

Aligning Newborn Hyperbilirubinemia Care With American Academy of Pediatrics Guidelines at an Urban Community Hospital

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ABSTRACT

Background: In August 2022, the American Academy of Pediatrics updated its newborn hyperbilirubinemia guideline. This quality improvement initiative aimed to reduce newborns receiving inpatient phototherapy and subthreshold phototherapy initiation by 50% in 12 months.

Methods: A multidisciplinary team implemented interventions at an urban community hospital in Wisconsin. Retrospective chart review from February 2022 through November 2023 identified newborns receiving phototherapy during birth hospitalization and readmission (primary outcome), subthreshold phototherapy initiation (process measure), and length of stay with meeting escalation of care criteria (balancing measures).

Results: We identified 167 newborns. Median birth hospitalization phototherapy decreased from 10 to 2 newborns per month; there was no change in readmissions. Length of stay and meeting escalation of care criteria were unchanged.

Discussion/Conclusions: This study shows a decrease in inpatient phototherapy use during birth hospitalizations.

INTRODUCTION

Newborn hyperbilirubinemia is a common condition, affecting approximately 80% of newborns in the first week of life.¹ Severe hyperbilirubinemia may lead to permanent neurological damage, including kernicterus,² which underscores the importance of screening for and treating hyperbilirubinemia. However, phototherapy can negatively impact caregiver bonding and successful breastfeeding,³ impose additional costs on the health care system,⁴ and has potential long-term harms, such as childhood seizures.¹

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In August 2022, the American Academy of Pediatrics (AAP) updated the clinical practice guideline for newborn hyperbilirubinemia for newborns born at ≥ 35 weeks' gestation,¹ raising the phototherapy threshold. While guidelines serve as tools to provide evidence-based care, the publication of guidelines alone may be insufficient to change clinical practice.⁵ Furthermore, substantial variation in inpatient management of newborn hyperbilirubinemia was noted with the prior iteration of the AAP guideline.⁴

The global aim of this quality improvement (QI) project was to align newborn hyperbilirubinemia management at our urban, community hospital with the 2022

AAP guidelines. Our specific aim was to decrease both the number of newborns receiving inpatient phototherapy and decrease subthreshold phototherapy initiation by 50% in 12 months.

METHODS

SSM St Mary's Hospital is an urban, community hospital in Madison, Wisconsin, with approximately 2000 births per year, an inpatient pediatric general care unit, and a level III neonatal intensive care unit (NICU). Local data were collected by retrospective chart review from February 2022 through November 2023 as part of the Learning and Implementing Guidelines for Hyperbilirubinemia Treatment (LIGHT) QI initiative from the AAP Pediatric Acute and Critical Care Quality Network. This project was deemed exempt by the local institutional review board. Newborns ≤ 14 days of age born at ≥ 35 weeks' gestation receiving phototherapy were included. Newborns received phototherapy either (1) during birth hospitalization in the newborn nursery or (2) during readmission to the pediatric inpatient unit from the

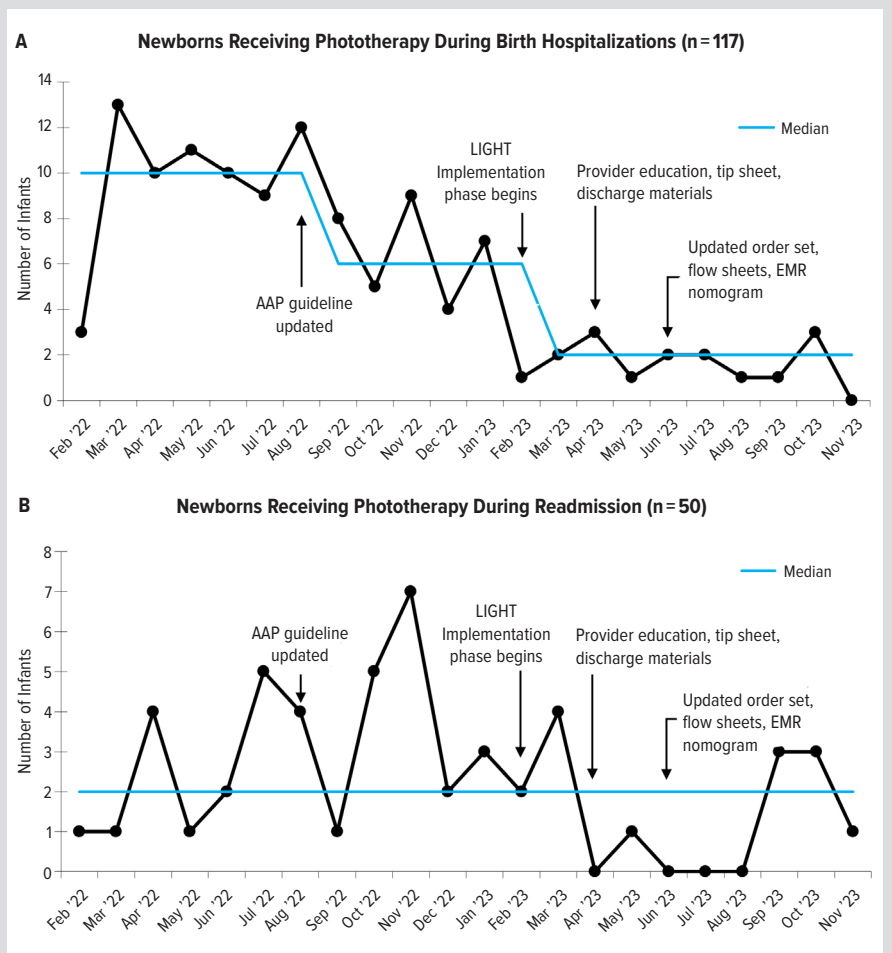
emergency department or outpatient clinics. Newborns requiring NICU admission were excluded. Collected data included patient sex, self-reported race, ethnicity, gestational age, birth weight, weight prior to phototherapy initiation, length of stay (LOS), meeting escalation of care criteria, and whether supplementation with donor milk or formula was started. These metrics were tracked to describe our study population and identify future opportunities for interventions.

Using the model for improvement, a multidisciplinary stakeholder team consisting of a pediatric hospitalist, outpatient pediatrician, neonatologist, and nurses from the NICU, newborn nursery, and pediatric inpatient units gathered to identify key drivers and develop interventions. In April 2023, dedicated education reviewing updated guidelines was instituted for pediatric clinicians and nursing staff in the newborn nursery and inpatient unit. In addition, a tip sheet with key recommendations from the updated guideline was disseminated to all clinicians. The “After Visit Summary,” which includes discharge instructions provided to caregivers, was updated and tailored for the newborn nursery and inpatient unit. The next step of interventions took place in June 2023. In the newborn nursery, the order set for routine care was updated to reflect timing of obtaining serum bilirubin. For both settings, order set updates included relevant nursing orders for phototherapy and options for ordering follow-up labs, such as complete blood cell count, hemoglobin, total bilirubin, direct bilirubin, direct Coombs, and blood type. The 2022 gestational age-specific bilirubin treatment nomograms¹ were incorporated within the electronic medical record (EMR) for easy access for clinicians. All nursing flowsheets were updated to optimize documentation within the EMR.

The primary outcome measure was the number of newborns receiving phototherapy per month. The process measure was frequency of subthreshold phototherapy initiation per month, defined as initiating phototherapy at total serum bilirubin ≥ 0.3 mg/dL below the AAP phototherapy threshold. LOS and meeting escalation of care criteria were tracked as balancing measures. Escalation of care was defined as newborns with a total serum bilirubin 2 mg/dL below the exchange transfusion threshold or higher.

Baseline data were collected from February 2022 through

Figure 1. Run Charts Tracking Number of Newborns Receiving Phototherapy Per Month During (A) Birth Hospitalization and (B) Readmissions



Abbreviations: AAP, American Academy of Pediatrics; LIGHT, Learning and Implementing Guidelines for Hyperbilirubinemia Treatment EMR, electronic medical record.

Table. Demographics of Newborns From Birth Hospitalization and Readmitted Newborns (N=167)

Sex		Admission type	
Male	53%	Birth hospitalization	70%
Female	47%	Readmission	30%
Race		Gestational age	
White	65%	35–36 weeks	12%
Black	9%	37 weeks	29%
Asian	9%	38 weeks	15%
More than 1 race	10%	39 weeks	31%
Other/unknown	7%	40+ weeks	13%

January 2023 and implementation data from February 2023 through November 2023. Data were analyzed using Microsoft Excel QI-Charts, version 2.0.23 (Process Improvement Products, San Antonio, Texas). The number of newborns receiving inpatient phototherapy per month and instances of subthreshold phototherapy initiation were tracked on run charts; LOS was tracked on an I-chart. Special cause variation was identified using established run chart rules.⁶

RESULTS

During the study period, 167 newborns received phototherapy: 70% during birth hospitalization and 30% in the inpatient pediatric unit. Newborns were 53% male and 65% White, with the majority born at term (Table).

The median number of newborns receiving phototherapy during birth hospitalization each month decreased from 10 to 6 patients in September 2022, then decreased again in March 2023 to 2 patients. There was no significant change in the median number of newborns readmitted for phototherapy (Figure 1). For birth hospitalizations, the median occurrence of subthreshold initiation of phototherapy decreased from 5 to 1 per month, while there was only 1 instance of subthreshold phototherapy initiation among readmissions (Figure 2).

Average LOS during the baseline phase was 63.8 hours for birth hospitalizations and 28.3 hours for readmissions. For both groups, the centerline was not shifted as there was no sustained change in LOS during the implementation phase (Figure 3). For birth hospitalizations, LOS above the upper control limit (UCL) occurred in 3 patients (patient 98, 105, and 106)—all with concern for active hemolysis—and were transferred to the pediatric inpatient unit. For readmissions, LOS above the UCL occurred in 2 patients: a newborn with Coombs-negative hemolysis likely from hereditary spherocytosis (patient 3) and another with ABO incompatibility (patient 27). Only 6 newborns (3.6%) met criteria for escalation of care: 1 birth admission and 2 readmissions prior to guideline release and 1 birth admission and 2 readmissions postguideline release.

Birth rates at our hospital remained stable throughout the study period, with 161 births per month during the baseline phase and 156 births per month during the implementation phase. Average weight loss at the time of phototherapy initiation for all patients was 5% from birth weight, with 32% of newborns exclusively breastfed, 65% breastfed with donor milk or formula supplementation, and 4% exclusively formula fed.

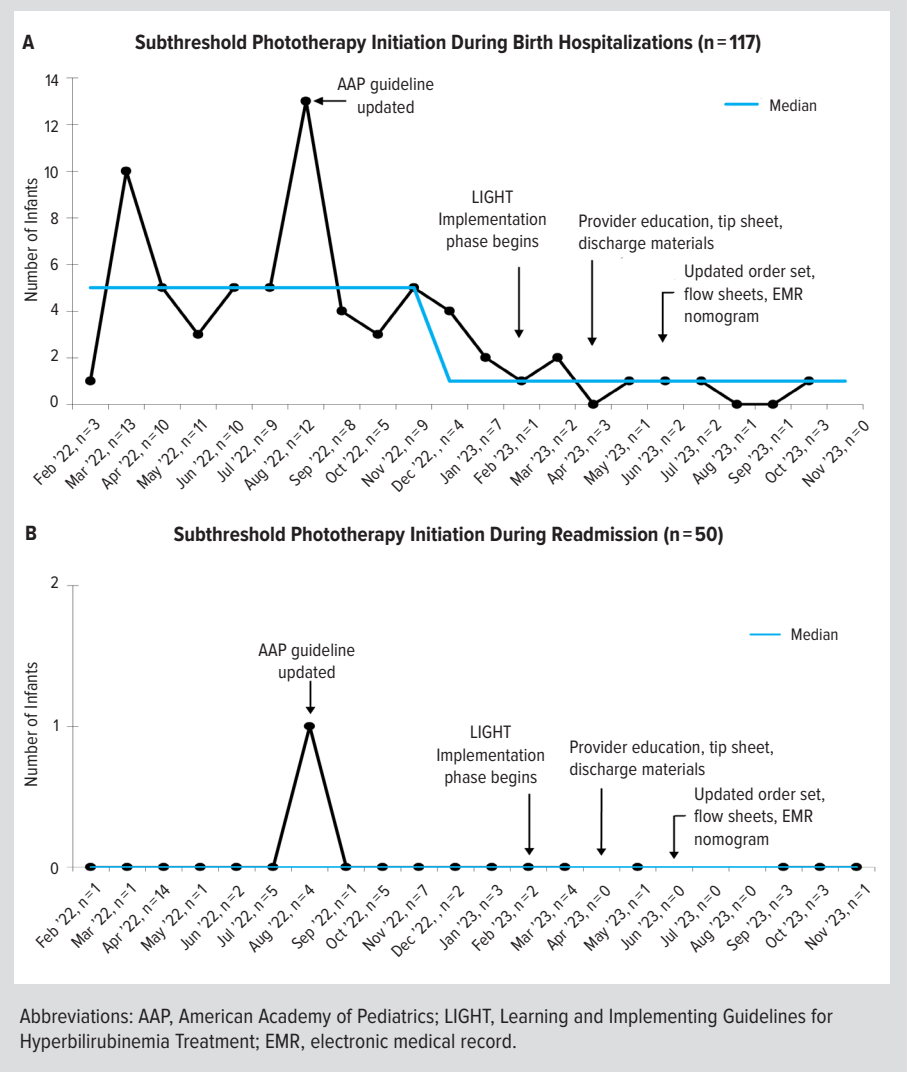
DISCUSSION

The publication of the 2022 AAP hyperbilirubinemia guideline¹ has put a national spotlight on newborn hyperbilirubinemia management. Existing literature evaluates pooled data featuring free-

standing children's hospitals where reduction in newborns receiving phototherapy has been reported.⁷ However, approximately 70% of children receiving care in the United States do so in a community hospital setting,⁸ where published data on newborn hyperbilirubinemia are more limited. This QI study highlights the practical implementation of the updated AAP guidelines at an urban, community hospital.

In the newborn nursery, there was a significant decrease in the number of newborns receiving phototherapy and subthreshold phototherapy initiation. Not only does this decrease health care costs and harm, it also minimizes disruption to breastfeeding and caregiver bonding. While there was a reduction in subthreshold phototherapy initiation for birth hospitalizations, this trend is confounded by the decrease in the overall number of newborns receiving phototherapy. However, the 3 months with no occurrences of subthreshold phototherapy initiation occurred in the last 8 months, reflecting positive progress.

Figure 2. Run Charts Tracking Number of Instances of Subthreshold Initiation of Phototherapy per Month During (A) Birth Hospitalization and (B) Readmissions



Despite interventions to implement the 2022 clinical practice guideline, the median number of newborns readmitted for phototherapy was unchanged. The lack of subthreshold phototherapy initiation during the implementation phase suggests patients were appropriately readmitted for phototherapy. We hypothesized that raised phototherapy thresholds should have reduced the number of newborns requiring readmission; however, reduced rates of phototherapy treatments during birth hospitalizations may have led to increased hyperbilirubinemia in discharged newborns. Notably, the 4 months without readmissions occurred exclusively during the implementation phase. Ongoing data monitoring is necessary to capture trends in the number of readmitted newborns.

Potential adverse outcomes associated with the higher phototherapy threshold include increased symptoms from hyperbilirubinemia, increased risk of meeting escalation of care criteria, and prolonged hospitalization or requiring transfer to the NICU. However, in this study, LOS and occurrence of meeting escalation of care criteria remained unchanged in both populations. The average readmission LOS of 28.3 hours in this study was similar to LOS at freestanding children's hospitals.^{4,9} Average LOS for birth hospitalizations in this study was significantly longer at 63.8 hours, likely due to feeding difficulty, newborn comorbidities, or maternal medical care affecting birth hospitalization. There was no difference in the number of newborns meeting escalation of care criteria in both populations, indicating no increase in newborn morbidity with the 2022 guidelines.

In our study, 65% of newborns were breastfed and received supplemental donor breast milk or formula. While newborns with excessive weight loss (>10% from birth weight) require intervention with supplementation, the average weight loss in our study was only 5%, indicating that supplementation was not solely initiated for excessive weight loss. Furthermore, the nadir weight loss was not captured in this study. Additional studies exploring reasons for initiating supplementation may inform future interventions to decrease jaundice from suboptimal intake.

This study was performed at a single center, limiting generalizability to other health systems. Additionally, the study period may be insufficient to capture long-term outcomes related to

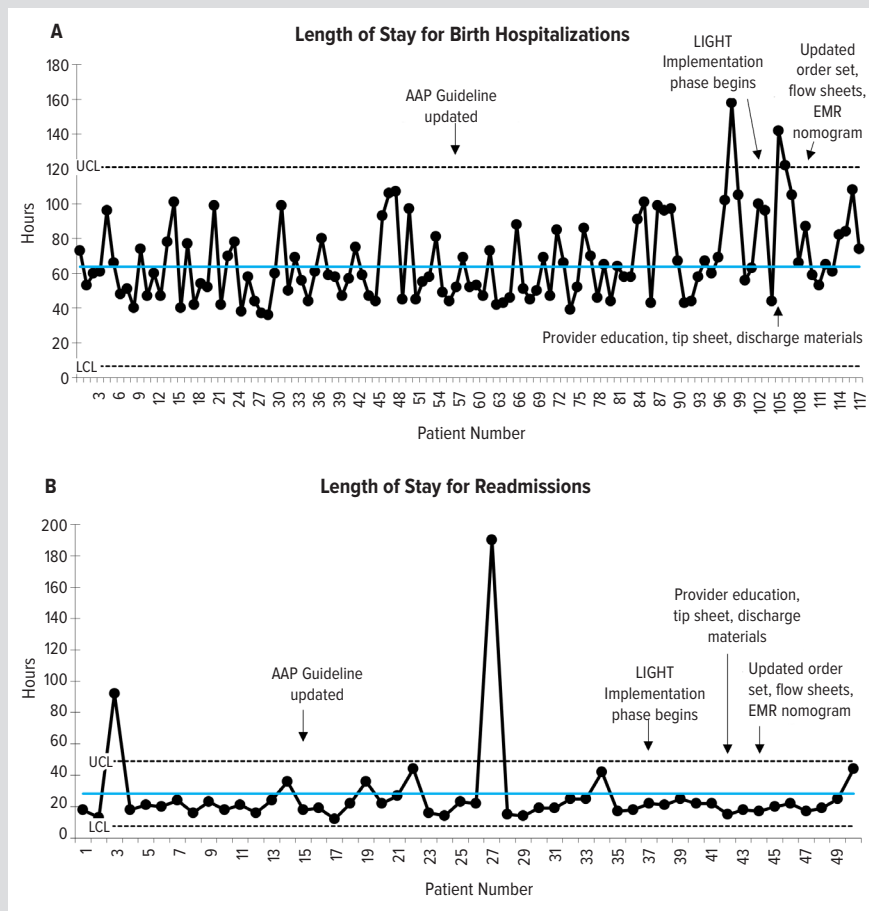
the implementation of new guidelines. With no change in birth rates during the study period, the overlap of the study period with the COVID-19 pandemic likely did not impact the findings.

This QI initiative demonstrates a significant decrease in the number of newborns receiving inpatient phototherapy and reduction in initiation of subthreshold phototherapy during birth hospitalization at an urban, community hospital in Wisconsin. Inpatient newborn care is provided at over half of Wisconsin hospitals, and adapting national guidelines to local settings requires leveraging local resources for successful QI implementation.¹⁰ This process can be tailored to community hospital settings for local improvement efforts with a multidisciplinary team to standardize care of newborns with hyperbilirubinemia. At our institution, next steps will focus on continued engagement of clinicians and data surveillance to ensure sustained trends.

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Figure 3. I-Charts Tracking Length of Stay for (A) Birth Hospitalization and (B) Readmissions



Abbreviations: AAP, American Academy of Pediatrics; LIGHT, Learning and Implementing Guidelines for Hyperbilirubinemia Treatment; EMR, electronic medical record; UCL, upper control limit; LCL, lower control limit.

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