



# Aarhus University Hospital

Validation of Tempus600®

Transport system for blood tube samples

Department of Clinical Biochemistry, NBG

October 2012

## Validation of Tempus 600® transport system for blood tube samples

Biochemist, MSc Anne Dilani Schrøder. Email: annperse@rm.dk

Department of Clinical Biochemistry, Aarhus University Hospital. Noerrebrogade 44, 9, 3<sup>rd</sup>. 8000 Aarhus C.



### Abstract

#### Tempus600®

Tempus600®[1] is a transport system dedicated for transporting blood sample tubes. After drawing the blood sample, the tubes are placed in the Tempus600® rack and loaded in the Tempus600® launch unit. The Tempus600® system was installed at Aarhus University Hospital Noerrebrogade in August 2012. The launch unit is placed in the emergency department and the point of delivery is in the laboratory, Department of Clinical Biochemistry. The transport pipes are  $\varnothing 25$ , placed above the lowered ceilings. The system is the first of its kind transporting blood samples tubes covering a distance of 135 meters with a height difference of 3 floors (13 meters) in less than 30 seconds.



Launch unit in the emergency department



Point of delivery in the lab.

#### Daily use

The blood tube sample transport system is handled by the biomedical laboratory technicians with the aim of securing fast delivery of blood samples of acute care patients mainly from the emergency department, as well as from the medical and surgical preadmission assessment departments.

#### Method and materials

##### Patients

50 patients for chemistry and coagulation analysis and 49 patients for hematology analysis were included in the validation.

The samples were drawn in the daytime from 21<sup>st</sup> – 28<sup>th</sup> August 2012. The patients were randomly chosen among patients in the department's phlebotomy clinic.

## Validation

The Tempus600® system was examined with a view to assess to what extent the blood samples were affected by the transport. Physical impact, such as shaking, acceleration, speed or G-forces, might destroy the blood cells, especially erythrocytes (the red blood cells) and give an incorrect test result[2]. 2 blood samples were drawn from each patient. One sample tube was sent by routine courier transport to the laboratory (reference) and the second one was sent with Tempus600®. Both sample batches were centrifuged as soon as possible upon arrival in the laboratory.

## Blood analysis

The blood samples were tested for:

Biochemical tests (Roche Cobas6000 Analyzer)

- Plasma Potassium and Lactate dehydrogenase (LD) tests are influenced by erythrocyte destruction. The concentration of potassium and LD in erythrocytes are higher compared to content in plasma.
- Plasma Alkaline phosphatase has shown to be ascending by haemolysis [3]
- Haemolytic index (H-index) determines the level of free haemoglobin in plasma, as a measurement for erythrocyte destruction. We have established limits for allowable haemolysis in the samples (changes < 10%), expressed by H-index. H-index limits are <100 for Potassium, <15 for Lactate dehydrogenase and <200 for Alkaline phosphatase.

Additional tests:

Coagulation tests (Stago STA-R analyzer)

- International Normalized Ratio (INR) and Activated Partial Tromboplastin Time (APTT)

Heamatology test (Sysmex XE2100 analyzer)

- Leucocyte, Lymphocyte and Trombocyte,

## Blood collection

Becton Dickinson tubes were used for blood collection

- Lithium heparin plasma catalog number. 368884 (biochemical test)
- Sodium citrate plasma catalog number. 363048 (INR, APTT)
- EDTA plasma catalog number 368860 (leucocyt, lymphocyte, trombocyte)

## Statistical procedures

We used Microsoft Excel 2003 with additional Analyze-IT program, for all statistical analyses. Comparisons of Tempus600® and routine courier transport (reference) were done by using Bland-Altman difference plots (figure 1). Two-sided F- and T-test were done to test for significant differences of Tempus600® and reference data. When p-value is less than the significance level 0.05, the result is said to be statistically significant. See below table.

## Results

### Table

|                         | Unit     | Tempus<br>mean | Reference<br>mean | bias   | bias % | p-value              | n  |
|-------------------------|----------|----------------|-------------------|--------|--------|----------------------|----|
| Potassium               | mmol/l   | 3,96           | 3,95              | 0,01   | 0,20%  | 0,90                 | 50 |
| LD                      | U/l      | 172,04         | 172,70            | 4,34   | 2,85%  | 0,53                 | 50 |
| Alkaline<br>phosphatase | U/l      | 100,54         | 100,90            | -0,36  | -0,51% | 0,99                 | 50 |
| H-index                 | mg/dl    | 4,58           | 2,24              | 2,34   | 69,62% | $2,6 \times 10^{-5}$ | 50 |
| INR                     | *        | 1,01           | 1,02              | -0,005 | -0,38% | 0,92                 | 50 |
| APTT                    | s        | 31,33          | 31,33             | -0,07  | -0,25% | 0,95                 | 50 |
| Leucocyte               | $10^9/l$ | 7,26           | 7,23              | 0,04   | 0,11%  | 0,96                 | 49 |
| Lymphocyte              | $10^9/l$ | 2,09           | 2,08              | 0,02   | 0,57%  | 0,97                 | 49 |
| Trombocyte              | $10^9/l$ | 245,16         | 247,14            | -1,98  | 0,90%  | 0,91                 | 49 |

\* ratio

### Comments

#### H-index

Significant differences were found between routine transport and Tempus600® transport for H-index (p-value <0,05). When transporting the blood sample tubes using Tempus600® the H-index went up approx. 2,3 mg/dl compared to routine transport (min. -7 to max. 10 mg/dl). Overall the higher values for the H-index were acceptable for the blood sample testing.

#### Other analyses

For the other analyses no significant difference was noticed between routine transport and Tempus600® transport. (p-values > 0,05)

### Conclusion

The validation of Tempus600® has shown very satisfying results. Based on the findings it is recommended using Tempus600® for transporting blood sample tubes.

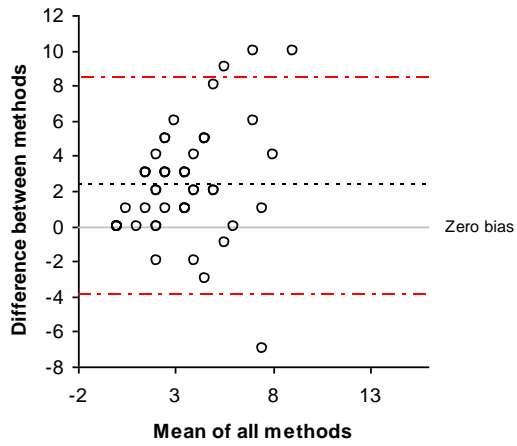
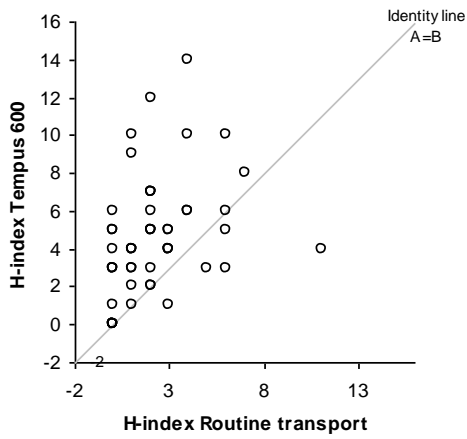
#### References

1. [www.Tempus600.com](http://www.Tempus600.com)
2. Streichert et al. Clinical Chemistry 57:10, 1390-1397 (2011)
3. Nyboe et al. Ugeskr Læger 168:33, 2653-2655 (2006)

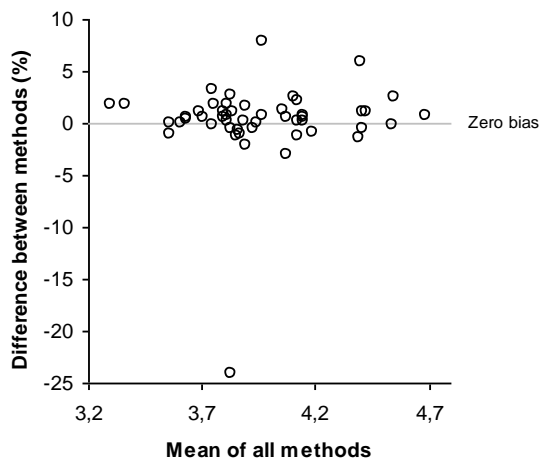
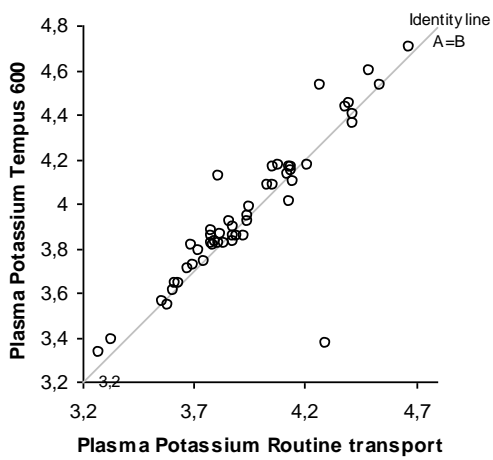
**Figure 1:** Bland-Altman difference plots

Biochemical test

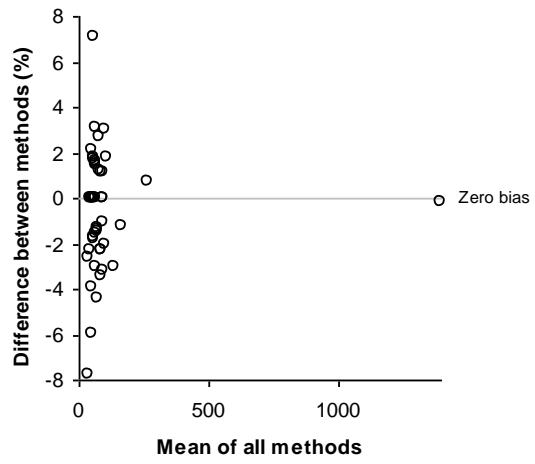
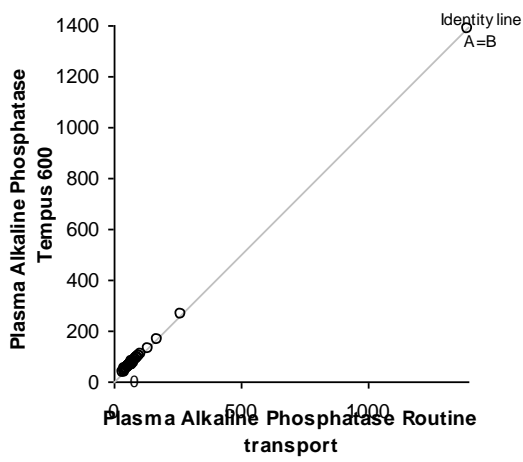
H-index



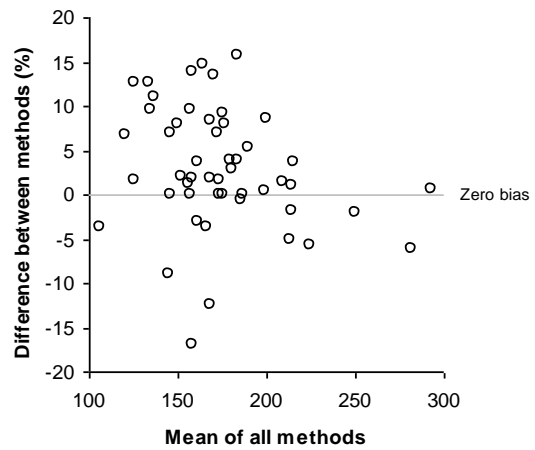
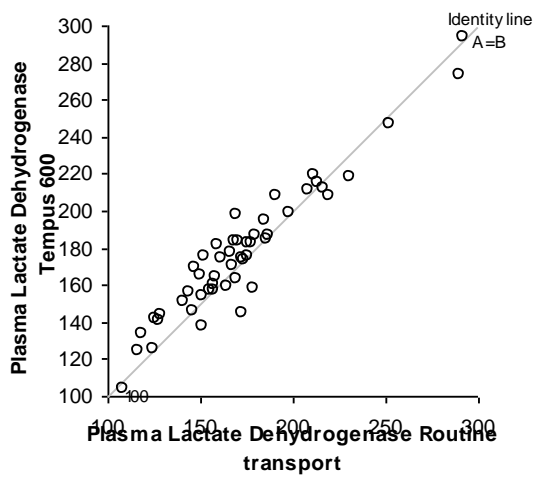
Plasma Potassium



### Plasma Alkaline Phosphatase

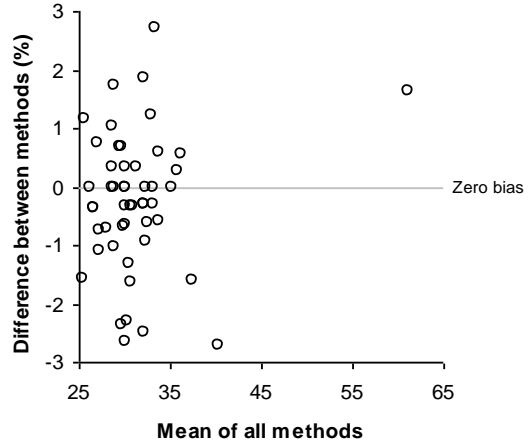
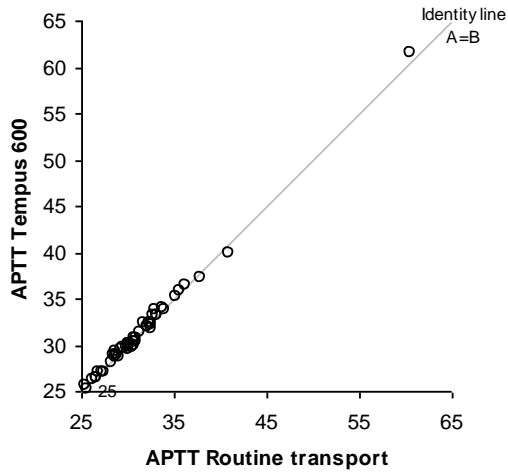


### Plasma Lactate Dehydrogenase

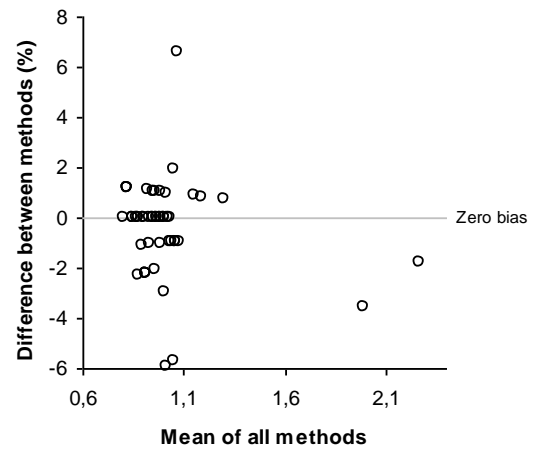
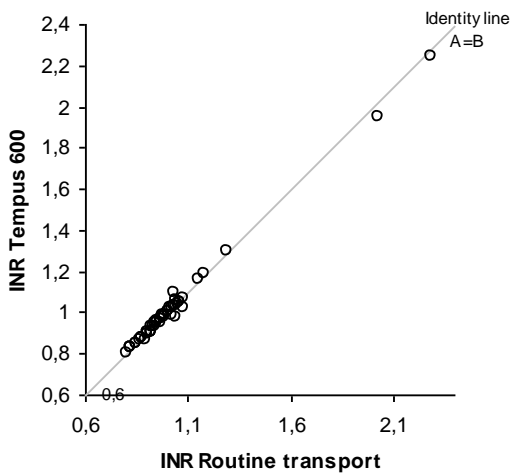


Coagulation tests

APTT

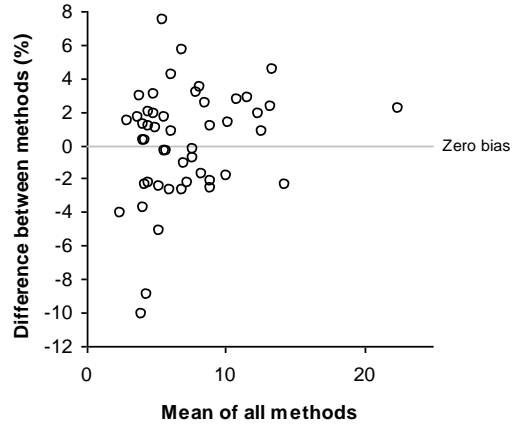
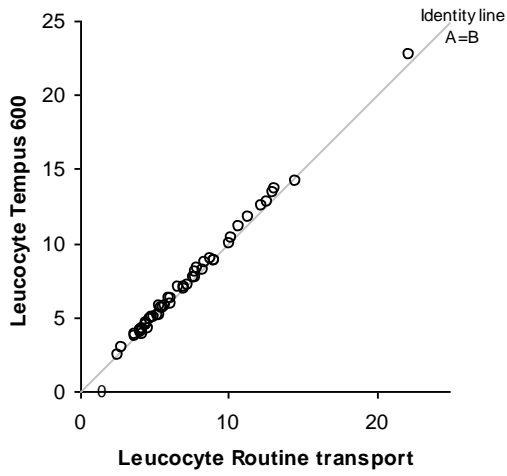


INR

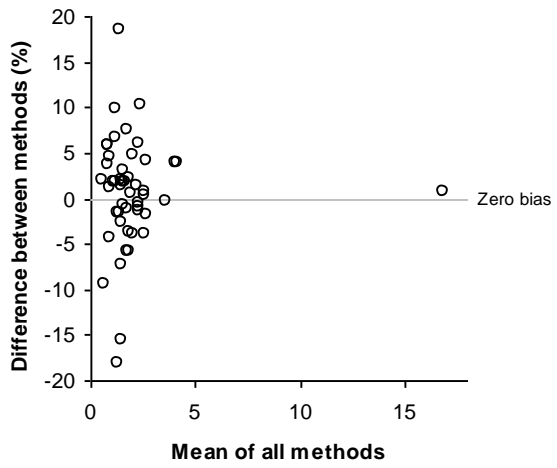
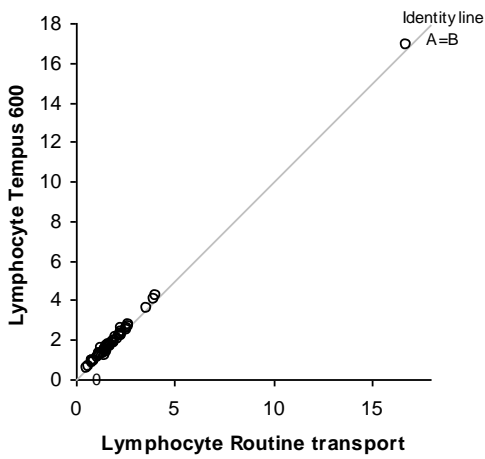


Heamatology test

Leucocyte



Lymphocyte



Trombocyte

