Abstract

Background: Late preterm infants are infants born between 34 and 36 6/7 weeks gestation. Compared to term infants, late preterm infants are at increased risk for breastfeeding difficulties, hypoglycemia, hyperbilirubinemia, and hypothermia due to their relative physiologic and metabolic immaturity.

Problem: Medical record reviews performed at a level III maternal and newborn hospital in central Illinois revealed only 64% of late preterm infants admitted to the newborn nursery received care per the unit late preterm infant policy. The aim of this quality improvement project was to increase nurse adherence to the policy to 80%.

Methods: Between May 2022 and September 2022, several interventions were implemented for maternal–child nurses and support clinicians: an education offering, creation of a late preterm infant-specific breastfeeding log, and electronic medical record updates. Post-intervention medical record reviews measured policy adherence through documentation of feeding sessions, hypoglycemia, hypothermia, and hyperbilirubinemia. Descriptive statistics were performed to determine improvement.

Results: Nurse adherence to the late preterm infant policy increased to 90% over the period of the project.

Clinical Implications: Late preterm infant care protocols should be in place in all newborn nurseries. Late preterm infant policy adherence can be supported through electronic medical record prompts, use of a late preterm infant-specific breastfeeding log, and continuing education.

Key words: Breast feeding; Infant nurseries; Newborn; Premature infant; Quality improvement.

STANDARDIZING CARE OF THE LATE PRETERM INFANT

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Preterm birth, or birth before completion of 37 weeks' gestation, is the leading cause of neonatal mortality worldwide (Cao et al., 2022; Karnati et al., 2020). Nearly 75% of preterm births are late preterm infants (LPIs), born between 34 weeks and 36 6/7 weeks gestation (Karnati et al., 2020). LPIs are often the size and weight of term infants and because of this, LPIs ≥35 weeks are admitted to the newborn nursery rather than the neonatal intensive care unit (NICU; Chen et al., 2022). However, the LPIs' physiologic and metabolic immaturity increases their risk for complications such as breastfeeding difficulty, hypoglycemia, hyperbilirubinemia, hypothermia, respiratory distress, and neurologic issues (Ahmed & Rojjanasrirat, 2021). Hospital readmission rates for LPIs are double that of term infants (4.2% vs. 2.1%), and risk for rehospitalization is higher for LPIs who were never admitted to the NICU, had short NICU stays, or who were discharged from the hospital after less than 2 nights (Kardum et al., 2022; Speer et al., 2021). Later in life, LPIs have a higher risk for cognitive and speech delays, behavioral problems, and psychological disorders (Karnati et al., 2020). The interventions presented here are aimed at decreasing LPI morbidities during the post-birth hospital stay and increasing long-term breastfeeding success to prevent future cognitive, behavioral, and psychological issues.

Local Problem

This quality improvement project took place in the maternal–child units of a level III maternal and newborn hospital (Illinois Department of Public Health [IDPH], 2016) in central Illinois. The team on the postpartum unit includes 38 registered nurses and 14 health care technicians. The labor and delivery unit has 71 registered nurses, 9 health care technicians, and 10 surgical technicians. There are 7 registered nurses in the hospital breastfeeding clinic and 13 additional registered nurses who float between the postpartum and labor and delivery units. Numbers fluctuate due to turnover and traveler contracts, but clinicians on all of these units participate in LPI care.

There were 2,650 births in 2022 at the project hospital. Of these, 280 were late preterm, and 143 were LPIs ≥35 weeks gestation and admitted to the newborn nursery. Infants less than 35 weeks' gestation are admitted to the NICU. The maternal–child units have an LPI policy that aligns with care recommendations from the Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN) Clinical Practice Guideline, *Assessment and Care of the Late Preterm Infant* (2017). The LPI policy was released in June 2020, during the COVID-19 pandemic. However, the maternal–child unit educator noted in conversations with clinicians that while they were aware of the new policy, they were not always following it.

In late 2020, the maternal–child unit educator convened a quality improvement team of four nurses from the postpartum unit and one nurse from breastfeeding clinic. The team conducted a medical record review of the 25 LPIs admitted to the newborn nursery in November and December 2020 to obtain a baseline for how closely the LPI policy was being followed. This medical record review provided measurement data for the four critical components of LPI care: breastfeeding, hypoglycemia, hyperbilirubinemia, and hypothermia (Table 1). The review team used the results to determine which changes they believed would be most beneficial to LPI care, namely, creation of a breastfeeding and pumping plan for the first 24 hours post-birth.

In 2021, the team completed a literature review on LPI care in the first 24 hours of life, focusing on interventions to help prevent LPIs from being transferred to the NICU. The search database used was PubMed, and limits were set to include research articles published in English in peer-reviewed academic journals going back 5 years. Search terms included *late preterm*; the Boolean AND the terms *breastfeeding, hospital interventions, hospital care, hypoglycemia, hypothermia,* and *early feeding*. Results of the search included 77 articles that were reviewed for relevance. Of these, 15 were appraised by the team of five nurses using a tool created by nurse researchers at the perinatal center. The appraisal tool followed a standard literature review format but also asked two questions that would be used to shape this project: "How do the author's recommendations compare with practices in your setting?" and "What changes, if any, would you recommend in your setting based on the evidence presented?" Completed appraisals were submitted to the maternal–child unit educator and the group met to discuss results. But in mid-2021, the project was put on hold due to COVID-19-related staffing shortages. The project was restarted by the first and third authors in May 2022.

Establishing an early breastfeeding plan is crucial for late preterm infants.


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Rationale

The theoretical framework used to guide this project was the Reach, Effectiveness, Adoption, Implementation, and Maintenance Model, or RE-AIM Model (Glasgow et al., 1999). The RE-AIM framework allows for all stakeholders to be aware of essential program elements, ultimately improving implementation and sustainability of evidence-based interventions (Glasgow et al., 1999). The model was applied as follows:

- Reach: LPIs; their parents; and maternal–child registered nurses, neonatal nurse practitioners, and clinicians
- Effectiveness: Success of project interventions was measured via medical record review of nursing documentation
- Adoption: Completion of an online LPI care educational course
- Implementation: Two new tools put into place in the electronic medical record (EMR) to assist in documentation of LPI care
- Maintenance: Program maintenance assured by both the maternal–child unit educator and the maternal–child quality improvement coordinator.

The project proposal was presented to the perinatal center's inpatient pediatric best practice committee and approved for implementation. The proposal was also submitted to the hospital institutional review board but because it was a quality improvement project, approval was not required.

Specific Aim

The initial medical record review revealed a 64% adherence rate to the LPI policy. The aim of this project was to

TABLE 1. LATE PRETERM INFANT MEDICAL RECORD REVIEW QUESTIONS AND RESULTS

Medical Record Review Question	Pre-Intervention Sample Size (*n* = 25)	Pre-Intervention Adherence Rate	Post-Inter vention Sample Size (*n* = 25)	Post-Intervention Adherence Rate
Thermoregulation				
Was the infant placed in the warmer if the temperature was 97.5 °F or below?	8	63%	11	86%
Was a temperature check completed every 30 minutes while in the warmer?	8	75%	11	86%
Was the temperature rechecked 30 minutes after the infant was removed from the warmer?	8	38%	11	71%
Were glucose checks performed for infants with low temperature?	7	86%	11	100%
Was the bath postponed until temperature criteria were met?	20	95%	25	100%
Was the temperature checked 1 hour post-bath?	21	62%	23	100%
Was thermoregulation policy followed post-bath?	21	100%	23	100%
Hypoglycemia				
Was hypoglycemia protocol followed?	25	100%	22	100%
Hyperbilirubinemia				
Was a transcutaneous bilirubin charted every 12 hours?	21	95%	23	100%
Breastfeeding				
Was the infant fed at least every 3 hours?	25	56%	25	85%
Did the mother practice triple feeding?	20	75%	21	100%
Was the amount of milk expressed documented?	16	50%	17	80%
Was a lactation note written within 24 hours?	25	40%	20	70%
Was a special feeding plan written?	17	41%	21	100%
Was the special feeding plan followed by staff?	7	57%	16	100%

increase the rate to 80% in the first round of the quality improvement process with the goal of additional improvement in subsequent rounds until a 100% adherence rate is reached (Institute for Healthcare Improvement, 2016).

Literature Review

A second literature search was conducted by the first author in May 2022 to ensure current LPI care practices at the perinatal center were consistent with available evidence. PubMed, CINAHL, and Embase were searched, and limits were set to include research articles published in English in peer-reviewed academic journals between 2012 and 2022. Search terms included *late preterm*; the Boolean AND; and the search terms *breastfeeding, hypothermia, hypoglycemia,* and *neonatal hyperbilirubinemia*. Initial searches yielded 658 articles, which were condensed down to 578 after duplicates were removed. Of these, 28 articles were reviewed and 10 were found to have direct application to this quality improvement project. These addressed various aspects of LPI care, including breastfeeding and nutrition needs, inpatient care planning, quality improvement initiatives, and nursing education.

Breastfeeding

The literature search revealed the importance of using standardized care practices for LPIs with a special emphasis on breastfeeding. Adequate feeding affects the LPI's ability to manage hypoglycemia, hyperbilirubinemia, and hypothermia (Ahmed & Rojjanasrirat, 2021; Lober et al., 2021). Human milk reduces risk of both short-term and long-term morbidities (Natalia et al., 2022). To establish and encourage breastfeeding during the post-birth hospital stay and beyond, mothers should put LPIs skin-to-skin, breastfeed within 1 hour of birth, keep them in the room ("rooming in"), and use lactation specialist support (Ahmed & Rojjanasrirat, 2021; AWHONN, 2017). Triple feeding, or attempting to breastfeed, then using the breast pump, then bottle-feeding expressed milk, should be used to protect maternal milk supply and ensure LPIs receive sufficient milk (Adams, 2023).

Hypoglycemia

Hypoglycemia can occur up to three times more often in LPIs than term infants (Karnati et al., 2020). Therefore, blood glucose checks before each feeding for the first 24 hours of life should be part of a standardized LPI care plan (AWHONN, 2017). Early, frequent feedings (every 2–3 hours at a minimum) should be encouraged to prevent precipitous drops in glucose levels (AWHONN, 2017; Thornton et al., 2015). Mild to moderate hypoglycemia can be managed with breastfeeding, bottle feeding, and/or administration of glucose gel per institutional policy (AWHONN, 2017; Harris et al., 2013).

Hyperbilirubinemia

Compared to term infants, LPIs are twice as likely to develop hyperbilirubinemia due to increased production and delayed conjugation of bilirubin (Brown et al., 2020). Presence of jaundice should be assessed in the first 24 hours of life via transcutaneous or serum bilirubin levels, with repeat levels every 12–24 hours until discharge (AWHONN, 2017). Establishing an early breastfeeding plan can be crucial, as hospital readmissions are often due to breastfeeding-related concerns, including jaundice (Busch & Silbert-Flagg, 2021; Karnati et al., 2020).

Hypothermia

LPIs are not able to maintain a stable body temperature as easily as term infants (Karnati et al., 2020). Skin-to-skin contact is an effective way to maintain infant body temperature and parents should be encouraged to have frequent skin-to-skin sessions with their LPIs (American Academy of Pediatrics & American College of Obstetricians and Gynecologists, 2017). Temperature checks should be performed every 30 minutes for the first 2 hours of life, then every 4 hours for the first 24 hours, then once a shift if stable, for early detection of hypothermia and subsequent intervention as needed (American Academy of Pediatrics & American College of Obstetricians and Gynecologists, 2017; AWHONN, 2017). Bathing should be delayed as long as possible, ideally until 12–24 hours of age, to decrease complications from cold stress (AWHONN, 2017; Loring et al., 2012; Warren et al., 2020).

Synthesis of Literature

Findings from the literature review support the need for standardization of care for LPIs. A breastfeeding plan that includes nursing assessments and interventions is key to reducing risk for hypoglycemia, hyperbilirubinemia, and hypothermia. Care protocols should be followed closely to ensure LPIs remain stable during the initial post-birth hospital stay.

Methods

Context

Several educational opportunities about LPI care have been provided by the project hospital since 2013, including a mandatory 4-hour course for registered nurses, a delayed bathing project in 2016 to help decrease incidence of hypothermia, and a new hypoglycemia policy, also instituted in 2016. In 2020, the evidence-based LPI policy was put into effect. The policy was created by the newborn nursery nurse practitioners with the input of nurses and consistent with AWHONN (2017) LPI guidelines. Policy education was presented in a postpartum staff meeting by the nurse practitioners and those who did not attend the meeting were required to sign an education log to confirm they had reviewed the information. Despite these efforts, LPI care did not meet the present standards for thermoregulation, hypoglycemia and hypothermia, and breastfeeding based on the initial medical record review indicating only 64% LPIs were consistent with the unit's evidence-based LPI policy.

Interventions

This project included three major interventions: an online course, a new breastfeeding log, and an EMR shortcut.

The online course provided a review on how to care for LPIs on the maternal–child units. The course was written by the first and third authors and included both evidence-based guidelines and hospital-specific directions on how to apply the guidelines to LPI care. In June 2022, the hospital education team uploaded the course to the learning management system, and it was assigned to all nurses and technicians on the labor and delivery and postpartum units and the breastfeeding clinic. Nurses in traveler or agency roles were not required to complete the course but received emails with information on the changes made. The teams were given 6 weeks to complete the online course during work hours and 1 hour of continuing-education credit was provided. Reminder emails from both the hospital learning management system and the maternal–child unit educator were sent weekly as the due date approached.

The perinatal center's current breastfeeding log did not include information about LPI feeding needs or prompts for triple feeding, so a new LPI breastfeeding log was created in consultation with breastfeeding clinic nurses (Figure 1). The LPI-specific breastfeeding log is

FIGURE 1. LATE PRETERM INFANT-SPECIFIC BREASTFEEDING LOG

Breastfeeding Log

For Late Preterm Infants and Infants weighing less than 6 pounds

Establishing milk supply interventions:

1. Feed your baby every 3 hours at a minimum. Feedings should take a total of 30 minutes for both breast and bottle combined.
   - If baby is too sleepy or not sucking, you may attempt for 5–10 minutes maximum or begin breast pumping.
   - Consider offering the breast every other feeding as your baby begins to build stamina.
   - If alert and energetic, allow baby to nurse for 5–15 minutes. May only be one breast. Stop if baby is tired.
2. Breast Pump EVERY time your baby is fed.
   - You may only pump drops initially which is expected.
3. Supplement according to the Academy of Breastfeeding Medicine protocol (these amounts may be higher if your baby has low blood sugar levels)
   - First 24 hours: 2–10 ml with each feeding
   - Use expressed breastmilk/colostrum first (if available) before formula.

StartTime	Breastfeed		Breast Pump	Supplement
StartTime ________	Right: ________ min Energetic or Sleepy	Left: ________ min Energetic or Sleepy	Volume pumped ________ ml	Amount Fed: Colostrum ________ ml Formula ________ ml

StartTime	Breastfeed		Breast Pump	Supplement
StartTime ________	Right: ________ min Energetic or Sleepy	Left: ________ min Energetic or Sleepy	Volume pumped ________ ml	Amount Fed: Colostrum ________ ml Formula ________ ml

StartTime	Breastfeed		Breast Pump	Supplement
StartTime ________	Right: ________ min Energetic or Sleepy	Left: ________ min Energetic or Sleepy	Volume pumped ________ ml	Amount Fed: Colostrum ________ ml Formula ________ ml

StartTime	Breastfeed		Breast Pump	Supplement
StartTime ________	Right: ________ min Energetic or Sleepy	Left: ________ min Energetic or Sleepy	Volume pumped ________ ml	Amount Fed: Colostrum ________ ml Formula ________ ml

StartTime	Breastfeed		Breast Pump	Supplement
StartTime ________	Right: ________ min Energetic or Sleepy	Left: ________ min Energetic or Sleepy	Volume pumped ________ ml	Amount Fed: Colostrum ________ ml Formula ________ ml

printed and given to each mother–baby dyad on admission to the postpartum unit. After parents record their feedings, nurses transcribe them into the EMR every 4 hours. The new log prompted nurses to provide education on the feeding challenges LPIs face and provided parents and nurses with a way to document time and type of feeding.

LPI discharge instructions needed to be as easily accessible as term infant discharge instructions. The perinatal center uses an EMR database that allows for shortcuts to be created to assist in documentation. There is an existing shortcut that allows for newborn discharge education to populate into discharge paperwork, but there was no shortcut for LPI-specific discharge education. There were hard copies of LPI education materials available on the unit; however, these were stored in a cabinet at the nurses' station and often forgotten. To remedy this, a shortcut for LPI-specific discharge education was added to the EMR.

After maternal–child clinicians completed the online course, a follow-up email was sent detailing how to use the LPI breastfeeding log and EMR shortcut. This information was reinforced in shift huddles, weekly education emails, and quarterly team meetings by the unit educator and unit nurse leaders. To reinforce and encourage uptake of the revised LPI care workflow, progress toward meeting the goal of 80% policy adherence was documented via monthly medical record reviews and posted on the unit.

Results

Between June 15, 2022, and July 31, 2022, 100% of registered nurses, advanced practice nurses, and support clinicians completed the online course and passed a post-test. Adherence to the LPI policy was measured through medical record documentation. If it was documented, it was considered completed and if not documented, it was considered missed. Two samples of 25 LPI charts were used for both the 2020 pre-intervention medical record review and the 2022 post-intervention medical record review, respectively, because this was the number of LPIs admitted to the newborn nursery during each 2-month period, November and December 2020 and September and October 2022 (Table 1). Variations in sample size are seen because not every LPI required every intervention, parents refused care per protocol (as was the case with one parent who did not want to delay bathing), or one or more infants were admitted to the NICU partway through their post-birth stay. NICU care policies differ from maternal–child policies and were not a part of this project. Overall, 2-month post-intervention adherence to the LPI policy was 90%; an improvement of almost 40.6% over the pre-intervention percentage of 64%.

CLINICAL IMPLICATIONS

- Evidence-based practices for late preterm infants that are consistent with national standards and guidelines promote quality care.
- The second edition of AWHONN's (2017) *Assessment and Care of the Late Preterm Infant: Evidence-based clinical practice guideline* is an excellent starting point for improving LPI care.
- Nurses and other clinicians caring for LPIs should review and understand the evidence on the benefits of breastfeeding for this population and the association with reduction of risk for hypoglycemia, hyperbilirubinemia, and hypothermia.
- Electronic medical record review by staff nurses on specific aspects of clinical care can allow the team to examine current practice and make changes as needed.

Thermoregulation

Adherence to the thermoregulation protocol averaged 74% pre-intervention and 92% post-intervention. Within the thermoregulation subcategories, adherence to the thermoregulation protocol post-bath was highest at 100%. Documentation of LPI temperature rechecks 30 minutes after removal from the warmer improved from 38% to 71% post-intervention, less than the 80% goal. A documentation rate of 100% was achieved in the subcategories of performing glucose checks with low temperature, delayed bathing, and the post-bath 1-hour temperature check.

Hypoglycemia and Hyperbilirubinemia

Hypoglycemia protocol adherence was maintained at 100%. Hyperbilirubinemia protocol adherence improved from 95% to 100%.

Breastfeeding

Mean LPI breastfeeding adherence was 50% pre-intervention and 87% post-intervention. The pre-intervention medical record review revealed low scores in three subcategories: documenting feedings every 3 hours (56%), documenting amount of milk expressed during pumping sessions (50%), and having a lactation consult within 24 hours of birth (40%). Post-intervention these increased to 85%, 80%, and 70%, respectively.

Discussion

LPIs are cared for in the labor and delivery, postpartum, newborn nursery, and NICU units. Lack of awareness of evidence-informed research on this infant population can cause nurses to rely on their experiential knowledge, which can lead to inconsistencies in care and confusion for parents and families (Currie et al., 2018). The initial medical record review finding of 64% adherence to the LPI policy confirmed the need for improvement in nurse documentation of LPI care. Two months after interventions were implemented, adherence to the LPI policy was 90%, surpassing the original 80% goal.

Thermoregulation

Overall improvement was seen in this area, which is consistent with previous quality improvement work that implemented multiple strategies to improve thermoregulation in LPIs (Andrews et al., 2018). One area (post-warmer temperature recheck) did not meet the 80% goal. This is likely because the newborn is returned to mother from the newborn nursery after warmer removal. The temperature recheck then falls to the postpartum dyad nurse. Responsibility for several mother–baby dyads, staffing shortages, or forgotten or delayed communication between the nursery nurse and the dyad nurse are possible reasons why the post-warmer recheck scored lowest in adherence in this category. Improved communication strategies between the nursery nurse and postpartum nurse are needed to increase adherence in this area.

Hypoglycemia and Hyperbilirubinemia

Both adherence categories (following hypoglycemia protocol and performing regular bilirubin checks) were above the 80% threshold pre-intervention and at 100% post-intervention. These nursing protocols are followed for each newborn admitted to the newborn nursery and are not unique to LPIs. This familiarity likely resulted in the high adherence rates seen.

Breastfeeding

The most challenging area of care for nurses was the breastfeeding needs of LPIs (Lober et al., 2021). LPIs should breastfeed every 2 to 3 hours, and often need increased nursing support to do so effectively (AWHONN, 2017; Coleman, 2020; Jonsdottir et al., 2020). The pre-intervention medical record review showed that only about half of LPIs were feeding every 3 hours. One reason for this may be that parents are expected to document feedings on the feeding log themselves. The nurse later transcribes entries from the log into the chart. However, if the parent does not document a feeding it will not be charted by the nurse. Misplaced logs may also result in missed documentation of feedings. Many missed feedings occurred at night, perhaps because parents were sleeping through them. This should have been identified and addressed with education from the nurse. Increased post-intervention adherence rates indicate that the new breastfeeding log improved communication and documentation, confirming findings from previous projects (Pisegna & Pyka, 2014). Further investigation to determine if the root cause is forgotten documentation or missed feedings would help to clarify this issue and determine next steps.

Pre-intervention, the perinatal center experienced difficulty providing a breastfeeding consultation to mothers of LPIs within 24 hours of birth due to staffing issues, particularly over the weekend. It appears that breastfeeding clinic nurse completion of the LPI online course helped them to reprioritize seeing LPIs first, because post-intervention, the number of LPIs being seen within 24 hours greatly improved.

Limitations

This project had a small sample size and a short timeline. It was completed at a level III maternal and newborn facility (IDPH, 2016) in a rural area and was part of a student project, which may have contributed to small sample size.

Conclusion

Results were shared with the inpatient pediatric best practice committee and presented at the perinatal center's annual research conference. With the conclusion of this initial phase of the project, the maternal–child unit educator and the maternal–child quality improvement coordinator assumed responsibility for project maintenance. To sustain the improvement observed during this project, they plan twice-yearly medical record reviews, and updates to the policy as needed. The LPI online course and the LPI policy and procedures were added to the postpartum and labor and delivery units' registered nurse orientation.

Future quality improvement initiatives could investigate breastfeeding documentation by parents and nurses as well as improved communication between newborn nursery and postpartum nurses. Follow-up to determine if the project's interventions helped with continued breastfeeding at 6 months and a year postpartum and whether it contributed to decreased readmission rates are planned at 1-year post-intervention. ✣

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