Hyperbilirubinemia Screening, Assessment and Treatment in Newborns Greater Than or Equal to 35 Weeks of Age

Effective: March 18, 2025

Objectives

To reduce the incidence of **severe hyperbilirubinemia** and related consequences in newborns greater than or equal to 35 weeks gestational age by:

- Identifying newborns at risk for hyperbilirubinemia;
- Identifying neonatal hyperbilirubinemia in a timely and accurate manner;
- Providing timely interventions and/or treatment as required; and
- Ensuring appropriate follow-up in the **community** after hospital discharge.

Principles

Prevention of bilirubin encephalopathy in the newborn requires clinical assessment and management of hyperbilirubinemia.

Universal screening for newborn hyperbilirubinemia using either **total serum bilirubin** (TSB) or **transcutaneous bilirubinometry** (TcB) should occur within the first 24 hours of birth, prior to the period of highest risk. Screening helps determine the risk for newborn hyperbilirubinemia and facilitates effective anticipatory management.

Infants born at earlier gestations are at higher risk for injury from hyperbilirubinemia; preterm infants are at higher risk than late preterm infants and late preterm infants are at higher risk than term infants.

TcB screening for hyperbilirubinemia is highly effective. TcB is objective, non-invasive, and reduces the likelihood that a clinically significant TSB level will be missed, while significantly reducing the number of serum bilirubin measurements required. TcB measurements require less effort to perform than TSB measurements and the results are available immediately.

Alberta Health Services

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1. Points of Emphasis

1.1 Implementation of this guidance shall be in accordance with the AHS Consent to Treatment/Procedure(s) Policy Suite.

1.2 The intended application of this guidance is for the identification and management of early acute jaundice in newborns between birth and approximately 10 days of age.

1.3 This guidance applies to newborns greater than or equal to 35 weeks gestational age.

1.4 This guidance applies to newborns admitted to postpartum, pediatric, and neonatal intensive care units across Alberta and extends to managing infants immediately after discharge to the community.

1.5 Visual estimation of jaundice is inaccurate and can fail to identify infants with significant hyperbilirubinemia. It is important to implement universal screening with TcB and TSB, which are objective measures reflecting serum bilirubin levels. If the clinician has a high level of suspicion for clinical jaundice, it is reasonable to confirm their suspicion with a TcB or TSB.

1.6 TcB is a screening tool for hyperbilirubinemia. An elevated TcB should not be used to determine if a newborn receives treatment such as phototherapy or exchange transfusion. Infants with a TcB level within plus or minus 30-50 µmol/L of a phototherapy threshold, requires confirmation with a TSB to determine need for phototherapy.

1.7 Where available, a TcB should be performed on all newborns born in hospital in the first 12 to 24 hours after birth, with earlier screening (less than or equal to 12 hours) suggested for newborns with risk factors for hyperbilirubinemia. Refer to sections 2.2 / 2.3.

1.8 If TcB screening is not available in the hospital setting, a TSB should be drawn prior to discharge. If discharged at less than 24 hours of age, then perform a TSB before discharge home. In the absence of clinical symptoms, the TSB should be completed at approximately 24 hours after birth, while the newborn is still in hospital, to coincide with the Newborn Blood Spot Screen, with earlier screening at less than or equal to 12 hours of age for newborns with risk factors for hyperbilirubinemia.

1.9 **Phototherapy**, when indicated by a high TSB, should be recommended as part of the treatment plan.

1.10 TcB screening can be resumed 24 hours after completing phototherapy. The clinician may consider performing a TSB during phototherapy to document a mid-therapy decline (refer to section 5.2.8)

1.11 When managing prolonged or pathological jaundice, testing and treatment options beyond those included in this document may be appropriate.

1.12 Breastfeeding support should be provided to minimize the risk of hyperbilirubinemia.

1.13 Where possible, we should endeavor to follow the guidance provided here. However, sites across the province will have different resources and hence may not be able to comply with all of the recommendations outlined below. Where practice deviates from the guidance below, we suggest ensuring appropriate safety mechanisms are in place to mitigate risk.

2. In Hospital Identification of Hyperbilirubinemia

2.1 General Principles

2.1.1 Healthcare professionals with the training to recognize hyperbilirubinemia should clinically assess the newborn for jaundice in the first 24 hours after birth and then every 24 hours until hospital discharge.

2.1.2 Assessment includes but is not limited to:

a. Visual examination of the sclera, mucous membranes, and blanching of skin (performed in a well-lit area);
b. Assessment of cueing and effective feeding, hydration status, and adequacy of urine output and stooling;
c. Daily weight assessment (as appropriate), and
d. Level of alertness, **lethargy**, tone and excessive or high-pitched crying.

2.1.3 All newborns should have routine jaundice monitoring with a TcB or TSB until values have stabilized or there is a downward trend. If values are not stabilizing or trending upwards, monitoring can continue up to the first 10 days of age.

2.1.4 All newborns should be assessed by the **health care professional** for risk factors of hyperbilirubinemia which should be considered in conjunction with the clinical assessment and TcB/TSB results.

2.2 Risk Factors for Developing Significant Hyperbilirubinemia

The presence of any of these risk factors indicates the need for more frequent screening for hyperbilirubinemia. These factors include:

- Lower gestational age (for example, risk increases with each additional week less than 40 weeks).
- Jaundice in the first 24 hours 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 greater than 5 µmol/L per hour in the first 24 hours or greater than 3.6 µmol/L 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. Suboptimal intake is indicated by urine output (number of diapers), lack of stool output, quality of urine (presence of urate crystals), excessive weight loss (greater than 10%) and/or signs of dehydration (elevated sodium, dry mucous membranes, reduced skin turgor).
- Scalp hematoma or significant bruising.
- Down syndrome (Trisomy 21).
- Macrosomic newborn with pregnancy complicated by diabetes.

2.3 Risk Factors for Developing Hyperbilirubinemia Neurotoxicity

Decisions to initiate phototherapy or escalate care are guided by the gestational age, the hour-specific TSB, and the presence of risk factors for hyperbilirubinemia neurotoxicity. The presence of hyperbilirubinemia neurotoxicity risk factors lowers the threshold for treatment with phototherapy and/or exchange transfusion and the level at which care should be escalated. Hyperbilirubinemia Neurotoxicity risk factors include:

- Gestational age less than 38 weeks – this risk increases with the degree of prematurity.
- Isoimmune hemolytic disease, for example positive **direct antiglobulin test**), G6PD deficiency, or other hemolytic conditions.

- Sepsis.
- Significant clinical instability in the previous 24 hours.

2.4 TcB Measurement in Hospital – Technical Aspects

TcB can be used for screening newborns greater than or equal to 30 weeks gestation at birth. The first screen should be completed between 12 and 24 hours of age, sooner (closer to 12 hours) if there are significant risk factors for hyperbilirubinemia or immediately in the first 24 hours of age for any newborn that appears to be jaundiced.

2.4.1 If available, a newborn's bilirubin level should be measured using an approved and validated transcutaneous bilirubin meter (TcB meter).

2.4.2 TcB measurement should only be performed using a meter that has been correctly validated according to Alberta Precision Laboratories (APL) Point of Care Testing (POCT) program standards for newborn screening that:

a. Less than or equal to 10 days old;
b. Greater than or equal to 30 weeks gestation at birth;
c. Either before initiating phototherapy or after having completed a course of phototherapy at least 24 hours before the TcB measurement, and
d. Have not received an exchange transfusion.

2.4.3 TcB measurements should only be performed by health care professionals who have successfully completed the appropriate education and certification requirements for TcB meter use in their clinical setting.

2.4.4 TcB measurements should be taken consistently on the same site, either the forehead or the sternum, and the measurements should be documented in the newborn's **health record**.

2.4.5 TcB should not be used during periods of phototherapy including for a 24-hour period after cessation of phototherapy. With the resumption of TcB readings greater than 24 hours after stopping phototherapy, the preferred location for performing a TcB reading is either the forehead or sternum, consistent with pre-phototherapy management.

2.5 TSB Measurement in Hospital – Technical Aspects

2.5.1 Note that while there is considerable variability in measuring TSB concentrations through our labs, this is the clinical marker of choice for determining treatment options. The gold standard for TSB measurement is High Performance Liquid Chromatography which is not feasible for routine clinical use.

2.5.2 Please follow local guidelines for the proper method of TSB blood collection, storage and transport to the lab.

3. Hospital Management of Hyperbilirubinemia

3.1 Using TcB and TSB Results to Guide Hospital Management of Hyperbilirubinemia

3.1.1 TcB levels and the newborn's skin tone assessment are entered manually by the Nurse into Connect Care, using the Aegis POC Manual Test Result Entry module.

3.1.2 TcB results are automatically plotted to the appropriate graph in Connect Care.

3.1.3 TSB results are automatically plotted on the appropriate graph and do not require the Nurse to enter the result into Connect Care.

3.1.4 The RN or LPN shall notify the **Most Responsible Health Practitioner (MRHP)** of the TcB and/or TSB results to determine if further investigation or other management is required (refer to Section 5.2 Managing Phototherapy).

3.1.5 The MRHP shall consider the rate of rise and trending of TcB and/or TSB levels, and clinical status. All treatment decisions shall be based on a TSB level (refer to Section 5.2. Managing Phototherapy).

3.1.6 If the TcB measurement is inconsistent with the health care professional's clinical assessment, then the individual assessing the newborn shall collaborate with the MRHP regarding further assessment needs, which may include an order for a TSB test as indicated.

3.2 Hospital Management of TcB Results Using Calgary TcB Graphs (Calgary Zone) Refer to Calgary TcB Algorithm for Acute Care Screening and Management of Hyperbilirubinemia

3.2.1 Calgary TcB graphs should only be used for newborns greater than or equal to 35 weeks gestation. For newborns less than 35 weeks gestation at birth, utilize the appropriate National Institute for Health and Care Excellence (NICE) graph.

3.2.2 If a TcB measurement plots in the red zone, a TSB level should be drawn as per MRHP's order to determine if further investigation, initiation of phototherapy, or closer follow-up is required. Notify the MRHP if the TSB level is elevated by referring to the appropriate graphs.

3.2.3 A newborn with a TcB measurement that plots in the yellow zone should be reassessed clinically by the health care professional (including feeding and other risk factors) and if clinically well, a TcB screen performed the following day. If clinically unwell, notify the MRHP.

3.2.4 If a TcB measurement plots in the green zone, only routine care is required (for example, continue TcB screening every 24 hours while in hospital).

3.2.5 The rate of rise, and trending of the TcB measurements should be considered when determining the next action.

3.2.6 If the TcB measurement is inconsistent with the health care professional's clinical assessment, then the individual assessing the newborn shall collaborate with the MRHP regarding further assessment needs, including an order for a TSB test as indicated.

3.2.7 A small minority of infants will consistently have falsely high TcB readings which prompt unnecessary blood draws for TSB. For infants with two consecutive falsely high TcB readings, it is reasonable to consider discontinuing further TcB screening and rely on TSB results to guide further management.

3.3 Hospital Management of TcB Results Using AAP (2022) Graphs (Outside Calgary Zone)

For centers outside Calgary, Connect Care will automatically plot TcB results on the appropriate American Academy of Pediatrics (AAP) graphs (2022).

4. Nutrition

There is a strong association between exclusive breastfeeding and hyperbilirubinemia. However, given the benefits of establishing breastfeeding, if supplemental feeds are indicated, expressed breast milk is the supplement of choice, if available and with the consent of the newborn's **guardian(s)**.

4.1.0 The healthcare team should educate families on resources for breastfeeding support and encourage breast milk feeding within the first hour after birth with frequent feeding on demand.

4.2.0 In selected situations, and after discussion with the family about risks and benefits, formula supplementation may be appropriate as it may enhance the clearing of bilirubin from the body.

4.3.0 Do not provide oral supplementation with water or dextrose to prevent hyperbilirubinemia or decrease bilirubin concentrations.

4.4.0 Phototherapy may be interrupted during feeding but interruptions in therapy should be kept to a minimum. High-risk newborns, may be wrapped in a phototherapy blanket (e.g., Bili-blanket) when removed from overhead phototherapy for the purposes of feeding if there are concerns regarding the rate of TSB increase.

5. Phototherapy

5.1 Background

5.1.1 The Nurse should refer to the appropriate graph to determine the potential need for phototherapy treatment or the potential for exchange transfusion. The Nurse should notify the MHRP for patient assessment and potential referral to Neonatology or

Pediatrics if the Nurse is concerned that the infant may currently qualify, or it is anticipated the infant will soon qualify, for either phototherapy or exchange transfusion.

5.1.2 The MRHP is responsible for ordering phototherapy and any additional diagnostic testing and treatment decisions including transfer to an appropriate level of care or other care provider if required.

a) Consider ordering the following laboratory tests for newborns that have risk factors for either significant hyperbilirubinemia or bilirubin neurotoxicity:

(i) Complete blood count (CBC);

(ii) Reticulocyte count;

(iii) Direct antiglobulin test (DAT). If the mother is Type O or has RBC antibodies, consider the strength of reaction and whether the mother received prophylactic anti-D immunoglobulin during pregnancy.

(iv) After maternal receipt of RhIG, a newborn with a positive direct antiglobulin test (DAT) caused by an antibody other than anti-Rh(D) should be considered to be DAT positive.

b) The following laboratory tests may also be clinically indicated:

(i) Blood glucose-6-phosphate dehydrogenase (G6PD) levels (dependent on ethnic origin or family history). Note that measuring the G6PD activity during/after a hemolytic event or exchange transfusion may lead to a falsely normal result.

(ii) Blood for culture and sensitivity if infection is suspected.

(iii) Serum albumin concentration.

5.2 Managing Phototherapy

5.2.1 Phototherapy should not be used for newborns whose TSB level does not exceed the phototherapy threshold level on the appropriate graph unless the rate of rise is excessive, or a newborn is approaching the phototherapy threshold and has risk factors for bilirubin neurotoxicity.

5.2.2 When deciding on whether to begin phototherapy or proceed with exchange transfusion, the clinician should consider the hour-specific TSB, gestational age, and the presence of risk factors for significant hyperbilirubinemia and/or bilirubin neurotoxicity.

5.2.3 The health care team should ensure all phototherapy equipment is maintained and used according to the manufacturers' guidelines and that proper biomedical support is in place.

5.2.4 Phototherapy light with a wavelength between 430 to 490 nanometres (nm) is recommended as it tends to penetrate the skin well and is absorbed maximally by bilirubin. There are several options for providing phototherapy, including banks of lights, single halogen bulbs, Bili-blankets and newborn cots with integrated phototherapy.

a) Spectral irradiance of phototherapy equipment shall be measured by the health care team with an appropriate irradiance meter.

b) Measurements with the irradiance meter should be performed on multiple sites on the newborn with at least one measurement reaching the threshold of 'intensive phototherapy' and documented in the newborn's health record. Note that different phototherapy manufacturers have different definitions for 'intensive phototherapy'.

c) It is recommended that irradiance levels of overhead phototherapy be measured at the surface level of the newborn and documented any time that phototherapy is initiated or repositioned.

d) Only use the irradiance meter recommended by the manufacturer of the phototherapy lights you are using. Using the wrong irradiance meter is a safety concern and can lead to using inappropriate intensity of phototherapy. Refer to Phototherapy Devices & Radiometers.

5.2.5 When there is indication for phototherapy and upon issuance of the MRHP order, irradiance should be delivered to as much of the newborn's skin surface area as possible.

a) The newborn should be preferentially placed in the supine position.

b) Avoid the use of creams or petroleum containing products on the skin area.

c) Newborns should only be wearing a diaper and eye cover.

5.2.6 The Nurse shall monitor and document the newborn's vital signs, tone, level of alertness, and intake and output every three to six hours while under phototherapy.

5.2.7 In general, the timing of the initial TSB measure after starting phototherapy and the frequency of TSB monitoring during phototherapy should be guided by the age of the newborn, the presence of any risk factors, the TSB concentration, and the TSB trajectory.

5.2.8 At the discretion of the MRHP and in consideration of the condition of the newborn and irradiance of the phototherapy equipment used, a follow-up TSB level is recommended no more than 12 hours following the initiation of phototherapy, as per the AAP 2022 guidelines. A follow-up TSB level is recommended four hours following initiation of phototherapy if:

a) Previous TSB levels demonstrate a pattern of a rapidly rising bilirubin level, or

b) There is a critical TSB level greater than 400 µmol/L.

5.2.9 The MRHP and Nurse should provide phototherapy information to the newborn's guardian(s) including but not limited to:

a) why phototherapy is being considered;

b) possible adverse effects of phototherapy (interference with maternal newborn interaction, temperature instability, intestinal hypermotility, diarrhea, and rarely, bronze discolouration of the skin);

c) anticipated duration of treatment;

d) importance of frequent feeding and the need to wake newborn if necessary for feeds;

e) the need for eye protection; and

f) encouragement of interaction with the newborn but the need to keep breaks from phototherapy to a minimum.

5.3 Discontinuation of Phototherapy

5.3.1 The decision to discontinue phototherapy is at the discretion of the MRHP in consideration of the age of the newborn, when phototherapy was started, and the cause of the hyperbilirubinemia.

5.3.2 Consider stopping phototherapy when the TSB has decreased by at least 35 µmol/L below the hour-specific threshold. It is reasonable to consider a longer period of phototherapy if risk factors for rebound hyperbilirubinemia exist. Risk factors for rebound hyperbilirubinemia include:

- need for early (for example, less than 48 hours) phototherapy,
- hemolytic disease,
- gestational age less than 38 weeks, and
- higher TSB at the time of phototherapy discontinuation in relationship to the phototherapy threshold

5.3.3 Testing for rebound hyperbilirubinemia should occur 12 to 24 hours after stopping phototherapy or at 6 to 12 hours after stopping phototherapy for newborns with risk factors for rebound hyperbilirubinemia. This provides enough time for the bilirubin concentration to demonstrate whether there is rebound hyperbilirubinemia. Rebound hyperbilirubinemia should be treated according to the recommendations above regarding the initiation of phototherapy. TcB screening can resume when a minimum of 24 hours have passed since stopping phototherapy.

5.3.4 Where possible, hospital discharge should not be delayed to accommodate bilirubin monitoring unless baby is clinically unwell, has a rapidly rising bilirubin or has a borderline bilirubin level in the setting of risk factors for significant hyperbilirubinemia or bilirubin neurotoxicity. Given difficulties in after-hours lab

access for some rural communities, delaying discharge to permit further bilirubin monitoring may be appropriate in these communities.

5.3.5 The MRHP shall make arrangements with the guardian(s) to have a repeat TcB (where available and only for infants less than or equal to 10 days old) or TSB collected within 24 hours of discharge from hospital for the following newborns:

a) all newborns, regardless of risk factors, who received phototherapy and are discharged at less than 72 hours of age; and

b) newborns who received phototherapy and are discharged before 96 hours of age with risk factors for significant hyperbilirubinemia or bilirubin neurotoxicity.

5.4 TcB Post Phototherapy

It is an option to measure TcB instead of TSB if it has been at least 24 hours since phototherapy was stopped. Refer to the appropriate treatment graph for your institution.

6. Escalation of Care and Exchange Transfusion

6.1.0 Care should be escalated when a newborn's TSB reaches or exceeds the escalation-of care threshold, which is 35 µmol/L below the appropriate exchange transfusion threshold.

6.2.0 Starting escalation of care is a medical emergency. The escalation of care period starts from the time the newborn's TSB result first indicates starting escalation of care and ends when the TSB is below the escalation of care threshold. These newborns are optimally managed in a neonatal intensive care unit (NICU).

6.3.0 For newborns requiring escalation of care, blood should be sent STAT for:

- total and direct-reacting serum bilirubin,
- complete blood count,
- serum chemistries, and
- type and crossmatch.

6.4.0 Newborns requiring escalation of care should receive intravenous hydration and emergent intensive phototherapy. A neonatologist should be consulted about urgent transfer to a NICU that can perform an exchange transfusion.

6.5.0 TSB should be measured at least every 2 to 4 hours from the start of the escalation of care period until the escalation of care period ends. Once the TSB is lower than the escalation of care threshold, refer to management as described under the Section 5.3 Discontinuation of Phototherapy.

6.6.0 Intravenous immune globulin (IVIG; 0.5 to 1 g/kg) over 2 hours may be provided to newborns with isoimmune hemolytic disease (for example, positive DAT) whose TSB reaches or exceeds escalation of care threshold. The dose can be repeated in 12 hours (2 doses total).

6.7.0 An urgent exchange transfusion should be performed for newborns with any of the following signs of intermediate or advanced stages of acute bilirubin encephalopathy:

- hypertonia,
- arching,
- retrocollis,
- opisthotonos,
- high-pitched cry, or
- recurrent apnea.

6.8.0 Immediate preparation for an exchange transfusion should occur if the TSB is at or above the exchange transfusion threshold. If, while preparing for the exchange transfusion, a TSB concentration drops below the exchange transfusion threshold and the newborn does not show signs of intermediate or advanced stages of acute bilirubin encephalopathy, then the exchange transfusion may be deferred while continuing intensive phototherapy and following the TSB every 2 hours until the TSB is below the escalation of care threshold.

6.9.0 Refer to your local guidelines for exchange or partial exchange transfusion.

7. Community Management

7.1 Preparing for Discharge and Follow-up in the Community

7.1.1 Outpatient follow-up plans should be established before discharge from hospital. This includes:

- identification of a community physician or midwife,
- referral to the physician or midwife in the community within 2 to 7 days after discharge,
- Ambulatory Referral to Public Health Postpartum at the time of discharge, (refer to Public Health Services for Hyperbilirubinemia Follow-Up)

7.1.2 It is the responsibility of the acute care MRHP to:

- Order required outpatient lab tests including TSB as STAT and follow-up on the results if the acute care MRHP has not confirmed transfer of the patient to a community physician that agrees to follow-up outstanding results.
- Specify on the outpatient lab requisition provided to the family, the community MRHP or physician indicated on the Notice of Birth (NOB) on all lab results

7.1.3 It is important to identify a community primary health care provider (community pediatrician, family physician and/or midwife) where available, for each patient before discharge from hospital so that outpatient TcB and TSB results can be forwarded to them to facilitate management in the community. Discharged infants should follow up with their community health care provider (for example, family physician, pediatrician, midwife) within 7 days of discharge home.

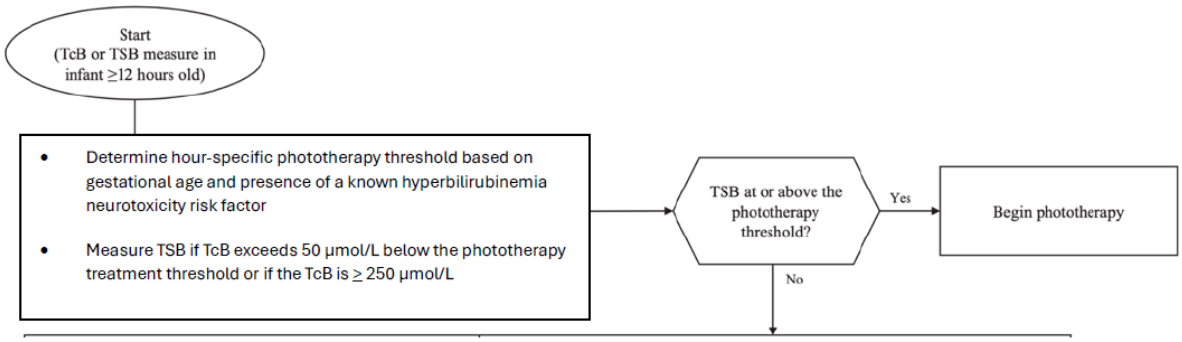
7.1.4 Beginning at least 12 hours after birth, if discharge is being considered, the difference between the bilirubin concentration measured closest to discharge and the phototherapy threshold at the time of the bilirubin measurement should be calculated and used to guide follow-up, as detailed in Figure 1 (see below).

7.1.5 Figure 1 is only applicable for infants at least 12 hours after birth and for infants who have not received phototherapy before discharge. Insufficient information is

available to provide discharge follow-up guidance based on TcB or TSB measured before 12 hours after birth. Any infant discharged before 12 hours of age should have a follow-up bilirubin measure between 24 and 48 hours of age in the community. It is important for the acute care MRHP to provide the family with a lab requisition for outpatient TSB testing (where appropriate), to ensure the results are forwarded both to themselves and to the community healthcare provider. Failure to do this can result in delays in testing and delays in initiating appropriate treatment.

7.1.6 Note that some regions in Alberta do not have access to a lab for blood draws and testing on holidays/weekends. It is also important to consider that not every community lab is able to draw TSB samples. These factors should be considered when determining the appropriate date for discharge and determining where the family should present for community TSB testing.

Refer to Service Locations section for Alberta Precision Laboratory availability: https://www.albertahealthservices.ca/findhealth/service.aspx?id=4245



Phototherapy threshold minus TcB or TSB		Discharge Recommendations
< 35 µmol/L	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: * 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
35-60 µmol/L	Regardless of age or discharge time	TSB or TcB in 4 to 24 hours[a]
61-90 µmol/L	Regardless of age or discharge time	TSB or TcB in 1-2 days
91-120 µmol/L	Discharging <72 hours	Follow-up within 2 days; TcB or TSB according to clinical judgment[b]
	Discharging ≥72 hours	Clinical judgment[b]
≥120 µmol/L	Discharging <72 hours	Follow-up within 3 days; TcB or TSB according to clinical judgment[b]
	Discharging ≥72 hours	Clinical judgment[b]

FIGURE 1

Flow diagram for infants during the birth hospitalization to determine postdischarge follow-up for infants who have not received phototherapy.
[a]Use clinical judgment and shared decision making to determine when to repeat the bilirubin measure within this 4 to 24 hour time window.
[b]Clinical judgment decisions should include physical examination, the presence of risk factors for the development of hyperbilirubinemia or hyperbilirubinemia neurotoxicity risk factors , feeding adequacy, weight trajectory, and family support.

7.2 Preparing the Family for Discharge from Hospital

7.2.1 The acute care MRHP shall provide the guardian(s) of newborns who require a TSB test with an outpatient laboratory requisition and instructions to have the specimen drawn at a laboratory or hospital. The requisition shall include the name of the ordering physician, covering designate as appropriate and the primary health care provider responsible for the newborn's follow-up in the community, if known. Follow up from Public Health will occur within 48 hours post discharge, depending on local resources. Any follow-up required in less then 24 hours requires the acute care MRHP to provide the guardian(s) of the newborn with an outpatient STAT laboratory TSB requisition. Whenever possible, draw lab work early in the morning so the results are available during regular working hours.

7.2.2 Before discharge, all families should receive written and verbal education about neonatal jaundice. Guardian(s) should be provided written information to facilitate post-discharge care, including the date, time, and place of the follow-up medical appointment if known and, when necessary, a STAT lab requisition for a follow-up TSB. Birth information, including the last TcB or TSB and the age at which it was measured, and DAT results (if any) should be transmitted to the primary care provider who will see the infant at follow-up. If there is uncertainty about who will provide the follow-up care, this information should also be provided to families.

7.2.3 Note that it may not be possible to identify a community MRHP before discharge for some patients. These patients may be managed in walk-in clinics. The family is encouraged to bring any written information they were provided to the walk-in clinic visit.

7.2.4 Information provided to guardian(s) prior to hospital discharge should include the following:

a) that jaundice is common, providing reassurance that it is usually transient and harmless;

b) factors that influence the development of significant hyperbilirubinemia such as lower gestational age, hemolytic disease, insufficient oral intake (not wetting diapers or pooping sufficiently);

c) the Healthy Parents, Healthy Children Client Resource Card and recommend reading the section on how to check the newborn for signs of increasing jaundice;

d) the designation of risk of hyperbilirubinemia and necessary follow-up for jaundice assessment;

e) to seek medical advice if visible jaundice is recognized as progressing, the newborn is not feeding well, has inadequate output, and/or decreased level of alertness;

f) with early discharge from hospital, the importance of seeking urgent medical advice if jaundice is recognized in the first 24 hours;

g) advice on when and how to contact Health Link; and

h) The role of Public Health in providing follow-up in the community. Please refer to Public Health Services for Hyperbilirubinemia Follow-Up for list of Public Health Services available.

7.3 Discharge and Follow-up in the Community

7.3.1 The **late preterm infant** should not be discharged from the hospital before 72 hours.

7.3.2 Infants discharged to areas that do not have access to community TcB should have a STAT follow-up TSB (ordered by the acute care MRHP) on the day following discharge if either of the following are present and the results should be reported to both the ordering and community physician:

a. Newborns with TcB that is within 50 µmol/L of the phototherapy threshold (below threshold) on the AAP graph where the TcB values are still rising.

b. Newborns with a TcB in the red or yellow zone on the Calgary TcB graph (applies to Calgary residents).

7.3.3 Newborns requiring follow up within 24 hours (as per Figure 1) should have a STAT follow-up TSB (ordered by the acute care MRHP) on the day following discharge.

7.3.4 Specific plans of care should be clearly communicated on the Provincial Notice of Birth (PNOB). Deviations from regular protocol based on clinical judgement should be emphasized in these plans.

7.4 Role of Public Health

7.4.1 Public Health Nurses provide services that are essential to the safe management of newborns with hyperbilirubinemia in the community. Approximately 90 to 98% of discharged infants have contact with Public Health, either via phone, home or clinic visits, within 48 hours of discharge. Assessment of newborn jaundice by Public Health Nurses shall be in accordance with recommendations in the Public Health Nursing Maternal/Newborn Practice Manual (0-2 months). Patients that Public Health are unable to see in person are directed to the local emergency department or primary care practitioner for acute management of hyperbilirubinemia.

7.4.2 Public Health Nursing follow-up should be provided as per zone processes. Public Health Nurse resources differ across the province, access to TcB meters and ability to collect lab specimens varies depending on where the patient is discharged home to. Refer to Public Health Services for Hyperbilirubinemia Follow-Up.

7.5 Role of Community Primary Heath Care Provider

7.5.1 The primary health care provider responsible to respond to the TSB result shall be identified on the lab requisition for reporting of critical values.

7.5.2 In all areas outside of Calgary urban, medical follow-up should be in accordance with the management and follow-up recommendations within this document.

7.5.3 The current 2022 AAP guideline recommends using the difference between the bilirubin concentration and the phototherapy threshold at the time of measurement to determine the interval between discharge and follow-up and the need for additional TSB or TcB measurements (Figure 1). This approach incorporates both gestational age and other hyperbilirubinemia neurotoxicity risk factors into the decision-making process.

7.6 Readmission to Hospital

7.6.1 Infants who received phototherapy during the birth hospitalization and who were later readmitted for exceeding the phototherapy threshold should have bilirubin measured the day after phototherapy discontinuation. Follow-up from Public Health will occur within 48 hours post discharge, depending on local resources. Any follow-up required in less 24 hours requires the acute care MRHP to provide the guardian(s) of the newborn with an outpatient STAT laboratory TSB requisition.

7.6.2 Infants readmitted because they exceeded the phototherapy threshold following discharge but who did not receive phototherapy during the birth hospitalization should have bilirubin measured 1 to 2 days after phototherapy discontinuation or clinical follow-up 1 to 2 days after phototherapy to determine whether to obtain a bilirubin measurement. Risk factors for rebound hyperbilirubinemia to consider in this determination include:

- TSB at the time of phototherapy discontinuation in relation to the phototherapy threshold,
- gestational age less than 38 weeks,
- adequacy of feeding and weight gain, and
- presence of hyperbilirubinemia and hyperbilirubinemia neurotoxicity risk factors.

7.7 Persistent Hyperbilirubinemia After Discharge

Infants 7 days or older with a persistently elevated TSB within 35 µmol/L of the phototherapy threshold may have prolonged indirect hyperbilirubinemia. The indirect bilirubin concentration is the difference between the total and the direct-reacting or conjugated bilirubin. Most of these infants have breast milk jaundice, but other causes include hemolytic disease, hypothyroidism, extravascular blood, pyloric stenosis, Gilbert syndrome, and Crigler-Najjar syndrome.

7.8 Care with Registered Midwives

Registered Midwives (RMs) work closely within their communities of practice to create seamless access to services and remove barriers to access where possible. Clients who

decline serum or transcutaneous screening for bilirubin continue to have access to regular RM visits to assess other markers of newborn wellbeing. RMs will reoffer a previously declined assessment if they perceive that the newborn is at increasing risk and or there are changes to other clinical assessments.

7.8.1 Primary care with RMs – Irrespective of place of birth, infants with RMs as their primary care provider have close follow-up with home visits during the first week after birth and will be assessed within 24 to 48 hours of discharge from hospital. Newborn transition, feeding and physical wellbeing are assessed during home visits. These assessments include physical and laboratory investigations. Continuity of care within small teams of 1 to 4 RMs ensure close and thorough follow-up. Methods of quantitative bilirubin assessment, for example with TSB or TcB, will vary by community. Type(s) of testing will be dependent on the local community of practice and resources and clinical indications. Midwives often collect TSB, and/or DAT specimens during visits with clients, but may collaborate with local public health and outpatient labs to ensure timely follow-up of bilirubin levels. As RMs offer comprehensive in-home newborn feeding assessment and support, as well as physical exam and in-community quantitative bilirubin assessment, outpatient management of infants with borderline bilirubin levels may be more common than with other provider types.

7.8.2 Shared care with RMs – Integration of RMs with other providers such as obstetrics, pediatrics, family medicine, and public health is at various stages and levels throughout the province. Some sites have fully integrated and shared practices that are based exclusively in hospital and clinic settings rather than community visits. Midwives in these practice settings work within the framework of public health and community laboratory collections to offer hyperbilirubinemia surveillance.

7.8.3 Out of hospital birth with Registered Midwives – It is in the scope of Registered Midwives (RMs) to manage birth both inside and outside of hospital settings. Infants born outside of the hospital setting with RMs have access to the provincial standard of bilirubin surveillance as well as other newborn screening programs during home and clinic visits. Out-of-hospital births with RMs does not hamper access to these assessments or treatment.

7.8.4 Direct discharge from hospital with Registered Midwives – It is not uncommon for clients with RMs as primary care providers to choose direct discharge from hospital after giving birth. Direct discharge clients have access to the provincial standard of bilirubin surveillance as well as other newborn screening programs during home and clinic visits with their midwives. Direct discharge from hospital does not hamper access to these assessments or treatment.

Definitions

Community means any member of the health care team that provides care in the community setting such as a Family Physician, Midwife, and Public Health Nurse or Laboratory Technician.

Direct antiglobulin test (DAT) means a test that detects the presence of antibodies bound to red blood cells.

Guardian means, where applicable:
For a minor:

a) as defined in the Family Law Act (Alberta);
b) as per agreement or appointment authorized by legislation (obtain copy of the agreement and verify it qualifies under legislation; e.g., agreement between the Director of Child and Family Services Authority and foster parent(s) under the Child, Youth and Family Enhancement Act [Alberta]; or agreement between parents under the Family Law Act; or as set out in the Child, Youth and Family Enhancement Act regarding Guardians of the child to be adopted once the designated form is signed);
c) as appointed under a will (obtain a copy of the will; also obtain grant of probate, if possible);
d) as appointed in accordance with a Personal Directive (obtain copy of Personal Directive);
e) as appointed by court order (obtain copy of court order; for example, order according to the Child, Youth and Family Enhancement Act); and,
f) a divorced parent who has custody of the minor.

Health care professional means an individual who is a member of a regulated health discipline, as defined by the Health Disciplines Act (Alberta) or the Health Professions Act (Alberta), and who practices within scope and role.

Health record means the collection of all records documenting individually identifying health information, in relation to a single person.

Late preterm infant means an infant born between 34 weeks and zero (0) days and 36 weeks and six (6) days gestation.

Lethargy means that the newborn appears to be listless and have little or no energy and is drowsy or sluggish. The lethargic newborn may sleep longer than usual, be hard to wake for feedings and even when awake, may not be alert or attentive to sounds and visual cues.

Most responsible health practitioner (MRHP) means the health practitioner who has responsibility and accountability for the specific treatment/procedure(s) provided to a patient and who is authorized by Alberta Health Services to perform the duties required to fulfill the delivery of such a treatment/procedure(s) within the scope of his/her practice. (For the purposes of this document MRHP indicates Physician or Midwifery roles).

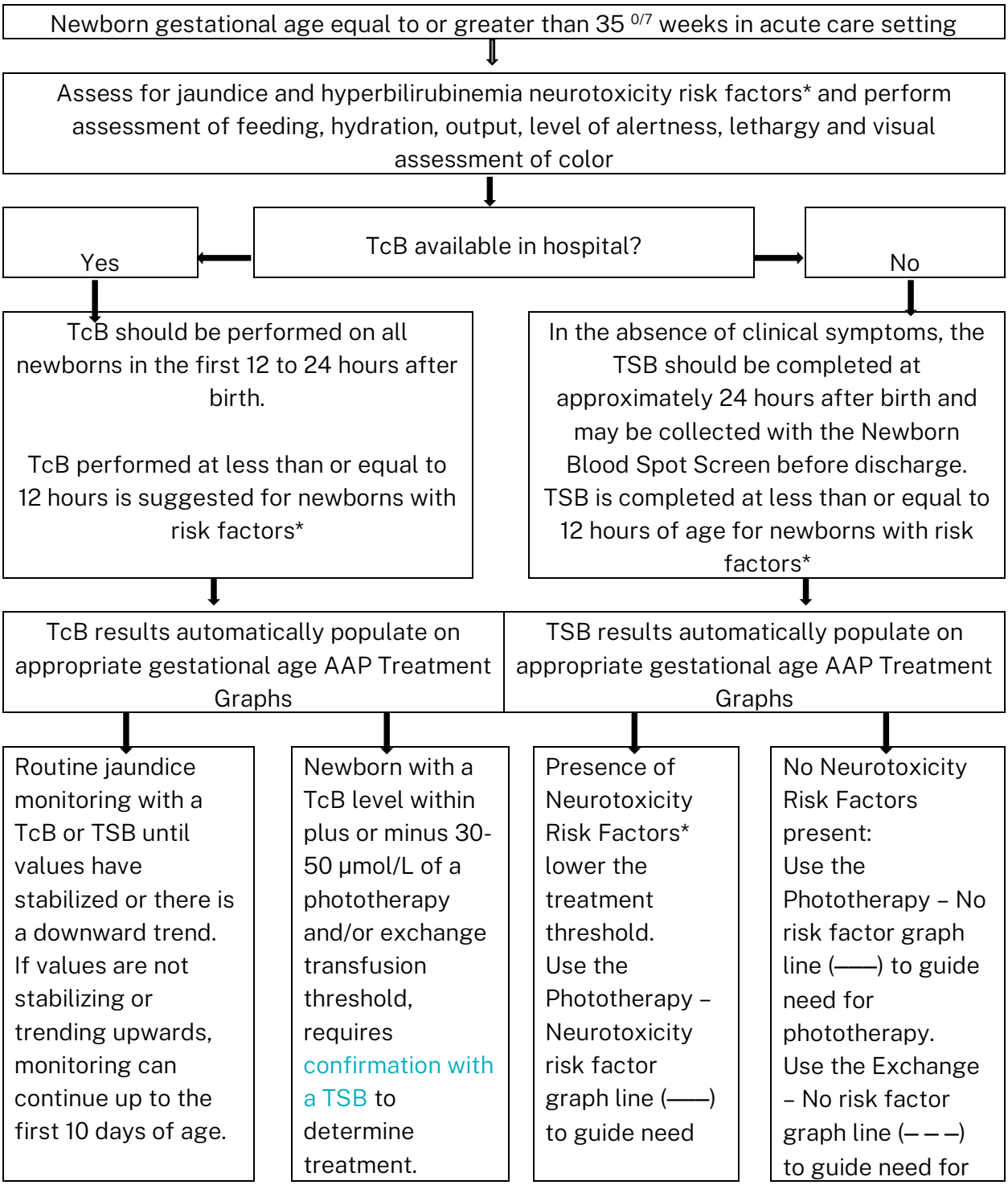
Phototherapy means an intensive light treatment used to treat jaundice. Phototherapy lights come in fluorescent, high-intensity fluorescent, fibre optic, or halogen. Different technologies provide different light intensities. Devices that emit lower radiance may be supplemented with additional devices. Much higher doses (65 $\mu W/cm^2/nm$) might have as yet unidentified adverse effects.

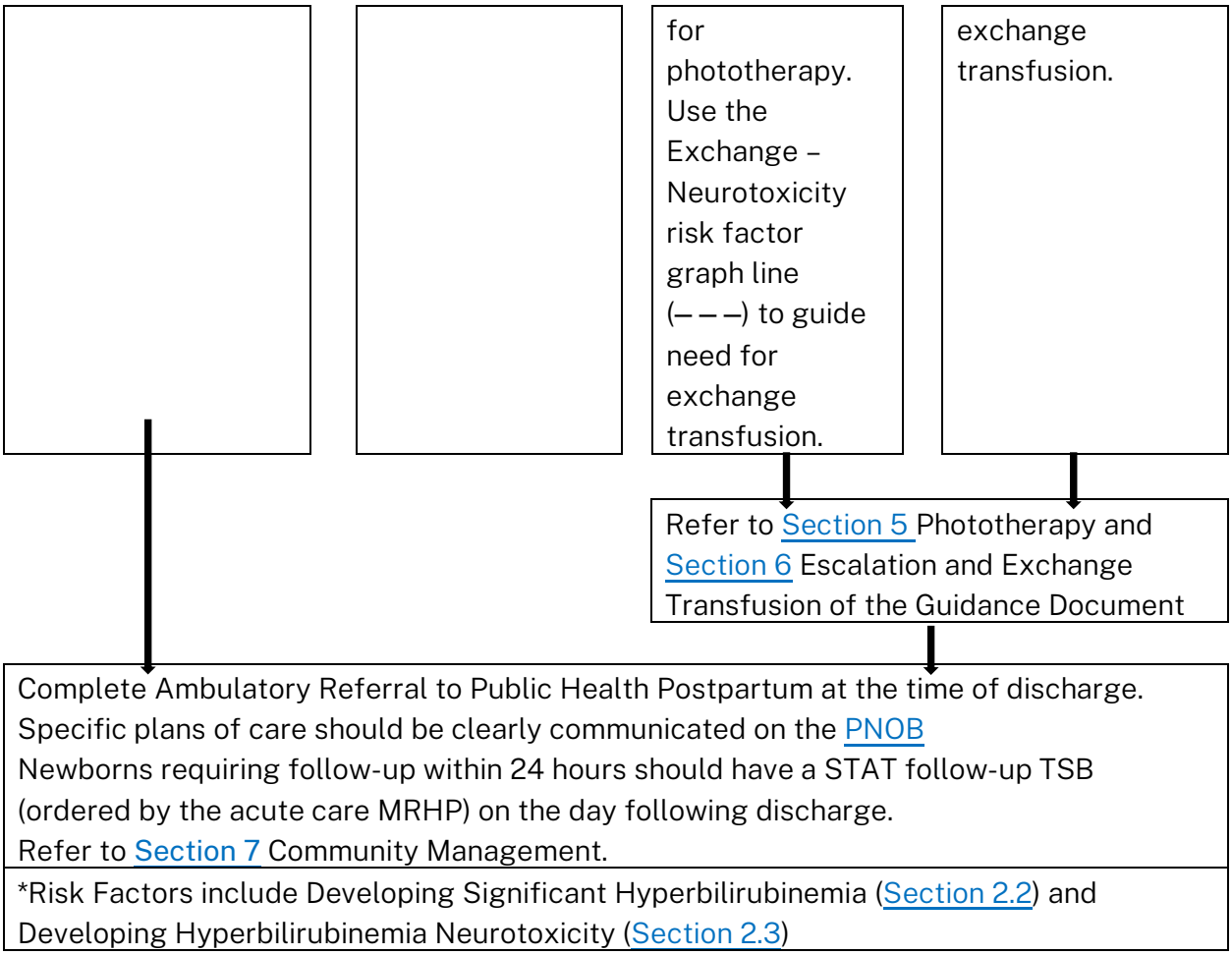
Severe hyperbilirubinemia means a total serum bilirubin concentration greater than 340 µmol/L at any time during the first 28 days of age (CPS 2016).

Total serum bilirubin (TSB) means the total serum bilirubin concentration in a capillary or venous blood sample, analyzed in the lab.

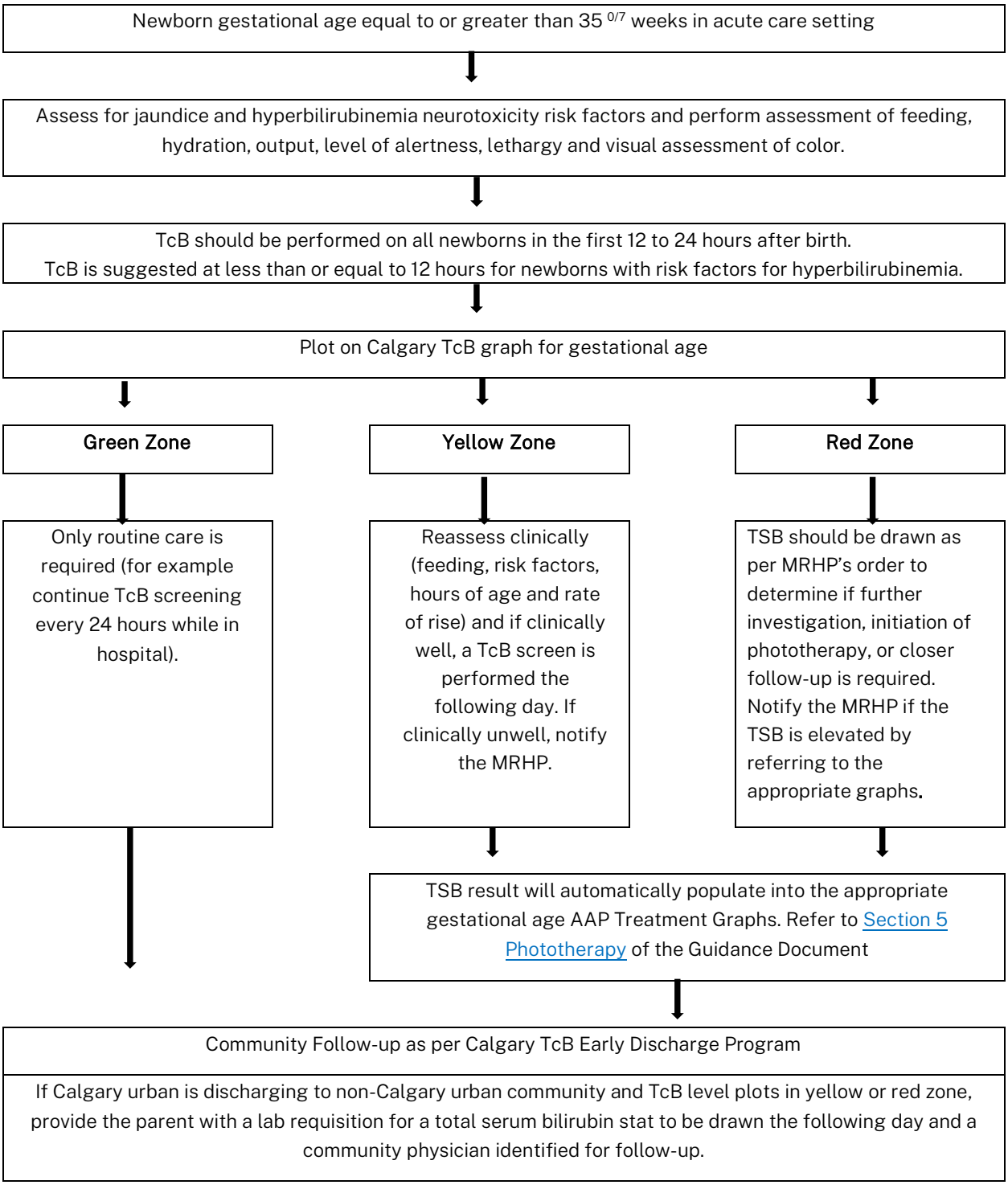
Transcutaneous bilirubinometry (TcB) means a non-invasive, point-of-care estimate of total serum bilirubin concentration, based on the amount of bilirubin deposited in the skin, performed with a meter that uses multi-wavelength spectral analysis.

Non-Calgary TcB Algorithm for Acute Care Screening and Mgmt of Hyperbilirubinemia




for phototherapy. Use the Exchange – Neurotoxicity risk factor graph line (– – –) to guide need for exchange transfusion.
exchange transfusion.
Refer to Section 5 Phototherapy and Section 6 Escalation and Exchange Transfusion of the Guidance Document
Complete Ambulatory Referral to Public Health Postpartum at the time of discharge.
Specific plans of care should be clearly communicated on the PNOB
Newborns requiring follow-up within 24 hours should have a STAT follow-up TSB (ordered by the acute care MRHP) on the day following discharge.
Refer to Section 7 Community Management.
*Risk Factors include Developing Significant Hyperbilirubinemia (Section 2.2) and Developing Hyperbilirubinemia Neurotoxicity (Section 2.3)

Calgary TcB Algorithm for Acute Care Screening and Mgmt of Hyperbilirubinemia



Phototherapy Devices & Radiometers

Phototherapy is used in the clinical management of newborns diagnosed with hyperbilirubinemia. Each type of phototherapy device must be paired with an appropriate manufacturer-approved radiometer (light meter) to determine the intensity of the light. Pairing the Correct Light Meter with Phototherapy Devices to Treat Hyperbilirubinemia Issue (albertahealthservices.ca). The information in this table was provided by AHS Clinical Engineering – Center of Expertise, Capital Management.

Phototherapy Equipment	**Radiometer to be used**
ATOM BILI-THERAPY Pad	Ohmeda BiliBlanket Meter II
ATOM BILI-THERAPY Spot Type	Ohmeda BiliBlanket Meter II
Draeger BiliLux	Proprietary BiliLux Radiometer
GE BiliSoft	Ohmeda BiliBlanket Meter II **OR** Natus neoBLUE Radiometer
GE Giraffe Blue Spot PT Lite	Ohmeda BiliBlanket Meter II **OR** Natus neoBLUE Radiometer
Maquet BiliSoft	Ohmeda BiliBlanket Meter II or Natus neoBlue Radiometer
Maquet Giraffe Blue Spot	Ohmeda BiliBlanket Meter II or Natus neoBlue Radiometer
MEDELA Bilibed	Olympic Bili-Meter Model 22 with type B-22 sensor
Natus neoBLUE LED Overhead Lights	Ohmeda BiliBlanket Meter II **OR** Natus neoBLUE Radiometer **OR** ***For FMC only* Olympic Bili-Meter Model 22
Natus neoBLUE blanket (large)	Natus neoBLUE Radiometer
Natus neoBLUE blanket (small)	Natus neoBLUE Radiometer
Natus neoBLUE cozy	Ohmeda BiliBlanket Meter II **OR** Natus neoBLUE Radiometer
Ohmeda BiliBlanket	Ohmeda BiliBlanket Meter II
Ohmeda Giraffe Spot PT Lite (white or blue)	Ohmeda BiliBlanket Meter II or Natus neoBlue Radiometer
Olympic Medical Bili-Bassinet Model 10	Olympic Bili-Meter Model 22
Olympic Medical 33	Olympic Bili-Meter Model 22
Respironics BiliTx	Joey Dosimeter (JD-100)

** as per FMC Clinical Engineering. Refer to manufacturer's manual for recommended irradiance testing and levels.

Public Health Services for Hyperbilirubinemia Follow-Up

What can you expect when you refer to Public Health (PH) for hyperbilirubinemia community management follow-up

North Zone

- TcB
  - Unavailable in PH clinics or patient's home
- TSB
  - PH does not collect blood samples
- PH availability
  - Monday to Friday
- Services provided
  - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
  - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

South Zone

- TcB
  - Meters available at most locations – see list below
- TSB
  - PH does not collect blood samples
- PH availability
  - Daily 0815-1630
- Services provided
  - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
  - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

TcB Jaundice Meters (Draeger JM 105) are available at the following Public Health locations:
Bow Island, Brooks, Cardston, Coaldale, Crowsnest Pass, Fort Macleod, Lethbridge, Medicine Hat, Picture Butte, Pincher Creek, Raymond, Taber

The following Public Health locations DO NOT have TCB Jaundice Meters:
Magrath, Milk River, Oyen, Vauxhall

Edmonton Zone

- TcB
  - Unavailable in PH clinics or patient's home
- TSB
  - Collected in PH clinic or the patient's home, results received by PHN
  - PHN reports results to Physician indicated on the PNOB
- Public Health availability
  - Daily 0900-1700
- Services provided

    - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
    - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

Calgary Zone Urban

- TcB
    - Meters available with processes for interpreting results
- TSB
    - Collected in PH clinic or the patient's home, results received by PHN
    - Processes available for interpreting results below light level
    - Pediatricians on call available for infants requiring assessment for phototherapy if TSB results are over light level
- PH availability
    - Daily 0900-1700
- Services provided
    - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
    - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

Calgary Zone Rural

- TcB
    - Unavailable in PH clinics or patient’s home
- TSB
    - PH does not collect blood samples
- PH availability
    - Daily 0900-1700
- Services provided
    - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
    - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

Central Zone

- TcB
    - Unavailable in PH clinics or patient’s home
- TSB
    - PH does not collect blood samples
- Public Health availability
    - Monday to Friday 0830-1645
    - Virtual Services on weekends / stat holidays
- Services provided
    - Provides an initial assessment by Home Visit, Clinic Visit or Telephone Call within 48 hours of hospital discharge
    - Provides ongoing hyperbilirubinemia support as clinically relevant from hospital discharge

Provincial Notice of Birth (PNOB)

Public Health Postpartum Services receives an Ambulatory Referral to Postpartum Public Health at time of discharge. An accurate Provincial Notification of Birth (PNOB) provides Public Health (PH) with an important summary of information as they begin providing care to newborns and their families.

PNOB completion – Inpatient unit guidance

Whenever possible, please provide the following:

- Populate the PNOB to the Media tab
    - Blank, missing or duplicate PNOBs create extra workload for Public Health and Acute services
- Discharge address details MUST be accurate:
    - If patient(s) belongs to a First Nation Community, ensure that the appropriate First Nation is identified
    - If patient(s) will not be staying at their permanent address following discharge, ensure that the physical address at discharge is fully entered on the PNOB
    - PO box addresses are not helpful in locating a patient
- Accurate, current telephone number(s) should be entered on both the PNOB and in the patient demographic information
- Newborns discharged with someone other than the birth parent. Guardianship contact information must be accurate and as complete as possible
    - Name, number, address and relationship
    - Guardianship paperwork whenever possible
- Accurate Gestational age
- Newborn Blood Screen completion please - indicate ☑ Done or ☑ Not done
    - If NOT done, please indicate if a requisition was provided
- Hearing screen accurate please - indicate ☑ Done or ☑ Not done
- Translator Required – Prenatal History - please indicate Yes or No as appropriate
    - If Yes, please consider updating the Story Board Language Field for both newborn and parent
- Accurate Discharge Date and Time for newborn and birth parent

Discharge Planning

A clear discharge plan including an MRHP (family physician, pediatrician) is always helpful but is particularly important when hyperbilirubinemia follow-up is required in the community.

When bilirubin levels indicate that a TSB requisition should be sent home with the newborn:

- A MRHP, alternate, or ordering physician will be available to view/action the results in a timely manner.

Follow-up will be provided by the MRHP or Public Health Postpartum Nurse depending on Public Health Zone programs/resources.

Connect Care Sample Graph