm births.1 Recent research regarding the outcomes of LPT infants indicates that they should not be treated as term infants.2–4 Compared with those born at term, LPT infants are at increased risk of neonatal mortality5 and morbidity, including feeding problems, hyperbilirubinemia, hypoglycemia, and respiratory problems.6,7 As the body of literature on the complications of LPT birth is becoming well established, there is also growing awareness about the risks of being born on the earlier end of term gestation. Term gestation, traditionally defined as delivery between 37 and 42 weeks, had originally been thought of as a relatively homogenous category of uniform mortality and morbidity across the spectrum. However, recent studies have revealed that infants born at early term (ET; 37 0/7–38 6/7 weeks), comprising 27.6% of all US births in 2009,1 bear a greater risk of complications than their term counterparts (39 0/7–41 6/7 weeks).8–11 For both LPT and ET birth, the focus of recent research has been on hospital care, with little known about the receipt of care after discharge and in the home setting, particularly at the national level. Thus, the objective of our study was to compare the timing of infant hospital discharge, subsequent outpatient follow-up, and home care practices of infants born LPT, ET, and at term by using nationally representative population-based surveillance data.

METHODS

Data Source

We analyzed retrospective cohort data from the Pregnancy Risk Assessment Monitoring System (PRAMS), an ongoing state-based surveillance system funded by the Centers for Disease Control and Prevention. PRAMS is designed to monitor selected, self-reported maternal behaviors and experiences among women who recently delivered a live-born infant in a hospital in the previous 2 to 4 months, with a maximum allowable recall period of 9 months postpartum. By using standardized data collection methods, monthly stratified samples were selected from recent birth certificates. Surveys were obtained from mothers by using a mixed-mode data collection method with mailed questionnaires and telephone follow-up for nonrespondents. Survey data were linked to birth certificate data and weighted for sample design, nonresponse, and noncoverage. Additional details about the PRAMS methodology have been described elsewhere.12,13 Institutional ethics approval was granted by the Centers for Disease Control and Prevention and participating PRAMS states. Institutional review board exemption was granted by Children’s Hospital Boston.

Our study included states with a ≥70% response rate that permitted use of gestational age in discrete weeks to categorize LPT, ET, and term births. There was yearly variation in states’ inclusion in PRAMS due to nonparticipation as well as inability to meet threshold response rates in particular years. Among the 29 states with these high response rates, we analyzed data from women with singleton live births in 2000–2008.

Variables

By using clinical estimates of gestational age from linked birth certificates, we defined live-born infants aged between 34 0/7 and 36 6/7 weeks’ gestation as LPT, those aged from 37 0/7 to 38 6/7 weeks’ gestation as ET, and those born alive between 39 0/7 and 41 6/7 weeks’ gestation as term.14 We excluded surveyed women whose infants were (1) of a gestational age <34 or ≥42 weeks, (2) of unknown gestational age, (3) twins or higher order multiples, and (4) delivered at home, in a clinic, en route to a hospital, or in free-standing birth centers. We also excluded infants who died or were not living with their birth mother at the time of the survey or were of unknown race/ethnicity. The infant selection flowchart is shown in Fig 1.

Maternal demographic characteristics included data obtained from birth certificates (maternal age, education, race/ethnicity, and marital status). Maternal race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other (which included Asian, Native American/Alaska Native, and other). A history of previous live birth and insurance before pregnancy were obtained from the survey. First-trimester prenatal care use as well as method of delivery (vaginal or cesarean), infant gender, and infant birth weight were obtained from birth certificates.

Data on hospital discharge, outpatient follow-up, and home care practices were obtained from PRAMS survey data. For the analysis of early discharge, we excluded women who delivered by caesarean delivery because their infants would most likely remain in the hospital for ≥3 days given the increased maternal length of stay. We defined early discharge as a stay of <1 day for vaginal deliveries. Outpatient follow-up included an office or home follow-up visit by a health care professional. Timely follow-up for newborns was defined as a home or office visit occurring within 1 week of discharge, a highly conservative criterion relative to the American Academy of Pediatrics (AAP) recommendations (24 to 48 hours after hospital discharge for LPT infants).15
Home-related care included breastfeeding, infant tobacco exposure through maternal smoking, and infant sleep position. For breastfeeding, mothers were asked if they “ever breastfed or pumped breast milk” (initiation) during the postpartum period. Breastfeeding continuation was defined as breastfeeding for ≥10 weeks after delivery. PRAMS asks mothers if they are “still breastfeeding or feeding pumped milk” to their infants at the time of the survey and asks mothers to list the number of weeks or months that they breastfed or fed pumped milk to their infant. Given that nearly 98% of mothers in our cohort returned their surveys at ≥10 weeks postpartum, with 26% of mothers returning the survey at 10 to 13 weeks postpartum, we excluded the 2% of mothers who returned the survey earlier than 10 weeks for this portion of the analysis because we would be unable to assess breastfeeding continuation. Mothers were considered to be continuing to breastfeed if they reported that they were “still breastfeeding or feeding pumped milk” to their infants at the time of the survey. In addition, mothers who were not breastfeeding at the time of survey completion but reported that they had breastfed for ≥10 weeks were included in the breastfeeding continuation group.

Tobacco exposure postpartum was measured by whether a mother reported smoking (yes/no) at the time of the survey. For infant sleep position, mothers were asked in which position they usually put their infant to sleep (side, back, stomach). Responses were then categorized into supine (back) and nonsupine, which included a combination of sleep positions.

Analysis

By using state-specific sampling weights, we calculated the population prevalence of LPT, ET, and term infants, with 95% confidence intervals (CIs), for the entire sample and by each state. We then compared maternal demographic, delivery, and infant birth characteristics of LPT and ET infants with term infants. χ² Analyses were used to measure differences in maternal and infant characteristics, timing of hospital discharge, timing of outpatient follow-up, and home care practices among LPT, ET, and term infants using a significance level of P < .001. A P value < .001 was considered statistically significant given the very large sample size. We calculated adjusted risk ratios for the risk of adverse care outcomes among LPT and ET infants compared with term infants by estimating predicted marginals and then converting these estimates to adjusted risk ratios. 16 We adjusted for maternal age, education, race/Hispanic ethnicity, marital status, previous live birth, insurance status before pregnancy, method of delivery, and maternal length of hospital stay (calculated as discharge date minus admission date) on the basis of documented associations in the literature. All analyses were conducted by using SAS, version 9.2 (SAS Institute, Cary, NC), and SUDAAN, version 10.0.1 (RTI International, Research Triangle Park, NC), to account for selection and response probabilities of the survey design.
RESULTS
Prevalence of LPT, ET, and Term Deliveries by PRAMS States

Within the cohort of 29 participating PRAMS states, there were 242,471 singleton deliveries representing a population estimate of 10,850,420 deliveries. Among these, 31,493 were LPT, 7,014 were ET, and 140,964 were term, representing a total population estimate of 767,274 LPT, 3,055,725 ET, and 7,118,421 term singleton deliveries (Table 1).

Overall, LPT births represented 6.2% and ET births represented 28.2% of singleton births in our PRAMS cohort from 2000 to 2008. States reported significant variation in the prevalence of LPT and ET delivery as a percentage of all births.

LPT, ET, and Term Deliveries by Maternal and Infant Characteristics

For all gestational age categories, mothers in our study population were most likely to be between the ages of 25 and 34 years, to be non-Hispanic white, to have ≥12 years of education, to be married, to have had prenatal care in the first trimester, to have been insured before pregnancy, to have had a previous live birth, to have delivered vaginally, to have delivered a male infant, and to have not received NICU care (Table 2). Women delivering LPT and ET were more likely to have had cesarean deliveries and their infants were more often admitted to the NICU. The percentage of cesarean deliveries and NICU admissions increased with each earlier gestational age grouping.

Timing of Hospital Discharge, Timing of Outpatient Follow-up, and Home Care Practices

Table 3 shows the prevalence of care practices including hospital discharge and outpatient follow-up timing and home care behaviors for LPT, ET, and term infants in the PRAMS cohort. For

TABLE 1 Prevalence of Singleton Late-Preterm, Early Term, and Term Deliveries by 29 PRAMS Sites, 2000–2008

<table>
<thead>
<tr>
<th>State</th>
<th>晚产</th>
<th>早产</th>
<th>AEE 95% CL</th>
<th>晚产</th>
<th>早产</th>
<th>AEE 95% CL</th>
<th>晚产</th>
<th>早产</th>
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<td>Overall</td>
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<td>6.4</td>
<td>70,014</td>
<td>28.2</td>
<td>27.9</td>
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<td>7.4</td>
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<td>27.7</td>
<td>26.6</td>
<td>28.9</td>
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<td>7.5</td>
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<td>Nebraska</td>
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<td>5.2</td>
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<td>Washington</td>
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<td>4.4</td>
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<td>3.9</td>
<td>6.2</td>
<td>43,232</td>
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<td>7.3</td>
<td>8.6</td>
<td>37,452</td>
<td>34.2</td>
<td>33.0</td>
<td>35.3</td>
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</table>

infants born via vaginal delivery, LPT infants were less likely to be discharged early than were ET and term infants. For infant follow-up practices, LPT infants were the most likely to have timely follow-up after discharge. However, nearly 11% of LPT infants were not seen by a health care professional by the first week after hospital discharge.

Women delivering LPT and ET infants were significantly less likely to initiate breastfeeding than were mothers of term infants. Among women who did breastfeed, a significantly lower proportion of women with LPT and ET infants continued to breastfeed for ≥10 weeks compared with those with term infants. Postpartum smoking at the time of survey completion was significantly more prevalent among mothers of LPT and ET infants compared with mothers of term infants. Women with LPT and ET infants reported a lower prevalence of placing their infants exclusively on their backs to sleep compared with mothers with term infants.

**Multivariable Analysis**

Adjusted risk ratios for care from hospital discharge to home are shown in Table 4. LPT infants were less likely to be discharged early, whereas there was no difference between ET and term infants. LPT and ET infants were more likely to have timely follow-up compared with term infants. Compared with mothers of term infants, mothers of LPT and ET infants were significantly more likely to be smoking at the time of the survey. In addition, they were less likely to initiate breastfeeding and less likely to continue breastfeeding for ≥10 weeks. LPT and ET infants were less likely to be placed exclusively on their backs to sleep compared with term infants.

**DISCUSSION**

Our study provides new findings on the timing of hospital discharge, outpatient follow-up, and home care of LPT and ET infants compared with term infants in the United States. The effect sizes of significant factors identified in our adjusted analysis appear small, particularly for timely follow-up, breastfeeding initiation, and supine sleep position. However, given the large number of infants born LPT and ET (>36% of all US births in 2009), small differences may result in large effects on a population level.

**Early Discharge**

Our adjusted analysis revealed that LPT infants were appropriately less likely to be discharged early compared with term infants, whereas there was no difference between ET and term infants, consistent with the recommendations established by the AAP for the care of...
Early discharge, the early discharge percentage of our study, was not as high as in some previous studies. A 2007 AHA report recommended early discharge 48 hours of birth because they are not likely to demonstrate the necessary skills for discharge before this time, such as feeding competency and thermoregulation. Given our conservative definition of early discharge as <1 day, the early discharge percentage of our cohort was not as high as in some previous studies. Early discharge places these infants at greater risk of complications such as rehospitalization, particularly in breastfed infants. For ET infants, studies investigating the outcomes of early hospital discharge are limited and specific discharge guidelines have not yet been established. However, given the evidence for the increased risk of morbidity and mortality for these infants, a hospital stay beyond 2 nights might be considered so that these higher risk infants can demonstrate their necessary competencies before discharge.

**Timely Follow-up**

LPT and ET infants were appropriately more likely to have timely follow-up with a physician or other health care worker than were term infants. Even with the liberal definition of timely follow-up (within 1 week of discharge and not the 24–48 hours recommended by the AAP), we found that nearly 11% of LPT and 15% of ET infants did not receive follow-up within 1 week. The AAP recommends a follow-up visit 24 to 48 hours after hospital discharge for LPT infants given their increased risk of rehospitalization secondary to jaundice, feeding difficulties, dehydration, and sepsis compared with term infants. Again, data are lacking for the possible complications that ET infants may suffer after discharge from the hospital, and thus a conservative approach of outpatient follow-up similar to that recommended for LPT infants seems prudent until additional studies are available.

**Breastfeeding**

Our finding that mothers of LPT and ET infants were significantly less likely to initiate and continue breastfeeding compared with mothers of term infants is in line with previous studies. A 2007 National Survey of Children’s Health study in >25,000 children aged 6 months through 5 years revealed that although children with birth weights <1500 g were more likely to have been breastfed than children with normal or above-normal birth weights, this trend was not observed among children born with birth weights of 1500 to <2500 g.

A possible reason for these findings is that premature infants are not fed by mouth until they reach ~34 weeks’ postconception age and mothers of very preterm and/or very low birth weight infants who are interested in breastfeeding are pumping and storing breast milk to be fed via gavage tubes. On the other hand, mothers of LPT infants and/or moderately low birth weight infants who are interested in breastfeeding are more likely attempting to breastfeed shortly after birth and may confront feeding difficulties due to their infant’s developmental immaturity, which may preclude them from continuation. As should be done for all mothers, effective education and support should be offered to promote breastfeeding initiation and continuation. Mothers of LPT and ET infants may face additional obstacles and thus may require additional support from providers.

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**TABLE 3** Hospital Discharge, Outpatient Follow-up and Home Care Practices Among Late-Preterm, Early-Term, and Term Infants From 29 PRAMS Sites, 2000–2008

<table>
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<tr>
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<th>Late-Preterm</th>
<th>Early-Term</th>
<th>Term</th>
<th>P</th>
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</thead>
<tbody>
<tr>
<td>Early discharge*</td>
<td>2.1 (1.7–2.5)</td>
<td>4.1 (3.9–4.4)</td>
<td>4.7 (4.5–4.9)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Timely follow-up*</td>
<td>89.1 (88.3–89.8)</td>
<td>84.7 (84.3–85.1)</td>
<td>83.2 (82.9–83.5)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Breastfeeding initiation</td>
<td>70.4 (69.3–71.4)</td>
<td>73.5 (72.9–74.0)</td>
<td>76.5 (76.2–76.8)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Breastfeeding continuation*</td>
<td>54.8 (53.2–55.9)</td>
<td>60.4 (59.7–61.1)</td>
<td>64.1 (63.7–64.5)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Maternal smoking*</td>
<td>20.7 (19.8–21.6)</td>
<td>18.5 (18.0–19.0)</td>
<td>17.1 (16.8–17.4)</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Supine sleep position</td>
<td>61.4 (60.3–62.5)</td>
<td>63.7 (63.1–64.3)</td>
<td>66.3 (65.9–66.6)</td>
<td>&lt;.0001</td>
</tr>
</tbody>
</table>

Data are weighted percentages (95% CI).  
* Defined as a hospital stay of <1 day for vaginal deliveries; cesarean deliveries were excluded from analysis.  
+ Defined as as home or office visit within 1 week of discharge.  
* Defined as breastfeeding for ≥10 weeks after delivery among those who initiated breastfeeding; survey responses obtained earlier than 10 weeks were excluded from this portion of the analysis.

**TABLE 4** Adjusted Risk Ratios of Hospital Discharge, Timely Outpatient Follow-up, and Home Care Practices Among Late-Preterm and Early-Term Infants Compared With Term Infants From 29 PRAMS Sites, 2000–2008

<table>
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<tr>
<th></th>
<th>Late-Preterm</th>
<th>Early-Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early discharge*</td>
<td>0.65 (0.54–0.79)</td>
<td>0.95 (0.88–1.02)</td>
</tr>
<tr>
<td>Timely follow-up*</td>
<td>1.07 (1.06–1.08)</td>
<td>1.02 (1.02–1.03)</td>
</tr>
<tr>
<td>Breastfeeding initiation</td>
<td>0.95 (0.84–0.97)</td>
<td>0.98 (0.97–0.98)</td>
</tr>
<tr>
<td>Breastfeeding continuation*</td>
<td>0.88 (0.86–0.90)</td>
<td>0.94 (0.93–0.99)</td>
</tr>
<tr>
<td>Maternal smoking*</td>
<td>1.09 (1.05–1.14)</td>
<td>1.08 (1.06–1.11)</td>
</tr>
<tr>
<td>Supine sleep position</td>
<td>0.95 (0.93–0.97)</td>
<td>0.97 (0.96–0.98)</td>
</tr>
</tbody>
</table>

Data are adjusted risk ratios (95% CI), adjusted for the following: maternal age, education, race/Hispanc ethnicity, marital status, previous live birth, insurance status before pregnancy, method of delivery, infant gender, and maternal length of hospital stay. Reference group: term infants.

* Defined as a hospital stay of <1 day for vaginal deliveries; cesarean deliveries were excluded from analysis.  
+ Defined as as home or office visit within 1 week of discharge.  
* Defined as breastfeeding for ≥10 weeks after delivery among those who initiated breastfeeding; survey responses obtained earlier than 10 weeks were excluded from this portion of the analysis.

* Defined as smoking at the time of survey completion.
Tobacco Exposure

We found that mothers of LPT and ET infants were more likely to smoke at the time of the survey compared with mothers of term infants, even after adjusting for relevant confounding variables. It is well established that smoke exposure increases an infant’s future risk of middle ear infections, reactive airway disease, asthma, hospitalization, and sudden infant death syndrome (SIDS).20,21 Given the already increased risk of pulmonary complications in LPT infants,22 it is worrisome that these infants have added risk through secondhand smoke exposure. Less is known about the degree of pulmonary fragility of ET infants, but given that these infants are more likely to suffer respiratory complications after birth than their term counterparts, minimizing additional risk exposure such as secondhand smoke should be a priority. Additional smoking cessation education and support for all mothers who smoke during pregnancy and after delivery are needed to empower them to improve their health as well as to optimize the future health of their infants at all gestational ages.

Sleep Position

Also worrisome was our finding that LPT and ET infants were significantly less likely to be placed on their backs to sleep compared with term infants. Even among term infants, only two-thirds of these infants were placed on their backs. It is well established that sleeping in the nonsupine position increases an infant’s risk of SIDS, and there has been a dramatic decrease in the incidence of SIDS in the United States since the initiation of the back-to-sleep campaign.23 Given that preterm birth is an independent risk factor for SIDS,24,25 placing preterm infants in a nonsupine position may compound this risk. Evidence about the risk of SIDS in specifically LPT and ET infants is lacking. Until research is available, it is imperative that the mothers and other caretakers of these infants engage in, at the very least, the same home care practices recommended for all infants to optimize health outcomes.

Strengths and Limitations

Although our study has many strengths including a large, nationally representative sample and inclusion of states with a >70% response rate, there are a few limitations. First, our study may suffer from information bias due to maternal self-reporting of the outcome variables. Second, our study lacked information about early follow-up visits, and we could not determine if follow-up appointments were recommended and/or scheduled by clinicians. Finally, because we could not differentiate between 1- and 2-day-length hospital stays we could not examine which infants had an early discharge as per AAP guidelines (defined as <2 days [<48 hours] for vaginal deliveries).14

CONCLUSIONS

In this population-based study, compared with mothers of term infants, we found that mothers of LPT and ET infants were more likely to smoke at the time of the survey, were less likely to place the infants in a supine position for sleep, and less likely to initiate as well as continue breastfeeding. Given the increased risk of morbidity and mortality in this population of infants, greater attention needs to be given not only to their medical care in the hospital but also to engaging families in providing appropriate home care after discharge.

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