Clinical Pathways

Hyperbilirubinemia in the Neonate

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Connecticut Children's

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What is a Clinical Pathway?

An evidence-based guideline that decreases unnecessary variation and helps promote safe, effective, and consistent patient care.

Objectives of Pathway

- To decrease variation in the care of neonates admitted for hyperbilirubinemia
- To triage admission processes including when to directly admit to medical/surgical floors vs. Neonatal Intensive Care Unit
- To standardize breastfeeding support during admission, including pumping, when to supplement, and lactation consultation for all breastfeeding infants
- To encourage continuation of exclusive breastfeeding
- To decrease unnecessary use of intravenous therapies
- To guide care involving phototherapy, and decrease delay in initiation of phototherapy
- To standardize laboratory monitoring and decrease unnecessary rebound total serum bilirubin testing
- To ensure Vitamin D supplementation, when indicated

Why is Pathway Necessary?

- Neonates requiring readmission for treatment of hyperbilirubinemia patients are a vulnerable low volume though high risk population
- In 2022 the APP released updates from the original 2004 guidelines for the care of infants ≥ 35 weeks gestation
- Primary goal of care is the prevention of kernicterus; a permanent disabling neurological condition
- Reducing variation in care such as feeding support, laboratory assessments, and phototherapy treatment is essential to providing high value and equitable care for this vulnerable population
- Maximizing nutrition and initiating lactation support at the start of the admission are essential parts of care often overlooked for these patients

Updates to Pathway 2023

- Page 1 of pathway is a navigation page for quick clicking to admission algorithm, ED management, inpatient management, and helpful appendices
- Updated bilirubin nomograms and treatment criteria based upon updated APP clinical practice guideline released August 2022
- Clarified recommendations for extended lab evaluation and when it is indicated
- Improved guidance for Total Serum Bilirubin (TSB) monitoring during and after phototherapy
- Appendix C Etiologies and Risk Factors updated
- Defined phototherapy dosing to ensure patient receives intensive phototherapy
- Improved guidance for expected feeding volumes of a neonate based on age (Inpatient algorithm and appendix D) and how to assess for suboptimal intake (appendix D)

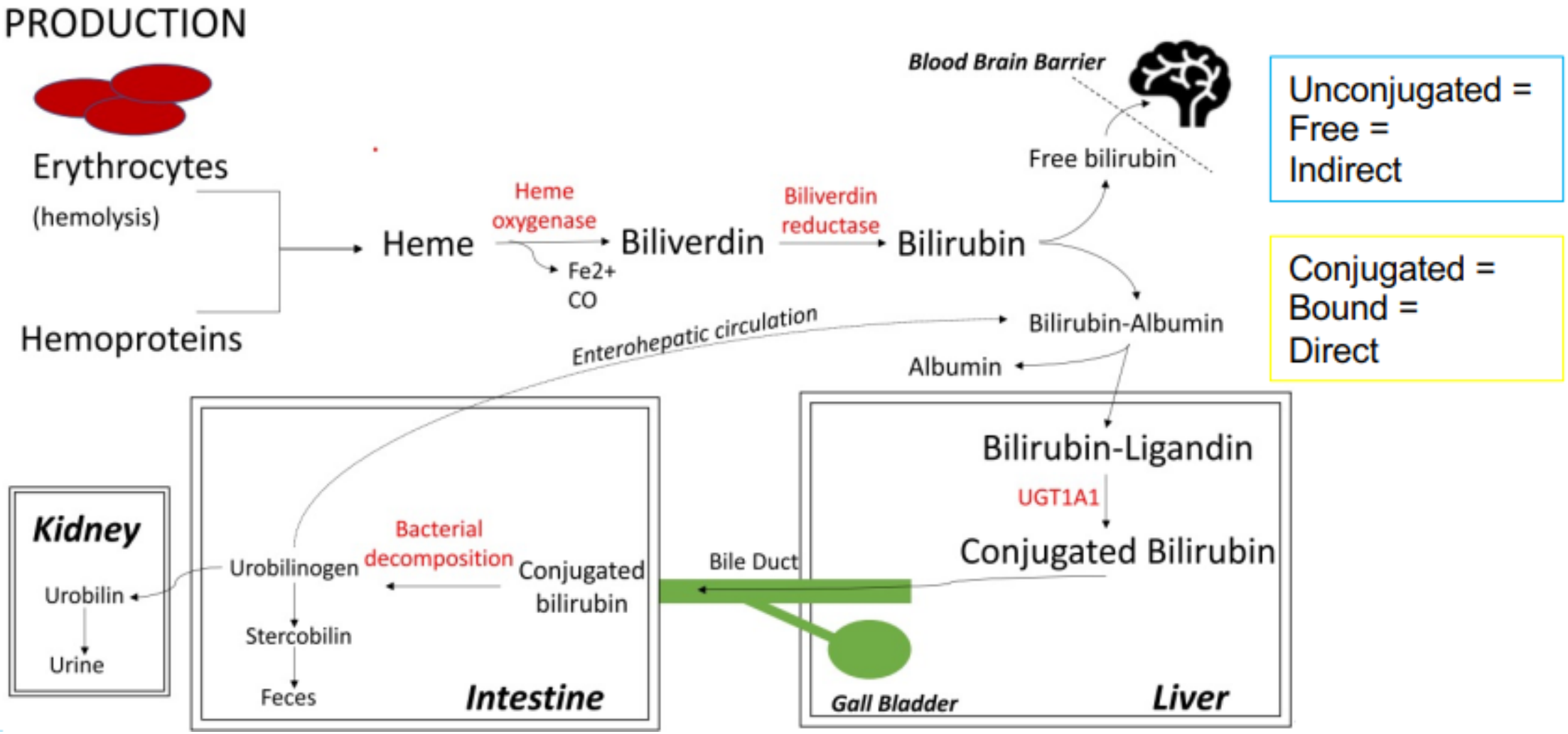
What is Neonatal (Indirect) Hyperbilirubinemia

- More than 80% of neonates will have some degree of jaundice
- Neonatal Hyperbilirubinemia is nearly a universal condition in the newborn
- Clinical Manifestations
  - yellowing of skin, sclera, mucous membranes (jaundice)
- Biochemical Manifestations
  - Increased total serum bilirubin (TSB) as a result of an elevated indirect serum bilirubin
- Requires a consistent approach to screening and treatment
- The mainstay of treatment is NUTRITION and PHOTOTHERAPY (when indicated)

Kemper, A. R., et al. (2022).

Gallois, Sarathy, & Staude (2022)

Bilirubin Metabolism



Gallois, Sarathy, & Staude (2022)

What's the big deal?

- Bilirubin is a cell toxin
- High free unconjugated bilirubin can be deposited in the tissues, including the brain
- Bilirubin neurotoxicity and kernicterus are preventable consequences brain damage caused by bilirubin deposition in the brain

This is the Hyperbilirubinemia in the Neonate Clinical Pathway **– Navigation page**

Navigation page provides quick clicking to admission algorithm, ED management, inpatient management, and helpful appendices

We will be reviewing each component of the pathway in the following slides.

CLINICAL PATHWAY:
Hyperbilirubinemia in the Neonate

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

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 E: Feeding Log

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Hyperbilirubinemia in the Neonate Clinical Pathway

Please review these updated inclusion and exclusion criteria:

- Newborns already discharged from birth hospital or who remain in NICU AND
  …rest of criteria remain the same

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 E: Feeding Log

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This is the Hyperbilirubinemia in the Neonate Clinical Pathway. – **Admission Algorithm**

- Admission algorithm helps determine if patient requires admission, and if may be direct admission to med/surg vs. requires ED visit vs. requires direct admission to NICU
  - Many patients can avoid the ED and be directly admitted!
- Admission criteria are based on updated bilirubin nomograms and patient's risk for hemolysis.
- Links added to bring you directly to nomograms and bilitool.org to assist with assessment for treatment based on updated nomograms
- Gestational age is accounted for in each nomogram (no risk factors & 1 or more risk factors)

CLINICAL PATHWAY:

Hyperbilirubinemia Admission Algorithm

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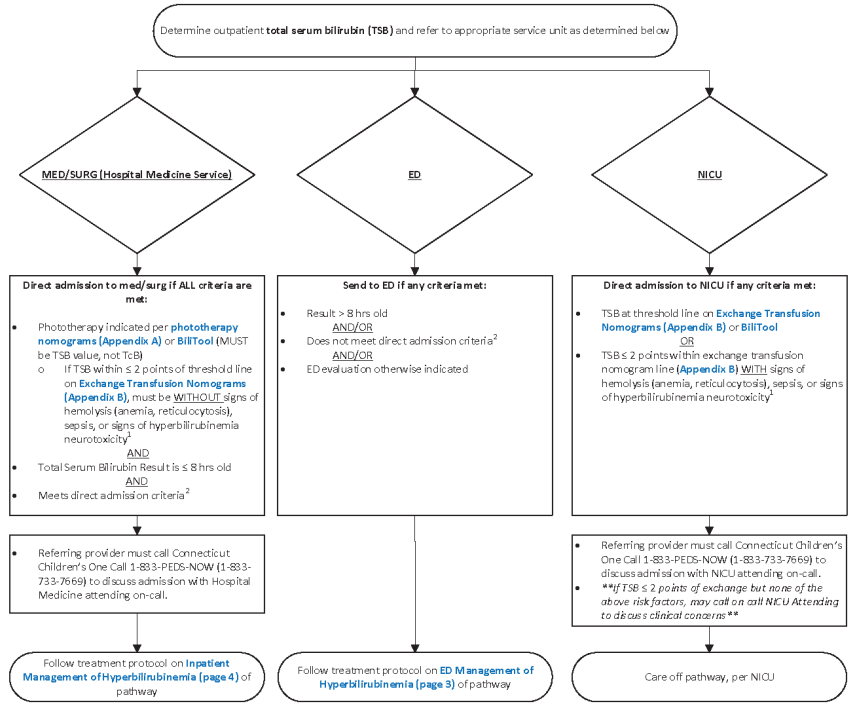

[1] Signs of Hyperbilirubinemia Neurotoxicity
- Hypertonia
- Arching
- Retrocollis
- Opisthotonos
- Fever
- High pitched cry

[2] Direct 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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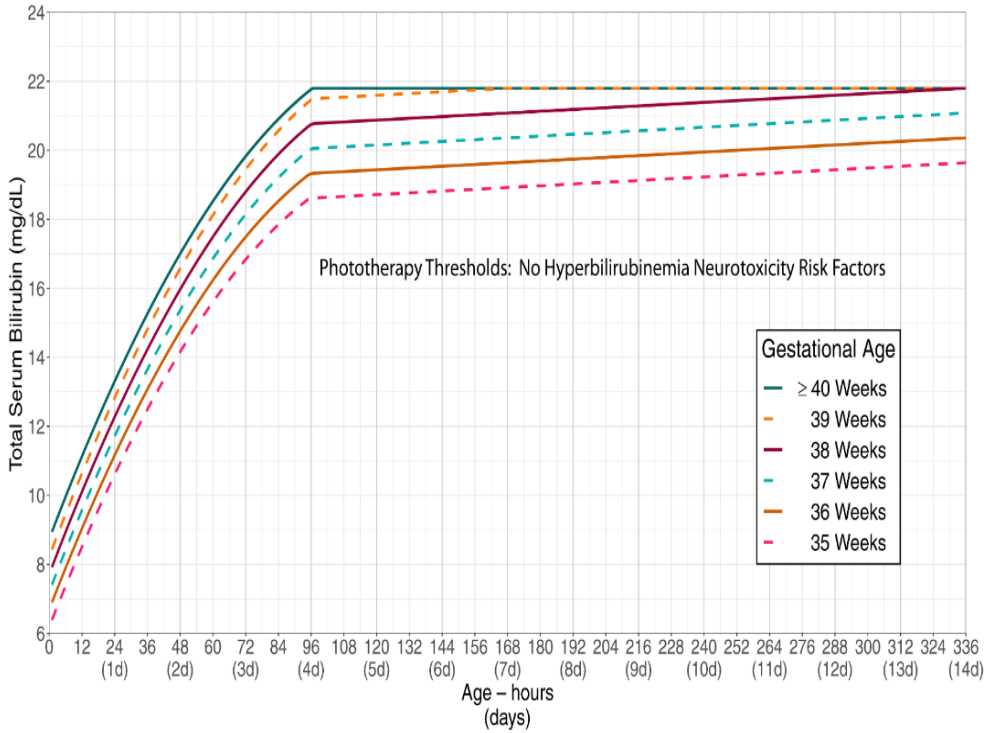
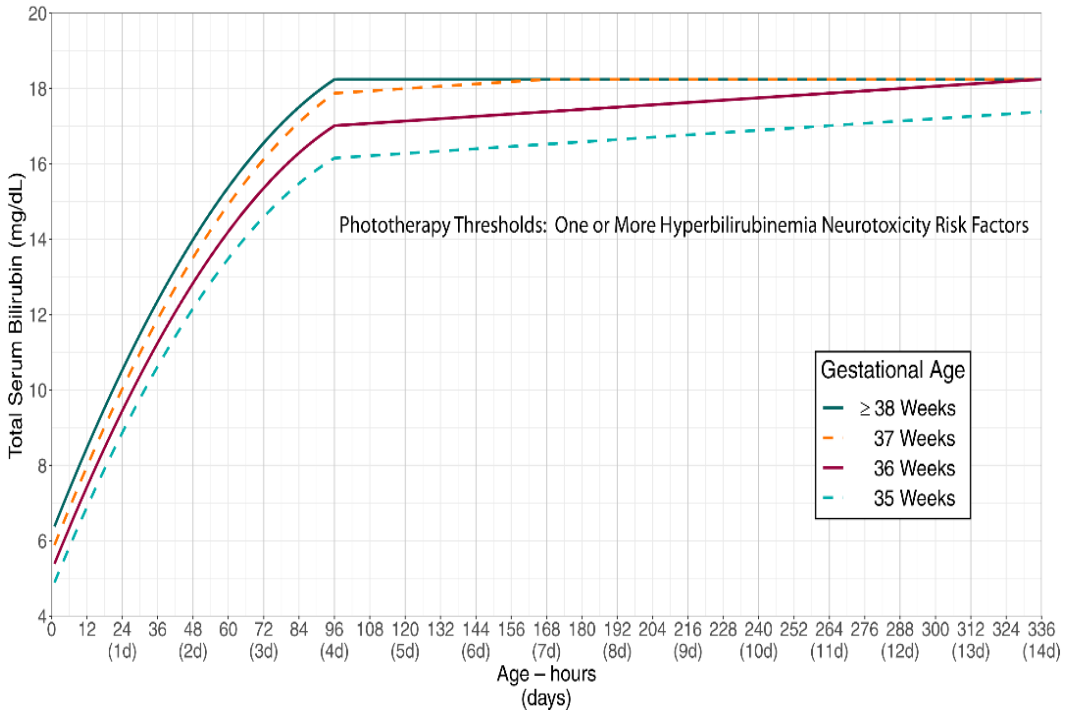
Phototherapy Nomograms

Phototherapy Thresholds: No Hyperbili Neurotoxicity Risk Factors



Phototherapy Thresholds: One or More Hyperbili Neurotoxicity Risk Factors



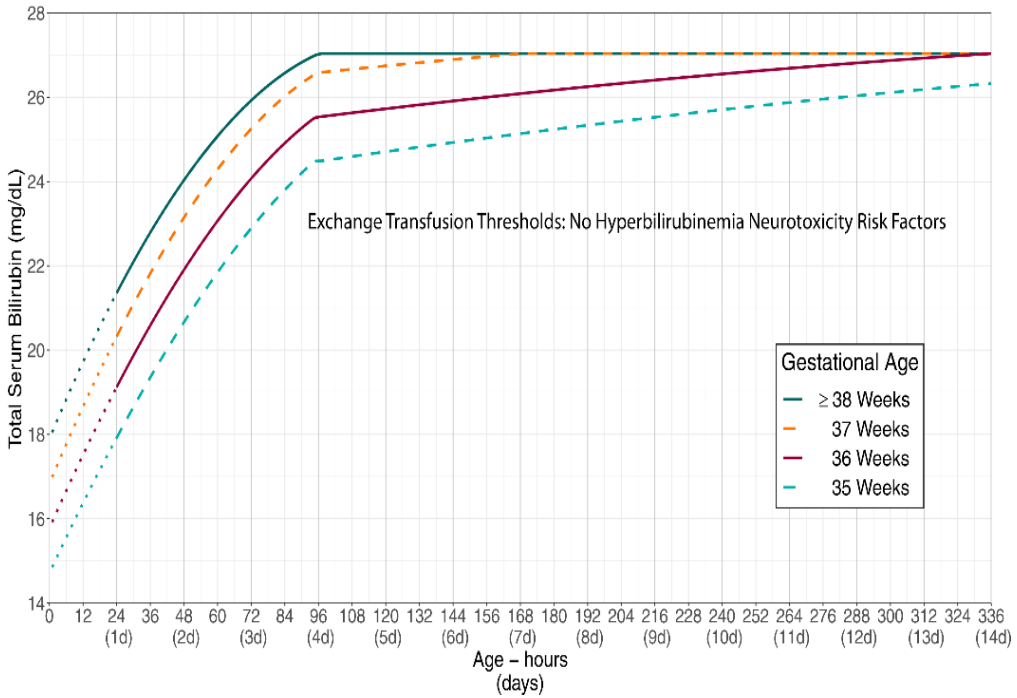
Hyperbilirubinemia Neurotoxicity Risk Factors:

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. Gestational age accounted for within in nomogram.

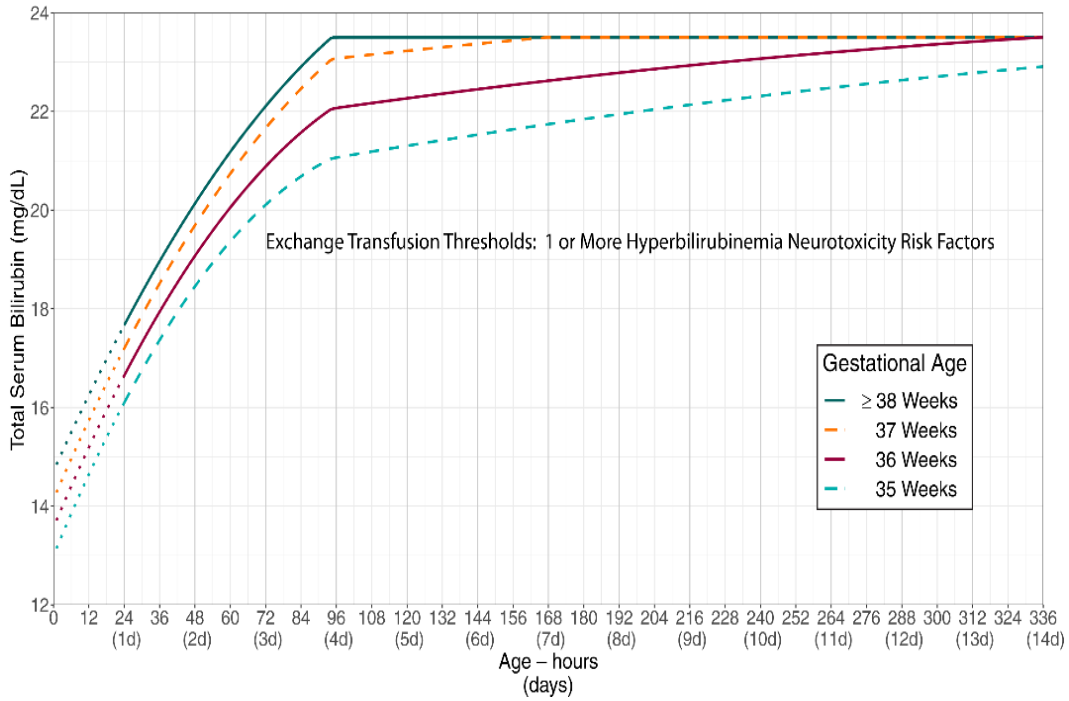
Adapted from: Kemper, A. R., et al. (2022). Clinical Practice Guideline Revision: Management of Hyperbilirubinemia in the Newborn Infant 35 or More Weeks of Gestation. *Pediatrics*, *150*(3), e2022058859.

Exchange Transfusion Nomograms

Exchange Transfusion Thresholds: No Hyperbili Neurotoxicity Risk Factors



Exchange Transfusion Thresholds: One or More Hyperbili Neurotoxicity Risk Factors



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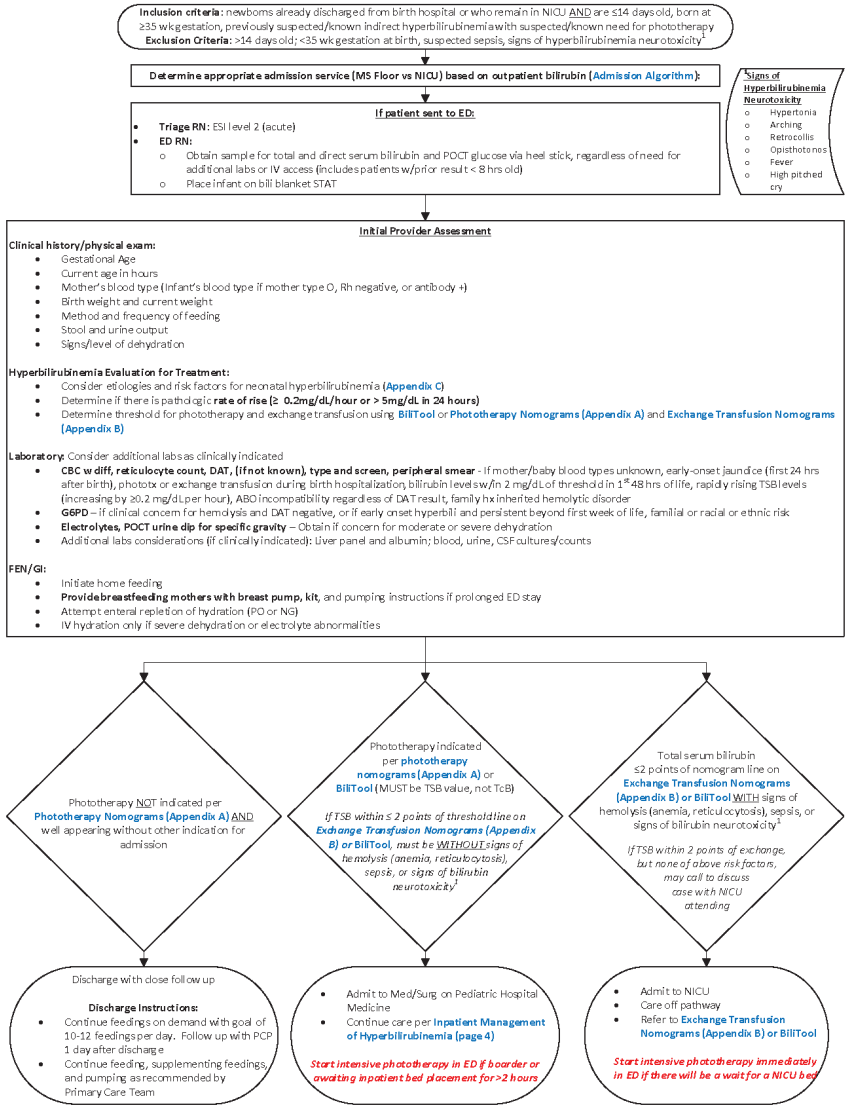
This is the Hyperbilirubinemia in the Neonate Clinical Pathway. – **Emergency Room Management**

We will be reviewing each component in the following slides.

CLINICAL PATHWAY:

Hyperbilirubinemia Emergency Room Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



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Hyperbilirubinemia in the Neonate Clinical Pathway. **–Emergency Management**

Delay in initiation of phototherapy must be avoided

- ED RN to obtain total and direct serum bilirubin & POCT glucose by heal stick upon rooming
- Start patient on **biliblanket STAT** while labs are pending

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Hyperbilirubinemia Emergency Room Management

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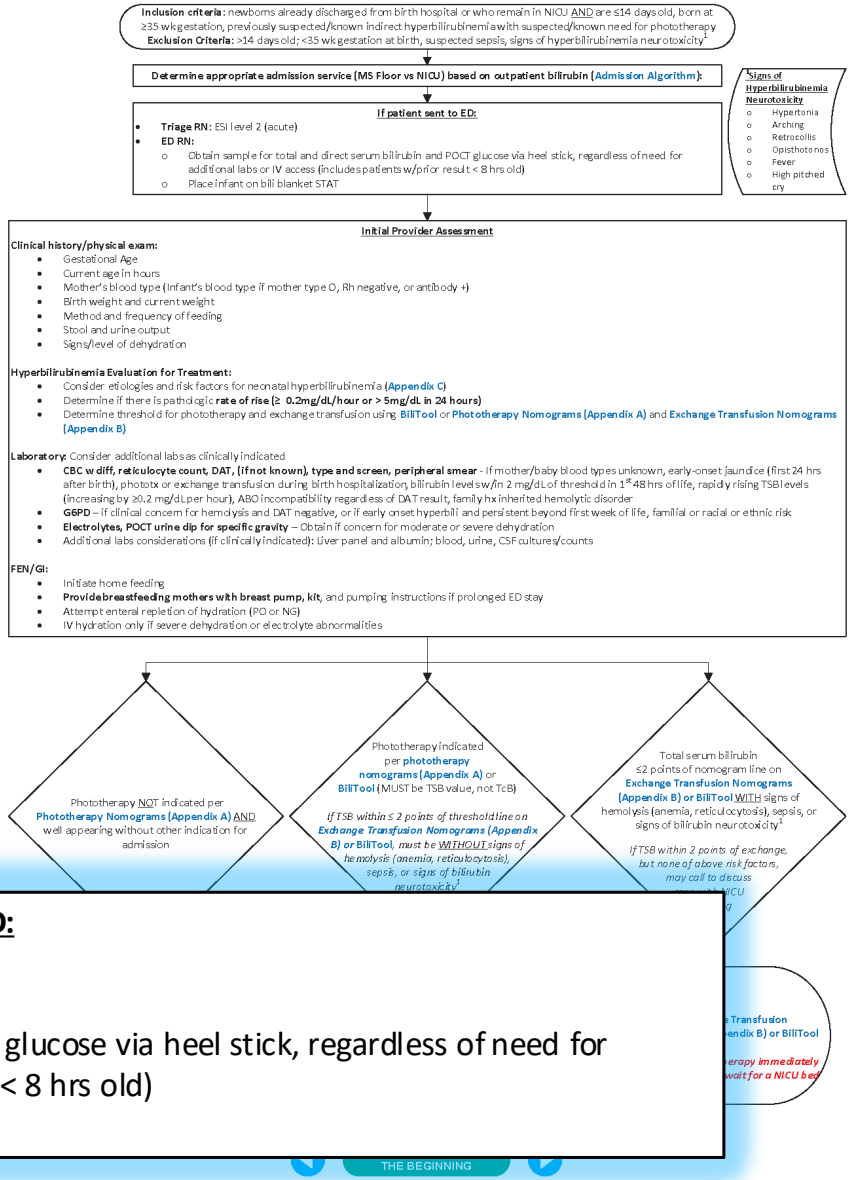

If patient sent to ED:

- **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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Hyperbilirubinemia in the Neonate Clinical Pathway. – **Emergency & Inpatient Management**

Initial provider assessment

- Critical clinical history & physical exam are included
  - essential to determine phototherapy and exchange transfusion criteria
- Determine treatment threshold with BiliTool.org or AAP nomograms 2022
- Must also consider if there is a pathological rate of rise ≥ 0.2mg/dL/hour
- Appendix C added to support review of etiologies and risk factors

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Hyperbilirubinemia Emergency Room Management

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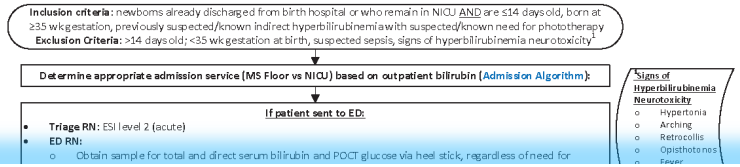


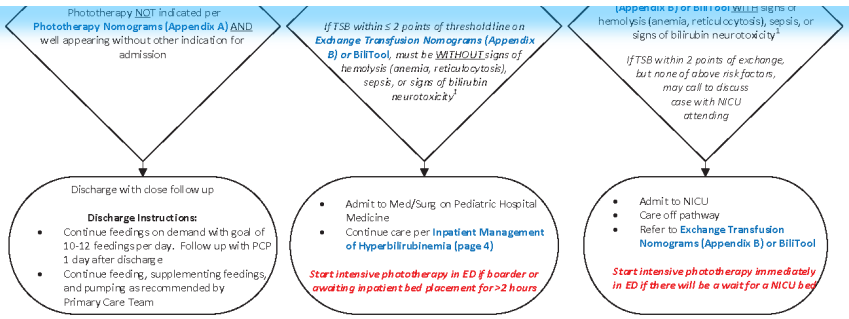
Initial Provider Assessment

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 +)
- Birth weight and current weight
- 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 (≥ 0.2mg/dL/hour or > 5mg/dL in 24 hours)**
- Determine threshold for phototherapy and exchange transfusion using BiliTool or Phototherapy Nomograms (Appendix A) and Exchange Transfusion Nomograms (Appendix B)



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Hyperbilirubinemia in the Neonate Clinical Pathway. – **Appendix C: Etiologies and Risk Factors**

Etiologies of Hyperbilirubinemia

Increased Bilirubin Production

- **Hemolytic Disease**
  - Isoantibodies
    - ABO
    - Rh
    - Minor antibodies
  - Enzyme defects
    - Glucose-6-phosphate deficiency
    - Pyruvate kinase deficiency
  - Structural defects
    - Spherocytosis
    - Ellipotocytosis
- **Birth trauma**
  - Scalp hematoma
  - Excessive bruising
- **Polycythemia**

Other or Combined Etiologies

- **Family history of inherited hemolytic disorders**
- **Prematurity**
- **Metabolic disorder**
  - Hypothyroidism
  - Galactosemia
- **Infection**
  - Urinary tract infection
  - Sepsis
- **Breastfeeding (non-breastfeeding/starvation jaundice)**
- **Drugs**
  - Sulfisoxazole
  - Streptomycin
  - Benzyl alcohol
  - Chloramphenicol

Decreased Bilirubin Excretion

- **Biliary obstruction**
  - Biliary atresia
  - Choledochal cyst
  - Dubin-Johnson syndrome
  - Rotor syndrome

Impaired Bilirubin Conjugation

- Gilbert syndrome
- Crigler-Najjar syndrome I and II
- Human milk jaundice

Risk Factors to Consider

Risk Factors for Development of Significant Hyperbilirubinemia for Infants ≥ 35 Weeks Gestation

- Lower gestational age (ie, risk increases with each week < 40 weeks)
- Jaundice observed in first 24 hours after birth
- Predischarge from birth hospital TcB or TSB close to phototherapy threshold
- Phototherapy before birth hospital discharge
- Blood group incompatibility
  - 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

Risk Factors for Hemolysis

- 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 2mg/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
- ABO incompatibility, regardless of DAT
- Familial or racial or ethnic history of inherited hemolytic disorder

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.

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Hyperbilirubinemia in the Neonate Clinical Pathway. – **Emergency & Inpatient Management**

Initial Laboratory

- Guidance for evaluating patient's risk for hemolysis and appropriate labs to obtain added
- Included clarification for which patients to screen for G6PD
- Clarified additional lab considerations

CLINICAL PATHWAY:
Hyperbilirubinemia Emergency Room Management

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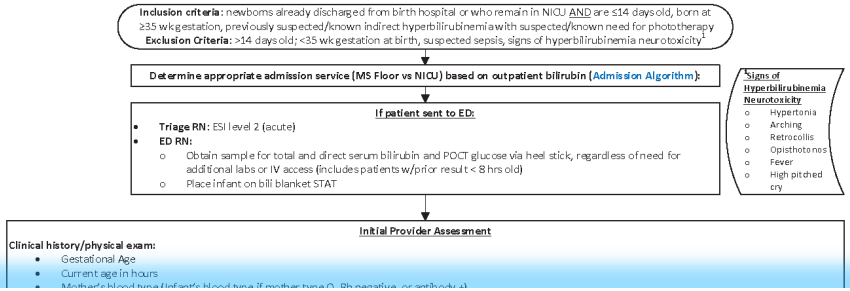
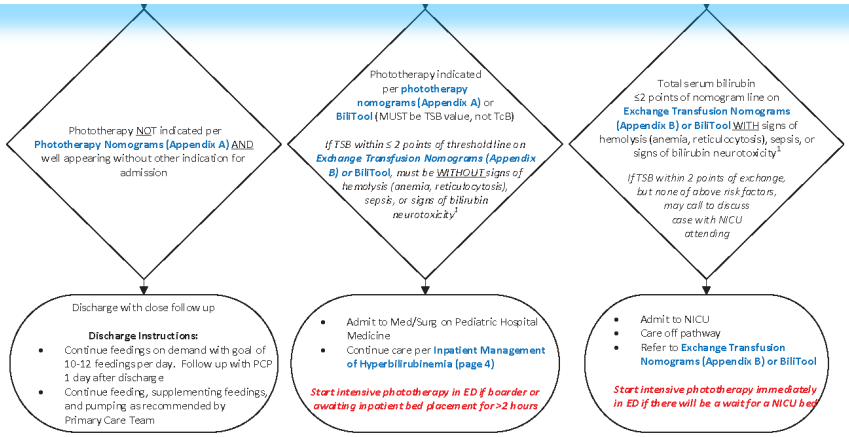


Laboratory: Consider additional labs as clinically indicated

- **CBC w diff, reticulocyte count, DAT, (if not known), type and screen, peripheral smear** - If mother/baby blood types unknown, early-onset jaundice (first 24 hrs after birth), phototx or exchange transfusion during birth hospitalization, bilirubin levels w/in 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** – Obtain if concern for moderate or severe dehydration
- Additional labs considerations (if clinically indicated): Liver panel and albumin; blood, urine, CSF cultures/counts



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Hyperbilirubinemia in the Neonate Clinical Pathway. – **Emergency Room Management**

If meets criteria for discharge from ED

- Critical to provide appropriate post discharge feeding and pumping guidance to caregivers
- Ensure timely post discharge follow up with primary care provider

Discharge with close follow up

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 Primary Care Team

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Hyperbilirubinemia Emergency Room Management

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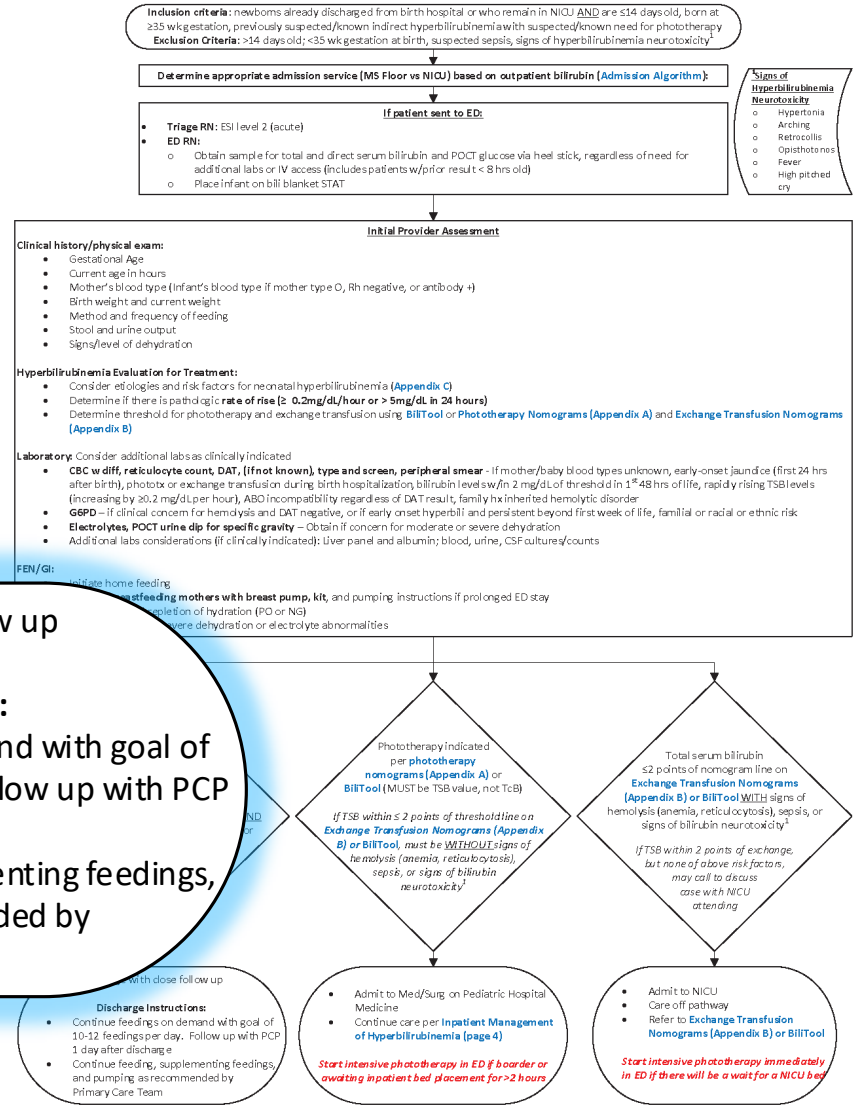

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This is the Hyperbilirubinemia in the Neonate Clinical Pathway. – **Inpatient Management**

Inpatient algorithm also pulls out initial provider assessment, important H&P details, risk factors, and initial laboratory guidance which is the same as the ED content

We will review the additional inpatient management content on the next few slides

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

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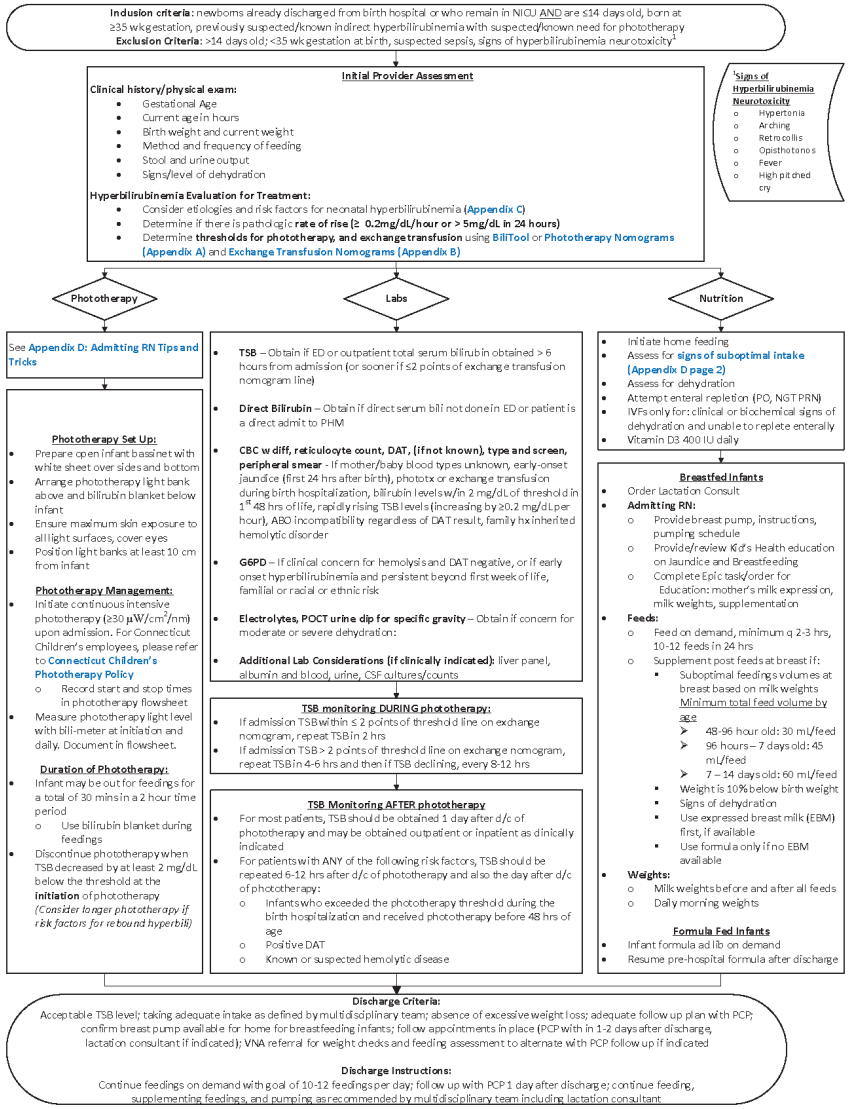

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Appendix D provides additional tips and tricks for nurses

- Setting up for admission
- Setting up phototherapy
- Where to obtain equipment at CT Children's Hartford campus
- Admitting RN responsibilities

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 ≥ 30 $\mu W/cm^2/nm$ – 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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Setting up phototherapy

- White sheet to cover bottom and all sides of open cot
- Biliblanket below infant
- Light bank above infant
- Ensure maximum skin exposure to all light surfaces

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Initial Provider Assessment

Clinical history/physical exam:
- Gestational Age
- Current age in hours
- Birth weight and current weight
- Method and frequency of feeding
- Stool and urine output
- Signs/level of dehydration

Hyperbilirubinemia Evaluation for Treatment:
- ...ories and risk factors for neonatal hyperbilirubinemia (Appendix C)
- ...athologic **rate of rise (≥ 0.2mg/dL/hour or > 5mg/dL in 24 hours)**
- **...otherapy, and exchange transfusion** using BiliTool or Phototherapy Nomograms
- **...sfusion Nomograms (Appendix B)**

[1]**Signs of Hyperbilirubinemia Neurotoxicity**
- Hypertonia
- Arching
- Retrocollis
- Opisthotonos
- Fever
- High pitched cry

Phototherapy

Phototherapy | Labs | Nutrition

See **Appendix D: Admitting RN Tips and Tricks**

- ...erum bilirubin obtained > 6 ...points of exchange transfusion
- ...n bili not done in ED or patient is
- 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
- **CBC w diff, reticulocyte count, DAT, (if not known), type and screen, peripheral smear** - if mother/baby blood types unknown, early-onset jaundice (first 24 hrs after birth), phototx or exchange transfusion during birth hospitalization, bilirubin levels w/in 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
- ...ative, or if early ...week of life,
- ...tain if concern for
- ...): liver panel,
- ...n exchange
- ...nge nomogram, ...8-12 hrs
- ...r d/c of ...atient as clinically
- ...SB should be ...the day after d/c
- ...old during the ...) before 48 hrs of

- 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 q 2-3 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

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

...excessive weight loss; adequate follow up plan with PCP; confirm breast pump available for home for breastfeeding infants; follow appointments in place (PCP with in 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

RETURN TO THE BEGINNING

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LAST UPDATED: 02.27.23

Hyperbilirubinemia in the Neonate Clinical Pathway. **–Inpatient Management**

Phototherapy

- Defined intensive phototherapy dose: ≥ 30 μW/cm²/nm
- Tips on setting up, maintaining, and monitoring intensive phototherapy added
- Added guidance to consider discontinuing phototherapy when TSB decreased by at least 2 mg/dL below threshold at the initiation of phototherapy

Phototherapy

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

See **Appendix D: Admitting RN Tips and Tricks**

Phototherapy Set Up:

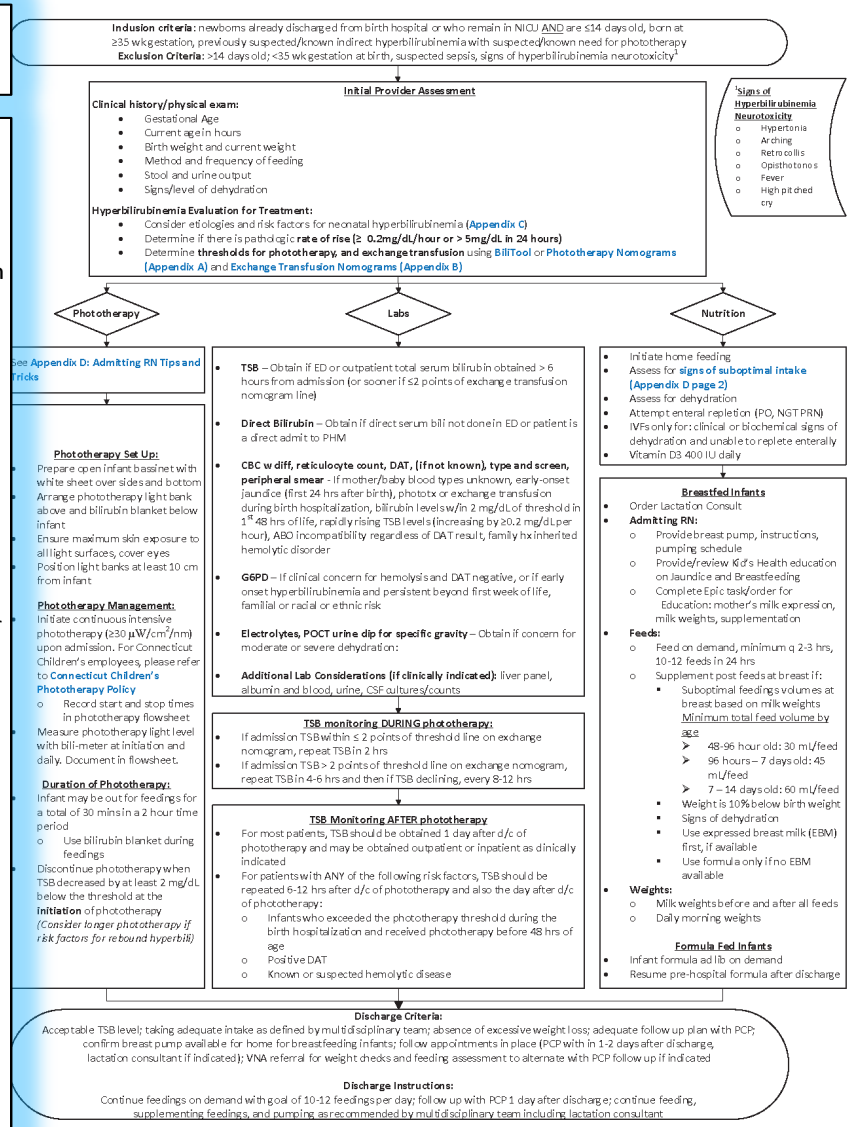
- Prepare open infant bassinet with white sheet over sides and bottom
- Arrange phototherapy light bank above and bilirubin blanket below infant
- Ensure maximum skin exposure to all light surfaces, cover eyes
- Position light banks at least 10 cm from infant

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 rebound hyperbili)*



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Management of phototherapy

- Goal irradiance dose is ≥ 30 μW/cm²/nm
- Recording start and stop times of treatment on phototherapy flow sheet is essential
- Measuring phototherapy irradiance/light level with bili-meter ensures proper light dose

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

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[1]

Initial Provider Assessment

Clinical history/physical exam:
- Gestational Age
- Current age in hours
- [illegible] and current weight
- [illegible]cy of feeding

[illegible]tment:
- [illegible] and risk factors for neonatal hyperbilirubinemia (Appendix C)
- [illegible] there is pathologic **rate of rise (≥ 0.2mg/dL/hour or > 5mg/dL in 24 hours)**
- Determine **thresholds for phototherapy, and exchange transfusion** using **BiliTool** or **Phototherapy Nomograms** (Appendix A) and **Exchange Transfusion Nomograms** (Appendix B)

[1]**Signs of Hyperbilirubinemia Neurotoxicity**
- Hypertonia
- Arching
- Retrocollis
- Opisthotonos
- Fever
- High pitched cry

Phototherapy

See **Appendix D: Admitting RN Tips and Tricks**

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.

Phototherapy Set Up:
- Prepare open infant bassinet with [illegible]

[illegible] bilirubin obtained > 6 [illegible]oints of exchange transfusion [illegible]nomogram only]

- **Direct Bilirubin** – Obtain if direct serum bili not done in ED or patient is a direct admit to PHM
- **CBC w diff, reticulocyte count, DAT, (if not known), type and screen,** [illegible]known, early-onset [illegible]ge transfusion [illegible]mg/dL of threshold in [illegible]g by ≥0.2 mg/dL per [illegible], family hx inherited

[illegible]egative, or if early [illegible]st week of life,

[illegible]Obtain if concern for

[illegible]ed): liver panel,

[illegible]on exchange

[illegible]hange nomogram, [illegible]ry 8-12 hrs

[illegible]fter d/c of [illegible]npatient as clinically

[illegible]TSB should be [illegible]so the day after d/c

[illegible]shold during the [illegible]spy before 48 hrs of

Nutrition
- 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 q 2-3 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

[illegible] excessive weight loss; adequate follow up plan with PCP; confirm breast pump available for home for breastfeeding infants; follow appointments in place (PCP with in 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

RETURN TO THE BEGINNING

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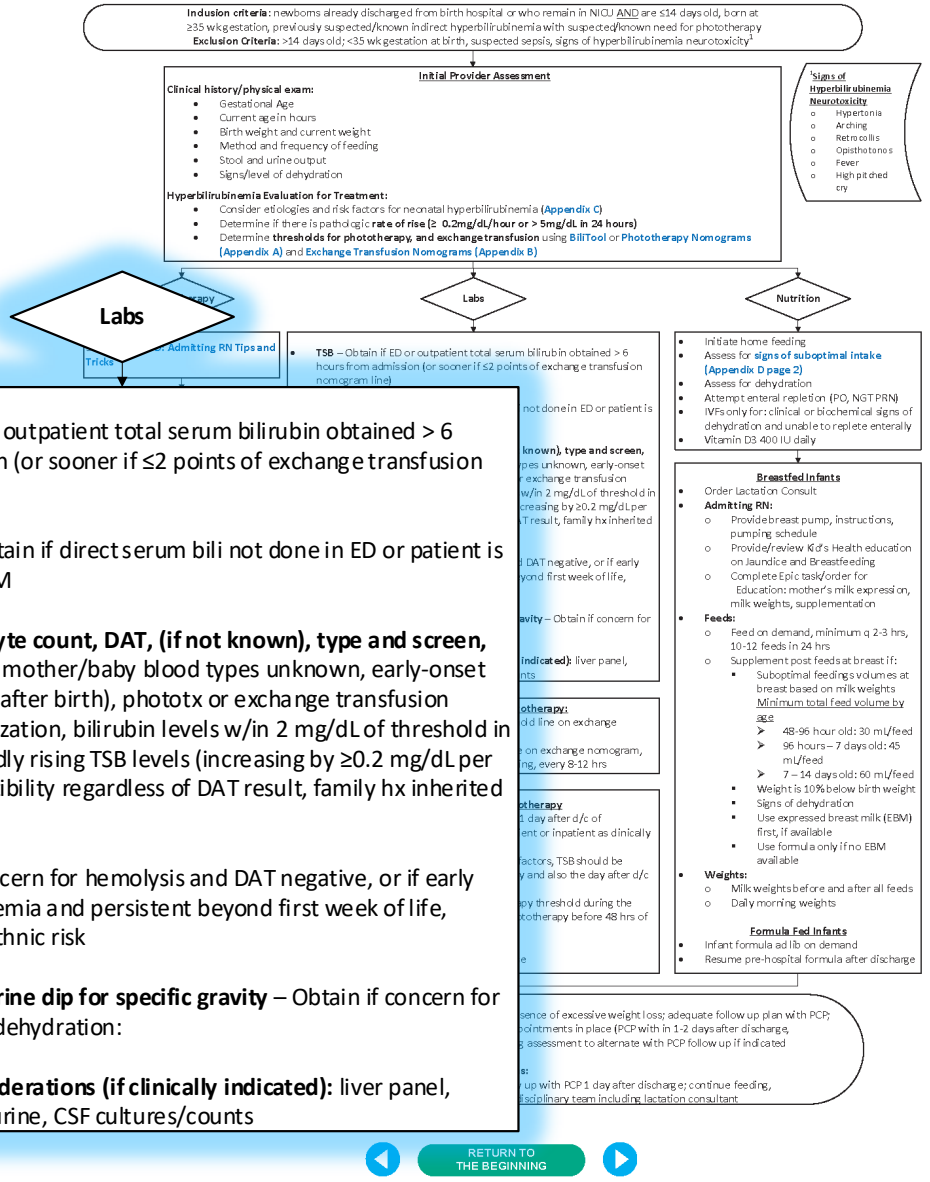
Initial Laboratory

- Guidance for evaluating patient's risk for hemolysis and appropriate labs to obtain added
- Included clarification for which patients to screen for G6PD
- Clarified additional lab considerations

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.



- **TSB** – Obtain if ED or outpatient total serum bilirubin obtained > 6 hours from admission (or sooner if ≤2 points of exchange transfusion nomogram line)
- **Direct Bilirubin** – Obtain if direct serum bili not done in ED or patient is a direct admit to PHM
- **CBC w diff, reticulocyte count, DAT, (if not known), type and screen, peripheral smear** - If mother/baby blood types unknown, early-onset jaundice (first 24 hrs after birth), phototx or exchange transfusion during birth hospitalization, bilirubin levels w/in 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 hyperbilirubinemia and persistent beyond first week of life, familial or racial or ethnic risk
- **Electrolytes, POCT urine dip for specific gravity** – Obtain if concern for moderate or severe dehydration:
- **Additional Lab Considerations (if clinically indicated):** liver panel, albumin and blood, urine, CSF cultures/counts

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TSB monitoring DURING phototherapy

- Ensure effective decline in TSB with treatment
- Distance for exchange tx line determines next TSB timing
- Once TSB is declining, AND > 2 points from exchange threshold can repeat ~ every 6-12 hours

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

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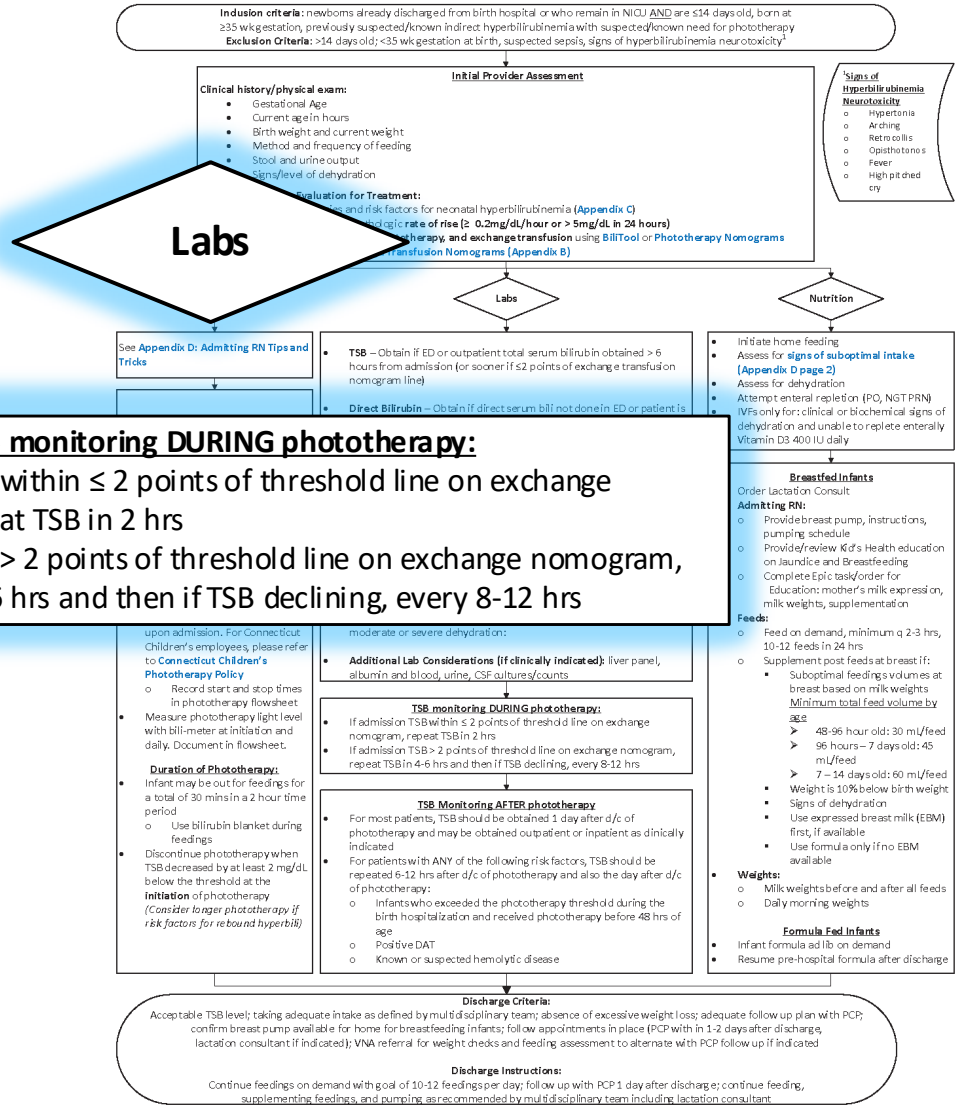

TSB monitoring DURING phototherapy:

- 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

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TSB monitoring AFTER phototherapy

- For most patients a repeat TSB 1 day after stopping phototherapy is appropriate
- Can be obtained as outpatient or inpatient, as clinically indicated
- Updated criteria for when to consider TSB 6-12 hours after phototherapy discontinued

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

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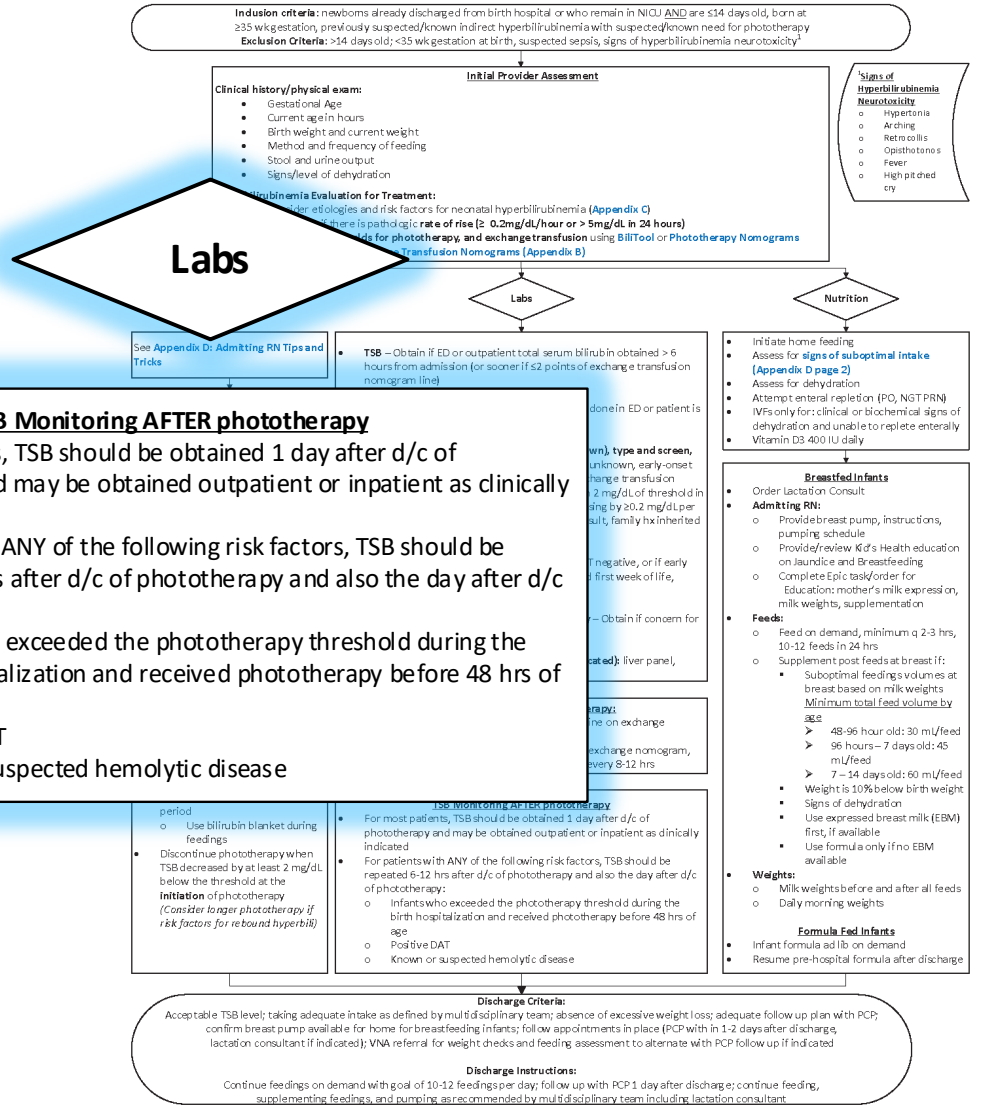

Labs

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

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Nutrition

- Nutrition optimization is essential for hyperbili treatment
- Goal feeding volumes based on age have been added to guide supplementation
- Lactation support for breastfeeding patients is integral to feeding optimization
- Goal breastfeedings is at least 10-12 time per day (minimum every 2-3 hours)

Nutrition

- 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 q 2-3 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

CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

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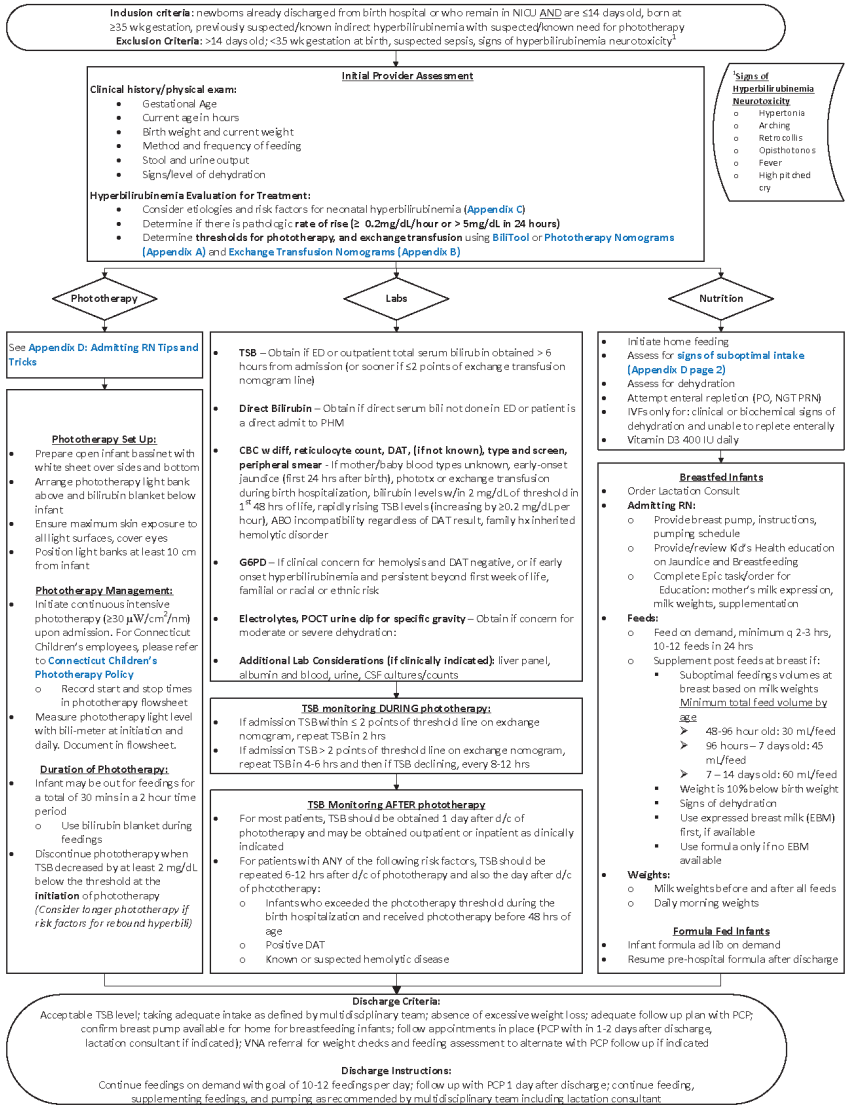

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Importance of Enteral Feeding

- Enteral feeding allows optimal excretion of bilirubin via bile and intestinal route
- Consider Nasogastric feedings if there are feeding difficulties
- Inadequate feeding results in increased intestinal resorption of bilirubin and higher unconjugated bilirubin levels (“increased enterohepatic circulation”)
- Meconium is a reservoir of unconjugated bilirubin
  - Poor passage of stool = more absorption of unconjugated bilirubin

Appendix D page 9 also provides additional tips and tricks for nurses

- Admitting RN responsibilities
  1. Tips for phototherapy and labs
  2. Breastfeeding and nutritional support to provide upon arrival (pump and pump kit, instructions for pumping, milk weight scale, provide feeding log)
  3. Guidance for how to assess for suboptimal intake

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 (≥ 30 µW/cm^2/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 **≥ 30 µW/cm^2/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 ≥ 30 µW/cm^2/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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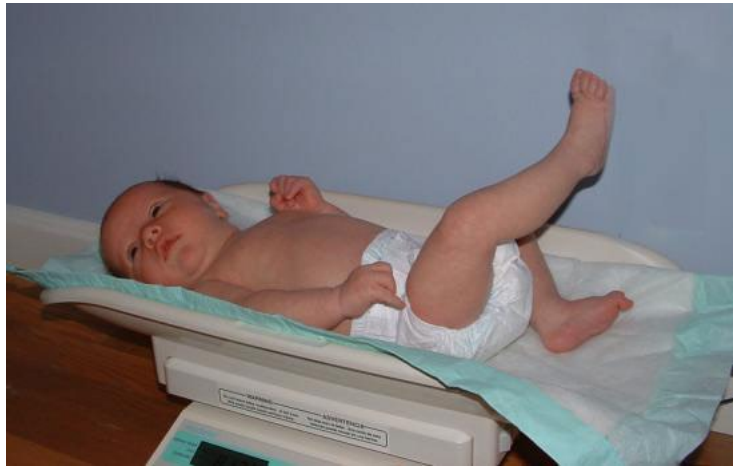
Measuring feedings at Breast with Milk Weight Scale

Milk Weight Scale

- Use before and after feedings at breast
  - 1 gram = 1 mL breast milk
- Assists in assessing supply
- Help determine potential need to supplement
- Every feeding at breast & recorded on flow sheet



Use of IV Fluids

- Most infants with hyperbilirubinemia do not require IV fluids
- IVFs may decrease infant's desire to take oral feedings, and thus prolong jaundice
- Consider use of nasogastric tube in place of IVFs, if unable to take adequate PO intake, as clinically appropriate
- Consider IVF if evidence of moderate dehydration:
  - Hemodynamic instability
  - Moderate to severe electrolyte abnormalities
  - Unable to correct these factors enterally

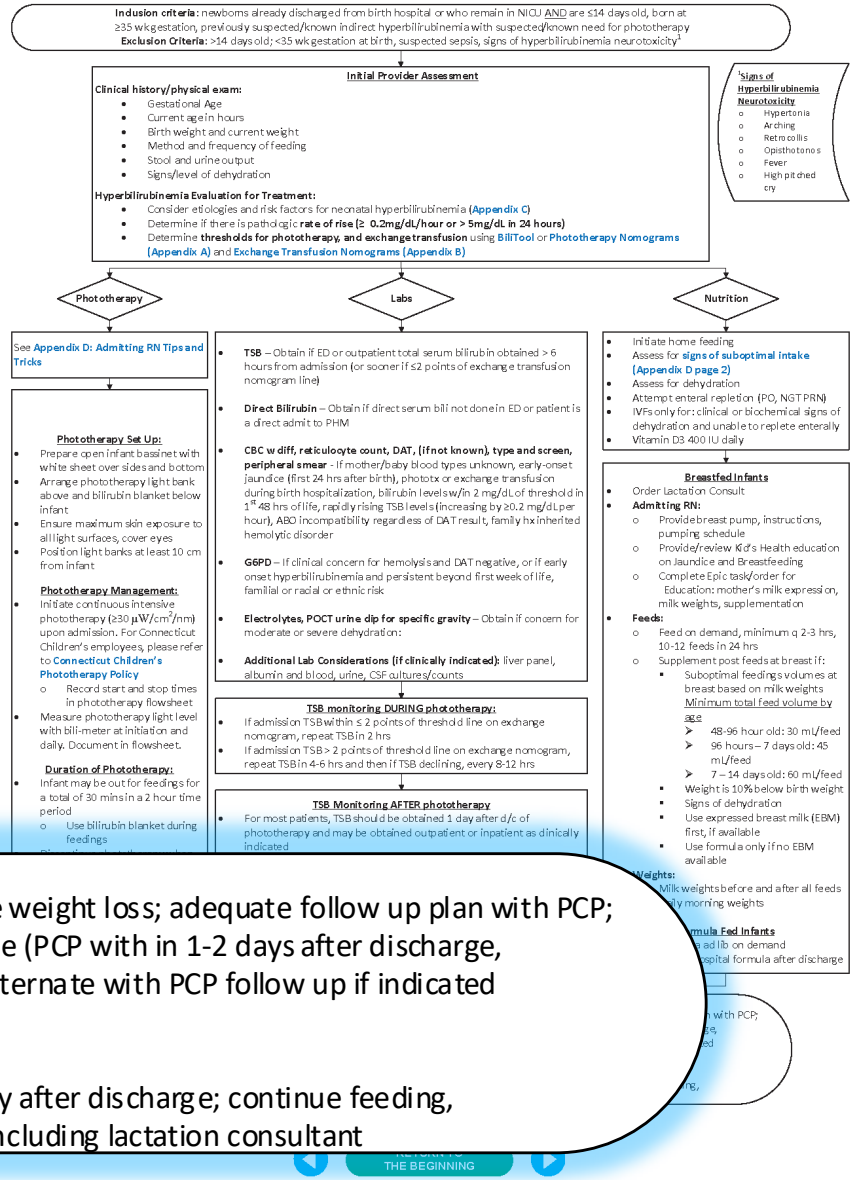
CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

THIS PATHWAY SERVES AS A GUIDE AND DOES NOT REPLACE CLINICAL JUDGMENT.

Discharge Criteria:

- Infant medically stable with an acceptable TSB level
- For most patients TSB level at least 2 pts below the threshold at the initiation of phototherapy is acceptable (consider longer phototx for patients with rebound risk factors)
- Oral intake and weight are appropriate
- Appropriate follow up services in place: PCP, lactation, VNA as needed



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 appointments in place (PCP with in 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

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CLINICAL PATHWAY:

Hyperbilirubinemia Inpatient Management

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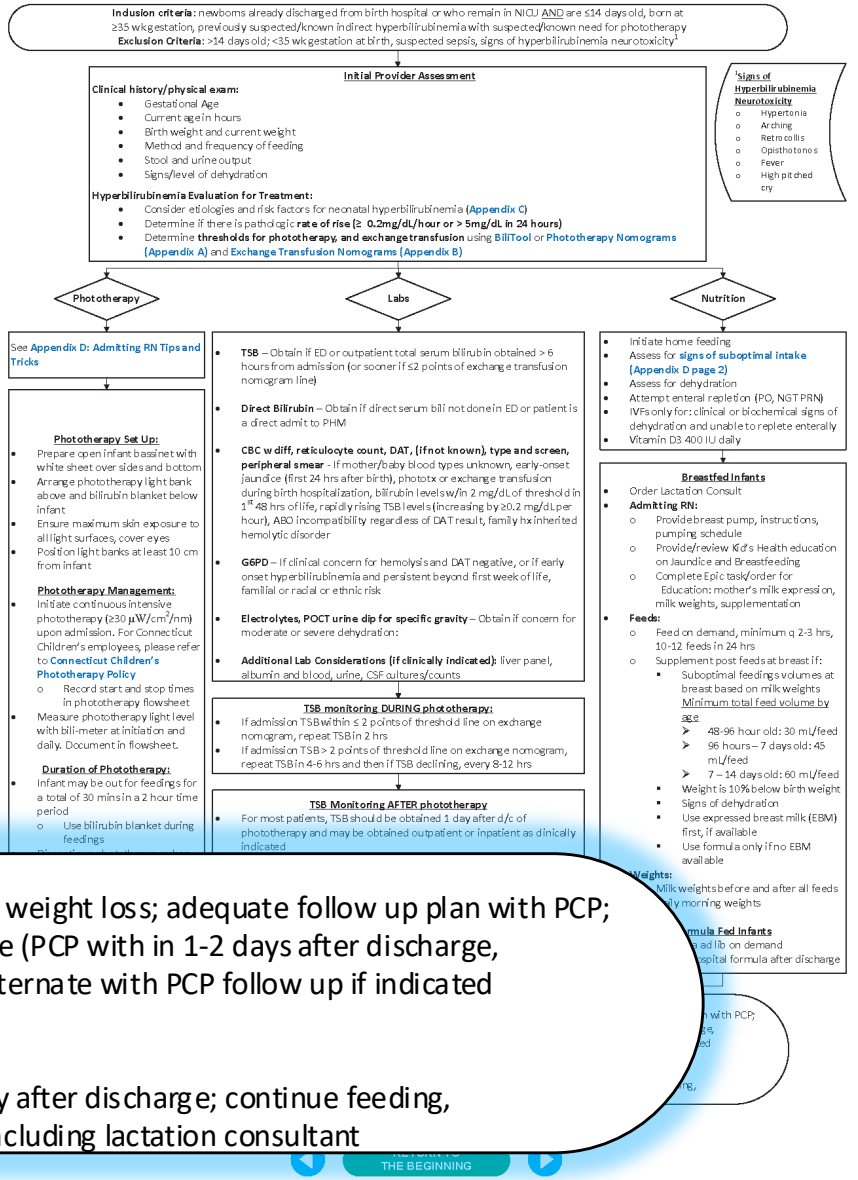
Discharge Instructions:

- Ensure family is given a feeding plan to support continued feeding optimization
  - Includes guidance for supplementing and when it would be appropriate to stop supplementing
  - Goal feeding 10-12 times per day
- PCP follow up 1 day 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 appointments in place (PCP with in 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:

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Review of Key Points

- Clear admission and treatment criteria
- Phototherapy and Exchange Transfusion nomograms updated in line with APP 2022 revision
- Optimization of feeding and nutrition is critical
- Appropriate set up and dose of phototherapy are essential
- Appropriate lab evaluation for at risk populations guides phototherapy duration and need for closer rebound testing, as well as other long term monitoring needs
- Close follow up with PCP after discharge is a must

Quality Metrics

- % Patients with pathway order set
- % Patients with breastfeeding education performed
- % Patients with lactation consult obtained < = 24 hours of arrival
- % Patients with phototherapy start time documented
- Average time (minutes) from arrival to phototherapy start time
- % Patients with phototherapy intensity > 30
- % Families reporting breastfeeding continued at 1 week
- % Families reporting breastfeeding continued at 1 month
- % Families unable to be reached at 1 week
- % Families unable to be reached at 1 month
- ALOS (days), IP/OBS

Pathway Contacts

- Jill Herring, APRN
  - Pediatric Hospital Medicine
- Ilana Waynik, MD
  - Pediatric Hospital Medicine
- Mary Lussier, RN, IBCLC
  - Lactation
- Kristin Welch, MD
  - Pediatric Emergency Medicine

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Thank You!

About Connecticut Children's Clinical Pathways Program

The Clinical Pathways Program at Connecticut Children's aims to improve the quality of care our patients receive, across both ambulatory and acute care settings. We have implemented a standardized process for clinical pathway development and maintenance to ensure meaningful improvements to patient care as well as systematic continual improvement. Development of a clinical pathway includes a multidisciplinary team, which may include doctors, advanced practitioners, nurses, pharmacists, other specialists, and even patients/families. Each clinical pathway has a flow algorithm, an educational module for end-user education, associated order set(s) in the electronic medical record, and quality metrics that are evaluated regularly to measure the pathway's effectiveness. Additionally, clinical pathways are reviewed annually and updated to ensure alignment with the most up to date evidence. These pathways serve as a guide for providers and do not replace clinical judgment.