Eurolyser smart 700/340

C-reactive protein (CRP)
A system for measurement of CRP
manufactured by Eurolyser Diagnostica GmbH, Austria

Report from the evaluation SKUP/2013/92

organised by SKUP at the request of

HaemoMedtec ApS, Denmark

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The report was written by SKUP, April 2013. For more details about SKUP, see attachment 1.
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Attachments 7 and 9 with raw data of the Eurolyser smart CRP are included only in the report to SKUP and HaemoMedtec ApS, Denmark.

1. Summary

Background
The measurement of C-reactive protein (CRP) with the Eurolyser smart 700/340 instrument has previously been evaluated by SKUP (SKUP/2011/70*). That evaluation was performed in a hospital laboratory and included capillary samples and control materials. Since that evaluation, the lid on the cuvettes has been reconstructed to include a sample collector device. The supplier for Eurolyser in Denmark, HaemoMedtec, has requested this evaluation.

The aim of the evaluation was to
- examine the analytical quality of Eurolyser smart CRP when measuring venous whole blood samples in a hospital laboratory
- examine the analytical quality of Eurolyser smart CRP when measuring capillary blood samples at two primary health care centres
- evaluate the Eurolyser control material
- evaluate the user-friendliness of Eurolyser smart CRP at two primary health care centres

Materials and methods
Three Eurolyser smart instruments and three lots of Eurolyser test cuvettes were used. 100 venous whole blood EDTA patient samples in a hospital laboratory were included as well as capillary samples from 86 patients in two primary health care centres. In addition two levels of control materials were analysed.

Results
Capillary samples at two primary health care centres: A coefficient of variation (CV) <10,0% was obtained for capillary blood CRP concentrations ≥3,2 mg/L in both primary health care centres, n=62. For CRP concentrations <3,2 mg/L the CV was higher than 10%. (For the mean concentrations 4,4 – 9,0 – 34,1 and 38,6 mg/L the CV% was 15,4-8,3-8,6 and 8,3% and bias was −17%, −11,2%, −4,8% and –8,6%). 96,4% of the sample results fulfilled the quality goal of a deviation less than ±1mg/L or <26% from the comparison method.
Venous EDTA samples in a hospital laboratory: The CV and the upper confidence interval for CV were <10,0% in the range CRP 1,8 to 281 mg/L. The bias was negative for concentrations <16,7 mg/L and positive for higher concentrations. 98% of the results had a deviation less than ±1,0 mg/L or <26% from the comparison method.
User-friendliness: The quick manual, the time factors and the operation were rated as satisfactory by the four evaluators. All evaluators had difficulties with the *control material*, which had a CV <10,0% in the hospital laboratory evaluation and ≥20% in the two primary health care centres.
Technical errors: There were in total three technical errors.

Conclusion
The Eurolyser smart CRP fulfilled the quality goals for imprecision with venous EDTA whole blood samples in the hospital laboratory and with capillary CRP results above 3,2 mg/L in the primary health care centres. CRP concentrations <3,2 mg/L do not fulfil the quality goal. The quality goal for accuracy was fulfilled with venous EDTA samples in the hospital evaluation and with capillary samples at both primary health care centres.
User-friendliness: Both primary health care centres found the instrument easy to use. The control materials were not useful in the primary health care centres as the CV was ≥20%.
The fraction of technical errors: was less than 1,0%

Comments from Eurolyser
A letter with comments from Eurolyser is attached to the report.

2. Abbreviations

CI	Confidence Interval
C-NPU	Committee on Nomenclature, Properties and Units
CRP	C-reactive protein
CV	Coefficient of Variation
DAK-E	Danish Quality Unit of General Practice
DEKS	Danish Institute of External Quality Assurance for Laboratories in Health Care
EQA	External Quality Assessment
Equalis	External quality assurance in laboratory medicine in Sweden
ERS	Eurolab Reagent System
GP	General Practitioner
IFCC	The International Federation of Clinical Chemistry and Laboratory Medicine
IUPAC	International Union of Pure and Applied Chemistry
Noklus	Norwegian Quality Improvement of Primary Care Laboratories
SD	Standard Deviation
SKUP	Scandinavian evaluation of laboratory equipment for primary health care

3. Quality goals

To qualify for an overall good assessment in a SKUP evaluation, the measuring system must show satisfactory analytical quality as well as satisfactory user-friendliness.

3.1. Analytical quality goals

International guidelines for analytical quality requirements for Plasma—C-reactive protein (P—CRP) are few. The biological within-subject-variation is 42,2% and the biological between-subject-variation is 76,3% for healthy individuals [1]. The reference interval is <3 mg/L. The desirable quality specifications calculated from the biological variation give high figures; imprecision <21,1% CV, bias ±21,8%, and total error <56,6% [2]. As the CRP test is mostly used for non-healthy individuals with higher CRP-concentrations several papers have discussed the issue [2-6]. The National Danish Committee for General Practice Laboratory Testing appointed by the National Ministry of Health has specified the demands to analytical quality [7,8] for CRP for instruments used in primary health care. General practitioners in Denmark want to be able to detect a CRP decrease from 40 mg/L to 20 mg/L and they want to be able to differ between concentrations of 35 mg/L and 50 mg/L. The Danish goals also include demands to the comparison laboratory:

Danish goals

The analytical quality goals for CRP >15 mg/L are:

Near Patient Tests used in primary health care centres	Bias ≤±10% and CV ≤10%
Hospital laboratory methods, used as comparison methods	Bias ≤±3% and CV ≤5%

Norway has no similar requirements.

Swedish goals

For Near Patient Tests used in primary health care centres Equalis Expert group for Protein analysis has decided the that the maximum deviation for a single result measured in whole blood should be ±15% when compared to an assigned value set by five agreeing hospital laboratory methods for separated plasma.

For hospital laboratory methods Equalis Expert group for Protein analysis has decided that the maximum deviation for a single result measured in plasma should be ±10% when compared to an assigned value set as the mean of five agreeing method group means.

SKUP

In previous CRP evaluations (report no 23, 61, 70*, 77 and 90), SKUP has used the quality limits given below:

- Repeatability CV ≤10%
- Allowable deviation ≤ ± [| bias | + 1,65 x CV], where bias <10%, CV <10% ~ <±26%

The above allowable deviation limits are however too strict for low CRP concentrations. A CRP variation of ±1 mg/L has no clinical relevance in any concentration level; therefore the allowable deviation is ≤±1mg/L or a deviation ≤±26%.

With the Eurolyser smart CRP very low results are reported to the clients as "<2 mg/L"
With the comparison method very low results are reported as "<1 mg/L"
With the Eurolyser smart CRP very high results are reported to the clients as ">240 mg/L"
With the comparison method very high results are reported as ">300 mg/L".
Low results e.g. <2 mg/L with Eurolyser smart CRP and 1,35 mg/L with the comparison method as well as high results e.g. >240 mg/L Eurolyser smart CRP and 281 mg/L with the comparison method are considered to be agreeing and correct.

3.2. Evaluation of user-friendliness

The evaluation of user-friendliness is carried out by asking the evaluating persons (end-users) to fill in a questionnaire.

The questionnaire divides the user-friendliness into four sub-areas:

- Rating of information in manual and insert
- Rating of time factors at the measurement and preparation
- Rating of performing internal and external quality control
- Rating of operation facilities. Is the system easy to handle?

Evaluation of user-friendliness is graded as satisfactory, intermediate or unsatisfactory, also depicted by the colours green, yellow and red, respectively.

3.3. Principles for the assessments

3.3.1. *Assessment of the analytical quality*

The analytical results are assessed according to the quality goals set for the evaluation.

Precision

The distinction between the ratings, and the assessment of precision according to the quality goal, are shown in table 1.

Table 1 The rating of precision

Distinction between the ratings	**Assessment according to the quality goal**
The CV is lower than the quality goal	The quality goal is fulfilled
The CV is lower than the quality goal (not statistically significant)	Data is inconclusive on fulfilling the quality goal. Most likely the quality goal is fulfilled
The CV is higher than the quality goal (not statistically significant)	Data is inconclusive on fulfilling the quality goal. Most likely the quality goal is not fulfilled
The CV is higher than the quality goal	The quality goal is not fulfilled

Accuracy
The accuracy is illustrated in a difference-plot with limits for the tolerated deviation according to the quality goal. The fraction of results within the limits is counted.
The accuracy is judged as either fulfilling the quality goal or not fulfilling the quality goal.

3.3.2. *Assessment of the user-friendliness*
The user-friendliness is assessed according to the answers and comments given in the questionnaire (see section 5.5.). For each question, the user must choose between three given ratings, as for instance satisfactory, intermediate or unsatisfactory. The response from the users is reviewed and summed up. To achieve the overall rating "satisfactory", the tested equipment must reach the total rating of "satisfactory" in all four sub-areas of characteristics mentioned in section 5.5.

The evaluating person registers the fraction of error codes and technical errors during the evaluation. The National Danish Committee for General Practice Laboratory Testing believes that the proportion of "tests wasted" caused by technical errors should not exceed 2%.

3.4. SKUP´s quality goals in this evaluation
SKUP will assess the results from the evaluation of Eurolyser smart CRP against the following quality goals:

Repeatability (CV) ..... ≤10%

Accuracy (Allowable deviation) ..... ≤±1 mg/L
or ..... ≤±26%
Required percentage of individual results within the above allowable deviation ..... ≥95%

Fraction of technical errors ..... ≤2%

User-friendliness ..... Satisfactory

Low results in both Eurolyser smart CRP and the comparison method e.g. <2,0 and 1,35 mg/L or >240 mg/L and 281 mg/L are considered correct.

4. Materials and methods

4.1. Definition of the CRP

The International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) and International Union of Pure and Applied Chemistry (IUPAC) work in a joint Committee on Nomenclature, Properties and Units (C-NPU). The descriptions of clinical laboratory tests are listed in the ”NPU database” [9]. In the database the recommended name is given for the measurand, together with which unit the result should be reported in, see table 2.

Table 2 Name, code and unit for the CRP test according to C-NPU

NPU code	Full name of test according to NPU	Short name	Unit
NPU19748	P—C-reactive protein; mass c. mg/l	P — CRP	mg/L

In this report the term CRP will be used for the measurand.

4.2. The evaluated Eurolyser smart System

The Eurolyser smart instrument (Eurolyser smart) can be used to measure several components in whole blood or serum. The intended users are health care personnel from primary health care centres. When measuring CRP, the instrument is used together with the Eurolyser smart CRP kit. The measurement system, instrument and kit together, is in this report called “Eurolyser smart CRP”. The kit consists of Eurolab Reagent System cuvettes containing buffer and Eurolab Reagent System-Caps containing rabbit anti-human CRP antibodies. The caps also serve as sample collectors.
The Eurolyser smart instrument (figure 1) is based on photometer technology to perform turbidimetric measurements. The instrument measures the difference in turbidity of the liquid before and after the reaction of the liquids within the cuvette. It then calculates the CRP concentration and displays the result on the instrument screen.

Figure 1. The Eurolyser smart

Technical data from the manufacturer is shown in table 3.
For more technical data about the Eurolyser smart CRP, and for sampling information, see attachment 2. For name of the manufacturer and the suppliers in the Scandinavian countries, see attachment 3.

Table 3. Technical data Eurolyser smart CRP

Sample material	capillary blood, venous whole blood, serum, plasma
Sample volume	5 µL
Measuring time	3 minutes
Measuring range	Whole blood: <2 mg/L, 2,0 – 240,0 mg/L and >240 mg/L Serum/plasma: <1 mg/L, 1,0 – 120,0 mg/L and >120 mg/L
Storage capacity	100 results
Electrical power supply	AC (100-240V)
Dimensions	Width: 145 mm Depth: 140 mm Height: 260 mm Weight: 3,5 kg
Instruments used in the evaluation*	AF6256, AF6257, AF6258, AF6259
Lot numbers of the cuvettes used in the Hospital Laboratory	411-1, 611-1, 911-1
Lot numbers of the cuvettes used in Primary health care	Centre 1: 411-1, 911-1, Centre 2: 611-1, 911-1

* the backup instrument AF6258 was not used in the evaluation

When using Eurolyser smart CRP for measuring CRP in a whole blood sample, the measured blood concentration is recalculated within the instrument to the corresponding CRP concentration in plasma. In this recalculation a fixed haematocrit value of 40% was used in the evaluation. It is also possible to use the actual haematocrit value, if that is known.

4.3. The selected comparison method

A selected comparison method is a fully specified method which, in the absence of a Reference method, serves as a common basis for the comparison of a field method.

4.3.1. *The selected comparison method in this evaluation*

The selected comparison method in this evaluation is the method implemented on Cobas Integra 800 from Roche (table 4), hereafter called "the comparison method".

Table 4 Information about the comparison method on Cobas Integra 800, Roche

Instrument	Cobas Integra 800, Roche. Three instruments were included in the evaluation, called Integra 1, 2, or 3. Integra 3 was used as a back-up instrument for the two other instruments
Reagent	C-Reactive Protein (Latex) from Roche (CRPLX) [10]
Traceability	Certified Reference Material (CRM) 470 [11]
Calibration	A six-point calibration using Calibrator for automated systems for protein analysis from Roche
Samples	Venous serum samples, collected in tubes containing gel separator
Measurement Principle	The CRPLX is a particle enhanced turbidimetric assay, where human CRP agglutinates with latex particles coated with monoclonal anti-CRP antibodies. The concentration of the precipitate is determined turbidimetrically at 552 nm.
Quality requirements	Bias in external quality control from DEKS: ≤±15,0% or ≤±3,0% [8] Imprecision with internal quality control samples: ≤5,0 CV%
Measuring interval	1,0 – 300 mg/L. Low results are given to the clients as <1 mg/L and very high results as >300 mg/L
Internal quality control materials	CRPHK from DEKS: 81,5 mg/L n = 620 CV 6,1% CRPHK from DEKS: 76,6 mg/L n = 301 CV 6,3% HK10 from DEKS: 25,0 mg/L n = 277 CV 3,1% Precipath Protein, Roche (PCM1): 9,1 mg/L n = 149 CV 2,1%
External quality control	Labquality survey number 1072, Finland (distributed via DEKS)

4.4. The evaluation

4.4.1. *Planning of the evaluation*

Eurolyser smart CRP has previously been evaluated by SKUP, report (SKUP/2011/70*) [12]. The evaluation was a hospital evaluation carried out with venous EDTA whole blood and capillary samples. Since this evaluation, the lids on the cuvettes have been changed to also serve as sample collectors for both venous and capillary blood samples.

Inquiry about an evaluation

HaemoMedtec, Denmark requested this new evaluation of Eurolyser smart CRP in 2011. SKUP in Denmark accepted to carry out this evaluation.

Protocol and contract

The protocol for the evaluation was approved in October 2011. HaemoMedtec, Denmark, and SKUP in Denmark signed the contract in November 2011.

Preparations and training program
Stine B. Weber was trained for approximately one hour by Helle Skovmand Christensen, HaemoMedtec, in October 2011. Test samples of venous and capillary blood were analysed using four Eurolyser smart-instruments at the Department of Clinical Biochemistry, Hillerød Hospital.

4.4.2. *Evaluation sites and persons involved*
Evaluation under standardised conditions took place at the Department of Clinical Biochemistry, Hillerød Hospital. All participants in the evaluation are presented in table 5.

Table 5 Persons responsible for various parts of the evaluation

Name	Title	Organisation	Responsibility
Bue Svendsen	Director	HaemoMedtec, Denmark	Ordered the evaluation
Helle Skovmand Christensen	Product Specialist	HaemoMedtec, Denmark	Training
Stine B. Weber	Cand. Scient.	Hillerød Hospital	Hospital testing and contact person for Primary care Co-author of the report
Esther A Jensen	Physician	Hillerød Hospital	Main author of the report Responsible for the evaluation
Steen Ingemann Hansen	Civil engineer	Hillerød Hospital	The comparison method
Grethe Schrøder	Biomedical laboratory scientist	Hillerød Hospital	The comparison method
Inge Lykke Pedersen	Biomedical laboratory scientist	Hillerød Hospital	Consultant for Primary care quality
Vivi Hartvig Christensen	Biomedical laboratory scientist	Primary care	Primary care testing
Mette Bækgaard	Biomedical laboratory scientist	Primary care	Primary care testing
Margit Lyngsø	Nurse	Primary care	Primary care testing
Signe Kristensen	Nurse	Primary care	Primary care testing

4.4.3. *The evaluation model*
The evaluation consists of two parallel parts. One part of the evaluation was carried out under standardised and optimal conditions by laboratory educated personnel in a hospital laboratory using about 100 samples from 100 individuals. The evaluation in the hospital laboratory had to last over at least 20 days and 3 lots of test cuvettes had to be used. This part documents the quality of the system under conditions as favourable as possible for achieving good analytical quality.
The second part of the evaluation was performed in two primary health care centres under 'real conditions'. The centres included at least 40 patients each. At least one of the evaluators should not be a biomedical laboratory scientist. Each primary health care centre used two of the three lots of test cuvettes that were used in the hospital. The evaluation had to last over at least five days.
According to the protocol the results were evaluated after the first 20 results to decide whether the evaluation should continue. In case of continuation, it should also be decided whether the evaluation should continue with serum or whole blood EDTA samples.

4.4.4. *The aim of the evaluation*

The evaluation of Eurolyser smart CRP in a hospital laboratory includes:

- An examination of the analytical quality under standardised and optimal conditions, performed with about 100 venous whole blood patient samples
- Comparison with an established hospital laboratory method
- An evaluation of the Eurolyser smart CRP-Control material low and high
- Evaluation of user-friendliness

The evaluation in primary health care centres includes:

- An examination of the analytical quality with 40 patient samples (capillary) at each of the primary health care centres
- Comparison with an established hospital laboratory method
- Evaluation of user-friendliness

4.4.5. *The evaluation procedure under standardised and optimal conditions in a hospital laboratory*

Internal analytical quality control

The internal quality control material (Eurolyser smart CRP-Control) was measured in duplicates each evaluation day during the evaluation period. The purpose was to examine if the control material results were representative for the results of the genuine samples and if the control material is suitable for troubleshooting.

Collection of 100 samples

The samples were selected from the routine production in the laboratory; only patients on which both an EDTA whole blood sample and a serum sample had been collected in the same sampling were selected for the evaluation. 20 serum samples and 20 whole blood EDTA samples were included in the evaluation. The whole blood EDTA samples were used for Eurolyser smart CRP measurements and the serum samples were used both for Eurolyser smart CRP and for measurements on the comparison method.

After the assessment of the results from these 20 first patients, it was agreed with the HaemoMedtec to continue the evaluation with only whole blood EDTA samples for the Eurolyser smart CRP. 80 more EDTA samples were then selected for the evaluation. The samples were selected to achieve the distribution shown in table 6. The 100 samples originate from 100 different patients.

When measuring whole blood samples with Eurolyser smart CRP an error is introduced as the measurement result (plasma concentration) is calculated with a fixed factor assuming that the haematocrit always is normal, 40%. See explanation in section 4.2. The main part of this evaluation is performed with whole blood samples and the errors described above are included in the evaluated results.

The practical work with the hospital evaluation was carried out between November 2011 and June 2012.

Table 6 Requirements on the distribution of the CRP concentrations in the samples selected for the evaluation

CRP concentration range (mg/L)	**<5**	**5 – 15**	**15 – 50**	**50 – 100**	**>100**
Required proportion of the samples	5 %	5–10 %	≥60 %	≥15 %	≥5 %

Handling of samples and measurements for Eurolyser smart CRP
The EDTA whole blood samples were analysed in duplicates using the Eurolyser smart CRP, a total of two measurements for each patient. Samples from one patient were measured with the same instrument and with test cuvettes from the same lot number.
Three lot numbers of Eurolyser smart CRP cuvettes were used in the evaluation.

Analysing with the comparison method
The serum samples were measured with the comparison method. The first measurement was performed after centrifugation and less than four hours after sampling. The second measurement was measured on the same tube but with another comparison method instrument. If the second measurement was not analysed on the same day as the sample was collected, the tube was kept at +4^{o}C until analysis the following day.
The repeatability of the CRP duplicate measurements on the two comparison method instruments should be as good as the goal for the Eurolyser smart CRP (CV <10%).

Recording of results
All results were registered consecutively on a registration form prepared by SKUP. All recorded data from the instruments were stored. All analysing data, mistakes and errors were reported. All results were signed by the person performing the practical work. The Eurolyser smart instrument was connected to an external printer during the evaluation.

4.4.6. *Evaluation procedure in two primary health care centres*

Training
The supplier was responsible for the training with Eurolyser smart CRP. When the evaluation began, the evaluators had to handle Eurolyser smart CRP on their own without any supervision or correction from the manufacturer or the supplier. If there were any questions, they were addressed to SKUP. Helle Skovmand Christensen, HaemoMedtec, trained the staff at the primary health care centre in Slangerup in November 2011. Since it was not possible to find a date for the training of the staff at the primary health care centre in Helsingør, SKUP and HaemoMedtec agreed that Stine B.Weber from SKUP would do the training in this centre. Stine B. Weber explained the SKUP protocol at both centres.

Recruitment of patients
At least 40 patients, coming to each of the two Primary Health Care Centres to have their CRP measured, were invited to participate in the evaluation. Participation was voluntary and verbal consent was considered to be sufficient. Each patient was included only once.

Collection of samples
At least 40 patients were included in the evaluation in each primary health care centre. About 30 patients should have a CRP concentration ≥5,0 mg/L. The practical work with the evaluation was carried out between November 2011 and March 2012 in primary health care centre 1. The other centre had difficulties in recruiting patients and stopped the evaluation in January 2012. Stine B. Weber then trained the nurses in 'Lægerne Strandgade 95', Helsingør, February 2012. They finished the inclusion of patients October 2012.

Internal analytical quality control
The control materials ST1000 Control low and ST1000 Control high were measured in duplicates each evaluation day.

Handling of samples and measurements on Eurolyser smart CRP
The patients had two capillary samples taken using two skin penetrations. The second blood drop was used for analysing on Eurolyser smart. The capillary samples were measured immediately after skin penetration.
The samples from the 40 patients in each of the primary health care centres were measured on one instrument and using cuvettes of two different lot numbers. Both capillary samples from one patient were measured with test cuvettes with the same lot number.
All results were registered and signed by the evaluator. If an instrument showed an error code while analysing a sample, a new measurement was made, if possible. The error codes were recorded.

If more than 10 patients had a CRP less than 2,0 mg/L, the patients were included in the evaluation only if the first capillary result was above 2,0 mg/L. In all cases the patient, including patient data, was registered.

Recording of results
All results were registered consecutively on a registration form prepared by SKUP. All recorded data from the instruments were stored. All analysing data, mistakes and errors were reported. All results were signed by the person performing the practical work

Handling of samples for the comparison method
One venous sample (a tube containing Z serum Separator gel and Clot Activator) per patient was collected for measurements with the comparison method. This sample was sent with the routine transportation system for blood samples to the Department of Clinical Biochemistry, Hillerød Hospital within 24 hours. After registration, the samples were centrifuged and serum was analysed on two comparison instruments.

Evaluation of user-friendliness
The evaluators filled in the user-friendliness questionnaire after completing the practical work with the evaluation. They evaluated the four categories: manual, time factors, control possibilities and operation facilities.

5. Results and discussion

Statistical expressions and calculations used by SKUP are shown in attachment 4.
Formula 2 is used for calculation of repeatability in this evaluation.

5.1. Number of samples

In the hospital evaluation, 20 serum samples and 20 EDTA whole blood samples from 20 patients were collected from the routine production. Further 80 EDTA whole blood samples were collected, in total 100. All measurements were made in duplicates, in total four results on Eurolyser smart CRP for the first 20 patients and two results for the remaining 80 patients.

In the primary health care evaluation, one centre recruited 42 patients for duplicate capillary measurements, the other recruited 44 patients.

5.1.1. *Excluded and missing results*

Primary health care centre 1:
Seven comparison method results were not measured in duplicates. These single results were still looked upon as an estimate of the true value, and were included in the calculations.

Primary health care centre 2:
No. 412: the Eurolyser smart CRP results were 100,0 mg/L and 28,7 mg/L. The duplicate measurement was excluded as an outlier. The comparison method showed the result 89,0 mg/L.
No. 437: the Eurolyser smart CRP results were 1,3 mg/L and 2,6 mg/L. The first capillary sample was measured as a serum sample and not as a whole blood sample and the result was therefore excluded. The comparison method results were 3,1 mg/L twice.
Eight samples for the comparison method were not measured in duplicates and three second comparison method results were lost. These single results were still looked upon as an estimate of the true value, and were included in the calculations.

5.1.2. *Failed measurements*

Primary health care centre 1: No. 313: no results with the comparison method.

Primary health care centre 2: No. 428 and 433 gave ‘errors’ in one of the capillary measurements and were not measured in duplicate with Eurolyser smart.

The number of technical errors was three (No. 428, 433 and 437); therefore the fraction of errors was less than 1,0%.

Conclusion
Eurolyser smart had three technical errors and did fulfil the quality goal of a maximum of 2,0% waste due to technical errors.

5.2. Analytical quality of the selected comparison method

5.2.1. *Internal quality control*

The internal quality controls for the three Cobas Integra instruments were measured daily using four concentrations: 9,1 mg/L, 25 mg/L, 76,6 mg/L and 81,5 mg/L. The CV% in the evaluation period for the internal control material was 2,1% for the low concentrations and 6,3% for the high concentrations (table 4). The analytical quality goal for the comparison method (CV <5%) was fulfilled for the lowest concentrations (9,1 mg/L and 25 mg/L), but not for the highest concentrations (76,6 and 81,5 mg/L).

5.2.2. *The precision of the comparison method*

Repeatability

Venous samples were collected according to table 6 for measurement on the comparison method. For determination of the repeatability the duplicate measurements of the samples always originate from two comparison instruments. The formula used for the calculation of repeatability (formula 2), and the assumption for using it, is shown in attachment 4. The repeatability of the comparison method is shown in table 7. Raw data is shown in attachment 5.

Table 7. Repeatability of Cobas Integra, calculated from duplicate measurements originating from two instruments

Level	Comparison method interval (mg/L)	n	Excluded results	Comparison method mean (mg/L)	CV (95% CI) (%)
Low	1,8 — 27,4	33	0	16,7	2,1 (1,7 — 2,8)
Medium	27,5 — 41,1	34	0	35,6	1,4 (1,2 — 1,9)
High	41,7 — 281	33	0	69,7	2,0 (1,6 — 2,6)
All	1,8 — 281	100	0	40,6	1,8 (1,5 — 2,0)

Discussion

The calculated CV values (table 7) are measures of imprecision. However, the 'repeatability' is not just 'repeatability' because the duplicate measurements always originate from two different Cobas Integra 800 instruments.

The lowest internal control material with the concentration 9,1 mg/L do not represent the low CRP concentrations of the evaluation. The quality goal for the comparison method was a CV <3,0%. The comparison method fulfils this goal.

Conclusion

As seen in table 7, the three instruments used for the comparison method measure with good agreement for CRP concentrations between 1,78 and 281 mg/L. A 'repeatability' of 1,8% of the combination of two and two Integra instruments fulfils the goal for CV <3,0% for the comparison method using venous serum samples. The CV% is better than the CV% obtained with control materials (Table 4).

5.2.3. *The trueness of the comparison method*

During the period from November 2011 to September 2012 the comparison method showed a bias of −3,0% for CRP concentrations above 26 mg/L in the external quality control program from DEKS. The program presents results both for "Turbidimetric methods" and for "all methods". The bias is calculated against the "Turbidimetric methods".

5.3. Analytical quality of Eurolyser smart CRP in a hospital laboratory

5.3.1. *External quality control*

It is possible to analyse external quality control samples on Eurolyser smart CRP; however external quality control was not part of the evaluation.

5.3.2. *Internal quality control*

The two levels of control material were measured in duplicate each evaluation day.
The reproducibility of Eurolyser smart CRP is shown in table 8 and raw data is shown in attachment 6.

Table 8. Imprecision of Eurolyser smart CRP with control materials in the hospital laboratory

Control	n	Mean CRP (mg/L)	Reproducibility CV%
ST1000 control low	40	9,7	7,9
ST1000 control high	40	75,5	3,7

Discussion

The CV achieved with the control materials was 7,9% and 3,7% for the ST1000 control low and ST1000 control high, respectively. The quality goal for imprecision, a CV less than 10,0% was achieved with both control materials.

Conclusion

These results show that the controls can be used to check the imprecision of the Eurolyser smart CRP measurements.

5.3.3. *Comparison of the 1st and 2nd measurement*

The two venous EDTA whole blood samples were taken from the same tube for measurements on Eurolyser smart CRP. The results were checked to meet the assumption for using formula 2 in attachment 4. There were no systematic differences pointed out between the paired measurements (data not shown).

5.3.4. *The precision of Eurolyser smart CRP*

Repeatability under standardised and optimal measuring conditions in a hospital laboratory was obtained with venous EDTA whole blood samples (table 9) measured in duplicates on the Eurolyser smart CRP. The formula used for the calculation of repeatability (formula 2), and the assumption for using it, is shown in attachment 4. Repeatability was calculated for three subgroups of CRP-values: Low (n=33), Medium (n=34) and High CRP-values (n=33). The three groups were chosen according to their concentration with the comparison method.

Table 9. Repeatability of Eurolyser smart CRP with venous EDTA whole blood samples in the hospital laboratory

Level	Comparison method mean and (interval) (mg/L)	n	Excluded results	Eurolyser smart CRP CRP mean (mg/L)	CV (95% CI) (%)
Low	16,7 (1,8 — 27,4)	33*	1	17,5	6,7 (5,4 — 8,9)
Medium	35,6 (27,5 — 41,1)	34	0	37,6	4,1 (3,4 — 5,4)
High	69,7 (41,7 — 281)	33**	1	69,7	3,3 (2,7 — 4,4)
All	40,6 (1,8 — 281)	100	2	41,2	4,9 (4,3 — 5,7)

*one result was lower than 2,0 mg/L on Eurolyser smart CRP and the comparison method **one result was 281,2 mg/L on the comparison method and >240 mg/L in Eurolyser smart. The given numbers of results (n) are counted before the exclusions. Mean and CV are calculated after the exclusions.

Discussion

One CRP result was lower than 2,0 mg/L on Eurolyser smart and 1,8 mg/L on the comparison method) and one result was 281,2 mg/L on the comparison method and >240 mg/L in Eurolyser smart. These two sample results are considered as correct; however the results are not included in the calculations in table 9. The calculated CV-values in table 9 are measures of repeatability. For the CRP concentration interval Low, Medium, and High the repeatability CV was 6,7%, 4,1%, and 3,3% with venous EDTA samples, respectively. For all concentrations and CI, the repeatability CV fulfilled the quality goal of ≤10,0%.

The results <5,0 mg/L and > 240 mg/L are shown in attachment 7.

Conclusion

The Eurolyser smart CRP system can obtain a CV ≤10,0% for both genuine samples and the ST1000 control low and high under optimal and standardised conditions.

5.3.5. *The trueness of Eurolyser smart CRP*

The mean deviation of the Eurolyser smart CRP results from the comparison method (bias) was calculated from the results achieved by a chemist with three lots of test cuvettes on one Eurolyser smart instrument. The results are sorted and divided into three CRP levels according to the mean results on the comparison method. The trueness of Eurolyser smart CRP is shown in table 10.

Table 10. Trueness of Eurolyser smart with venous whole blood samples in the hospital laboratory

Level	Comparison method mean and (interval) (mg/L)	n	Excluded results	Eurolyser smart CRP mean (mg/L)	Bias (95% CI) (%)
Low	16,7 (1,8 — 27,4)	33*	1	17,5	−4,4 ((−7,4) – (−1,4))
Medium	35,6 (27,5 — 41,1)	34	0	37,6	+5,5 ((+2,9) – (+8,2))
High	69,7 (41,7 — 280)	33**	1	69,7	+9,6 ((+5,6) – (13,5))
All	40,6 (1,8 — 280)	100	2	41,2	No calculation

*one result was lower than 2,0 mg/L on Eurolyser smart CRP and 1,78 mg/L on the comparison method **one result was 281,2 mg/L on the comparison method and >240 mg/L in Eurolyser smart. It is not possible to calculate the results "<2 mg/L" or ">240 mg/L". The given numbers of results (n) are counted before the exclusions. Mean and CV are calculated after the exclusions. Bias for 'all' is not calculated, since the bias varies significantly.

Discussion

One result was lower than <2,0 mg/L on Eurolyser smart and 1,8 mg/L on the comparison method) and one result was 281,2 mg/L on the comparison method and >240 mg/L with Eurolyser smart CRP. These two sample results are considered correct; however the results are not included in the calculations in table 10 since it is not possible to calculate the results "<2 mg/L" and ">240 mg/L".

The Eurolyser smart CRP results had a negative bias (−4,4%) at low concentrations and positive bias (+9,6%) at high concentrations. The bias for the results below 27 mg/L was significantly lower than the bias for the high concentrations. There was no quality goal for trueness in the evaluation. In case of a high bias the quality goals for accuracy are more difficult to achieve.

5.3.6. *The accuracy of Eurolyser smart CRP*

To evaluate the accuracy of the CRP results on Eurolyser smart, the agreement between Eurolyser smart CRP and the comparison method is illustrated in two accuracy plots. The plots show the deviation of single measurement results on Eurolyser smart CRP from the true value (mean result of the comparison method). They give a picture of both random and systematic deviation, thus reflecting the total measuring error on Eurolyser smart. Only the results from the first measurements of the duplicates on Eurolyser smart are shown in the figures.

The accuracy of Eurolyser smart CRP, with venous EDTA samples and three lots of test cuvettes, under standardised and optimal measuring conditions is shown in figure 2. The accuracy of Eurolyser smart, as measured with serum sample and the corresponding EDTA sample is shown in figure 3.

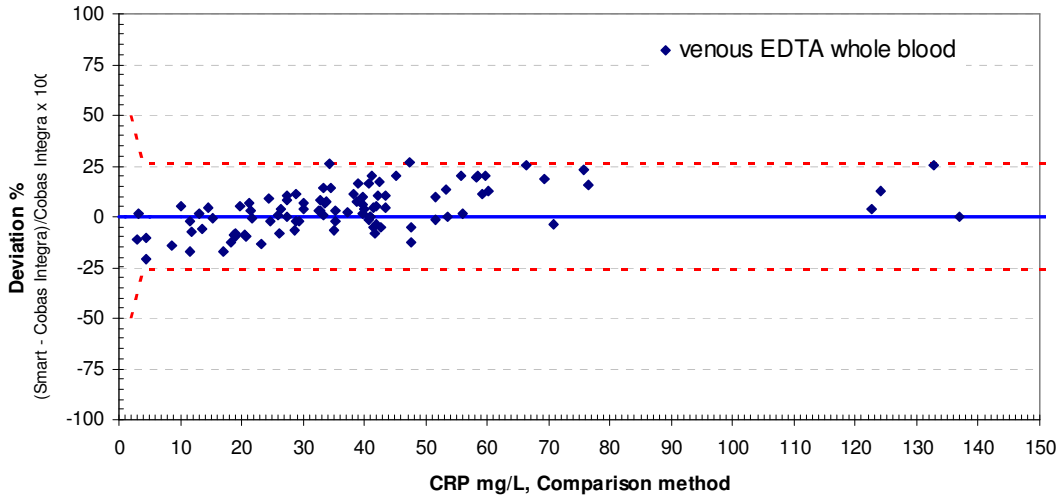

Figure 2. Accuracy of Eurolyser smart CRP in the hospital laboratory evaluation. The x-axis represents the mean serum CRP result of the comparison method. The y-axis shows the difference between the first measurement on Eurolyser smart CRP and the mean result of the comparison method. The stippled lines represent quality goal limits ±1mg/L or allowable deviation of 26%, n = 100, however, the two results <2,0 mg/L and >240 with Eurolyser smart CRP are not visualised.

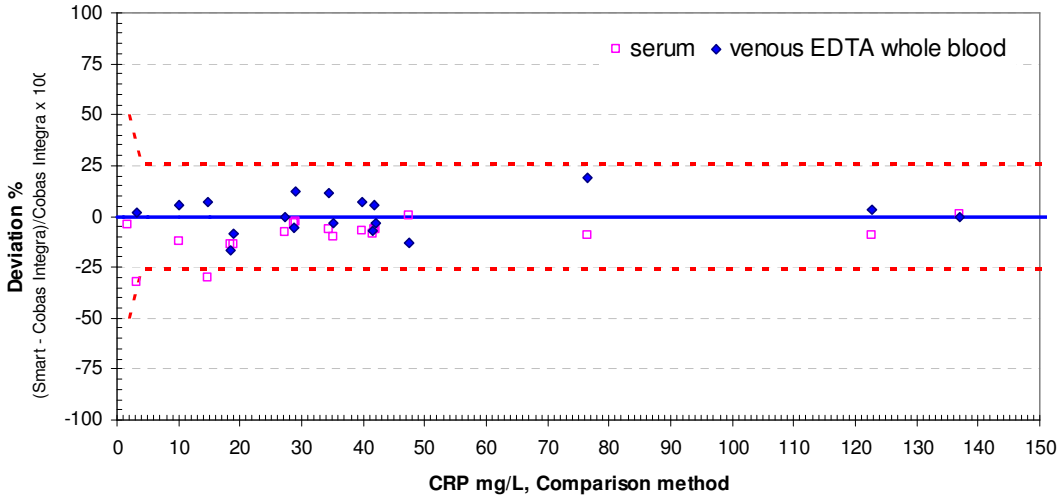

Figure 3. Accuracy of Eurolyser smart CRP in a hospital laboratory. The x-axis represents the mean serum CRP result of the comparison method. The y-axis shows the difference between the first measurement on Eurolyser smart CRP and the mean result of the comparison method. From each patient there is one result from a serum sample and one result from an EDTA whole blood sample. The stippled lines represent quality goal limits ±1mg/L or allowable deviation of 26%, n=20, however, the two results <2,0 mg/L and >240 with Eurolyser smart CRP are not visualised.

Discussion

Figure 2 demonstrates that the Eurolyser smart CRP results with venous EDTA whole blood samples show good agreement with the comparison method. Two Eurolyser smart CRP results, <2,0 mg/L and >240 mg/L, which are not shown in the figure, are included in the following

calculation. 98 out of 100 results (98%) were inside the limits for the allowable deviation. Figure 3 shows the Eurolyser smart CRP results for 20 patients. For each patient both the result from a serum sample and the result from a venous whole blood EDTA sample are shown. Two Eurolyser smart CRP results, <2,0 mg/L and >240 mg/L, which are not shown in the figure, are included in the following calculation. 19 of 20 (95%) serum results were inside the limits for the allowable deviation. 20 of 20 (100%) venous whole blood EDTA results were inside the limits for the allowable deviation. After these results had been assessed, it was agreed to continue the evaluation using only venous whole blood EDTA samples.

Conclusion
The 100 Eurolyser smart CRP results obtained with venous whole blood EDTA samples in the hospital laboratory fulfil the accuracy quality goals. The results from serum samples also fulfilled the quality goal.

5.3.7. *Variation between three lots of cuvettes – Influence of lot numbers*
No difference in bias between the lots was seen in the evaluation. Data not shown.

5.4. Analytical quality of Eurolyser smart CRP in primary health care centres

5.4.1. *Internal quality control*
The two control materials low and high were measured each evaluation day.
The reproducibility of the results is shown in table 11 and raw data is shown in attachment 8.

Table 11. Internal quality control in two primary care centres

	Primary health care centre 1			Primary health care centre 2		
Control	**n**	**Mean CRP (mg/L)**	**Reproducibility CV (%)**	**n**	**Mean CRP (mg/L)**	**Reproducibility CV (%)**
ST1000 control low	28	9,7	23,1	18	11,3	25,4
ST1000 control high	32	74,5	25,7	21	79,1	21,0

Discussion
In Primary health care centre 1 two experienced biomedical laboratory scientists conducted the evaluation. They wrote “nothing unusual to note” after the sampling of control material in all cases except one, where the comment was “unable to determine whether the material was sucked up”. If this value (9,8 mg/L) is omitted, the CV for the high level was 20,0%. Primary health care centre 2 had “nothing unusual to note” to the control measurements. All four evaluators were very concerned about the control results of the evaluation. They had no explanations for the results except that the controls had no colour and it was hard to know if the correct volume was used. The CV obtained with the control materials was >20,0% in both primary health care centres. If Burnett’s outlier test, truncated results [13] was used, there would have been a total of five outliers. The CV% for the low control after exclusion of an outlier would be 20,5 (n=45) and the CV% for the high control material after four truncated exclusions was 11,7 (n=49). Thus, the quality goal for imprecision, a CV less than 10,0% was not obtained for the control materials.

Conclusion
Reproducibility with the control materials in two concentrations at the two primary health care centres was poor. The control materials were not useful in the primary health care centres with CV ≥20% or five percentages of outliers.

5.4.2. *The precision of Eurolyser smart CRP*

Repeatability in two primary health care centres was obtained with capillary samples (table 12). Repeatability was calculated for two subgroups of the CRP concentrations: low and high. The two groups were chosen according to the concentration of results with the comparison method.

Table 12. Repeatability of Eurolyser smart CRP with capillary patient samples in the primary health care centres

Level	Comparison method (interval) (mg/L)	n	Excluded results	Eurolyser smart CRP mean (mg/L)	CV (95% CI) (%)
Primary health care centre 1					
Low	(0,3 — 13,5)	22*	7	9,0	8,3 (6,1 — 12,8)
High	(14,3 — 148)	20	0	37,3	6,7 (5,1 — 9,6)
All	(0,3 — 148)	42	7	23,8	7,4 (6,0 — 9,7)
Primary health care centre 2					
Low	(0,3 — 9,0)	24*	9	4,3	15,4 (11,3 — 24,3)
High	(9,8 — 109)	20**	3	33,0	8,6 (6,5 — 12,9)
All	(0,3 — 109)	44	12	20,9	12,1(9,7 — 16,2)
Primary health care centre 1+2					
	(>3,17 — 148)	62		24,3	8,0 (6,8 — 9,7)

*It is not possible to calculate the results "<2 mg/L" on Eurolyser smart and results "<1,0 mg/L" on the comparison method. **Two results were not duplicate measurements on Eurolyser smart CRP (No. 428 and 433) and one sample was an outlier (No. 412). The given numbers of results (n) are counted before the exclusions. Mean, CV and CV for "all" are calculated after the exclusions.

Discussion
According to the protocol, at least 30 of 40 results from the primary health care centres should have CRP-concentrations >5,0 mg/L, since low mean results and high standard deviation for mathematically reasons (CV%=SD/mean × 100) gives high CV%. The distribution in primary health care centre 1 fulfilled this criterion with 10 results lower than 5,0 mg/L. Of these, seven had a concentration of <2,0 mg/L in both Eurolyser smart CRP and the comparison method. 18 out of 44 results (41%) from primary health care centre 2 were below 5,0 mg/L.
The calculated CV values are measures of repeatability. For the capillary sample results >14,3 mg/L, the repeatability CV% fulfilled the goal of <10,0% in primary health care centre 1. For the CRP concentration intervals between 0,3 and 13,5 mg/L in primary health care centre 1 and the

CRP concentrations between 9,8 and 109 mg/L in primary health care centre 2, the repeatability CVs were below 10,0% with capillary samples while the upper limit of the CIs were above 10,0%. The repeatability CVs for these capillary sample results are inconclusive on fulfilling the quality goal, but most likely the quality goal is fulfilled. Five results in the concentration 2,64 to 3,17 mg/L are the cause of the high CV% in the low concentration level in primary health care 2. The five results deviated less than ±1mg/L from the comparison method. All results <5,0 mg/L are shown in attachment 9.
The distribution of results is crucial for achieving the quality goal in this type of testing. Therefore, it was examined to what concentration the quality goal was met by general practitioners. CV was 8,0% (95% CI 6,8 – 9,7), n=62, for capillary CRP concentrations >3,17 mg/L in the two primary health care centres.
With control materials in two concentrations at the two primary health care centres the imprecision was ≥20% and not as good as the repeatability with genuine patient samples.

Conclusion
The Eurolyser smart instrument can obtain a CV% ≤10,0% for capillary blood CRP concentrations >3,17 mg/L. For lower concentrations the CV is higher than 10%.

5.4.3. *The trueness of Eurolyser smart CRP in primary health care*

The mean deviation of Eurolyser smart CRP from the comparison method (bias) was calculated from the results achieved by two nurses and two biomedical laboratory scientists with three lots of test cuvettes on two Eurolyser smart instruments. The results were sorted and divided into two CRP levels according to the mean concentration of the comparison method. The trueness of Eurolyser smart CRP is shown in table 13.

Table 13. Trueness of Eurolyser smart CRP with capillary patient samples in the primary health care centres

Level	Comparison method mean and (interval) (mg/L)	n	Excluded results	Eurolyser smart CRP mean (mg/L)	Bias (95% CI) (%)
Primary health care centre 1					
Low	10,0 (0,3 — 13,5)	22*	7	9,0	−11,2 ((−14,7) – (−7,8))
High	35,5 (14,3 — 148)	20**	1	38,6	−8,6 ((−12,9) – (−4,3))
All	26,0 (0,3 — 148)	42	8	23,8	−9,8 ((−12,5) – (−6,9))
Primary health care centre 2					
Low	5,2 (0,3 — 9,0)	24***	10	4,4	−17 ((−24) – (−9,6))
High	34,1 (9,7 — 109)	20¤	3	34,1	−4,8 ((−9,9) – (+0,3))
All	21,0 (0,3 — 109)	44	13	20,7	−10,3 ((−15,1) – (−5,6))

* It is not possible to calculate the results "<2 mg/L" on Eurolyser smart and results "<1,0 mg/L" on the comparison method. **No comparison method result (No 313). *** 9 results "<2mg/L" and one technical error (No. 437). ¤Two results were not duplicate measurements on Eurolyser smart CRP (No. 428 and 433); one sample was an outlier (No.

412). The given numbers of results (n) are counted before the exclusion of outliers. Mean and bias are calculated after the exclusions.

Discussion

CRP results "<2,0 mg/L" on Eurolyser smart are not used for calculation of bias. Results >2 mg/L that deviate less than ±1 mg/L from the comparison method are considered correct, but in table 13 they are calculated and for the primary health care centres the result is a very negative bias for the low concentrations.

The distribution of CRP-concentrations in the hospital laboratory and in the two primary health care centres is not alike. The distributions of results were lower in the primary health care centres than in the selected samples from the hospital laboratory. In the hospital laboratory the deviation when compared with Cobas Integra was negative in concentrations <27 mg/L and positive for higher concentrations.

In the primary health care centres the deviation when compared with Cobas Integra was negative for all concentrations. The lowest CRP concentrations had the highest negative deviations in percent. There was no separate goal for bias in the evaluation. In case of a high bias the quality goals for accuracy are more difficult to achieve.

5.4.4. *The accuracy of Eurolyser smart CRP in primary health care*

The agreement between Eurolyser smart CRP and the comparison method is illustrated in an accuracy plot. The plot shows the deviation of single measurement results on Eurolyser smart CRP from the true value. It gives a picture of both random and systematic deviation, reflecting the total measuring error on Eurolyser smart CRP. The accuracy is demonstrated for the first measurements of the paired results, only. The accuracy of Eurolyser smart CRP, with capillary samples and three lots of test cuvettes is shown in figure 4.

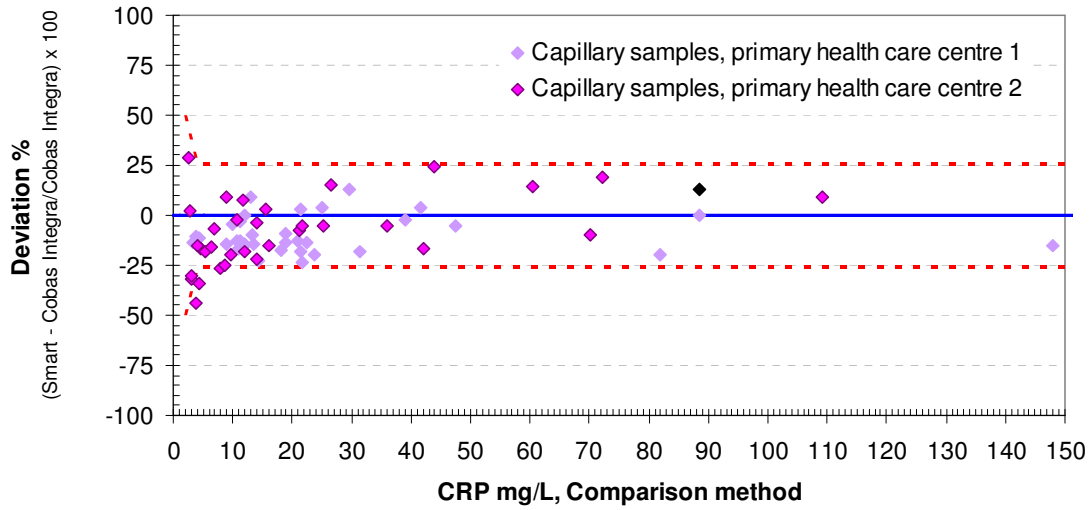

Figure 4. Accuracy of Eurolyser smart CRP (three lots of cuvettes) in two primary health care centres. The x-axis represents the mean serum CRP result of the comparison method. The y-axis shows the difference between the first measurement on Eurolyser smart and the mean result of the comparison method. Stippled lines represent quality goal limits ±1mg/L or allowable deviation of 26%, n=84, however, the 16 results <2,0 mg/L with Eurolyser smart are not visualised ♦dark diamond is an outlier

Discussion
More than halves of the CRP results measured in primary health care centres are within normal CRP concentrations. Therefore it is important to demonstrate, that an instrument for CRP-measurements are able to measure the low CRP-concentrations correct. Figure 4 demonstrates that the Eurolyser smart CRP results with venous EDTA whole blood samples in primary health care centres show good agreement with the comparison method. The 16 Eurolyser smart CRP results <2,0 mg/L are not shown in the figure, the corresponding comparison method results were between 0,3 and 2,05 mg/L and the 16 results are considered correct. Additional three low results (see attachment 9) deviate more than 26%; however the deviation is less than ±1 mg/L and they are therefore fulfilling the quality goal. In total 81 out of 84 results (96,4%) were inside the limits for the allowable deviation.

Conclusion
Figure 4 demonstrates that the Eurolyser smart CRP results with capillary samples in the primary health care centres fulfil the quality goal of a deviation less than ±1mg/L or 26% from the comparison method. 81 out of 84 results (96,4%) were inside the limits for the allowable deviation.

5.5. Evaluation of user-friendliness

5.5.1. *Questionnaire to the evaluators*

The most important response regarding user-friendliness comes from the users themselves. The end-users often emphasize other aspects than those pointed out by more extensively trained laboratory personnel.

At the end of the evaluation period, each user filled in a questionnaire about the user-friendliness of the instrument. The questionnaire is divided into four sub-areas:

- Rating of the information in the manual and insert
- Rating of time factors for the measurement and preparation
- Rating of performing internal and external quality control
- Rating of operation facilities. Is the system easy to handle?

The questionnaire and the expressed opinions are presented in Table 14 to 17. The first column shows what is up for consideration. The second column shows the rating by the individual users at the evaluation sites. The third to fifth column show the rating options. Coloured frames mark the cells with the overall ratings from all evaluating sites. The last row in each table summarises the total rating in the table. The total rating is an overall assessment of the described property, and not necessarily the arithmetic mean of the rating in the rows. Consequently, a single poor rating can justify an overall poor rating, if this property seriously influences on the user-friendliness of the system.
Unsatisfactory and intermediate ratings will be marked with an asterisk and explained below the table.

Comment

In this evaluation, the user-friendliness was assessed by the two nurses in one primary health care centre and two biomedical laboratory scientist in the other primary health care centre.

Table 14 Rating of the information in the manual / insert

Information in the manual / insert	Ratings	Red	Yellow	Green
General impression	G, G	Unsatisfactory	Intermediate	Satisfactory
Table of contents	G, G	Unsatisfactory	Intermediate	Satisfactory
Preparations / Pre-analytic procedure	G, G	Unsatisfactory	Intermediate	Satisfactory
Specimen collection	G, G	Unsatisfactory	Intermediate	Satisfactory
Measurement / Reading	G, G	Unsatisfactory	Intermediate	Satisfactory
Measurement principle	G, G	Unsatisfactory	Intermediate	Satisfactory
Sources of error	G, G	Unsatisfactory	Intermediate	Satisfactory
Fault-tracing / Troubleshooting	G, G	Unsatisfactory	Intermediate	Satisfactory
Keyword index	R*, G**	Unsatisfactory	Intermediate	Satisfactory
Readability / Clarity of presentation	G, G	Unsatisfactory	Intermediate	Satisfactory
Available insert in Danish, Norwegian, Swedish	G, G	Unsatisfactory	Intermediate	Satisfactory
Others comments about information in the manual / insert (please specify)		Unsatisfactory	Intermediate	Satisfactory
Rating for the information in the manual				Satisfactory

* There is no index in the quick manual. **Primary health care centre 2 wrote: have only used ‘quick’ information in Danish.

Table 15. Rating of time factors

Time factors	Ratings	Red	Yellow	Green
Time for preparations / Pre-analytical time	G, G	>10 min	6 to 10 min.	<6 min.
Analytic time	G, G	>20 min	10 to 20 min.	<10 min.
Required training time	G , G	>8 hours	2 to 8 hours	<2 hours
Stability of test, unopened package	-, -	<3 months	3 to 5 months	>5 months
Stability of test, opened package	-, -	<14 days	14 to30 days	>30 days
Other comments about time factors (please specify)		Unsatisfactory	Intermediate	Satisfactory
Rating of time factors				Satisfactory

Table 16. Rating of quality control possibilities

Quality control	Ratings*	Red	Yellow	Green
Internal quality control	Y* , -	Un-satisfactory	Intermediate	Satisfactory
External quality control	- , -	Un-satisfactory	Intermediate	Satisfactory
Stability of quality control material, unopened	G , -	<3 months	3 to5 months	>5 months
Stability of quality control material, opened	G, -	≤1 day	2 to 6 days	>6 days or disposable
Storage conditions for quality control materials, unopened	Y, -	–20°C	+2 to +8°C	+15 to +30°C
Storage conditions for quality control materials, opened	Y, -	–20°C	+2 to +8°C	+15 to +30°C
Usefulness of the quality control	R**, -	Unsatisfactory	Intermediate	Satisfactory
Other comments about quality control (please specify)		Unsatisfactory	Intermediate	Satisfactory
Rating of quality control			Intermediate	

*The internal quality control material is impossible to see, when it is sucked up. Label on the control material was not attached to the bottle. **Primary health care centre 2 was unhappy with the control material results during the evaluation and contacted SKUP. They had 'no further' comments after the evaluation.

Table 17. Rating of the operation facilities

Operation facilities	Ratings	Red	Yellow	Green
To prepare the test / instrument	G, G	Unsatisfactory	Intermediate	Satisfactory
To prepare the sample	G, G	Unsatisfactory	Intermediate	Satisfactory
Application of specimen	G, G	Unsatisfactory	Intermediate	Satisfactory
Specimen volume	G, G	Unsatisfactory	Intermediate	Satisfactory
Number of procedure step	G, G	Unsatisfactory	Intermediate	Satisfactory
Instrument / test design	G, G	Unsatisfactory	Intermediate	Satisfactory
Reading of the test result	G, G	Difficult	Intermediate	Easy
Sources of errors	G, G	Unsatisfactory	Intermediate	Satisfactory
Cleaning / Maintenance	G, G	Unsatisfactory	Intermediate	Satisfactory
Hygiene, when using the test	G, G	Unsatisfactory	Intermediate	Satisfactory
Storage conditions for tests, unopened package	Y, Y	–20°C	+2 to +8°C	+15 to +30°C
Storage conditions for tests, opened package	Y, Y	–20°C	+2 to +8°C	+15 to +30°C
Environmental aspects: waste handling*	Y, Y	Special precautions	Sorted waste	No precautions
Intended users	G, G	Biomedical scientists	Laboratory experienced	GP personnel or patients
Size and weight of package	Y**, G	Unsatisfactory	Intermediate	Satisfactory
Other comments:	-, G***	Unsatisfactory		Satisfactory
Rating of operation				Satisfactory

*both centres threw the used cuvettes in 'sorted waste' because they contain reagent and biological material.
** Reagents take relatively much space in a small refrigerator. *** 'Easy to work with'.

5.5.2. *Rating of the user-friendliness*

Discussion

The evaluators agreed that the instrument is easy to work with. Both the nurses and the biomedical laboratory scientists in the primary health care centres had difficulties with the control material and the control material results.

6. References

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7. Attachments

Attachment 1 The organisation of SKUP

Scandinavian evaluation of laboratory equipment for primary health care, *SKUP*, is a co-operative commitment of Noklus [1] in Norway, DAK-E[2] in Denmark, and Equalis[3] in Sweden. SKUP was established in 1997 at the initiative of laboratory medicine professionals in the three countries. SKUP is led by a Scandinavian *steering committee* and the secretariat is located at Noklus in Bergen, Norway.

The purpose of SKUP is to improve the quality of near patient testing in Scandinavia by providing objective and supplier-independent information on analytical quality and user-friendliness of laboratory equipment. This information is generated by organising SKUP *evaluations*.

SKUP offers manufacturers and suppliers evaluations of equipment for primary health care and also of devices for self-monitoring. Provided the equipment is not launched onto the Scandinavian market, it is possible to have a confidential pre-marketing evaluation. The company requesting the evaluation pays the actual testing costs and receives in return an impartial evaluation.

There are *general guidelines* for all SKUP evaluations and for each evaluation a specific *SKUP protocol* is worked out in co-operation with the manufacturer or their representatives. SKUP signs *contracts* with the requesting company and the evaluating laboratories. A *complete evaluation* requires one part performed by experienced laboratory personnel as well as one part performed by the intended users.

Each evaluation is presented in a *SKUP report* to which a unique *report code* is assigned. The code is composed of the acronym SKUP, the year and a serial number. If suppliers use the SKUP name in marketing, they have to refer to www.skup.nu and to the report code in question. For this purpose the company can use a logotype available from SKUP containing the report code.

SKUP reports are published at www.skup.nu.

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[1] Noklus (Norwegian Quality Improvement of Primary Care Laboratories) is an organisation founded by Kvalitetsforbedringsfond III (Quality Improvement Fund III), which is established by The Norwegian Medical Association and the Norwegian Government. Noklus is professionally linked to “Seksjon for Allmennmedisin” (Section for General Practice) at the University of Bergen, Norway.

[2] SKUP in Denmark is placed in Hillerød Hospital. SKUP in Denmark reports to DAK-E (Danish Quality Unit of General Practice), an organisation that is supported by KIF (Foundation for Quality and Informatics) and Faglig udvalg (Professional Committee), which both are supported by DR (The Danish Regions) and PLO (The Organisation of General Practitioners in Denmark).

[3] Equalis AB (External quality assurance in laboratory medicine in Sweden) is a limited company in Uppsala, Sweden, owned by “Sveriges Kommuner och Landsting” (Swedish Association of Local Authorities and Regions), “Svenska Läkaresällskapet” (Swedish Society of Medicine) and IBL (Swedish Institute of Biomedical Laboratory Science).

Attachment 2 Facts about the Eurolyser smart System

Parts of this form are filled in by HaemoMedtec.

Table 1. Basic facts

Name of the measurement system:	Eurolyser smart Laboratory Photometer 700/340
Dimensions and weight:	Width: 145 mm Depth: 140 mm Height: 260 mm Weight: 3,5 kg
Components of the measurement system:	Eurolyser smart Photometer; Printer (Seiko DPU-414); Barcodereader (Datalogic Touch 65)
Measurand:	CRP
Sample material:	Freshly drawn fingertip blood or serum
Sample volume:	5 µL
Measuring principle:	Kinetic determination of the concentration of CRP by photometric measurement at 700 nm of antigen-antibody reaction between antibodies to human CRP bound to polystyrene particles and CRP present in the sample
Traceability:	Certified Reference Material (CRM) 470
Calibration:	Against CRM470 standards
Measuring range:	Whole blood: 2,0 – 240,0 mg/L (HCT pending) Serum/plasma: 1,0 – 120,0 mg/L
Linearity:	Whole blood 240 mg/L, serum 120 mg/L
Measurement duration:	3 minutes
Operating conditions:	A dry, clean, level surface. Avoid direct sunlight.
Electrical power supply:	Adapter 12 V DC
Recommended regular maintenance:	None
Package contents:	Eurolyser smart Laboratory Photometer; Mains adapter (12 V DC 3A/40 W); Power cable; Users Manual
Necessary equipment not included in the package:	None

Table 2. Post analytical traceability

Is input of patient identification possible?	Yes
Is input of operator identification possible?	No (in an upcoming redesign version starting 04/2012: Yes)
Can the instrument be connected to a bar-code reader?	Yes
Can the instrument be connected to a printer?	Yes
What can be printed?	Name, ID, Sex, Sample Material, HCT-value (input), Measurement Result, Range, Time, Date
Can the instrument be connected to a PC?	Yes
Can the instrument communicate with LIS (Laboratory Information System)? If yes, is the communication bidirectional?	Yes Monodirectional
What is the storage capacity of the instrument and what is stored in the instrument?	100 patient- and control results
Is it possible to trace/search for measurement results?	No

Table 3. Facts about the reagent/test strips/test cassettes

Name of the reagent/test strips/test cassettes:	smart CRP Test with integrated sample collection device
Stability in unopened sealed vial:	Up to expiration date (typically 12 months)
Stability in opened vial:	Test to be performed within 1 day after opening cartridge
Package contents:	32 tests/pack and 1 RFID-card

Table 4. Quality control

Electronic self check:	Yes, built in
Recommended check materials and volume:	smart CRP Control Kit, 2 x 1 mL (high and low range)
Stability in unopened sealed vial:	Up to expiration date (typically 12 months)
Stability in opened vial:	If re-closed after opening, stable until expiration date (typically 12 months)
Package contents:	2 x 1 mL smart CRP Control Kit (high and low range)

Product information, Sampling

The instrument utilizes 5 µL sample material. The measuring range is 2-240 mg/L when using whole blood and 1-120 mg/L when using serum or plasma. The lids also serve as sample collectors. Below the test procedure is shown for capillary samples, but the procedure is similar when using venous samples.

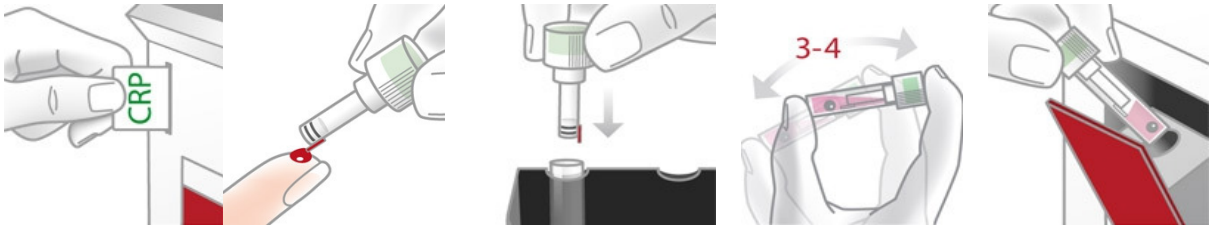

Figure 1: Test procedure for Eurolyser smart CRP.

Lot numbers used in the evaluation

Hospital: 411-1, 611-1, 911-1
Primary health care centre 1: 411-1, 911-1
Primary health care centre 2: 611-1, 911-1

Expiring dates between April and November 2012.

Attachment 3 Supplier and Marketing information

Manufacturer:	EUROLyser Diagnostica GmbH, Bayernstraße 11a, 5020 Salzburg, Austria
Retailers in Scandinavia:	Denmark: HaemoMedtec ApS, Granlyvej 4, 6920 Videbæk Norway: Sweden:
In which countries is the system marketed:	Globally ☐ Scandinavia ☐ Europe ☐
Date for start of marketing the system in Scandinavia:	Denmark: June 2009 Norway: ? Sweden:?
Date for CE-marking:	04.05.2008
In which Scandinavian languages is the manual available:	User Manual: None Quick Guide: Danish

Attachment 4 Statistical expressions and calculations

This chapter with standardised text deals with the statistical expressions and calculations used by SKUP. The chapter is a short extract of the comprehensive SKUP-document "Statistics in SKUP reports", presented at www.skup.nu**,** under the option "The SKUP evaluation". The statistical calculations will change according to the type of evaluation. The descriptions in section 4.2 are valid for evaluations of quantitative methods with results on the ratio scale.

Statistical terms and expressions

The definitions in this section come from the ISO/IEC Guide 99; International Vocabulary of Metrology, VIM [a].

Precision

Definition: Precision is the closeness of agreement between measured quantity values obtained by replicate measurements on the same or similar objects under stated specified conditions.

Precision is measured as *imprecision*. Precision is descriptive in general terms (good, poor e.g.), whereas the imprecision is expressed by means of the standard deviation (SD) or coefficient of variation (CV). SD is reported in the same unit as the analytical result. CV is usually reported in percent.

To be able to interpret an assessment of precision, the precision conditions must be defined.
Repeatability is the precision of consecutive measurements of the same component carried out under identical measuring conditions (within the measuring series).
Reproducibility is the precision of discontinuous measurements of the same component carried out under changing measuring conditions over time.

Trueness

Definition: Trueness is the closeness of agreement between the average of an infinite number of replicate measured quantity values and a reference quantity value.

Trueness is inversely related to systematic measurement error. Trueness is measured as *bias*. Trueness is descriptive in general terms (good, poor e.g.), whereas the bias is reported in the same unit as the analytical result or in percent.

Accuracy

Definition: Accuracy is the closeness of agreement between a measured quantity value and the true quantity value of a measurand.

Accuracy is not a quantity and cannot be expressed numerically. A measurement is said to be more accurate when it offers a smaller measurement error. Accuracy can be illustrated in a difference-plot. Accuracy is descriptive in general terms (good, poor e.g.).

a. ISO/IEC Guide 99:2007, International vocabulary of metrology – Basic and general concepts and associated terms, VIM, 3rd edition, JCGM 200:2008

Statistical calculations

Statistical outliers

The criterion promoted by Burnett [b] is used for the detection of outliers. The model takes into consideration the number of observations together with the statistical significance level for the test. The significance level is set to 5%. The segregation of outliers is made with repeated truncations, and all results are checked. Where the results are classified according to different concentration levels, the outlier-testing is carried out at each level separately. Statistical outliers are excluded from the calculations.

Calculation of imprecision

The precision of the field method is assessed by use of paired measurements of genuine patient sample material. The results are divided into three concentration levels, and the estimate of imprecision is calculated for each level separately, using the following formula [c,d]:

$$SD = \sqrt{\frac{\sum d^2}{2n}}$$

d = difference between two paired measurements
n = number of differences

(formula 1)

This formula is used when the standard deviation can be assumed reasonable constant across the concentration interval. If the coefficient of variation is more constant across the concentration interval, the following formula is preferred:

$$CV = \sqrt{\frac{\sum (d/m)^2}{2n}}$$

m = mean of paired measurements

(formula 2)

The two formulas are based on the differences between paired measurements. The calculated standard deviation or CV is still a measure of the imprecision of single values. The assumption for using the formulas is that there is no systematic difference between the 1st and the 2nd measurement of the pairs.

Calculation of bias

The mean deviation (bias) at different concentration levels is calculated based on results achieved under optimal measuring conditions. A paired t-test is used with the mean values of the duplicate results on the comparison method and the mean values of the duplicate results on the field method. The mean difference is shown with a 95% confidence interval.

Assessment of accuracy

The agreement between the field method and the comparison method is illustrated in a difference-plot. The x-axis represents the mean value of the duplicate results on the comparison method. The y-axis shows the difference between the first measurement on the field method and the mean value of the duplicate results on the comparison method. The number of results within the quality goal limits is counted and assessed.

b. Burnett RW, "*Accurate Estimation of Standard Deviations for Quantitative Methods Used in Clinical Chemistry*". Clinical Chemistry 1975; **21** (13): 1935 – 1938
c. Saunders, E. Tietz textbook of clinical chemistry and molecular diagnostics. 2006. Chapter 14, Linnet, K., Boyd, J. "*Selection and analytical evaluation of methods – with statistical techniques*", ISBN 0-7216-0189-8
d. Fraser, C.G, Biological variation: *From principles to practice*. 2006. Chapter 1 "*The Nature of Biological Variation*". AACC Press. ISBN 1-890883-49-2

Attachment 5 CRP results from the comparison method

Raw data, CRP results, Cobas Integra in a hospital laboratory

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Attachment 6 Internal quality control, Eurolyser smart, hospital laboratory

Raw data, Eurolyser smart CRP in a hospital laboratory

date	low1 mg/L	low2 mg/L	high1 mg/L	high2 mg/L
03-11-2011	10,4	9,9	80,4	75,4
03-11-2011	10,9	9,2	74,7	75,9
04-11-2011	10,0	9,8	73,9	78,7
08-11-2011	9,7	9,6	76,6	75,8
11-11-2011	9,7	10,1	76,6	81,0
28-11-2011	9,0	9,7	76,2	72,4
11-01-2012	10,1	9,9	74,8	75,3
23-01-2012	9,5	10,1	73,7	71,5
30-01-2012	9,5	9,5	74,1	73,7
31-01-2012	9,2	8,0	74,1	76,4
09-02-2012	11,5	10,7	74,9	74,9
13-02-2012	10,7	11,4	80,3	77,0
15-02-2012	9,6	11,1	76,7	78,2
16-02-2012	10,0	9,9	76,7	76,0
17-02-2012	9,4	9,4	75,7	75,8
20-02-2012	9,9	9,8	76,9	81,8
21-02-2012	9,4	9,1	74,7	75,0
23-02-2012	8,9	8,3	67,7	69,2
27-02-2012	9,1	8,3	73,6	73,3
02-03-2012	9,1	9,3	73,7	74,8
Mean CRP (mg/L)	**9,7**		**75,5**	
CV	**7,9%**		**3,7%**	

Attachment 7 Eurolyser smart CRP in a hospital laboratory

Raw data, Eurolyser smart CRP results from a hospital laboratory, concentrations <5 mg/L.

Eurolyser smart			Cobas Integra			
Eurolyser smart1 mg/L	Eurolyser smart2 mg/L	mean mg/L	First result Cobas integra mg/L	Second result Cobas integra mg/L	mean mg/L	comments
<2	<2	<2	1,82	1,73	1,78	
2,1	3,1	2,6	2,95	2,9	2,93	
3,3	3,3	3,3	3,19	3,31	3,25	
3,4	3,7	3,55	4,39	4,56	4,48	
4	4,1	4,05	4,5	4,54	4,52	

Results from Cobas integra 1: red background, Cobas integra 2: blue background

Attachment 8 Internal quality control Eurolyser smart in two primary health care centres

Raw data, Eurolyser smart CRP in two primary health care centres

Primary health care centre 1					Primary health care centre 2				
date	**low1 mg/L**	**low2 mg/L**	**high1 mg/L**	**high2 mg/L**	**date**	**low1 mg/L**	**low2 mg/L**	**high1 mg/L**	**high2 mg/L**
21-11-2011			70,0	68,5	15-02-2012			73,6	70,5
22-11-2011	8,6	9,8			27-02-2012			74,4	
23-11-2011			129,6	133,4	28-02-2012	11,5	11,0		
24-11-2011	10,5	9,9			01-03-2012			79,4	87,3
25-11-2011			75,6	75,0	02-03-2012	13,7	15,1		
28-11-2011	9,7	9,5			13-03-2012			73,4	74,6
30-11-2011	10,8	9,5			19-03-2012	10,3	11,4		
01-12-2011			73,8	73,2	19-04-2012	11,7	15,5		
06-12-2011			66,5	75,1	22-05-2012			76,7	94,1
07-12-2011	10,1	9,9			26-03-2012			81,4	79,5
08-12-2011			73,7	87,5	24-05-2012	10,5	12,1		
13-12-2011			69,0	75,2	25-06-2012			91,6	21,0
14-12-2011	9,9	9,6			21-08-2012	4,4			
15-12-2011			60,6	71,9	27-08-2012			100,6	106,0
20-12-2011			72,6	74,3	03-09-2012			76,5	86,9
21-12-2011	10,6	8,3			01-10-2012	8,8	10,1		
22-12-2011			74,7	73,2	26-09-2012			75,8	62,4
02-01-2012	9,0	9,7			04-10-2012	7,9			
03-01-2012			72,7	9,8	05-10-2012	13,3	14,6		
05-01-2012			77,4	76,5	11-10-2012			94,4	80,2
19-01-2012	10,6	8,7			12-10-2012	10,3	10,3		
24-01-2012			67,5	65,3					
26-01-2012			74,8	74,0					
31-01-2012	8,7	8,5							
13-02-2012	10,0	15,5							
20-02-2012	9,0	1,9							
27-02-2012			73,4	75,9					
05-03-2012	14,2	9,5							
07-03-2012			71,1	72,4					
13-03-2012	10,8	9,7							
Mean CRP									
(mg/L)	**9,7**		**74,5**			**11,3**		**79,1**	
CV%	**23,1**		**20,0 (25,7)**			**25,4**		**21,0**	

In Primary health care centre 1 two experienced Biomedical laboratory scientists performed the evaluation. They wrote “nothing unusual to notice” after the sampling in all cases except the 3rd of January, where the comment was “could not determine, if material was sucked up” If this value (9,8 mg/L) is excluded, the CV% for the high level is 20,0.

Primary health care centre 2 had “nothing unusual to notice” to the control measurements

Attachment 9 Eurolyser smart CRP in two primary health care centres

Eurolyser smart CRP results from two primary health care centres. Concentration <5 mg/L

Eurolyser smart			Cobas Integra			
Eurolyser smart1 mg/L	Eurolyser smart2 mg/L	mean mg/L	First result Cobas integra mg/L	Second result Cobas integra mg/L	mean mg/L	comments
<2	<2	<2	0,21	0,30	0,26 (<1,0)	
<2	<2	<2	0,20	0,38	0,29 (<1,0)	
<2	<2	<2	0,24	0,41	0,33 (<1,0)	
<2	<2	<2	0,50	0,44	0,47 (<1,0)	
<2	<2	<2	0,57		0,57 (<1,0)	
<2	<2	<2	0,59	0,76	0,68 (<1,0)	
<2	<2	<2	0,77	0,63	0,70 (<1,0)	
<2	<2	<2	0,65	0,79	0,72 (<1,0)	
<2	<2	<2	1,02	0,95	0,99 (<1,0)	
<2	<2	<2	1,36	1,33	1,35	
<2	<2	<2	1,43	1,42	1,43	
<2	<2	<2	1,50	1,75	1,63	
<2	<2	<2	1,83		1,83	
<2	<2	<2	1,90	1,80	1,85	
<2	<2	<2	1,90		1,90	
<2	<2	<2	1,96	2,13	2,05	
3,4	2,4	2,9	2,65	2,62	2,64	
2,9	2	2,45		2,83	2,83	
2,1	2,7	2,4	3,00	3,13	3,07	
						*Serum
1,3*	2,6**		3,16	3,07	3,12	**capillary blood
2,2	3,4	2,8	3,12	3,22	3,17	
2,9	2,3	2,6	3,29	3,41	3,35	
3,5	3,3	3,4	3,47	4,35	3,91	
2,2	2,3	2,25	3,94	3,94	3,94	>±1 mg/L
3,4	3	3,2	4,00		4,00	
3,8	3,7	3,75	4,22	4,38	4,30	
2,9	2,6	2,75	4,39		4,39	>±1 mg/L
3,9	3,9	3,9	4,69	4,68	4,69	

Results from Cobas integra 1: red background, Cobas integra 2: blue background and Cobas integra 3: white background. Grey background: no result.

Attachment 10 List of latest SKUP evaluations

Summaries and complete reports from the evaluations are found at www.skup.nu. In addition, SKUP reports are published at www.skup.dk, where they are rated according to the national Danish quality demands for near patient instruments used in primary health care. SKUP summaries are translated into Italian by Centre for Metrological Traceability in Laboratory Medicine (CIRME), and published at http://users.unimi.it/cirme. SKUP as an organisation has no responsibility for publications of SKUP results on these two web-sites.

SKUP evaluations from number 69 and further

Evaluation no.	**Component**	**Instrument/testkit**	**Producer**
SKUP/2012/92	CRP	Eurolyser smart	Eurolyser Diagnostica GmbH Salzburg, Austria
SKUP/2012/95	Glucose[1]	Mendor Discreet	Mendor Oy
SKUP/2012/94	Glucose[1]	Contour XT	Bayer Healthcare
SKUP/2011/93*	Glucose	Accu-Chek Performa	Roche Diagnostics
SKUP/2012/91	HbA1c	Quo-Test A1c	Quoient Diagnostics Ltd
SKUP/2011/90	CRP	*i*-Chroma	BodiTech Med. Inc.
SKUP/2010/89*	Glucose	FreeStyle Lite	Abbott Laboratories
SKUP/2010/88*	HbA1c	*Confidential*	
SKUP/2011/86	Glucose[1]	OneTouch Verio	LifeScan, Johnson & Johnson
SKUP/2011/84*	PT-INR	Simple Simon PT and MixxoCap	Zafena AB
SKUP/2010/83*	Glucose	*Confidential*	
SKUP/2010/82*	Glucose, protein, blood, leukocytes, nitrite	Medi-Test URYXXON Stick 10 urine test strip and URYXXON Relax urine analyser	Macherey-Nagel GmBH & Co. KG
SKUP/2010/81*	Glucose	mylife PURA	Bionime Corporation
SKUP/2010/80	PT (INR)	INRatio2	Alere Inc.
SKUP/2010/79*	Glucose, protein, blood, leukocytes, nitrite	CombiScreen 5SYS Plus urine test strip and CombiScan 100 urine analyser	Analyticon Biotechnologies AG
SKUP/2010/78	HbA1c	In2it	Bio-Rad
SKUP/2011/77	CRP	*Confidential*	
SKUP/2009/76*	HbA1c	*Confidential*	
SKUP/2009/75	Glucose	Contour	Bayer HealthCare
SKUP/2009/74	Glucose[1]	Accu-Chec Mobile	Roche Diagnostics
SKUP/2010/73	Leukocytes	HemoCue WBC	HemoCue AB
SKUP/2008/72	Glucose[1]	*Confidential*	
SKUP/2009/71	Glucose[1]	GlucoMen LX	A. Menarini Diagnostics
SKUP/2011/70*	CRP	smartCRP system	Eurolyser Diagnostica GmbH
SKUP/2008/69*	Strep A	Diaquick Strep A test	Dialab GmbH

*A report code followed by an asterisk indicates that the evaluation is not complete according to SKUP guidelines, since the part performed by the intended users was not included in the protocol, or the evaluation is a follow-up of a previous evaluation, or the evaluation is a special request from the supplier.

[1] Including a user-evaluation among diabetes patients

Attachment 11 List of previous SKUP evaluations for CRP

SKUP evaluations for CRP

Evaluation no.	**Component**	**Instrument/testkit**	**Producer**
SKUP/2012/92	CRP	Eurolyser smart	Eurolyser Diagnostica GmbH Salzburg, Austria
SKUP/2011/90	CRP	*i*-Chroma	BodiTech Med. Inc.
SKUP/2011/77	CRP	*Confidential*	
SKUP/2011/70*	CRP	smart CRP system	Eurolyser Diagnostica GmbH
SKUP/2008/61	CRP	i-CHROMA	BodiTech Med. Inc.
SKUP/2002/23*	Haematology with CRP	ABX Micros CRP	ABX Diagnostics
SKUP/2001/12	CRP	QuikRead CRP	Orion

For comments regarding the evaluations, please see the indications on the previous page.

Attachment 12 Comments from Eurolyser

EUROLyser DIAGNOSTICA

Eurolyser Diagnostica GmbH
Bajemstraße 11a
5020 Salzburg/Austria

Tel. +43(0)662/43 21 00
Fax +43(0)662/43 21 00-50
www.eurolyser.com

SKUP

Dr. Esther Jensen
Hillerod Hospital
Klinisk Biokemisk Afdeling
Dryehavevej 29, indgang 16A
K-3400 Hillerod
Denmark

Re: SKUP/2013/92, Eurolyser smart 700/340: A system for measurement of CRP, manufactured by Eurolyser Diagnostica GmbH, Austria

We, Eurolyser Diagnostica GmbH, would like to express our thankfulness to SKUP for the evaluation of the Smart 700/340 point of care system. Our thanks are also extended to the operators who performed the analyses.

The results obtained at both the hospital and at the primary health care centers clearly confirm that the Eurolyser smart point of care system is a highly accurate and useful instrument in the daily routine of a hospital lab and/or a primary health care lab.

QUOTE: conclusion on page 24 of the report
"The 100 Eurolyser smart CRP results obtained with venous whole blood EDTA samples in the hospital laboratory fulfil the accuracy quality goals. The results from serum samples also fulfilled the quality goal."

QUOTE: conclusion on page 28 of the report
Figure 4 demonstrates that the Eurolyser smart CRP results with capillary samples in the primary health care centres fulfil the quality goal of a deviation less than ±1mg/L or 26% from the comparison method. 81 out of 84 results (96,4%) were inside the limits for the allowable deviation.

Bank: Oberbank AG **BLZ:** 15070 **Account No:** 341-03770.03 **IBAN:** AT21 1509 0003 4103 7703 **BIC:** OBKLAT2L
Firmenbuch Nummer: FN 257153 h **UID:** ATU 61454713 **EORI-Nr.:** ATEOS1000003620

On page 31, the section "Rating of quality control possibilities" the SKUP report indicates an „unsatisfactory" for the "usefulness of quality material". This grading was driven by the users in the primary health care lab. The users in the hospital lab had no negative remarks regarding the QC material or usage

We, Eurolyser would herewith would like to take the opportunity to explain the actions that we have taken since the SKUP trials:

It is essential to know that the QC has been performed with the integrated capillary on the CRP test cuvette. This capillary has been designed to aspirate whole blood; the operator clearly can see when the capillary is filled with the red blood – hence exactly 5µl sample are aspirated every time a test is performed.

However, when using the transparent control liquid it may be difficult to judge if the capillary has aspirated the total amount of the required 5µl QC material – which can lead to high variations when performing control measurements.

Eurolyser has changed the IFU for the control measurement. It is now requested that the control material is aspirated with a 5 µl pipette. This eliminates the risk of variations in the quantity of the QC material used in the QC measurement.

Internal evaluations and the feedback from our customers have demonstrated that this improvement leads to QC measurements resulting in CV values below 3%.

Sincerely

Gerhard Bonecker
CEO, Eurolyser Diagnostica GmbH

Salzburg, 10.05.2013

Attachment 13 Answer from SKUP to 'Comments from Eurolyser'

SKandinavisk **U**tprøvning af laboratorieudstyr til **P**rimærsektoren

SKUP i Danmark

Klinisk Biokemisk Afdeling
Hillerød Hospital
Dyrehavevej 29
3400 Hillerød

Telefon +45 48 29 48 29
Direkte +45 48 29 41 76

Dato: 3. juli 2013

Gerhard Bonecker, MBA
CEO
Eurolyser Diagnostica GmbH
Bayernstrasse 11a
5020 Salzburg
Austria

Concerning the Comments from Eurolyser to the report

SKUP are very pleased that Eurolyser has taken action on the issue with the control material.

After the change in order to improve the use of the control material in Primary Health Care Centres, SKUP has not tested, whether the end users can obtain CV 3% with the control material.

Kind regards

Esther Jensen