

Wednesday, July 29, 2015

Poster Session: 9:30 AM - 5:00 PM

Technology/Design Development

B-345

**Validation of Peritoneal Dialysis Fluid Assays: Does Analytical Performance Meet Clinical Need?**S. A. Palmer, N. A. Baumann, H. C. Graupman, C. D. Birkestrand, H. Salazar, S. Chanakarnjanachai, D. R. Block. *Mayo Clinic, Rochester, MN***Background/Objectives**

Peritoneal dialysis is an alternative to hemodialysis for patients with kidney failure. Removal of waste products occurs using an osmotic gradient across the peritoneal membrane by instillation and exchange of hyperosmotic solutions (eg. 4.25% dextrose) into the peritoneal cavity. Glucose, creatinine, and urea are measured to derive the patient's membrane transporter category and estimate dialysis adequacy (defined as  $Kt/V \geq 1.7$ ). Peritoneal dialysate (PD) fluid composition varies due to manufacturer, addition of antibiotics, and osmotic agent concentration. In vitro diagnostics manufacturers do not list PD fluid as an acceptable specimen type, therefore analytical validation is required. The goal of this work is to evaluate how well the analytical performance of glucose, creatinine, and urea nitrogen assays in PD fluid meets what is required for clinical use of the assays.

**Methodology**

Validation was performed on the Cobas c701 (Roche Diagnostics) using residual clinical PD specimens. Recovery (n=6) was performed by spiking standard solutions (10% by volume, Sigma or Maine Standards) of creatinine and urea nitrogen, while specimens were serially diluted (n=1 up to x128) and mixed (n=4) to evaluate glucose accuracy. Interference from cefazolin (10mg/mL), vancomycin (31mg/mL), ceftazidime (10mg/mL), and heparin (20 units/mL) was assessed by calculating % difference upon spiking (n=2) for all three analytes. Stability was assessed by calculating average (range) % difference at ambient (20-25°C, n=10), refrigerated (2-8°C, n=10), and frozen (-20 to -24°C, n=8) temperatures in plain tubes and NaF/K-oxalate tubes for glucose. Transporter categories were determined using glucose ( $PD4hr_{gluc}/PD0hr_{gluc}$ ) and creatinine ( $PD_{creat}/Serum_{creat}$ ) ratios for a cohort of 25 patients, and  $Kt/V$  calculated as  $(24hrPD_{urea}/Serum_{urea} * 24hrDrainVol * 7) / (VolUreaDistribution)$  where  $Serum_{urea}$  varied from 40mg/dL to 80mg/dL. A bias in  $PD4hr_{gluc}$  and  $PD_{creat}$  was simulated by systematically adding -15 to +15% glucose, -0.2 to +0.2 mg/dL and -10 to +10% creatinine, and  $PD_{urea}$  -15 to +15% using Microsoft Excel to determine the tolerance limits defined as changing transporter category for more than 80% of the cohort or interpretation of adequacy defined as >10% decrease in  $Kt/V$  near the 1.7 decision limit.

**Results**

The mean (range) % recovery for creatinine = 105.2% (99.6%-108.0%) and urea nitrogen = 109.6% (95.0-121.0%). Average (range) % recovery = 98.6% (97.1%-99.8%) for serial glucose dilutions and 98.1% (94.2%-99.9%) upon mixing. Drug spiking showed an average % difference for glucose  $\leq \pm 1\%$ , creatinine  $\leq \pm 2\%$ , and urea nitrogen  $\leq \pm 3\%$ . Ambient PD fluid storage for one day had an average (range) % difference for glucose = -3.0% (-19.7%-6.6%), creatinine = -1.5% (-9.3%-3.6%), and urea nitrogen = -1.2% (-5.9%-3.7%); refrigerated storage for seven days demonstrated glucose = -5.7% (-19.4%-9.1%), creatinine = -0.7% (-9.3%-9.1%) and urea nitrogen = 1.5% (-3.5%-5.0%); 30 day frozen storage revealed glucose = -1.7% (-24.6%-1.1%), creatinine = -2.3% (-8.2%-3.1%), and urea nitrogen = -0.5% (-4.5%-2.5%). PD glucose stability assessed in NaF/K-oxalate tubes revealed average (range) difference = -2.8% (-8.8%-2.0%) ambient for one day and refrigerated 1.4% (-4.3%-5.7%) for seven days. The clinically defined tolerance limits for glucose =  $\pm 5\%$ , creatinine =  $\pm 0.1$  mg/dL or  $\pm 4\%$ , and urea nitrogen =  $\pm 15\%$ .

**Conclusions**

Average recovery of creatinine in PD fluid did not meet clinical tolerance limits while urea nitrogen and glucose studies did. Drug spiking did not alter results. PD fluid analyte stability was limited to one day ambient, 7 days refrigerated, and 30 days frozen in plain tubes, with the exception of glucose demonstrating a wide range of differences that was mitigated by storage in NaF/K-oxalate tubes one day ambient and 7 days refrigerated. Assessing body fluid assay utility and impact on interpretation is essential to derive meaningful analytical performance criteria.

B-347

**Using RFID technology in research laboratories to decrease material inventory and identification time.**P. Schwebel, R. Hohs, S. Kotlinski, C. Foster, M. Grandone, K. Ramp, D. Brotherton, J. Sailer. *Abbott Laboratories, Abbott Park, IL*

Background: Inventory management is the process of effectively monitoring the flow of products into and out of an area. Companies need to determine their inventory levels to avoid over purchasing since an unlimited amount of items cannot be maintained. Inventory management and identification plays a pivotal role in the operational efficiency of any company. Most companies measure the inventory turnover of finished on-market products. However, materials utilized in-house for R&D projects are often not inventoried, but have turnover similar to finished goods. This inventory is considerably more critical to control as development materials are produced in smaller volumes and to specific formulations that may not be easily reproduced. Reducing over-stocking of this inventory, as well as the amount of time to find products leads to an increase in productivity with internal research and development groups.

Objective: Utilize passive Ultra High Frequency (UHF) Radio Frequency Identification (RFID) technology to monitor inventory quantities and locations of materials required for research and development activities.

Methods: Using the Abbott Laboratories' Inventory Manager Product, all reagents, calibrators, and controls used by the Diagnostic Division's Assay Development Organization were RFID tagged and placed into room temperature, refrigerated or frozen storage locations. Inventory Manager has the ability to print RFID tags and monitor inventory levels within one or multiple sites. Inventory locations were monitored with fixed RFID read zones. Inventory sites were additionally monitored on a bi-weekly basis with an RFID handheld reader to ensure the accuracy of the inventory levels.

Results: RFID antennas detected materials stored in room temperature, refrigerated, or frozen environments without any additional work required by laboratory personnel. Inventory was updated immediately after a walk-in refrigerator or freezer door was transitioned. When comparing Inventory Manager's RFID functionality to a manual physical inventory, the monitoring time of that inventory was reduced from two (2) employees for eight (8) hours (16 person-hours) to one employee for 4 minutes when the RFID handheld reader was utilized. This represents a >99% reduction in time spent inventorying materials. The accuracy that was measured over a six-week period of physical inventory actions was on average 97.7% accurate.

The RFID handheld reader was also utilized to find materials using its Product Locator feature. The closer you get to the tagged item, the faster an audible indicator is produced by the handheld reader. The handheld reader also displays how far or close you are to the item you are trying to locate with a visual indicator gauge. The average time to find materials went from

two (2) employees for three (3) hours (6 person-hours) to one employee in less than 10 minutes. The location time of materials was reduced by 97% utilizing the Product Locator functionality.

Conclusions: The level of accuracy and overall productivity in monitoring and managing inventory was significantly improved and provided in real-time by utilizing Inventory Manager's functionality. The time personnel spent in refrigerated and frozen storage locations to perform physical inventories were dramatically reduced as well. Additionally, materials were much easier to find utilizing the Product Locator feature of the RFID handheld reader.

B-348

**Study of the correlation between urine test strips and sediment analysis in Urysis®/IQ-200® and Aution Max®/Sedimax®**C. González, J. Maesa, A. Gallego, Á. Fernández, M. de Toro, V. Sánchez-Margalet. *Hospital Universitario Virgen Macarena, Sevilla, Spain***Background:**

The urinalysis is a valuable tool for the detection and monitoring of kidney and urinary disorders, in addition to systemic or metabolic diseases.

Systematic analysis of the urine is done by test strips, which provide a semi quantitative determination as a screening, and is followed by an analysis of urine sediment in those samples presenting positive values in the parameters determined in the strip.

The aim of the study is to compare the results in test strips with the urine sediment analysis in two automated systems for urinalysis, Urysis® vs IQ-200® and Aution Max® vs Sedimax® to determine the correlation of these results.

## Methods:

The measurements were performed with 261 routine urine specimens, which were processed in the Aution Max and Sedimax, after being processed by institution's routine systems (Urysis and IQ-200). Sample processing was performed for three days with prior shaking of the tubes in order to homogenize the sediments. In all of them leukocytes and erythrocytes were determined.

In the statistical analysis we determined the correlation between the results in test strips for leukocytes and blood (hemoglobin) and white blood cells and red blood cells in urinary sediment, calculating sensitivity (SS), specificity (SP), positive predictive rate (PPR), negative predictive rate (NPR), false positive rate (FPR), false negative rate (FNR), accuracy (A), positive and negatives likelihood ratios (LR+, LR-) and Cohen's kappa coefficient (k).

## Results:

Correlation for Urysis/IQ-200:

SS = 87.50%; SP = 69.48%; PPR = 39.25%; NPR = 96.10%; FPR = 30.50%; FNR = 12.5%; A = 72.80%; LR(+) = 2.87; LR(-) = 0.18; k = 0.39.

Correlation for Aution Max/Sedimax:

SS = 100%; SP = 77.29%; PPR = 38.10%; NPR = 100%; FPR = 22.7%; FNR = 0%; A = 80.10%; LR(+) = 4.40; LR(-) = 0; k = 0.45.

## Conclusion:

Correlation between tests strips and particle analysis in urine sediment is good in both systems, but all the statistical parameters determined in the study give a better result for Aution Max/Sedimax. The rates for specificity are similar, as well as positive predictive rate, because both instruments give a very low number of false positives. The sensitivity, negative predictive rate are clearly better in Aution Max/Sedimax. The most accurate method is also Aution Max/Sedimax.

## B-349

### Glycation in human finger nail clipping using reflectance IR spectrometry, a new marker for diabetes diagnosis and monitoring.

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## Background:

Human fingernail clippings contain  $\pm$  85% of keratins, which are prone to glycation. The underlying capillary bed of the distal phalanx of the finger is a source of glucose, which is able to react with the nail keratins. Nail keratin glycation may therefore reflect the average glycemia over the last couple of months. FT-IR spectroscopy allows to assess glycation non-invasively without the use of any reagents. In the present study, we wanted to explore keratin glycation of fingernail clippings as a non-invasive diagnostic tool for assessing long-term glycation in diabetes.

## Methods:

Fingernail clippings ( $\pm$  20 mg) were powdered using a dental drill. After incubation in a solution containing 100g/L glucose (48 h, 37°C), the remaining glucose in the powders was carefully washed out in an ultrasonic bath and then airdried. Subsequently, the powders were analyzed using reflectance infra red spectroscopy in the range from 4500 cm<sup>-1</sup> to 450 cm<sup>-1</sup> using a Perkin Elmer FT-IR Spectrometer Two (Perkin Elmer, Waltham, MA). Furthermore, incubation of the clippings with fructosamine-3-kinase (F3K) (1  $\mu$ g/ml, 3h; 37 °) was used to analyse effects of protein deglycation.

Nail clippings of 25 diabetic and 25 healthy subjects were collected and subjected to IR spectroscopy.

## Results:

In vitro glycation resulted in an increased absorption at  $\pm$  1050 cm<sup>-1</sup>. After enzymatic deglycation (F3K) this peak greatly diminished, proving this zone of interest represents glycated proteins (lysine-bound glycation). In diabetics (n = 25), absorbance at 1050 cm<sup>-1</sup> was statistically ( $p < 0.01$ ) higher than in age-matched controls (n = 25). The instrument readings were very reproducible (CV < 2%). As nail growth rate of the various fingers is comparable, there is no significant between-finger variability. Storage of the clippings at room temperature for 1 month did not significantly alter the IR spectrum.

## Conclusion:

Analysis of protein glycation in human fingernail clippings with FT-IR spectrometry could be an alternative affordable technique for diagnosis and monitoring of diabetes. As the test does not consume reagents, and considering the fact the pre-analytical phase is extremely robust, the proposed test could be particularly useful in developing countries.

## B-350

### Effective PCR from Clinical Specimens Using an Improved KOD DNA Polymerase with Reduced Carry-over Contamination

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**Background:** PCR, a powerful technology used in many scientific disciplines, is also important in the analysis of clinical specimens. Recently, novel PCR enzymes have been developed with higher efficiencies than conventional Taq DNA polymerase for use in research and diagnostic fields. Among these, KOD DNA polymerase, especially the 3'-5' exonuclease-deficient mutant KOD exo(-), is expected to be useful for diagnostic purposes because of its efficiency at amplifying long DNA and GC-rich DNA targets, and its ability to directly amplify from crude clinical specimens such as blood. However, family B DNA polymerases such as KOD DNA polymerase demonstrate poor incorporation of dUTP used in the uracil-N-glycosylase carry-over prevention system. To circumvent this problem, we developed an improved KOD exo(-) mutant, UKOD exo(-), bearing an enhanced dUTP incorporation ability. Here, we describe the basic performance and application data of UKOD exo(-).

**Objective:** To determine and evaluate the performance of UKOD exo(-) in the DNA polymorphism analysis of crude clinical specimens.

**Methods:** The sensitivity and effectiveness of UKOD exo(-) were evaluated using real-time PCR with SYBR Green I. Various probe detection systems (Scorpion, Beacon, FRET, and Q probes) were tested for compatibility with UKOD exo(-), and the latter two systems were used in association with UKOD exo(-) to detect single nucleotide polymorphisms in *CYP2C19* from whole blood samples. All experiments were performed in the presence of dUTP.

**Results:** Two copies of human *beta-actin* (295 bp) were detectable using the SYBR Green system with UKOD exo(-). Moreover, the quantitative detection of human *CCNI* (179 bp, GC content: 71%) was achieved with the same system, whereas the target could not be amplified using a conventional system based on Taq DNA Polymerase. All four probe detection systems enabled the quantitative detection of all targets with UKOD exo(-). Furthermore, all *CYP2C19* polymorphisms in human whole blood specimens were distinguishable from each other using FRET and Q probe systems and the end point assay, whereas Taq DNA polymerase failed to amplify the targets. The overall performance of UKOD exo(-) was almost identical to that of KOD exo(-).

**Conclusion:** UKOD exo(-) exhibited excellent PCR performance even in the carry-over prevention system using dUTP. The enzyme therefore shows potential to be a powerful new tool for various high-throughput assays in a diagnostic field with reduced carry-over contamination.

## B-351

### A Fast Polarity Switching LC-MS/MS Analysis of Benzodiazepines and Barbiturates

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## Background:

ESI-LC-MS/MS has been widely used to monitor pain management drugs on a routine basis in many labs worldwide. Because certain drugs ionize better in negative mode than that in positive electrospray ionization mode, the panel of interest is usually split into positive mode and negative panels. Recent advances in fast and robust polarity switching technologies allows for these panels to be recombined into a single run. This study seeks to demonstrate a high-throughput, robust polarity switching ESI-LC-MS/MS method on an IONICS 3Q 120 triple quadrupole mass spectrometer.

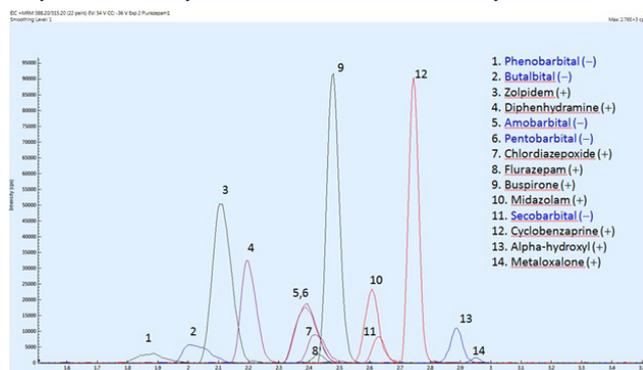
## Methods:

The mixed barbiturates and benzodiazepine drug standards and analytical LC column were provided by Restek. 5  $\mu$ L of diluted standard at various levels were loaded on a Raptor Biphenyl column (100X2.1mm, 2.7 $\mu$ m) and eluted by a gradient method at a flow rate of 0.6 mL/min and a total LC cycle time of 6.5 minutes. The signal is detected by an IONICS 3Q 120 triple quadrupole coupled to a Shimadzu Prominence UPLC system. All solvents are HPLC grade. The 3Q system indicated is able to perform fast polarity switching (<15ms) with high ionization and ion sampling efficiencies. The separation and sensitivity reproducibility is monitored as a function of number of injection.

## Results:

All 14 compounds eluted within the 6.5 minutes run time showed good chromatogram separation and excellent peak shape. No sensitivity loss is found for 14 compound

panel as compared to the run if split into two panels. The CVs were <5% for all analytes within intra-day run and <9% within 3 series of inter-day run.



#### Conclusion:

The results indicate that the ESI-LC-MS/MS method with ultra-fast polarity switching using IONICS 3Q 120 mass spectrometer can greatly improve sample throughput in clinical pain management monitoring application. The dwell time and pause time effect for co-eluting positive and negative mode ions will also be explored and discussed.

### B-352

#### A new enzymatic method for determination of serum zinc based on D-aminoacylase activity

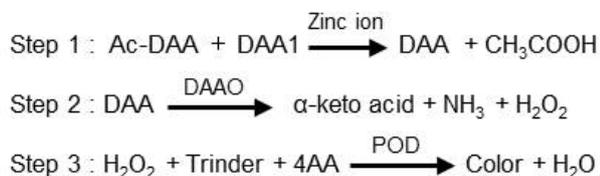
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**Background:** Zinc ions are required for activation of metalloenzymes in vivo and zinc deficiency causes various diseases. Here, we describe an enzymatic assay for measurement of the zinc concentration in serum, based on the zinc-dependent activity of D-aminoacylase 1 (DAA1).

**Methods:** The assay depends on zinc ion-dependent catalysis of deacetylation of an N-acyl-D-amino acid (Ac-DAA) to a D-amino acid (DAA) by DAA1, followed by D-amino acid oxidase (DAAO) catalysis of oxidation of DAA to hydrogen peroxide and production of a quinone pigment using the Trinder reagent with peroxidase. The rate of product formation is linearly related to the acylase activity of DAA1, which depends on the zinc content of serum, and thus the zinc concentration can be determined from the absorbance of the quinone pigment. Assay principles are shown in Figure 1.

**Results:** The optimum assay conditions were pH 9.0 with measurements between 2 and 5 minutes after addition of the Ac-DAA (N-acetyl-D-phenylalanine). The within-assay CV was 0.92-1.55%, the between-run CV was 0.96-1.12%, and the day-to-day CV was 1.03-1.80%. The assay gave linear results over zinc concentrations of 0 to 60  $\mu\text{mol/L}$ . The percentage recovery was 95-105%. The results from the new method were correlated with those from the 5-Br-PAPS and ICP-AES methods.

**Conclusion:** In conclusion, we have developed a novel enzymatic assay for zinc in serum. The method has good recovery, good precision, and a good correlation with the ICP-AES method and other conventional methods. The assay is linear over a concentration range that should be useful for routine zinc measurement in clinical laboratories.



### B-355

#### High-sensitivity immunoassays for IVD applications: Evaluation of the analytical performance characteristics of the Simoa HD-1 automated platform

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#### Background:

Simoa™ (Single Molecule Array) technology allows the development of ultrasensitive immunoassays by enabling the quantitative detection of protein analytes at very low concentrations. Enzyme-bound immunocomplexes are formed on the surface of paramagnetic microparticles, which are then individually confined into femtoliter-sized wells and imaged with a fluorescent substrate. This digital approach, based on Poisson statistics, allows measurements in the femtomolar range, a sensitivity improvement of up to 1000-fold over traditional ELISA.

Quanterix Corp's HD-1 platform harnesses the benefits of the Simoa technology in a fully-automated package. An RUO version of the system is commercially available for life science research, with a rapidly expanding menu of assays (currently >25) showing up to 1000x higher sensitivity compared to current best-in-class conventional immunoassay systems.

In the prospect of developing an IVD-compliant version of the system, key analytical performance characteristics were evaluated using a prototype assay for the quantification of PSA (prostate-specific antigen) in human serum. An ultrasensitive IVD assay for PSA would have clinical value, as a prognosis marker, to aid in the identification of patients at risk of prostate cancer recurrence following prostatectomy. Other ultrasensitive Simoa IVD assays could contribute to the improvement of standard of care: by providing clinicians with earlier detection of clinically relevant biomarkers, rapid diagnosis and application of appropriate treatment could be achieved. Simoa IVD assays could also be deployed for companion diagnostics.

#### Methods:

Evaluation of the analytical performance of the system consisted in a set of studies, based on CLSI guidelines, designed to determine precision (CLSI EP5-A2) and sensitivity (CLSI EP17-A2). Three instruments and two distinct lots of assay reagents were used for the evaluation. For precision determination, 10 replicate runs were performed on each instrument. Each run included the measurement of a full calibration curve, from which concentration values for specimens were derived. Calibrators were prepared from WHO standard in a diluted serum matrix. Six human serum samples were measured in triplicate as part of each run.

#### Results:

Precision levels of 2.6%-9.4% intra-instrument (between-run) CV and 3.6%-7.0% between-instrument CV were obtained for samples ranging from 3 pg/mL to 80 pg/mL in concentration. Intra-instrument precision is maintained when a calibration curve from a different run is used for sample concentration determination. Sensitivity is characterized by LoB, LoD and LoQ values of 0.019 pg/mL, 0.046 pg/mL and 0.076 pg/mL, respectively.

#### Conclusions:

Superior analytical performance of the Simoa HD-1 system has been confirmed, with demonstration of ultra-high sensitivity capability and adequate precision levels at low analyte concentrations, in line with IVD requirements. The transitioning of ultrasensitive immunoassays from life science research to IVD is expected to enable successful translation of biomarker discovery into clinical practice, with the potential to address many unmet clinical needs.

### B-356

#### Validation of Ella™, a multiplexed immunoassay analyzer, for the measurement of 4 cytokines.

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**Background:** Multiplexed immunoassay analyzers provide simultaneous measurement of multiple analytes in biological samples. While these assays offer significant savings in terms of time and sample volume compared to single-analyte assays, there are downsides to measuring multiple analytes at the same time in the same sample. In particular, there can be cross-reactivity between different antibodies and/or analytes, and the dynamic range is often compromised. Simple Plex (Protein-Simple, San Jose, CA) is a novel multiplexed immunoassay platform where a sample is split across

different analyte-specific microfluidic channels. Because the individual antibody-antigen reactions are physically separated, this design overcomes many limitations of traditional multiplexed assays and allows the process to be automated. The objectives of this study were to evaluate the performance of the Simple Plex platform and determine the analytical performance characteristics of 4 cytokines: TNF $\alpha$ , IL-10, IL-6 and IL-1 $\beta$ . **Methods:** Quality control (QC) material, sample diluent, running buffer, Simple Plex cartridges and Ella were obtained from Protein Simple. De-identified patient samples were obtained from the clinical laboratory. Samples were diluted 1:2 with sample diluent and were loaded onto the cartridge. All samples were run in duplicate. Concentrations were calculated using vendor-determined calibration curves. High and low QC material was used to determine assay precision. The limit of detection was established by running blank samples (n=19). Analyte stability was determined by spiking 3 serum and 3 plasma samples with high QC material and incubating at 4 °C or 20 °C for various times. Analytical linearity was determined by serially diluting high quality control material and 3 patient samples. Recovery was tested by spiking normal serum specimens with a fixed amount of each analyte. Reference ranges were determined by measuring each analyte in 35 apparently healthy volunteers. Each analyte was also measured in samples obtained from patients with various disease states including prostate cancer (n=21), breast cancer (n=7), pancreatic cancer (n=7), sepsis (n=7) and non-malignant disease (n=4). Finally, results obtained on Ella were compared to another multiplexed platform (Meso Scale Delivery, Rockville, MD) using patient samples (n=24) that had been previously assayed for the four analytes. **Results:** Within-run precision ranged from 2.9 - 5.6%; total precision ranged from 6.3 - 13.5%. The precision of replicate sample measurements ranged from 2-3%. The limit of detection was 1.40, 0.31, 0.54 and 0.54 pg/mL for IL-10, IL-1 $\beta$ , IL-6 and TNF $\alpha$ , respectively. Overall, the linearity of the assay was acceptable; slopes ranged from 0.9833 - 0.9955, R<sup>2</sup> values ranged from 0.9985 to 0.9998. No significant differences between serum and plasma were observed in terms of analyte concentration or stability. IL-10 and IL-6 were relatively stable over 24 hours. TNF $\alpha$  and IL-1 $\beta$  concentrations decreased 15-30% over 24 hours. Overall, Simple Plex values correlated well with MSD (R<sup>2</sup> 0.9689 - 0.9876). However, slopes ranged from 1.5 to 2.0. We are currently investigating this discordance. **Conclusion:** We found Simple Plex to have acceptable precision, limits of detection, linearity, and recovery for measurement of TNF $\alpha$ , IL-10, IL-6 and IL-1 $\beta$ . The instrument is easy to use and is a good alternative to traditional multiplexed immunoassay platforms.

### B-357

#### Paper test card for quantifying iodate in fortified salt

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**Background:** One-third of the global population is at risk for iodine deficiency disorders, so iodine supplementation programs focus on providing this micronutrient to those who need it the most. The most common delivery platform is table salt fortified with potassium iodate. During production of iodized salt, local regulation usually dictates a level of 30-50 ppm I (expressed as mass of iodine atoms per mass of salt). Because iodine content decreases with time, monitoring agencies performing household and market surveys expect levels of at least 15 ppm. Current portable technologies for accurate measurement of iodate content in iodized salt are relatively expensive, which restricts their use in low resource settings.

**Method:** A paper millifluidic device was created to quantify iodate in iodized salt samples. A piece of paper the size of a playing card is printed with wax to define reaction zones. All of the reagents needed to perform an iodometric titration are stored dry in the paper. To measure the iodine content in salt, the user mixes 1 part salt and 5 parts water and then applies 125  $\mu$ L of test solution to 12 regions on the test card. The test is complete in 3 minutes and the response can be assessed either by visual comparison to standard images or by computer analysis of a cell phone image of the card. The response of the card was calibrated to quantify iodate in the range of 0-75 ppm I, detect excessive iodization levels of > 150 ppm, and perform negative and positive controls. Using blinded methodology, 2 analysts ran 110 test cards with standardized iodate solutions to establish the analytical metrics of the test card.

**Results:** Computer image analysis was more accurate than visual interpretation, particularly for newly trained users. The accuracy and precision for determination of mg iodine/kg salt are both 4.5 ppm for the automated image analysis, and the accuracy is 7.0 ppm and the precision is 4.5 ppm when newly trained users read the test card visually.

**Conclusion:** The test card can quickly quantify iodate over a range that is useful to both salt manufacturers and monitoring agencies. The test card does not depend upon any specialized glassware or electronic devices and therefore has the potential to be utilized outside of the laboratory. Paper millifluidic devices can provide quantitative

information to address quality and regulatory compliance issues in the developing world.

### B-358

#### Analytical evaluation of the 25-OH Vitamin D total assay on the BioPlex® 2200

M. Abou El Hassan, D. C. Lin, T. Earle, M. Millar, I. M. Blasutig. *University Health Network, University of Toronto, Toronto, ON, Canada*

**Background:** Vitamin D plays an essential role in calcium and phosphorus homeostasis. Vitamin D deficiency is linked to numerous diseases and conditions. 25-hydroxy (OH) vitamin D is the major metabolite and therefore is measured to assess the vitamin D status. Testing for 25-OH Vitamin D has increased dramatically over the past decade and several automated immunoassays exist to test vitamin D in serum. Here we evaluate the recently released automated Bio-Rad BioPlex® 2200 25-OH Vitamin D immunoassay, which is claimed to equally detect 25-OH D<sub>2</sub> and 25-OH D<sub>3</sub>, against a gold-standard liquid chromatography-tandem mass spectrometry (LC-MS/MS) method and the DiaSorin LIAISON® 25-OH Vitamin D TOTAL immunoassay. **Methods:** Imprecision was determined using third party controls over 21 days. Linearity over the entire measuring range was assessed using low and high patient pools. Correlation between the BioPlex and LC-MS/MS (n=137) or the LIAISON (n=56) was assessed using patient samples with varying amounts of 25-OH D<sub>3</sub> and/or 25-OH D<sub>2</sub>. **Results:** The total imprecision was 9.2%, 6.8% and 4.4% at concentrations of 39.3nmol/L, 70.7nmol/L and 242.9nmol/L, respectively. The assay was linear from 18.1-375nmol/L with a R<sup>2</sup> of 0.988. Method comparison revealed a strong correlation between the BioPlex assay and LC-MS/MS for samples containing 25-OH D<sub>2</sub> alone (n=5; R<sup>2</sup>= 0.999), 25-OH D<sub>3</sub> alone (n=119; R<sup>2</sup>=0.935) and both (n=13; R<sup>2</sup>=0.919). A strong correlation with the LIAISON assay was also observed (n=56; R<sup>2</sup>=0.853). **Conclusion:** The analytical characteristics of the BioPlex assay make it suitable for the measurement of total serum 25-OH Vitamin D. The assay correlates well with the LC-MS/MS method and to a lesser extent with the LIAISON assay. Importantly, the assay is capable of equivalent detection of both 25-OH D<sub>2</sub> and 25-OH D<sub>3</sub>.

### B-359

#### An Imaging Reflectometer for Measuring Dry Slides Technology

K. Ryan, J. Kelly, G. Denton. *Ortho Clinical Diagnostics, Rochester, NY*

**Background:** A new reflectometer for reading VITROS® MicroSlide™ Technology was developed using a 2D imaging system and light emitting diode (LED) illumination. Through the use of machine vision, the flexibility of the reflectometer is increased to support the development of new assay formats. Reduction in patient sample volumes is also possible through decreased sensitivity to metering position and incubator alignment.

**Methods:** A camera containing a full frame, charge coupled device (CCD) image sensor was used to capture images of slides using a VITROS® 4600 Chemistry System. A pulsed LED with bandpass filter provided the necessary illumination. Using time delay and integration, the sensitivity of the camera was increased and images were captured in real-time without any change to normal slide processing. An initial estimate for center was made using criteria of low local pixel standard deviation and intensity. This was refined by locating points along the edge of the spot. These points defined chords, the perpendicular bisectors of which identify the center. Reflectance was computed by averaging pixels contained within a 1mm radius about the center. Performance of the system was tested by measuring the within-run precision of 20 repetitions of the VITROS® Chemistry Products CREA, BUN/UREA, PROT, ACET, Ca and ALKP slides using VITROS® Chemistry Performance Verifier (PV) I and II fluids at two drop volumes: 10 $\mu$ L and 5 $\mu$ L.

**Results:** The coefficients of variation (CV) were as follows for PVI at 10 $\mu$ L: CREA 2.17%, BUN/UREA 1.17%, PROT 8.25%, ACET 0.75%, Ca 0.55% and ALKP 1.66%. For PVII, CV were: 0.60%, 1.06%, 3.18%, 0.92%, 0.40%, and 0.94%, respectively. Reducing drop volume to 5 $\mu$ L resulted in a decrease in precision due to metering volume sensitivity for both PVI and PVII. Further investigation using CREA revealed LED instability to be a large contributor to imprecision, as improving the stability of the power supply decreased CV from 4.17% to 2.17% for PVI and 1.91% to 0.60% for PVII at 10 $\mu$ L.

**Conclusion:** We found an imaging system and LED to be a viable method for reflectance measurement of the VITROS® MicroSlide™. Although a decrease in precision was noted due to drop volume sensitivity and light source instability, future work aims to reduce these effects.

**B-361****Evaluation of the Sebia Capillars 2 FLEX PIERCING Instrument for Determination of HbA1c in a High Volume Laboratory**J. Reddic. *Greenville Health System, Greenville, SC***Background:**

Greenville Memorial Hospital Laboratory is the reference laboratory for a seven hospital system in the upstate region of South Carolina, and performs approximately three million tests per year. The hospital system provides laboratory services to a large number of regional physician practices and health screening services to many regional employers. Hemoglobin A1c (HbA1c) has become a common test performed at the laboratory as a part of the diagnosis and monitoring of diabetes mellitus type 2 and as part of these routine health screens. The laboratory averages 3,500 HbA1c tests per month and requires a reliable high-throughput method to meet this testing volume. This necessity is additionally complicated by the fact that the region's population has a relatively large rate of Hb variants. Empirical evidence has shown that approximately 3% of the region's population carries the HbS variant trait that may interfere with accurate HbA1c determination for some methodologies. Based on these criteria, the laboratory evaluated the Sebia Capillars 2 FLEX PIERCING system (Sebia, Lisses, France) as a possible alternative to the current Trinity Premier Hb9210 system.

**Methods:**

The evaluation involved three Sebia instruments, each running different buffer lots, over a three day evaluation period. Reproducibility was evaluated using twenty pre-selected patient samples covering a reportable range of 4-16% HbA1c. Specimens were aliquoted and frozen prior to the evaluation period. Acceptance criteria for precision was a total CV of less than 4% for each of the twenty pre-selected patient samples over the three day evaluation period. Accuracy was evaluated using eight NGSP samples run in duplicate for three days on one of the three instruments. Acceptance criteria for accuracy was +/-5% of the NGSP target values. Additionally, a method comparison was performed versus the current Trinity system using 342 patient samples from daily testing. Where possible, the reproducibility specimens and NGSP samples were also analyzed on the Trinity system.

**Results:**

The total CV for the twenty pre-selected patient samples ranged from 0.56% to 1.94% for samples run in duplicate on three Capillars FLEX PIERCING instruments for three days (n=18). All eight NGSP samples passed the accuracy requirement with a total allowable error of less than 5%. The eight NGSP samples were additionally evaluated using six-sigma metrics with an average sigma value of 3.2 using the current standard performance criteria of 6% total allowable error. The method comparison showed a linear relationship between the Sebia and Trinity methods but with average negative bias of approximately 0.3% HbA1c on the Sebia. Six homozygous Hb variant samples were additionally evaluated on the Sebia system producing no quantifiable result as expected (these samples have no Hb A0 present) and verifying that the method is not subject to the variant hemoglobin inaccuracies associated with some HbA1c methods.

**Conclusion:**

In every instance the Sebia system met or exceeded this laboratory's acceptance criteria and the method is being adopted as our laboratory standard for HbA1c testing.

**B-362****Clinical Trial of a Fast, Accurate and Multiplexing Method for CYP2C19 Genotyping**L. Nan, X. Zeng, M. Kong, Y. Qian, Y. Wu, D. Yu. *Ningbo Health Gene Technologies, Ningbo, China*

Accurate genotyping of cytochrome P450 genes is often very challenging due to the extreme similarity of sequences among gene family members and frequently existing pseudo genes. Simultaneous genotyping multiple SNP loci of a cytochrome P450 gene is even more difficult. Here we developed an advanced fragment analysis (AFA)-based multiplexing SNPs detection method that is able to accurately genotyping 3 SNP loci of CYP2C19 gene, CYP2C19\*2 (rs4244285), CYP2C19\*3 (rs4986893) and CYP2C19\*17 (rs12248560) in a single tube. In addition to detecting the 3 SNP loci, the multiplex reaction also includes 3 human DNA controls and an internal reaction control. A clinical trial was performed at four major hospitals in different regions of China from April 2014 to October 2014. Total 1,338 of double-blinded human genomic DNA samples were extracted from peripheral blood samples of patients with cardiovascular diseases. Each DNA sample was separately used for genotyping with AFA-based method (trial reagent) and Sanger sequencing (reference method). 10-50 ng of genomic DNA was used for AFA-based PCR reaction. The dye-labeled

PCR fragments were separated, identified and quantified with a genetic analyzer. Genotyping results were determined by the specific fragment lengths and the ratios between alleles. All genotyping results were further compared to the results of Sanger sequencing. The accuracy of the AFA-based genotyping from 1,338 samples was 100% concordant to that from Sanger sequencing. In brief, the present study provides an accurate, fast and cost-effective genotyping method for detection of multiple SNP loci.

**B-363****Disposable Dispense Cartridge (DDC) revolutionizing clinical diagnostic automation**K. Rehfeldt<sup>1</sup>, J. Stackawitz<sup>2</sup>. <sup>1</sup>STRATEC Biomedical AG, Birkenfeld, Germany, <sup>2</sup>Quotient Biodiagnostics, Newtown, PA**Background:**

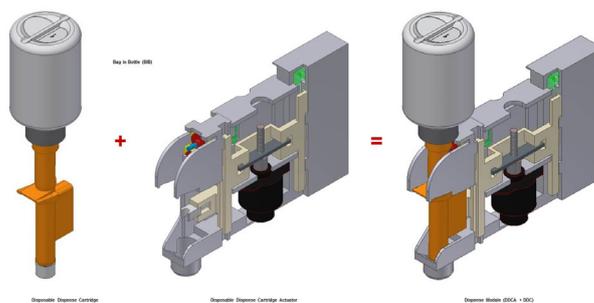
Dispensing of liquids includes typically pumps, tubing, valves and dispense nozzles implicating the known constraints of high dead volume, loss of reagent for priming, the contamination risks between different reagents or lots of reagents as parts of the liquid path are used by more than one liquid. Especially expensive and sensitive (light, gas or temperature sensitivity) reagents require a sophisticated and costly technical effort on the automation side to either reduce the waste of reagent or increase the on board stability of these reagents.

**Methods:**

STRATEC has developed a Disposable Dispense Cartridge (DDC) which overcomes the above mentioned limitations of the current technologies used for dispensing reducing the hardware cost to a minimum. The solution of STRATEC offers accurate dispensing of liquids while realizing secure identification (RFID) of closed self-contained reagent dispensing containers enabling increased on board stability without the risk of contamination or large priming volumes.

**Results:**

One of the first implementations of this new dispense technology and reagent concept is realized on the MosaiQ™ a blood typing/grouping automation solution of Quotient Biodiagnostics Ltd. This application requires light and oxygen sensitive reagents containing particles to be dispensed directly in the process consumable. Existing dispense technologies showed to be non-compatible with these reagents or resulting in a not acceptable on board stability; therefore the decision to use of this new dispense technology has been made. The system is still under development but the onboard stability has already been increased from minutes to hours (the goal is to reach multiple days). As the dispensation is depending on the assay type and is highly time sensitive the DDCs are located on axis making it possible to define different points and time of dispense. To realize continuous loading for each reagent two DDCs are loaded onto the automation system.

**B-364****Novel drug delivery system based on N-palmitoyl chitosan polymeric micelles encapsulating ellagic acid with addition of cinnamaldehyde for the treatment of triple negative breast cancers**Z. Lin<sup>1</sup>, S. Jiang<sup>2</sup>, X. Zhang<sup>1</sup>, C. Mohan<sup>1</sup>, T. Wu<sup>1</sup>. <sup>1</sup>University of Houston, Houston, TX, <sup>2</sup>University of Wuhan, Wuhan, China**Background:**

Triple-negative breast cancer (TNBC), a highly aggressive malignancy, accounts for about 10%-20% of breast cancer, yet without effective molecularly targeted therapies

due to the lack of existing molecular targets of breast cancer, thereby chemotherapy is the major treatment. However, chemotherapy usually causes severe side effects. To minimize the side effects, herbal medicines have drawn lots of attention. For instance, ellagic acid (EA) and cinnamaldehyde (CD) derived from pomegranate seeds and cinnamon, have been exhibited anticancer property in high concentration because of hydrophobic nature and low bioavailability, thus it requires efficient drug delivery platform.

**Methods:**

N-palmitoyl chitosan polymeric micelles (PLCS) have demonstrated as an efficient carrier for hydrophobic drugs in our previous study. Herein, we designed a drug delivery system utilizing a very small amount of CD to enhance therapeutic efficiency of PLCS loading with EA.

**Results:**

As the figure shown, the preliminary results of in vitro experiment indicated that after 48 hours PLCS micelles loading with EA and with addition of CD showed a 2 fold and 3.5 fold enhanced effect on cell growth inhibition of MDA-MB-436 cells, compared to PLCS micelles loading with EA but without the addition of CD, and the free EA. This system might because the CD decrease physical properties of PLCS such as size and drug loading efficiency, resulting in the improving the therapeutic efficiency of EA. To determine this system's suitability, we employed PLCS loading with docetaxel (DTX) and with addition of CD. DTX is a well-studied chemotherapy drug. We found the similar results. This drug system loading with DTX displayed an approximately 2 fold and 4 fold enhanced effect on cell growth inhibition, compared to PLCS loading with EA but without the addition of CD, and the free DTX.

**Conclusion:**

This drug delivery system can enhance therapeutic efficiency of EA and CD for the treatment of TNBC.

**Objective:** Estimate 95% confidence intervals for the three cutoffs as defined in terms of Ishak ranges and sensitivities or specificities. These are important to prevent confusing, insignificantly different, cutoff proliferation.

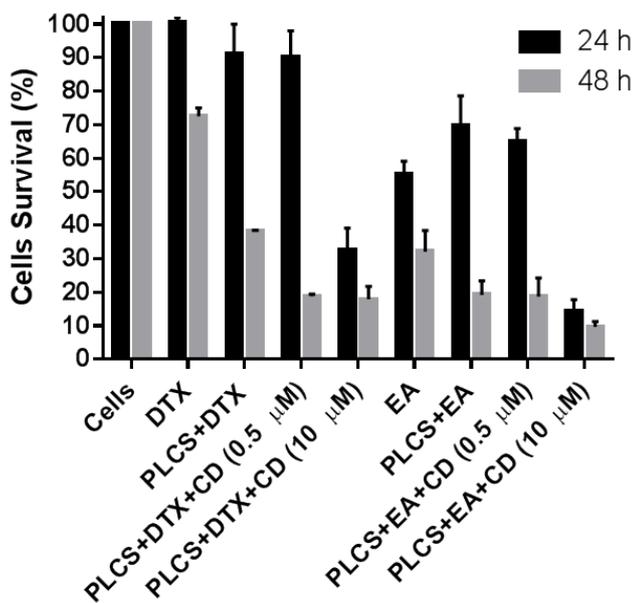
**Materials and Methods:** ELF scores and Ishak biopsy scores from the original study were used. The ELF score to distinguish high and low biopsy ranges (say, 3-6 vs. 0-2) with a sensitivity or specificity closest to a target was developed. It allows a single ELF score at target, a range of scores each at target, or scores below and above, but not at, target. The 7.7 and 9.8 cutoffs had been established informally from tables of ELF score, sensitivities and specificities. The 11.3 was established from a different data set by Lichtenhagen. A bias-corrected and accelerated 1000-fold bootstrap calculation (Efron and Tibshirani, "An Introduction to the Bootstrap," Monographs on Statistics and Applied Probability 57, Chapman & Hall/CRC, 1993, 1998) was made for three cutoffs: Ishak 3-6 vs. 0-2, 90% specificity; Ishak 5-6 vs. 0-4, 90% specificity; and Ishak 6 vs. 0-5, 97% specificity. A "double-bootstrap" was used. Specifically, an Ishak score was resampled from the observed distribution of Ishak scores. Then an ELF score was resampled from the observed distribution of ELF scores for patients with the selected Ishak score.

**Results:** The Ishak discriminations, targets, algorithmic cutoffs with the observed data, and 95% confidence intervals are:

- Ishak 3-6/0-2, 90% sensitivity, 7.67, 7.48-7.93,
- Ishak 5-6/0-4, 90% specificity, 9.81, 9.63-10.02, and
- Ishak 6/0-5, 97% specificity, 11.47, 10.99-11.65.

**Conclusions:** 95% confidence ranges have been established for the three ELF Test cutoffs. Each cutoff's nominal value is near the center of the corresponding range.

\* The ELF Test and the HA, PIHNP and TIMP-1 assays have not been submitted to FDA and are not available for sale in the US. This test and these assays are CE marked on the ADVIA Centaur Immunoassay Systems.



**B-366**

**An improved reference method for serum cations measurement by ion chromatography**

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**Background:** In order to improve the accuracy, precision and robustness of the reference method for serum cations based on ion chromatography, an simple sample treatment procedure has been adopted for the determination of serum cations, which can be completely remove the proteins and/or organics in human serum.

**Methods:** Chromatographic conditions for the separate and simultaneous determination of serum sodium, potassium, magnesium and calcium were investigated. Furthermore, various influencing factors on the mineralization of human serum, such as the selection and amount of oxidant were also examined systematically and optimized. The measurement accuracy and precision was calculated by analyzing IFCC-RELA specimens and serum specimens.

**Results:** The optimized experimental conditions 1.0 mL of serum specimen digested with 2 mL nitric acid (120°C) followed by 2 mL hydrogen peroxide (80°C). The specimens were then redissolved and determined by ion chromatography under the optimum eluent concentration of 32 mmol/L methanesulfonic acids. The measurement accuracy and precision is less than 1.2% for all the analytes by analyzing IFCC-RELA specimens and serum specimens (listed in Table 1). The results were also comparable with the reference values obtained by ICP-MS, which were found to be in good agreement.

**Conclusions:** Ion chromatography with a simple sample treatment procedure for the determination of cations in human serum with high sensitivity and specificity. Compared with most of the other reference methods for the determination of serum cations, the advantages of the proposed method can be summarized as follows: (1) simultaneous separation and determination of serum sodium, potassium, magnesium and calcium effectively; (2) this wet digestion method could be completely remove the organics in serum, avoiding the risk of suppressor injury and column contamination which can long-term application with these types of samples; (3) this simple sample treatment procedure could be combined with other methods of analysis, such as ICP-AES and ICP-MS.

**B-365**

**95% Confidence Intervals for the ELF™ Test Cutoffs**

P. W. Dillon. Siemens Healthcare Diagnostics, Tarrytown, NY

**Background:** The ELF™ Test is a composite score calculated from the results of three direct markers of liver fibrosis (HA, PIIINP and TIMP-1).\* It correlates well with liver biopsy results (Rosenberg et al, Gastroenterology, 2004, 1704-1713). Using the data from the 921-sample multi-center trial used to establish the ELF equation, two cutoffs (7.7 and 9.8) had been determined; the lower to distinguish Ishak biopsy scores greater than 2 from those 2 or less with 90% sensitivity and those with Ishak 5 or 6 from lower with 90% specificity. A third cutoff (11.3) was proposed (Lichtenhagen et al, J. Hepatology, 2013, 236-242) to distinguish cirrhosis from lesser fibrosis. Finally, other cutoffs, often close to those above, have been proposed (unpublished) for various purposes. The question arises: are these various cutoffs significantly different from each other?

Table 1 Inaccuracy of the proposed method for lyophilized and liquid serum specimens (mmol/L)

Cations	Specimen	IC	CV(%)	Reference Value	Bias(%)
Na	Serum	132.79	0.36	133.00	-0.16
Na	2013 RELA-A	126.16	0.32	126.73	-0.45
Na	2013 RELA-B	129.35	0.62	129.88	-0.41
K	Serum	3.444	0.30	3.460	-0.46
K	2013 RELA-A	3.756	0.46	3.749	+0.19
K	2013 RELA-B	6.679	0.59	6.691	-0.18
Mg	Serum	0.732	0.39	0.730	+0.27
Mg	2013 RELA-A	1.439	0.61	1.443	-0.28
Mg	2013 RELA-B	1.370	0.67	1.366	+0.29
Ca	Serum	2.037	0.83	2.030	+0.34
Ca	2013 RELA-A	2.552	0.78	2.582	-1.16
Ca	2013 RELA-B	2.866	0.86	2.879	-0.45

**B-367****An extraction-free method for quantification of cell-free plasma DNA in cancer patients**L. Xie, X. Song. *Shandong Cancer Hospital and Institute, Jinan, China***Background:**

Cell-free DNA (cfDNA) in plasma of cancer patients, mainly deriving from apoptosis and necrosis of cancer cells, is able to be served as an important marker for cancer diagnosis and monitoring, which circumvents the difficulties associated with lack of biopsy samples. Currently, extraction of cfDNA from plasma is indispensable for quantification of cfDNA. Nevertheless, the extraction stage is critical in ensuring clinical sensitivity of analytical methods measuring minority nucleic acid fractions. The extraction efficiency and fragment size bias are quite different among DNA purification techniques or commercial reagents.

**Methods:**

To sweep this obstacle, we developed a cfDNA-extraction-free method and a Super Green quantitative PCR(qPCR) assay based on the 18S rRNA gene for the determination of total plasma cfDNA and DNA integrity. The qPCR assay designed three different assays with comparable efficiency for the amplification of 62, 147 or 297 bp amplicon, respectively. Two integrity index (147/62 and 297/62) were used for the investigation of the circulating cfDNA integrity. We investigated cfDNA yield in plasma samples by comparing our cfDNA-extraction-free method with four specific cfDNA extraction methods [QIAamp circulating nucleic acid Kit (QIA), GenMag Circulating DNA from Plasma (GEN), FitAmp Plasma/Serum DNA Isolation Kit (FIT) and Circulation DNA Kit (CIR)]. Then plasma cfDNA in 30 patients with non-small-cell lung cancer and 28 healthy people was analyzed using our extraction-free method.

**Results:**

We found that the median amount of the same cfDNA quantified by different isolation methods varied from 6.6 to 39.9 ng/mL. The extraction efficiencies among those ranked in the order cfDNA-extraction-free method > QIA kit > GEN kit > CIR kit > FIT kit. The cfDNA from extraction-free method did not effect the specificity and sensitivity of the qPCR assay. Furthermore, our Super Green quantitative PCR assay showed an increase in assay specificity and sensitivity over the conventional qPCR. The cfDNA-extraction-free method gave a better representation of smaller DNA fragments in the extract than the others.

**Conclusion:**

The cfDNA-extraction-free method gives a more reliable estimate of total cell-free plasma DNA quantity in cancer patients.

**B-370****Evaluation of General Chemistry Assays on the Mindray™ BS-480 Chemistry Analyzer**B. Medaugh, R. H. Brown. *MedTest, Canton, MI***Background:**

The Mindray™ BS-480 Chemistry Analyzer is a fully automated, discrete, random access chemistry analyzer designed for mid-volume laboratories with a throughput of 400 photometric tests per hour, and up to 560 tests per hour including ISEs.

The analyzer is capable of performing general chemistry and urine drugs of abuse screening analysis simultaneously or independently. The sample carousel contains 90 sample positions for barcoded primary collection tubes or sample cups and offers STAT testing capability. The refrigerated reagent carousel contains 80 reagent positions and can accommodate testing methodologies up to 4 reagents. The reaction carousel consists of a dry bath heating system utilizing borosilicate glass cuvettes coupled with an 8-step washing/rinsing/drying process. This analyzer offers many features commonly found on high-volume systems: intuitive software interaction; touch screen monitor; on-board operator's manual with intelligent indexing; intelligent probe management system offering bubble detection, collision protection with auto-recovery, liquid level sensing and clot detection (Sample Probe Only); and remote access diagnostic capability.

**Objectives:**

This study evaluated the precision, accuracy, linearity, interference and limit of detection of 24 assays on the Mindray BS-480 Analyzer, using the Beckman Coulter AU400 analyzer as a reference testing analyzer. The general chemistry reagents are manufactured at the MedTest corporate headquarters located in Canton Michigan.

**Methods:**

Analysis was performed based on modified versions of applicable CLSI Protocols. Within Run and Total Precision were determined by running three levels of control material. Within Run Precision was determined by running 20 replicates of controls in a single day. Total Precision was determined by running materials in duplicate across 20 shifts. Accuracy assessment through a correlation of at least 80 patient samples on the Mindray BS-480 and Beckman Coulter AU400 analyzers is in process. Carryover studies using reagents and samples historically observed to cause carryover in cuvettes, probes, and mixers are in process. Interference studies for hemolysis, lipid, and bilirubin will be conducted using a 10% margin of variability and compared to reagent manufacturer's claims. Limit of Detection for calibrated assays will be determined by statistical analysis of response values from five replicates of a low sample and ten replicates of a negative sample. For factored enzymes the limit of detection will be determined by observation of the lowest concentration sample yielding nonzero results.

**Results:**

All assays yielded within run precision CVs below 6.8% and most assays had CVs ranging between 0.0% to 4.8%. All assays yielded total precision CVs below 8.3%, with the exception of carbon dioxide, and most assays had CVs ranging between 0.7% to 5.0%. Accuracy, carryover, interference, and limit of detection studies are currently in process; but preliminary data suggest comparable performance to the Beckman Coulter AU400.

**Conclusion:**

The performance characteristics of the general chemistry assays on the Mindray BS-480 Analyzer were comparable to the Beckman Coulter AU400. Based upon data generated to date, it can be concluded that the Mindray BS-480 Analyzer is a suitable instrument for use in mid-volume laboratories based upon throughput capabilities and performance.