Medimate Mini-lab Lithium validation results part 2
Performance study professional versus lay-user

B. Geerling[a], A.W.M.M. Stevens[a], J.A. Bartholomewa[b], J.G. Krabbe[b], K. Movig[c] P. Kolling[d], M.C. Ungerer[e], S.S. Staal[e]
a. Dimence, centre for bipolar disorders, Deventer The Netherlands. b. Medlon BV, medical diagnostics, Enschede, The Netherlands. c. Departement of Clinical Pharmacy, Medical Spectrum Twente, Enschede, The Netherlands. d. Delta Psychiatric centre, Portugaal, the Netherlands.
e. Medimate BV, Enschede, The Netherlands

Introduction

Lithium is globally used to treat and prevent manic or depressive episodes in bipolar disorder. The drug has a small therapeutic window, and is in potention a toxic substance. Since the difference between therapeutic window and a toxic concentration is small, close monitoring of the lithium concentration is necessary.

The Medimate Minilab makes it possible to assess the lithium concentration in serum as well as fingerstick whole blood. The system is suitable for professional and self test use.

The Medimate Minilab combines a measurement apparatus called the Multireader and a disposable cartridge called the lab-chip. A measurement is performed after applying the sample at the lab-chip and inserting the lab-chip into the Multireader. The device detects the lab-chip and performs the measurement. After 9 minutes the Multireader displays the measured lithium concentration, see Figure 1.

The test results are part of an extensive validation study approved by the Medical Ethical Committee Twente in the Netherlands with reference number: NL34961.044.10

The objective of the study is to investigate performance differences between experienced professionals and lay users.

Method

Method comparison experiments are carried out according to CLSI EP-9 A2.

46 Patients on Lithium therapy are measured. Each measurement was performed 3 times, each set from one fingerstick. The measurements were conducted by the patient, followed by the physician officer and the specialist. An extra fingerstick sample was obtained for reference measurements by the physician officer. After the fingerstick measurements a venous sample was obtained for serum analysis. All fingerstick measurements from one patient were performed within one hour. Plasma and serum samples were created within two hours. The reference samples were measured within two days. Prior to the measurements the patient and the physician officer were instructed on site according to the training protocol.

All serum measurements on both methods were measured within two hours from each other. The IL943 was used as reference method.

Acceptance criteria

The Dgrhoads table for total allowable error[1] provides acceptance criteria from several different parties for lithium monitoring in serum, see Table 3.
As the Medimate Minilab is intented to be equivalent with serum these acceptance criteria are used for serum as well as for fingerstick whole blood.

1. Allowable total error database, www.dgrhoads.com.
More detailed information can be found in the validation reports. For more information please visit the website: www.medimate.com or send an e-mail to info@medimate.com.
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Figure 1: Measurement steps. 1. Perform fingerstick, 2. Apply blood droplet, 3. Insert Cartridge, 4. Readout result

Person	(mmol/l)	BIN boundary mmol/l < 0.05	< 0.10	< 0.15	< 0.2	All
Lay user	0,02	64%	90%	94%	98%	100%
Phys office	0,02	66%	91%	95%	98%	100%
Specialist	0,02	64%	89%	95%	98%	100%
All	0,02	65%	90%	95%	98%	100%

Person	(mmol/l)	BIN boundary mmol/l < 0.05	< 0.10	< 0.15	< 0.2	All
Specialist	0,03	86%	98%	99%	100%	100%

Table 1, 2: BIN results for fingerstick whole blood (top) and serum (bottom)

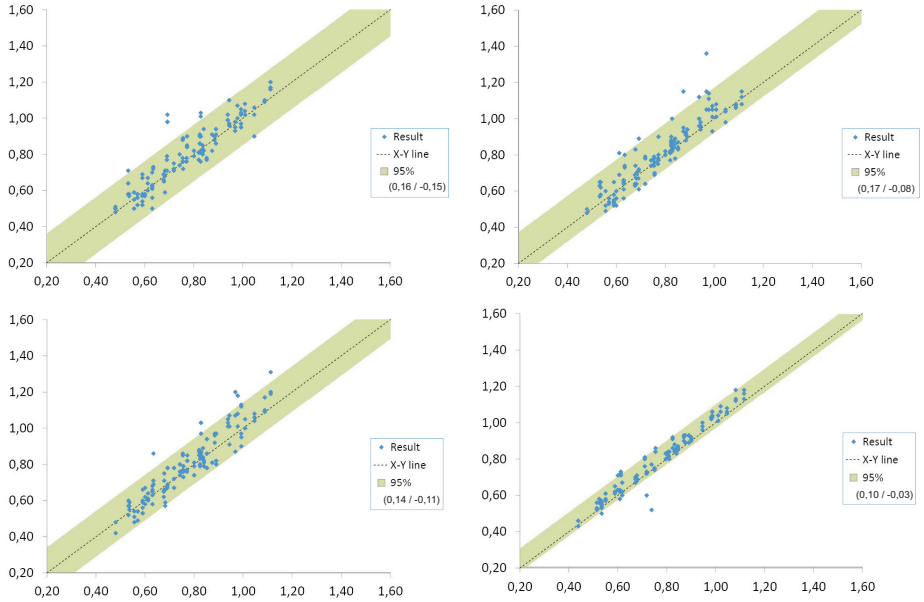

Figure 2: Patient (top left), physician officer (top right) and specialist (bottom left) Medimate Minilab fingerstick measurements are compared by Method Comparison with fingerstick plasma measurements on the II943 reference method. The shaded area encloses 95% of the measurements. Bottom right serum results performed by the specialist. X-Axis lithium [mmol/l] II943 reference method. Y-Axis lithium [mmol/l] Medimate Minilab.

Results & Discussion

Sample collection:
Each measurement was conducted by performing a fingerstick, acquiring a blood droplet, placing the blood droplet on a lab-chip, placing the lab-chip in the Multireader followed by a readout of the result from the Multireader.
Sample evaluation:
It has to be noted that errors are included due to instability of the measurement sample. This is caused by time differences in sampling from the subject as well as differences in preparing the reference sample.
One persons sample was found instable and was rejected from the dataset. The medication intake took place three hours prior to performing the measurement instead of the required minimal time of 10 hours.
Bin results:
Bin results are shown in table 1 and 2 for fingerstick and serum respectively. The table states the following clinical relevant parameters:
- the offset observed for fingerstick is 0,02 and for serum is 0,03.
- 95% of all fingerstick measurements are within 0,15 mmol/l
- 95% of all serum measurements are within 0,07 mmol/l
Individual results:
In the method comparison figures all individual Multireader measurement results are plotted versus the reference result.
Verification criteria results:
From Table 3 can be derived that all criteria are met by the Medimate Minilab.

Total Allowable Error	Reference	Venous serum Specialist	Fingerstick whole blood Specialist	Phys. Off	Lay User
+/- 20% or 0.3 mmol/L	CLIA, WLSH, CAP, AAB	PASS	PASS	PASS	PASS
+/- 15% or 0.3 mmol/L	NYS	PASS	PASS	PASS	PASS
0.2 mmol/L	RCPA	PASS	PASS	PASS	PASS
serum 10% or 0,1 mmol/l fingerstick 15% or 0,15 mmol/l	Medimate	PASS	PASS	PASS	PASS

Table 3: Third party performance criteria
Abbreviations: CLIA '88 Proficiency Testing Limits: U.S. Federal Register, WSLH: Wisconsin State Laboratory of Hygiene, CAP: College of American Pathologists, AAB: American Association of Bioanalysts, NYS: New York State Department of Health, RCPA: Royal College of Pathologists of Australasia.

Comparison results:
One-Way Anova analysis indicated that there was no difference in measurements results when performed by patients, physician officer or specialist

Conclusions

- There are no significant differences observed between lay user, physician officer and specialist.
- Fingerstick and serum measurements passes all acceptance criteria with an offset of 0,02 and 0,03 mmol/l respectively.