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Length of Stay and Readmission Among Late Preterm Infants: An Instrumental Variable Approach

Neera Goyal, MD, MSc^{1,2,3}, José R. Zubizarreta, MA⁴, Dylan S. Small, PhD⁴, and Scott A. Lorch, MD, MSCE^{5,6,7,8}

¹Division of Neonatology and Pulmonary Biology, Department of Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio

²Division of Hospital Medicine, Department of Pediatrics, Cincinnati Children's Hospital Medical Center, Cincinnati, Ohio

³University of Cincinnati College of Medicine, Cincinnati, Ohio

⁴Department of Statistics, The Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania

⁵Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, Pennsylvania

⁶Center for Outcomes Research, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

⁷Division of Neonatology, Department of Pediatrics, The Children's Hospital of Philadelphia, Philadelphia, Pennsylvania

⁸Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania

Abstract

OBJECTIVE—Evidence to guide safe discharge for late preterm infants (34–36 weeks' gestation) is lacking. Previous studies have demonstrated the increased risk of neonatal readmission for these infants compared with those born at term (≥37 weeks' gestation). The purpose of this study was to estimate the effect of length of stay (LOS) on 7-day readmissions in this population.

METHODS—This was a retrospective study using hospital discharge data linked with vital records for late preterm infants delivered vaginally in California from 1993 to 2005. Exclusion criteria included complications likely requiring neonatal intensive care. The effect of LOS was assessed by using birth hour as an instrumental variable to account for unmeasured confounding.

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Address correspondence to Neera Goyal, MD, MSc, Cincinnati Children's Hospital Medical Center, Department of Pediatrics, 3333 Burnet Ave, ML #7009, Cincinnati, OH 45229. neera.goyal@cchmc.org.

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By using a matching algorithm, we created pairs of infants with different LOS based on birth hour but otherwise matched on known confounders for readmission risk, including birth year, hospital, and clinical and demographic covariates such as gestational age, birth weight, race, and insurance.

RESULTS—We produced 80 600 matched pairs of infants with different LOS based on birth hour. In 122 pairs, both infants were readmitted within 7 days, and in 75 362 pairs, neither infant was readmitted. Of the remaining 5116 matched pairs in which only 1 infant was readmitted, 2456 infants with long LOS and 2660 infants with short LOS were readmitted. We found no evidence that longer LOS reduces the odds of readmission (1-sided P value = .99).

CONCLUSIONS—By using an instrumental variable approach and matching algorithm, longer LOS was not associated with decreased readmission within 7 days of discharge for these late preterm infants.

Keywords

early discharge; instrumental variable; late preterm; length of stay; neonatal readmission; newborn care

Of all pediatric hospitalizations in the United States, the majority (4 million annually) are for neonates <30 days of age.¹ Although most neonatal hospitalizations are for births during that hospital stay, readmissions in the first 30 days of life, particularly for potentially preventable causes such as jaundice and poor feeding, account for >100 000 hospitalizations each year.¹ Neonatal readmissions have a significant impact on new families and may be decreased by appropriate hospital care and follow-up.^{2–4} Given the volume of neonatal hospitalizations and their contribution to pediatric health care spending, this represents an important area for potential improvements in hospital care quality.^{5,6}

One group at particular risk for neonatal readmission is late preterm infants, delivered at 34 to 36 weeks' gestation, comprising >70% of infants born preterm.⁷ Several studies have described the morbidity and mortality risks associated with this group compared with term infants delivered at ≥37 weeks' gestation^{8–12}; specific complications include higher risks of hyperbilirubinemia, poor feeding, and temperature instability. In the neonatal period, they are more likely to be readmitted for jaundice as well as non-jaundice-related diagnoses.^{13–15} Despite these known risks, current gaps in knowledge include evidence-based recommendations for discharge care to minimize readmissions.¹²

Although policy statements from the American Academy of Pediatrics assert that late preterm infants are unlikely to meet eligibility criteria for early discharge (before 48 hours of life), previous research suggests that early discharge of these infants is common.^{12,16,17} The implications of this practice are unclear. Previous studies of healthy term infants suggest a minimal, if any, association between length of stay (LOS) and neonatal readmissions.^{18–20} However, given the known risks of complications in late preterm infants, further research is necessary to understand the effect of LOS on neonatal readmissions in this population.

One methodologic challenge in studying the association between LOS and readmission is unmeasured confounding. An infant requiring prolonged LOS may have more complications, such as feeding inadequacy, and also may be more likely to be readmitted than an infant discharged before 48 hours. Alternatively, there could be unmeasured reasons for early discharge, such as parental attitudes and competence in caregiving, which may be associated with reduced readmission risk. We therefore used an instrumental variable (IV) approach, an increasingly recognized alternative to standard statistics when the association between primary predictor and outcome is confounded by unmeasured factors.^{21,22} An IV is

a variable correlated with the primary predictor (ie, LOS) but does not belong in the causal pathway with the outcome (ie, readmission). The purpose of the current study was to use birth hour as an IV in an attempt to mimic a randomized assignment of LOS to late preterm infants to test the hypothesis that longer LOS reduces 7-day readmissions within a population otherwise matched on clinical and sociodemographic characteristics.

METHODS

Data Set

We used statewide discharge data on birth hospitalizations in California from 1993 to 2005, available from the California Office of Statewide Health Planning and Development. Each hospital record contains information from the UB-92 form (ie, demographic data, admission source, dates of admission and discharge), principal diagnoses, and procedures; these data have been linked to birth certificate data with a 98% match rate as described previously, as well as to maternal hospital records.^{23,24} In addition, hospitalizations up to 1 year after birth are matched to infant birth certificates. The resulting data set is a powerful tool to evaluate an expansive group of maternal–infant factors, including demographic characteristics, pregnancy-related health conditions, medical treatments during hospitalization, and readmission outcomes in a population-based sample (~8.7 million births in total over 13 years). This project was approved by the institutional review boards of the California Department of Health and The Children’s Hospital of Philadelphia.

Study Population

Our study evaluated live-born infants delivered vaginally at 34 to 36 weeks’ gestation and discharged from the hospital. Gestational age was identified by using birth certificate data from the best obstetric estimate. *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9-CM) codes and birth certificate data were used to exclude infants delivered via cesarean delivery because they are usually hospitalized at least 72 hours’ postpartum. Of the 322 904 vaginally delivered late preterm infants, 66 641 with maternal postpartum LOS >2 days were excluded because infants remained in the hospital while awaiting maternal discharge. By using ICD-9-CM codes, we also excluded those likely to require neonatal intensive care: major congenital anomalies ($n = 3335$), surgeries ($n = 107$), or complications such as respiratory distress syndrome or sepsis ($n = 8153$). We also excluded 12 837 infants with LOS >5 days because prolonged hospitalization likely reflects significant complications and possible need for neonatal intensive care and thus ineligibility for early discharge. The resulting sample (before infant matching) comprised 231 831 infant–maternal pairs delivered at 310 hospitals.

Birth Hour as an IV

Based on previous studies, we used birth hour as an IV due to its correlation with infant LOS.^{25,26} For this approach to be valid, the IV must meet 3 criteria: (1) strength: how well the IV is associated with LOS; (2) independence: lack of additional unmeasured confounding; and (3) no association with readmission except through its effect on LOS.²¹ Previous research has described how reimbursement patterns for birth hospitalizations, which are generally billed in number of midnights, may contribute to the association between birth hour and LOS.²⁶ As an example, infant A delivered late in the evening will be billed for that first midnight, whereas infant B delivered after midnight, at 01:00, will have almost a full 24 hours of care before being billed for the first hospital day. As a result, infant A may be less likely than infant B to be discharged from the hospital after only 1 night of observation in the hospital. As such, birth hour may essentially randomize infants to differing LOS. Because birth hour should only affect an infant’s readmission risk through this association with LOS, it can be used to estimate the impact of LOS on readmissions.

To calculate each infant's actual LOS, we used previously reported data on infant discharge timing, because hour of discharge was not available in our data set.^{25,27} For infants born and discharged from the hospital within the same calendar day, we assumed a discharge time of 17:00; for all others staying at least 1 night, we assumed a discharge time of 13:00. For each birth hour (0:00 to 23:00), we then calculated a median LOS; as an example, the median LOS for infants born at 18:00 was 43 hours. Thus, birth hour can be transformed into an expected LOS, which is the IV for each infant's actual LOS based on his or her birth hour.

Strength of the IV was assessed by its association with LOS by using an F statistic in the first stage of a 2-stage least squares regression testing the null hypothesis that birth hour has no effect on actual LOS; an F statistic <10 suggests a weak correlation between birth hour and actual LOS.²⁸ Independence of the IV from confounding variables was assessed by using the standardized difference in means for each covariate. The association between the IV and primary outcome variable was assessed by using a χ^2 test for difference in the proportion readmitted.

Matched Study Design

Although often calculated by using a 2-stage least squares method, an IV estimator is a Wald estimator that can be calculated by using other approaches.²¹ Recent studies have demonstrated that the use of a matched study design, as an alternative to a 2-stage least squares model, yields a nonparametric approach that helps strengthen the instrument and avoid over extrapolation of the data.^{29,30} We therefore used an algorithm to match pairs of infants with similar clinical and demographic characteristics but different IV values. Within each pair, 1 infant had a long expected LOS and 1 infant had a short expected LOS. As an example, an infant born at 11:00, IV of 26 hours, might be paired with an infant born at 18:00, IV of 43 hours. To maximize strength of the instrument, we restricted analysis to pairs of infants who were far apart in expected LOS, and the algorithm preferentially created pairs of infants with a short expected LOS between 21 and 27 hours and a long expected LOS between 38 and 44 hours.³¹ For every pair, the difference in expected LOS was at least 12 hours; on average, it was 14 hours.

We identified, a priori, several covariates for matching that may be important potential measured confounders.³² To account for temporal trends in both early discharge and readmission, we exactly matched infants on birth year.^{17–19,33} We also exactly matched on hospital to account for hospital-level variability.^{15,17} Gestational age, gender, race, insurance, education, parity, and single versus multiple gestation were finely balanced to yield an exactly equal covariate distribution between the long-IV group and the short-IV group, even if individual pairs of infants were not exactly matched on these covariates.³⁴ For birth weight, multiple approaches were used to ensure optimal matching. More than 97% of pairs were exactly matched on an indicator variable for low birth weight (ie, <2500 g). Mean birth weights between short-IV and long-IV infants were also constrained to be similar (~3065 g in both groups). Finally, an effort was made to pair infants with similar birth weights. Additional clinical covariates were near-finely balanced in the algorithm, so that their distributions between short-IV and long-IV infants were permitted to differ but only slightly. These variables were constructed from ICD-9-CM codes and included oligohydramnios, cord and placental abnormalities, chorioamnionitis, premature rupture of membranes, and birth injury (Appendix).

Analysis

Outcome Definition—Readmission was defined as any hospitalization within 7 days of discharge because readmission beyond the first week may be more influenced by decisions in the primary care office rather than the hospital. By using the IV to control for unmeasured

confounding, the odds ratio and the confidence interval for 7-day readmission were assessed among matched infants with longer versus shorter expected LOS. A 1-sided test of the null hypothesis was conducted that longer LOS does not reduce readmission risk. As a sensitivity analysis, we also stratified this test on year of birth (data not shown).

RESULTS

Evaluation of Birth Hour as an IV

We produced 80 600 pairs of late preterm infants matched on clinical and demographic characteristics but with different IV values. Table 1 depicts birth hours for paired infants and the mean difference in expected LOS for each pairing.

IV Strength—Table 2 depicts the relationship between birth hour and number of nights in the hospital. Although ~60% of infants born between 20:00 and midnight stayed 2 nights in the hospital, only 13% of infants born between midnight and 04:00 stayed 2 nights, suggesting a meaningful correlation between birth hour and actual LOS. The F statistic for association with LOS was 98.82, indicating that the IV was sufficiently strong.

IV Independence—Table 2 depicts the distribution of covariates according to birth hour. Overall, these were evenly distributed, with only small differences in means across blocks of time.

7-Day Readmissions

Unadjusted Analysis—Among the matched sample of 161 200 infants, 3.3% were readmitted within 7 days of discharge. As seen in Fig 1, the percentage of readmitted infants increased during the study time frame from 3.0% in 1993 to 3.8% in 2005; this trend is statistically significant (Cochran-Armitage P value $<.001$).

Table 3 depicts the unadjusted association of actual LOS, the IV, and all covariates with readmission status. In unadjusted comparisons, multiple covariates were associated with being readmitted compared with not being readmitted, including birth weight <2500 g (13% vs 10%) and being the first born (53% vs 37%) (P values $<.001$). However, there was no unadjusted association between the IV and readmission status, with 16% and 17% of readmitted and non-readmitted infants, respectively, having an expected LOS <24 hours ($P = .66$).

Matched Pairs Analysis—Table 4 depicts readmission status among pairs of infants with longer and shorter expected LOS after matching on all other covariates. In 122 matched pairs, both the longer LOS and shorter LOS infants were readmitted within 7 days, and in 75 362 pairs, neither was readmitted. Among the remaining 5116 matched pairs in which only 1 infant was readmitted, the odds ratio for readmission for infants with longer versus shorter expected LOS was estimated to be 1.08 (95% confidence interval: 1.02–1.14). By using a 1-sided test of the null hypothesis, there was no evidence that longer LOS reduces readmissions ($P = .99$). When we stratified this analysis on birth year, results were similar.

DISCUSSION

This study evaluated the relationship between LOS and readmissions for late preterm infants. We demonstrated the utility of an IV approach to account for unmeasured factors that may contribute to differences in readmission risk, and we extended previous approaches by using a novel matching algorithm. Trend data suggest an increase in the percentage of

late preterm infants readmitted over time. Results of our analysis suggest that longer LOS does not reduce readmissions in this population.

Our results are consistent with previous studies of LOS and readmissions for term infants. Much of this literature focuses on state and federal legislation from the 1990s, which mandated insurers to cover hospital stays of 48 hours for vaginal deliveries and 96 hours for cesarean deliveries³⁵; this served as a natural experiment to determine the effect of trends in LOS on neonatal readmissions. Overall, studies suggest minimal, if any, effect of longer LOS on readmission risk for term, healthy infants.^{20,33,36} Danielsen et al³⁷ demonstrated that among healthy California infants delivered vaginally from 1992 to 1995, before postpartum discharge legislation, there was no association between early discharge and 28-day readmissions. By using similar California data on term and late preterm infants born from 1991 to 2000, Burgos et al¹⁸ found no effect of LOS <2 days on 14-day readmissions for jaundice after adjustment for gestational age and other risk factors. Other statewide studies of healthy, term infants receiving Medicaid have also shown no difference in neonatal readmission risk based on LOS.^{38,39}

Many studies have demonstrated a higher readmission rate among late preterm infants compared with term infants.^{13–15,18} This literature emphasizes the risks associated with late preterm birth and underscores the need for parental counseling regarding these infants, who may appear more mature than they are. Our current finding that longer LOS has no effect on reducing neonatal readmissions in this population may have useful implications for hospitals seeking to improve late preterm infant care; discharge appropriateness criteria may need to focus less on LOS and more on clinical and social factors. This finding is further supported by those of Escobar et al,¹⁵ who demonstrated increased readmission rates among late preterm infants never admitted to a NICU compared with those who spent at least some time in a NICU before discharge. Because care and resources in the NICU may be more systematically focused on issues such as feeding and parental readiness, this would again suggest that specific processes of care during hospitalization are more important than LOS alone in affecting readmissions.

Although the focus of the current study was to determine whether longer LOS is associated with reduced readmissions in this population, a 2-sided confidence interval actually suggested evidence of slightly increased odds of readmission among infants with longer LOS. This unanticipated finding raises a potential concern that the birth hour instrument is still confounded with risk factors for readmission, despite our attempts to account for observed covariates. An alternative possibility is that differences in care for infants discharged early, such as early primary care follow-up or home nursing visits, resulted in improved care coordination and decreased readmissions compared with those discharged after longer LOS. Future research may focus on these aspects of postdischarge care, including home visits, that may be more directly associated with readmissions as well as other important outcomes (ie, discontinuation of breastfeeding).^{14,15,20}

One limitation of this study was our inability to precisely determine LOS in hours, which we estimated by using birth hour, number of hospital nights, and assumptions about discharge timing. For this estimation, we repeated the approach of Malkin et al, by using median discharge times from a Rand survey conducted in 2000 of 2447 infants born in California and Iowa; among the population surveyed, >70% of infants had an actual discharge within 3 hours of the median.^{25,27} Another limitation was our use of administrative data, which may result in misclassification bias if undercoded or overcoded. Although we adjusted for observable characteristics, there may still be residual unmeasured confounding based on birth hour. However, this is unlikely given previous research demonstrating no difference in mortality or short-term morbidity in preterm infants by birth hour after adjustment for

maternal and infant characteristics.⁴⁰ Finally, an additional limitation was our focus on readmission rather than more specific health outcomes such as breastfeeding failure. Readmission is relatively infrequent, and it may be influenced by other processes of care such as home visits and other outpatient follow-up factors. However, readmission is widely used as an indicator of adverse health outcomes; it is costly, it reflects morbidity, and it can be systematically measured.

CONCLUSIONS

Neonatal readmissions have a significant impact on new families and may be decreased by appropriate hospital care and follow-up.^{2–4} Given the high volume of neonatal hospitalizations, readmissions represent an important area for potential improvement in hospital care quality. Although late preterm infants are particularly vulnerable to complications, including readmission, our study demonstrated no reduction in 7-day readmissions associated with longer LOS for this population. Further research is needed to validate and extend these findings for late preterm infant cohorts in other regions of the country. These results underscore the importance of focusing attention on other aspects of care, particularly postdischarge management, that may improve outcomes for this population.

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ABBREVIATIONS

ICD-9-CM	<i>International Classification of Diseases, Ninth Revision, Clinical Modification</i>
IV	instrumental variable
LOS	length of stay

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APPENDIX ICD-9-CM. Diagnosis Codes Used to Identify Maternal Comorbidities

Condition	ICD-9-CM Codes
Birth injury	767.2–767.9
Placental disorders	641.0x, 641.1x, 641.2x
Eclampsia	642.6x
Chorioamnionitis	658.4x, 659.2x, 659.3x
Diabetes mellitus	250.x, 357.2, 362.0x, 366.41, 648.0x
Premature rupture of membranes	658.1x, 658.2x
Oligohydramnios	658.0x
Cord abnormalities	663.0x, 663.1x, 663.5x
Maternal postpartum fever	672.x

FIGURE 1.

Percentage of infants with 7-day readmissions according to year of birth. Depicts the change in percentage of late preterm infants readmitted within 7 days over study time frame. Scatterplot represents unadjusted percentages of infants for each birth year. Solid line represents the fitted linear regression predicting readmission percentage from birth year.

TABLE 1
Number of Infant Pairs According to Birth Hour With Corresponding Mean Difference in Expected LOS

	Shorter Expected LOS Infants												
	Longer Expected LOS Infants												
	16:00	15:00	14:00	13:00	12:00	11:00	10:00	9:00	8:00	7:00	6:00	5:00	
17:00	180 (23)	272 (22)	325 (21)	414 (20)	469 (19)	501 (18)	600 (17)	788 (16)	924 (15)	1151 (14)	1662 (13)	2537 (12)	
18:00	238 (22)	289 (21)	373 (20)	471 (19)	550 (18)	623 (17)	767 (16)	996 (15)	1227 (14)	1537 (13)	2127 (12)		
19:00	259 (21)	358 (20)	460 (19)	584 (18)	683 (17)	758 (16)	951 (15)	1176 (14)	1560 (13)	1994 (12)			
20:00	290 (20)	386 (19)	542 (18)	685 (17)	846 (16)	917 (15)	1195 (14)	1403 (13)	2023 (12)				
21:00	409 (19)	500 (18)	615 (17)	787 (16)	963 (15)	1255 (14)	1494 (13)	1924 (12)					
22:00	444 (18)	588 (17)	780 (16)	981 (15)	1255 (14)	1495 (13)	1925 (12)						
23:00	510 (17)	719 (16)	928 (15)	1191 (14)	1676 (13)	1859 (12)							
0:00	491 (16)	692 (15)	952 (14)	1308 (13)	1746 (12)								
1:00	708 (15)	997 (14)	1412 (13)	1997 (12)									
2:00	987 (14)	1486 (13)	2176 (12)										
3:00	1612 (13)	2501 (12)											
4:00	3176 (12)												

Vertical axis represents infants with birth hours conferring longer LOS; horizontal axis represents infants with birth hours conferring shorter LOS. Table values are the number of infant pairs for each birth hour combination. Values in parentheses indicate the mean difference in expected LOS between paired infants for each birth hour combination.

TABLE 2
Distribution of Clinical and Demographic Characteristics According to Birth Hour ($N = 165\ 146$)

Characteristic	Birth Hour					Standardized Differences in Means ^a
	00:00–4:00	05:00–9:00	10:00–14:00	15:00–19:00	20:00–23:00	
Observed LOS						
0 nights	11.7	2.1	0.7	0.3	0.2	0.71
1 night	71.0	66.3	59.3	48.8	34.3	0.77
2 nights	12.9	26.7	34.7	45.3	59.1	1.02
3 nights	4.4	4.9	5.2	5.6	6.4	0.08
Gestational age, wk						
34	14.4	14.4	13.8	13.4	13.6	0.03
35	28.3	28.3	28.1	28.3	28.2	0.00
36	57.3	57.3	58.1	58.3	58.2	0.02
LBW <2500 g	9.0	9.6	10.2	10.5	10.3	0.05
Mean birth weight, g	3060.56	3055.72	3068.07	3072.01	3060.74	0.04
Female	48.1	47.2	47.5	46.7	46.9	0.03
Race						
Hispanic	51.8	51.3	50.0	48.9	49.8	0.06
White	26.9	27.6	30.3	31.6	30.6	0.10
Asian	10.3	10.4	9.6	9.6	9.5	0.03
Black	8.1	7.9	7.3	7.2	7.3	0.03
Other	2.9	2.9	2.9	2.9	2.8	0.00
Insurance						
Federal	54.5	53.6	52.3	50.5	51.9	0.08
HMO	36.6	37.4	39.2	40.7	39.5	0.08
Fee-for-service	4.4	4.4	4.5	4.6	4.5	0.01
Uninsured	3.8	4.0	3.4	3.5	3.5	0.03
Other	0.7	0.6	0.7	0.7	0.7	0.01
Missing	0.0	0.0	0.0	0.0	0.0	0.01
High school degree	56.9	57.9	60.4	61.8	60.3	0.10
Nulliparous	33.1	35.3	38.2	40.3	38.8	0.15
Multiple gestation	1.6	1.8	2.1	2.7	2.2	0.06

Characteristic	Birth Hour					Standardized Differences in Means ^a
	00:00–4:00	05:00–9:00	10:00–14:00	15:00–19:00	20:00–23:00	
Birth injury	1.1	1.2	1.1	1.1	1.1	0.01
Oligohydramnios	0.8	0.8	0.9	0.9	1.0	0.02
Cord abnormality	3.4	3.1	3.4	3.6	3.4	0.03
Placental disorders	1.1	1.0	0.9	1.0	1.0	0.02
Eclampsia	0.0	0.0	0.0	0.0	0.0	0.01
Chorioamnionitis	1.4	1.0	1.0	1.4	1.9	0.08
Postpartum fever	0.1	0.1	0.2	0.2	0.2	0.02
Gestational diabetes	3.2	3.0	3.3	3.6	3.6	0.04
Diabetes mellitus	0.5	0.3	0.4	0.4	0.5	0.03
PROM	7.6	6.4	7.4	9.4	9.4	0.11

Data are presented as % unless otherwise indicated. HMO, health maintenance organization; LBW, low birth weight; PROM, premature rupture of membranes.

^aFor each covariate, standardized differences are calculated as the quotient of the maximum of the means minus the minimum of the means, and the pooled SD across all time blocks.

TABLE 3

Unadjusted Clinical and Demographic Characteristics of Infants Readmitted Versus Not Readmitted

Characteristic	Readmitted (N = 5360)	Not Readmitted (N = 155 840)	P Value (χ^2)
Actual LOS			<.001
<24 h	21.7 (1165)	25.6 (39 946)	
24–48 h	62.6 (3354)	58.8 (91 577)	
>48 h	15.7 (840)	15.6 (24 317)	
IV, h ^a			.66
<24	16.3 (874)	16.5 (25 781)	
24–48	83.7 (4486)	83.5 (130 059)	
>48	—	—	
Gestational age, wk			<.001
34	11.2 (599)	13.9 (21 667)	
35	28.9 (1548)	28.2 (43 964)	
36	59.9 (3213)	57.9 (90 209)	
LBW <2500 g	12.7 (679)	10.0 (15 521)	<.001
Mean birth weight, g ^b	2977.59	3068.01	<.001
Female	41.1 (2204)	47.4 (73 898)	<.001
Race			<.001
Hispanic	38.1 (2043)	50.5 (78 641)	
White	40.9 (2192)	29.5 (45 942)	
Asian	13.5 (726)	9.6 (15 016)	
Black	4.0 (217)	7.6 (11 801)	
Other	3.4 (182)	2.8 (4440)	
Insurance			<.001
Medicaid	42.7 (2291)	52.5 (81 831)	
HMO	48.8 (2614)	38.7 (60 308)	
Fee-for-service	5.5 (297)	4.5 (6993)	
Uninsured	2.0 (109)	3.6 (5651)	
Other	0.9 (49)	0.7 (1045)	
High school degree	73.1 (3920)	59.5 (92 710)	<.001
Nulliparous	53.1 (2844)	37.3 (58 066)	<.001
Multiple gestation	1.8 (97)	2.2 (3429)	.06
Birth injury	2.1 (111)	1.1 (1697)	<.001
Oligohydramnios	0.7 (37)	0.9 (1394)	.14
Cord abnormality	3.5 (188)	3.4 (5336)	.77
Placental disorders	1.3 (72)	1.0 (1525)	.01 ^c
Eclampsia	0.1 (5)	0.0 (42)	.02 ^c
Chorioamnionitis	1.7 (93)	1.3 (2055)	.01 ^c
Postpartum fever	0.2 (12)	0.2 (237)	.25
Gestational diabetes	5.2 (278)	3.3 (5146)	<.001

Characteristic	Readmitted (<i>N</i> = 5360)	Not Readmitted (<i>N</i> = 155 840)	<i>P</i> Value (χ^2)
Diabetes mellitus	0.7 (38)	0.4 (612)	<.001
PROM	16.4 (880)	7.9 (12 344)	<.001

Data are presented as % (*n*) unless otherwise indicated. HMO, health maintenance organization; LBW, low birth weight; PROM, premature rupture of membranes.

^a Although some infants had an actual LOS >48 hours, the IV was calculated as a median LOS based on birth hour. Because the IV represents an expected, not actual, LOS, the range of IV values does not exceed 48 hours.

^b *P* value for difference in mean birth weights represents the *F* statistic *P* value.

^c The *P* values in this table were also calculated with a Bonferroni correction for multiple comparisons. The *P* values that changed from being statistically significant at the 5% percent level to not being significant are denoted.

TABLE 4

Seven-Day Readmission Status Within Matched Pairs of Infants With Longer and Shorter Expected LOS

Longer Expected LOS Infants	<u>Shorter Expected LOS Infants</u>	
	No Readmission	Readmission
No readmission	75 362	2456
Readmission	2660	122

Table values represent number of infant pairs based on readmission status and whether the readmitted infant was in the shorter LOS or longer LOS group.