Supporting Breastfeeding in Infants Hospitalized for Jaundice

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ABSTRACT

BACKGROUND: Infants readmitted for neonatal hyperbilirubinemia requiring phototherapy are less likely to exclusively breastfeed than infants who are not readmitted for phototherapy. Our aim for this study was to increase breastfeeding exclusivity for infants admitted for neonatal hyperbilirubinemia.

METHODS: Using the Model for Improvement, we conducted 3 plan-do-study-act cycles to improve exclusive breastfeeding (EB). Our outcome measure was to increase the percentage of EB for infants hospitalized for phototherapy from 30% to 80% in 12 months. Our process measure was to increase lactation consultations from 60% to 80%. Balancing measures included the development of >10% weight loss, acute bilirubin encephalopathy, readmissions, and length of stay. Interventions involved staff breastfeeding education, automated orders for lactation consultations, and use of bilirubin blankets during breastfeeding. Data were analyzed by using run charts and statistical process control.

RESULTS: A total of 92 infants with neonatal hyperbilirubinemia were admitted from December 2016 to August 2019, with 61 in the postintervention period. After implementation of an automated order for lactation consultation, EB improved from 30% to 60% and completed lactation consultations increased from 60% to 90%. Infants who received a lactation consultation within the first shift during their hospitalization were 4 times more likely to have EB during hospitalization than infants who did not (odds ratio 3.8; confidence interval: 1.17–12.39.) No infant experienced >10% weight loss, acute bilirubin encephalopathy, or a readmission, and length of stay did not significantly change.

CONCLUSIONS: Early involvement of trained lactation consultants safely improves rates of EB for infants hospitalized with neonatal hyperbilirubinemia.

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Neonatal hyperbilirubinemia is one of the most common indications for pediatric hospital admission. Admissions for neonatal hyperbilirubinemia are increasing, with a 160% increase in the number of admissions for phototherapy from 2000 to 2011. Breastfeeding jaundice, an exaggerated physiologic jaundice often attributed to inadequate neonatal intake of breast milk, is the most frequent underlying etiology for the development of hyperbilirubinemia requiring admission for phototherapy.

In infants requiring hospital admission for neonatal hyperbilirubinemia, phototherapy has been shown to lead to a decrease in the duration and exclusivity of breastfeeding. Maternal stress and poor maternal confidence in breastfeeding are factors frequently endorsed by mothers of infants who are hospitalized that have been associated with decreased exclusive breastfeeding (EB) rates. Because breastfeeding support has been shown to increase duration and exclusivity, providing breastfeeding support during hospitalization for phototherapy may increase maternal confidence and improve breastfeeding exclusivity.

Currently, the American Academy of Pediatrics guidelines recommend continuing breastfeeding during phototherapy and only supplementing with formula if the infant is dehydrated, if the infant has experienced excessive weight loss, or when there is inadequate intake. In light of this, we began a quality improvement (QI) initiative with the global aim to increase EB for infants admitted for neonatal hyperbilirubinemia. We hypothesized that limited availability of lactation consultants and lack of nursing and physician breastfeeding training at our hospital were contributing to our low EB rates. Our specific aims were (1) to increase the percentage of exclusively breastfeeding mothers of infants hospitalized for phototherapy from 30% to 80% in 12 months and (2) to increase lactation consultations for mothers who desired a lactation consultation from 60% to 80% in 12 months.

**METHODS**

**Context and Setting**

Our suburban hospital is a children's hospital within an adult hospital with 16 pediatric beds and 57 NICU beds that receives ~1500 pediatric admissions per year. The adult hospital has ~7000 births per year. We have an average of 60 admissions per year to the children's hospital of infants who were discharged after birth and require readmission for neonatal hyperbilirubinemia.

At our hospital, mothers and infants room-in together, and the child is cared for by a pediatric nurse and pediatric hospital medicine attending. Before the start of this QI project, pediatric nurses did not receive any structured breastfeeding training, nor did the pediatric hospitalists, outside of completing a pediatric residency. International Board-Certified Lactation Consultants (referred to as lactation consultants) were available to evaluate mother-infant dyads; however, their consultation required the placement of a formal order through the electronic medical record. Often, physicians would not order an official lactation consultation or would remember just before discharge, limiting the ability of the lactation consultants to evaluate the mother-infant dyad. In addition, infants admitted for phototherapy are usually directly admitted from community pediatricians to the hospitalist service in the early evening after lactation consultants are no longer available within the hospital.

At baseline within our institution, well-hydrated infants without excessive weight loss admitted for phototherapy were supplemented with formula 70% of the time, with 40% receiving little to no lactation support. One hundred percent of infants admitted requiring phototherapy were admitted after 12 PM and 62% were admitted after 5 PM.

Infants were included in this study if they were readmitted to the children's hospital for neonatal hyperbilirubinemia at ≤10 days of life from December 2016 to August 2019 and if they were eligible to breastfeed. Eligibility to breastfeed was defined as infants meeting all inclusion and exclusion criteria and also not having a contraindication to breastfeeding, per the American Academy of Pediatrics policy statement “Breastfeeding and the Use of Human Milk.” Infants were excluded for (1) dehydration, defined as ≥10% weight loss from birth weight, decreased urine output, or physical examination findings consistent with intravascular depletion; (2) demonstrating signs of acute bilirubin encephalopathy, with early findings of lethargy, irritability, or difficulty to console; (3) requiring admission to the NICU for exchange transfusion; and (4) maternal refusal of a lactation consultation. After admission of an infant for neonatal hyperbilirubinemia, a nurse would contact the patient’s admitting physician to determine if any exclusion criteria were met on admission.

**Interventions**

The Model for Improvement was used as a framework for our QI project. We met with multidisciplinary key stakeholders, including nursing staff, lactation consultants, and physicians, to identify key drivers for improving breastfeeding support (Fig 1). We conducted 3 plan-do-study-act cycles with the following interventions: cycle 1, nurse and physician education with order set creation; cycle 2, initiation of phototherapy blankets during breastfeeding and institution of bedside nursing documentation of latch, audible swallowing, type of nipple, comfort, hold (LATCH) score; cycle 3, deimplementation of biliblanket use and nursing LATCH documentation.

**Nurse Training and Physician Education**

During multidisciplinary meetings in October 2017, nursing staff identified a lack of training regarding assessing breastfeeding quality and latch and a knowledge gap in how to provide guidance around breastfeeding problems. To address this, lactation consultants provided a 6-hour in-person classroom education for nurses, followed by 3 hours of additional hands-on training with nursing mothers. These sessions included how to assess breastfeeding efficacy via the LATCH score, a
validated tool for predicting breastfeeding efficacy. In addition, all pediatric hospitalist physician staff attended a breastfeeding training focused on familiarity with lactation consultation services and precedence in obtaining consultation before discharge.

Order Set Creation
Previously, we had an admission order set for neonatal hyperbilirubinemia that did not include a lactation consultation. In October 2017, an automatic order for a lactation consultation was added and already prechecked to the neonatal hyperbilirubinemia admission order set. With the ordering of a lactation consultation, the lactation consultant would assess the mother’s milk supply by doing weights before and after breastfeeding and assessing the amount and color of expressed breast milk. They would also address breastfeeding problems, such as improper latch or hold, and address maternal concerns about insufficient milk supply.

**Phototherapy Blankets**
Mothers of infants admitted for phototherapy are often experiencing challenges with breastfeeding sometimes taking more than an hour to feed their infants, during which time the infant is not receiving phototherapy. Because of concerns regarding balancing the amount of time spent receiving phototherapy with the amount of time spent breastfeeding, we initiated the use of phototherapy blankets (Bilisoft [approved by the US Food and Drug Administration for use during breastfeeding]; GE Healthcare, Chicago, IL) during breastfeeding in May 2018.

**Initiation of LATCH Scoring Documentation**
Starting May 2018, nurses began documenting EB on a standardized breastfeeding evaluation form each shift (Supplemental Fig 4). If the infant was not exclusively breastfed, the nurse additionally documented whether this was due to maternal preference, developing an exclusion criterion, or another reason.

Nurses scored efficacy of breastfeeding at the beginning and end of each shift using a LATCH score. Nursing staff also documented whether a lactation consultant saw the infant during that shift. If the lactation consultant had not seen the infant, nurses documented whether the mother had declined a lactation consultation or whether the mother had seen a lactation consultant during another shift during the infant’s hospitalization.

**Deimplementation**
In November 2018, because of lack of efficacy, we stopped using biliblankets during breastfeeding, and nurses stopped recording LATCH scores on the standardized form. The automatic order for lactation consultation remained in place within the hyperbilirubinemia admission order set. We also conducted physician and nursing reeducation around early involvement of the lactation consultants.

**Study of Interventions**
We conducted a retrospective chart review to identify infants with hyperbilirubinemia...
admitted to the children’s hospital between December 2016 and August 2019. We collected 9 months of baseline data, followed by 3 plan-do-study-act cycles: cycle 1 from October 2017 to April 2018, cycle 2 from May 2018 to October 2018, and cycle 3 from November 2018 to August 2019. Infants were identified in the baseline period, cycle 1, and cycle 3 by using the Patient Keeper Application (PatientKeeper, Inc, Waltham, MA) This application is used to identify infants through diagnosis and age. Infants in cycle 2 were identified by using the bedside nursing LATCH documentation sheet. These sheets were completed by each bedside nurse for included patients and placed into a binder, where they were collected and reviewed. Demographic data on the infants, breastfeeding exclusivity, placement of a lactation order, and length of stay (LOS) were identified through a manual chart review conducted by the primary investigator.

LATCH scores were used as a marker that the nurse had assessed breastfeeding as well as an objective measure of whether breastfeeding efficacy had improved. Lactation consultants and the nurse manager recorded whether nurses had completed their 6 hours of training and 3 hands-on sessions with a lactation consultant.

Statistical Analysis

Our primary process measure was breastfeeding exclusivity during hospitalization. EB was defined as only feeding with expressed breast milk and/or direct breastfeeding without the use of supplementary formula or intravenous fluids. We calculated our outcome measure as the mothers who exclusively breastfed through the duration of hospitalization over the total number of infants eligible to be exclusively breastfed.

Our primary process measure was lactation consultations completed. We calculated this process measure as the number of infants whose mothers received a lactation consultation over the number of infants whose mothers were eligible to breastfeed. Additional process measures in cycle 2 included bilirubin blanket usage and breastfeeding assessment via LATCH scoring.

Balancing measures included development of dehydration, loss of ≥10% from birth weight, acute bilirubin encephalopathy, 7-day readmission for phototherapy, and LOS. LOS was defined as the number of hours from admission order to discharge order. LOS was chosen as a balancing measure because of concern that the interventions would prolong LOS through increased time for lactation consultation and nursing assessment of breastfeeding.

RESULTS

In total, 92 patients were included in this study, with 31 (34%) patients in the baseline cycle and 61 (66%) patients in cycle 1, cycle 2, and cycle 3. There were 20 patients in cycle 1, 21 patients in cycle 2, and 20 patients in cycle 3. Infant demographics in the pre- and postintervention cycles were similar, with 65% boys in the preintervention cycle and 64% in cycles 1 to 3. Average infant age at admission was 4.4 days in the preintervention phase, 4.3 days in cycle 1, 4.5 days in cycle 2, and 4.9 days in cycle 3.

Our primary outcome measure, EB, rose from a median of 30% to 60% (Fig 2). The median increased after implementation of an automatic order for lactation consultation. Implementation of the automatic order for lactation consultation led to an increase in completed lactation consultations from 60% to 90% (Fig 3). Increases in the rate of completed lactation consultations during the first shift were significantly associated with increased EB. Excluding the baseline cycle, mothers receiving a lactation consultation within the first shift after admission were almost 4 times more likely to exclusively breastfeed during hospitalization than mothers who did not receive a lactation consultation within the first shift (OR 3.8; 95% confidence interval [CI]: 1.17–12.39). For mothers who chose not to exclusively breastfeed, maternal preference was the most common reason cited for not exclusively breastfeeding (9 mothers; 69%), and concerns about not having enough milk supply was the second most common reason (3 mothers; 23%).

Within cycle 2, 60% of shifts in which there were infants admitted for phototherapy were staffed by nurses who had completed the lactation training. The rate of nursing assessment of breastfeeding via LATCH scoring increased from 0% to 80%. The percentage of shifts in which a biliblanket was used during breastfeeding increased...
from 0% to 65%. Mothers were not more likely to exclusively breastfeed if they received a LATCH score (OR 1.18; 95% CI: 0.24–5.86), used a biliblanket during breastfeeding (OR 1.2; 95% CI: 0.27–5.36), or had a trained nurse (OR 1.31; 95% CI: 0.4–4.27).

No infants developed acute bilirubin encephalopathy or dehydration. There were no readmissions for phototherapy. LOS did not significantly change, with the baseline cycle LOS at 18 hours and the postintervention LOS at 19 hours (Supplemental Fig 5). There was 1 infant who did not display signs of dehydration or excessive weight loss but whose mother was not producing sufficient milk by lactation assessment. This infant was appropriately supplemented with formula.

**DISCUSSION**

This study reveals that a multimodal approach to supporting breastfeeding in infants admitted with neonatal hyperbilirubinemia can improve EB rates. Standardizing the ordering of a lactation consultation and collaboration with a lactation consultant during hospitalization for phototherapy specifically increases the likelihood of EB without increasing the risk of an infant developing dehydration or acute bilirubin encephalopathy and without increasing LOS.

Within the literature, maternal concerns for inadequate milk supply, along with provider perception of need for supplementation, often leads to decreased EB. However, in our study, we only identified 1 mother with an inadequate supply requiring supplementation. Galipeau et al demonstrated that mothers perceive that they have insufficient milk supply even when their actual milk supply is adequate. Through involving the lactation consultants within care early in the hospitalization, they were able to enact targeted interventions to address mechanical breastfeeding problems and maternal concerns and potentially demonstrate sufficient milk supply through pre- and postfeeding weights, audible swallowing by the infant, and hand expression of milk. Maternal confidence has been shown to be predictive of breastfeeding duration, and it is possible that the involvement of the lactation consultants improved maternal confidence in breastfeeding, resulting in an increased likelihood of infants being exclusively breastfed.

**Before cycle 1,** physicians decided whether to enter an order for lactation consultation on a case-by-case basis, which often led to missed opportunities for consultation. Our results reveal that an automatic order added to our admission order set led to an increase in completed lactation consultations. This is consistent with published improvement literature revealing that prechecked orders within order sets successfully drive physician ordering habits.

In addition, physician and nursing education around recognizing breastfeeding difficulties may also have contributed to the increase in lactation consultations. Increased provider awareness has been shown to contribute to positive changes in QI. In our study, after the meeting with nurses in October 2017, many nurses started calling the lactation consultants at the time of an infant’s admission. Increased physician awareness of breastfeeding difficulties may have led physicians to ask mothers about breastfeeding difficulties more frequently on admission, include information about breastfeeding difficulties during handoffs, and increase recommendations for lactation consultations before discharge.

**During cycle 2,** nurses recorded their assessment of the LATCH score and breastfeeding exclusivity using standardized documentation, with the intention that the act of recording would promote nurse-mother interaction and support of breastfeeding. Unfortunately, this intervention was not associated with a significant increase in EB. Nurses are
typically responsible for 4 to 5 patients during a shift and may not have had sufficient time to provide additional breastfeeding support to the mother and infant. Additionally, although our nurses underwent 6 hours of didactic training and 3 hours of hands-on training, this is still less than the 15 hours of didactic training and 5 hours of hands-on training required by Baby-Friendly hospitals.20

It was also anticipated that providing a bilirubin blanket for use during direct breastfeeding would increase EB through increased comfort and ease of breastfeeding. The biliblankets were also expected to help mothers realize that breastfeeding and phototherapy are not mutually exclusive. Before cycle 1, physicians and nurses were recommending that mothers limit time spent breastfeeding to maximize time under the phototherapy lights. Additionally, mothers were often concerned that poor breastfeeding caused the hospitalization and harmed their infant, and recommendations to limit breastfeeding reinforced this. Biliblankets did not increase the ease and comfort of breastfeeding as expected; frequent concerns were that blankets were bulky and difficult to use while breastfeeding. As an alternative to bulky biliblankets, Szucs and Rosenman21 published a new technique for providing phototherapy in which both the mother and infant are under the phototherapy overhead light during breastfeeding sessions, providing maximum time under phototherapy and maximum time to breastfeed. A possible approach to more comfortable and family-centered care of infants hospitalized for phototherapy in the future may benefit from the use of Szucs and Rosenman’s21 phototherapy technique during breastfeeding.

There are limitations to our study. First, the generalizability of this study is limited to hospitals where lactation consultants are available. Second, we may have missed eligible infants by using different methods (PatientKeeper versus bedside nursing sheet) to identify infants in different cycles. Because the primary investigator manually chart reviewed each individual patient, we believe the likelihood of this was limited. Third, the results may have been biased or skewed because a single investigator extracted all the charts independently. Fourth, because of a small sample size, run charts rather than statistical process control charts were used to graph our primary outcome and process measures. Next, we excluded infants for dehydration on the basis of percentage of weight loss and physical examination findings, which can be subjective. Our definition of dehydration, however, is consistent with other clinical dehydration scales (such as the Centers for Disease Control and Prevention dehydration assessment scale) that use weight loss and subjective physical examination findings to define dehydration.22 Next, in excluding all infants with >10% weight loss and concern for dehydration, we likely undercaptured mothers with a low milk supply. Although our study sample potentially underestimated the numbers of mothers experiencing a low supply, the principle of early involvement of lactation consultants to support with the assessment and identification of these mother-infant dyads is applicable across groups. Finally, although breastfeeding exclusivity during the newborn hospitalization period has been shown to improve the duration of breastfeeding, it is unclear whether EB during readmission for neonatal hyperbilirubinemia similarly improves duration of breastfeeding.23

CONCLUSIONS
Early involvement of trained lactation consultants improves the rates of EB for infants hospitalized with neonatal hyperbilirubinemia. This study reveals that a multimodal approach to improving EB can provide adequate support for the mother-infant dyad without compromising safety.

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