Neonatal Jaundice

Clinical Practice guideline 2013
HWCPG-PED-NICU-004
First Edition

Adapted from source CPG:
Neonatal jaundice, May 2010
National Collaborating Centre for Women’s and Children’s Health
National Institute for Health and Clinical Excellence
Statement of Intent

This Clinical Practice Guideline is not intended to be explained or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve, these parameters of practice should be considered CPGs only. Adherence to the CPG recommendations will not ensure a successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan; the doctor. This judgment should only be arrived at following discussion of the options with the patient, in light of the diagnostic and treatment choices available. However, it is advised that significant departures from the national CPG or any local CPGs derived from it should be fully documented in the patient’s case notes at the time the relevant decision is taken.

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It was in the year 2000 when all had endeavored to prepare clinical practice guidelines for our unit in an attempt to unify and standardize our management practices. Since then, it had remained just a seeming unreachable goal.

But in the Name of the Almighty Allah, by His Grace, this long time endeavor had been completed. Our unit wishes to acknowledge the effort our team had put in this project. We know the team have been putting in a lot of extra time, and the results had finally paid off. We are so happy to see their hard work resulting in such success with the help and patient guidance from the Chair of Sheikh Abdullah BaHamdan for Evidence-Based Health Care & Knowledge Translation in King Saud University and the Clinical Practice Guidelines Committee of King Saud University Hospitals. The team’s positive attitude has had a terrific influence on the way the entire project had turned out. Your efforts are greatly appreciated. Surely, this is only the start of a good beginning.

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We wish to acknowledge the National Collaborating Centre for Women’s and Children’s Health and National Institute for Health and Clinical Excellence, the developers of the source CPG. We would also like to express our sincerest gratitude to all the staff of the Neonatal Intensive Care Unit for their patience and understanding. Likewise, our deepest appreciation to Sheikh Abdullah Bahamdan Research Chair for Evidence Based Health Care and Knowledge Translation, namely Dr. Lubna Al-ansary, Dr. Hayfaa Wahbi and Dr. Rasmieh Alzeidan, King Khalid University Hospital, Hospital’s CPG Committee, namely Dr. Yasser Amer and Quality Management Department, namely Dr. Farheen Shaikh for the endless support and guidance that was extended to us during the making of this guideline.

We would like to extend also our deepest appreciation to all our NICU Consultants who supported us endlessly in every which way they can in research and time management, and who offered opinions and suggestions to make this guideline a piece of work at its best. Without all your support, this guideline would have remained as it was in our unit... only an endeavor.
**Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DAT</td>
<td>Direct Antiglobulin Test (Direct Coomb’s Test)</td>
</tr>
<tr>
<td>KSU</td>
<td>King Saud University</td>
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<tr>
<td>KKH</td>
<td>King Khalid University Hospital</td>
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<td>NICU</td>
<td>Neonatal Intensive Care Unit</td>
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<td>GDG</td>
<td>Guideline Development Group</td>
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**Key terms**

Conventional phototherapy

- Phototherapy given using a single light source (not fibreoptic) that is positioned above the baby.

Direct Antiglobulin Test (DAT)

- Also known as the direct Coombs’ test; this test is used to detect antibodies or complement proteins that are bound to the surface of red blood cells.

Fibreoptic phototherapy

- Phototherapy given using a single light source that comprises a light generator, a fibre-optic cable through which the light is carried and a flexible light pad, on which the baby is placed or that is wrapped around the baby.

Multiple phototherapy

- Phototherapy that is given using more than one light source simultaneously; for example, two or more conventional units, or a combination of conventional and fibreoptic units.

Near-term

- 34 to 36 + 6/7 weeks gestational age

Preterm

- Less than 37 weeks gestational age

Prolonged jaundice

- Jaundice lasting more than more than 14 days in term babies and more than 21 days in preterm babies

 Significant hyperbilirubinaemia

- An elevation of the serum bilirubin to a level requiring treatment Term 37 weeks or more gestational age

Visible jaundice

- Jaundice detected by a visual inspection
1- Statement of intent 3
2- Preface 4
3- Acknowledgments 5
4- Abbreviations/ Key terms 6
5- Overview material 8
6- Introduction 9  
   ▪ Clinical need for a guideline
7- Scope and Purpose: Health/Clinical Questions (PIPOH) 13
8- Recommendations 16  
   • Summary of strength of evidence assigned  
   • Information for parents and caregivers  
   • How to measure the bilirubin level  
   • Information for parents or caregivers on treatment  
   • How to manage hyperbilirubinaemia  
   • Measuring and monitoring bilirubin thresholds during phototherapy  
   • Type of phototherapy to use  
   • Factors that influence the risk of kernicterus  
   • Formal assessment for underlying disease  
   • Care of babies with prolonged jaundice  
   • Intravenous immunoglobulin  
   • Exchange transfusion  
   • Other therapies
9- Implementation Considerations and Tools 28  
   1. Threshold table  
   2. Treatment threshold graphs  
   3. Jaundice investigation pathway  
   4. Phototherapy pathway  
   5. Exchange transfusion pathway
10- Adaptation Process Methodology 49
11- External Review/Consensus process 54
12- Plan for scheduled review and update 56
13- References 57
14- List of funding sources 58
15- Appendix 59  
   • Neonatal Jaundice Parent Information Factsheet  
   • Research recommendations
Overview material

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Print and electronic sources:
Printed copies are available in Neonatal Intensive Care Unit, Postnatal Nursery, Department of Pediatrics, Emergency Medicine Department Pediatric Division, Sheikh Abdullah Bahamdan Research Chair for Evidence Based Health Care and Knowledge Translation, CPG Committee, Quality Management Department and KSU College of Medicine Library.
Electronic sources are available on the KSU College of Medicine and University Hospitals website (icity.ksu.edu.sa) and will be sent to staff through KSU e-mails. And will be made available to all points of care in the KSU hospitals

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Jaundice occurs in most newborn infants. Most jaundice is benign, but because of the potential toxicity of bilirubin, newborn infants must be monitored to identify those who might develop severe hyperbilirubinemia and, in rare cases, acute bilirubin encephalopathy or kernicterus.

Although originally a pathologic diagnosis characterized by bilirubin staining of the brainstem nuclei and cerebellum, the term “kernicterus” has come to be used interchangeably with both the acute and chronic findings of bilirubin encephalopathy. Bilirubin encephalopathy describes the clinical central nervous system findings caused by bilirubin toxicity to the basal ganglia and various brainstem nuclei.

The focus of this guideline is to reduce the incidence of severe hyperbilirubinemia and bilirubin encephalopathy while minimizing the risks of unintended harm such as maternal anxiety, decreased breastfeeding, and unnecessary costs or treatment.

Clinical need for the guideline:

a) Jaundice is one of the most common conditions requiring medical attention in newborn babies. Approximately 60% of term and 80% of preterm babies develop jaundice in the 1st week of life, and about 10% of breastfed babies are still jaundiced at 1 month of age. In most infants with jaundice there is no underlying disease, and this early jaundice (termed ‘physiological jaundice’) is generally harmless.

b) Neonatal jaundice refers to the yellow colouration of the skin and the sclera of newborn babies that result from accumulation of bilirubin in the skin and mucous membranes. This is associated with a raised level of bilirubin in the body, a condition known as hyperbilirubinaemia.

c) Bilirubin is a breakdown product of the red cells in the blood. Red cell breakdown produces unconjugated (or ‘indirect’) bilirubin, which is partly bound to albumin. Normally this is metabolised in the liver to produce conjugated (or ‘direct’) bilirubin, which then circulates through the gut and is excreted in the urine and the stool.

d) Newborn babies have more circulating red cells and a shortened red cell lifespan, so the bilirubin levels are higher than they are later in life. The breakdown and excretion of bilirubin is also slower. Thus degrees of hyperbilirubinaemia occurring as a result of this normal physiological mechanism are common in newborn babies and usually benign (harmless) compared with adult levels.

e) Breastfed infants are more likely to develop physiological jaundice within the 1st week of life. Prolonged jaundice, that is jaundice persisting beyond the first 14 days, is also seen more commonly in these infants. The mechanism for this ‘breast milk jaundice
syndrome’ is still not completely understood and the condition appears to be generally harmless.

f) Jaundice may also have other, non-physiological, causes, including blood group incompatibility (Rhesus, ABO or similar problems), other causes of haemolysis, sepsis, bruising and metabolic disorders. Gilbert’s and Crigler–Najjar syndromes are rare causes of neonatal jaundice. Deficiency of a particular enzyme, glucose-6-phosphate-dehydrogenase (G6PD), can cause severe neonatal jaundice. G6PD deficiency is more common in certain ethnic groups and runs in families. Congenital obstruction and deformities affecting the biliary system, such as in the condition known as biliary atresia, cause an obstructive jaundice associated with conjugated hyperbilirubinaemia. This condition needs specialist management and surgical treatment.

g) In young babies, unconjugated bilirubin can penetrate across the membrane that lies between the brain and the blood (the blood-brain barrier). Unconjugated bilirubin is potentially toxic to neural tissue (brain and spinal cord) because it acts as a ‘cell poison’ slowing essential processes. Entry of unconjugated bilirubin into the brain can cause both short-term and long-term neurological dysfunction. Acute problems include lethargy, abnormal muscle tone, irritability, temporary cessation of breathing (apnoea) and convulsions. This presentation is known as acute bilirubin encephalopathy. This deposition of bilirubin causes a yellow staining of a particular part of the deep neural tissue (the deep grey matter) within the brain; this staining is referred to as ‘kernicterus’. The term kernicterus is also used to denote a group of signs typical of chronic bilirubin encephalopathy. These signs include athetoid cerebral palsy, hearing loss, visual and dental problems. The exact level of bilirubin that is likely to cause neurotoxicity in any individual baby varies, and depends on the interplay of multiple factors that probably include acidosis, postnatal age, rate of rise of bilirubin level, serum albumin concentration, and whether the baby has another illness at the time (including infection).

h) Although neonatal jaundice is very common, kernicterus is very rare. There is a poor correlation between levels of bilirubin in the body and the clinical features of bilirubin encephalopathy. There seems to be tremendous variability in susceptibility towards bilirubin encephalopathy among newborns for a variety of unexplained reasons. However, there are certain factors that probably influence the passage of bilirubin into the brain and hence increase the risk of acute bilirubin encephalopathy. These include dehydration, preterm birth, respiratory distress, sepsis, hypoxia, seizures, acidosis and hypoalbuminaemia. The rate of rise of the level of bilirubin is probably important, hence the increased risk of kernicterus in babies with haemolytic disease such as G6PD deficiency or Rhesus haemolytic disease.

i) The correlation between actual bilirubin levels and kernicterus is poor for the various reasons discussed above in 3 g and h. Kernicterus in healthy term babies with none of the factors (as described above) is virtually unknown below a threshold level of 425
micromoles of bilirubin per litre of serum, but the number of cases rises above this threshold level and the risk of kernicterus is greatly increased in full term newborns with bilirubin levels above 515 micromol/litre. Kernicterus is also known to occur at lower levels of bilirubin in full term babies who have any of the factors described in 3 h.

j) Levels of bilirubin can be controlled by placing the baby under a lamp emitting light in the blue spectrum; this is known as phototherapy. Light energy in the appropriate part of the spectrum converts the bilirubin in the skin to a harmless form that can be excreted in the urine. Phototherapy has proved a very efficient safe and effective treatment for jaundice in newborns, reducing the need to perform an exchange transfusion of blood (the only other means of removing bilirubin from the body).

k) Clinical recognition and assessment of jaundice can be difficult. This is particularly the case in babies with darker skin. Once the diagnosis is made, there is uncertainty about when to treat raised bilirubin levels and there are variations in the use of phototherapy, exchange transfusion and other treatments. There is a need for more uniform, evidence-based practice, and for more widespread consensus-based practice in areas lacking evidence.
**Scope and Purpose**

**Disease/ condition**
Neonatal Hyperbilirubinemia (Neonatal Jaundice)

**CPG Objective:**
The focus of this guideline is to reduce the incidence of severe hyperbilirubinemia and bilirubin encephalopathy while minimizing the risks of unintended harm such as maternal anxiety, decreased breastfeeding, and unnecessary costs or treatment.

*This guideline has been developed with the aim of providing guidance on:*
- recognition and assessment
- prediction of later significant hyperbilirubinaemia and adverse sequelae
- treatment
- information and education for parents/caregivers of babies with jaundice.

*This guideline does not address:*
- primary prevention of jaundice
- jaundice that requires surgical treatment to correct the underlying cause
- management of babies with conjugated hyperbilirubinaemia, although the importance of identifying conjugated hyperbilirubinaemia has to be considered.

**Health/ Clinical Questions (PIPOH)**

**P: Patient population/ target audience of the CPG:**

*Groups that will be covered:*
- a.) All newborn infants (both term and preterm) from birth to 28 days.
- b) Special attention will be given to the recognition and management of neonatal jaundice in babies with darker skin.

*Groups that will not be covered:*
- a) Babies with jaundice that lasts beyond the first 28 days.
- b) Babies with jaundice that requires surgical treatment to correct the underlying cause.
- c) Management of babies with conjugated hyperbilirubinaemia.

**I: Interventions and practices considered and CPG Category:**

Diagnosis, treatment and management of babies with hyperbilirubinemia
Clinical management:

a) Identification of factors that increase the risk of kernicterus in a baby with jaundice

b) Recognition and management in primary care (includes community care).
   - Role and timing of assessment in primary care.
   - Estimation of hyperbilirubinaemia and its management.
   - Management at home, in the community and after discharge.
   - Indications for referral to secondary care

c) Recognition and management in secondary care.
   - Assessment in secondary care.
   - Investigations including:
     - bilirubin – components and methods of estimation
     - other relevant haematological and biochemical tests
     - urine tests
     - screening for metabolic disorders
     - end tidal carbon monoxide concentration
   - Timing of lab investigations including point of care testing. Indications for referral to tertiary care.

d) Treatment of hyperbilirubinaemia.
   - Interpretation of bilirubin levels and use of nomograms.
   - Phototherapy (various modalities).
   - Blood exchange transfusion.
   - Other treatment modalities.
   - Role of nutritional support and rehydration.

f) Information and support that should be given to parents and caregivers:
   - At the time of initial presentation
   - After diagnosis and during management
   - About long-term effects, including significant morbidities and functional outcome.

g) Note that guideline recommendations will normally fall within licensed indications; except and only if clearly supported by evidence, use outside a licensed indication may be
recommended. The guideline will assume that prescribers will use the summary of product characteristics to inform their decisions for individual patients.

h) The guideline development group will take reasonable steps to identify ineffective interventions and approaches to care. If robust and credible recommendations for repositioning the intervention for optimal use, or changing the approach to care to make more efficient use of resources can be made, they will be clearly stated. If the resources released are substantial, consideration will be given to listing such recommendations in the ‘Key priorities for implementation’ section of the guideline.

**P: Professionals/ target users and clinical specialty**
This guideline is intended for use by hospitals and Pediatricians, Neonatologists, Family physicians and advanced practice nurses who treat newborn infants in the hospital and as outpatients.

**O: Outcome and outcome measures:**
- Major outcomes:
  - Mortality
  - Morbidity, seizures
  - Neurological complications (immediate, short-term and long-term)
  - Impact on resource use and costs
- Other outcomes:
  - Auditory, visual and other non-neurological complications
  - Hospital admission (duration, frequency, acquired infections)
  - Effect on maternal infant bonding, breastfeeding and family bonding

**H: Health care setting and context:**
The guideline will cover management in neonatal intensive care setting as well as the Postnatal Nursery. This will also cover primary (including community care) and secondary care. Guidance regarding tertiary referral will also be included.
Recommendations

Summary of strength of evidence assigned

Level 2
Which factors affect the relationship between neonatal hyperbilirubinaemia and kernicterus or other adverse outcomes (neurodevelopmental, auditory)?

How useful are the following tests in predicting neonatal hyperbilirubinaemia?
- **Level 1b** - Prediction of hyperbilirubinaemia (diagnostic accuracy)
- **Level 2** - Prediction of hyperbilirubinaemia (effectiveness)

Level 2
What is the best method of recognizing hyperbilirubinaemia?

Level 2
What should be included in a formal assessment of a baby with neonatal hyperbilirubinaemia?

Level 1 ++
Phototherapy

Level 1 +
Is it beneficial to give additional fluids (cup feeds, fluids) during treatment with phototherapy?

Level 1 +
How to monitor a baby with jaundice?
When to discharge a baby treated for hyperbilirubinaemia? What follow-up is required?

Level 1 -
Exchange transfusion

Level 1 -
What are the other ways of treating hyperbilirubinaemia? Are they effective?

Level 3
What information and support should be given to parents/carers of babies with neonatal hyperbilirubinaemia?
Table 1: Levels of evidence for intervention studies

<table>
<thead>
<tr>
<th>Level</th>
<th>Source of evidence</th>
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<tbody>
<tr>
<td>1++</td>
<td>High-quality meta-analyses, systematic reviews of randomized controlled trials (RCTs), or RCTs with a very low risk of bias</td>
</tr>
<tr>
<td>1+</td>
<td>Well-conducted meta-analyses, systematic reviews of RCTs, or RCTs with a low risk of bias</td>
</tr>
<tr>
<td>1−</td>
<td>Meta-analyses, systematic reviews of RCTs, or RCTs with a high risk of bias</td>
</tr>
<tr>
<td>2++</td>
<td>High-quality systematic reviews of case-control or cohort studies; high-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal</td>
</tr>
<tr>
<td>2+</td>
<td>Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal</td>
</tr>
<tr>
<td>2−</td>
<td>Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal</td>
</tr>
<tr>
<td>3</td>
<td>Non-analytical studies (e.g. case reports, case series)</td>
</tr>
<tr>
<td>4</td>
<td>Expert opinion, formal consensus</td>
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Information for parents and caregivers:

1. Offer parents or carers information about neonatal jaundice that is tailored to their needs and expressed concerns. This information should be provided through verbal discussion backed up by written information. Care should be taken to avoid causing unnecessary anxiety to parents or caregivers.

   Information should include:
   - factors that influence the development of significant hyperbilirubinaemia
   - how to check the baby for jaundice
   - what to do if they suspect jaundice
   - the importance of recognising jaundice in the first 24 hours and of seeking urgent medical advice
   - the importance of checking the baby’s nappies for dark urine or pale chalky stools
   - the fact that neonatal jaundice is common, and reassurance that it is usually transient and harmless
   - reassurance that breastfeeding can usually continue.
Care for all babies:

2. Identify babies as being more likely to develop significant hyperbilirubinemia if they have any of the following factors:
   - gestational age under 38 weeks
   - a previous sibling with neonatal jaundice requiring phototherapy
   - mother’s intention to breastfeed exclusively
   - visible jaundice in the first 24 hours of life.

3. Ensure that adequate support is offered to all women who intend to breastfeed exclusively.

4. In all babies:
   - check whether there are factors associated with an increased likelihood of developing significant hyperbilirubinaemia soon after birth examine the baby for jaundice at every opportunity especially in the first 72 hours.

5. Parents, caregivers and healthcare professionals should all look for jaundice (visual inspection).

6. When looking for jaundice (visual inspection):
   - check the naked baby in bright and preferably natural light
   - examination of the sclerae, gums and blanched skin is useful across all skin tones.

7. Do not rely on visual inspection alone to estimate the bilirubin level in a baby with jaundice.

8. Do not measure bilirubin levels routinely in babies who are not visibly jaundiced.

9. Do not use any of the following to predict significant hyperbilirubinaemia
   - umbilical cord blood bilirubin level
   - end-tidal carbon monoxide (ETCOc) measurement
   - umbilical cord blood direct antiglobulin test (DAT) (Coombs’ test).

Additional care:

10. Ensure babies with factors associated with an increased likelihood of developing significant hyperbilirubinaemia receive an additional visual inspection by a healthcare professional during the first 48 hours of life.

Urgent additional care for babies with visible jaundice in the first 24 hours:

11. Measure and record the serum bilirubin level urgently (within 2 hours) in all babies with suspected or obvious jaundice in the first 24 hours of life.
12. Continue to measure the serum bilirubin level every 6 hours for all babies with suspected or obvious jaundice in the first 24 hours of life until the level is both:
   - below the treatment threshold
   - stable and/or falling.

13. Arrange a referral to ensure that an urgent medical review is conducted (as soon as possible and within 6 hours) for babies with suspected or obvious jaundice in the first 24 hours of life to exclude pathological causes of jaundice.

14. Interpret bilirubin levels according to the baby’s postnatal age in hours and manage hyperbilirubinemia according to the threshold table and treatment threshold graphs.

**Care for babies more than 24 hours old:**

15. Measure and record the bilirubin level urgently (within 6 hours) in all babies more than 24 hours old with suspected or obvious jaundice.

**How to measure the bilirubin level:**

16. When measuring the bilirubin level:
   - use a transcutaneous bilirubinometer in babies with a gestational age of 35 weeks or more and postnatal age of more than 24 hours if a transcutaneous bilirubinometer is not available, measure the serum bilirubin
   - if a transcutaneous bilirubinometer measurement indicates a bilirubin level greater than 250 micromol/litre check the result by measuring the serum bilirubin
   - always use serum bilirubin measurement to determine the bilirubin level in babies with jaundice in the first 24 hours of life
   - always use serum bilirubin measurement to determine the bilirubin level in babies less than 35 weeks gestational age always use serum bilirubin measurement for babies at or above the relevant treatment threshold for their postnatal age, and for all subsequent measurements
   - do not use an icterometer.

**Information for parents or caregivers on treatment:**

17. Offer parents or caregivers information about treatment for hyperbilirubinaemia including:
   - anticipated duration of treatment
   - reassurance that breastfeeding, nappy-changing and cuddles can usually continue.

18. Encourage mothers of breastfed babies with jaundice to breastfeed frequently, and to wake the baby for feeds if necessary.
19. Provide lactation/feeding support to breastfeeding mothers whose baby is visibly jaundiced.

**How to manage hyperbilirubinaemia:**

20. Use the bilirubin level to determine the management of hyperbilirubinaemia in all babies (see threshold table and treatment threshold graphs)

21. Do not use the albumin/bilirubin ratio when making decisions about the management of hyperbilirubinaemia unless there is significant hypoalbuminemia.

22. Do not subtract conjugated bilirubin from total serum bilirubin when making decisions about the management of hyperbilirubinaemia (see management thresholds in the threshold table and treatment threshold graphs)

**Measuring and monitoring bilirubin thresholds during phototherapy:**

**Starting phototherapy:**

23. Use serum bilirubin measurement and the treatment thresholds in the threshold table and treatment threshold graphs when considering the use of phototherapy.

24. In babies with a gestational age of 38 weeks or more whose bilirubin is in the ‘repeat bilirubin measurement’ category in the threshold table repeat the bilirubin measurement in 6–12 hours.

25. In babies with a gestational age of 38 weeks or more whose bilirubin is in the ‘consider phototherapy’ category in the threshold table repeat the bilirubin measurement in 6 hours regardless of whether or not phototherapy has subsequently been started.

26. Do not use phototherapy in babies whose bilirubin does not exceed the phototherapy threshold levels in the threshold table and treatment threshold graphs.

**During phototherapy:**

27. During phototherapy:
   - repeat serum bilirubin measurement 4–6 hours after initiating phototherapy
   - repeat serum bilirubin measurement every 6–12 hours when the serum bilirubin level is stable or falling.
**Stopping phototherapy:**

28. Stop phototherapy once serum bilirubin has fallen to a level at least 50 micromol/litre below the phototherapy threshold (see threshold table and treatment threshold graphs).

29. Check for rebound of significant hyperbilirubinaemia with a repeat serum bilirubin measurement 12–18 hours after stopping phototherapy. Babies do not necessarily have to remain in hospital for this to be done.

**Type of phototherapy to use:**

30. Do not use sunlight as treatment for hyperbilirubinaemia.

**Single phototherapy treatment for term babies:**

31. Use conventional ‘blue light’ phototherapy as treatment for significant hyperbilirubinaemia in babies with a gestational age of 37 weeks or more unless:
   - the serum bilirubin level is rising rapidly (more than 8.5 micromol/litre per hour)
   - the serum bilirubin is at a level that is within 50 micromol/litre below the threshold for which exchange transfusion is indicated after 72 hours (see the threshold table and treatment threshold graphs).

32. Do not use fibreoptic phototherapy as first-line treatment for hyperbilirubinaemia for babies with a gestational age of 37 weeks or more.

**Single phototherapy treatment in preterm babies:**

33. Use either fibreoptic phototherapy or conventional ‘blue light’ phototherapy as treatment for significant hyperbilirubinaemia in babies less than 37 weeks unless:
   - the serum bilirubin level is rising rapidly (more than 8.5 micromol/litre per hour)
   - the serum bilirubin is at a level that is within 50 micromol/litre below the threshold for which exchange transfusion is indicated after 72 hours (see treatment threshold table and treatment threshold graphs).

**Continuous multiple phototherapy treatment for term and pre term babies:**

34. Initiate continuous multiple phototherapy to treat all babies if any of the following apply:
   - the serum bilirubin level is rising rapidly (more than 8.5 micromol/litre per hour)
• the serum bilirubin is at a level within 50 micromol/litre below the threshold for which exchange transfusion is indicated after 72 hours (see threshold table and treatment threshold graphs).
• the bilirubin level fails to respond to single phototherapy (that is, the level of serum bilirubin continues to rise, or does not fall, within 6 hours of starting single phototherapy)

35. If the serum bilirubin level falls during continuous multiple phototherapy to a level 50 micromol/litre below the threshold for which exchange transfusion is indicated step down to single phototherapy.

Information for parents or caregivers on phototherapy:

36. Offer parents or caregivers verbal and written information on phototherapy including all of the following:
• why phototherapy is being considered
• why phototherapy may be needed to treat significant hyperbilirubinaemia
• the possible adverse effects of phototherapy
• the need for eye protection and routine eye care
• reassurance that short breaks for feeding, nappy changing and cuddles will be encouraged
• what might happen if phototherapy fails
• rebound jaundice
• potential long-term adverse effects of phototherapy
• potential impact on breastfeeding and how to minimise this.

General care of the baby during phototherapy

37. During phototherapy:
• place the baby in a supine position unless other clinical conditions prevent this
• ensure treatment is applied to the maximum area of skin
• monitor the baby’s temperature and ensure the baby is kept in an environment that will minimise energy expenditure (thermoneutral environment)
• monitor hydration by daily weighing of the baby and assessing wet nappies
• support parents and carers and encourage them to interact with the baby.

38. Give the baby eye protection and routine eye care during phototherapy.

39. Use “bilimasks” as eye covers for eye protection in babies with a gestational age of 37 weeks or more undergoing conventional blue light’ phototherapy.
Monitoring the baby during phototherapy

40. During conventional ‘blue light’ phototherapy:
   - using clinical judgement, encourage short breaks (of up to 30 minutes) for breastfeeding, nappy changing and cuddles
   - continue lactation/feeding support
   - do not give additional fluids or feeds routinely.
   - Maternal expressed milk is the additional feed of choice if available, and when additional feeds are indicated.

41. During multiple phototherapy:
   - do not interrupt phototherapy for feeding but continue administering intravenous/enteral feeds
   - continue lactation/feeding support so that breastfeeding can start again when treatment stops.
   - Maternal expressed milk is the additional feed of choice if available, and when additional feeds are indicated.

Phototherapy equipment:

42. Ensure all phototherapy equipment is maintained and used according to manufacturers’ guidelines.

43. Use incubators or bassinets according to clinical need and availability.

44. Do not routinely cover incubators while phototherapy is going on as they may impair observation of the baby.

Factors that influence the risk of kernicterus:

45. Identify babies with hyperbilirubinaemia as being at increased risk of developing kernicterus if they have any of the following:
   - a serum bilirubin level greater than 340 micromol/litre in babies with a gestational age of 37 weeks or more
   - a rapidly rising bilirubin level of greater than 8.5 micromol/litre/hour
   - clinical features of acute bilirubin encephalopathy.

Formal assessment for underlying disease:

46. In addition to a full clinical examination by a suitably trained healthcare professional, carry out all of the following tests in babies with significant hyperbilirubinaemia as part
of an assessment for underlying disease (see threshold table and treatment threshold graphs).

- serum bilirubin (for baseline level to assess response to treatment)
- blood packed cell volume
- blood group (mother and baby)
- DAT (Coombs’ test). Interpret the result taking account of the strength of reaction, and whether mother received prophylactic anti-D immunoglobulin during pregnancy.

47. When assessing the baby for underlying disease consider whether the following tests are clinically indicated:

- full blood count and examination of blood film
- blood glucose-6-phosphate dehydrogenase levels, taking account of ethnic origin
- Microbiological cultures of blood and/or cerebrospinal fluid (if infection is suspected). Consider urine culture if neonate is more than 72 hours old.

Care of babies with prolonged jaundice:

48. In babies with a gestational age of 37 weeks or more with jaundice lasting more than 14 days, and in babies with a gestational age of less than 37 weeks with jaundice lasting more than 21 days:

- look for pale chalky stools and/or dark urine that stains the nappy
- measure the conjugated bilirubin
- carry out a full blood count
- carry out a blood group determination (mother and baby) and DAT (Coombs’ test). Interpret the result taking account of the strength of reaction, and whether mother received prophylactic anti-D immunoglobulin during pregnancy.
- carry out a urine culture
- ensure that routine metabolic screening (including screening for congenital hypothyroidism) has been performed.

49. Follow expert advice about care for babies with a conjugated bilirubin level more than 25 micromol/litre because this may indicate serious liver disease.

Intravenous immunoglobulin:

50. Use intravenous immunoglobulin (IVIG) (500 mg/kg over 4 hours) as an adjunct to continuous multiple phototherapy in cases of Rhesus haemolytic disease or ABO haemolytic disease when the serum bilirubin continues to rise by more than 8.5 micromol/litre per hour.

51. Offer parents or caregivers information on IVIG including:

- why IVIG is being considered
• why IVIG may be needed to treat significant hyperbilirubinaemia
• the possible adverse effects of IVIG
• when it will be possible for parents or carers to see and hold the baby.

**Exchange transfusion:**

52. Offer parents or caregivers information on exchange transfusion including:
• the fact that exchange transfusion requires that the baby be admitted to an intensive care bed
• why an exchange transfusion is being considered
• why an exchange transfusion may be needed to treat significant hyperbilirubinaemia
• the possible adverse effects of exchange transfusions
• when it will be possible for parents or carers to see and hold the baby after the exchange transfusion.

53. Use a double-volume exchange transfusion to treat babies:
• whose serum bilirubin level indicates its necessity (see threshold table and treatment threshold graphs)
and/or
• with clinical features and signs of acute bilirubin encephalopathy.

54. During exchange transfusion do not:
• stop continuous multiple phototherapy
• perform a single-volume exchange
• use albumin priming
• routinely administer intravenous calcium.

55. Following exchange transfusion:
• maintain continuous multiple phototherapy
• measure serum bilirubin level within 2 hours and manage according to threshold table and treatment threshold graphs).

**Other therapies:**

56. Do not use any of the following to treat hyperbilirubinaemia:
• agar
• albumin
• barbiturates
• charcoal
• cholestyramine
• clofibrate
• D-penicillamine
Key priorities for implementation:

Information for parents and caregivers:
Offer parents or caregivers information about neonatal jaundice that is tailored to their needs and expressed concerns. This information should be provided through verbal discussion backed up by written information. Care should be taken to avoid causing unnecessary anxiety to parents or carers. Information should include:

- factors that influence the development of significant hyperbilirubinaemia
- how to check the baby for jaundice
- what to do if they suspect jaundice
- the importance of recognizing jaundice in the first 24 hours and of seeking urgent medical advice
- the importance of checking the baby’s nappies for dark urine or pale chalky stools
- the fact that neonatal jaundice is common, and reassurance that it is usually transient and harmless
- reassurance that breastfeeding can usually continue.

Care for all babies:
Identify babies as being more likely to develop significant hyperbilirubinaemia if they have any of the following factors:

- gestational age under 38 weeks
- a previous sibling with neonatal jaundice requiring phototherapy
- mother’s intention to breastfeed exclusively
- visible jaundice in the first 24 hours of life.

In all babies:

- check whether there are factors associated with an increased likelihood of developing significant hyperbilirubinaemia soon after birth
- examine the baby for jaundice at every opportunity especially in the first 72 hours.

When looking for jaundice (visual inspection):

- check the naked baby in bright and preferably natural light
- examination of the sclerae, gums and blanched skin is useful across all skin tones.
Additional care:
Ensure babies with factors associated with an increased likelihood of developing significant hyperbilirubinaemia receive an additional visual inspection by a healthcare professional during the first 48 hours of life.

Measuring bilirubin in all babies with jaundice:
Do not rely on visual inspection alone to estimate the bilirubin level in a baby with jaundice.

How to measure the bilirubin level:
When measuring the bilirubin level:
- use a transcutaneous bilirubinometer in babies with a gestational age of 35 weeks or more and postnatal age of more than 24 hours
- if a transcutaneous bilirubinometer is not available, measure the serum bilirubin
- if a transcutaneous bilirubinometer measurement indicates a bilirubin level greater than 250 micromol/litre check the result by measuring the serum bilirubin
- always use serum bilirubin measurement to determine the bilirubin level in babies with jaundice in the first 24 hours of life
- always use serum bilirubin measurement to determine the bilirubin level in babies less than 35 weeks gestational age
- always use serum bilirubin measurement for babies at or above the relevant treatment threshold for their postnatal age, and for all subsequent measurements

How to manage hyperbilirubinaemia:
Use the bilirubin level to determine the management of hyperbilirubinaemia in all babies (see threshold table and treatment threshold graphs).

Care of babies with prolonged jaundice:
Follow expert advice about care for babies with a conjugated bilirubin level greater than 25micromol/liter because this may indicate serious liver disease.
### Implementation considerations and tools

Table 2: Threshold table
Consensus-based bilirubin thresholds for management of babies 38 weeks or more gestational age with hyperbilirubinaemia

<table>
<thead>
<tr>
<th>Age (hours)</th>
<th>Bilirubin measurement (micromol/litre)</th>
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<tbody>
<tr>
<td>0</td>
<td>–</td>
</tr>
<tr>
<td>6</td>
<td>&gt; 100</td>
</tr>
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<td>&gt; 100</td>
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<tr>
<td>90</td>
<td>–</td>
</tr>
<tr>
<td>96+</td>
<td>–</td>
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</table>

**Action**
- Repeat bilirubin measurement in 6–12 hours
- Consider phototherapy and repeat bilirubin measurement in 6 hours
- Start phototherapy
- Perform an exchange transfusion unless the bilirubin level falls below threshold while the treatment is being prepared
Table 3:

Treatment threshold graph for babies with neonatal jaundice

<table>
<thead>
<tr>
<th>Baby's name</th>
<th>Date of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital number</td>
<td>Time of birth</td>
</tr>
</tbody>
</table>

| Direct Antiglobulin Test | 23 weeks gestation |

<table>
<thead>
<tr>
<th>Total serum bilirubin (micromol/litre)</th>
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</thead>
<tbody>
<tr>
<td>Days from birth</td>
</tr>
</tbody>
</table>

Shade for phototherapy

- Exchange transfusion
- Phototherapy

Baby's blood group
Mother's blood group
Treatment threshold graph for babies with neonatal jaundice

Baby’s name

Date of birth

Hospital number

Time of birth

Direct Antiglobulin Test

25 weeks gestation

Shade for phototherapy

Days from birth

Total serum bilirubin (micromol/litre)

Baby’s blood group

Mother’s blood group
Treatment threshold graph for babies with neonatal jaundice

Baby's name ___________________________ Date of birth _______________________

Hospital number ________________________ Time of birth ________________________ Direct Antiglobulin Test ______

26 weeks gestation

Baby's blood group ________________ Mother's blood group ________________

Days from birth

Total serum bilirubin (micromol/litre)

Multiple
Single

Exchange transfusion

Phototherapy

Shade for phototherapy
Treatment threshold graph for babies with neonatal jaundice

Baby's name

Date of birth

Hospital number

Time of birth

Direct Antiglobulin Test

27 weeks gestation

Multiple
Single

Total serum bilirubin (micromol/litre)

Exchange transfusion

Phototherapy

Days from birth

Baby's blood group

Mother's blood group
Treatment threshold graph for babies with neonatal jaundice

Baby's name

Date of birth

Hospital number

Time of birth

Direct Antiglobulin Test

28 weeks gestation

Shade for phototherapy

Exchange transfusion

Phototherapy

Total serum bilirubin (micromol/litre)

Days from birth

Baby's blood group

Mother's blood group
Treatment threshold graph for babies with neonatal jaundice

Baby’s name ___________________________ Date of birth ___________________________
Hospital number ___________________________ Time of birth ___________________________
Direct Antiglobulin Test ___________________________ 29 weeks gestation

Shade for phototherapy

Total serum bilirubin (micromol/litre)

- Exchange transfusion
- Phototherapy

Days from birth

Baby’s blood group ___________________________ Mother’s blood group ___________________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name

Date of birth

Hospital number

Time of birth

Direct Antiglobulin Test

30 weeks gestation

Shade for phototherapy

Exchange transfusion

Total serum bilirubin (micromol/litre)

Days from birth

Baby's blood group

Mother's blood group
Treatment threshold graph for babies with neonatal jaundice

Baby's name ___________________________ Date of birth ___________________________
Hospital number ________________________ Time of birth __________________________
Direct Antiglobulin Test ___________________ 31 weeks gestation _______________________

Shade for phototherapy

Multiple
Single
550
500
450
400
350
300
250
200
150
100
50
0

Total serum bilirubin (micromol/litre)

Days from birth

Baby's blood group ________________________ Mother's blood group ____________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name ____________________________ Date of birth ____________________________

Hospital number ____________________________ Time of birth ____________________________ Direct Antiglobulin Test ____________________________ 32 weeks gestation

Shade for phototherapy

Multiple Single

550 500 450 400 350 300 250 200 150 100 50 0

Total serum bilirubin (micromol/litre)

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

Days from birth

Exchange transfusion

Phototherapy

Baby's blood group ____________________________ Mother's blood group ____________________________
Treatment threshold graph for babies with neonatal jaundice

Baby’s name ___________________________ Date of birth ___________________________

Hospital number ___________________________ Time of birth ___________________________ Direct Antiglobulin Test ___________________________

33 weeks gestation

Shade for phototherapy

Exchange transfusion

Phototherapy

Total serum bilirubin (micromol/litre)

Days from birth

Baby’s blood group ___________________________ Mother’s blood group ___________________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name ___________________________ Date of birth ___________________________

Hospital number ___________________________ Time of birth ___________________________ Direct Antiglobulin Test ___________________________ 34 weeks gestation

Shade for phototherapy

Exchange transfusion

Phototherapy

Total serum bilirubin (micromol/litre)

Days from birth

Baby's blood group ___________________________ Mother's blood group ___________________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name _______________________ Date of birth ___________________
Hospital number ___________________ Time of birth __________________
Direct Antiglobulin Test ____________ 35 weeks gestation ____________

Shade for phototherapy

Multiple Single

<table>
<thead>
<tr>
<th>Total serum bilirubin (micromol/litre)</th>
<th>Days from birth</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7 8 9 10 11 12 13 14</td>
<td>0 2 4 6 8 10 12 14</td>
</tr>
<tr>
<td>Exchange transfusion</td>
<td>350</td>
</tr>
<tr>
<td>Phototherapy</td>
<td>250</td>
</tr>
</tbody>
</table>

Baby's blood group _________________ Mother's blood group ________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name __________________________ Date of birth __________________________

Hospital number __________________________ Time of birth __________________________ Direct Antiglobulin Test ____________

36 weeks gestation

Shade for phototherapy

Exchange transfusion

Phototherapy

Total serum bilirubin (micromol/litre)

Days from birth

Baby's blood group __________________________ Mother's blood group __________________________
Treatment threshold graph for babies with neonatal jaundice

Baby's name ___________________________ Date of birth ___________________________
Hospital number ___________________ Time of birth __________ Direct Antiglobulin Test ___________ 37 weeks gestation

Shade for phototherapy

Multiple

Single

550

450

400

350

300

250

200

150

100

50

Multiple

Single

0

10

20

30

40

50

60

70

80

90

100

110

120

130

140

Days from birth

Total serum bilirubin (micromol/litre)

Exchange transfusion:

Phototherapy:

Baby's blood group ___________ Mother's blood group ___________
Treatment threshold graph for babies with neonatal jaundice

Baby's name ___________________________ Date of birth ___________________________
Hospital number ___________________________ Time of birth ___________________________ Direct Antiglobulin Test ___________________________ >=38 weeks gestation

Shade for phototherapy

Multiple
Single
550
500
450
400
350
300
250
200
150
100
50
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
Days from birth

Total serum bilirubin (micromol/litre)

Exchange transfusion

Phototherapy

Baby's blood group ___________________________ Mother's blood group ___________________________
Offer parents/caregivers information about neonatal jaundice

Identify babies as being more likely to develop significant hyperbilirubinemia if they have any of the following factors:
- Gestational age under 38 weeks
- A previous sibling with neonatal jaundice requiring phototherapy
- Mother’s intention to breastfeed exclusively
- Visible jaundice in the first 24 hours

Does baby have suspected or obvious jaundice in the first 24 hours?

Does baby have any other factors?
- Gestational age under 38 weeks
- A previous sibling with neonatal jaundice requiring phototherapy
- Mother’s intention to breastfeed exclusively

Examine the baby for jaundice at every opportunity, especially in the first 72 hours

Does baby have visible jaundice?

Measure and record serum bilirubin level within 2 hours

Ensure babies receive an additional visual inspection by a healthcare professional within 48 hours

Additional care for babies who are more likely to develop jaundice

Ensure adequate support is offered to all women who intend to breastfeed exclusively

Examine for jaundice at every opportunity, especially in first 72 hours

Monitor bilirubin levels

Treat using phototherapy

Go to Phototherapy Pathway

Treat using exchange transfusion

Go to Exchange Transfusion Pathway

The threshold table is on the foldout page at the front of this quick reference guide. The treatment threshold graphs are available in separate file from www.nice.org.uk/guidanceCG98

Figure 1: INVESTIGATION PATHWAY
Offer information to parents and caregivers about phototherapy

Perform formal assessment:
- Clinical examination
- Serum bilirubin
- Blood packed cell volume
- Blood group of mother and baby
- DAT

Consider
- Full blood count and examination of blood film
- Blood glucose-6-phosphate
- Microbiological cultures of blood, urine, and CSF

Is serum bilirubin level:
- Rising rapidly (more than 8.5 micromol/liter/hour) and or
- Within 50 micromol/liter below the threshold for which exchange transfusion is indicated after 72 hours (see the threshold table and treatment threshold graphs)?

Start Single Phototherapy
- Using clinical judgment encourage short breaks for breastfeeding, nappy changing and cuddles
- Continue lactation / feeding support
- Do not give additional fluids or feeds routinely
- Monitor hydration by daily weighing of the baby and assessing wet nappies

Check serum bilirubin level:
- 4-6 hours after starting phototherapy
- Every 6-12 hours if bilirubin level is stable or falling

Is serum bilirubin level stable or falling?

Is serum bilirubin level at least 50 micromol/liter below threshold for phototherapy?

Stop phototherapy. Check serum bilirubin for rebound after 12-18 hours

Go to 'Manage Hyperbilirubinemia' box in 'Investigation Pathway'

Start Continuous Multiple Phototherapy
- Do not interrupt for feeding
- Continue administering intravenous / enteral feeds
- Continue lactation / feeding support
- Monitor hydration by daily weighing of the baby and assessing wet nappies

Check serum bilirubin level:
- 4-6 hours after starting phototherapy
- Every 6-12 hours if bilirubin level is stable or falling

Is serum bilirubin level stable or falling?

Is serum bilirubin level 50 micromol/liter below threshold for exchange transfusion?

Step down to single phototherapy

Go to 'Manage Hyperbilirubinemia' box in 'Investigation Pathway'

Continue multiple phototherapy and check serum bilirubin level every 6-12 hours

In term babies use conventional 'blue light' phototherapy; In preterm babies use fiber optic or conventional 'blue light' phototherapy
Offer information to parents and caregivers about exchange transfusions and intravenous immunoglobulin (IVIG) including:
- Why the treatment is being considered
- Anticipated duration of treatment
- Possible adverse effects
- When it will be possible for parents or caregivers to see and hold the baby
- The need to admit the baby for intensive care for an exchange transfusion (if needed)

During exchange transfusion, do not:
- Stop continuous multiple phototherapy
- Perform a single-volume exchange
- Use albumin priming
- Routinely administer intravenous calcium

Prepare for Exchange Transfusion
- Initiate / maintain continuous multiple phototherapy
- Use IVIG (500 mg/kg over 4 hours) for babies with Rhesus or ABO hemolytic disease if serum bilirubin level rises by more than 8.5 micromol/liter/hour

Serum bilirubin level falls to below threshold for exchange transfusion

Baby has:
- Bilirubin level that remains above threshold for exchange transfusion and/or
- Clinical signs of acute bilirubin encephalopathy

Continue multiple phototherapy and perform exchange transfusion

Continue multiple phototherapy and measure bilirubin level within 2 hours of exchange transfusion and manage according to threshold table and treatment threshold graphs

Go to ‘Manage Hyperbilirubinemia’ box in ‘Investigation Pathway’
Clinical Practice Guideline Adaptation is the systematic approach to the endorsement and/or modification of a guideline(s) produced in one cultural and organizational setting for application in a different context. Adaptation may be used as an alternative to de novo guideline development, e.g., for customizing (an) existing guideline(s) to suit the local context.

The description of the methodology for the production of this CPG can be fulfilled by utilizing the sequential process for trans-contextual adaptation of CPGs proposed by the ADAPTE Working group of the Guidelines International Network (G-I-N); the ADAPTE Manual and Resource Toolkit Version 2.0 as this method was approved by KKUH/KAUH Official CPG Committee to be the method of CPG production in the University Hospitals and is in accordance with the Hospital-Wide Policy and Procedure for CPG adaptation (HWQPP-010).

Search and Selection of the source CPGs

Topic: Neonatal Jaundice (Hyperbilirubinemia)

Search strategy

A systematic search was done for the selected topic (Neonatal Jaundice, Hyperbilirubinemia) in the CPGs and Specialized Societies internet websites, as documented below in the list.

5. Scottish Intercollegiate Guidelines Network (SIGN): http://www.sign.ac.uk/guidelines/
Keywords and search terms: newborn jaundice, hyperbilirubinemia, jaundice assessment and management, neonates with jaundice and 3 source CPGs were retrieved.

Inclusion / Exclusion Selection Criteria for the source CPGs

1) **Methods of development**: only evidence-based CPGs (i.e. with detailed methodology of development documented and links of recommendations to evidence and systematic reviews) rather than consensus-based CPGs (expert opinions)

2) **Authors(s)**: CPG development group that are affiliated to organizations (e.g. CPGs producer and finder databases and specialized clinical specialty rather than single authors.

3) **Country**: international rather than national CPGs.

4) **Date of publication**: range of publication decided to be 5 years (2008-2013).

5) **Language**: only English CPGs.

6) **Status**: only original source CPGs (developed de novo) rather than CPGs adapted from other sources.

Results of the internet search:

The panel has reviewed the 3 CPGs that were retrieved and have excluded CPGs that have been adapted from other source CPGs or those that had restricted access to their development methodology and evidence tables and reports. Therefore 2 CPG were excluded leaving only 1 source CPG to continue assessing Neonatal jaundice, May 2010 National Collaborating Centre for Women’s and Children’s Health and National Institute for Health and Clinical Excellence (NICE CG98).

Guideline authorship: The organizing committee has decided on group authorship and stated the order of authorship: **Name of the chair**: Dr. Lena C. Ignacio. **Name of the Working group (Panel)**: ‘CPG Adaptation group for Neonatal Jaundice’

Appraisal of the quality of the source CPGs

Table 4: AGREE Domain Scores with colour coding of the selected source CPG (NICE 2010)

<table>
<thead>
<tr>
<th>AGREE II DOMAINS</th>
<th>CPG</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1: Scope &amp; Purpose</td>
<td>100 %</td>
</tr>
<tr>
<td>D2: Stakeholder Involvement</td>
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<tr>
<td>D3: Rigour of Development</td>
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</tr>
<tr>
<td>D4: Clarity &amp; Presentation</td>
<td>100 %</td>
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<td>D5: Applicability</td>
<td>96 %</td>
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<tr>
<td>D6: Editorial Independence</td>
<td>100 %</td>
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<td>Overall assessment</td>
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<td>Recommended for use</td>
<td>Yes</td>
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*This table uses the AGREE II Domain score colour coding proposed by Dr Lubna Al-Ansary*

Therefore the panel decided to adopt all the recommendations of the updated CPG from the NICE 2010 CPG.

Assessment of the currency of the source CPG

Table 5: Currency Survey of source CPG

<table>
<thead>
<tr>
<th>NICE 2010 (CG 98)</th>
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<tbody>
<tr>
<td>1. Are you aware of any new evidence relevant to this CPG statement? <strong>NO</strong></td>
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<tr>
<td>2. Is there any new evidence to invalidate any of the recommendations comprising the CPG? <strong>NO</strong></td>
</tr>
<tr>
<td>3. Are there any plans to update the CPG in the near future? <strong>Reviewed on May, 2013 but there were no review documents found.</strong></td>
</tr>
<tr>
<td>4. When the CPG was last updated? May, 2013 <strong>but there were no review documents found.</strong></td>
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What is the citation for the latest version? [http://guidance.nice.org.uk/CG98](http://guidance.nice.org.uk/CG98)
Table 6: Decision support for King Khalid University Hospital Adaptation Working Group/ Organizing Committee/ Panel for CPGs for ‘Neonatal Jaundice in KSUMC’ Chair: Dr. Lena Ignacio

<table>
<thead>
<tr>
<th>PHASE</th>
<th>MODULE</th>
<th>STEP</th>
<th>TOOL</th>
<th>DECISION</th>
<th>REASON (if not utilized)</th>
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<td>11</td>
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</tbody>
</table>

TWO: ADAPTATION

2.1. Scope and Purpose

2.2. Search and Screen

2.3. Assessment
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4. Decision and selection</td>
<td>Table 6</td>
<td>16</td>
<td>Decided to rely on D3 Scores of AGREE II</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2.5. Customization</td>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.1. External Review and Acknowledgment Module</td>
<td>19</td>
<td>17</td>
<td></td>
</tr>
<tr>
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<td>20</td>
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<td>22</td>
<td></td>
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<tr>
<td>3.2. Aftercare Planning</td>
<td>23</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>3.3. Final Production</td>
<td></td>
<td>24</td>
<td></td>
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</tbody>
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External Review and Consensus Process

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- **Hospital-wide Clinical Practice Guidelines Committee Methodologists Panel for final review and official approval of University hospitals’ adapted clinical practice guidelines**

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Plan for Scheduled Review and Update

The panel has decided to review the adapted CPGs for updates after 3 years from its publication date (October 2013) which would be on (October 2016) after checking for updates in the source guidelines and clinical audit and feedback from implementation efforts in KKUH except if the panel finds new evidence-based recommendations before that date then members may decide to update the CPG document earlier.
The following bodies of King Saud University provided non-financial funding throughout the development of this work in terms of utilization of its facilities (i.e. medical libraries, websites resources, hospital records, availability of project management personnel, leadership commitment, technical support, expert methodologists review, administrative support, storage, documentation and meeting coordination and continuous training for members of the Hospital CPGs Subcommittees on CPGs evaluation, adaptation and implementation.

- King Khalid University Hospital (KKUH)
- Neonatal Intensive Care Unit (NICU)
- Department of Pediatrics
- Hospital Clinical Practice Guidelines Committee.
- Pediatrics – NICU CPGs Subcommittee (PED-NICU-CPG)
- Quality Management Department (QMD).
- Shaikh Abdullah Bahamdan Research Chair for Evidence-Based Health Care and Knowledge Translation (EBHC-KT).

References
http://www.guideline.gov/content.aspx?id=23806
(last accessed 17/11/2013)
Parent Information Factsheet:

The GDG have developed this parent information factsheet to accompany the guideline. The information included in this appendix will be used as the basis for an implementation tool.

Neonatal Jaundice Parent Information Factsheet:

What is jaundice?
Jaundice is a common condition in newborn babies. Jaundice is caused by a build-up of a chemical in the blood called bilirubin. Newborn babies’ bodies are not developed enough to process bilirubin and remove it from the blood. Because of this more than half of all newborn babies become slightly jaundiced for a few days. Jaundice is usually noticeable to the eye because the build-up of bilirubin causes the skin and the whites of the eyes and gums to appear yellow. In most babies jaundice is mild, causes no harm and clears up by itself. Nevertheless it is still important to contact your midwife or another health care professional if you think that your baby might have jaundice.

How can I check my baby for jaundice?
It is important to check your baby for any signs of yellow colouring particularly during the first week of life. The yellow coloring will usually appear around the face and forehead first and then spread to the body arms and legs. A good time to check your baby for jaundice is when you are changing his/her nappy or clothes. From time to time gently press your baby’s skin to see if you can see a yellow tinge developing. Check the whites of the eyes if they are open and when your baby cries have a look inside their mouth and see if the sides of the gums or roof of the mouth look yellow. Ask your midwife to show you how to check your baby for jaundice if you are not sure.

What should I do if I think my baby has jaundice?
• If you believe that your baby’s skin, gums or eyes are yellow on the first day of life, contact your physician or any healthcare professional urgently as this could be a sign of another medical problem.

• If your baby is more than 24 hours old and you think that your baby’s skin, gums or eyes are yellow, contact your physician or any healthcare professional on the same day.

It is also important to let your physician or any healthcare professional know:
• If any of your other children needed treatment for jaundice as babies
• If your baby was born at less than 38 weeks
• How you are feeding or intending to feed your baby (breast/bottle/both)
• If your baby passes pale, chalky coloured stools (poo) or dark urine (wee) that stains the nappy.
How is jaundice diagnosed?
If you think your baby has jaundice then the level of bilirubin should be measured by a healthcare professional. The levels can be measured either by using a simple device known as a transcutaneous bilirubinometer that is placed on the baby’s forehead or chest and gives a reading, or by taking a blood sample, usually from the baby’s heel. It is important to monitor the level of bilirubin so a repeat test will often be required 6–12 hours later.

How is jaundice treated?
Slightly elevated levels of bilirubin are not harmful but you may need additional support to establish breastfeeding. If the level of bilirubin in your baby’s blood is found to be unusually high or continues to rise, then your baby may need to receive treatment in hospital. This treatment usually consists of light therapy or ‘phototherapy’. Phototherapy involves placing the baby under a lamp which shines a special type of light (light in the blue spectrum) onto the skin. This light helps to break down the bilirubin so it can be removed from the body in urine. Phototherapy does not involve giving the baby medicine. Your baby will be placed under the light naked apart from a nappy. This is to make sure that the light can shine on as much of the skin as possible. During phototherapy your baby’s bilirubin levels will need to be measured every six hours. Your baby’s eyes will be protected from the light with eye pads or a Perspex eye shield. If the doctor is confident that the treatment is working and the bilirubin level is not too high, you will be encouraged to take your baby out for short breaks for feeds. If your baby’s bilirubin level is very high then more than one lamp will be used at the same time. In this situation the baby will need to remain under the light without breaks until the bilirubin level has dropped.

Are there any complications of jaundice?
Jaundice does not cause any problems in the majority of babies. In some rare cases the bilirubin level may become very high and this could result in a serious condition called kernicterus which can cause long term problems such as hearing loss and cerebral palsy. If your baby is at risk of kernicterus they will need to have a different type of emergency treatment in an intensive care unit. This emergency treatment is called an exchange transfusion. An exchange transfusion involves replacing the baby’s blood with new blood from a donor. Though neonatal jaundice is very common, kernicterus is extremely rare.

What if my baby remains jaundiced?
In most babies jaundice clears up within a few days. However if jaundice lasts more than two weeks (or more than three weeks in babies that were born premature) then it is called prolonged jaundice. If your baby has prolonged jaundice contact your physician or any healthcare professional straight away because your baby may need some additional blood tests to ensure that there are no liver problems.

Will my baby recover from jaundice?
The outcome for a baby with jaundice is extremely good, as long as the jaundice is recognized before the levels get too high and it is treated appropriately.

Research recommendations
Key priorities for research:

What are the factors that underline the association between breastfeeding and jaundice?

*Why this is important?*

**Evidence:** Breastfeeding has been shown to be a factor in significant hyperbilirubinaemia. The reasons for this association have not yet been fully elucidated. **Population:** Infants in the first 28 days of life.

**Exposure:** Feeding type (breast milk, formula feeds or mixed feeds).

**Comparison:** Infants who do not develop significant hyperbilirubinaemia will be compared with infants with significant hyperbilirubinaemia.

**Outcome:** Factors to be analysed include I) maternal factors, II) neonatal factors, III) blood analyses.

What is the comparative effectiveness and cost-effectiveness of universal pre-discharge transcutaneous bilirubin screening alone or combined with a risk assessment in reducing jaundice-related neonatal morbidity and hospital readmission?

*Why this is important?*

**Evidence:** There is good evidence that a risk assessment that combines the result of a timed transcutaneous bilirubin level with risk factors for significant hyperbilirubinaemia is effective at preventing later significant hyperbilirubinaemia.

**Population:** Babies in the first 28 days of life. Subgroups should include near-term babies and babies with dark skin tones.

**Exposure:** A. Timed pre-discharge transcutaneous bilirubin level. B. Timed pre-discharge transcutaneous bilirubin level combined with risk assessment.

**Comparison:** Standard care (discharge without timed transcutaneous bilirubin level). **Outcome:** i) Significant hyperbilirubinaemia ii) Cost effectiveness, III) Parental anxiety.

What is the comparative accuracy of the Minolta JM-103 and the BiliChek when compared to serum bilirubin levels in all babies?

*Why this is important?*

**Evidence:** The accuracy of transcutaneous bilirubinometers (Minolta JM-103 and BiliChek) has been adequately demonstrated in term babies below treatment levels (bilirubin < 250 micromol/litre). New research is needed to evaluate the accuracy of different transcutaneous bilirubinometers in comparison to serum bilirubin levels in all babies.

**Population:** Babies in the first 28 days of life. Subgroups to include preterm babies, babies with dark skin tones, babies with high levels of bilirubin and babies after phototherapy.

**Exposure:** Bilirubin levels taken from different transcutaneous bilirubinometers. **Comparison:** Bilirubin Neonatal jaundice 12 levels assessed using serum (blood) tests. **Outcome:** Diagnostic accuracy (sensitivity, specificity, positive predictive value, negative predictive value), parental anxiety, staff and parental satisfaction with test and cost effectiveness.

How frequently and for how long can conventional phototherapy be interrupted without adversely effecting clinical outcomes?
Why this is important?

**Evidence:** The effectiveness and tolerability of intermittent phototherapy has been adequately demonstrated in term babies at low treatment levels (bilirubin < 250 micromol/litre). New research is needed to evaluate the effectiveness and tolerability of different frequencies of interruptions of different durations.

**Population:** Babies in the first 28 days of life in conventional phototherapy.

**Exposure:** Interruptions of 45 or 60 minutes either on demand, every hour or every 2H.

**Comparison:** Interruptions of up to 30 minutes every 3 hours.

**Outcome:** Effectiveness in terms of the mean decrease in bilirubin levels and the mean duration of phototherapy. Extra outcomes should include adverse effects, parental bonding and parental anxiety, staff and parental satisfaction with treatment and cost effectiveness.

National registries are needed of cases of significant hyperbilirubinaemia, kernicterus and exchange transfusions.

Why this is important?

**Evidence:** There is good evidence that prospective surveys in the UK and from a national Kernicterus Register in the US can help to identify root-causes of kernicterus and acute bilirubin encephalopathy.

**Population:** All children with a peak bilirubin level greater than 450 micromol/litre which is the threshold for an exchange transfusion recommended by NICE.

**Exposure:** All maternal, prenatal, peri-natal and neonatal factors. Comparison: Not applicable.

**Outcome:** Shortcomings in clinical and service provision to prevent recurring themes in kernicterus cases.

Other research recommendations

What is the clinical and cost-effectiveness of:

- **LED phototherapy compared to conventional phototherapy in term and preterm babies with significant hyperbilirubinaemia?**

 Why this is important?

Existing research has shown that while there is no difference between LED phototherapy and conventional phototherapy, LED phototherapy may be easier to use in clinical setting by reducing the need for additional fluids. New randomised controlled trials are needed to examine LED phototherapy.

**Population:** Term and preterm babies with significant hyperbilirubinaemia in the first 28 days of life.

**Interventions:** LED phototherapy compared with fiberoptic phototherapy or conventional phototherapy.

**Outcome:** Effectiveness in terms of the mean decrease in bilirubin levels and the mean duration of phototherapy. Extra outcomes should include adverse effects, parental bonding and parental anxiety, staff and parental satisfaction with treatment and cost effectiveness.
Fibreoptic phototherapy using large pads compared to conventional phototherapy in term babies with significant hyperbilirubinaemia?

Why this is important?
Existing research has demonstrated the effectiveness of fibreoptic phototherapy in preterm babies but not in term babies. This is due to the fact that existing fibreoptic pads are small and cannot ensure adequate skin coverage in larger babies. New devices using larger pads may be effective in term babies. New randomised controlled trials are needed to examine fibreoptic phototherapy which uses larger pads. **Population:** Term babies with significant hyperbilirubinaemia in the first 28 days of life. **Interventions:** Fiberoptic phototherapy with larger pads compared with conventional phototherapy. **Outcome:** Effectiveness in terms of mean decrease in bilirubin levels and mean duration of phototherapy. Extra outcomes should include adverse effects, family adjustment, breastfeeding effects, parental bonding and anxiety, staff and parental satisfaction with treatment and cost effectiveness.

What is the effectiveness, cost-effectiveness and safety of Clofibrate alongside phototherapy versus phototherapy alone for non-haemolytic significant hyperbilirubinaemia?

Why this is important?
Existing research has demonstrated that Clofibrate in combination with phototherapy can shorten time spent undergoing phototherapy. This can help minimise the disruption to breastfeeding and mother-baby bonding. However no studies have been carried out in a UK population. New placebo-controlled double-blind randomised controlled trials in a UK population are needed. **Population:** Term and preterm babies with significant hyperbilirubinaemia in the first 28 days of life. **Interventions:** Clofibrate (a single 100mg/kg dose) combined with phototherapy versus phototherapy with a placebo. **Outcome:** Effectiveness in terms of mean decrease in bilirubin levels and mean duration of phototherapy. Extra outcomes should include adverse effects, parental bonding and parental anxiety, staff and parental satisfaction with treatment and cost effectiveness.

What is the clinical and cost-effectiveness of IVIG when used to prevent exchange transfusion in newborns with haemolytic disease and rising bilirubin?

Why this is important?
Existing research has demonstrated that IVIG is effective in preventing the need for an exchange transfusion in babies with Rhesus haemolysis. New placebo-controlled double-blind randomised controlled trials are needed to examine if IVIG is effective in sub-groups of babies with ABO haemolysis, ie preterm babies, babies with bilirubin rising greater than 10 micromol/litre per hour or babies with co-morbid illnesses such as infections. **Population:** Term and preterm babies with significant hyperbilirubinaemia in the first 28 days of life. **Interventions:** IVIG (500mg/kg over 4 hours) alongside phototherapy versus phototherapy alone.
**Outcome:** Number of exchange transfusions needed. Extra outcomes should include adverse effects, mean duration of phototherapy, parental anxiety, staff and parental satisfaction with treatment and cost effectiveness.