

Northern Health

Xu A,^{1,2} Francis B,¹ Dargaville G,¹ Surkitt A,¹ Rischitelli B,¹
Tran D,^{1,2} Subhi R,^{1,2} Choy KW,¹ Fan WQ,^{1,2}

1. Northern Health
2. University of Melbourne



Neonatal jaundice is common, affecting ~60% of term and ~80% of preterm infants.¹ While often benign, severe hyperbilirubinemia can cause bilirubin-induced neurologic dysfunction (BND) and kernicterus, making early diagnosis and treatment critical. Our Neonatal Unit (NNU) routinely uses three bilirubin measurement methods: **serum bilirubin (SBR)** (gold standard), **blood gas analyser (BGA)** (Radiometer-ABL90)², and **transcutaneous bilirubinometry (TcB)**.³ While SBR is highly accurate, processing delays can impact timely management. TcB and BGA offer rapid, less invasive results, but their accuracy and reliability relative to TSB remain unclear.

This study **retrospectively analyses cases where all three methods were used concurrently to compare their accuracy and clinical utility.** Findings will help optimise jaundice management by determining whether TcB and BGA can reliably complement SBR in routine care.

Retrospective observational study including all neonates requiring bilirubin testing at Northern Health (Nov 2023 - Oct 2024). Maternal and neonatal clinical data, bilirubin measurement values, jaundice treatment, timing, and risk factors were extracted from medical records. Skin tone was inferred using the Fitzpatrick classification based on maternal ethnicity.

Agreement between SBR, BGA, and TcB assessed via Passing-Bablok regression, Bland-Altman analysis, and Pearson's correlation. **Predictive performance** evaluated using Bhutani nomogram. **Sub-group analysis** is performed to assess the **impact of phototherapy and skin tone** on measurement accuracy.

- 333 measurements were collected from 221 neonates.
- 99 neonates had hyperbilirubinemia **requiring phototherapy**.

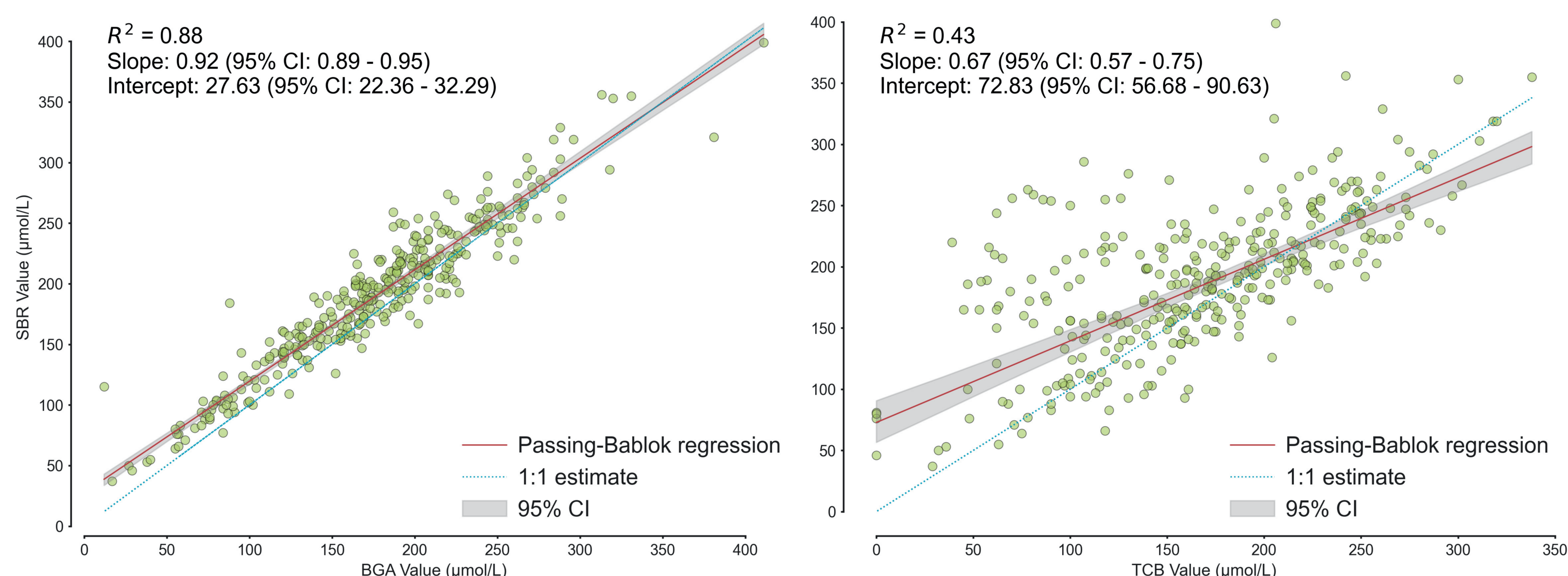
Demographic	Values
Gestational age (weeks)	Median: 37.1 IQR: [35, 39]
Postnatal age (days)	Mean: 3.49 SD: 2.85
Male sex	n: 135, %: 61.09
Birth weight (grams)	Mean: 2803.78 SD: 828.9
Prematurity	n: 102 %: 46.15
Phototherapy	n: 99 %: 44.8
Fitzpatrick ≥ III	n: 139 %: 62.9

Table 2: Predictive performance of bilirubin measurements

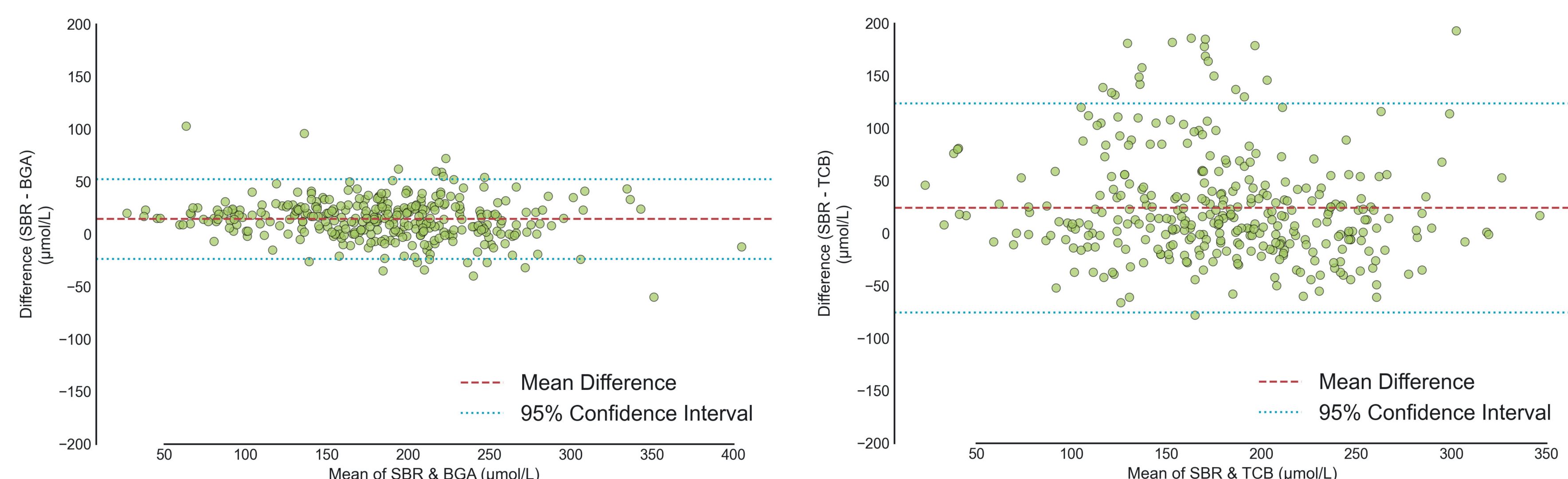
- BGA and TcB are similarly effective at **ruling out phototherapy treatment** at low bilirubin levels.

Metric	BGA vs SBR	TcB vs SBR
True positive	n = 22	n = 22
False positive	n = 5	n = 12
True negative	n = 281	n = 274
False negative	n = 26	n = 26
Sensitivity	45.83%	45.83%
Specificity	98.25%	95.80%
Spearman correlation	$r = 0.94$	$r = 0.66$

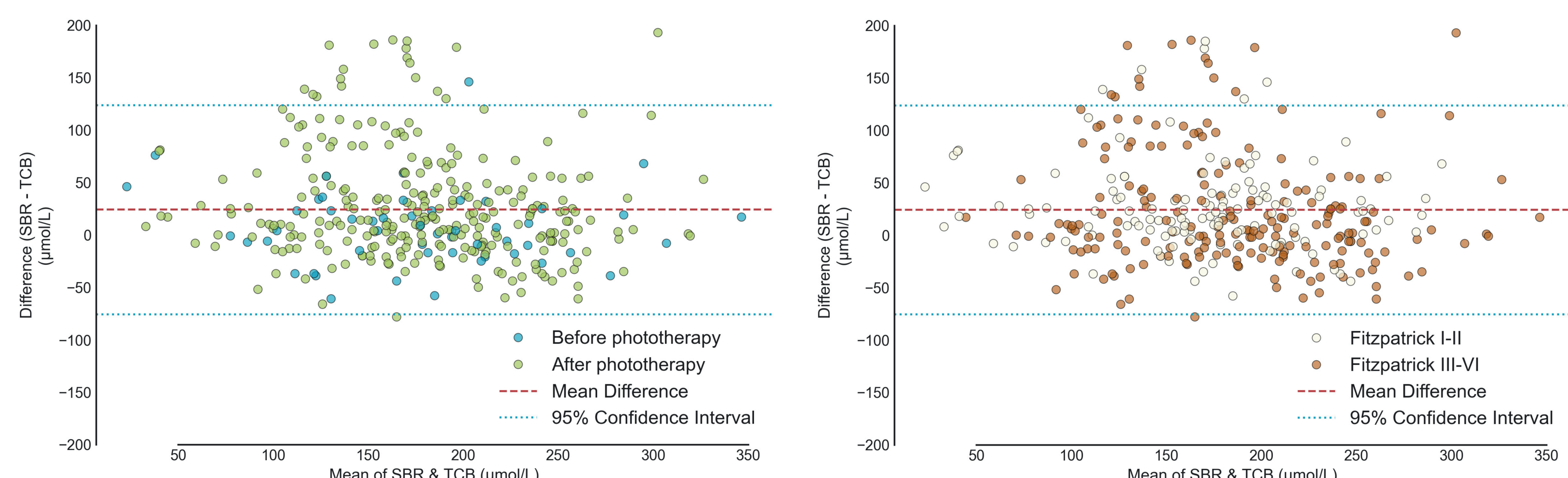
- Passing-Bablok regression shows that **BGA aligns more closely with SBR compared to TcB**.
- TcB displays significant proportional and systematic differences.
- **TcB significantly overestimates bilirubin at lower values and underestimates at higher values**, while BGA closely matches SBR, particularly above 300 μ mol/L.



- Bland-Altman analysis confirms that **BGA has a much narrower of limit of agreement with SBR than TcB**, which shows greater variability and a tendency to underestimate bilirubin.



- **Phototherapy significantly reduces TcB's coherence with SBR**, leading to greater measurement variability.
- **Fitzpatrick skin tone does not affect TcB's coherence with SBR**.



BGA aligns more closely with SBR than TcB, showing higher association and narrow limits of agreement. TcB significantly overestimates bilirubin at low levels and underestimates at high levels, with accuracy further reduced after phototherapy. Skin tone does not impact TcB accuracy. Both measures have low sensitivity but high specificity.

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2. Dai J, Parry DM, Krahn J. Transcutaneous bilirubinometry: its role in the assessment of neonatal jaundice. *Clin Biochem* 1997;30(1):1–9.
3. Peake M, Mazzachi B, Fudge A, Bais R. Bilirubin measured on a blood gas analyser: a suitable alternative for near-patient assessment of neonatal jaundice? *Ann Clin Biochem* 2001;38(5):533–40.