

Inclusion criteria: newborns already discharged from birth hospital or who remain in NICU AND are ≤ 14 days old, born at ≥ 35 wk gestation, previously suspected/known indirect hyperbilirubinemia with suspected/known need for phototherapy

Exclusion Criteria: > 14 days old, < 35 wk gestation at birth, suspected sepsis, signs of hyperbilirubinemia neurotoxicity (hypertonia, arching, retrocollis, opisthotonos, fever, high pitched cry)

Phase of Care Navigation Links

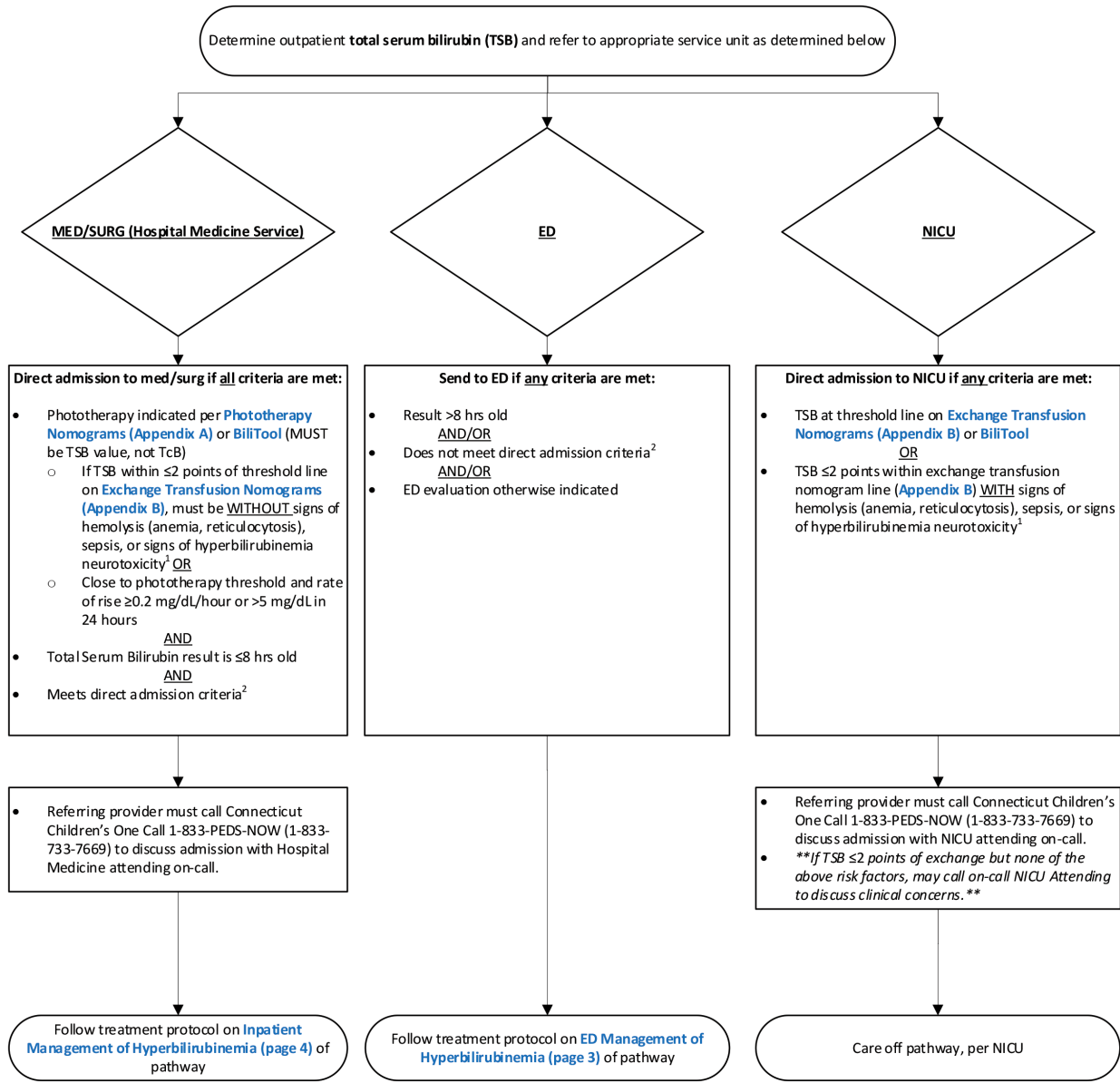
- [Admission Algorithm](#)
- [Emergency Department](#)
- [Inpatient Management](#)

Appendices and Feeding Log

- [Appendix A: Phototherapy Nomograms](#)
- [Appendix B: Exchange Transfusion Nomograms](#)
- [Appendix C: Etiologies and Risk Factors](#)
- [Appendix D: Admitting RN Tips and Tricks](#)
- [Appendix F: Feeding Log](#)

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¹Signs of Hyperbilirubinemia Neurotoxicity

- Hypertonia
- Arching
- Retrocollis
- Opisthotonos
- Fever
- High pitched cry

²Direct admission criteria:

- Patient has TSB within 8 hours of admission
- Patient seen in last 24 hours by referring service
- Patient has accepting attending
- Patient stable to be on med/surg unit without medical attention for 30 minutes



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Determine appropriate admission service (MS Floor vs NICU) based on outpatient bilirubin (Admission Algorithm):

- If patient sent to ED:**
- **Triage RN:** ESI level 2 (acute)
 - **ED RN:**
 - Obtain sample for total and direct serum bilirubin and POCT glucose via heel stick, regardless of need for additional labs or IV access (includes patients w/prior result <8 hrs old)
 - Place infant on bili blanket STAT

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Initial Provider Assessment

Clinical history/physical exam:

- Gestational Age
- Current age in hours
- Mother's blood type (infant's blood type if mother type O, Rh negative, or antibody +)
- Birthweight, current weight, and percent loss of birthweight
- Method and frequency of feeding
- Stool and urine output
- Signs/level of dehydration

Hyperbilirubinemia Evaluation for Treatment:

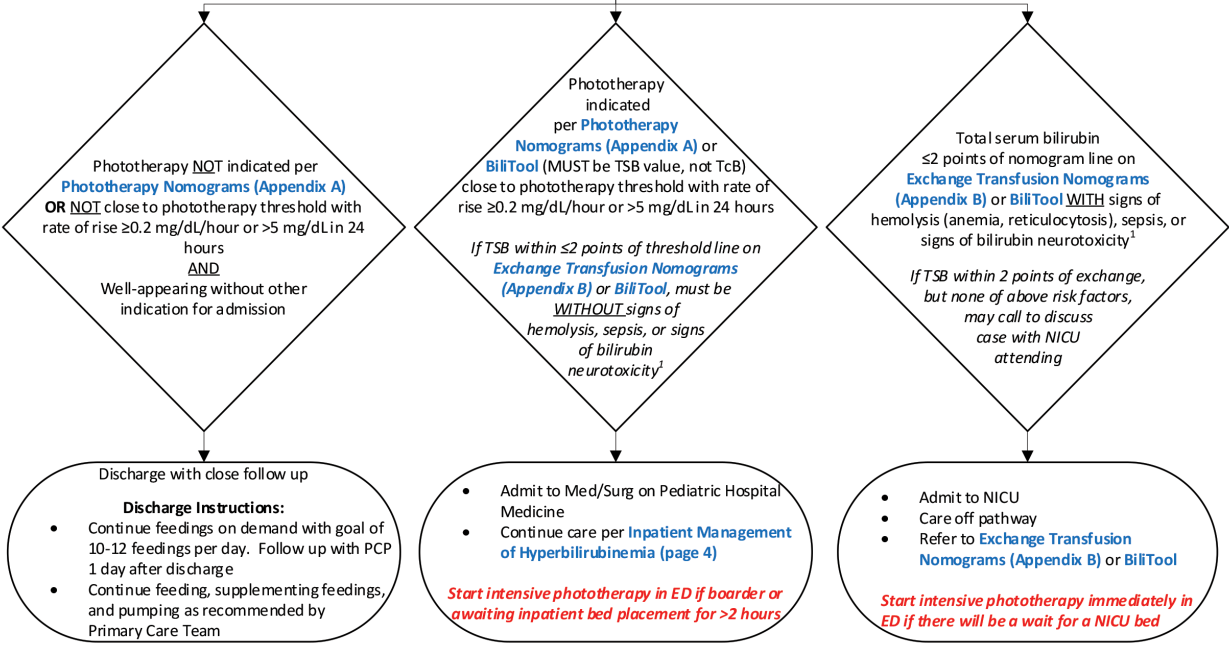
- Consider etiologies and risk factors for neonatal hyperbilirubinemia (Appendix C)
- Determine if there is pathologic rate of rise (≥ 0.2 mg/dL/hour or >5 mg/dL in 24 hours)
- Determine threshold for phototherapy and exchange transfusion using **BiliTool** or **Phototherapy Nomograms (Appendix A)** and **Exchange Transfusion Nomograms (Appendix B)**
 - If hemolytic anemia is strongly suspected, consider using high risk line on nomogram

Laboratory: consider additional labs as clinically indicated

- **CBC w diff, reticulocyte count, peripheral smear, DAT** (if not known), **type and screen** (of note, the screen is an indirect coombs and not the same test as the DAT): if mother/infant blood types unknown, early-onset jaundice (first 24 hrs after birth), phototx or exchange transfusion during birth hospitalization, bilirubin levels within 2 mg/dL of threshold in 1st 48 hrs of life, rapidly rising TSB levels (increasing by ≥ 0.2 mg/dL per hour), ABO incompatibility regardless of DAT result, family hx inherited hemolytic disorder
- **G6PD:** if clinical concern for hemolysis and DAT negative, or if early onset hyperbili and persistent beyond first week of life, familial or racial or ethnic risk
- **Electrolytes, POCT urine dip for specific gravity:** if concern for moderate or severe dehydration
- **Additional labs considerations (if clinically indicated):** liver panel and albumin; blood, urine, CSF cultures/counts

FEN/GI:

- Initiate home feeding
- **Provide breastfeeding mothers with breast pump, kit,** and pumping instructions if prolonged ED stay
- Attempt enteral repletion of hydration (PO or NG)
- IV hydration only if severe dehydration or electrolyte abnormalities



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Initial Provider Assessment

Clinical history/physical exam:

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Hyperbilirubinemia Evaluation for Treatment:

- Consider etiologies and risk factors for neonatal hyperbilirubinemia (Appendix C)
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Signs of Hyperbilirubinemia Neurotoxicity

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Phototherapy

Labs

Nutrition

See Appendix D: Admitting RN Tips and Tricks

Phototherapy Set Up:

- Prepare open infant bassinet with white sheet over sides and bottom
- Arrange phototherapy light bank above and bilirubin blanket below infant
- Ensure maximum skin exposure to all light surfaces; cover eyes
- Position light banks at least 10 cm from infant

Phototherapy Management:

- Initiate continuous intensive phototherapy (≥30 μW/cm²/nm) upon admission. For Connecticut Children's employees, please refer to Connecticut Children's Phototherapy Policy
 - Record start and stop times in phototherapy flowsheet
- Measure phototherapy light level with bili-meter at initiation and daily. Document in flowsheet.

Duration of Phototherapy:

- Infant may be out for feedings for a total of 30 mins in a 2 hour time period
 - Use bilirubin blanket during feedings
- Discontinue phototherapy when TSB decreased by at least 2 mg/dL below the threshold at the initiation of phototherapy
 - Consider longer phototherapy if risk factors for ongoing hemolysis
 - If no rebound level needed, keep under phototherapy lights to maximize treatment until leaving hospital

- **TSB:** if ED or outpatient total serum bilirubin obtained >6 hours from admission (or sooner if ≤2 points of exchange transfusion nomogram line)
- **Direct Bilirubin:** if direct serum bili not done in ED or patient is a direct admit to PHM
- **CBC w diff, reticulocyte count, peripheral smear, DAT** (if not known), type and screen (of note, the screen is an indirect coombs and not the same test as the DAT): if mother/baby blood types unknown, early-onset jaundice (first 24 hrs after birth), phototx or exchange transfusion during birth hospitalization, bilirubin levels within 2 mg/dL of threshold in 1st 48 hrs of life, rapidly rising TSB levels (increasing by ≥0.2 mg/dL per hour), ABO incompatibility regardless of DAT result, family hx inherited hemolytic disorder
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- **Electrolytes, POCT urine dip for specific gravity:** if concern for moderate or severe dehydration
- **Additional lab considerations (if clinically indicated):** liver panel, albumin and blood, urine, CSF cultures/counts

TSB monitoring DURING phototherapy:

- If admission TSB within ≤2 points of threshold line on exchange nomogram: repeat TSB in 2 hrs
- If admission TSB >2 points of threshold line on exchange nomogram: repeat TSB in 4-6 hrs and then if TSB declining, every 8-12 hrs

TSB Monitoring AFTER phototherapy

- For most patients, TSB should be obtained 1 day after d/c of phototherapy and may be obtained outpatient or inpatient as clinically indicated
- For patients with ANY of the following risk factors, TSB should be repeated 6-12 hrs after d/c of phototherapy and also the day after d/c of phototherapy:
 - Infants who exceeded the phototherapy threshold during the birth hospitalization and received phototherapy before 48 hrs of age
 - Positive DAT
 - Known or suspected hemolytic disease

- Initiate home feeding
- Assess for signs of suboptimal intake (Appendix D, page 2)
- Assess for dehydration
- Attempt enteral repletion (PO, NGT PRN)
- IVFs only for: clinical or biochemical signs of dehydration and unable to replete enterally
- Vitamin D3 400 IU daily

Breastfed Infants

- Order Lactation Consult
- **Admitting RN:**
 - Provide breast pump, instructions, pumping schedule
 - Provide/review Kid's Health education on Jaundice and Breastfeeding
 - Complete Epic task/order for "Education: mother's milk expression, milk weights, supplementation"
- **Feeds:**
 - Feed on demand, minimum q2-3 hrs, 10-12 feeds in 24 hrs
 - Supplement post feeds at breast if:
 - Suboptimal feedings volumes at breast based on milk weights. **Minimum total feed volume by age**
 - 48-96 hour old: 30 mL/feed
 - 96 hours – 7 days old: 45 mL/feed
 - 7 – 14 days old: 60 mL/feed
 - Weight is 10% below birth weight
 - Signs of dehydration
 - Use expressed breast milk (EBM) first, if available
 - Use formula only if no EBM available
- **Weights:**
 - Milk weights before and after all feeds
 - Daily morning weights

Formula Fed Infants

- Infant formula ad lib on demand
- Resume pre-hospital formula after discharge

Discharge Criteria: Acceptable TSB level; taking adequate intake as defined by multidisciplinary team; absence of excessive weight loss; adequate follow up plan with PCP; confirm breast pump available for home for breastfeeding infants; follow up appointments in place (PCP within 1-2 days after discharge, lactation consultant if indicated); VNA referral for weight checks and feeding assessment to alternate with PCP follow up if indicated

Discharge Instructions: Continue feedings on demand with goal of 10-12 feedings per day; follow up with PCP 1 day after discharge; continue feeding, supplementing feedings, and pumping as recommended by multidisciplinary team (including lactation consultant)



Phototherapy Nomograms
May use www.bilitool.org to plot patient.

Hyperbilirubinemia Neurotoxicity Risk Factors:

Albumin <3.0 g/dL; isoimmune hemolytic disease, glucose-6-phosphate dehydrogenase (G6PD) deficiency, or other hemolytic conditions; sepsis; or any significant clinical instability in the previous 24 hours.

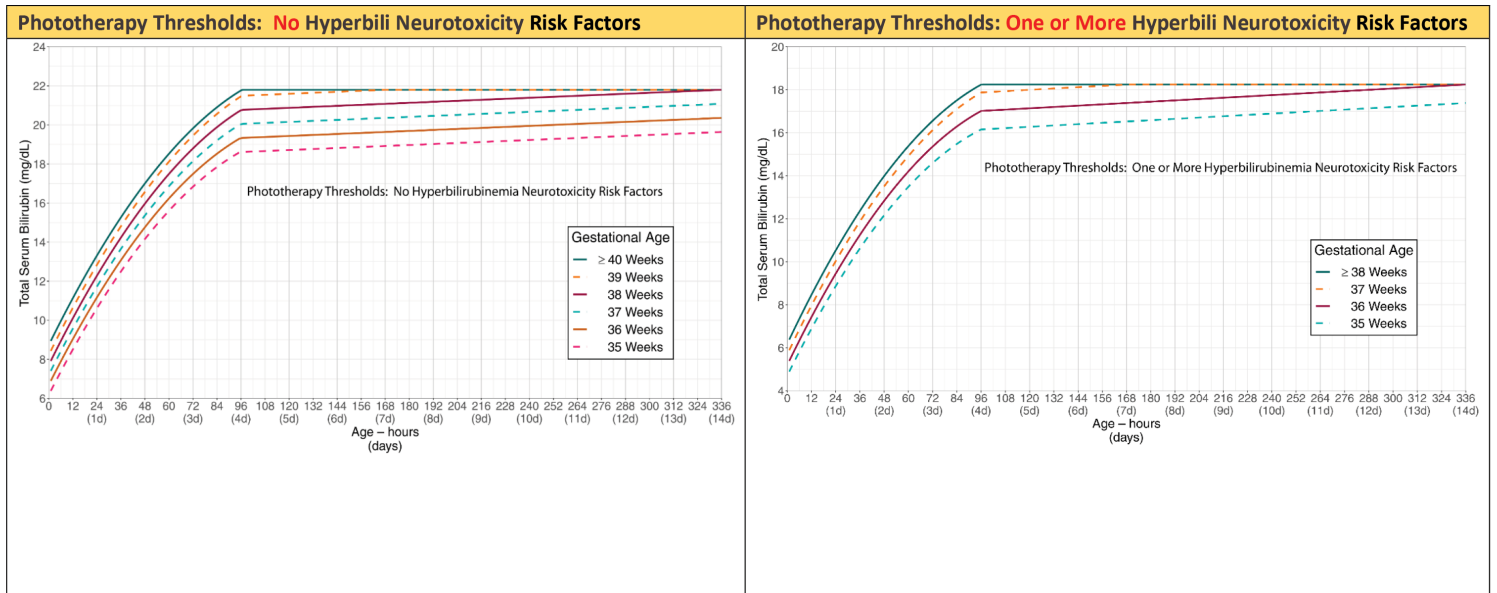


Figure Legend:

These thresholds are based on expert opinion rather than strong evidence on when the potential benefits of phototherapy exceed its potential harms. Use total serum bilirubin concentrations; do not subtract direct-reacting or conjugated bilirubin from the total serum bilirubin. In rare cases of severe hyperbilirubinemia in which the direct-reacting or conjugated bilirubin exceeds 50% of the TSB, consult an expert. Note that infants <24 hours old with a TSB at or above the phototherapy threshold are likely to have a hemolytic process and should be evaluated for hemolytic disease.

Adapted from: Kemper, A. R., et al. (2022). Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. *Pediatrics*, 150(3), e2022058859.



Exchange Transfusion Nomograms
 May use www.bilitool.org to plot patient.

Hyperbilirubinemia Neurotoxicity Risk Factors:

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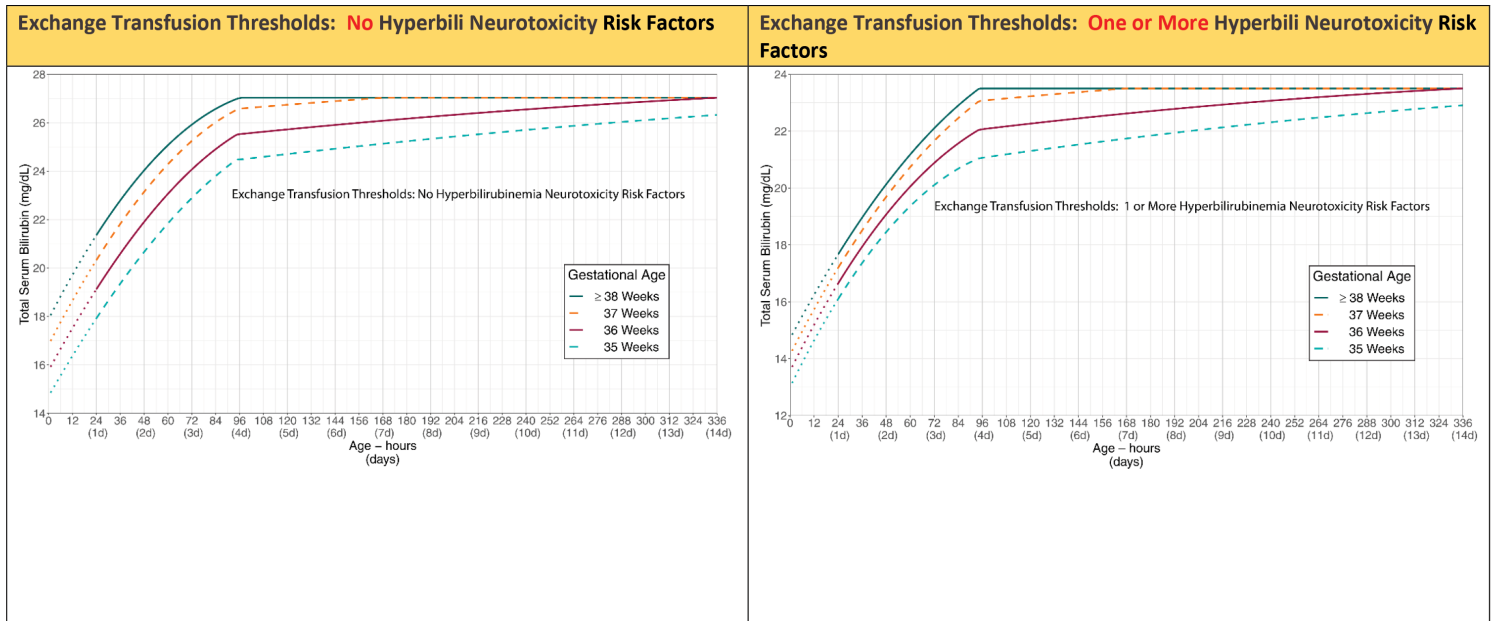


Figure Legend: These thresholds are based on expert opinion rather than strong evidence on when the potential benefits of escalation of care exceed its potential harms. The stippled lines for the first 24 hours indicate uncertainty because of the wide range of clinical circumstances and responses to intensive phototherapy. Use total serum bilirubin concentrations; do not subtract direct bilirubin from the total serum bilirubin. In rare cases of severe hyperbilirubinemia in which the direct-reacting or conjugated bilirubin exceeds 50% of the TSB, consult an expert.

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Etiologies of Hyperbilirubinemia

<p style="text-align: center;"><u>Increased Bilirubin Production</u></p> <ul style="list-style-type: none"> • Hemolytic Disease <ul style="list-style-type: none"> ○ Isoantibodies <ul style="list-style-type: none"> ▪ ABO ▪ Rh ▪ Minor antibodies ○ Enzyme defects <ul style="list-style-type: none"> ▪ Glucose-6-phosphate deficiency ▪ Pyruvate kinase deficiency ○ Structural defects <ul style="list-style-type: none"> ▪ Spherocytosis ▪ Elliptocytosis • Birth trauma <ul style="list-style-type: none"> ○ Scalp hematoma ○ Excessive bruising • Polycythemia 	<p style="text-align: center;"><u>Other or Combined Etiologies</u></p> <ul style="list-style-type: none"> • Family history of inherited hemolytic disorders • Prematurity • Metabolic disorder <ul style="list-style-type: none"> ○ Hypothyroidism ○ Galactosemia • Infection <ul style="list-style-type: none"> ○ Urinary tract infection ○ Sepsis • Breastfeeding (non-breastfeeding/starvation jaundice) • Drugs <ul style="list-style-type: none"> ○ Sulfisoxazole ○ Streptomycin ○ Benzyl alcohol ○ Chloramphenicol
<p style="text-align: center;"><u>Decreased Bilirubin Excretion</u></p> <ul style="list-style-type: none"> • Biliary obstruction <ul style="list-style-type: none"> ○ Biliary atresia ○ Choledochal cyst ○ Dubin-Johnson syndrome ○ Rotor syndrome 	<p style="text-align: center;"><u>Impaired Bilirubin Conjugation</u></p> <ul style="list-style-type: none"> • Gilbert syndrome • Crigler-Najjar syndrome I and II • Human milk jaundice

Risk Factors to Consider

<p style="text-align: center;"><u>Risk Factors for Development of Significant Hyperbilirubinemia for Infants ≥35 Weeks Gestation</u></p> <ul style="list-style-type: none"> • Lower gestational age (i.e., risk increases with each week <40 weeks) • Jaundice observed in first 24 hours after birth • Pre-discharge from birth hospital TcB or TSB close to phototherapy threshold • Phototherapy before birth hospital discharge • Blood group incompatibility <ul style="list-style-type: none"> ○ Positive direct antiglobulin test ○ Other hemolytic disease (G6PD) ○ Elevated ETCO₂ • Parent or sibling requiring phototherapy or exchange transfusion • Family history or genetic ancestry suggestive of inherited red blood cell disorders, including G6PD • Scalp hematoma or significant bruising • Down syndrome • Macrosomic infant of a diabetic mother 	<p style="text-align: center;"><u>Risk Factors for Hemolysis</u></p> <ul style="list-style-type: none"> • Early onset jaundice (within 1st 24 hours after birth) • Requirement for phototherapy or exchange transfusion during the birth hospitalization • Near-threshold bilirubin levels within the first 48 hours after birth (within 2 mg/dL of phototherapy threshold) • Rapidly rising TSB levels (increasing by ≥0.3 mg/dL per hour in the 1st 24 hours or ≥0.2 mg/dL per hour thereafter or 5 mg/dL in 24 hours) • ABO incompatibility, regardless of DAT • Familial or racial or ethnic history of inherited hemolytic disorder
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Setting up for Admission:

- **Review Phototherapy Nursing Policy**
- **Gather equipment (location listed in table below)**
- **Set up for Phototherapy**
 - White sheet should be covering all sides of open bassinet, and infant placed on top of sheet
 - Bilirubin blanket should be placed in bassinet and will be beneath infant, overhead lights above
 - Overhead lights slide underneath cot
 - Overhead lights no closer than 30 cm to infant as per manufacturer recommendations
 - Goal dose of phototherapy is $\geq 30 \mu\text{W}/\text{cm}^2/\text{nm}$ – assessed with bili-meter at time of set up and once daily on MS floors

Equipment	Location
Open cot/bassinet	One cot designated for MedSurg units, usually found in back storage hallway (MS7), otherwise call NICU and 5-TEAM will deliver
Isolette (incubator) – only when indicated for critically ill, premature, temperature concerns	NICU
Overhead Phototherapy Lights	Equipment Depot
Bilirubin Blanket	Equipment Depot
Bilirubin Blanket Disposable Pad Covers	MS6 and MS7 Omni
Bilimeter (radiometer)	Equipment Depot
Purple eye shields	MS6 and MS7 Omni
Breast Pump and Supplies	Equipment Depot/Omni
Milk weight scale	MS Clean Storage Room
White linen	MS Clean Utility/Storage Rooms



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RN Responsibilities Upon Admission:

1. Phototherapy and Bilirubin Labs Tips

- Obtain Total Serum Bilirubin if >2 hours since last and then start phototherapy
- Start continuous intensive phototherapy ($\geq 30 \mu\text{W}/\text{cm}^2/\text{nm}$) with lights above and bilirubin blanket beneath patient - when infant arrives
- Adjusting the phototherapy dose
 - Measure the irradiance (light intensity) of the phototherapy with the Bili-meter
 - Loosen the height adjustment clamp on the stand and adjust the height of the phototherapy unit to achieve an irradiance goal of at least $\geq 30 \mu\text{W}/\text{cm}^2/\text{nm}$
 - Minimum clearance between the lower edge of the phototherapy lamp and the patient is at least 30 cm per manufacturer guidelines
 - Infant is only wearing a diaper to maximize skin to light exposure
 - Purple eye shields in place on infant
 - Light intensity level should be checked at initiation of phototherapy and at least once a day with bili-meter. **Goal intensity is $\geq 30 \mu\text{W}/\text{cm}^2/\text{nm}$.** (blanket meter is tan, overhead light meter is blue)
- Document on "Phototherapy Flowsheet": start, stop, and any phototherapy documentation items in this flow sheet

2. Breastfeeding and Nutrition Support Upon Patient Arrival

- **Breast pump and pumping kit**
 - Instruct breastfeeding mother on **use of the pump** and to **pump after all feedings**
 - Complete/document completion of this order/task by clicking "done" in Epic
- **Milk weight scale**
 - Instruct mother on how to weigh the baby pre- and post- feedings
 - **Milk weights** are to be done for **all feedings** at breast and recorded on flow sheet
- **Provide mother a breastfeeding log (Appendix E)**
- **Document** that breast pump, pumping kit, pumping instructions, milk weight scale, and feeding log were given to mother
- Print off "**Breastfeeding and Jaundice**" patient hand out from **Kids Health** and review with mother
- **Assess feedings** at breast for **suboptimal intake**
 - Goal total feed volume by age
 - 48-96 hour old: 30 mL/feed
 - 96 hours – 7 days old: 45 mL/feed
 - 7 – 14 days old: 60 mL/feed
 - Ineffective latch and/or suck
 - Sleepy and difficulty to wake for feedings
 - Delayed milk supply
 - Laboratory abnormalities (hypoglycemia)
 - Uric acid crystals in urine
 - <4 stools on day 4 or meconium stools on day 5



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