TRANSCUTANEOUS BILIRUBIN (TCB) MEASUREMENT (MATERNITY) USING JAUNDICE METER

AIM

1. **To provide guidance on bilirubin measurement by Transcutaneous Bilirubinometer.**
2. **A screening tool to use TcB measurement to identify more accurately babies who require further evaluation of jaundice with a serum bilirubin (SBR).**

INTRODUCTION/BACKGROUND

The incidence of clinical jaundice in newborn infants is reported to be as high as 60 to 80 per cent during the first days following birth. For most term infants, jaundice is safe, but high levels of unconjugated bilirubin can be neurotoxic and cause bilirubin encephalopathy in susceptible newborns. Therefore preventative, screening and management strategies remain a significant clinical practice issue during the early postnatal period.

Visual assessment of jaundice is an inaccurate means to ascertain if the level of jaundice is clinically important and requires treatment. If an infant appears jaundiced or is at risk of hyperbilirubinemia the jaundice level needs to be measured. This can be done either by blood sample or transcutaneous means.

Serum bilirubin (SBR) is a laboratory test and is the gold standard for measuring levels of jaundice. Capillary blood gas samples (CAP) analysed by the blood gas analyser can also be used for measuring bilirubin and is an acceptable alternative. This is a smaller sample and less likely to become haemolysed.

Jaundice levels can also be measured transcutaneously (in the skin) using a transcutaneous bilirubinometer. When serum bilirubin levels are at the lower spectrum, studies have demonstrated transcutaneous bilirubin (TcB) measurements allow for a relative prediction of serum bilirubin up to 14 days of age.

TcB readings are useful in certain settings as are instant and can help avoid delays in treatment. They can also indicate the need for formal SBR testing. TcB measuring can therefore be used as **screening tool** for jaundice in certain infants in certain circumstances. It does not replace the SBR but helps to determine more accurately than visual assessment if an SBR/CAP specimen is required.

NOTE: as CAP is the usual method of bilirubin estimation in Christchurch Women's Hospital when a bilirubin level is needed after or without a TcB, it shall be referred to for ease as SBR in the rest of this document. This can be done by either LAB or CAP.

The transcutaneous bilirubinometer may also be referred to as a jaundice meter or TcB for ease in the rest of this document.

DEVICE DESCRIPTION

Transcutaneous measurement of bilirubin in this hospital uses a Drager JM-105® bilirubinometer. The Bilirubinometer is a non-invasive, painless, time-sparing and cost-effective screening device. The meter measures the yellowness of the subcutaneous tissue of the infant by measuring the difference in optical density of two different wavelengths of light through the skin. Transcutaneous bilirubin measurements are taken either on a baby's forehead or sternum. The forehead is the preferential site used in this hospital.

TRAINING AND QUALITY CONTROL

Accuracy is dependent on correct usage of the device.

- All staff are required to be accredited in use and completed Point of Care (POC) training if using. Training will be by Midwifery Educator, Midwifery Clinical Coach or TcB champion – documented on POCT Initial Training Record (Appendix 1).
- The meter must be used in accordance with manufacturer guidelines.
- Midwives and nursing staff will carry out daily quality control assessment using the in-built 'checker function' and document the results on the daily check sheet (Appendix 2). The values should read within the reference value of the unit cover and represented on the daily check sheet.

CRITERIA FOR TCB SCREENING

The TcB is a very useful screening tool but is not suitable for all infants in all circumstances.

Criteria for TcB consideration:

- ≥ 35 weeks gestation (on NICU restricted to ≥32 weeks)
- ≥ 24 hours of age
- ≤ 14 days of age

An SBR is required:

- After a TcB when:
  - TcB measurement is inconsistent with baby's clinical context or anticipated result.
  - TcB measurement is outside accepted range (see chart below).
  - TcB measurement blinks '340 μ mol/l' (indicates reading is too high to be measured, an SBR is urgently required).
- There are maternal-fetal blood group incompatibilities (eg. Rhesus, Kell, Duffy, other antibodies). These babies require Direct Antibody Test (DAT)/Coombs test on cord blood.
- There is known haemolysis (positive DAT/Coombs). These babies need to be in a secondary/tertiary setting.
- Prior to initiating phototherapy and during or after phototherapy (off > 24 hours)[8] SBR should be performed to track progress once phototherapy is instigated as transcutaneous bilirubin is unreliable following the commencement of phototherapy.

INITIAL SCREENING

When combined with a systematic assessment of risk factors for hyperbilirubinemia, the TcB can identify neonates who are at greater risk for hyperbilirubinemia and might require closer monitoring.

In the following babies TcB measurements should be performed as an initial screen for jaundice IF the baby is more than 24 hours old to determine the need for an SBR.

1 . Any infant with risk factors for haemolysis:

ACTION: **routinely screen** with TcB **at 24-48 hours** before Newborn Metabolic Screen ("Guthrie") if:

- **Maternal** blood group **O positive**
- **Maternal** blood **Rhesus negative** (RhD negative) *and* **Baby Rhesus positive** (RhD positive)

2. Any other infant with visible jaundice after 24 hours

ACTION: perform TcB measurement **immediately**.

- If under threshold for SBR continue to perform **TcB every 6-12 hrs.** A rise of over 10 µmol/L per hr since previous TcB result will require SBR.
- If jaundice peaks and starts to fall and remains below the phototherapy line, then TcB monitoring can discontinue.

3. Any other infant with risk factors, especially when there is more than one:

ACTION: **consider screening** with TcB **at 24-48 hours** before Newborn Metabolic Screen ("Guthrie") if:

- Bruising/vacuum extraction/cephalohematoma
- Plethoric/very red (in a light skinned baby)
- History of a sibling that had jaundice as a neonate and required phototherapy
- Inadequate feeding/excessive weight loss
- Southeast Asian, Mediterranean and African ethnicity (increased prevalence of G6PD deficiency)[9]
- *Possible diagnosis of sepsis (as indicated by neonatal medical staff)

TCB MEASUREMENTS AND ACTIONS

If transcutaneous bilirubinometer measurement indicates a bilirubin level is greater than a certain level (as indicated below), an SBR measurement is required. This is because TcB have only been shown to give a linear correlation with SBR at lower levels. When TcB readings reach certain levels SBR will still be required to ensure clinically significant jaundice levels are identified.

Record all measurements in clinical notes and plot on the phototherapy chart with notation 'TcB' above plotted level.

TcB READING	ACTION
• Over 250 µmol/L? • Over standard phototherapy line? • Within 50 µmol/L of standard phototherapy line? • Above phototherapy haemolytic line?	If any of these readings noted **or if combined with other clinical concerns**: • Perform SBR • Calculate NEWS

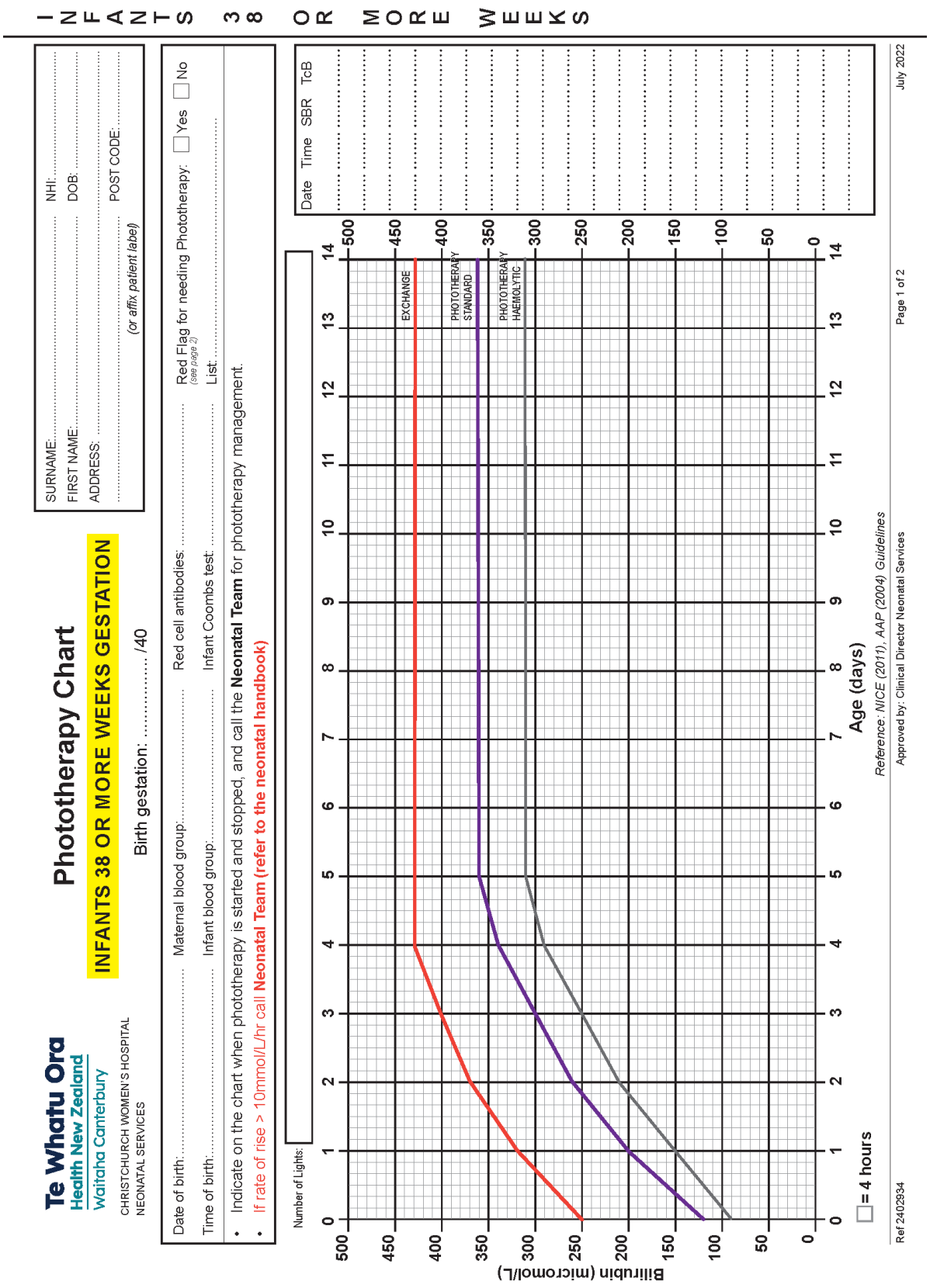
TcB READING	ACTION
• A rise of over 10 µmol/L per hr since previous TcB result?	If SBR level requires phototherapy contact neonatal ward registrar/nurse practitioner for a clinical plan.
Blinking '340' value – this represents a reading **out of** the **measuring range** (0 to 340umol/L)	• **URGENT REVIEW** by neonatal registrar/nurse practitioner • Perform SBR • Commence phototherapy • Calculate NEWS

TCB IN PRIMARY MATERNITY UNITS

- Only to be used for infants who are inpatients
- TcB for initial screening as per criteria outlined above
- If TcB measurement is outside accepted range (see chart below) the infant will require transfer to tertiary care.
- SBR will be required on admission to tertiary unit and follow up by neonatal team if SBR requires phototherapy or if any other clinical concerns

TcB READING	ACTION
• Over 250 µmol/L? • Over standard phototherapy line? • Within 50 µmol/L of standard phototherapy line? • Above phototherapy haemolytic line? • A rise of over 10 µmol/L per hr since previous TcB result?	If any of these readings noted **or if combined with other clinical concerns**: • Calculate NEWS • Transfer to tertiary care
Blinking '340' value – this represents a reading **out of** the **measuring range** (0 to 340umol/L)	**URGENT TRANSFER TO TERTIARY CARE** Calculate NEWS and observe infant closely for signs of deterioration

38 WEEK + PHOTOTHERAPY CHART



TRANSCUTANEOUS BILIRUBIN (TCB) MEASUREMENT: OPERATIONAL INSTRUCTION SHEET

DAILY OPERATIONAL CHECK

Daily Quality Control check required.

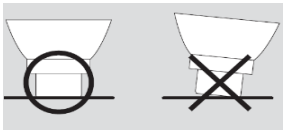
Must have been undertaken for day, prior to any clinical use.

To be undertaken by MW/RN on morning shift prior to first TcB of Day.

PROCEDURE

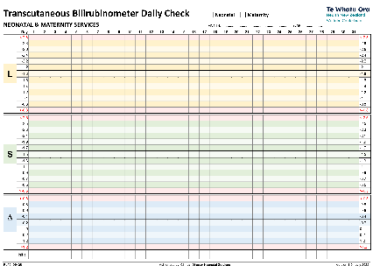
1. Remove the Jaundice Meter JM-105 from the docking station
2. Press the power switch on.
3. Select **CHECKER** and touch **OK** to save selection.
4. Open the checker lid on the charging unit.
5. When the green **'READY'** light illuminates, place the tip of the Jaundice meter perpendicular on the reading checker circle. Press down gently until a flash occurs.

NOTE:
Do not take measurement with device slanted on the Checker



6. The display screen shows the 'L' (long), 'S' (short), and Delta values.
7. Review results displayed under checker cover.
8. All values must read within the reference values posted under the checker cover.
9. Document readings on the TcB Daily Check Form bedside the jaundice meter
10. If values within range (ie. in the yellow, green and blue zones on the form) the unit is ready to use. Close Checker cover.
11. If values outside range (ie. in the "pink zone") clean checker and meter probe tip with alcohol prep pad and repeat the measurement.

    If values are still out of range, do not use the unit. Contact Te Whatu Ora Clinical Engineering (03 364 0440) or NICU Equipment Nurse. After hours NICU ACNM (pager 5088).



12. Return to Docking Station. Ensure docking station plugged in and charging.

NOTE: for further information refer to jaundice meter instruction manual.

TCB MEASUREMENT PROCEDURE

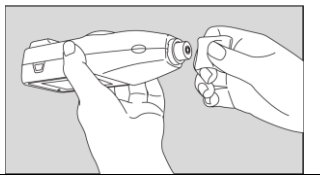
1. Ensure daily quality control check has been done before taking a measurement.

   Check infant suitability for TcB prior to use: gestation, age, risk factors

2. Perform hand hygiene

   Remove meter from Docking Station/Charger

   Clean tip with an alcohol prep pad



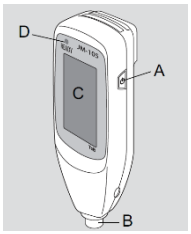
3. Switch on (power switch at side of meter)

   A = Power button

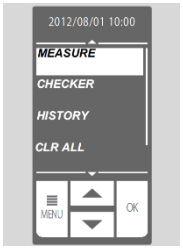
   B = Measuring Probe

   C = Display/Touch Panel

   D = Ready Lamp



4. Select **Measure** and Press **OK** (meter is touch screen)



5. Scan **Nurse ID** or key in **Employee Number** and press **OK** (not optional must be entered)

6. Scan **Baby ID** or key in **Baby NHI** and press **OK** (not optional must be entered)

7. Ensure **'Ready'** lamp is on.

   Check measurement reading is in **µ mol/L**

   (To reconfigure to correct measurement refer to jaundice meter instruction manual)

   The meter is now ready to take a measurement.

8. **Select the measurement site** *(forehead or mid sternum)*
Forehead preferred, but mid sternum may be used if any swelling, bruising, discoloured areas are present on baby's forehead.

Take TWO single readings
Hold the device vertically on the forehead with the measuring probe tip flat and flush against the baby's skin, below the hairline.

Apply gentle downward pressure until jaundice meter flashes.

The measured value will now appear in the display.

Lift the meter from the skin, wait for the green 'ready' light to illuminate again. Repeat procedure again.

A second measured value will now be displayed.

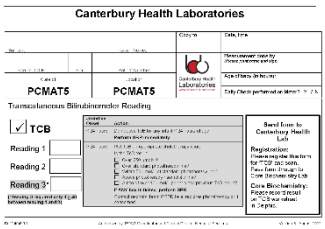
9. The **highest** reading is the measurement to be used and recorded.

If there is a difference in readings of greater than **±40µmol/L**, take a third reading.

If the third reading is also greater than **±40µmol/L**, when compared to the first reading, perform SBR.

If the reading is out of the measuring range (0 to 340 µmol/L), a blinking 340 value appears. Indicates reading is too high to be measured: **Perform SBR immediately and contact NICU**

10. **Documentation and follow up**
Record result on Point of Care lab form* (Appendix 3).



Record and PLOT the results on phototherapy chart (Ref.2402931 or Ref.2402934), writing TcB above result. **Ensure correct chart for gestation is used.**

Record result in baby clinical notes/Cortex progress note.

Check TcB reading does not require an SBR/CAP to be performed (refer to lab form or to table above).

If TcB level requires SBR and level requires phototherapy (or you have any clinical concerns) contact Neonatal Registrar/Nurse Practitioner

***** At CWH place lab form in blue tray next to TCB docking station (collected daily by ward clerks and sent to lab for data entry).
At primary units, email form to chl.testadds@cdhb.health.nz OR, if baby is transferred to CWH, send with baby clinical notes.)

11. **Cleaning**
Clean the measuring probe with alcohol prep pad after use (avoid using Clinell wipe over this probe).

Clean **instrument** with Clinell wipe after use, wipe off gently with dry cloth.

12. Return to charging unit.

REFERENCES

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4. King Edward Memorial Hospital (2014) Hyperbilirubinemia and Neonatal Jaundice Postnatal Guideline.
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8. RPA Newborn Care (2003) RPA Newborn Care Guidelines: Transcutaneous Bilirubinometer (updated May 2003). Sydney: Royal Prince Alfred Hospital. http://www.cs.nsw.gov.au/rpa/neonatal/default.htm
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10. NHS National institute for Health and Care Excellence (2010) NICE clinical guideline 98; Jaundice in newborn babies under 28 days (updated 2016) https://www.nice.org.uk/guidance/cg98/resources/jaundice-in-newborn-babies-under-28-days-975756073669

APPENDIX 1 POCT INITIAL TRAINING RECORD TCB

Te Whatu Ora
Health New Zealand
Waitaha Canterbury

Canterbury Health Laboratories

POCT Initial Training Record

Transcutaneous Bilirubinometer (TcB)

JM105

Name: ..... Employee number: .....

Date: ...../...../..... Department: .....

Key aspects

- ☐ Able to identify the difference between TcB and SBR
- ☐ Know **appropriate** guideline for use for their department and requirements for testing
- ☐ Performance check:
  - ☐ Importance and requirements
  - ☐ Documentation
  - ☐ Daily operational check procedure
  - ☐ Actions if out of range
- ☐ Device operation: overview of JM105 Jaundice Meter, operating, storing
- ☐ Can successfully perform testing:
  - ☐ Demonstrate use and note unit of measure is µmol/L.
  - ☐ Explain what device displays when measurement out of range
- ☐ Interpretation of results
- ☐ Documentation of results:
  - POCT lab form
  - Phototherapy Chart (note TcB)
  - Clinical notes, Cortex
- ☐ Contact NICU if SBR level requires phototherapy or if concerned
- ☐ Cleaning instructions for Bilirubinometer

Trainer: ..... *(name)*

..... *(designation)*

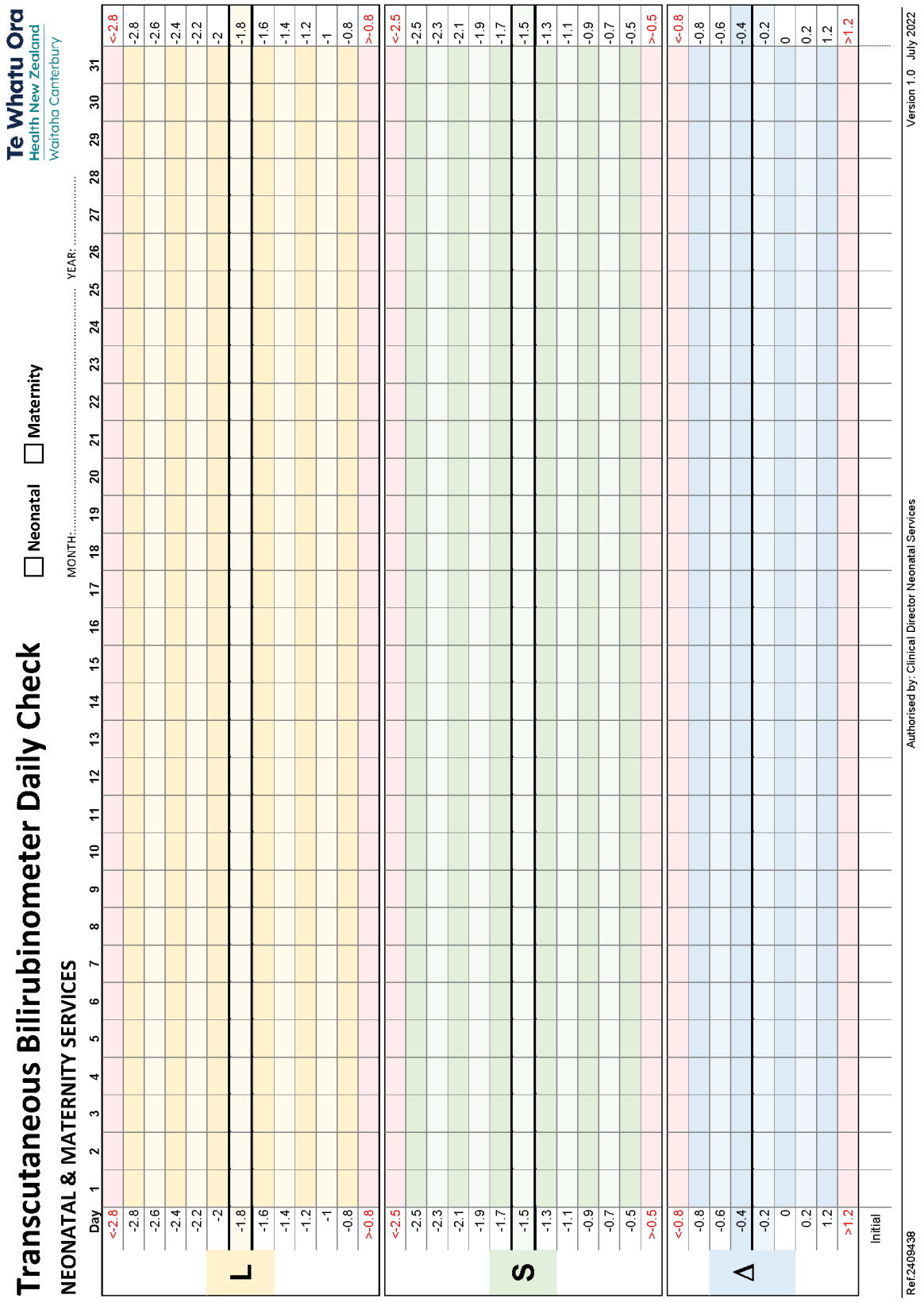
..... *(signature)*

Trainee: ..... *(signature)*

SIGN OFF STAFF ON HEALTHLEARN TCB COURSE ONCE PRACTICAL AND ONLINE COMPLETED

Ref.2409394 Authorised by: POCT Coordinator Version 3 February 2024

APPENDIX 2 TCB DAILY CHECK RECORD



APPENDIX 3 POINT OF CARE LAB FORM (MATERNITY)

Canterbury Health Laboratories

Surname	Given Names		Copy to	Date, time
Age or D.O.B.	Sex	Patient Number	Canterbury Health Laboratories www.chl.co.nz | 0800THELAB	Measurement done by: *(Please print name and sign)*
Care of **PCMAT5**		Location **PCMAT5**		Age of baby (in hours):
				Daily Check performed on Meter? Y / N

Transcutaneous Bilirubinometer Reading

☑ **TCB**

Reading 1 ☐

Reading 2 ☐

Reading 3* ☐

(*Reading 3 required only if ≥ 40 between reading 1 and 2)

Jaundice Onset	Action
< 24 hours	Do not use TcB for any infant < 24 hours of age. **Perform SBR immediately.**
> 24 hours	Plot TcB on appropriate phototherapy chart. Is the TcB result: ☐ Over 250 µmol/L? ☐ Over standard phototherapy line? ☐ Within 50 µmol/L of standard phototherapy line? ☐ Above phototherapy haemolytic line? ☐ A rise of over 10 µmol/L per hr since previous TcB result? **If ANY box is ticked, perform SBR.** Contact neonatal team if SBR level requires phototherapy or if concerned.

Send form to Canterbury Health Lab

Registration:
Please register this form for 'TCB' and scan. Pass form through to Core Biochemistry Lab

Core Biochemistry:
Please record result on TCB worksheet in Delphic.

Ref.2404909 Authorised by: POCT Coordinator and Clinical Director Neonatal Services Version 8 August 2022