Guideline

Neonatal Jaundice and Hyperbilirubinaemia Identification and Management in ≥ 32 weeks gestation

Summary This Guideline provides information on the identification and management of neonatal jaundice in ≥ 32 weeks gestation. It supports maternity and neonatal services to provide safe and evidence-based clinical care inline with service capability throughout NSW.

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NSW Health

Guideline

Neonatal Jaundice and Hyperbilirubinaemia Identification and Management in ≥ 32 weeks gestation

Guideline Summary

Identifying and managing jaundice and hyperbilirubinaemia are essential for the wellbeing of all neonates.

Evidence-based recommendations are provided for the screening, identification, and management of jaundice and hyperbilirubinaemia in neonates born at or beyond 32 weeks' gestation.

The Guideline mandates universal transcutaneous bilirubin (TcB) screening. This follows an increase in the threshold at which phototherapy is commenced.

This Guideline applies to NSW Health staff providing care to neonates receiving care within NSW Health hospital-based maternity and neonatal services including both inpatient and outpatient models of care, Neonatal and paediatric Emergency Transport (NETS) and NSW Ambulance. This also includes neonates referred into the service from other settings.

Key Principles

Identification and screening

Early identification and prompt treatment is key to preventing encephalopathy and Kernicterus spectrum disorder (KSD). Early identification begins in pregnancy by recognising and treating women at risk, including planning of appropriate place for care and birth.

All neonates, without exception, must be assessed for jaundice to determine whether treatment is needed. A neonate with visible jaundice < 24 hours of age is presumed to have pathological jaundice and needs immediate investigation and treatment. All neonates must be screened with TcB or serum bilirubin (SBR) between 24 to 48 hours of birth or before discharge. Any neonate discharged early must have a follow-up plan in place.

Management and treatment

Individualised care plans are required for neonates with risk factors for severe jaundice and for neonates who have met criteria for increased monitoring and/or treatment.

The appropriate test should be determined, conducted and result plotted on the correct gestational jaundice management graph.

The decision to treat is based on several factors, including SBR/POCT/TcB result, gestational age, clinical condition and presence of risk factors for severe jaundice.

Phototherapy is the primary treatment for hyperbilirubinaemia. Neonates who have severe, rapidly rising or refractory hyperbilirubinaemia may need an exchange transfusion and additional supportive therapies.

Family-centred care

Whenever possible, keep the woman and neonate together during phototherapy. The location for treatment will depend on local policies and context. Separation and isolation from their neonate may trigger trauma for some parents and must always be considered when planning care and treatment. The provision of clear information, and inclusion of families and carers in the treatment and care planning process is vital. Decision-making must reflect local service context and include senior medical/neonatologist input using the Tiered Perinatal Network (TPN) as per the NSW Health Policy Directive *Tiered Networking Arrangements for Perinatal Care in NSW* (PD2023_035) and the NSW Health Guideline *Maternity and Neonatal Service Capability* (GL2022_002) or the NSW Health Policy Directive *NSW Paediatric Clinical Care and Inter-hospital Transfer Arrangements* (PD2023_019).

Revision History

Version	Approved By	Amendment Notes
GL2026_002 January-2026	Deputy Secretary, Clinical Innovation and Research	Updated Guideline with: • Universal TcB screening of all neonates born under the care of NSW Health • Clarification on modes of investigating • New neonatal jaundice management graphs • Inclusion of home phototherapy.
GL2016_027 November-2016	Deputy Secretary, Strategy and Resources	New Policy.

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1. Background

Jaundice is a common condition in neonates caused by elevated levels of bilirubin, a by-product of heme degradation. As levels of bilirubin increase, the neonate may present with a yellowish appearance of the skin and sclerae[1] commonly referred to as jaundice. The presence of jaundice is an unreliable indicator of hyperbilirubinaemia. This is because appreciation of colouring is subjective, particularly if hyperbilirubinaemia is mild, in the early stages of bilirubin elevation and in neonates with darker skin tones.

Approximately 60% of neonates born at term (37 weeks or more gestation) and 80% of preterm neonates (below 37 weeks gestation) will develop jaundice. Some neonates may need treatment to prevent hyperbilirubinaemia related neurotoxicity caused by unconjugated bilirubin which can cross the blood brain barrier.[2,3] When this happens, it is deposited in and stains the auditory pathways, basal ganglia, and oculomotor nucleus and may cause permanent neurodevelopmental impairment. The Australian incidence of extreme hyperbilirubinemia is 9.4/100 000 live births.[3]

1.1. About this document

This Guideline applies to NSW Health staff providing care to neonates under the care of hospital-based maternity and/or neonatal services including inpatient and outpatient models of care, Neonatal and paediatric Emergency Transport (NETS) and NSW Ambulance. This also includes neonates referred into the service from other settings.

This Guideline applies to neonates born from 32 weeks gestation onwards. Neonates below this gestation will most likely be managed in neonatal intensive care units (NICUs) and may have other health issues that impact treatment of jaundice.

For neonates discharged from hospital-based maternity and/or neonatal services into primary health care or child and family health services, please refer to the Royal Children's Hospital Melbourne resource *Jaundice in early infancy* for guidance.

In this Guideline, the term hyperbilirubinaemia is used to refer to the biochemical condition. Jaundice is used to refer to the visible yellowing of the skin and sclerae caused by hyperbilirubinaemia.

1.2. Key definitions

ABO-blood group incompatibility	Occurs when the maternal blood type is O, and the fetal blood type is A, B or AB.
Acute bilirubin encephalopathy (see Kernicterus for Chronic encephalopathy)	Acute brain dysfunction caused by excessive bilirubin levels. Signs and symptoms may include lethargy, hypotonia, poor suck and progress to irritability, hypertonia, apnoea, abnormal posture (opisthotonus – rigid with back arched and retrocollis – head tilted backwards), high pitched cry, seizures, coma.

Conjugated bilirubin	Binding (or conjugation) of bilirubin to glucuronic acid making bilirubin water-soluble and is excreted in stools and urine. Unconjugated bilirubin has the potential to cross lipid soluble barriers and is the cause of neurotoxicity and ototoxicity if bilirubin levels become very high, such as with rapid haemolysis or prematurity.
Bilirubin	Yellow pigment created by normal breakdown of red blood cells which leads to the production of unconjugated bilirubin.
Biliary atresia	Condition where the bile ducts inside and outside the liver are blocked or absent, preventing bile from draining into the intestines.
Breast milk jaundice	Type of jaundice that occurs in neonates fed breast milk. Breast milk jaundice typically presents within the first 2 weeks of life in an otherwise healthy neonate who is predominantly breastfed. Can last up to 3 months and is almost always non-pathological.
Direct antiglobulin test (DAT)	An agglutination test that detects the presence of antibodies that are bound to red blood cells, providing information on the risk for and/or cause of haemolysis. Due to blood group incompatibility. Historically known as a Coombs test.
Glucose-6-phosphate dehydrogenase (G6PD) deficiency	Lifelong deficiency of the G6PD enzyme in red cells that may predispose to haemolysis (red blood cell destruction) especially triggered by certain food and medications. It can present with anaemia, without anaemia or with jaundice.
Haemolysis	Destruction of red blood cells.
Haemolytic disease of the fetus and newborn (HDFN)	Haemolytic disease of the fetus and newborn is characterised by a breakdown of red blood cells by maternal antibodies. Antibodies to the RhD, Rhc and Kell antigen are the most common causes of severe HDFN in Australia.

Hyperbilirubinaemia	A biochemical condition defined by elevated levels of bilirubin in the blood. Bilirubin is a yellow pigment produced during the breakdown of haemoglobin. Hyperbilirubinaemia is a measurable finding that indicates an excess of bilirubin, typically detected through blood tests. Visual diagnosis of hyperbilirubinaemia is not accurate.
Intensive phototherapy	Phototherapy provided by light source(s) with irradiance of at least 30microW/cm^2/nm over the wavelength interval 460–490 nm, with maximum body surface exposure.
Irradiance	Irradiance is the measurement of the light source power and defined as surface per unit area. It is a measure of how effective the phototherapy lights are.
Jaundice	The clinical manifestation (visible sign) of hyperbilirubinaemia. It is characterised by the yellowing of the skin, mucous membranes, and the whites of the eyes (sclerae). It is due to an excess of bilirubin in the bloodstream which then starts to deposit in the tissues giving them a yellow appearance.
Kernicterus/ Chronic bilirubin encephalopathy	Form of permanent brain injury caused by excessively high levels of unconjugated bilirubin crossing into brain tissue, characterised by choreoathetoid cerebral palsy and other chronic neurologic impairments, including sensorineural hearing loss.
Kernicterus spectrum disorder (KSD)	A neurological condition resulting from bilirubin toxicity, specifically the accumulation of unconjugated bilirubin in the brain, causing damage. This damage can lead to a range of long-term consequences, including motor impairment, hearing loss and cognitive difficulties.
Neonate	A baby from birth up to and including 28 days of corrected age (when speaking with families and caregivers the term baby should be used).
Physiological jaundice	A common condition caused by the breakdown of fetal red blood cells combined with an immature liver that cannot effectively metabolise bilirubin and prepare it for excretion. Usually presents on day 2-3 of age and has resolved by 14 days of age.[2,4]

Porphyria	Inherited disorder caused by the deficiency in the enzyme uroporphyrinogen III synthase (URO-synthase) involved in heme biosynthesis. It is characterised by photosensitivity and haematological abnormalities.[4]
Pathological jaundice	When there are non-physiological causes resulting in jaundice of the neonate, most commonly due to blood group incompatibility and G6PD.
Prolonged jaundice	Jaundice persisting beyond 14 days of age in a term neonate and 21 days in a preterm neonate, without other symptoms. It is more common in breast fed neonates.
Rh blood group D antigen (previously known as Rhesus)	A protein on the surface of red blood cells whose presence or absence determines whether blood type is positive or negative.
RhD incompatibility (previously known as Rhesus incompatibility)	When a pregnant woman with an RhD negative blood type is exposed to the RhD positive blood of the fetus, triggering the woman's immune system to produce antibodies that destroy the fetus' RhD positive red blood cells.
RhD alloimmunisation (previously known as Rhesus isoimmunisation)	When a maternal immune system response is mounted from exposure to foreign Rh antigens (RhD negative woman and RhD positive fetus) causing destruction of fetal/neonatal RhD positive red blood cells.
Serum bilirubin (SBR)	This is a blood test that measures the total amount of bilirubin in the blood, including both conjugated (direct) and unconjugated (indirect) bilirubin. SBR provides the most accurate measure of bilirubin levels, which is essential for assessing and managing hyperbilirubinaemia, especially in neonates. It may also be referred to as total serum bilirubin (TSB) but SBR is used in this Guideline to avoid confusion with transcutaneous bilirubin (TcB).
Severe hyperbilirubinaemia	SBR measurement above exchange transfusion threshold line.
Standard phototherapy	Phototherapy provided by light source(s) with irradiance of 25–30 microW/cm^2/nm over the wavelength interval 460–490 nm.

Transcutaneous bilirubin (TcB)	This is a non-invasive method of estimating bilirubin levels in neonates to assess the risk of hyperbilirubinaemia. TcB is measured using a device called a transcutaneous bilirubinometer, which directs light through the skin and analyses the light reflected to estimate bilirubin concentration just beneath the skin.
Unconjugated bilirubin	The form of bilirubin that results from the initial breakdown of haemoglobin in red blood cells. This type of bilirubin is fat-soluble, meaning it cannot be easily dissolved in blood or excreted in bile or urine without first undergoing further processing by the liver (conjugation).

1.3. Relevant NSW Health policies, guidelines, standards and frameworks

This Guideline should be read in conjunction with the following documents:

NSW Health Policy documents	
PD2023_035	*Tiered Networking Arrangements for Perinatal Care in NSW*
GL2022_002	*Maternity and Neonatal Service Capability*
PD2025_035	*Health Care Records – Documentation and Management*
PD2017_044	*Interpreters – Standard Procedures for Working with Health Care Interpreters*
PD2025_014	*Recognition and management of patients who are deteriorating*
PD2023_019	*Paediatric Clinical Care and Inter-hospital Transfer Arrangements*
Child Safe Standards	*Guide to the Child Safe Standards*
Trauma-Informed Care Framework	*Integrated Trauma-Informed Care Framework: My Story, my health, my future*

2. Meeting the needs of families/carers and priority populations

Providing and enabling access to consistent, integrated, and continuous care is important for all families and carers, especially for priority populations (including young families and carers under 18 who fall under the scope of the Child Safe Standards). To communicate effectively with families and carers, it is important for NSW Health staff to understand the context and needs of the communities they are working with.

When events occur which take the birthing mother, parents or baby away from their local hospital and support networks, it can be particularly distressing for parents and families. Local processes in the transferring and receiving service must be in place to support and maintain contact. Separation of mother and babies should be prevented whenever possible.

The Agency for Clinical Innovation's *Effective communication in neonatal services* resource provides information for clinicians to enhance communication with parents and carers in neonatal units.

2.1. Care of Aboriginal families

NSW Health staff should:

- provide comprehensive family-centred care that is informed by the NSW Health *NSW Aboriginal Health Plan*, strategic direction 2.
- build strong relationships and work in partnership with Aboriginal parents, and their families to support their engagement with services, including the Aboriginal Maternal Infant Health Service (AMIHS) and share their health history, aspirations for post-natal care and concerns. Decision-making can be supported by using the ACI resource *Finding your way*.
- provide culturally safe care and consider when planning care that some Aboriginal people continue to have mistrust in health services due to the ongoing impacts of colonisation and intergenerational trauma.
- ensure that Aboriginal families are offered referral to appropriate services, such as Aboriginal Liaison Officers and Aboriginal Health Workers/Practitioners for cultural support (contact the Aboriginal Health Unit).
- communicate in a way that is easy to understand, without the use of medical jargon and allow sufficient time for parents and caregivers to make decisions about their care.

2.2. Care of Culturally and Linguistically Diverse families

NSW Health staff should:

- use interpreter services for all parents and carers where English is not their first language in line with the NSW Health Policy Directive *Interpreters – Standard Procedures for Working with Health Care Interpreters* (PD2017_044).
- provide written information in the families' preferred language, where available.

- use additional services, such as multicultural liaison officers, to support and inform families and care givers.

2.3. Care of LGBTIQ+ people

NSW Health staff should:

- create an environment where the person can share what language best describes themselves, their health care experiences and needs, relationships and family or support network.
- use appropriate pronouns, language and terminology about bodies, sexuality, gender, and intersex variations as this supports recognition, trust, and safety.

2.4. Care of young families

As required under the *Children's Guardian Act 2019* (NSW), care providers must provide care to children and young people under 18 in alignment with the Office of the Children's Guardian Child Safe Standards. This includes:

- providing young families with opportunities to express their views and participate in decisions about care.
- involve and inform young families' support networks (their families and relevant community supports) about care provision, where safe and appropriate to do so.
- adapt care to young families' diverse needs and abilities.

2.5. Care of people living with a disability

NSW Health aims to provide high-standard and diverse services to all people including those living with disability.

Parents living with a disability experience particular disadvantage, especially in relation to parenting. Parents living with intellectual disabilities can have fewer social support systems.

Services and referrals must be tailored to specifically meet the needs of parents and their families living with disability, including intellectual disability, to ensure the best outcomes.

2.6. Trauma-informed care

Trauma-informed care may be of particular importance in the management of neonatal jaundice. Trauma-informed care is a strengths-based approach to providing health care based on an understanding of the ways trauma affects people's lives and influences their health care needs and approach to health services. Principles include:

- safety
- collaboration
- trustworthiness
- integration

- choice
- empowerment
- culture
- gender
- history, and
- identity.

For further information, see Integrated trauma-informed care.

2.7. Mental health

The experience of having an unwell neonate can significantly affect the mental health of parents, families, and carers. These impacts may be unrecognised, with mental health conditions remaining undiagnosed and untreated. This can lead to serious consequences for the emotional wellbeing of women and their families during the perinatal period and beyond. It is essential that clinicians proactively assess and respond to mental health concerns, ensuring timely support and referral where needed.

Aboriginal families should be provided with information about Aboriginal Mental Health services. For further guidance on supporting emotional health and well-being for women and their families, please see:

- The Centre for Perinatal Excellence *Mental Health Care in the Perinatal Period, Australian Clinical Practice Guideline (2023)*
- NSW Health Perinatal and Infant Mental Health Services (PIMHS)
- NSW Health *Mental health services and support contact list*.

3. Identification of jaundice

All neonates, without exception must be assessed for jaundice to determine whether treatment is needed. Early identification and prompt treatment is key to preventing acute or chronic encephalopathy and the associated kernicterus spectrum disorder (KSD).[2,5,6] In the Australian study of extreme neonatal hyperbilirubinaemia, all peak SBRs were identified at beyond 48 hours of life in the most severely affected cases with long-term neurodevelopmental impairment[3].

3.1. Initial Neonatal Risk Assessment for jaundice

The Risk Assessment, located on the NSW Health State Form *Standard Neonatal Observation Chart (SNOC)* [SMR110014], should be completed at time of birth. Conduct an assessment for jaundice using the risk factors outlined in Table 1.

Neonates with risk factors for jaundice, including babies below 35 weeks gestation, must have an individualised care plan for jaundice screening (refer to Appendix 1: Routine jaundice assessment in neonates ≥ 35 weeks).

Neonates without risk factors should still be assessed regularly for development of jaundice (refer to Section 3.2. Ongoing assessment).

If there are concerns at any time, escalate as per local Clinical Emergency Response System (CERS) protocols (see NSW Health Policy Directive *Recognition and management of patients who are deteriorating* [PD2025_014]).

Table 1: Risk factors indicating increased potential for development of hyperbilirubinaemia

Timing	Risk factor	Consideration
Antenatal To be identified prior to birth.	Known or potential blood group incompatibility*	• Maternal blood group O • Maternal Rh D negative where fetal Rh D status is either positive or unknown • Maternal red cell antibodies – D, C, c, E, e, Kell and Duffy
	Family history of neonatal hyperbilirubinaemia requiring treatment*	
	Family history of haemolytic disease*	Including G6PD deficiency, hereditary spherocytosis
Intrapartum	Instrumental birth	Consider bruising
Neonatal	Haemolytic disease (such as blood group incompatibility, G6PD deficiency, other haemolytic conditions)	
	Jaundice or rapidly rising bilirubin in first 24 hours after birth	
	Suboptimal breastfeeding	Such as low supply, ineffective milk transfer
	Excessive bruising	Cephalo or subgaleal haematoma
	Prematurity (< 37 weeks gestation)	
	Excessive postnatal weight loss (> 10%)	
	Trisomy 21 and other genetic variations[7, 8]	
	Polycythaemia	Delayed cord clamping, small for gestational age, twin to twin transfusion syndrome
	Significant clinical instability	Such as sepsis, Hypoxic Ischaemic Encephalopathy (HIE)
	Maternal diabetes[8]	Polycythaemia, immature liver function, prematurity, birth trauma from macrosomia

*All neonates of RhD negative or O Positive women should have cord blood collected for group and DAT. This will identify blood group incompatibility for those discharging home under 24 hours of age.

3.2. Ongoing assessment

All neonates, regardless of their level of risk, should have ongoing assessment for the development of jaundice. The level of risk determines the frequency of assessment:

- Neonates with no risk factors, at least once per day.
- Neonates with risk factors, at least 3 times per day before discharge.

The frequency and mode of assessment should be individualised in the clinical care plan considering number and type of risks (refer to Appendix 1: Routine jaundice assessment in neonates ≥ 35 weeks).

Hyperbilirubinaemia and/or visible jaundice before 24 hours of age should always be considered pathological until proven otherwise. Neonates presenting with these signs should receive urgent management, as outlined in Section 3.4.1. Urgent management of the neonate with visible jaundice < 24 hours of age. Clinical review is to be escalated as per local CERS protocols (see NSW Health Policy Directive *Recognition and management of patients who are deteriorating* [PD2025_014]).

Physiological neonatal hyperbilirubinaemia usually presents on day 2 to 3 of age and resolves by 14 days. Care should be taken to ensure there is no pathological cause. All neonates between 24 and 48 hours after birth, or before discharge, should have a transcutaneous bilirubin (TcB) or serum bilirubin (SBR).

For neonates discharged before 24 hours of age, guidance for timing of follow-up, with or without risk factors, is provided in Section 6. Discharge planning and follow up.

3.3. Assessment methods

3.3.1. Visual assessment

Visual assessment may be used to identify jaundice in neonates. However, it is not a sufficiently accurate method on its own as some neonates may have hyperbilirubinaemia without visible jaundice. Any visibly jaundiced neonate should be assessed urgently by either transcutaneous bilirubin (TcB), a point of care test (POCT) or SBR. Management should be guided by charting the values on gestation and risk-appropriate phototherapy graph.[3, 6,9, 10]

The accuracy and reliability of visual estimation of a neonate's serum bilirubin levels vary considerably and may be impacted by clinician experience[11] and other factors, such as skin colour[12] or prematurity.[13]

Visual assessment is not an appropriate method of ongoing assessment following phototherapy. These neonates should have ongoing assessment via SBR (refer to Section 4.1.6. Ceasing phototherapy).

3.3.2. Transcutaneous bilirubin (TcB)

TcB measurement is a non-invasive method that provides a reliable estimate of SBR levels.

TcB measurement is highly sensitive[14] and is recommended as a screening tool for neonatal jaundice. TcB performed < 24 hours of age should be repeated after 24 hours of life. TcB is accurate for neonates from 29 weeks gestation and above.[15] TcB maybe influenced by the

neonate's skin colour. If there is concern regarding a TcB result or over the appropriateness of TcB for a neonate, an SBR should be performed.[16,17]

TcB should be performed either on neonatal forehead or sternum and must not be performed on bruised or discoloured skin.[18]

For neonates ≥ 35 weeks gestation, a TcB measurement that is within 50 micromol/L of the threshold for treatment requires confirmation through SBR measurement.[14] This requirement is incorporated into the neonatal jaundice graphs line 'conduct SBR'.

For neonates born under 35 weeks gestation, a TcB measurement that is within 20 micromol/L of the threshold for treatment requires confirmation through serum bilirubin measurement.[9] 'Conduct SBR' lines are not included in these graphs as TcBs are rarely used in this group.

TcB is inaccurate after phototherapy and should **not** be used for monitoring jaundice levels for at least 24 hours after phototherapy has ceased or as per the manufacturer's product information.[3,17,19]

Not all devices are of acceptable quality. TcB devices should only be purchased in consultation with the tiered perinatal network neonatal service. Follow the manufacturer's guidance for maintenance and calibration.

3.3.3. Serum bilirubin (SBR)

SBR remains the reference standard for diagnosing hyperbilirubinaemia and is the recommended test for guiding treatment and escalation of care. Neonates requiring phototherapy must have a bilirubin verified with an SBR at least once during the course of treatment.

Point of care testing of bilirubin (such as a blood gas analyser) can be used to screen and guide treatment but should always be verified with an SBR if there are clinical concerns.[20,21]

It is recognised internationally[22,23,24] and within NSW Health[25] that there is currently unavoidable variation in SBR results between assay methods and analysers. This variation was considered during the development of the Neonatal Jaundice Management Graphs.[25]

3.3.4. Use of Neonatal Jaundice Management Graphs

Results from the TcB, POCT or SBR measurements should be plotted on the appropriate Neonatal Jaundice Management Graph based on gestational age at birth and risk level. See Table 2 for the appropriate Neonatal Jaundice Management Graph to use based on neurotoxicity risk factors.

Table 2: Neonatal Hyperbilirubinaemia and Jaundice graph recommendations

Risk factor	Recommended Jaundice Threshold Graph
Significant clinical instability, such as sepsis, Hypoxic ischaemic encephalopathy (HIE)	Neurotoxicity risk graph
Haemolytic disease (such blood group incompatibility, G6PD deficiency, other haemolytic conditions)	
Jaundice or rapidly rising bilirubin in first 24 hours after birth	
Prematurity (< 37 weeks gestation)	Standard* graph for gestation**
Known or potential blood group incompatibility***	Standard* graph
Family history of haemolytic disease	
Suboptimal breastfeeding	
Excessive bruising	
Excessive postnatal weight loss (> 10%)	
Trisomy 21 and other genetic variations[7, 8]	
Polycythaemia	
Maternal diabetes[8]	

*Standard graph refers to neonates with *no neurotoxicity risk* factors.

** Use gestation at birth not corrected gestational age.

*** Without evidence of haemolysis

Any neonate with a SBR or TcB that plots on or above the exchange transfusion threshold, or which is rapidly rising (SBR >8.5 mmol/L per hour[23]) should be considered a **neonatal emergency** and senior medical staff must be contacted urgently to:

- monitor progression of jaundice
- guide investigations
- guide interventions including escalation of treatment
- monitor treatment response.

Neonatal jaundice management graphs are **not** adjusted or the neonate's post-menstrual age.

3.4. Immediate management

An unwell neonate requires urgent clinical review and management. Care must be escalated to a higher level service within the tiered perinatal network (NSW Health Policy Directive *Tiered Networking Arrangements for Perinatal Care in NSW* [PD2023_035]) where the neonate's care needs exceed the local service capability (NSW Health Guideline *Maternity and Neonatal Service Capability* [GL2022_002]).

3.4.1. Urgent management of the neonate with visible jaundice < 24 hours of age

If a neonate has **visible jaundice < 24 hours** of age, the hyperbilirubinaemia is more likely to have an underlying pathological cause. These neonates need to be **managed urgently** as follows:

- Perform SBR
- Consider performing TcB or POCT to guide commencement of treatment while awaiting SBR result
- Plot on appropriate neonatal jaundice management graph
- Assess the need for
    - phototherapy
    - additional fluids
    - Immunoglobulin
    - exchange transfusion
- Measure SBR at least every 6 hours until rate of rise is trending down, or levels have returned below the management threshold.

For more information, refer to Appendix 3: Additional investigations and management.

3.4.2. Immediate management of a neonate with visible jaundice ≥ 24 hours of age

Any neonate ≥ 24 hours of age may be affected by severe hyperbilirubinaemia and require immediate management. These neonates need to be managed without delay as follows:

- Measure SBR when TcB is within 50 micromol/L of management threshold.
- Start treatment if TcB measurement indicates need for treatment in a neonate < 48 hours old and SBR result is unlikely to be available within 2 hours.
- Repeat SBR as per individualised care plan, until SBR is below the management threshold,[22] stable and/or trending down after phototherapy treatment.

For more information, refer to Appendix 3: Additional investigations and management.

3.4.3. Monitoring for signs of further deterioration

All hyperbilirubinaemic and/or jaundiced neonates must be monitored for potential signs of bilirubin encephalopathy. These include:

- lethargy
- poor feeding
- vomiting
- high pitched cry

- hypotonia followed by hypertonia
- opisthotonos (abnormal arching of the back, neck, and head due to extreme muscle spasms and rigidity)
- seizures.

4. Treatment

Phototherapy is the primary treatment for hyperbilirubinaemia. Neonates who have rapidly rising or failing to trend down severe hyperbilirubinaemia may need an exchange transfusion. Additional supportive therapies may also be required, these include additional nutritional support and intravenous fluids. Consider intravenous immunoglobulin (IVIG) if jaundice is due to blood group incompatibility.

The decision to treat hyperbilirubinaemia is based on several factors, including[9,23,26,27] interpretation of serum bilirubin (SBR) and/or transcutaneous bilirubin (TcB) levels according to:

- gestational age
- clinical condition of the neonate
- presence of other risk factors for hyperbilirubinemia (see Table 1).

If SBRs vary between different labs (for example, before and after neonatal inter-hospital transfer) the decision to initiate, escalate or vary treatment will need to be based on an individualised clinical care plan informed by a comprehensive assessment of the neonate.

4.1. Phototherapy

Phototherapy is the first-line treatment for neonatal jaundice and effectively reduces SBR in most neonates. Phototherapy converts bilirubin into water-soluble isomers that are readily excreted in urine and stools.

Clinical response to phototherapy depends on:

- irradiance level
- skin surface area exposed to phototherapy, which is increased if both front and back of the neonate is exposed to phototherapy
- cause and severity of the hyperbilirubinaemia.

It is essential to monitor the effectiveness of phototherapy because neonates, despite treatment, may have increasing levels of bilirubin and require further intervention.[9]

4.1.1. Contraindications to phototherapy

Phototherapy is contraindicated in the following circumstances:

- Congenital porphyria or family history.
- Concurrent treatment with photosensitive drugs, e.g. Amiodarone[30,31] (blue light therapy has lower risk compared to UV light).[28]

Phototherapy is ineffective in the management of conjugated hyperbilirubinemia.

4.1.2. Potential adverse effects

Phototherapy is an effective and safe therapy, but potential adverse effects have been identified.

Blue LED lights are safer as they generate minimal heat and do not emit UV light, compared to fluorescent or halogen lights.[3,34]

Erythema and second-degree burns have been reported, especially in preterm neonates and in situations where daylight bulbs are used without plexiglass shields, resulting in prolonged ultraviolet (UV) A exposure.[32]

In the short-term, phototherapy may separate the woman/neonate dyad and interfere with bonding and lactation.[33]

Exposure to phototherapy in neonates with conjugated hyperbilirubinemia can result in a bronze-like skin discolouration, which is not considered harmful.

4.1.3. Types of light used in phototherapy

The effectiveness of phototherapy is determined by irradiance level.

Unconjugated bilirubin is removed more efficiently from circulation with high intensity phototherapy at specific spectrums.

Phototherapy can be delivered by:

- blue LED lights
- fluorescent or halogen lights
- fibreoptic lights.

Phototherapy can be intensified when required if the SBR is rapidly rising or fails to respond to the initial phototherapy by:

- increasing neonate's surface area exposed
- reducing the distance of the phototherapy lights from the baby, following manufacturer's instructions, or
- adding another light source.

Different devices deliver significantly different levels of irradiance (see Table 3).

Consult the manufacturer's product information for different devices irradiance levels.

Table 3: Irradiance Levels

Treatment type	Irradiance levels	Light source
Standard Phototherapy	At least 16 microwatts per square centimetre per nanometer(microW/cm^2/nm) (430–490 nm)[23]	• blue-green, fluorescent light (peak emission at 490 nm) > blue, fluorescent light (peak emission at 452 nm) • blue-green light-emitting diode (LED) light (peak emission at 478 nm) > blue LED light (peak emission at 459 nm) • blue-green LED light (peak emission at 497 nm) = blue LED light (peak emission at 459 nm)
Intensive Phototherapy	30 microW/cm^2/nm or more (430–490 nm)	

4.1.4. When to start phototherapy

SBR is generally recommended as the definitive test to guide phototherapy and escalation-of-care decisions, such as increasing phototherapy irradiance and exchange transfusion.[5] The primary goal is to decrease the risk of neurotoxicity.

Phototherapy is indicated when SBR reaches recommended management level as indicated on the graphs, or the rate of rise of SBR indicates a potential risk of exchange transfusion. This will vary due to gestation, age in hours, birth weight and risk factors.[1-2,5,6,9]

Therapeutic management levels to commence phototherapy or exchange transfusion are largely based on clinical consensus. See Section 3.3.4. Use of Neonatal Jaundice Management Graphs.

4.1.5. Clinical care during phototherapy

The clinical care of a neonate receiving phototherapy is detailed in Table 4.

Whenever possible, keep the woman and neonate together during phototherapy. The location of treatment will depend on local policies but may include:

- postnatal ward
- neonatal services
- home (see Section 6.1. Phototherapy in the home).

Separation or isolation from their neonate may be a trigger of trauma for some parents, especially in Aboriginal and refugee families. Always consider a trauma informed approach and identify parents and carers who may require additional support. Women/parents should be supported to room in with the neonate, especially if the hyperbilirubinemia is not severe.

Provide clear information to the family and carers and ensure they are included in the treatment and care planning process.

Table 4: Clinical care of the neonate receiving phototherapy

Step	Action
Assessments	• Assess hydration status. • Document input/output - loose stools are common (dark urine and/ or light stools may indicate obstructive causes of jaundice). • Observe and document assessments as per the agreed individualised care plan, usually within a 3 to 6 hourly timeframe.
Monitoring	• Monitor the neonate's temperature. • Provide care in an environment that will ensure thermal stability. • Take into consideration the light source used (for example, LED phototherapy lights produce least heat). • Observe and record assessments on a Standard Newborn Observation Chart (SNOC) as per NSW Health Policy Directive *Recognition and management of patients who are deteriorating* (PD2025_014). Escalate for clinical review as per local Clinical Emergency Response System (CERS) protocols. • Oxygen saturation monitoring is recommended for neonates receiving blue fluorescent lights as it is difficult to assess skin colour. Where possible, oxygen saturation monitoring should be continuous. Oxygen monitoring is not required for LED and fiberoptic products (used in both hospital and home settings).
SBR measurement	• Within 4 to 24 hours of starting as per individualised care plan. • Frequency of ongoing testing is dependent on: - risk factors/underlying cause - initial result - SBR rate of rise as plotted on Neonatal Jaundice Management graph.
Surface area exposed	• Expose maximum skin surface area to the phototherapy source.
Eye and skin care	• Use eye protection, recommended in both the ward and home. • Remove eye protection at feeds. • Monitor for eye discharge and conjunctivitis. • Do not apply oils or creams to exposed skin. • Consider protective barrier creams if the neonate has loose stools.
Feeding	• Encourage frequent feeding - minimum 8 to 10 feeds in a 24 hour period. • It may be necessary to wake early term or term neonates for oral feeds. • Provide lactation support, if indicated, for women to continue breastfeeding. • Consider need for enteral feeds if required.

Step	Action
	• Note – neonates with severe jaundice near threshold for exchange, an individualised care plan needs to be in place to support lactation.

4.1.6. Ceasing phototherapy

The decision to cease phototherapy is based on the need to balance exposure to phototherapy and separation of the woman and neonate against the risk of rebound in SBR. Use clinical judgment to consider ceasing based on suitable duration of phototherapy for the underlying cause and severity of jaundice.

The suggested SBR measurement for ceasing phototherapy is ≥ 50 micromol/L below the phototherapy treatment line on the appropriate neonatal jaundice management graph for gestational age at birth and risk of neurotoxicity.[1,9]

A rebound in total SBR can occur after phototherapy is discontinued.[1] A clinically significant rebound is more likely in preterm neonates (< 37 weeks gestation) and those with haemolytic disease and other pathologies such as sepsis. Check for rebound by repeat SBR within 24 hours of stopping phototherapy.[9]

A longer period of phototherapy may be required for neonates with pathological causes of jaundice.

Parent education is needed to help make sure jaundice is recognised following discharge. Local processes are required to ensure families and carers can access follow up services and treatment if needed.

4.2. Nutrition

Inadequate feeding and/or intake leads to reduced nutrition and dehydration, resulting in elevated SBR.

Although neonates fed with breast milk have higher bilirubin levels, successful lactation reduces the risk of severe hyperbilirubinaemia.[36] Suboptimal nutrition can contribute to decreased stool frequency and increased enterohepatic circulation of bilirubin.[37,38] A feeding assessment may be required.

Provide lactation support to women who wish to breastfeed. As a short-term measure, with valid parental consent, expressed breast milk or infant formula may be given to support neonatal intake. The impact of introducing infant formula to an otherwise exclusively breastfed baby must be carefully considered.

4.3. Intravenous immunoglobulin (IVIG)

IVIG is currently not reimbursed for treatment of haemolytic disease of the fetus and newborn (HDFN). Access to IVIG for severe jaundice may be discussed with the National Blood Authority on a case-by-case basis and escalated for approval as per local processes.

Consider IVIG if[39,40]:

- there is Direct Antiglobulin Test (DAT) positive jaundice, AND

- SBR is at the exchange line, or within 35-50 micromol/L and rising, OR
- awaiting blood for an exchange transfusion, OR
- the neonate is awaiting transfer to a neonatal intensive care unit (NICU) for an exchange transfusion, OR
- SBR is increasing at rates of >8.5 micromol/L/hour[23] despite intensive phototherapy. Neonates with a rapidly rising bilirubin level of greater than 8.5 micromol/litre per hour[20] are at an increased risk of developing complications from hyperbilirubinaemia.

Initial dose: 1g/kg IV over 2 hours. A repeat dose of 1g/kg 12 to 24 hours after the initial dose can be considered. Refer to the Australasian Neonatal Medicines Formulary (ANMF).

4.4. Exchange transfusion

A SBR at an exchange level is a medical emergency and requires urgent management. If the neonate is not currently located in a Level 5 or 6 service capability neonatal unit, contact the Newborn and Paediatric Emergency Transport Service (NETS) for urgent transfer to the appropriate level of neonatal service NSW Health Policy Directive *NSW Paediatric Clinical Care and Inter-hospital Transfer Arrangements* (PD2023_019).

Exchange transfusions should be considered if the following is present:

- Severe hyperbilirubinaemia – a SBR level on or above the exchange transfusion threshold as plotted on the appropriate Neonatal Jaundice Management Graph.
- A rapidly rising SBR ≥ 8.5 micromol/L per hour [23] despite multiple light phototherapies, especially in a neonate with known haemolysis. This may be suggestive of aggressive haemolysis.
- Evidence of bilirubin encephalopathy.

The aim of exchange transfusion is to remove bilirubin, antibodies and the products of haemolysis whilst preserving a safe circulating blood volume, haemodynamic and acid-base status.

4.4.1. Service capability and escalation

An exchange transfusion should only be performed at a Level 5 or 6 neonatal service. Tertiary level neonatal services should have local guidelines and procedures to perform a neonatal exchange transfusion. *The Neonatal Exchange Blood Transfusion Record (SMR090070)* is available to assist with documentation and standardisation of the procedure.

If the neonate is admitted to a lower-level service or presents to an Emergency Department, urgent consultation with a neonatologist within the tiered perinatal network or via NETS is required.

Intensive irradiance phototherapy should commence immediately and continue throughout and after an exchange transfusion.

4.5. Management of RhD Alloimmunisation

Prevention of hyperbilirubinaemia begins in pregnancy by recognising and treating women

who are at risk for developing antibodies to red cell antigens, which can lead to haemolytic disease of the fetus and newborn (HDFN) (i.e. alloimmune haemolytic disease).[2]

A fetus with known alloimmunisation should be born at a tertiary facility that has the capacity to perform an exchange transfusion. Transfer the neonate to a tertiary facility as soon as possible if birth has occurred at a lower-level facility.

The following investigations should be completed at birth on cord blood:

- ABO blood group and screen
- RhD status
- DAT
- SBR
- Full Blood Count (FBC) and reticulocyte count.

Further information on the management of RhD alloimmunisation can be found in the NSW Health Guideline *RhD Immunoglobulin (RhD Ig)* [GL2026_001].

5. Prolonged jaundice

Prolonged jaundice is defined as jaundice lasting more than 14 days after birth in the term neonate and 21 days in the preterm neonate.[41] It is usually benign, but may signal more serious conditions such as biliary atresia or serious liver disease, especially if there is conjugated hyperbilirubinaemia.[9]

The most common cause of prolonged jaundice is breast milk jaundice, which occurs in up to 30% of well breastfeeding neonates. [42,43] Advise the mother to continue breastfeeding because of the benefits of breast milk.[5, 45]

Other causes of prolonged jaundice include:

- haemolysis due to G6PD deficiency
- hypothyroidism
- infections (especially urinary tract infection)
- hepatitis
- biliary atresia
- other rare genetic causes.

Prolonged jaundice presentations should undergo investigations, as outlined in Table 5.

Table 5: Investigations for prolonged jaundice

Blood tests	Other investigations
Serum bilirubin	Urine culture if there is clinical suspicion of urinary tract infection
G6PD	
Conjugated bilirubin	Assess urine – look for dark urine that stains the nappy
Full blood count (FBC) to exclude a red cell structural problem (such as spherocytosis)	Assess stool colour – look for acholic pale chalky stools
Blood group (if not already done)	
Confirm maternal blood group	
Direct Antiglobulin Test (DAT) [if not already done] Interpret the result of the DAT taking account of the strength of reaction, and whether the woman received prophylactic RhD immunoglobulin during pregnancy	
Thyroid function tests (TFTs) including Thyroid Stimulating Hormone (TSH) and Free T4	

Conjugated bilirubin > 20 micromol/L and/or > 20% of the SBR may be pathological[44]. If conjugated jaundice persists beyond 14 days in term neonates and 21 days in preterm neonates, immediate medical attention, including referral to a paediatrician, is required. The neonate must be evaluated urgently for causes of conjugated jaundice, including biliary obstruction (acholic or pale stools, very dark urine), metabolic and thyroid disorders or intestinal obstruction.

6. Discharge planning and follow-up

Hyperbilirubinaemia is a potentially preventable cause of 35% of early readmissions of neonates, with higher rates among late preterm neonates.[46,47] It is important that individualised discharge plans include hyperbilirubinaemia monitoring and escalation pathways. This individualised discharge plan needs to consider neonatal age, gestation and risk factors for developing severe hyperbilirubinemia.

In consultation with the medical team, at the earliest opportunity, consider screening for G6PD deficiency, if:

- there is a family history of haemolytic blood disorders.
- the neonate has genetic ancestry from an ethnic origin or geographic region associated with a high prevalence of G6PD deficiency—such as African, Asian, Mediterranean, or Middle Eastern descent—including cases where conception involved donor gametes (egg, sperm, or embryo).

Early discharge, especially before 24 hours of age, may delay the identification and management of significant hyperbilirubinaemia. A transcutaneous bilirubin (TcB) performed < 24 hours of age must be repeated after 24 hours of life. Clinicians should ensure this occurs during the first postnatal consultation after 24 hours of age.

Parent education is vital to support timely recognition of jaundice requiring treatment following discharge. Families and carers are to be provided with verbal and written information prior to discharge.

To enable all families and carers to participate in discharge planning, information must be communicated in a way that is tailored to individual circumstances (including young parents and carers under the age of 18 who fall under the scope of the Child Safe Standards). This includes considering age, health literacy, level of understanding, background and additional accessibility or support needs.

Ongoing lactation support is important to decrease the risk of jaundice from suboptimal breastfeeding. The need for earlier follow up to support the establishment of breast feeding may be required.

Local processes are required to ensure families and carers can access follow up services and treatment if required. Aboriginal families should be offered connection with Aboriginal specific community-based care services in their area, for example, from an Aboriginal Health Worker working in an Aboriginal Maternal and Infant Health Service.

Prior to discharge provide parents and carers with information on jaundice. Discuss:

- feeding

- output
- pale stools/dark urine
- concerns with waking
- Skin colour

There is no specific serum bilirubin (SBR) level that predicts neurodevelopmental impairment, any clinical concern should trigger an individualised care plan for follow-up.

6.1. Phototherapy in the home

If there are no other concerns (such as pathological jaundice), then treatment with an LED phototherapy device at home is an option.

Home phototherapy for neonates > 36 weeks gestation is as effective as inpatient phototherapy for treatment of hyperbilirubinemia that is not severe. It is also cost effective and improves bonding.[23,48]

Identification of neonates at risk of hyperbilirubinaemia, along with their management and escalation, is to follow the recommendations defined in this Guideline. Local guidance should outline the service's inclusion and exclusion criteria and provide clear information for parents about the program.

Parents of neonates treated with home phototherapy should have information that includes:

- feeding support.
- education on the setup and safe use of the device.
- safety of the intervention, particularly for eyewear use (for example, correct placement, and minimisation of exposure of the eyes to blue light).
- local contact information for escalation or advice while their baby is receiving phototherapy at home.

6.2. Information for parents and carers

The Agency for Clinical Innovation's webpage can be accessed to find the most appropriate resources for neonatal jaundice.

On discharge, written information on G6PD deficiency should also be given to all parents whose neonate has been diagnosed, or at risk of G6PD. Risk includes:

- family history of another child with G6PD deficiency.
- a male neonate from a geographic area or their ethnicity is associated with an increased risk of G6PD deficiency (African, Asian, Mediterranean, and Middle Eastern).[1]

See the Royal Children's Hospital Melbourne *G6PD deficiency* factsheet.

Affected neonates can develop massive haemolysis at virtually any time within hours of exposure to triggers, such as:

- clothes stored with moth balls containing naphthalene

- maternal ingestion of fava beans - also called broad beans
- sepsis
- medication, including some antibiotics.

Women who are breastfeeding their neonate with a diagnosis of G6PD may need to avoid the substances and medications that can trigger haemolysis.

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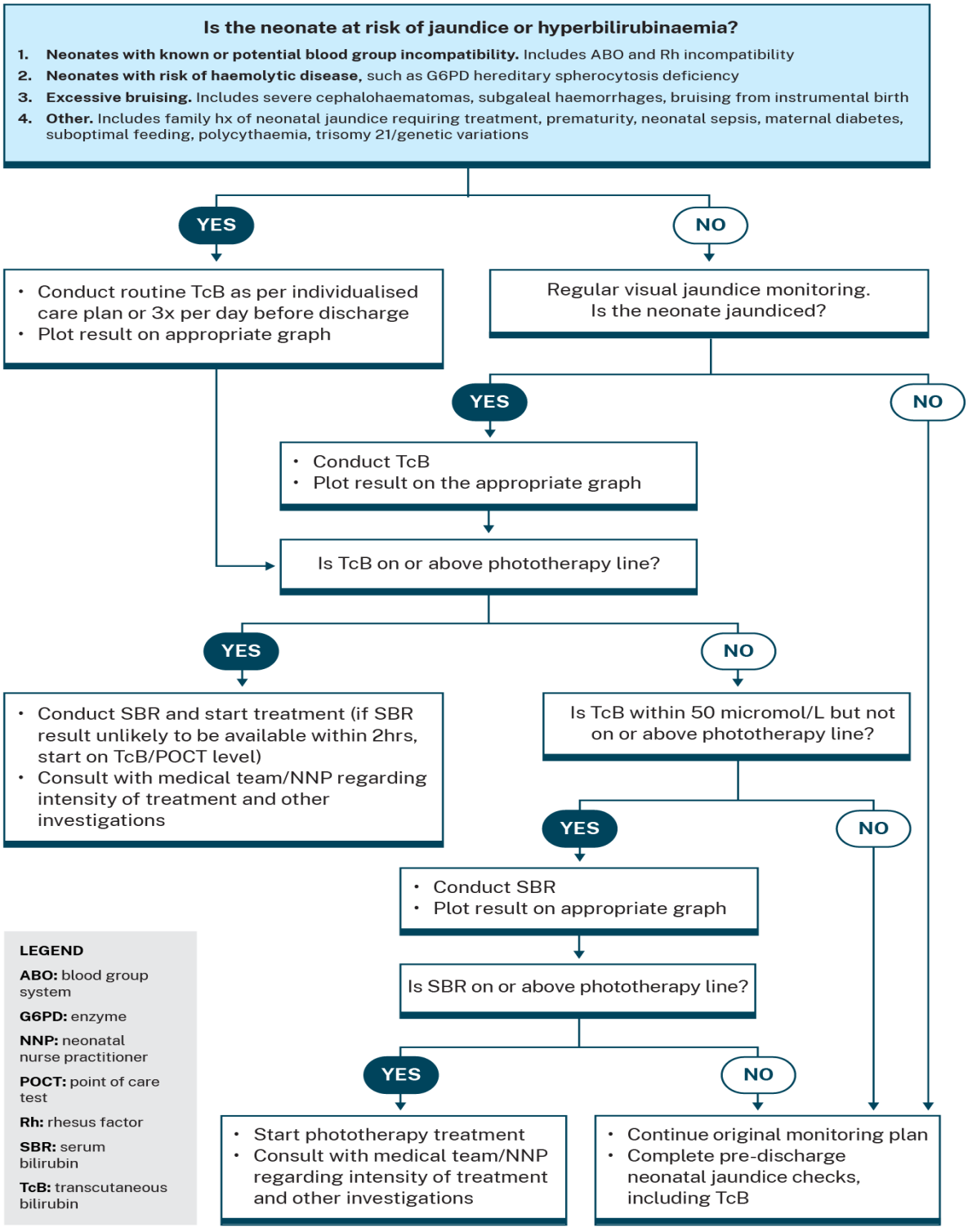
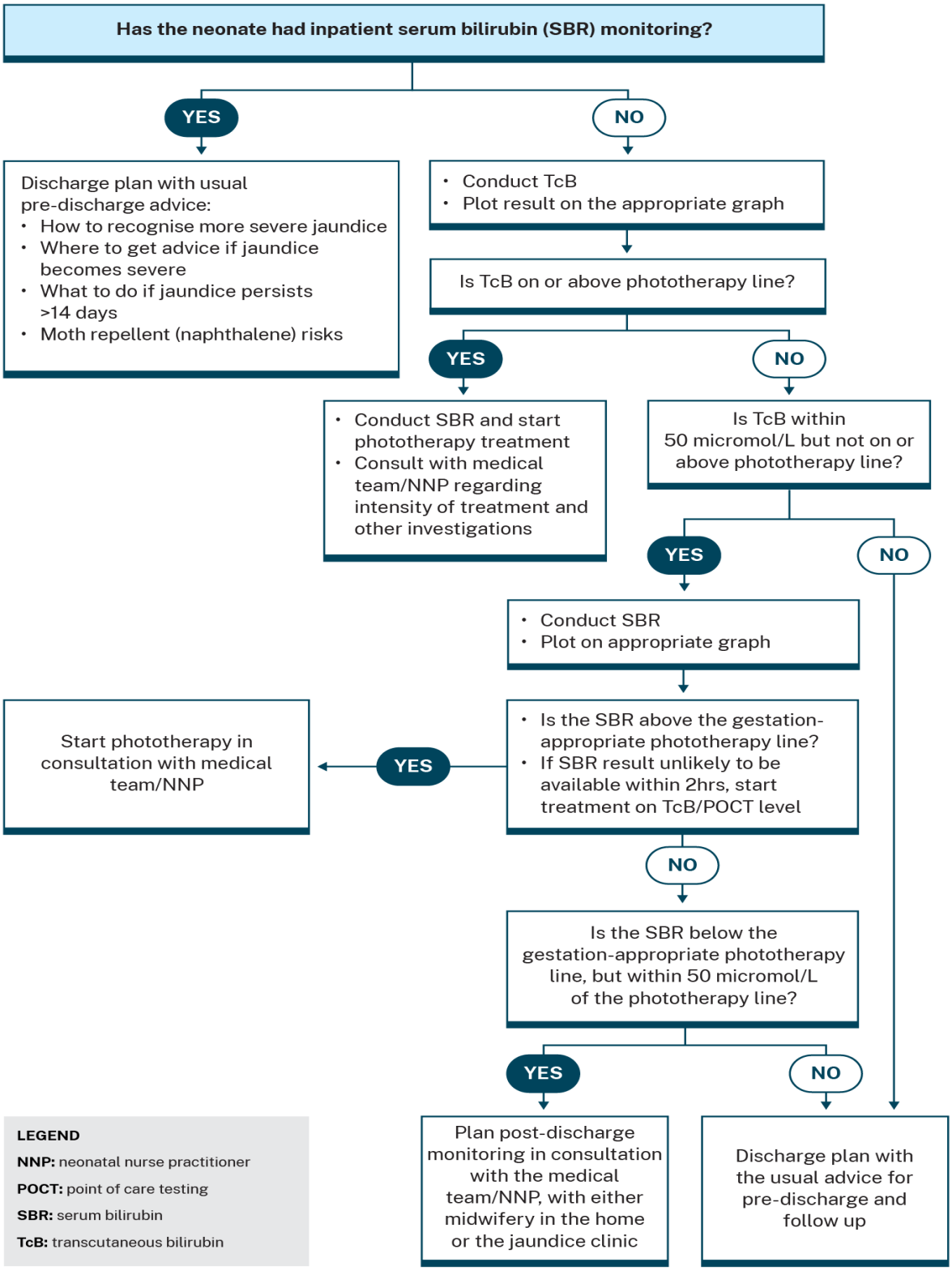
8. Appendices

1. Routine jaundice assessment in neonates ≥ 35 weeks
2. Pre-discharge neonatal jaundice check
3. Additional investigations and management

8.1. Appendix 1: Routine jaundice assessment in neonates ≥ 35 weeks



8.2. Appendix 2: Pre-discharge neonatal jaundice check



8.3. Appendix 3: Additional investigations and management

Clinical Feature	Investigation
Neonate of RhD negative woman	• Cord blood for SBR • Blood group and full blood count (FBC) • DAT • An immediate SBR if the DAT is positive, and the SBR is unknown
DAT positive neonates	• Blood group and FBC (if not already done) • TcB measured at 12, 24 and 48 hours • SBR measured if indicated by TcB result
The maternal blood group should be known and considered with the above investigations	
Neonate with visible jaundice ≤24 hours of age	• Urgent investigation to exclude haemolysis due to RhD or ABO blood group incompatibility • Urgent SBR, may be requested from cord blood if collected at birth • Blood group and FBC • DAT
Neonate with a rapidly rising SBR (> 8.5 micromol/L/hour) OR Neonate with a total SBR above the phototherapy threshold	• FBC and film with reticulocyte count • Blood group, DAT • A glucose 6 dehydrogenase deficiency (G6PD) screen if: - a family history of haemolytic blood disorders - from a high-risk ethnic origin/geographic area for G6PD e.g. African, Asian, Mediterranean, and Middle Eastern descent (most commonly males). • Consider septic screen if clinically indicated
Neonate with a SBR approaching exchange transfusion thresholds	• Serum albumin level • Liver function tests (LFTs)
Prolonged Jaundice (>2 weeks)	- SBR + conjugated bilirubin - Consider LFTs - FBC - G6PD - Thyroid function tests (TFTs) - urine microscopy culture sensitivity (MCS)
NOTE: Any neonate with a conjugated bilirubin > 20 micromol/L and/or > 20% of the total SBR, should have a medical review by the most senior medical officer or specialist paediatrician (same day) and not discharged from hospital without a clear follow-up plan.	