

SUPPORTING FEEDING OF LATE PRETERM INFANTS IN THE HOSPITAL: A QUALITY IMPROVEMENT PROJECT

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Abstract

Background: Feeding difficulty is the most common cause of delayed hospital discharge and readmission of late preterm infants. Frequent and adequate feedings from birth are protective against dehydration, hypoglycemia, and jaundice. The National Perinatal Association's feeding guidelines provide the foundation for late preterm infant standards of care. Feeding at least every 3 hours promotes nutritional status and neurologic development. One feeding assessment every 12 hours during the hospital stay can ensure quality of infant feeding.

Problem: At a large urban hospital, medical record reviews were completed to evaluate nursing care practices consistent with the hospital's late preterm infant care standard policy. Feeding frequency and nurse assessment of feeding effectiveness were far below acceptable targets. A quality improvement team was formed to address inconsistency with expected practice.

Methods: The project included an investigation using the define, design, implement, and sustain method of quality improvement. Parent education, nurse education, and visual cues were developed to sustain enhanced nursing practice.

Results: Late preterm infants who received feedings at least every 3 hours increased from 2.5% (1 of 40) to 27% (11 of 40); ($M = 0.275$, $SD = 0.446$), $p = 0.001$. Documented breastfeeding assessments increased from 2% (5 of 264) to 8% (10 of 126), $p = 0.001$. Documented bottle-feeding assessments increased from 15% (39 of 264) to 31% (53 of 172), $p < 0.001$. Intervention time was cut short due to reprioritization of efforts in response to the COVID-19 pandemic.

Conclusion: Interventions and implementation of this process improvement is easy to replicate through attainable and sustainable goals directed toward improved outcomes for late preterm infants.

Key words: Feeding; Late preterm infants; Neonatal; Process improvement; Quality improvement.

Problem

Late preterm infants are infants born between 34 weeks and 36 6/7 weeks gestation. Most late preterm infants are born spontaneously at 36 weeks with physiologic stability not requiring special care nursery admission throughout the hospital stay (Delnord & Zeitlin, 2019). Feeding difficulty is the most common reason for delayed discharge and readmission (Huff et al., 2019). Ensuring adequate and frequent newborn feedings is protective against dehydration, neurologic compromise, and readmission (Phillips et al., 2013).

As a part of routine medical record reviews for unit quality assurance, the medical records of 40 late preterm infants were examined between October and December 2019 for consistency with the hospital late preterm standards of care policy. The policy is aligned with late preterm infant care guidelines from the National Perinatal Association (Phillips et al., 2013). Key aspects of the policy include requirements for late preterm infants to be fed at least every 3 hours and nursing assessments of at least one feeding each shift. Of the sample, only one late preterm infant (2.5%) was fed at least every 3 hours throughout the hospital stay. Frequency between feedings ranged from 4 to 16 hours. Of the 264 nursing shifts in this sample, each 12-hour nursing shift was counted throughout the stay of all 40 late preterm infants, five (2%) of the shifts where breastfeeding occurred had a documented assessment and 39 (15%) of the shifts where bottle feeding occurred had a documented assessment. Due to the large gap between policy standards and actual practices, a quality improvement team was formed to improve consistency with expected practice.

Available Knowledge

Feeding complications are a significant challenge for late preterm infants. More than one third (32%) of late preterm infants are diagnosed with feeding issues during the birth hospitalization, compared with only 7% of term infants, delaying discharge and requiring supplementation (Huff et al., 2019; Kuhnly, 2018). Poor feeding increases risk of comorbidities, especially hypoglycemia and hyperbilirubinemia (Huff et al.; Williams & Pugh, 2018). Average length of stay is inversely related to gestational age: 12.6 days for 34 weeks, 6.1 days for 35 weeks, and 3.8 days for 36 weeks (Huff et al.). Feeding issues are responsible for approximately three-fourths of delayed discharges (Huff et al.).

Late preterm infant feeding difficulties are attributed to neurological immaturity (Huff et al., 2019). Between 34 weeks and 40 weeks gestation the fetal brain gains one third of its weight, the cortex increases two-fold, and white matter increases five-fold (Favrais & Saliba, 2019). The neurons of the late preterm infant brain have decreased myelination, delaying the speed and efficiency of electrical impulses (Favrais & Saliba). Neurologic immaturity prevents state regulation, coordination of feeding patterns, and adequate oromotor tone which prohibits effective feeding (Jonsdottir et al., 2021; Lapilonne et al., 2019). Excessive weight loss ($\geq 8\%$) due to

Development of an evidence-based program stressing the importance of regular frequent feedings can encourage postpartum and newborn nurses to standardize the care and clinical management of late preterm newborns.

ineffective feeding can cause growth restriction and failure to thrive (Phillips et al., 2013). Poor intake and hepatic immaturity lead to low bilirubin clearance and increased hyperbilirubinemia. Once in phototherapy treatment for jaundice, late preterm infants may have reduced opportunity for skin-to-skin contact and great risk for separation.

A steady intake of glucose fuels the neonatal brain promoting continued growth and development. However, late preterm infants get caught in a critical loop of neurological immaturity that can result in feeding difficulties preventing a steady intake of glucose and increasing the risk for further neurologic compromise. Late preterm infants who experienced untreated hypoglycemia demonstrated a four-fold increase in impaired executive function at the age of four, compared with those without hypoglycemic episodes, and a two-fold increase if treated (McKinlay et al., 2017). The immature late preterm brain is more susceptible to damage caused by hypoglycemia and jaundice compounding long-term neurological issues involving learning, speech, and behavioral issues (Woythaler, 2019). Late preterm infants are physiologically predisposed to hypoglycemia due to immature glycogenolysis, adipose tissue lipolysis, hepatic gluconeogenesis, hormonal dysregulation, and ketogenesis (Williams & Pugh, 2018). Neurologic immaturity coupled with physiologic immaturity leads directly to feeding difficulties further impeding neurologic and physiologic development. Neurological issues may persist into childhood. Children born as late preterm infants demonstrate lower reading and math scores, poorer school performance, and poorer verbal reasoning (Palumbi et al., 2018; Shah et al., 2016). Therefore, the National Perinatal Association has provided guidelines for the care of late preterm infants emphasizing prevention of hypoglycemia as an imperative (Phillips et al., 2013).

Rationale

The quality improvement method was guided by the change model principles of define, design, implement, and sustain (Council for Six Sigma Certification, 2018). The hospital system uses this model for all quality and process improvement projects. The leader of the late preterm infant project team received formal training through the hospital system on the quality improvement process prior



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Due to neurological immaturity, late preterm infants are prone to sleeping through feedings or tiring during feedings resulting in increased risk for repeated, prolonged hypoglycemia.

to initiating the project. The *AWHONN Conceptual Model for Late Preterm Infant Care* was used to guide the development of the intervention (Association of Women's Health, Obstetric and Neonatal Nurses [AWHONN], 2017). The AWHONN conceptual framework centers late preterm infant health outcomes as influenced by preterm physiologic factors, nursing care practices, the care environment, and the importance of family participation. This quality improvement project addressed each element to ensure a comprehensive change.

Specific Aims

The primary aim was to increase the number of late preterm infants fed at least every 3 hours to 50%. The second aim was to increase the number of documented

feeding assessments to 50% for all nursing shifts in the postpartum unit. As a measure of program effectiveness, outcome data were collected on late preterm infants experiencing at least one episode of hypoglycemia, excessive weight loss ($\geq 8\%$ over the hospital stay), and jaundice.

Methods

Context

In 2014, Banner Health developed a late preterm standards of care policy for the postpartum setting based on the National Perinatal Association guidelines. The feeding procedures included feeding frequency of at least every 3 hours and a feeding assessment documented once every nursing shift (Phillips et al., 2013). In 2019, Banner University Medical Center—Phoenix had 5,524 births; among them 284 (5%) were late preterm infants who received care in the postpartum unit (were not transferred to the neonatal intensive care unit or special care nursery). Skin-to-skin contact and feeding were routinely initiated within the first hour after birth for all stable infants. Nurses working in the labor and delivery and postpartum units receive breastfeeding and supplemental feeding education upon hire and annually.

Late preterm infants are often provided similar care as term infants as demonstrated through medical record reviews and interviews with nurses. An interdisciplinary approach was taken with the assembly of a quality improvement team. The focus of the team was to perform a robust analysis of the hospital feeding practices for late preterm infants and to develop interventions. The team was composed of the project leader who is a registered nurse and international board-certified lactation consultant, a maternal child clinical nurse specialist, two labor and delivery nurses, and three postpartum nurses. The institutional review board of the hospital system determined approval was not needed for quality improvement projects.

The team consulted with other staff nurses and nurse leaders. Through interviews with nursing staff, medical providers, and families, barriers were identified. Barriers were grouped into categories by stakeholders: antepartum nurses, labor nurses, couplet care nurses, patients and families, and providers. Nursing and family education emerged as the greatest areas of need. The team strove for a multidimensional approach as early efforts of education only had not changed practice. Due to the workload demand, nurses stated they struggled to remember the specific care needs of late preterm infants. Families stated they were inundated with new information in the immediate postpartum period. Therefore, written reference material and visual cues were developed.

Intervention

The quality improvement team developed education for nurses and families using multiple modalities. The aspects of the intervention were developed with feedback from nurses through conversations initiated by members of the team. Once the interventions (nursing checklist,

late preterm infant feeding records, and visual cues) were prepared for implementation, the team provided nurse education via multiple modalities. The team collaborated with the unit-based Shared Leadership team for further dissemination of the education.

Parent Education

All parents are provided with a feeding record containing breastfeeding education, indications of adequate intake, and a chart to track and write down infant feedings and output. A patient feeding record was developed specific for late preterm infant families (Figure 1 supplemental digital content at <http://links.lww.com/MCN/A70>). The form gave a brief description of late preterm feeding patterns and behaviors and encouraged mother/families to feed their infant every 3 hours with appropriate volumes for supplementation if the infant did not effectively breastfeed. To prevent missed or late feedings, parents were encouraged to set an alarm on their phones. The late preterm infant feeding records were printed on yellow paper to be easily distinguished from the full-term feeding records on white paper.

Nursing Education

Nursing education was developed to include an approved standard of care policy, typical feeding patterns and behaviors, need for frequent feedings, and long-term risks associated with missed feedings. To promote staff awareness, the education was distributed via multiple modalities: email, unit-based social media groups, walking rounds, posters, and meeting presentations. A late preterm checklist was created to guide nurses providing care to late preterm infants. Included on the checklist was scripting and teaching prompts to assist nurses when talking with families of late preterm infant. A plan for yearly education and continued late preterm workgroups were developed to sustain the culture change.

Visual Cues

To promote recognition of the increased care needs of late preterm infants, visual cues served as reminders to nurses, support staff, and parents. A room sign is located on the outside of every patient door. Different tiles are available to remind nurses of the specific precautions or care needs of the family inside the room. Door tile signs were created labeled LPI. All infants receive pink and blue striped knit hats to wear throughout their hospital stay. White hats were purchased for late preterm infants to set them apart from full-term infants. The door tile and the white hat provide two visual prompts to encourage nurses to check the feeding record with each visit inside the room.

Study of the Intervention

The program was implemented over 11 weeks. To determine program effectiveness, medical records of 40 infants were reviewed and data were analyzed. These data were compared with the initial review of 40 medical records of preterm infants.

Measures

Medical records of late preterm infants were evaluated for length of time between feedings, nurse documentation of breastfeeding on shifts where breastfeeding occurred, and nurse documentation of bottle feeding on shifts where bottle feeding occurred. A medical record was determined to not be consistent with expected practice if there was at least one gap of 4 hours or longer between feedings. Nursing shifts were determined to be inconsistent with expected practice if an assessment of feeding was not documented during the shift for breastfeeding or bottle feeding as appropriate. Additional outcome measures included were an evaluation of incidence of hypoglycemia, jaundice, and weight loss.

Analysis

Percent differences were determined when comparing data before and after the intervention. A paired *t*-test was conducted to determine level of difference between feedings frequency and occurrence of documented feeding assessments before and after the intervention.

Results

There was a significant increase in the number of late preterm infants receiving feedings at least every 3 hours before the quality improvement project (2.5% [1 of 40]; $M = 0.00$, $SD = 0.00$) compared with after the project was initiated (27% [11 of 40] $M = 0.275$, $SD = 0.446$); $p = 0.001$. Range of time between feedings for those exceeding the guideline remained similar, 4 to 16 hours before the intervention and 4 to 11.5 hours after. Number of nursing shifts a breastfeeding assessment was documented (during shifts where breastfeeding occurred) increased significantly from 2% (5 of 264, $M = 0.019$, $SD = 0.136$) to 8% (10 of 126, $M = 0.119$, $SD = 0.325$), $p = 0.001$. Number of nursing shifts a bottle-feeding assessment was documented (during shifts where bottle feeding occurred) increased significantly from 15% (39 of 264, $M = 0.148$, $SD = 0.355$) to 31% (53 of 172, $M = 0.567$, $SD = 0.495$), $p < 0.001$.

No significant difference was noted in the occurrence of hypoglycemia, excessive weight loss ($\geq 8\%$ during the hospital stay), and jaundice. Before the intervention, 17 infants of 40 experienced at least one episode of hypoglycemia ($M = 0.425$, $SD = 0.494$); compared with 10 of 40 infants after the intervention ($M = 0.250$, $SD = 0.433$), $p = 0.10$. Excessive weight loss occurred in 4 of 40 infants before the intervention ($M = 0.100$, $SD = 0.300$) compared with 1 of 40 infants after the intervention ($M = 0.025$, $SD = 0.000$), $p = 0.170$. Seven infants experienced jaundice before the intervention ($M = 0.175$, $SD = 0.471$); 4 after the intervention ($M = 0.100$, $SD = 0.296$), $p = 0.336$.

Discussion

The aim of this quality improvement project was to increase the number of late preterm infants who are fed at least every 3 hours to 50% and to increase the number of documented feeding assessments by 50% for all nursing

CLINICAL IMPLICATIONS

- Interdisciplinary teams provide insight into the opportunities and barriers to create quality improvement.
- Targeted education on importance of frequent feeding for late preterm infants and the consequences of delayed or skipped feedings is motivation for practice change.
- Applying adult learning principles to multiple modalities increases retention of new education.
- Visual cues serve as constant reminders of the unique care needs of late preterm infants that are essential for positive health outcomes.
- Providing care strategies, such as setting an alarm as reminders of feeding times, empowers the family to assume full care with appropriate response.

shifts. We did not achieve the targeted percentage for either goal. However, we did observe a clinically significant improvement in overall consistency with the policy.

A multidimensional approach grounded in the structure of define, design, implement, and sustain process and the AWHONN *Conceptual Model for Late Preterm Infant Care* allowed for the development of a robust program. The quality improvement process (Six Sigma) guided the team through the discovery of barriers and learning needs, design of a program to engage both nurses and parents, implementation of the late preterm infant program, and identification of strategies for sustainability. The AWHONN (2017) framework kept late preterm infant health outcomes central to the work while directing attention to the hospital environment, nursing care, parental roles, and late preterm infant physiologic needs. The interventions and implementation of this process improvement project are easy to replicate with attainable goals for best practices and improved outcomes for the vulnerable population of late preterm infants.

Continued work is needed to support late preterm infants via sustainability and program improvement. Conversations with nurses and medical record reviews can keep the unique care needs of late preterm infants as the focal point. The initial nurse reaction to practice that was inconsistent with the policy was motivating to create change and brainstorm for barriers and opportunities for improvement. Late preterm infant education has now been incorporated into new hire onboarding, annual nursing education, monthly email reports, and staff nurse meetings. Medical records that indicate care inconsistent with policy are reported to leaders for follow-up with individual nurses. Monthly reports provide timely feedback of unit progress and motivation for continued improvement. Efforts to enhance quality improvement process continue to promote a multidisciplinary method to support practice change and sustained improvement.

The next phase of this project will include family education on long-term care of late preterm infants covering supportive feeding methods (supplemental nursing system, paced bottle feeding), protection of breast milk production (hand expression, pumping, long-term skin-to-skin contact), effective assessment of infant feeding progress, and progression of late preterm infant feeding patterns and behaviors. This initial quality improvement project has demonstrated need for electronic medical record documentation prompting and reminders. Recommendations were submitted for development of a care plan with alerts triggered by the gestational age. Our goal is to extend feeding support beyond the hospital stay. Although late preterm infants may not initially exclusively breast-feed, they are able to achieve the skill with practice and maternal breast milk production.

Limitations

The intervention coincidentally occurred during the first wave of the COVID-19 pandemic. Attention was shifted during this time to the radical adjustments needed in response to the public health emergency. Therefore, the intervention may not have yielded as great of an effect as would have occurred under other circumstances. The data collection period included an opportunity for evaluation of progress, yet had the time period been longer, a different result may have occurred.

Clinical Indications

Purposeful care of late preterm infants may serve to mitigate the comorbidities associated with prematurity. Bringing stakeholders together (including lactation consultants and other feeding specialists, nurses, and providers) into the defining and designing phase of the quality improvement process secures committed involvement. Placing and reinforcing prompts into daily practice motivates nurses to observe specific care needs of this population. Succinct education on the potential long-term effects of delayed or skipped feedings and a checklist in alignment with policy promotes engagement into the program to sustain change.

Passive education alone may not be enough to support a quality improvement change process. Retention of education was aided using multiple delivery modalities including in-person, virtual, and passive formats. Visual cues, door tiles, white infant hats, and yellow feeding records proved to be reminders to check for recent feedings and perform a feeding assessment.

Families can be empowered to adapt to the care needs of their late preterm infants. Infant feeding development would be well supported by instructions coupled with an evolving feeding plan. The sleepiness of late preterm infants leads to delayed feedings (Huff et al., 2019); therefore, techniques, such as setting an alarm, can help parents stay on track.

There are more techniques to support feeding development of late preterm infants than offered here. During the hospital stay, frequent feedings and assessment of feeding effectiveness are the priorities. Further investigation

could discover other best practices that are protective against dehydration, neurologic compromise, and readmission. When nurses provide consistent education, families can quickly reset their expectations of infant feeding and behavior to care for late preterm infants. ✚

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