

HYPERBILIRUBINEMIA CLINICAL PATHWAY



EXECUTIVE SUMMARY

Physician Owner(s): Devin VanWanzelee, DO & Shubra Srinivas, MD

Primary Objective

The AAP updated clinical practices in 2022 for the management of neonatal hyperbilirubinemia. Notable changes and recommendations include raising the threshold to start phototherapy treatment, different treatment thresholds by gestational age, emphasis on evaluating for hemolysis, waiting at least 12-24 hours before obtaining a follow up bilirubin level after phototherapy for infants at low risk for rebound hyperbilirubinemia, and an emphasis on breastfeeding and enteral feeding over intravenous fluids unless the infant meets criteria for escalation of care.

With the organization of a pathway and order set based off the 2022 guidelines, Children's Hospital and Medical center will have improved management/treatment of neonates with hyperbilirubinemia as well as improved record keeping of pertinent information in each patient's chart. Currently, not all pertinent information, from the updated guidelines, is placed into the H&P in each neonate's chart. The implementation of the pathway will improve this and down the road, provide a measure of how many providers are utilizing the new pathway.

All neonates who require inpatient phototherapy for hyperbilirubinemia and are in one of the following areas of the hospital: ED, NICU, and Med/Surg.

Recommendations

**Based off of the 2022 AAP guidelines*

Kemper, A. R., Newman, T. B., Slaughter, J. L., Maisels, M. J., Watchko, J. F., Downs, S. M., ... & Russell, T. L. (2022). Clinical practice guideline revision: management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics, 150(3).

Intended for patients:

- Gestational age of 35 weeks or greater at birth
- Infant age 14 days or less
- All neonates who require inpatient phototherapy for hyperbilirubinemia and are in one of the following areas of the hospital: ED, NICU, and Med/Surg.

Exclusion criteria:

- Gestational age less than 35 weeks at birth
- Post-conceptual age greater than 14 days

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Identify risk factors for hyperbilirubinemia ¹⁻⁶:

TABLE 1

Risk Factors for Developing Significant Hyperbilirubinemia

Risk Factors
• Lower gestational age (ie, risk increases with each additional week less than 40 wk)
• Jaundice in the first 24 h after birth
• PredischARGE transcutaneous bilirubin (TcB) or total serum bilirubin (TSB) concentration close to the phototherapy threshold
• Hemolysis from any cause, if known or suspected based on a rapid rate of increase in the TSB or TcB of >0.3 mg/dL per hour in the first 24 h or >0.2 mg/dL per hour thereafter.
• Phototherapy before discharge
• Parent or sibling requiring phototherapy or exchange transfusion
• Family history or genetic ancestry suggestive of inherited red blood cell disorders, including glucose-6-phosphate dehydrogenase (G6PD) deficiency
• Exclusive breastfeeding with suboptimal intake
• Scalp hematoma or significant bruising
• Down syndrome
• Macrosomic infant of a diabetic mother

Identify the need for treatment:¹

- The following should be utilized to guide initiation of phototherapy and/or escalation of care: gestational age, hour-specific TSB, and presence of risk factors for bilirubin neurotoxicity.⁷
 - Gestational age <38 weeks, risk increases with the degree of prematurity
 - Albumin <3.0 g/dL
 - Isoimmune hemolytic disease (i.e., positive direct antiglobulin test (DAT), G6PD deficiency, or other hemolytic conditions)
 - Sepsis
 - Significant clinical instability in the previous 24 hours.⁸
- Transcutaneous bilirubin (TcB) measurement can be used as a screening tool, but TSB must be used to guide therapy ^{5,9-11}
- If TcB > 15 mg/dL or <3 mg/dl of phototherapy threshold obtain TSB. ⁹⁻¹⁴
- High risk of hyperbilirubinemia can be calculated based on a rate of rise of >0.3 mg/dL per hour in the first 24 hours or >0.2 mg/dl per hour after. ¹⁵⁻¹⁷

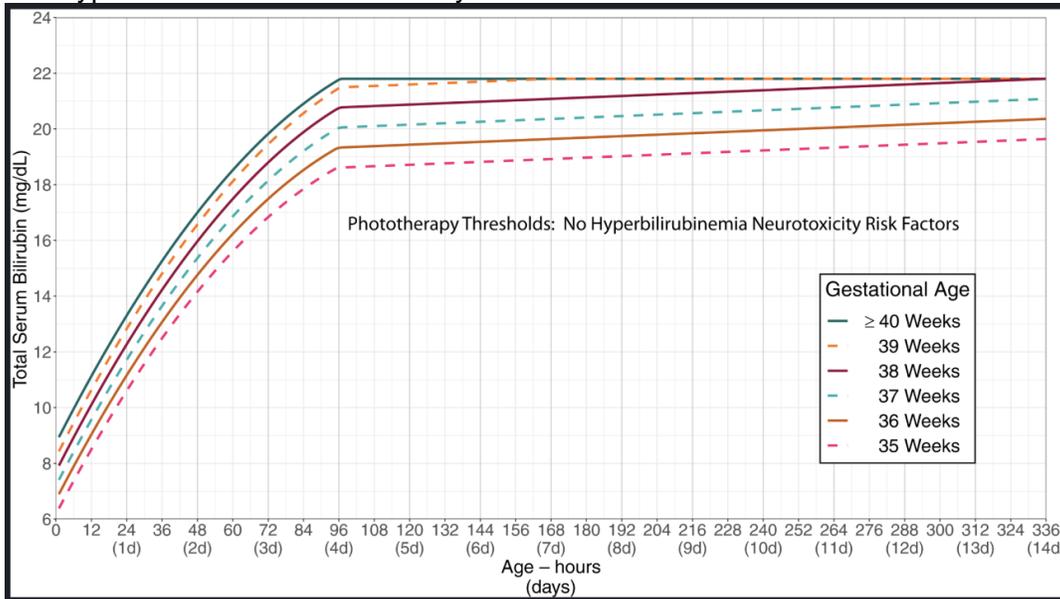
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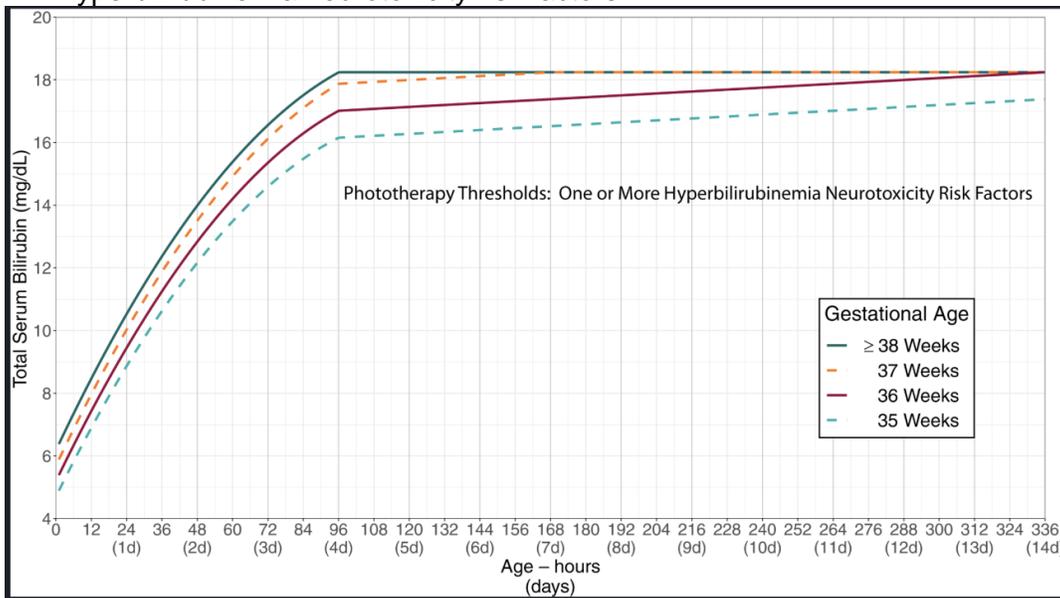
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Treatment of hyperbilirubinemia:^{1, 18-20}

- Phototherapy should be initiated at the TSB thresholds. These are recommended based on the gestational age and neurotoxicity risk factors. (Figures 1 and 2).
 - **Figure 1.** Phototherapy thresholds based on gestational age with no hyperbilirubinemia neurotoxicity risk factors.



- **Figure 2.** Phototherapy thresholds based on gestational age with one or more hyperbilirubinemia neurotoxicity risk factors.



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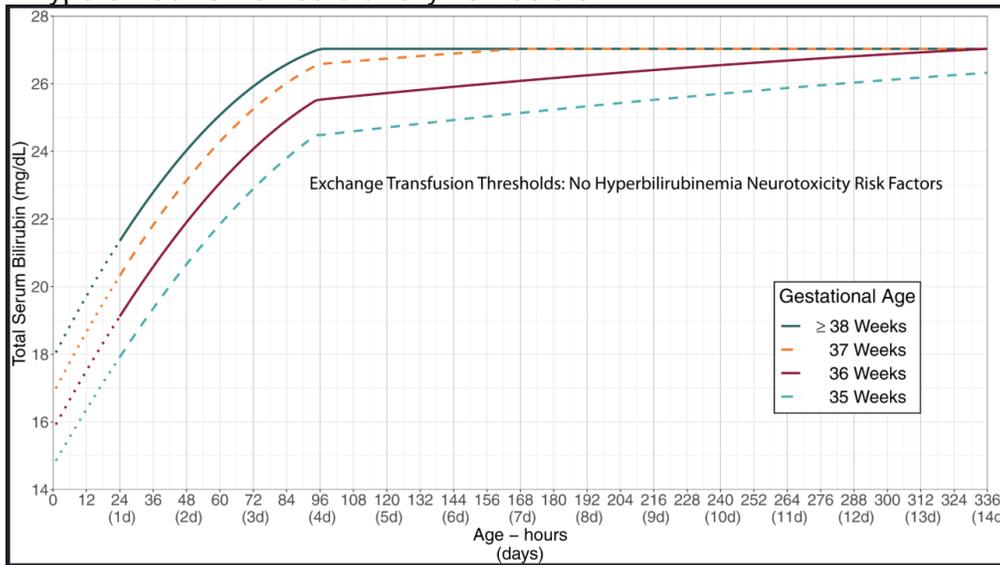
- Neonate should receive optimal amount of phototherapy at all times with minimal interruptions outside of basic care and feeds. ^{7, 21}
- Intravenous fluids should only be utilized if the TSB reaches the escalation of care thresholds or there are clinical signs of dehydration.

Monitoring infants receiving phototherapy:²⁹

- All infants should have a complete blood count and direct antiglobin test (DAT) if mother has blood group O or is Rh(D)-.
- After 12 hours of initiation of phototherapy, TSB should be measured.
- With a rising TSB, the lab should be repeated every 6 hours. Once stable or decreasing, can space TSB to every 12-24 hours until below threshold.

Escalation of care: ^{1, 22-23}

- If TSB is 2 mg/dL below exchange transfusion threshold, escalation of care should be initiated. (Figure 3 and 4).
 - **Figure 3.** Exchange transfusion thresholds based on gestational age with no hyperbilirubinemia neurotoxicity risk factors.

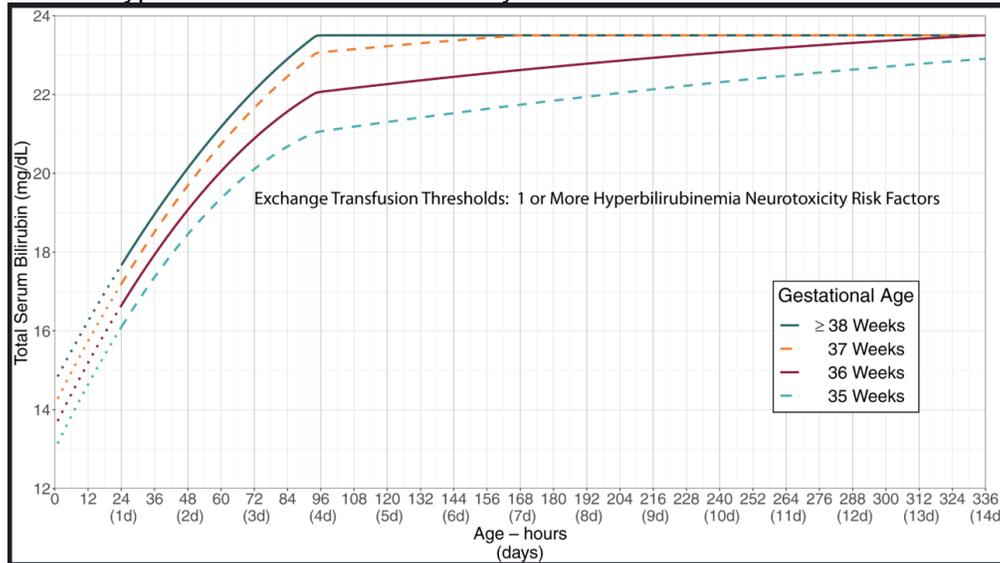


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- **Figure 4.** Exchange transfusion thresholds based on gestational age with one or more hyperbilirubinemia neurotoxicity risk factors.



- The infant should be transferred to a higher level of care at time of escalation.
- The following labs should be ordered: total and direct serum bilirubin, CBC, serum albumin, serum chemistry, and blood type and crossmatch. Every 2 hours a TSB should be obtained.
- Start intravenous fluids.
- If TSB is equal to or over the threshold for exchange transfusion, IVIG (0.5 to 1.0 g/kg) can be given over 2 hours and repeated after 12 hours. This is specifically for infants with isoimmune hemolytic disease.
- An urgent exchange transfusion should be performed for infants with:
 - Signs of intermediate or advanced stages of acute bilirubin encephalopathy: hypertonia, arching, retrocollis, opisthotonos, high-pitched cry, recurrent apnea
 - TSB at or above the exchange transfusion threshold for gestational age

Discontinuing phototherapy: 1, 22-23

- Discontinue phototherapy once TSB is >2 mg/dL below the phototherapy threshold at the initiation of treatment.²⁴
- If risk factors are present for rebound hyperbilirubinemia, can increase treatment length.
- Risk factors include <38 weeks gestational age, hemolytic disease, and <48 hours of age at initiation of therapy.

Follow-up: 1, 25-28

- After discontinuation of phototherapy, the following guidelines should be used:
 - Repeat TSB every 6-12 hours and the day after discontinuation if: infant <48 hours of age when phototherapy started, positive DAT, and concern for hemolytic disease.
 - If infant required phototherapy during birth hospitalization, repeat TSB the next day

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- Infants who receive phototherapy during a readmission should have repeat TSB 1-2 days after discontinuation or outpatient follow up in 1-2 days.
- Outpatients follow up is determined by the discharge bilirubin compared to the phototherapy threshold at time of discharge along with hyperbilirubinemia risk factors. (Table 2).
 - **Table 2.** Timing of post-discharge follow-up following phototherapy.

Phototherapy threshold minus TcB or TSB		Discharge Recommendations
0.1-1.9 mg/dL	Age <24 hours	Delay discharge, consider phototherapy, measure TSB in 4 to 8 hours
	Age ≥24 hours	Measure TSB in 4 to 24 hours ^a Options: <ul style="list-style-type: none"> • Delay discharge and consider phototherapy • Discharge with home phototherapy if all considerations in the guideline are met • Discharge without phototherapy but with close follow-up
2.0-3.4 mg/dL	Regardless of age or discharge time	TSB or TcB in 4 to 24 hours ^a
3.5-5.4 mg/dL	Regardless of age or discharge time	TSB or TcB in 1-2 days
5.5-6.9 mg/dL	Discharging <72 hours	Follow-up within 2 days; TcB or TSB according to clinical judgment ^b
	Discharging ≥72 hours	Clinical judgment ^b
≥7.0 mg/dL	Discharging <72 hours	Follow-up within 3 days; TcB or TSB according to clinical judgment ^b
	Discharging ≥72 hours	Clinical judgment ^b

- Families should receive education prior to discharge with regards to neonatal jaundice and follow up appointments.

Implementation Items

- Neonatal hyperbilirubinemia clinical pathway and order set.

Rationale

A pathway for the management and treatment for neonatal hyperbilirubinemia will standardize patient care and follow the 2022 AAP updated guidelines. The overall goals of the pathway based off the guidelines include decrease initiation of phototherapy below the treatment threshold, obtain direct antiglobin tests in all infants with blood type O mothers, decrease unnecessary IV fluids, and decrease rebound total serum bilirubin measurements if not indicated. With these goals, the pathway will overall increase quality of patient care and potentially decrease overall cost to each admission. Patients should receive standardized care leading to a decrease in unnecessary treatments and/or lab draws. Potential barriers to the pathway will be neonates who are just below phototherapy and are still placed on phototherapy. Another barrier will be overcoming the current practice of checking rebound total serum bilirubin measurements. To help with these barriers, education will be provided to all medical providers who work with this patient population.

Metrics

Inclusion Criteria: Gestational age ≥ 35 weeks and <14 days of age at time of admission

1. Decrease unnecessary IV fluid use to 50% of neonates who receive phototherapy and do not meet escalation criteria by May 2023. (Outcome metric)
2. Increase Direct Antiglobin Tests (DAT) being ordered/completed for all neonates with a mother with bloody type O and require phototherapy to 80% by May 2023. (Outcome metric)
3. Increase utilization of the order set/dot phrase to 50% by February 2024. (Process metric)

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4. Monitor transfers to the NICU from the medical/surgical units secondary to escalation of care. (Balancing metric)

Team Members

- Devin VanWanzeele, DO* (Pediatric Hospital Medicine Fellow)
- Shubra Srinivas, MD* (Hospitalist)
- Brian Juber, MD* (Neonatologist)
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- Whitney Bossert, MD (Hospitalist)
- Christopher Edwards, MD (Hospitalist)
- Melissa England, MD (Hospitalist)
- Garth Fletcher, MD (Neonataologist)
- Lauren Maskin, MD (Hospitalist)
- Katherine McGraw, MD (Hospitalist)
- Sara Moussa, MD (Hospitalist)
- Jay Snow, MD (Hospitalist)
- Sharon Stoolman, MD (Hospitalist)
- Jaci Timmons, MD (Hospitalist)
- Zahi Zeidan, MD (Neonataologist)
- Nathan Gollehon, MD (Neonataologist)
- James Buscher, MD (Emergency Medicine)

Evidence

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Figure 1. Phototherapy thresholds based on gestational age with no hyperbilirubinemia neurotoxicity risk factors.

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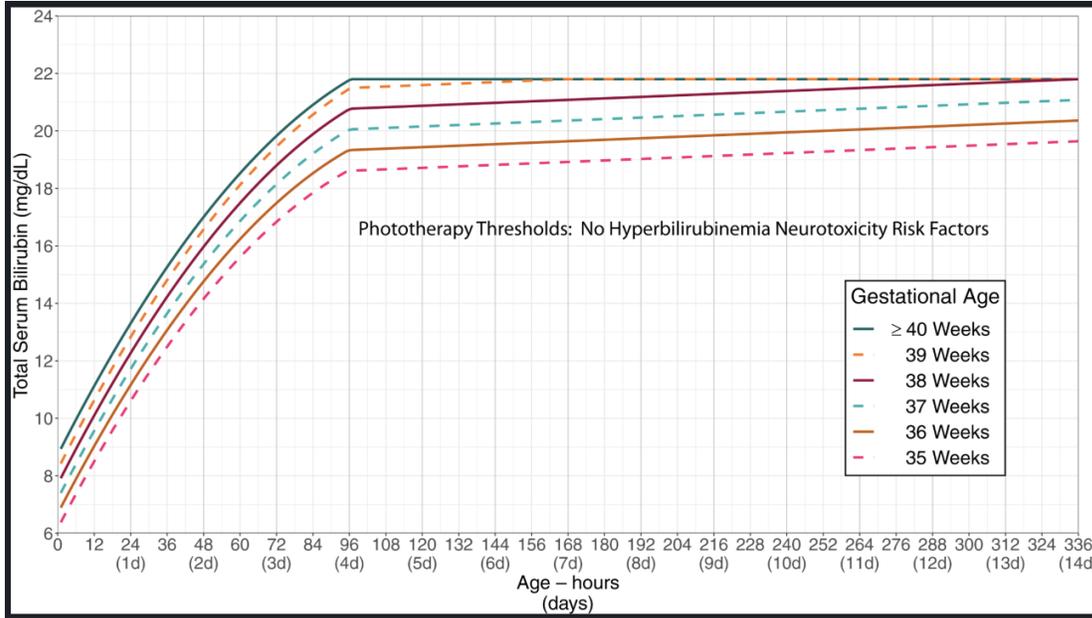


Figure 2. Phototherapy thresholds based on gestational age with one or more hyperbilirubinemia neurotoxicity risk factors.

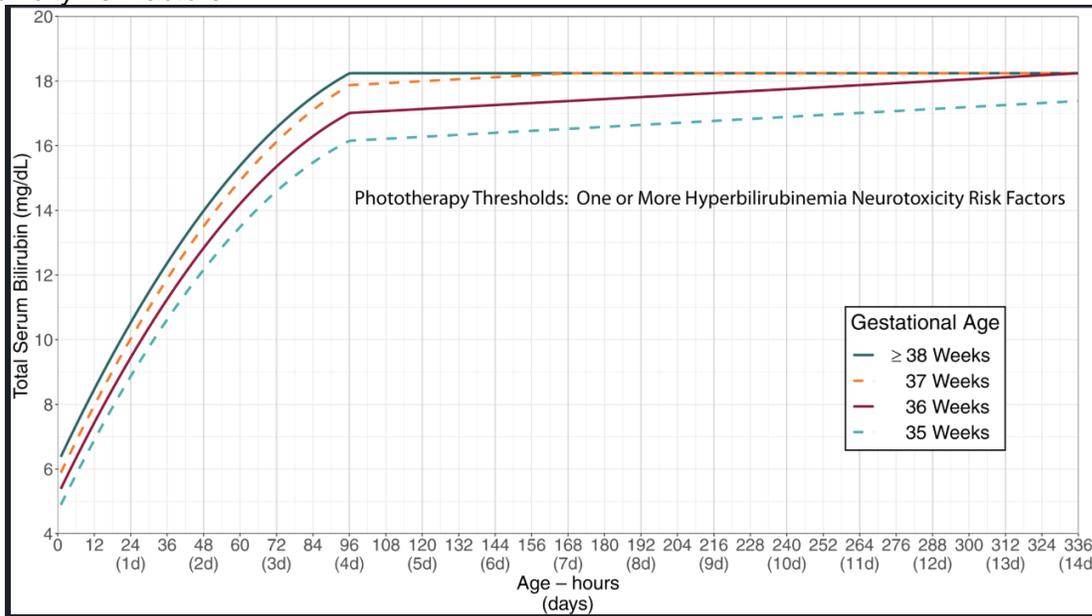


Figure 3. Exchange transfusion thresholds based on gestational age with no hyperbilirubinemia neurotoxicity risk factors.

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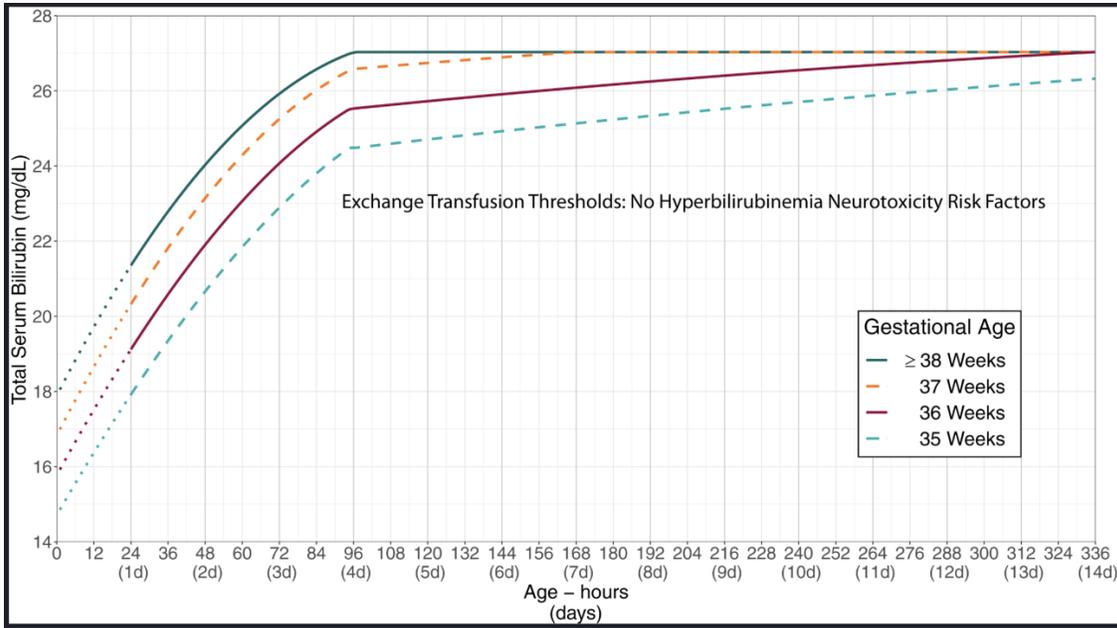


Figure 4. Exchange transfusion thresholds based on gestational age with one or more hyperbilirubinemia neurotoxicity risk factors.

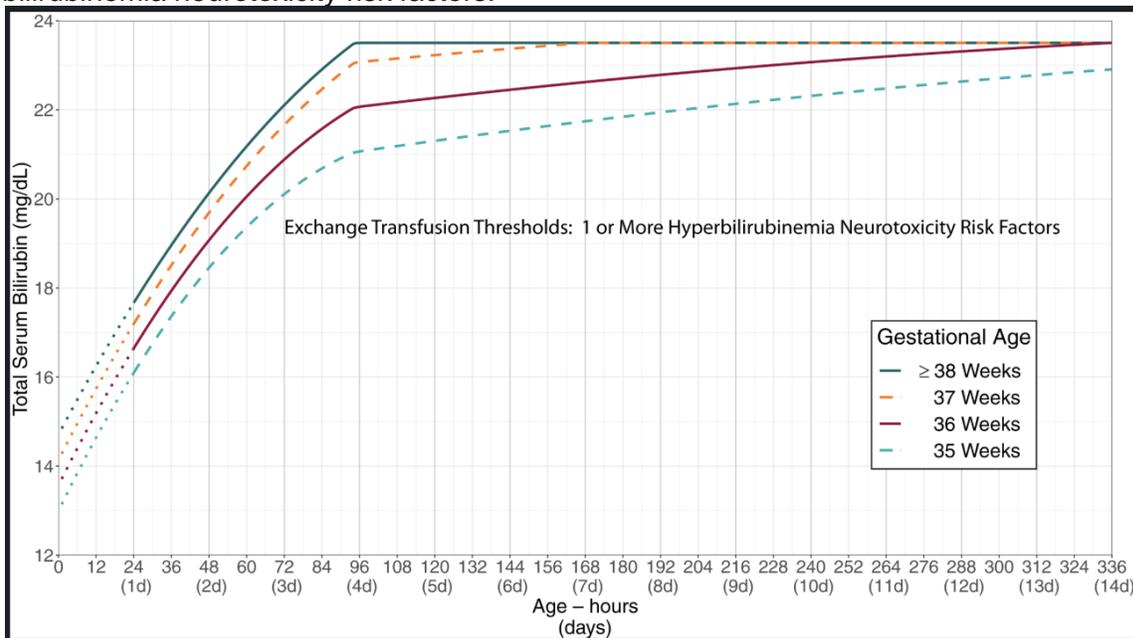


Table 2. Timing of post-discharge follow-up following phototherapy.

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Disclaimer: Pathways are intended as a guide for practitioners and do not indicate an exclusive course of treatment nor serve as a standard of medical care. These pathways should be adapted by medical providers, when indicated, based on their professional judgement and taking into account individual patient and family circumstances.