# Late Preterm Infants: Morbidities, Mortality, and Management Recommendations

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A significant increase in preterm births (those born less than 37 weeks of gestation) from 10.62 percent to 12.73 percent of all births occurred between 1990 and 2005.[1] Throughout this time, infants born later in the preterm period (variably referred to as "near term," "marginally preterm," "mildly preterm," among other descriptors) continued to account for the majority, nearly three quarters, of these preterm births. To emphasize the importance of better optimizing the care of late preterm infants, along with supporting epidemiologic investigations into morbidity and mortality, the National Institute of Child Health and Human Development of the National Institutes of Health gathered a panel of experts to define this group. This panel, defined infants born just prior to term as "late preterm" to emphasize their vulnerability and prematurity. Furthermore, "late preterm" was precisely defined as those born between, and including, the gestational ages of 34 weeks and 0 days (239 days) and 36 weeks and 6 days (259 days).[2]

The purpose of this review is to describe epidemiologic trends in the rate of late preterm births and the associated risks for morbidities and mortality of being born late preterm. Furthermore, we will discuss the importance of reducing the rate of late preterm births; monitoring and managing for short and long term complications; and understanding factors that increase risk for morbidity and mortality in this subgroup of preterm infants.

Late preterm infants are a population with historically underappreciated increased risk for significant morbidity and mortality compared to term infants.[2,3] In 2017, the rate of late preterm births in the United States increased for the third year in a row, up 5% since 2014, to 7.17% (**Table 1**).[4,5] Late preterm births account for more than 70% of all preterm births, which equaled

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This is the author's manuscript of the article published in final edited form as:
Huff, K., Rose, R. S., & Engle, W. A. (2019). Late Preterm Infants: Morbidities, Mortality, and Management Recommendations. Pediatric Clinics of North America, 66(2), 387–402. https://doi.org/10.1016/j.pcl.2018.12.008

279,382 births in 2016 alone (**Figure 1**).[4] While morbidities occur in only a fraction of these infants, given the large number of late preterm births annually, these infants contribute to a large burden of care and cost to the health care and education systems when compared to term infants.[6]

The recent increased rate of late preterm birth is concerning given the already large number that occur annually and prior successes in reducing such births between 2006 and 2014. The exact cause of this trend is unclear. Possible etiologies include the ongoing changes in maternal demographics (including increasing maternal age) and maternal health (including rising rates of obesity and opioid use) that contribute to preterm birth.[7-9] The increase in late preterm birth rate was observed across all maternal age groups, not just the older subgroups, so maternal age is less likely a new contributor.[4] Past cited etiologies, including increased number of multiple gestations, high rate of elective inductions, or cesarean sections, have actually decreased in recent years and are less likely to contribute to this recent increase.[4] Additional investigation is needed to clarify causation of this recent rise in late preterm birth rate and guide interventions to reverse this trend.

## Acute Morbidities During Birth Hospitalization

Late preterm infants are at risk for acute morbidities starting immediately after birth in the delivery room. Compared to term infants, late preterm infants more often require resuscitation (46% versus 28%, OR 2.14, 95% CI 1.88 – 2.44) including bag mask ventilation (14% versus 6%, OR 2.61, 95% CI 2.14 – 3.17).[10] These increased rates of delivery room intervention persist even when controlling for variables such as cesarean delivery. The level of resuscitation required decreases with increasing gestational age between 34 and 39 weeks of gestation.[11] After delivery, late preterm infants are at increased risk of neonatal intensive care

unit (NICU) admission.[11,12] NICU admission criteria vary by institution, but even when comparing "low risk" spontaneous late preterm delivery, late preterm infants continue to have an increased rate of NICU admission.[12] Reasons for NICU admission in this population include respiratory distress, hypothermia, feeding difficulties, hyperbilirubinemia, and hypoglycemia (**Figure 2**).[12,13]

Late preterm infants more often have symptoms of respiratory distress than term infants.[13] With decreasing gestational age, there is an increase in respiratory distress syndrome (RDS), transient tachypnea of the newborn (TTN), pneumonia, apnea, and pneumothorax (**Figure 3**).[11,14] These respiratory morbidities lead to an increased need for respiratory support, including oxygen therapy, non-invasive ventilation, invasive ventilation, and surfactant replacement.[11,14,15] Late preterm infants have structurally and functionally immature lungs with decreased surface area, decreased capacity for pulmonary fluid absorption at birth, and decreased surfactant production.[16-21] Antenatal betamethasone therapy has been shown to decrease the rates of respiratory morbidities in the late preterm population.[22] Based on these observations, it is now recommended that women at risk of delivery between 34 0/7 weeks and 36 and 6/7 weeks of gestation receive a single course of corticosteroids.[23] Additional studies are needed to further understand the effect of this new recommendation on the rate of respiratory and other short and long term morbidities in the late preterm population.[24]

About 10% of late preterm infants experience temperature instability early during the birth hospitalization.[13] Neonates in general rely on non-shivering thermogenesis to maintain body temperature.[25] Late preterm infants have lower amounts of brown adipose tissue and regulatory hormone concentrations compared to term infants, leading to a relatively diminished

ability to produce heat. Late preterm infants also have more heat loss than term infants due to relatively lower amounts of white adipose tissue and higher surface area to mass ratio.[3,19,25,26]

Feeding problems increase with decreasing gestational age; about 32% of late preterm infants compared with 7% of term infants have feeding difficulties during the birth hospitalization.[13] Wang et al found that poor feeding was the most common reason for discharge delay in late preterm infants.[13] Feeding difficulties are due to physiologic immaturity of the late preterm infant with decreased suck efficacy, abnormal sleep wake cycles, and problems with breathing and feeding coordination.[27,28] These feeding difficulties lead to an increased need for supplemental feeds and an increased time to full oral feedings (median time to full oral feedings of 12 days at 34 weeks of gestation, 3 days at 35 weeks, and 2 days at 36 weeks).[28,29] Feeding immaturity also complicates success with breastfeeding. Unfortunately, due to the normal delay in full maternal milk supply, breastfeeding problems may initially be unrecognized until a larger amount of breastmilk is delivered by suckling.[3,30,31] It is important to educate mothers, particularly first-time mothers, about such problems before the infant's discharge. A higher rate of separation of late preterm infants from their mothers because of medical complications is also associated with a higher rate of difficulties with breastfeeding compared to term infants (e.g. decreased maternal milk supply, increased time to oral feedings).[29,32]

Feeding problems can increase the risk of physiologic morbidities in late preterm infants such as hypoglycemia and hyperbilirubinemia. Late preterm infants have lower glucose stores and glucose production compared to more mature infants due to hepatic enzymatic immaturity.[3,33-35] Hepatic immaturity also contributes to more prolonged and clinically significant hyperbilirubinemia due to the relatively lower concentrations of UDP-glucoronosyltransferase, a key enzyme in the metabolism of hemoglobin.[36]

As previously noted, late preterm infants are neurologically immature. At 34 weeks gestational age, a neonate's brain weighs 65% that of a term neonate.[37] Even at term postmenstrual gestational age, late preterm infants continue to have relatively increased cerebral spinal fluid spaces, and decreased myelination, brain size, and biparietal diameter.[38] Such neurologic immaturity increases vulnerability to brain injury and long-term impairments in late preterm infants.[37]

During the birth hospitalization, late preterm infants have a longer length of stay compared to more mature infants, with length of stay increasing with decreasing gestational age. During the initial birth hospitalization, infants born at 34 weeks' gestation stay on average 12.6 days compared to 6.1 days at 35 weeks birth gestational age and 3.8 days at 36 weeks birth gestational age (**Figure 4**).[39] The most common factors contributing to increased length of stay in late preterm infants are feeding difficulties (75.9%), respiratory distress (30.8%), and jaundice (16.3%).[13] In addition to gestational age, hospital practice variation regarding neonatal intensive care, intermediate nursery care, or well newborn nursery admission also affects the length of stay.[40] Such practice variation may lead to differences in outcomes after hospital discharge, given readmission rates vary in late preterm infants based on NICU admission and duration of birth hospitalization.[41]

Late preterm infants have an increased rate of mortality compared to term infants. In 2013, per 1,000 live births, the *infant* mortality rate for gestational ages 34 to 36 weeks was 7.23 compared to 3.01 for 37 to 38 weeks and 1.85 for 39 to 40 weeks of gestation.[42] Notably, mortality in late preterm infants varies with the reason for delivery.[43] Those infants born because of isolated spontaneous preterm labor have a *neonatal* mortality rate of 1.9 per 1,000 live births. Comparatively, late preterm infants born with no specific indication, a medical indication, or an

obstetric indication have *neonatal* mortality rates of 3.3, 3.8, and 8.6 per 1,000 live births, respectively. Such different neonatal mortality rates emphasize the importance of causality of late preterm birth and associated intrauterine adversity on outcomes.

## Morbidity in Late Preterm Infants Following the Birth Hospitalization

Among infants of all gestational ages, readmission rates are highest among late preterm infants (<34 weeks 3%, 34-36 weeks 4.4%, >37 weeks 2.0%).[44] A higher rate of readmission in late preterm infants correlates with a short duration of birth hospitalization (< 4 days).[41] Other risk factors for readmission include any labor or delivery complication, primigravid mother, breastfeeding, and Asian/Pacific Islander ethnicity.[45] Common reasons for readmission include jaundice, feeding difficulties, respiratory distress/apnea, and infection.[41,44,46,47] Jaundice is also a frequent presenting complaint for Emergency Department visits among neonates, with late preterm infants, especially those born at 36 weeks of gestation, presenting more often than at other gestational ages.[48]

Later in life, long-term morbidities encountered by late preterm infants include neurodevelopmental, respiratory, and medical illnesses. Mortality rates during young adulthood are also higher in late preterm infants than term infants with rates of 0.65 per 1,000 person years versus 0.46 per 1,000 person years, respectively (Hazard Ratio 1.31, 95% CI 1.13-1.50).[49] Late preterm infants have increased rates of developmental delay and cerebral palsy compared to term infants.[50-52] For example, rates of developmental delay/cognitive dysfunction and cerebral palsy at 34 weeks of gestation are 12 per 1,000 children and 9 per 1,000 children, respectively; at 38 to 41 weeks of gestation, comparable rates are 9 per 1,000 and 3 per 1,000 children, respectively.[50,52] Partly because of higher rates of neurodevelopmental impairments, more late

preterm infants are enrolled in early intervention programs compared to term infants (23.5% versus 11.9%, respectively).[53]

Late preterm infants are also more likely to have behavioral problems, school difficulties, and autism.[51,54-56] Behavioral problems are more common in those diagnosed with developmental delays.[54] However, an increased risk of attention deficit hyperactivity disorder has not been consistently found.[57,58] A higher rate of psychiatric hospitalization among adolescents born late preterm has been reported.[59,60] Neurodevelopmental disabilities and impairments are also found in adults born late preterm.[60,61] In a Norwegian cohort of 20 to 36 year-olds, former late preterm infants had a higher rate of cognitive dysfunction, schizophrenia, disorders of psychological development, behavior and emotional disorders, and disabilities affecting their capacity to perform work.[60] Following late preterm birth, low neurocognitive test scores have been reported in adults in their late 60s.[62] Furthermore, late preterm infants have lower socioeconomic attainment in late adulthood with lower levels of education and income.[61,63] Other medical diagnoses including diabetes treated with oral medications or insulin and hypertension are also more prevalent in former late preterm infants.[64,65]

After the birth hospitalization, late preterm infants continue to be at increased risk of respiratory morbidities. In the first two years after birth, previously late preterm infants experience increased morbidity with common childhood illnesses. Late preterm infants have a higher likelihood of needing hospitalization with Respiratory Syncytial Virus infection compared to term infants (2.5% versus 1.3%, respectively).[66] Those presenting with respiratory illnesses also have an increased need for intensive care and longer durations of hospital stay than more mature infants.[67] At 18 months of age there is an increased rate of persistent asthma (aOR 1.68, 95% CI 1.01 – 2.80), need for inhaled corticosteroids (aOR 1.66, 95% CI 1.20 – 2.29), and

number of urgent visits for respiratory disorders (incident rate ratio 1.45, 95% CI 1.25 – 1.68).[68] During late childhood and adolescence, relatively poor pulmonary function tests are found in late preterm compared to term infants.[69,70] To control for environmental confounders, especially smoke exposure, contributing to respiratory morbidity, Todisco et al compared late preterm infants to their term siblings and found increased residual volume and residual volume to total lung capacity ratio.[70] Therefore, even when accounting for postnatal exposures, respiratory outcome differences persist suggesting that intrinsic pulmonary abnormalities are present during childhood and beyond in former late preterm infants.

## Risk Factors for Morbidity and Mortality in Late Preterm Infants

Given the relative increased rate of morbidity and mortality of late preterm infants, close monitoring for social, neurodevelopmental, and medical disabilities beyond the neonatal period are warranted. However, most late preterm infants survive, grow, and develop without identifiable medical or social difficulties. This lack of morbidities and mortality may reflect an absence of complications or evaluation at an age when problems have not yet presented.[71-76] Thus, an important question is: what factors are associated with development of complications of late prematurity? The answer is likely multifactorial and may include combinations of influences that include physical and physiologic immaturity, genetic endowment, fetal environmental exposures and stressors, congenital anomalies, infections, medical disorders, and complications associated with any of the preceding factors, along with the postnatal environment.[71,77,78]

In the United States, congenital anomalies are the leading cause of *infant* mortality (129 per 1,000 live births) and second leading cause of *neonatal* mortality after prematurity-associated complications (92.1 per 1,000 live births).[79] In a Swedish cohort of 14,030 late preterm infants,

41% of late preterm *neonatal* deaths (1.14 per 1,000 live births) were attributed to congenital anomalies.[77] When comparing the most commonly noted indications for late preterm delivery, major congenital anomaly is associated with the highest rate of *neonatal* (107.9 per 1,000 live births) and *infant* (140.7 per 1,000 live births) mortality.[43]

The cause of late preterm birth may be associated with an adverse intrauterine environment and is an important determinant of fetal outcomes including neonatal and infant mortality, acute birth hospitalization conditions, and long-term neurodevelopmental, medical, and social health.[43,77] In addition to congenital anomalies, other causes of late preterm delivery categorized as obstetric, medical, no recorded indication, and isolated spontaneous labor are associated with *infant* mortality rates of 13.3, 7.0, 6.8, and 4.8 per 1,000 live births, respectively.[43] Maternal factors affecting late preterm delivery and neonatal and infant outcomes include maternal race, marital status, age, smoking status, health (including diabetes and hypertensive disorders), diet, income and educational levels.[42,71,76-78,80,81] Pregnancy, labor, and delivery complications, including multiple gestation, intrauterine growth restriction, antepartum hemorrhage, abruption, preterm prelabor rupture of membranes, and chorioamnionitis, also occur in relatively higher rates in late preterm pregnancies.[77,78,81,82] Such complications contribute to premature birth and likely morbidity and mortality of late preterm infants.

Physiologic and structural immaturity are important fetal and neonatal contributions to the risks of morbidity and mortality in late preterm infants.[3,30,51,74] The rates of neonatal intensive care admission and acute birth hospital morbidities increase with decreasing gestational age, consistent with a major impact of immaturity on such outcomes.[11,13,77] Immaturity also adversely affects neurodevelopmental outcomes with decreasing gestational age in neonates without other genetic, metabolic, or neurologic disorders.[51,72] Across the gestational age spectrum from 32 to

41 weeks, the risk for neurodevelopmental delay compared to a term cohort is much higher in the younger gestational age groups. This risk of developmental delay for the moderately preterm (32 0/7 to 33 6/7 weeks), late preterm (34 0/7 to 36 6/7 weeks), and early term (37 0/7 to 38 6/7 weeks) infants is 3 fold (aOR 3.01, 95% CI 1.59 – 5.71), 2.6 fold (aOR 2.58, 95% CI 1.66 – 4.01), and 1.6 fold (aOR 1.56, 95% CI 1.19 – 2.06), respectively, compared to those born at 39 0/7 to 41 6/7 weeks gestational age.[72] In a cohort of 22,552 "healthy" late preterm infants (i.e. discharged from birth hospitalization within 3 days of birth), 4.24% of late preterm and 2.96% of full term infants were diagnosed with developmental delay or disability (aRR 1.36, 95% CI 1.29 – 1.43).[51] In this same cohort, referral for prekindergarten services, exceptional student education, retention in kindergarten, and suspension in kindergarten were all significantly increased in the late preterm group.

In contrast to the association of immaturity with relatively poor neurodevelopmental outcomes in non-anomalous late preterm versus term infants, conflicting evidence has been reported for an association with specific outcomes during early childhood such as intellectual disability (intelligence quotient <70), overall developmental score, problem solving, attention and behavior disorders, and learning disabilities.[57,71,73-75,83] Such contrasting results may be associated with absence of true difference in outcomes, variations in sensitivity of study methods to differentiate outcomes at some ages, methodologic issues, and population sample size limitations. Despite some contradictory evidence, the preponderance of information, including differences observed through adulthood, support an important contribution of immaturity on neurodevelopmental, educational, social, medical, and behavioral outcomes of infants born late preterm.[3,30,51,60-63,74]

In addition to immaturity, other fetal/neonatal factors including sex and birth weight, specifically those small for gestational age, are associated with late preterm delivery in addition to other outcomes, including mortality.[42,77,82] Late preterm infants who are also small for gestational age have been shown to have an increased risk for poor neurocognitive intelligence test scores in young adulthood (full-scale intelligence quotient score -11.84, 95% CI -18.33 to -5.36 compared to term AGA infants) and cerebral palsy in childhood (pooled OR 3.47, 95% CI 1.29 – 9.31) indicating the lasting impact of intrauterine growth restriction on this population.[71,84]

The morbidity and mortality risks found in late preterm infants compared to term infants are numerous. Adverse outcomes throughout the lifespan of infants born late preterm are the result of an interplay between immaturity and a host of unique pathobiologic and social determinants that also contribute to poor outcomes in infants born at other gestational ages.

## Costs Attributable to Late Preterm Births

The costs, including emotional and financial, for families and society attributable to consequences of late preterm birth are extensive.[85-87] Although the percentage of late preterm infants without congenital anomalies that have long term impairments is relatively low compared to extreme and moderate preterm infants, the relatively large absolute number of late preterm births (in 2016: 279,382 late preterm vs 108,836 extreme and moderate preterm infants), contributes to the large number of children in need of special care and support services.[4] For example, using population-based data from Finland where 0.55% of late preterm and 0.85% of combined extremely and moderately preterm infants have intellectual disability, late preterm births would contribute 1,537 children with intellectual disability compared to 926 extremely and moderately preterm births in 2016 alone.[83]

## Monitoring and Management of Late Preterm Infants

Given the significant morbidities encountered by late preterm infants, this population warrants increased observation and close monitoring during their birth hospitalization, soon after discharge, and throughout life. Understanding the morbidities and the time frame during which they may occur can guide health care professionals to care for this at-risk population. Monitoring for these morbidities and ensuring adequate care of the late preterm infant will help to decrease rates of negative outcomes.

During the birth hospitalization, as previously mentioned, late preterm infants are at risk for respiratory distress, hypothermia, hypoglycemia, hyperbilirubinemia, and feeding difficulties.[12,13] **Table 2** provides a sample guideline for monitoring and managing these morbidities. Those that care for late preterm infants during their birth hospitalization should consider setting guidelines to care for these infants, as variation in practice effects the length of stay, care received and potentially outcomes after discharge (e.g., readmission rates).[40] Prior to discharge, it is recommended that specific goals be met (**Table 3**). Other considerations prior to discharge include the parents' ability to provide care for the infant at the bedside. This ability of parents to care for their infant during the birth hospitalization has been linked to outcomes and future maternal infant interactions after discharge.[87]

After birth hospitalization, it is recommended that late preterm infants be followed closely by their primary care physician. Initial follow-up is recommended within 24 to 48 hours to evaluate the infant for feeding issues, jaundice, and other concerns.[30,88,89] Frequency of follow-up can be increased if issues arise, until the infant is clearly thriving and developing.[89] It is important for previously late preterm infants to have an established primary care physician.[89]

These infants should receive all recommended screens throughout childhood, with care taken to diagnose disabilities or medical disorders as early as possible. If a problem is identified, such as a developmental delay, referral for the appropriate intervention or therapies should be made as early as possible. Parents should be informed of the increased risk of long-term morbidities associated with prematurity, to emphasize the importance of continued timely follow-up of late preterm infants.

## Conclusions

Late preterm infants are at increased risk of significant morbidity and mortality. During their birth hospitalization, these morbidities include respiratory distress, hypothermia, feeding difficulties, hypoglycemia, and hyperbilirubinemia.[12,13] After discharge, they are at increased risk of rehospitalization due to feeding difficulties and jaundice, especially with shorter birth hospitalization.[41,43,44,46,47] Risks for morbidity and mortality continue throughout life for late preterm infants. This persistence emphasizes the need for well-defined long-term follow-up.

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**Table 1:** Percentage of annual births by gestational age 2014-2016. (Data from Martin JA, Hamilton BE, Osterman MJK, Driscoll AK, Drake P. *Births: Final Data for 2016.* U. S. Department of Health and Human Services;2018. and Hamilton BE, Martin JA, Osterman MJK, Driscoll AK, Rossen LM. *Births: Provisional Data for 2017.* Hyattsville (MD): National Center for Health Statistics, 2018. )

| Year | Number | <28 | 28-31 | 32-33 | 34-36 | 37-38 | 39-40 |
|---|---|---|---|---|---|---|---|
| **2010** | 3,999,386 | 0.71 | 0.94 | 1.18 | 7.15 | 27.29 | 56.08 |
| **2011** | 3,953,590 | 0.70 | 0.93 | 1.18 | 6.99 | 26.09 | 57.51 |
| **2012** | 3,952,841 | 0.71 | 0.92 | 1.17 | 6.96 | 25.47 | 58.30 |
| **2013** | 3,932,181 | 0.70 | 0.92 | 1.17 | 6.83 | 24.81 | 58.85 |
| **2014** | 3,988,076 | 0.69 | 0.91 | 1.15 | 6.82 | 24.76 | 58.72 |
| **2015** | 3,978,487 | 0.68 | 0.91 | 1.17 | 6.87 | 24.99 | 58.47 |
| **2016** | 3,945,875 | 0.68 | 0.92 | 1.17 | 7.09 | 25.47 | 57.94 |
| **2017** | 3,853,472 | - | - | - | 7.17 | - | - |

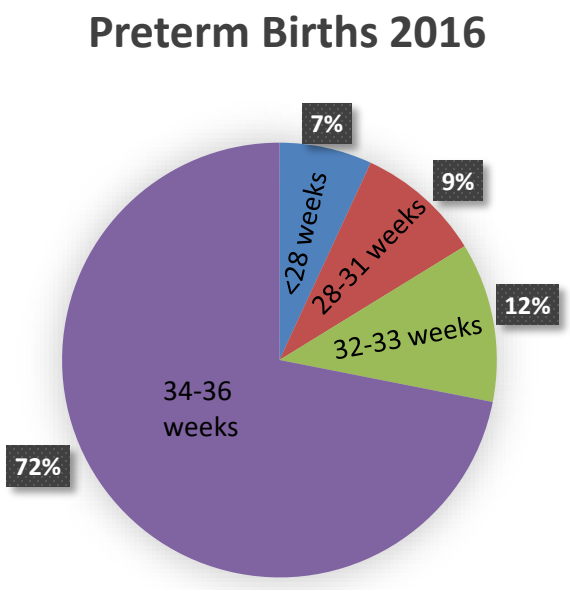


**Figure 1:** Breakdown of Preterm Births for 2016 (Data from Martin JA, Hamilton BE, Osterman MJK, Driscoll AK, Drake P. *Births: Final Data for 2016.* Hyattsville (MD): U. S. Department of Health and Human Services, 2018.)

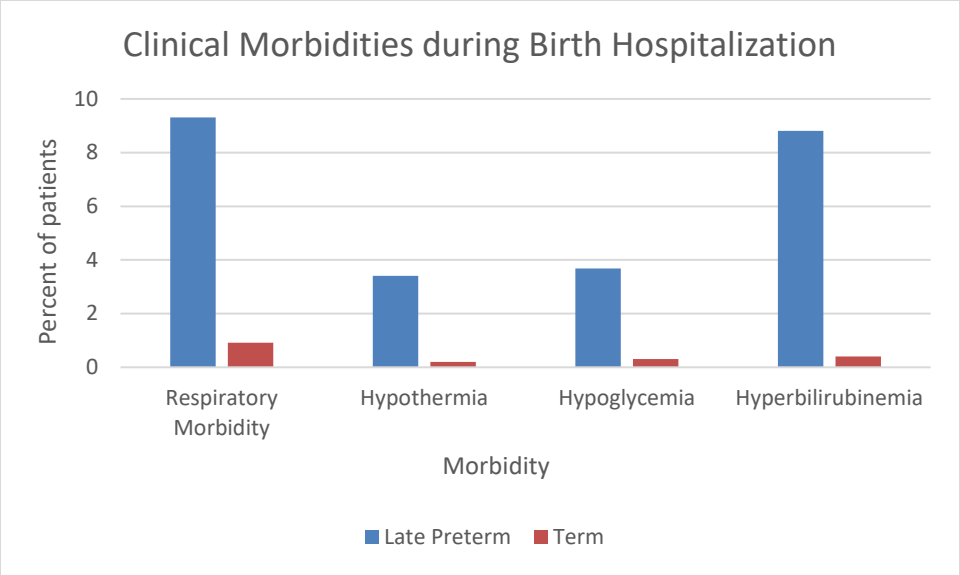


**Figure 2:** Clinical morbidities noted during birth hospitalization from pooled data for late preterm and term patients.[11-13,77,78,90,91]

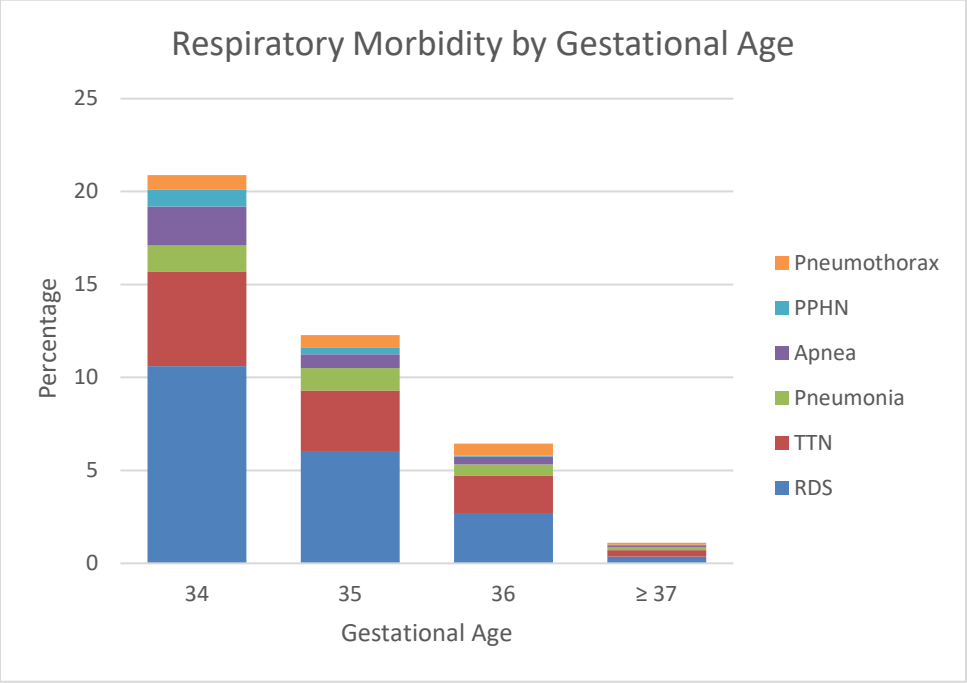


**Figure 3:** Respiratory morbidities by gestational age. (Data adapted from Teune MJ, Bakhuizen S, Gyamfi Bannerman C, et al. A systematic review of severe morbidity in infants born late preterm. *American Journal of Obstetrics and Gynecology.* 2011; 205(4):374.e371-379.)

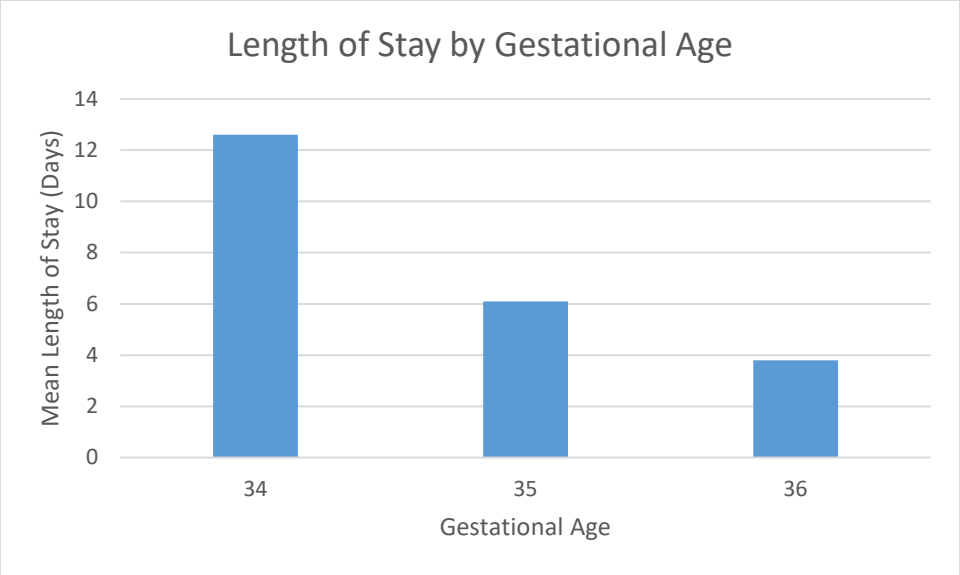


**Figure 4:** Mean Length of Stay by Gestational Age in Weeks (Data adapted from Pulver LS, Denney JM, Silver RM, Young PC. Morbidity and discharge timing of late preterm newborns. *Clinical Pediatrics.* 2010; 49(11):1061-1067.)

| **Table 2**<br>**Sample Management and Monitoring Guideline for Late Preterm Infants during the Birth Hospitalization** | |
|---|---|
| Delivery Room[30,88,89,92] | • Monitor for signs of respiratory distress<br>• NRP Guidelines followed if resuscitation is needed<br>• Thermoregulation measures: hat and skin to skin or radiant warmer<br>• Vital signs (heart rate, respiratory rate, and temperature) measured within the first hour of birth |
| NICU Admission Decision[30] | • Significant resuscitation in the delivery room (i.e. positive pressure ventilation, chest compressions, medications) or clinical concerns, observe patient with continuous vital sign monitoring for at least 6 hours<br>• Institution-specific guideline for gestational age and weight parameters for NICU admission considered when determining admission placement |
| Thermoregulation[30,88,89] | • Temperature measurement every hour for the first 6 hours and then minimum of every 6 hours until discharge<br>• If temperature is <36.0ºC, swaddle infant and cover head with a hat. In 30 minutes, if temperature remains <36.0ºC, place infant under radiant warmer. If still <36.0ºC despite radiant warmer, admit infant to higher level of care, if in Well Baby Nursery, for further evaluation and management. |
| Respiratory Distress[30,89] | • During the first 2 hours after delivery infants may have abnormal respiratory rates (rate 25-100 breaths per minute). Normalization is expected after this transitional period (respiratory rate 40-60 breaths per minute).<br>• Monitor for signs of respiratory distress throughout the birth hospitalization.<br>• If signs of respiratory distress arise, institute cardiorespiratory monitoring with consideration to move infant to higher level of care.<br>• Apnea with pause in breathing >20 seconds also requires closer cardiorespiratory monitoring and transfer to higher level of care. |
| Feeding[3,30,88,89] | • All aspects of feedings monitored including latch, frequency, volume, and duration.<br>• Daily weights monitored.<br>• Optimize feeding by having a health care professional observe at least one feeding each shift. If the infant is breastfeeding, this may be performed by a lactation consultant.<br>• If feeding difficulty noted, early consultation with speech therapy or occupational therapy. |

| | |
|---|---|
| | • If excessive weight loss (more than 3% per day of age or more than 7% of birth weight total) consider further evaluation for dehydration and possible supplementation.<br>• If the infant is unable to maintain adequate oral intake other forms of feeding, such as gavage feedings are recommended. |
| Hypoglycemia[93] | • Birth to 4 hours of age: Encourage feeding within 1 hour of birth and measure glucose 30 minutes after feeding. If glucose is <25 mg/dL refeeding is recommended. If glucose still <25 mg/dL one hour after feeding IV glucose is recommended. If glucose is 25-40 mg/dL refeeding or IV glucose is recommended.<br>• From 4 hours to 24 hours of age: Glucose measurement is recommended before each feeding. If <35 mg/dL feed, and recheck in 1 hour. If still <35 mg/dL IV glucose is recommended. If glucose 35-45 mg/dL encourage feeding or consider IV glucose.<br>• If symptomatic hypoglycemia, give IV glucose. |
| Hyperbilirubinemia[94,95] | • Assess risk factors for hyperbilirubinemia, including ABO incompatibility and presence of maternal antibody for each infant.<br>• If maternal blood type is Rh negative or O Rh positive, determine infant blood type.<br>• Monitor clinical signs of jaundice regularly.<br>• Within the first 24 hours, obtain transcutaneous or serum total bilirubin.<br>• For infants >35 weeks of age, treat hyperbilirubinemia with phototherapy per the AAP guidelines.<br>• For infants <35 weeks, initiate phototherapy at a lower threshold. Because of inadequate evidence regarding the treatment threshold in this group, each institution should establish their own guidelines. |

**Table 3**
**Discharge criteria recommendations for late preterm infants[3,30,88,89]**

| | |
|---|---|
| • Generally a minimum of 48 hours of age unless necessary competencies established beforehand<br>• 12 to 24 hours of stable vital signs (heart rate, respiratory rate, temperature)<br>• Physical examination without abnormalities for which ongoing hospital management is necessary<br>• Adequate feeding for at least 24 hours with at least two feedings observed by health care professionals.<br>• If weight loss more than 3% per day, or 7% total, at time of discharge consider dehydration evaluation and/or supplementation prior to release. | • Passage of at least one stool.<br>• Bilirubin level (transcutaneous or serum) documented and does not require intervention<br>• All state mandated screening evaluations performed (newborn metabolic, hearing, congenital heart screens)<br>• Car seat study passed if applicable.<br>• Family and social situation assessed and appropriate for discharge<br>• Outpatient follow-up scheduled within 24 to 48 hours of discharge |