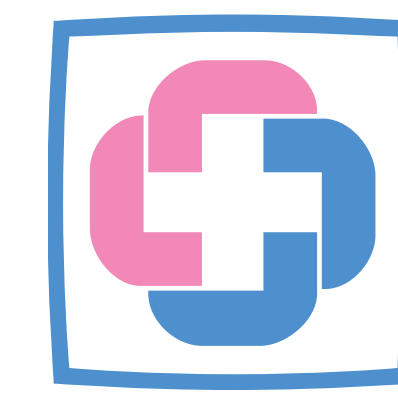




# Workflow improvement with use of Radiometer ABL 90 for Neonatal Bilirubin Testing

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## Introduction

In KKH, we performed about 36,000 neonatal bilirubin tests per year. Before June 2017, we were using disposable cuvettes tested on Reichert's UNISTAT Bilirubinometer. This method is tedious and labour intensive. For a single neonatal bilirubin testing, two mylar coated self-sealant heparinized capillary tubes were required. The samples required manual centrifugation to separate the plasma prior to testing. As the analysers do not have the capability to interface to the laboratory information system(LIS), all results have to be manually transcribed and a second staff was required to countercheck the manual transcription.

**There were many issues associated with this testing system:**

- (1) Significant increase in price of disposable cuvettes over the past 3 years.
- (2) A minimum of 2 capillary tubes were required.
- (3) Specimen spillage due to specimen transportation.
- (4) Worklist had to be filled up manually prior to sample testing.
- (5) Manual results can be wrongly keyed due to illegible handwriting.
- (6) Average transcription error rates ~ 0.13%.
- (7) A second person is needed to countercheck and this is dependent on staff availability and caused delay in identifying a mistake.
- (8) Staff had to be skilled to avoid introducing RBCs into the cuvettes which can affect bilirubin testing.

## Aim

In this project, we aimed to improve the following:

1. Improve the workflow in laboratory for neonatal bilirubin testing with use of radiometer ABL 90 analyser
2. To reduce the neonatal bilirubin result transcription error with elimination of manual neonatal bilirubin result transcription

## Methodology

The possible root causes of manual transcription error for neonatal bilirubin testing were identified by using Fishbone Diagram (Figure A). With the use of tree diagram (Figure B), the team had decided to change our neonatal bilirubin testing method to eliminate manual result transcription.

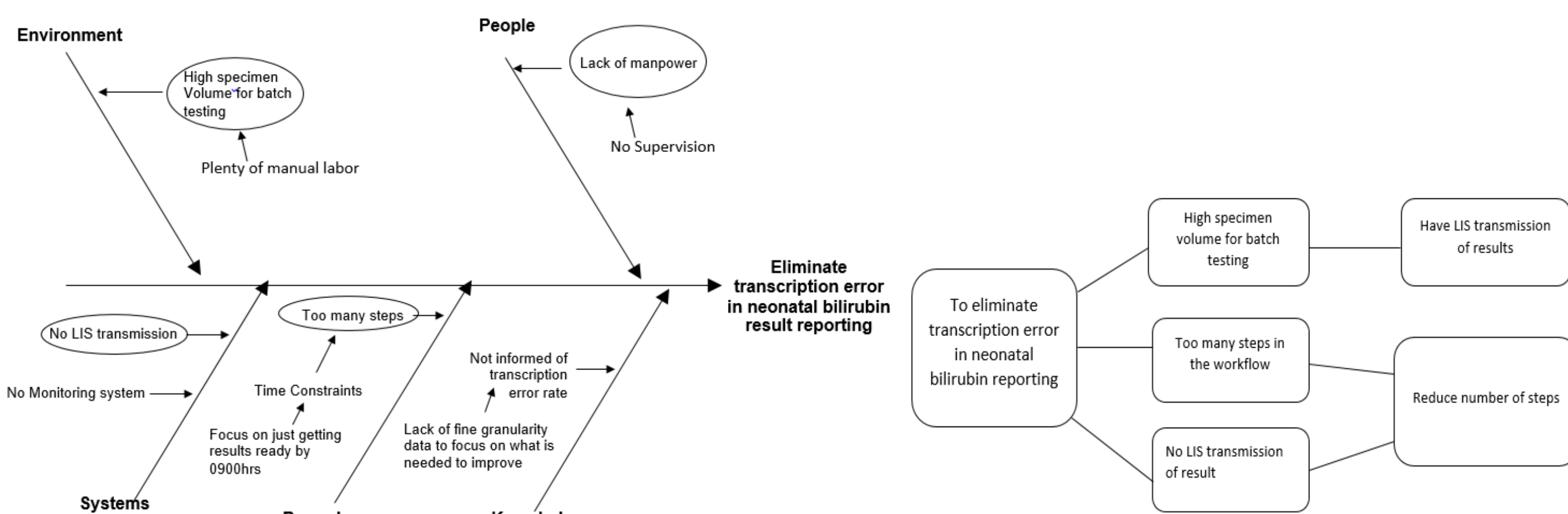


Figure A: Fishbone Diagram to identify possible root causes

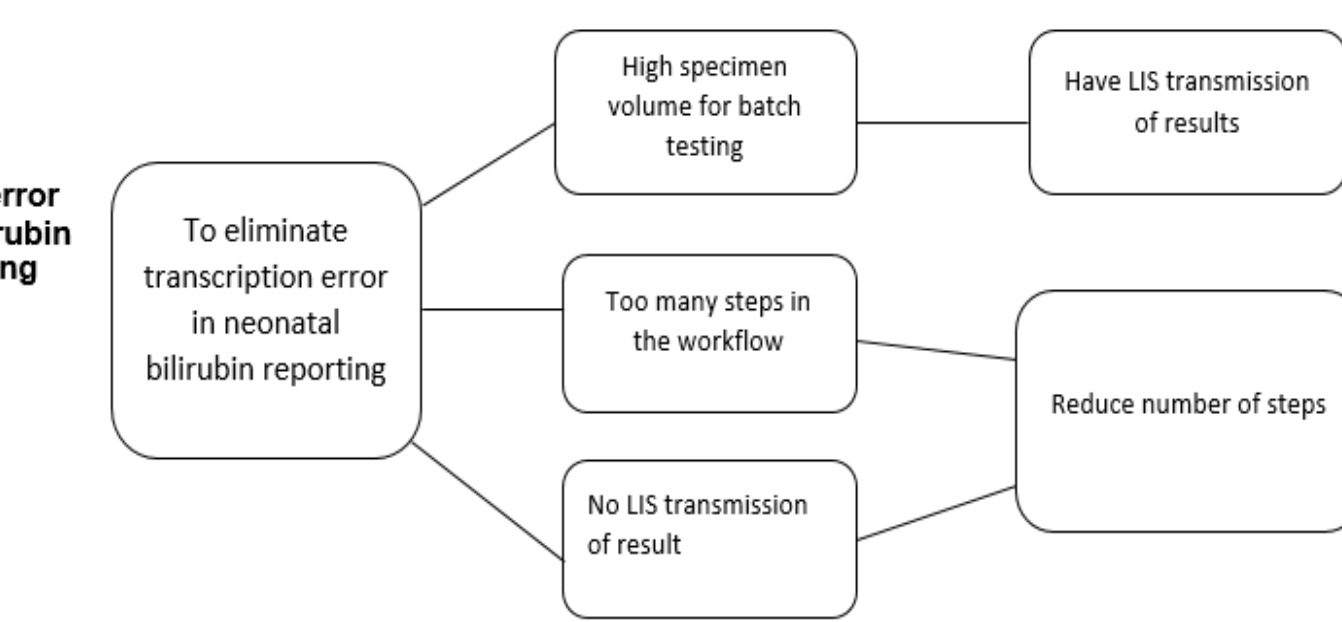


Figure B: A tree diagram as part of solution development

## Solution

The new neonatal bilirubin assay performance was evaluated on the Radiometer ABL 90. This analyser performs neonatal bilirubin test using only 65uL of whole blood which is the least volume required as compared to all other analysers available in the market. It can be interfaced to Cerner Laboratory Information System (LIS) for direct result transmission. With this change, direct tube sampling for neonatal bilirubin testing can be achieved using only a single SARSTEDT Microvette (200uL) lithium heparin collection tube.

With successful evaluation of the new blood collection container and the new ABL 90 analyser, we started to perform the neonatal bilirubin testing on the new Radiometer ABL90 analyser from June 2017 (Figure C). Prior to implementation, we conducted multiple roadshows to demonstrate the use of the new Sarstedt collection tube to all the nurses staff who were involved in the neonatal blood collection. All laboratory staff were also trained on the use of the new ABL 90 analysers.



Figure C: Change of testing platform from UNISTAT® Bilirubinometer to the new Radiometer ABL 90 Flex analyser

## Results

### 1. Zero error rate with direct result transmission to LIS

With successful implementation, we achieved zero transcription error with direct result transmission to laboratory information system (LIS) (see Figure D).

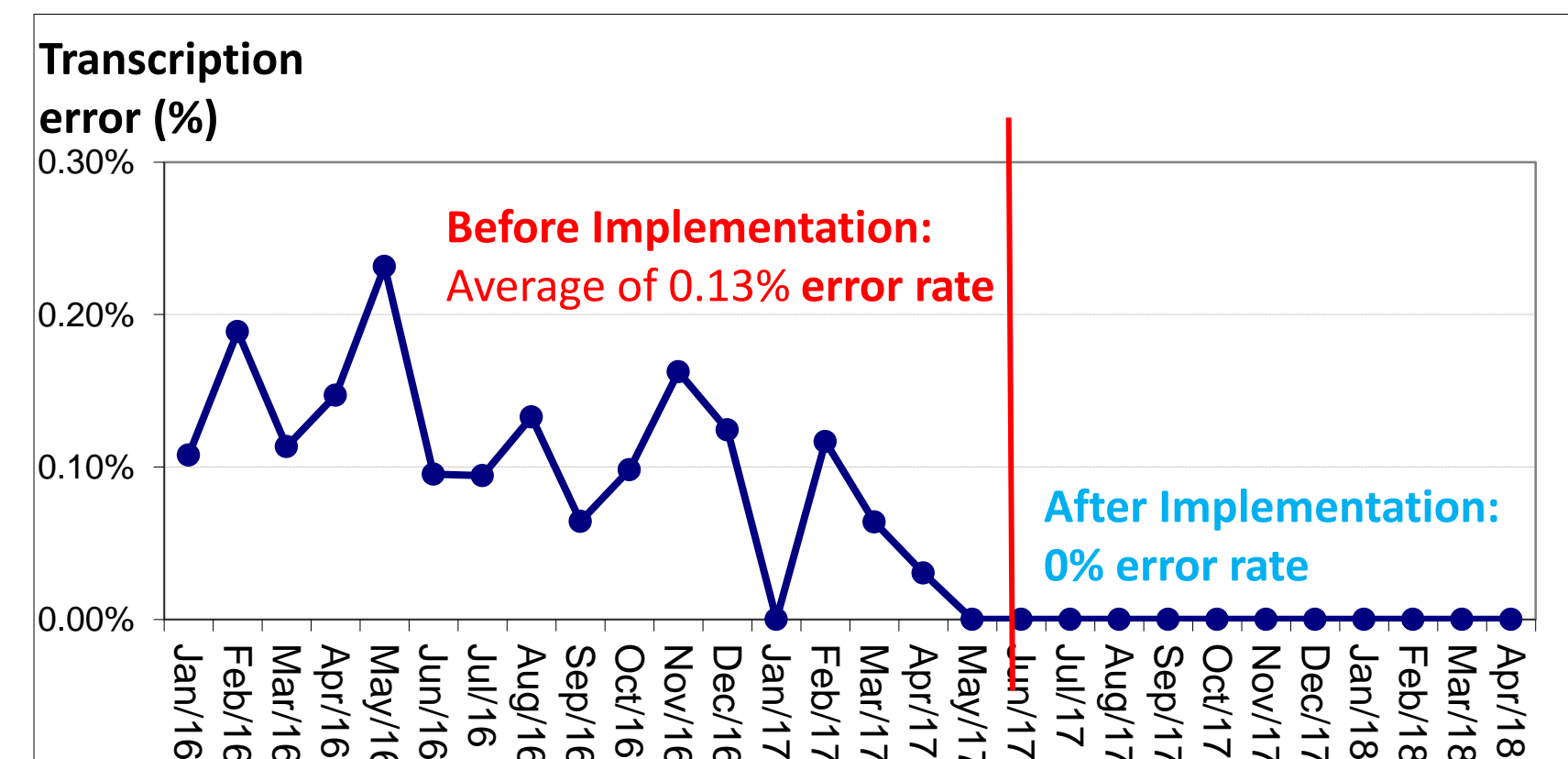


Figure D: Rate of Transcription Error for Neonatal Bilirubin Result

## 2. Improved and streamlined workflow

The workflow changes are highlighted in the flowcharts shown in Figure E.

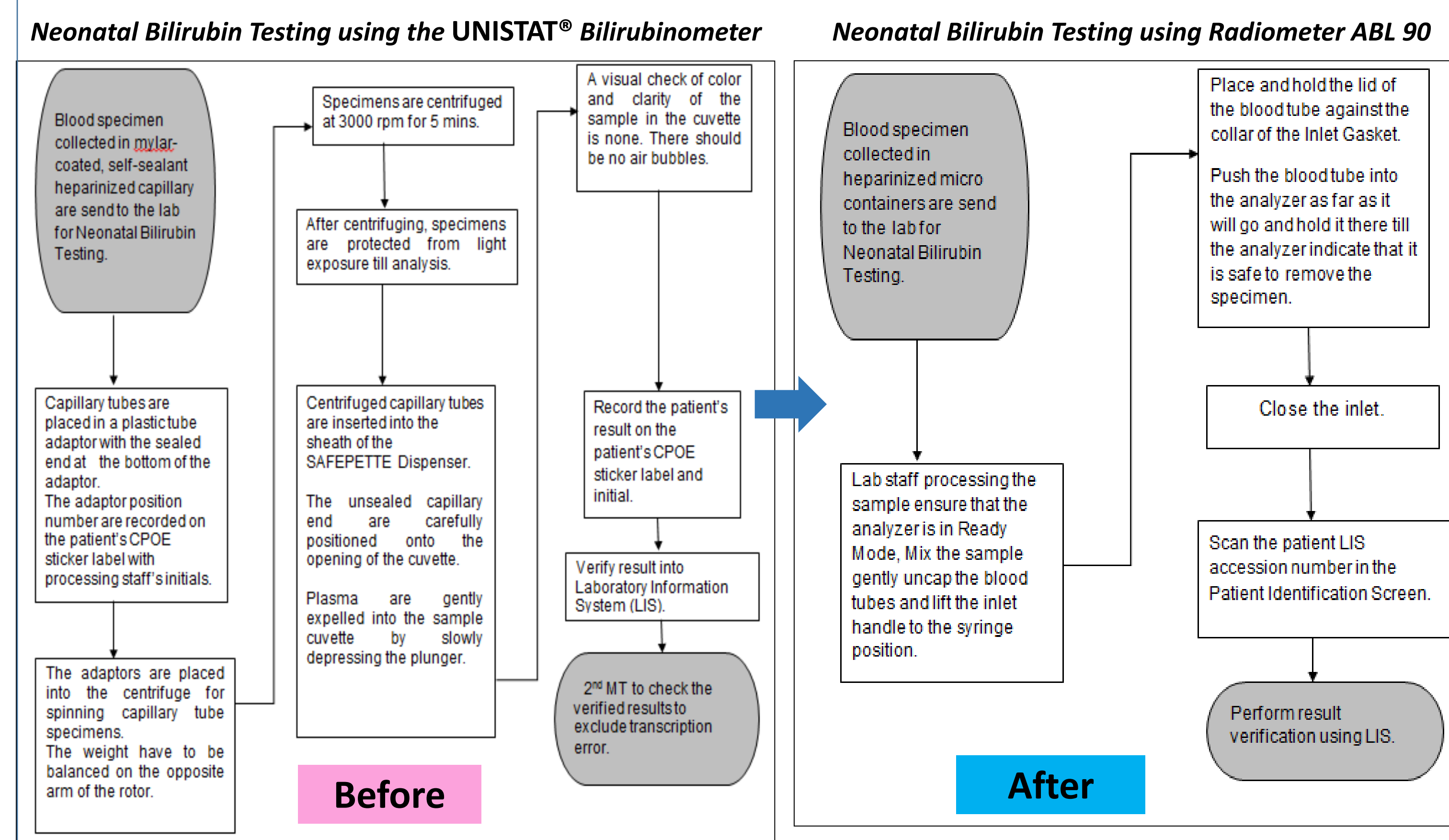


Figure E: Flowcharts illustrating the workflow changes before and after implementation of the new Radiometer ABL 90 for neonatal bilirubin testing

**Key changes to the workflow includes the following:**

1. Blood collected in one lithium heparin tube rather than 2 capillary tubes (see Figure F).
2. No centrifugation of sample required.
3. Direct sampling of whole blood on Radiometer ABL90.
4. No second lab personnel needed to countercheck result transcription



Before



After

Figure F: Change of blood collection tube from Mylar coated self-sealant heparinized capillary tubes to SARSTEDT Microvette Lithium Heparin Tube

## 3. Reduction in turnaround time (Batch testing and single testing)

Significant reduction in turnaround time (TAT) by 67% with use of Radiometer ABL 90 (See Table 1).

Time taken for neonatal bilirubin testing in batch and in singleton per day			
UNISTAT® Bilirubinometer		Radiometer ABL90 FLEX	
Process	Time Taken	Process	Time Taken
Processing a batch of 70 tests at 7am	2 hours	Processing a batch of 70 tests at 7am	1 hour
Processing 20 ad hoc neonatal bilirubin tests	3 hours	Processing 20 ad hoc neonatal bilirubin tests	40 mins
<b>Total time taken in a day</b>	<b>5 hours</b>	<b>Total time taken in a day</b>	<b>1 hour 40 mins</b>

**Turnaround time of a Neonatal Bilirubin sample is reduced by 67%**

Table 1: TAT comparison between UNISTAT Bilirubinometer and Radiometer ABL90

## 4. Estimated annual cost savings

There is a significant annual cost saving which was estimated to be \$91,499.60 (see Table 2).

	UNISTAT® Bilirubinometer	Radiometer ABL90 FLEX
Estimated Total Amount Spent in 1 year (Cuvettes, Manpower, Blood collection tubes, Service Contract Agreement, patient tests and Valid QCs)	\$214,764.60	\$123,265.00
<b>Annual Cost Savings</b>		<b>\$91,499.60</b>

Table 2: Cost saving before and after change of analyser

## 5. Intangible Benefits

- Enhance Patient Services and Increase Patient Satisfaction**  
→ Neonatal bilirubin results can be reported within a shorter time and doctors can provide earlier treatment to the patient
- Increase confidence in staff**  
→ Shorter turnaround time for processing neonatal bilirubin specimens without a need for a second staff to countercheck manual transcription error increase staff productivity and confidence level.
- Aligned with KKH's Quality Priorities**  
→ Achieve Target Zero Harm in attaining 0% transcript error rate in neonatal bilirubin result reporting

## Conclusion

We have successfully implemented Radiometer ABL90 as of June 2017. With the new analyser, it has significantly improved the workflow in laboratory for neonatal bilirubin. With this successful implementation, we have also migrated our blood gas and co-oximetry testings to this new platform since October 2017.

Being the first in Singapore to successfully implement this new testing method, we can share our experience with other laboratories in hospitals and polyclinics to improve neonatal bilirubin testing locally.