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C Spencer
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Thyroglobulin (Tg) protein is synthesised uniquely by thyroid tissue and is measured as a post-operative differentiated thyroid cancer (DTC) tumour-marker. Tg autoantibodies (TgAb), present in ~20 percent of DTC patients, interfere with Tg immunometric assay (IMA) measurements causing falsely low/undetectable serum Tg values. Tg radioimmunoassay (RIA) methodology appears resistant to such interferences but has limited availability, whereas new Tg mass-spectrometry methods have inferior sensitivity and unproven clinical value. When present, TgAb concentrations respond to changes in thyroid tissue mass. Thus, when Tg IMA measurements are compromised by the presence of TgAb the TgAb trend can serve as a surrogate DTC tumour-marker. Unfortunately, both physiologic and technical factors impact the interpretation of Tg and TgAb used as DTC tumour-markers.

Serum Tg Testing
Cirulating Tg concentrations change in response to thyroid tissue mass, injury (surgery, biopsy or radiiodine) and the degree of TSH stimulation. Technical factors (Tg assay sensitivity, specificity and interferences) additionally impact the clinical utility of Tg testing. Specifically, new 2nd generation Tg IMAs (functional sensitivities ≤ 0.1 µg/L) now mostly obviate the need for expensive recombinant human TSH(rhTSH)-stimulated Tg testing. Tg molecular heterogeneity remains responsible for two-fold between-method differences in Tg values that preclude switching methods and TgAb interference remains especially problematic.

Serum TgAb Testing
Reliable TgAb testing is critical for authenticating that Tg IMA measurements are not compromised by interference. Unfortunately, TgAb methodologies vary widely in specificity, sensitivity and the absolute values they report, necessitating that TgAb concentrations be monitored using the same method. Furthermore, adopting the manufacturer’s TgAb cut-off value to define a ‘detectable’ TgAb results in falsely classifying sera as TgAb-negative, because manufacturers’ cut-offs are set to diagnose thyroid autoimmunity and not to detect TgAb interference.

PLENARY 1

S3 HARMONISATION – THE COMPLETE PICTURE

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The terms ‘standardisation’ and ‘harmonisation’ denote two separate, albeit closely linked concepts. Clinical laboratories have been aware of the need for standardisation and harmonisation for more than four decades but have focused on analytical processes and, despite the efforts made, harmonisation of results remains the ‘holy grail’.

While the issue of standardisation and harmonisation is of prime importance for public health, its implementation cannot be overseen by an isolated group of laboratory professionals; it should be conducted through the concerted action of laboratory administrators, manufacturers, external quality assurance organisers, clinicians and other stakeholders. Therefore, there are manifold reasons for increasing our efforts to provide harmonisation in laboratory medicine, with a particular focus on the following: a) patient safety, as differences in practice can put patients at risk; b) clinical guidelines, as differences compromise the value of practice guidelines; c) public/patient confusion, as differences cause patients to lose confidence in laboratory medicine; d) clinical governance, as differences make laboratories vulnerable to challenge; e) electronic patient record, as differences preclude commutability of data.

Harmonisation in laboratory medicine should be considered as part of a program to assure quality in the total testing process, with a shift from a laboratory-centred to a patient-centred scenario. Indeed, the harmonisation of analytical results is not enough to fulfill patient expectations and issues such as appropriateness in test requesting, valid reference values and adequate interpretation criteria should be taken into consideration for an effective harmonisation process. Recently, a roadmap for the harmonisation of clinical laboratory procedures has been designed. In addition, the feasibility of programs aiming to provide laboratory information comparable across clinical laboratories, time, and location has been demonstrated. This, in turn, paves the way for further initiatives in this area.

DAVID ROTHFIELD MEMORIAL ORATION

S4 NEW US CARDIOVASCULAR DISEASE GUIDELINES AND BIOMARKERS TO ASSESS DISEASE RISK

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The role of low-density lipoprotein cholesterol (LDLc) in the assessment of cardiovascular disease (CVD) is firmly established from population and intervention studies. The US Adult Treatment Panel (ATP) issued guidelines in 1988 which identified elevated LDLc as the primary target of lipid-lowering therapy for reducing CVD risk. In the subsequent ATP II guidelines more attention was given to high-density lipoprotein cholesterol (HDLc) and it was added to the initial lipid screening panel. ATP III introduced non-HDLc as a secondary target of therapy for persons with triglycerides ≥200 mg/dL (≥2.3 mmol/L). Although the contribution of LDLc to the development of CVD is well recognised and accepted, evidence suggests it may not be the best biomarker. Results from recent studies have put in question the reliability of the newer direct assays for LDLc and HDLc analysis. These recent observations...
have again focused attention on alternative biomarkers, such as apolipoprotein B, as preferable and more powerful predictors of CVD. In addition, studies have shown that almost half of cardiovascular events affect individuals without evidence of hyperlipidaemia. In an attempt to improve CVD risk assessment, many investigators have focused on other ‘novel’ risk factors that reflect different aspects of disease with hopes that new biomarkers might prove better to identify high-risk individuals that require intervention. An ATP IV has been commissioned and a report with updated recommendations is expected. How will ATP IV incorporate other biochemical markers that have shown strong association with CVD risk? Performance issues with direct LDLC assays, evaluation of the evidence for apolipoprotein B as an alternative marker for LDLC and the evidence for C-reactive protein and markers of renal function as other possible biomarkers for assessing CVD risk will be reviewed.

PLENARY 5

S5 HARMONISATION OF HBA1C

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The prevalence of diabetes is increasing rapidly. There are estimated to be 366 million people in the world with diabetes and by 2030 this number is expected to reach 552 million. Measurement of haemoglobin A1c (HbA1c) is fundamental to the management of patients with diabetes. Large prospective randomised clinical trials, most notably the Diabetes Control and Complications Trial (DCCT) and United Kingdom Prospective Diabetes Study (UKPDS), documented that HbA1c predicts the risk for developing microvascular complications. Based on these data, HbA1c of 6.5 to 7% is recommended as the treatment target. Several influential clinical organisations have recently advocated HbA1c for diagnosis of diabetes, providing additional impetus for accurate HbA1c analysis.

Glycated haemoglobin (GHb) consists of HbA1a, HbA1b and HbA1c. More than 100 methods are commercially available to measure GHb. These factors have led to considerable variation among results reported by different clinical laboratories. Working with manufacturers of HbA1c assays, the NGSP has significantly reduced inter-laboratory variation using a harmonisation process based on the DCCT reference method. HbA1c values are reported using the same numbers as those in the DCCT and UKPDS. The International Federation of Clinical Chemistry and Laboratory Medicine (IFCC) developed a higher order reference method, which uses HPLC-mass spectrometry or HPLC-capillary electrophoresis, and reference materials for HbA1c analysis. The NGSP and IFCC serve complementary roles in the HbA1c harmonisation process and together have improved patient care.

S7 KEY INCIDENT MONITORING AND MANAGEMENT SYSTEMS (KIMMS)

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Pathology in Australia has been a leader in the introduction of accreditation and quality assurance for pathology laboratories to demonstrate competence and continual improvement. The focus of external quality assurance (EQA) has been on the analytical phase of testing.

Recent studies have shown that the majority of adverse patient incidents occur in the non-analytical phase of the request-test-report cycle. In order to minimise the risk of errors and incidents in pathology, the pre- and post-analytical phases of testing need to be measured and monitored. KIMMS has established quality indicators based on the likely failure points of the request-test-report cycle focusing on incidents that are high frequency and high risk to patient safety, predominantly in the pre-analytical phase where the correct identification of the pathology sample is paramount. Other indicators focus on the correct transport, storage and collection techniques of the sample.

The KIMMS program has developed from the early work undertaken by the RCPA to an EQA scheme that has developed key quality indicators for pathology services that can be measured, are relevant to pathology services and provide an indication of the risk to each participating laboratory, as a risk management tool. Efforts have been made to assist laboratories in applying the data from KIMMS to overcome issues with data extraction/collection, identify how best to use the data to facilitate and improve quality and reduce incident rates. Finally the Risk Matrix report assists participants to identify high risk areas for their pathology service. Effectively, KIMMS provides participants with additional tools to improve the quality of their entire quality system, reduce incident rates thus increasing patient safety.
S8 LABORATORY QUALITY INDICATORS – COLLECTION AND THEN WHAT? A PRACTICAL PERSPECTIVE
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It is well known that errors in pathology testing occur at a very low rate in the actual testing of the samples. This is largely attributable to the concentration of quality assurance programs (QAP) on the analytical component of the test sample life cycle. The majority of errors in delivering patient results now occur in the pre- and post-analytical phases of the test cycle. Techniques for collection of error statistics range from notes, both electronic and paper, with collation by spread-sheets, through to automated systems utilising structured data inputs into laboratory information management systems and linked or independent quality and incident management systems.

The outcome of internal or external monitoring of quality indicators should be seen in changes that can be implemented to continuously improve laboratory performance and reduce errors that impact upon patient diagnosis and treatment. The effectiveness of this outcome depends on the accuracy of the collected data, its relevance to the environment in which the laboratory operates and the availability of mechanisms to address the errors. It is critical to the effectiveness of programs such as this that clear and unambiguous definitions of errors are utilised so that we can be certain that performance is measured against identical criteria.

To reduce the pre- and post-analytical error rate, we must be sure we are measuring the same parameters in the same context, so that we can determine the true rate of error in the industry and specifically in the segment of the industry in which our facilities operate. Then we can determine the likely effective targets of action to improve overall error rates.

S9 QUALITY INDICATORS FROM AN INSTITUTIONAL PERSPECTIVE – THE UK EXPERIENCE
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It is a common observation by laboratory professionals that the majority of errors in the test-request-report cycle occur before samples reach the laboratory. Despite tight control of analytical areas with internal quality control and external quality assurance, it is not yet routine practice in the UK to collect data on pre-analytical errors. The resulting lack of evidence of the source, number and type of errors occurring leaves problem areas unidentified and issues unaddressed.

Our laboratory was the first in the UK to enrol in the Key Incident Monitoring and Management Systems (KIMMS) quality assurance scheme. A laboratory information management system was developed for automatic recording of errors and a mechanism was put in place to allow feedback to users. The differences in working practices between the UK and Australia presented a series of challenges for set-up, and difficulties were encountered when attempting to target the root causes of errors. The majority of UK laboratories are publicly run, handling a mixture of both general practice and hospital samples. A larger proportion of requests are received electronically through various systems e.g. Anglia ICE (GP) and Medway Sigma (hospital). Phlebotomy may be carried out in a number of different locations; transport and IT arrangements vary and these services are often outside laboratory management control.

In summary although difficulties were encountered when introducing pre-analytical error control systems, solutions were employed and we are now able to tackle pre-analytical errors alongside clinical colleagues in an effective manner.

S10 LAB TESTS ONLINE – PATHOLOGY INFORMATION FOR THE PEOPLE
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Lab Tests Online (LTO) is a website aimed at providing reliable information about pathology testing for the general public. It provides information about pathology tests, clinical conditions, appropriate screening for disease, pathology laboratories and the people who work in them and how specimens are collected and processed.

The first LTO site developed by the American Association for Clinical Chemistry went live in the US in 2001. The Australian site was launched in 2007 under the direction of the Australasian Association of Clinical Biochemists. There are now 17 sites world-wide in 14 languages.

All LTO sites share and can develop new content and a number of new articles have been developed by LTO Australasia editors. Most content has been initially developed in the US. A team of volunteer editors review this material and edit it to make it suitable for the Australian pathology scene with Australian practice, Australian statistics and Australian links to further information. LTO in Australia has been funded by grants from the Quality Use of Pathology program in the Commonwealth Department of Health and Ageing.

Users of LTO Australasia come from a variety of backgrounds. Most are patients or patient carers but the next biggest group is health professionals of various kinds. An online survey and six focus groups have been used to evaluate user perceptions of the site. Both the patients and carers and the health professionals rate the site around 8 out of 10 for ease of navigation, quality of content, correct amount of information, reliability of information and usefulness. LTO is already widely used by the Australian public and awareness and utilisation of the site continue to grow.

S11 PATHOLOGY REPORTS IN AUSTRALIA’S PERSONALLY CONTROLLED ELECTRONIC HEALTH RECORD (PCEHR) – BETTER VALUE FOR CONSUMERS
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National E-Health Transition Authority (NEHTA) is the lead organisation supporting a national vision for eHealth for Australia. Established in 2005, NEHTA is jointly funded by the Australian Government and all State and Territory Governments. There are 12 sites across Australia now rolling out eHealth. From 1 July 2012, all Australians can choose to register for a Personally Controlled Electronic Health Record (PCEHR).

The foundations for eHealth are now being put in place across Australia. Specifications and standards for software vendors working on the PCEHR system have been released. The adoption of eHealth has been encouraged through engagement and collaboration with consumers, healthcare providers, vendors, and policy makers.

S12 THE AUSTRALIAN PATHOLOGY UNITS AND TERMINOLOGY STANDARDISATION PROJECT (PUTS)
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Pathology reports have evolved from being department-specific to covering the whole patient episode; but now they are often synthesised from the results
and records of multiple sometimes-unrelated organisations. The reports are also now distributed more widely. It is now routine for clinicians to receive reports from multiple practices and for these to be further aggregated into regional health records (and soon national records).

Despite electronic reporting since 1993 and an Australian Standard since 1998, there is still significant variation in the form and content of electronic pathology reports, especially the way that tests are named and coded but also the units used. This variation arises from different laboratories having different policies but also from the same laboratory providing different outputs to different customers. Reports go to widely different healthcare settings including hospitals, community and indigenous health services and homes. Components of reports are frequently used in comparative displays and decision support.

There is a risk of misinterpretation if terminology and units differ, but even when these are the same, there are circumstances where differences in test methods and/or reference intervals make comparison inappropriate. All this has led to serious concerns for clinical safety. Combined with the growing desire to make more use of pathology in other information systems there has been a drive to standardisation of units and terminology.

A national project for the Standardisation of Pathology Units and Terminology (PUTS) was initiated by the RCPA in July 2011 with support from the Department of Health and Ageing (DoHA). Around 80 pathologists, scientists, informaticians and other clinicians have been working in eight working groups to establish guidelines for the use of terminology and standardised units covering each of the pathology disciplines. Constrained sets of the most common terms and their corresponding codes and units were developed for requesting and reporting pathology using consensus-based standards development and good clinical governance. The Project Steering Group decided on the adoption of: SNOMED for requesting; LOINC for the reporting question (HL7v2 OBX-3); and UCUM for the representation of units.

In conclusion, a standard has been written that describes the rules and records knowledge work done by the PUTS project teams. The resulting terminology sets are in the final stages of consultation and endorsement.

SYMPOSIUM 3 – MEDICAL SCIENTIST CAREER UPDATE

S13 TRAINING OF MEDICAL SCIENTISTS – AUSTRALIAN UPDATE

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There is a lot of interest in the optimal mix of staff for different types of laboratories and how to train staff for these different laboratory situations. Concerns have been raised about the ageing of the senior scientist group and the shortages of scientists in certain disciplines and geographical areas. The role of scientists, technicians and other laboratory staff is also topical. There are issues with lack of professional engagement, involvement and retention of medical scientists, the development of silos in industrial awards, lack of opportunity for promotion which may exacerbate the training and development of pathology staff. There is also a mismatch between the output of various educational sectors and the expectations of industry. This talk will look at laboratory staffing from the point of view of a career path that is a continuum of skills and education. What is needed for the future, what is the present state and the implications for laboratories and associations will be discussed. Ultimately, the sector needs a detailed workforce plan which could lead to a sustainable workforce. The framework that will be used will be the Competency Based Standards, the Scope of Practice, and the Career Pathways for Medical Scientists documents.

S14 TRAINING OF SCIENTISTS – UK PERSPECTIVE

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Proposals to transform the training and education of healthcare scientists in the UK were first consulted on by the Department of Health in 2008 following a similar initiative that transformed medical training (Modemising Medical Careers). This was an ambitious scheme to encapsulate a common training for the 51 differing disciplines across the NHS with diverse roles in life sciences, physiological sciences and physical sciences and engineering, where training and educational pathways were seen, in many cases, to be inadequate.

Modernising Scientific Careers (MSC) was launched in February 2010 as an enabler for change providing a strategic view of the healthcare science (HCS) workforce and a means of developing a sustainable and flexible workforce for the future. MSC set out its intentions with respect to career pathways, regulation and standards of education and training and redefined the career grades of the entire HCS workforce.

Educational packages have since been developed in consultation with professional bodies to support the training of staff from assistants to scientists, with the work focusing on a shared learning experience containing both generic and specialist components. A National School of Healthcare Science has been established to provide support to deliver these programs. The School has already produced a pilot program for genetics whose first students will graduate this year. Intake into other life science themes of blood and infection sciences took place across England in September 2011.

The changes have not been universally welcomed and do not yet sit easily with the expectation of statutory regulation. However the emergent Academy of Healthcare Science is positioning itself to offer an over-arching standard setting and quality assurance agency for the education, training and assured voluntary registration of the whole HCS workforce.

S15 TRAINING OF MEDICAL SCIENTISTS – USA PERSPECTIVE

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There are two tracks for training doctoral level medical scientists in the US, one for physicians and another primarily for PhD scientists but also open to physicians. The physician track is by a residency program accredited by the Accreditation Council for Graduate Medical Education (ACGME) which can be a combined four year anatomic and clinical pathology residency program, or a three year program in either anatomic or clinical pathology. Certification of competency is by examination by the American Board of Pathology. Specialist training in Chemical Pathology is by an additional one year fellowship and certification as a specialist by examination.

PhD scientists receive training in clinical chemistry or a related discipline by a two year fellowship program that is accredited by the Commission on Accreditation in Clinical Chemistry (ComACC). Analogous training for doctoral scientists is available in medical microbiology, cytogenetics and other clinical laboratory specialties. Certification is by examination by the American Board of Clinical Chemistry which has separate Specialty examinations in clinical chemistry, toxicological chemistry and molecular diagnostics.

Doctoral scientists enter training with a broad range of backgrounds including analytical chemistry, biochemistry, physiology, molecular biology, genetics, pharmacology, etc. but frequently have little experience in medical diagnostics. Physician pathology residency programs are formed disciplinarily and tend to emphasise the components for which a pathologist can bill for services which does not include many clinical laboratory test procedures. Nearly all academic centres that offer PhD training programs also have physician pathology residency programs and the curriculum has many common elements so the trainees with different backgrounds function as tutors for each other. Guidelines for curriculum content are provided by ComACC and by the Academy of Clinical Laboratory Physicians and
Scientists, and include analytical, clinical, statistical, administrative and quality management areas.

S16 MEDICAL LABORATORY SCIENCE IN NEW ZEALAND – A CHANGING DYNAMIC IN WORKFORCE EDUCATION
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Since the development of a full time university degree-based qualification, historic workforce patterns in diagnostic pathology remained relatively unaltered. However, in recent times a consequence of developing a degree-based qualification has been the expectation to undertake post-graduate qualifications, higher career expectations of individuals in the work place and an aging workforce across all disciplines in diagnostic pathology. In addition, the creation of a degree qualification provided well-qualified graduates with skills sought after by other sectors such as research groups and biotechnology industries. In this presentation the overall structure of the New Zealand qualification system will be considered, the requirements for registration, and the changing world of the medical laboratory scientist in relation to qualification routes and new technologies.

QC UPDATE PLENARY

S17 REVIEW OF QAP ACTIVITIES
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This session is a report to participant laboratories and AACB members on the activities of RCPA Quality Assurance Program (QAP) Chemical Pathology in 2012. The Chemical Pathology QAP currently offers 49 programs or program options and there are 1765 participants taking 6086 programs. This is a 6.6% increase in programs and a 4.3% increase in participants for 2012. Overseas enrolments (not Australia or New Zealand) now account for 27.8% of participants, coming from 48 different countries. As this includes our first South American enrolment and there are several in Antarctica, we now supply to all continents. During 2012 the program has passed NATA accreditation against ISO/IEC 17043. The 12 AACB working parties which support the QAP have again provided a major contribution to the program. The RCPA QAP Chemical Pathology is pleased to celebrate its 30th birthday in 2012.

For 2013 there will be a ‘Liquid serum chemistry’ program commenced using fresh frozen plasma to start addressing the important issue of sample commutability. The RCPA QAP Company itself is undertaking significant changes in 2012. Many of the programs are being brought together into a purpose-designed facility in Sydney to achieve improved co-operation and efficiencies although the timing of any relocation of the Chemical Pathology program remains uncertain.

S18 LOOKING CLOSELY AT THE END-OF-CYCLE CALCULATIONS
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In each end-of-cycle report for numerical programs from the RCPA Quality Assurance Program (QAP) there is a statistical summary of performance providing estimates of precision (standard deviation, SD; coefficient of variation, CV) and bias. These formats have been used for many years and it is important for participants to be aware of the strengths and weaknesses of the resulting data. The first issue is the number of data points. Any experimental estimate is more robust with more data. The QAP cycles generally contain either 12 or 16 results which limits the accuracy of the estimated SD and CV. Any missing data will further affect these results. The SD is calculated by scatter around the line of best fit for the laboratory and the CV uses an estimate of the centre of the results in place of the average of results. For some analytes these processes can adversely affect the accuracy of the estimates, for example with non-linear data or analyte concentrations which are clustered at one end of the concentration range. The bias estimate is also derived from the line of best fit for the individual laboratory allowing the use of all supplied data for the calculation. Assessment of bias using this tool is generally robust within a method group but there needs to be development of quality standards for assessment of the results.

S19 CELEBRATING 30 YEARS OF CHEMICAL PATHOLOGY QAP
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This year the Royal College of Pathologists of Australasia (RCPA) Chemical Pathology Quality Assurance Programs (QAP) celebrates its 30th year. This is an opportunity to reflect on the past and how we came to be a world leading external quality assurance (EQA) provider.

The introduction and development of the QAP represents a progressive collaboration of the Australasian Association of Clinical Biochemists (AACB) and the RCPA. The founding principles of the QAP come from the work of the South Australian Branch of the AACB QC Subcommittee which was formed in 1973 to provide EQA for South Australian laboratories. Through their innovative work were introduced lyophilised samples rather than fresh frozen serum, multiple levels by mixing, two sera per time and allowable limits of performance.

When in the late 1970s the RCPA and AACB decided that Australia needed a national QAP, the South Australian model became the basis with the first General Serum Chemistry Program being offered in 1982. From this small beginning the QAP has continued to grow in programs and participants and has continued the tradition of innovation.

SYMPOSIUM 4 – QC UPDATE

S20 NEW PROGRAMS / ANALYTE ISSUES
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The RCPA Chemical Pathology QAP are continually involved in developing, improving and monitoring the QAP materials and programs. This session will summarise the new programs and developments to existing programs which have been implemented in 2012 with specific focus on Faecal Occult Blood, Whole Blood Glycohaemoglobin, Urine Vanadium, Cholinesterase, Vitamin B2, Plasma Vitamin B6 and the re-introduction of Lipoprotein (a) and Serotonin.

Each year the RCPA Chemical Pathology QAP staffs reviews every analyte in all programs. We will present the analytes where optimum analyte concentrations were not achieved and what action is being taken to continue to provide a quality service for participants.
Every Australasian laboratory participates in external quality assurance (EQA) programs which are designed to give information on the bias and precision of their laboratory’s method in comparison to other laboratories using the same method and other methods. Bias is determined by the deviation of the laboratory or method from a target value. Ideally, the EQA material should be commutable, that is, it shows similar properties to patient samples. However, in practice, EQA material is often a manufactured product which has been designed to include many analytes and concentrations not normally seen together in patient serum. When inter-method performance differences are observed in EQA materials the question arises as to whether this is an artefact of the EQA material or represents a true inter-method difference. The protocol to determine this is to run patient samples in comparison with EQA samples.

The Australian Bias Study enabled this work to be performed in Australasia using 8 major chemistry platforms to analyse patient samples for 27 analytes. The extension of this work is to compare the results of the Australian Bias Study with the RCPA General Serum Chemistry Program to answer the question: is it a matrix effect? This talk will compare the results of the Australian Bias Study with those of the RCPA General Serum Chemistry program for selected analytes.

New analytes are continually being developed and adopted in laboratories. As part of this process opportunities to implement new programs and enhance existing programs are investigated. The QAP’s aim has always been to keep our program participants informed and involved in this process. The feedback we obtain from participants through questionnaires and regular communication via the day to day workings of the QAP has always been important to us and is invaluable in assisting with the development and improvement of our programs. This session will present the findings of the most recent Participant Questionnaire.

Interpretative commenting is an important aspect of the post-analytical phase in Chemical Pathology. There are many factors that enhance the importance of adding comments to Chemical Pathology reports. These include the introduction of new and complex tests including genetic testing, increased electronic data communication, use of expert systems, ability to build interpretative algorithms on new laboratory systems, competition between pathology laboratories and the introduction of clinical and regulatory guidelines. Commenting on reports is an art that needs to be acquired during training and continually refined afterwards. The RCPA Chemical Pathology QAP Patient Report Comments Program is an educational self-assessment program, aimed at the continuing professional development of individuals who currently add comments to reports generated by their laboratories, and the education of individuals training for such a role. Assessment of comments is an imperfect science and is a guide to, not a definition of, the appropriate approach. The case report comments program enables us to consider how commenting is performed and the extent of and reasons for variation.

Cases distributed in this program in 2012 will be presented in the clinical update symposium and discussed by the Review Panel with active audience participation. Dissecting views will be encouraged and an interactive format will be followed.

Increasingly clinical medicine is being turned on its head with diagnostic tools being used to identify genetics, biochemistry or imaging identifying an abnormality, which then requires a clinical assessment. This is exemplified by the phenomenon of the ‘adrenal incidentaloma’, a structural change in the adrenal gland identified by CT scan, ultrasound, MRI scan or even PET scan in a patient with no known adrenal disease. The challenge for the physician is to decide whether this structural abnormality is functionally significant. Assuming that the lesion is intrinsic to the adrenal, not an extrinsic lesion (i.e. not TB, a lymphoma, 2° metastasis etc.) where hypofunction will need to be considered, then the possibility that it arises from the cortex and thus secretes steroids or the medulla and secretes catecholamines must be considered.

Cushing’s syndrome due to hypercortisolaemia has a well-defined diagnostic pathway challenged by an exhaustive list of exceptions. This means that all test results must be qualified and more than one ‘definitive’ test required. Hyperaldosteronism (Conn’s syndrome) may occur in up to 10% of the hypertensive population yet routine assessment is uncommon and to some extent controversial. Disorders of androgen synthesis are usually associated with a fairly explicit clinical scenario such as is seen in congenital adrenal hyperplasia, however other causes and associations are often obscure. The diagnostics available to identify disorders of the adrenal medulla i.e. pheochromocytoma, have been extensively canvassed. The last decade has seen increasing clarification of both the germline (familial) and somatic (sporadic) genetics of many of these adrenal disorders.

An understanding of the underlying cellular processes of bone remodelling in the basic multicellular unit (BMU) has led to the development of biochemical markers of bone resorption and formation, measured either in the serum and urine. Biochemical bone markers are independent to bone mineral density (BMD) measurements in predicting bone loss and fracture risk. Bone markers, when utilised for monitoring anti-osteoporotic treatment with either anti-resorptive or anabolic agents, in addition to BMD, may allow early identification of non-responders, or non-compliance with therapy. Bone turnover markers (BTMs) are also clinically useful in determining possible causes of secondary osteoporosis by identifying patients with high bone turnover and rapid bone loss. Treatment-induced changes in specific markers account for a substantial proportion of fracture risk reduction with anti-resorptive drugs. However, there is still a need for stronger evidence on which to base practice in monitoring such treatment responses. An example is the prolonged anti-resorptive action
of intravenous zoledronic acid when BTMs are reduced for ≥2 years and whether BTM measurement can assist in the timing of subsequent infusions.

The International Osteoporosis Foundation and the International Federation of Clinical Chemistry and Laboratory Medicine recommend one bone formation marker (serum procollagen type I N propeptide, PINP) and one bone resorption marker (serum C-terminal telopeptide of type I collagen, CTX) to be used as reference markers, and international premenopausal reference intervals now exist. Increased experience with these markers in appropriate clinical settings will help resolve uncertainties over their clinical use. Automation and more widespread use of serum assays have reduced analytical variability. However, intra-individual variability in BTMs exists and must also be minimised by collecting serum at the same time of day in the early morning in the fasting state. Analytical variability can be reduced further by the adoption of international BTM standards. BTMs do hold promise in fracture risk prediction and for monitoring treatment and their transition into everyday clinical practice is now gaining momentum.

S26 STANDARDISATION OF BONE TURNOVER MARKERS
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The joint International Osteoporosis Foundation and International Federation of Clinical Chemistry and Laboratory Medicine Working Group (IOF-IFCC WG) on Bone Marker Standards in Osteoporosis has proposed the use of one bone formation marker (serum procollagen type I N propeptide, s-PINP) and one bone resorption marker (serum C-terminal cross-linking telopeptide of type I collagen, s-CTX) as reference bone turnover markers (BTMs) in clinical trials and in observational studies in order that adequate data be accumulated for their application in clinical practice. The reference standards were chosen based on predetermined criteria for clinical and analytical performance.

The use of other BTMs in clinical studies is not precluded by the adoption of reference standard markers. Rather, it provides internal references and the ability to pool studies easily for meta-analyses so that BTMs can be considered alongside other risk factors for fracture risk calculations and for inclusion in clinical trials to examine the relationship between change in BTMs with treatment and fracture risk reduction.

There is currently lack of inter-laboratory agreement of results for the same BTM, which makes it difficult to (i) follow a patient by testing in different laboratories, (ii) measure BTMs in different laboratories in multicentre clinical trials, and (iii) designate universal cut-points and decision levels. Therefore the IFCC-IOF WG on Standardisation of Bone Marker Assays has embarked on standardisation/harmonisation of measurement of the reference BTMs (s-PINP and s-CTX), which should help overcome the above problems by ensuring comparability of BTM data across laboratories and over time, and assist in standardising decision points.

SYMPOSIUM 8 – DISASTER RECOVERY

S28 LESSONS LEARNED FROM THE CANTERBURY EARTHQUAKES
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We came through the September 4 2010, magnitude 7.1 earthquake relatively unscathed, although we were certainly not expecting the magnitude 6.3 earthquake that devastated Christchurch at 12.51 pm on February 22 2011. Our building suffered only minimal structural damage, thanks to robust construction, including expansion joints. Our colleagues in the two community laboratories were less fortunate – although they escaped unharmed, their premises were condemned. Our ground floor Core Laboratory kept going, with emergency power and water supply maintained. Essential service was uninterrupted, with exemplary turnaround times maintained in the immediate aftermath. Despite the apocalyptic appearances, a major clean-up effort occurred the following day and we were up and running close to 100% in most areas within 24 hours. Briefings took place each day and access to counselling and support was available. Many people rallied from out of town to help. Sound buildings are essential and also reliable backup power supply. We are also fortunate in having a bore to our own artesian well. Fume cupboards need to be securely bracketed. Down lights are preferable to suspended light fittings. Ceiling tiles need to be of light construction and curtain wires on shelves are also helpful. Let instruments on trolleys run freely. Noxious chemicals need to be securely stored and preferably closer to ground level. Fortunately, people in NZ are very well versed from school age in what to do in the event of an earthquake – ‘drop, cover and hold’. In the final analysis, being able to maintain an effectively uninterrupted essential service, to clean up so quickly and thoroughly and take on extra work was testimony to the extraordinary resilience and fortitude of our staff.

S29 FLOOD PREPAREDNESS (QLD FLOODS)
T Badrick
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Sullivan Nicolaides Pathology has a central laboratory in the leafy suburbs of Brisbane near the Brisbane River, some 20 regional laboratories, and over 300 collection rooms spread throughout Queensland and northern NSW. As a consequence the practice was significantly affected by the flooding that occurred in 2011, with significant disruption to many of the laboratories including the main Brisbane laboratory. The central laboratory, several Brisbane hospital and regional laboratories were isolated for periods.

The flooding in the regional centres was predictable and steps were able to be put into place to develop contingency plans as the situation approached;
however the suddenness and extent of the flooding in Brisbane meant that no specific planning was in place. The laboratory had devised contingencies for many potential interruptions to services or staffing, however the extent in time and area of the flooding and the unpredictable nature of the disruption meant that most of the actions were in real time.

This talk will describe some of the problems encountered including the length of time for which there were no utility services, the uncertainty of staffing from hour to hour as the flood impacted personally on staff or their ability to travel to and from work, and the need to continue to operate the laboratory service as there was really no significant drop in demand. The lessons learned will be described and include the need for good public and organisational communications, the importance of not relying on ‘normal’ utilities, the need to use public systems to deliver samples and the importance of having key people available at all times.

SYMPOSIUM 9 – SRAC SYMPOSIUM

S30 THE VITAMINS WORKING PARTY: WORKING TOWARDS HARMONISATION

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Harmonisation of methods is an integral part of the pursuit of excellence in clinical biochemistry through continuous improvement in laboratory practice and the interpretation of results. As part of this endeavour, the Australasian Association of Clinical Biochemists (AACB) Vitamins Working Party, together with the RCPA Quality Assurance Programs, has directed efforts over the past decade towards the improvement of analytical methods for analysis of vitamins. We present here the consensus views, in association with peer reviewed evidence of the AACB Vitamins Working Party, a laboratory medicine best practice guideline for the collection, analysis and interpretation of vitamins A, E and the carotenoids.

This best practice document has been developed with reference to: (1) the Centers for Disease Control’s (CDC) Laboratory Medicine Best Practices: Developing an Evidence-Based Review and Evaluation Process; (2) the numerous surveys and studies conducted by the AACB Vitamins Working Party since 1999 relating to the practice of fat-soluble vitamin methods; and (3) a review of published literature. The CDC document cites the evaluation framework for making best practice recommendations that are specific for laboratory medicine and forms the structural basis for the design of the Laboratory Medicine Best Practice Guidelines: Vitamins A, E and the Carotenoids.

Despite the apparent method similarities between laboratories, there appear to be many confounding factors inhibiting the uniform reporting and standardisation of vitamin assays. The formation of this best practice document provides recommendations designed to improve the performance, reproducibility and accuracy in clinical biochemistry facilities for the measurement of vitamins A, E and the carotenoids.

S31 HOW MUCH HARMONY EXISTS BETWEEN LABORATORIES PERFORMING URINE BIOGENIC AMINE ANALYSES?

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Introduction
Various biogenic amines and their metabolites are measured in urine for the biochemical diagnosis, and the monitoring of treatment, of neuroendocrine tumours. The AACB Biogenic Amines Working Party decided to survey laboratories performing these tests to determine the degree of harmony that exists for analytical factors associated with their performance.

Methods
A questionnaire was circulated to all laboratories enrolled in 2012 for urine biogenic amines in the quality assurance program (QAP) of the RCPA. After follow-up, a response rate of 62% was achieved. Information was obtained on the urine sample collected, analytes measured, the analytical principles of methods, sources of calibrators and quality controls, and reference intervals used to interpret results.

Results
There was consistency between most laboratories in the collection and storage conditions for urine (HCl-acidified, cold), use of commercial calibrators, internal standards and QC’s, frequency of analysis (usually 1 run per week) and analytical technique (HPLC with electrochemical detection). The most notable differences were in the range of urine testing performed (free catecholamines and/or total metanephrines and/or acid metabolites), and extraction methods (solvent/ion-exchange/alumina/SPE). In addition, there was up to a 2-fold difference in the upper limit of in-house and literature-sourced reference intervals used to report urine biogenic amines for the biochemical diagnosis of neuroendocrine tumours.

Conclusion
Laboratories performing urine biogenic amine analyses are using similar HPLC analytical methods with the same commercial calibrators, and generally produce results within allowable limits of performance with samples from the RCPA QAP for biogenic amines. Further harmonisation may be achievable by updating reference intervals to align them to the best evidence-based literature sources.

S32 AACB TRACE ELEMENTS WORKING PARTY

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The RCPA Trace Elements Quality Assurance Program (QAP) commenced in 2011. The program covers 29 elements over 3 matrices (serum, urine and whole blood) with participants from Australia, New Zealand, Hong Kong, Malaysia and Singapore.

The Trace Elements Working Party (TEWP) was established under the auspices of the Scientific and Regulatory Affairs Committee (SRAC). The TEWP comprises members with appropriate expertise in the area of trace elements analysis from NSW, Queensland, Western Australia, New Zealand and a representative from the RCPA QAP. The TEWP meets on a yearly basis to review the QAP, attempt to resolve analytical issues, suggest improvements and to support participants. The areas reviewed include allowable limits of performance, method classification, concentration levels and the suitability of the material. A Participant Satisfaction survey sent out in May 2011 showed overall satisfaction with the program, the material, the analytes and reporting.

Now in its second year, the program is proving to be viable with good reports from participants. New analytes have been added and problems with the material have been identified and resolved. Current projects are looking at stability and reconstitution issues. Future activities include evaluating new analytes, value-added reporting, standardisation of units, interpretive comments and reference intervals.

S33 KIWI S 1 – AUSSIE S 1: COMMON REFERENCE INTERVALS NOW A DRAW

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The rather ‘tongue in cheek’ title of this talk seeks to pay a tribute to the New Zealanders among others, for the monumental amount of work that preceded the Harmonisation weekend on May 4-5 in Sydney earlier this year. By comparing a number of predetermined reference intervals from NZ, Melbourne Pathology, the Alfred Hospital, the UK and also using a bias assessment performed around Australia, real progress towards harmonised reference intervals was made over the weekend.
A number of chemistry reference intervals have been proposed for use throughout Australasia as a direct result of the weekend, and this was due to the consensus reached by the expert participants involved. Common reference intervals or decision limits have been recommended for calcium (and adjusted calcium), phosphate, magnesium, sodium, potassium, chloride, bicarbonate, creatinine, total protein, ALP, AST, ALT and LD (L to P method). Guideline decision limits have been recommended for glucose, fasting lipids and iron studies. Where to from here? Will we be able to publish a score of Kiwis 5 - Aussies 5 by the end of this year?

**SYMPOSIUM 10 – HGSA SYMPOSIUM**

**S34 CLUES FROM ROUTINE BIOCHEMISTRY IN DIAGNOSIS OF INBORN ERRORS OF METABOLISM**

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Inborn errors of metabolism are individually rare but collectively have an incidence of around 1:1500. Although the number of individual conditions is huge and the definitive diagnosis requires specialist testing, inborn errors with an acute presentation can be broadly placed in two groups: conditions with accumulation of a metabolite which acts as a toxin, or conditions resulting in an energy deficiency in one or more tissues. First-line biochemical testing can give important clues to the diagnosis and may allow treatment to be initiated before a final diagnosis is obtained.

Many of the toxic metabolites are organic acids and an increased anion gap and metabolic acidosis is an important finding. Several organic acidemias and the urea cycle defects will present with an increased ammonia, and a respiratory alkalosis is often the first clue to the presence of hyperammonaemia. Hypoglycaemia is a primary finding in glycogen storage disorders, fatty acid oxidation defects and other mitochondrial disorders. Free fatty acids and 3-hydroxybutyrate levels can be helpful if the samples are taken before giving intravenous glucose. Lactate and pyruvate measurements in plasma and CSF are very important for the mitochondrial respiratory chain disorders.

Other investigations which may be informative include; urate (low in purine disorders and molybdenum cofactor deficiency), creatine kinase (very high in some fatty acid oxidation defects), alkaline phosphatase (low in hypophosphatasia), and creatinine (low in creatine metabolism disorders).

It is important to realise not all inborn errors will present in childhood and the adult clinical chemistry laboratory must be equipped and prepared to initiate further investigations in response to atypical findings.

**S35 METABOLOMICS: TRANSLATION FROM RESEARCH TO CLINICAL PRACTICE**

J Pitt

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Modern mass spectrometric and nuclear magnetic resonance techniques can detect hundreds of components in biological samples. Combined with powerful statistical software, it is now relatively straightforward to perform comprehensive, non-targeted comparisons of samples from disease vs controls to identify potential biomarkers for disease. Many clinical research studies have identified patterns of abnormal biomarkers in various diseases. However, the translation of these research findings into reliable, routine clinical tests is often difficult. This can be due to relatively poor predictive value, the non-specific nature of the biomarkers in a routine clinical setting and poor analytical robustness. Clinical biochemists are in an important position to assess and validate preliminary research findings from metabolomic studies.

This talk focuses on the use of GC-MS and LC-MS in metabolomic studies to initially identify biomarkers and then develop targeted assays with improved sensitivity and precision. Some of the techniques of metabolomics will be illustrated with examples of targeted and non-targeted analyses of biomarkers for bacterial intestinal overgrowth.

**SYMPOSIUM 11 – LABORATORY TESTING IN DIABETES AND RENAL DISEASE**

**S37 URINE ALBUMIN: PROVIDING A HIGH QUALITY SERVICE**

G Miller

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Chronic kidney disease (CKD) is defined as abnormalities of kidney structure or function present for ≥3 months. The main markers used to identify patients with CKD are: GFR <60 ml/min/1.73 m², albuminuria >30 mg/day or an albumin creatinine ratio (ACR) >30 mg/g or 3.4 mg/mmol, urine sediment abnormalities, electrolyte and other abnormalities due to tubular disorders, or biopsy or imaging abnormalities. All guidelines for monitoring patients at high risk to develop CKD include a urine albumin (UA) measurement.

Current recommendations for utilising UA suggest that 24 hour collection is not needed; a first morning void is preferred and should be used to confirm
an initial positive random UA result, and the ACR should always be reported. In addition, decision values at lower concentrations than commonly used, as well as stratification by gender, race and age, may be appropriate for improved assessment of risk for CKD. Standardisation of sample collection becomes more important to properly utilise more sophisticated decision values.

Assessment of laboratory measurement procedures has identified that the imprecision is not adequate for some procedures, dilution protocols are not adequate for some procedures, and that calibration harmonisation needs improvement. A reference system is in development to enable standardised calibration.

Classification of CKD and assessment of risk for complications and progression should be based on the clinical condition causing the CKD and on information from multiple biomarkers. In addition to UA, creatinine and cystatin C provide complementary information on glomerular function but different assessment of overall kidney disease. Further investigation of decision algorithms based on multiple biomarkers will improve the ability to assess risk.

**HbA1C FOR THE DIAGNOSIS OF DIABETES**

**JE Shaw**
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HbA1c has recently been recommended for use in diagnosing diabetes, but much uncertainty remains over its value in comparison to the traditional blood glucose approach. There are many technical differences in both the strengths and weaknesses of glucose and HbA1c measurement, including pre-analytical and analytical factors, making it difficult to compare the technical performance of the two different diagnostic tools. This is further confounded by the fact that it is not clear which diagnostic test should be seen as the gold standard. Blood glucose has many limitations in regard to diabetes, not the least of which is that it measures instantaneous glucose levels, but we are trying to measure chronic glycaemia. Data from several large observational studies on nearly 50,000 participants show that the relationships of fasting plasma glucose, 2-hour plasma glucose and HbA1c with retinopathy are very similar, indicating that any one of them can be used to diagnose diabetes.

There remains some uncertainty over the possibility that the relationship between HbA1c and the oral glucose tolerance test may differ between subgroups defined by ethnicity and other factors. Some of these differences may be due to variations in the prevalence of haemoglobin variants, abnormalities of red cell turnover, iron deficiency and other influences on red cells. Another important explanation, not yet fully explored, is differences in day-to-day patterns of glycaemia.
O1 FALSELY ELEVATED ESTRADIOL LEVELS IN POST-MENOPAUSAL WOMEN WITH METASTATIC ER+ BREAST CANCER

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Introduction

Fulvestrant is an oestrogen antagonist used in postmenopausal women with progressive metastatic breast cancer following anti-oestrogen therapy. We report two post-menopausal women receiving fulvestrant therapy with unexplained elevated serum estradiol (E2) levels.

Methods

Two patients on fulvestrant therapy had frozen serum aliquots sent to four immunoassay platforms for E2 analysis. Fulvestrant obtained from the manufacturer was diluted (final concentration of 50 μg/L) in a male serum pool with a baseline E2 level of <43 pmol/L (immunoassay).

Results

Patients A and B had elevated serum E2 levels on the Siemens Centaur platform. Treatment with scantibodies did not alter the results and serial dilution was linear. Patient samples and a fulvestrant-spiked sample were sent to four immunoassay platforms. Fulvestrant did not interfere with the E2 result on the LC-MSMS.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (yr)</th>
<th>Serum FSH (IU/L)</th>
<th>Estradiol (pmol/L):</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>57</td>
<td>65.8</td>
<td>236, 56, 21.8, &lt;70</td>
</tr>
<tr>
<td>B</td>
<td>51</td>
<td>39.4</td>
<td>283, 72, &lt;18, &lt;70</td>
</tr>
</tbody>
</table>

Conclusion

Cross reactivity of fulvestrant with E2 immunoassay leading to falsely reported results may trigger unnecessary investigations, unwarranted treatments such as oophorectomy or affect eligibility for clinical trials requiring postmenopausal status. Fulvestrant cross-reactivity has not been reported on the Siemens Centaur platform. Our study demonstrated that the Roche and Beckman Coulter assays were least affected by drug interference.

O2 TIME TO REVIEW SYNACTHEN STIMULATION TESTS: CAUTION ON 550 NMOL/L CUT-OFF!

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Introduction

The 250 μg IM Synacthen stimulation test (SST) is a dynamic assessment of adrenal insufficiency. A 30-minute serum cortisol of >550 nmol/L has been widely accepted as an adequate response. Recent studies have demonstrated variability in cortisol measurements by different automated immunoassay platforms. At PathWest QEII serum cortisol has been analysed on the Abbott Architect since September 2008. Since a reagent lot change in October 2010 the median 30-minute stimulated cortisol has fallen from 670 nmol/L to 540 nmol/L, clinically significant as it is now below 550 nmol/L. By comparison, there has been no comparable drift on the Siemens Centaur.

Methods

All SSTs performed at PathWest QEII since January 2012 were analysed on the Abbott Architect, Roche E170 and the Siemens Centaur and Immulite. To date, there are 110 SSTs with complete data including 26 patients (24%) with a history of pituitary tumour or surgery.

Results

The median 30-minute cortisol was 540 nmol/L on Abbott, 666 nmol/L on Immulite, 599 nmol/L on Centaur and 706 nmol/L on E170. Using >550 nmol/L as the diagnostic cut-off, 45% patients would ‘pass’ on Abbott, 77% on Immulite, 64% on Centaur and 80% on E170. However, using published method-specific 30-minute serum cortisol cut-offs: 81% patients would ‘pass’ with either Abbott (>430.4 nmol/L), Centaur (>498.7 nmol/L) or E170 (>573.5 and >524.4 nmol/L, males and females respectively) and 85% patients would have ‘passed’ on Immulite (474.4 nmol/L).

Conclusion

Method specific cut-offs are required for Synacthen stimulation tests. We recommend adopting a serum cortisol of >430 nmol/L at 30-minutes as adequate response on the Abbott Architect.

O3 THE STABILITY OF ANTI-MULLERIAN HORMONE IN HUMAN SERUM

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Introduction

The Beckman Coulter AMH Gen II ELISA Kit Insert indicates that the stability of anti-Müllerian hormone (AMH) is best maintained in serum stored at 2–8 °C for up to 48 hours, or frozen at -20 °C thereafter. Previously unpublished observations in the Sullivan & Nicolaides laboratory suggest that AMH in human serum is affected within these storage conditions. The objective of this study was to determine more specific AMH stability data.

Methods

Human serum was collected from healthy volunteers, frozen at -80 °C for up to 48 h or at -20 °C for up to 120 h. Results indicate that the freezing of serum induces instability of AMH via an unknown biochemical mechanism.
**O4** TREATMENT OF ACUTE RENAL FAILURE IN MULTIPLE MYELOMA USING HIGH CUT-OFF DIALYSIS

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**Introduction**
Acute renal failure (ARF) is a presentation that occurs in about 15–20% of all cases of multiple myeloma (MM). Renal Failure in MM is usually caused by the formation of waxy casts inside the nephrons of the kidney, caused by an increased production of immunoglobulin free light chain (FLC). Monoclonal FLCs are nephrotoxic and recent work has discovered that unless their serum levels are rapidly decreased, renal failure is irreversible. Historically plasmapheresis has been used to reduce the level of FLC, although the efficacy of this has not been clearly demonstrated. A newly proposed method was to filter the FLC using extended sessions of high-cut off dialysis. This was then attempted at the Launceston General Hospital in conjuction with typical chemotherapy.

**Methods**
High cut-off dialysers were obtained from Gambro and used in 8 hour sessions to filter the FLC from the patient serum. To determine whether the treatment was effective, a blood sample from the patient was taken before and after each session and the concentration of FLC was determined. The results were analysed to determine if the treatment had been successful.

**Results**
The concentration of FLC was effectively reduced from 62,000 mg/L to <200 mg/L over a 35 day period. Following the end of the treatment, the patient was able to maintain creatinine and urea concentrations, indicating that normal renal function had returned.

**Conclusion**
The use of high cut-off dialysis resulted in the succesful and swift reduction in the amount of FLC. Following termination of treatment, normal renal function was maintained indicating that the patient was no longer dialysis-dependent.

**O5** SERUM 25-HYDROXY VITAMIN D – A PREDICTOR OF MICRO- AND MACROVASCULAR COMPLICATIONS IN PATIENTS WITH TYPE 2 DIABETES

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**Introduction**
People with diabetes frequently develop macrovascular or microvascular disease. This study investigated the relationship between serum 25-hydroxy vitamin D (25(OH)D) concentration and the risk of these complications in people with type 2 diabetes.

**Methods**
Macrovascular disease outcomes included myocardial infarction, stroke, CVD death, and coronary or carotid revascularisation; microvascular disease included retinopathy, neuropathy, nephropathy, and amputations without associated large vessel disease. All participants in the Fenofibrate Intervention and Event Lowering in Diabetes (FIELD) trial received 200 mg micronized fenofibrate daily during a 6-week active run-in phase before randomisation to either continued fenofibrate or matching placebo for 5 years. Cox proportional-hazards models and logistic regression were used for analysis.

**Results**
Levels of 25(OH)D in the FIELD cohort ranged from 5 to 196 nmol/L. Eight percent, 52% and 89% of subjects had serum 25(OH)D levels <25, <50 and <75 nmol/L respectively. Serum 25(OH)D was an independent predictor of both macrovascular and microvascular events, and remained so in multivariate analysis stratified for study treatment allocation and adjusted for potential confounders. Compared with those in the top quartile of serum 25(OH)D, the lowest group showed 21% (p<0.02) and 23% (p=0.001) greater macrovascular and microvascular event risks respectively. Each 50 nmol/L decrease in serum 25(OH)D was associated with a relative increase of 23.2% (95% CI 3–20%,

**Conclusion**
Low 25(OH)-D levels are common in type 2 diabetes and are predictive of increased risk of both macrovascular and microvascular complications.

**O6** HOW HARMONISED ARE THE CURRENT COMMERCIAL 25-HYDROXYVITAMIN D ASSAYS?

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**Introduction**
The requests for serum 25-hydroxyvitamin D [25(OH)D] test have increased exponentially. Automated 25(OH)D assays have been developed and many of them were modified in 2011. We evaluated the accuracy of the current assays.

**Methods**
The immunoassays examined were DiaSorin (RIA and Liaison XL), Abbott (Architect), Roche (e602), Siemens (Centaur) and IDS (ISYS); all except the DiaSorin-RIA and IDS-ISYS were newly released in 2011. Two LC-MS/MS systems at Pathology Queensland (PQ) and Douglas Hanley Moir Pathology (DHM) were used as reference methods. Serum specimens (n=133) from routine requests were selected and stored in 0.5 mL aliquots at -20 °C until analysis. Each immunoassay was assessed for correlation, concordance (correlation coefficient (CCC) <0.90 as poor concordance) and linearity (p<0.05 by Cusum test as nonlinear) using MedCal (version 12.2.1).

**Results**
The LC-MS/MS-PQ aligned well with the NIST standards (SRM972) and with the LC-MS/MS-DHM (all r^2>0.97). The performance of each immunoassay compared to the mean LC-MS/MS values (n=125) over 10–200 nmol/L are shown in the Table.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Regression (Passing-Bablok)</th>
<th>Linearity (p) (Cusum test)</th>
<th>Concordance</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>DiaSorin-RIA</td>
<td>y=0.96x+4.4</td>
<td>0.64</td>
<td>0.95</td>
<td>substantial</td>
</tr>
<tr>
<td>Liaison XL</td>
<td>y=1.03x-1.1</td>
<td>0.93</td>
<td>0.93</td>
<td>moderate</td>
</tr>
<tr>
<td>Architect</td>
<td>y=1.16x+1.9</td>
<td>0.02</td>
<td>0.75</td>
<td>poor</td>
</tr>
<tr>
<td>Roche</td>
<td>y=1.18x+5.7</td>
<td>0.81</td>
<td>0.76</td>
<td>poor</td>
</tr>
<tr>
<td>Centaur</td>
<td>y=0.90x-6.8</td>
<td>&lt;0.01</td>
<td>0.88</td>
<td>poor</td>
</tr>
<tr>
<td>IDS-ISYS</td>
<td>y=1.57x-10.4</td>
<td>0.66</td>
<td>0.66</td>
<td>poor</td>
</tr>
</tbody>
</table>

For specimens with LC-MS/MS values <10 nmol/L (n=7; mean±SD: 6.8±1.3 nmol/L), the lowest values were Dasorin-RIA (10.6±1.9) and Liaison XL (10.2±1.6) while the highest were Architect (20.4±5.9) and Roche (20.0±4.8). For specimens with LC-MS/MS values between 50 and 60 nmol/L (n=12; mean±SD: 55.8±2.7 nmol/L), Centaur gave the lowest results (36.5±6.5 nmol/L) while IDS-ISYS the highest (80.3±26.3 nmol/L).

**Conclusion**
DiaSorin assays aligned with LC-MS/MS. The Architect assay was non-linear and had positive bias, while the Centaur assay was non-linear and had significant negative bias. Overall, current assays are not harmonised and can give very different results at clinical decision points.
CONCURRENT SESSION 2

O7 ALKALINE PHOSPHATASE REFERENCE INTERVALS IN PREGNANCY
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Introduction
Serum alkaline phosphatase (ALP) is predominantly of liver and bone origin. It can also be from placenta. Thus, it is expected that ALP rises during pregnancy. We aimed to define trimester-specific ALP reference intervals.

Methods
Stored sera from 145 pregnant women, originally for a thyroid function reference interval study, were analysed for ALP using Roche c701 and Beckman DxC. After excluding women with GGT >55 U/L (n=2), ALP reference intervals were determined as 95% confidence intervals (mean±2SD) of the log-transformed ALP. This was compared to the non-pregnant range (Roche): 20–105 U/L.

Results
Compared to postpartum levels, ALP in 1st and 2nd trimesters were found to be lower (Tukey’s post Hoc p<0.001) and these values were well within the upper limit reported for non-pregnant women. In the 3rd trimester, a marked rise in ALP was observed compared to earlier pregnancy or postpartum (Tukey’s post Hoc p<0.001). The observed reference intervals were similar for both methods.

<table>
<thead>
<tr>
<th>ALP (mmol/L)</th>
<th>Trimester 1 (n=144)</th>
<th>Trimester 2 (n=97)</th>
<th>Trimester 3 (n=80)</th>
<th>Postpartum (n=84)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>9–13/40</td>
<td>22–26/40</td>
<td>35–39/40</td>
<td>8–12/52</td>
</tr>
<tr>
<td>Roche</td>
<td>44 (26–75)</td>
<td>52 (32–87)</td>
<td>104 (60–179)</td>
<td>70 (39–125)</td>
</tr>
<tr>
<td>Beckman</td>
<td>45 (26–77)</td>
<td>54 (32–89)</td>
<td>113 (64–200)</td>
<td>71 (40–128)</td>
</tr>
</tbody>
</table>

Conclusion
A marked rise in ALP is not seen until the 3rd trimester and likely reflects the higher production of placental ALP due to a greater increase in placental size in the 3rd trimester. Thus, an increase in ALP during the 1st or 2nd trimesters may be pathological. This should prompt further evaluation for possible hepatobiliary disease that may be either pre-existing, intercurrent or pregnancy associated, such as intrahepatic cholestasis of pregnancy.

O8 AACB HARMONISATION OF MANAGING CRITICAL RESULTS
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Introduction
The Australasian Association of Clinical Biochemists has undertaken a quality initiative to harmonise critical value management throughout Australasia. The first step toward harmonisation is to understand current critical value management practices.

Methods
Critical values from 36 laboratories across Australasia were compared to critical values from our systematic review of the literature. Fifty-eight Australasian laboratories were surveyed in relation to their critical value management practices. Findings from this survey were compared to similar surveys that had been conducted and reported from overseas.

Results
The majority of critical values used by Australasian laboratories were generally more conservative than those from the literature review. Literature sources were used to compile critical result lists in 59% of Australasian, 48% of Spanish and 57% of Italian laboratories. Clinicians were consulted by 41% of Australasian laboratories when deciding critical limits, a higher incidence than in Italy (21%) and Spain (10.3%) but considerably lower than in the US (73%). Critical values must be delivered within set time limits in 54% of Australasian, in 38% of Spanish and in 61% of US laboratories. A nurse responsible for the patient is considered appropriate to receive a critical result by 75% of Australasian and 91% of US laboratories. Read back of critical results upon delivery is only required in 46% of Australasian laboratories, while 91% of US laboratories, 81% of private laboratories in Thailand, and 62% of Italian laboratories require read back.

Conclusion
Critical result reporting policies and practices as well as the tests and values on the critical results lists of laboratories are very heterogeneous and reflect big variations in practices. Harmonised standards for reporting critical results, and critical values agreed with clinicians are needed for improved patient safety.

O9 MAINTAINING HARMONISATION OF GROWTH HORMONE ASSAYS: AN EVALUATION OF THREE LABORATORY METHODS
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Introduction
Harmonisation of human Growth Hormone (hGH) methods within New Zealand is vital because critical limits are used to assess eligibility for costly treatment with exogenous GH. This therapy is indicated in children with growth retardation and in adults to address the metabolic and psychological effects of GH deficiency. Our laboratory GH method had been harmonised previously with those in other NZ centres but required replacement because of withdrawal of the Bioclone kit. We therefore evaluated three alternative GH methods.

Methods
The reference method was the GH IRMA manual kit (Bioclone Australia Ltd) and test methods were ICLMAs from Beckman Coulter (Access2), DiaSorin (Liaison) and Roche (Elecsys 2010). Imprecision between runs (CVb) was assessed using three clinical sample pools and manufacturers’ controls; and within-run (CVw) and LOQ (CV=20%) from duplicate sample estimates. Suitability of sample type and stability on freezing and thawing was determined before performing method comparisons (Passing Bablok regression) using clinical serum and EDTA plasma specimens.

Results
GH in EDTA compared to serum (n>20) differed only for the Beckman assay (p=0.004). GH differed from basal concentrations (n=4) by ~30% over four freeze cycles for all test methods. CVb (n=20) was 2.0–3.1% (Roche), 3.2–3.9% (Beckman), 4.0–11% (DiaSorin), 2.3–7.3% (Bioclone); and CVw (n=27–50) was 0.8–2.7% (Roche), 2.0–2.9% (Beckman), 6.0–7.0% (DiaSorin), 1.7–12% (Bioclone). LOQ was <0.04 μg/L (Roche); 0.05 μg/L (Beckman, DiaSorin) and 0.3 μg/L (Bioclone). Regression slopes compared to Biocline were Roche 1.03 [0.996–1.061]; DiaSorin 0.766 [0.735–0.796], n=95 and Beckman (serum only) 0.783 [0.753–0.833], n=51.

Conclusion
The Roche GH assay has good precision, sensitivity and agreement with our current method. It therefore best meets our need to retain GH assay harmonisation within New Zealand.
O10 THE USE OF DATA LINKAGE AS A TOOL TO EVALUATE LABORATORY WORK PROCESSES AND PATIENT CARE PERFORMANCE INDICATORS
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Introduction
This study describes a large data linkage exercise and quality performance assessment of test utilisation volumes and turnaround times (TAT) in a pathology service.

Methods
Pathology test data for six NSW hospitals, supported by a single pathology service, were extracted from the laboratory information system (LIS) for the August-September period of 2008-2011. Datasets containing admission/discharge, patient demographic, Diagnosis-related Group (DRG), triage category, and mode of separation data, were extracted from each PAS and EDIS. Unique patient identifiers were used to link individual test order records with either the PAS or EDIS datasets, or both. The final dataset was established after validity and integrity testing of source data.

Results
Data linkage occurred for approximately 2.8 million pathology tests (from the LIS), 147,280 inpatient admissions (from the PAS), and 176,015 emergency department (ED) presentations (from the EDIS). This resulted in approximately 1.3 million records linked to an inpatient admission only, 158,957 linked to an ED presentation only, and 385,817 test records linked to both an inpatient admission and ED presentation; a success rate of 66%.

Conclusion
The linked dataset facilitated analysis of test order volumes for matched patient conditions (DRGs). It also permitted the generation of statistical regression models to assess the impact of laboratory performance indicators (e.g. TAT) on indicators of patient care (e.g. length of stay).

O11 EVALUATION OF USING INTERPRETATIVE CUTOFF VALUE AS DECISION LIMIT AMONGST PRACTISING CLINICIANS IN NEPAL
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Introduction
The use of clinical laboratory test results in diagnostic decision making is an integral part of clinical medicine. Once a clinical laboratory test with the appropriate diagnostic accuracy has been ordered, a reference interval or a decision limit or critical value is used, against which the patient’s test value is compared. Those values are specified for a number of analytical components based on which a medical diagnosis, therapeutic management decision or other physiological assessments are made. Thus, the purpose of this study was to evaluate interpretative decision limits or critical values for various biochemical parameters amongst practising clinicians in Nepal.

Methods
This evaluation was performed using a questionnaire that was designed according to the recommendations of Clinical Improvement Act (CLIA’88) and College of American Pathologists. A total of 1000 questionnaires were personally distributed during May to July 2011 to clinicians practicing at healthcare institutions in Kathmandu, Nepal. The responses were expressed in percentages.

Results
Eight hundred and seventeen clinicians responded to the questionnaire. The study showed 77% of the clinicians interpret values beyond the reference interval as the medical decision limit whereas 56% of the respondents still regard the reference limit and medical decision limit as the same term. The biochemical parameters that were most affected were blood glucose, sodium, ALT, bilirubin, free T4 and TSH.

Conclusion
The study showed that there is no consensus policy with regard to decision limits or critical values practiced by clinicians in Nepal. This therefore necessitates consequent preparation and adoption of effective standard operating procedures in this regard.

O12 EFFECT OF REPEAT CALIBRATION ON ASSAY PRECISION PROFILE
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Background
Frequent calibration increases the imprecision of an assay however the magnitude of this effect has not been quantified. Long term precision of an assay is made up of many components including within-run and between-run precision; between calibration precision; and precision of value assignment of different lots of calibrator. This study aims to assess the factors which influence the effect of repeat calibrations on assay precision at different analyte concentrations for linear assays with two point calibrations.

Methods
A model was developed to calculate the contribution of calibration to the overall assay SD (calibration SD, SDCal) at varying analyte concentrations. The effect of multiple calibrations was modelled in Excel using random number generators with a Gaussian distribution. The effect of selecting different calibrator concentrations (CalA, CalB) and the effect of analytical precision at the calibration points (SDCalA, SDCalB) on the precision profile were assessed. Precision profiles of the SDCal were produced for changes in these variables.

Results
The model derives a precision profile for input values CalA and CalB, SDCalA and SDCalB and replicate calibration measurements. At the calibration concentrations the SDCal is equal to the analytical SD. The minimal SDCal is between the two calibrator values, at the midpoint if the two SDCals are the same, and closer to the lower SDCal value if they are unequal. As SDCalA becomes small relative to SDCalB, the SDCal profile approaches a linear relationship.

Conclusion
The data presented allows assessment of the contribution of repeat calibration to long term imprecision. Selection of calibrator values should include consideration of assay analytical precision at the calibrator concentrations and effect on precision at important clinical decision points.

O13 SIMULTANEOUS PROFILING OF TEN BIOGENIC AMINES AND THEIR METABOLITES IN URINE BY POLARITY-SWITCHING LC-MSMS
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Introduction
The increased urinary excretion of biogenic amines and their acid metabolites is used for the biochemical diagnosis of neuroendocrine tumours, and for monitoring their treatment. The aim of this work was to use tandem mass spectrometry (LC-MSMS) to develop a simple method for simultaneous profiling of 10 biogenic amines and metabolites in urine.

Methods
An ABSCIEX 3200 MSMS was tuned to measure ions from noradrenalin, adrenalin, dopamine, normetanephrine, metanephrine, 3-methoxytyramine (3-MT), serotonin, HMMA, 5-HIAA and HVA. Deuterated internal standards were added to urine, calibrator and QC materials, and the equilibrated samples purified on solid-phase extraction (SPE) cartridges. The 10 analytes were separated by LC-MSMS with positive electrospray ionisation (ESI) for 5.4 min for amines, followed by negative ESI for 2.6 min for acids. Quantitation used isotope mass ratios and Analyst software.

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Results
For SPE clean-up of urine, amines were extracted as boronate-complexes, while acids were recovered from anion-exchange cartridges before being recombined with amines for LC-MSMS analysis. The concentrations of free catecholamines, metanephrines and acidic metabolites were highly correlated between the profiling method and 3 separate LC-MSMS methods in routine use. For cycle 55 of the RCPA 2012 EQA urine program, 112 out of 120 results using the profiling method (93%) were within the allowable limits of performance. Imprecision studies over 6 months with Recipe controls at 2 levels produced CVs in the range 4-13% for all 10 analytes.

Conclusion
LC-MSMS testing of urine for a panel of 10 biogenic amines and their metabolites can be achieved rapidly on a single chromatogram using polarity-switching to cover amines and acids.

O14 APPLICATION OF MASS SPECTROMETRY OF INTACT PROTEIN AND TYPTIC PEPTIDES IN THE ANALYSIS OF DES-LEU ALBUMIN IN PLASMA – A NOVEL MARKER FOR CHRONIC PANCREATITIS
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Introduction
The diagnosis of chronic pancreatitis is challenging, especially in early disease, and current tests have low sensitivity, may be invasive or have limited availability. At Canterbury Health Laboratories we have previously identified a truncated form of albumin lacking the C-terminal leucine known as des-Leu albumin, which was present at high concentrations in a patient with pancreatitis. With the recent application of mass spectrometry in the routine laboratory we now have the technology to develop simple methods for this novel marker and evaluate its clinical utility for the diagnosis and monitoring of pancreatitis.

Methods
We have investigated two methods of measuring des-Leu albumin in plasma. A direct method involves infusing albumin extracted from plasma into a single quadrupole mass spectrometer and deconvoluting the resulting mass spectra to calculate the molecular weight of the different forms of albumin. The indirect method involves the digestion of plasma with trypsin and separating the peptides by HPLC and monitoring the MRM signal of the two C-terminal peptides of albumin in a triple quadrupole mass spectrometer.

Results
The % des-Leu albumin levels are calculated from the abundance of the des-Leu albumin/sum (des-Leu albumin plus albumin). We have used these two methods to measure des-Leu albumin in patients with pancreatitis and found levels of 20–90% compared to levels <10% in the normal population.

Conclusion
We have validated the presence of des-Leu albumin in plasma by two independent methods and shown levels to be raised in patients with pancreatitis.

O15 UNDERSTANDING QC AND EQA – AN AUTHENTIC LEARNING MODEL FOR UNDERGRADUATE STUDENTS
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Introduction
Quality control (QC) and external quality assurance (EQA) are integral to good pathology laboratory practice. Medical Laboratory Science students undertake a project exploring internal QC and EQA procedures used in chemical pathology laboratories. Each student represents an individual laboratory and the class group represents the peer group of laboratories performing the same assay using the same method.

Methods
Using a manual bromocresol green (BCG) assay for serum albumin, normal and abnormal controls are run with a patient sample over seven weeks. The QC results are assessed each week using calculated z-scores and both 2S and 3S control rules to determine whether a run is ‘in control’. At the end of the seven weeks a completed Levy-Jennings (LJ) chart is assessed using the Westgard Multirules. Students investigate causes of error and the implications for both laboratory practice and patient care if runs are not ‘in control’. Twice in the seven weeks two EQA samples (with target values unknown) are assayed alongside the weekly QC and patient samples. Results from each student are collated and form the basis of an EQA program. Allowable limits of performance are provided and students complete a Youden Plot, which is used to analyse the performance of each ‘lab’ and the method to identify bias. Students explore the concept of possible clinical implications of a biased method and address the actions that should be taken if a laboratory is not in consensus with the peer group or the method shows a bias.

Conclusion
This project is a model of ‘real world’ practice in which students demonstrate an understanding of the importance of QC procedures in a pathology laboratory, apply and interpret statistics and QC rules and charts, apply critical thinking and analytical skills to quality performance data to make recommendations for improved practice and to improve their technical competence and confidence.

O16 IMPROVED PREDICTIVE VALUE FOR MULTIPLE SCLEROSIS OF CEREBROSPINAL FLUID OLIGOCLONAL BANDING PATTERNS – A SOUTH AUSTRALIAN EXPERIENCE
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Introduction
Diagnosis of multiple sclerosis (MS) relies on clinical, radiological and laboratory assessment. Intrathecal synthesis of IgG, identified as oligoclonal bands (OCB) is an important laboratory adjunct in this context. Although OCB are considered to be specific to MS, they have been reported in other inflammatory disorders that induce synthesis of intrathecal IgG. Therefore recognising distinct patterns of OCB was proposed to improve diagnosis of MS. The following study was conducted to ascertain if the proposed pattern correlated with clinical and radiological diagnosis of multiple sclerosis in outpatients presenting to a South Australian public hospital.

Methods
Paired CSF and serum for consecutive patients (Sept 2011 – April 2012) were analysed using isoelectric focusing and immunofixation with anti-IgG. Patients lacking radiological data were excluded. Specimens consistent with intrathecal IgG synthesis were selected (n=53; age 4 to 87 y). For each patient, OCB pattern (delta (prominent, ≥4 bands) or theta (diffuse banding; <4 bands)) was correlated with the radiological findings.

Results
The majority of intrathecal OCB was of delta pattern (72%). Of the patients with a delta pattern, evidence of demyelination was present in 82%. None of the theta group showed any evidence of intracranial demyelination (40% of theta had normal MRI vs 9% of delta). Theta pattern was associated with pathologies other than demyelination. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of delta pattern in the diagnosis of MS with demonstrated cranial demyelination on MRI are 100%, 58%, 71% and 100% respectively.

Conclusions
Delta pattern of OCB has 100% NPV and sensitivity in the diagnosis of CNS demyelination. Recognising and reporting the specific pattern of intrathecal IgG synthesis improves the diagnostic sensitivity for MS.

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O17 LIPID CHANGES IN PREGNANCY

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Introduction
Pregnancy is often listed as a secondary cause of hyperlipidaemia. Many studies report pregnancy lipid concentrations at a single time-point and compare these to non-pregnancy levels, not recognising that changes in lipid concentrations are continuous throughout gestation. We aimed to characterise lipid concentrations for each trimester in pregnancy using two independent sources of data.

Methods
Total cholesterol and triglyceride results (Roche Modular) from 40,000 pregnant women were extracted from a private pathology database in Australia. HDL-cholesterol (Beckman DxC) and calculated LDL-cholesterol were also obtained from sera in 154 pregnancies originally enrolled in a study for trimester-specific thyroid function reference intervals at the Mercy Hospital for Women, Melbourne.

Results
Results from both study populations showed significant increases in total cholesterol and triglycerides, peaking in the 3rd trimester. Despite using different assays, the observed reference intervals and medians (2.5–97.5th percentile) for both populations were similar (Table).

<table>
<thead>
<tr>
<th></th>
<th>Trimester 1 (9–13 weeks)</th>
<th>Trimester 2 (22–26 weeks)</th>
<th>Trimester 3 (35–39 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Roche Modular</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Chol (mmol/L)</td>
<td>4.5 (3.1–5.9)</td>
<td>6.0 (4.1–7.9)</td>
<td>6.8 (4.5–9.1)</td>
</tr>
<tr>
<td>Trigs (mmol/L)</td>
<td>1.0 (0.5–2.0)</td>
<td>1.8 (0.8–3.3)</td>
<td>2.8 (1.5–5.3)</td>
</tr>
<tr>
<td><strong>Beckman DxC</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Chol (mmol/L)</td>
<td>4.7 (3.5–6.9)</td>
<td>6.3 (3.7–8.8)</td>
<td>6.9 (5.0–10.2)</td>
</tr>
<tr>
<td>Trigs (mmol/L)</td>
<td>1.2 (0.6–2.9)</td>
<td>2.0 (0.9–5.0)</td>
<td>3.0 (1.5–5.8)</td>
</tr>
</tbody>
</table>

Fractionated cholesterol results from the Mercy population indicated that VLDL and LDL were the main contributors to the total cholesterol peak in the 3rd trimester. In contrast, HDL declined from the 2nd trimester onwards.

Conclusion
Lipid profiles change in pregnancy, not only from the non-pregnancy state but also between trimesters. Awareness of the timing and extent of these changes will allow clinicians to recognise when hyperlipidaemia in pregnancy requires further assessment.

O18 A BENCHMARK AUDIT OF THE TYPES AND FREQUENCY OF PATHOLOGY ERRORS RECORDED IN CENTRAL SPECIMEN RECEPTION

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Introduction
Errors in laboratory medicine can occur at any stage of the pathology request-test-report cycle. Many pathology services maintain an error log in order to monitor errors associated with laboratory test requests. This study undertook an audit of a Central Specimen Reception (CSR) error log to identify the types of errors and their causes and provide a benchmark for future studies and quality improvement exercises.

Methods
Data from the paper-based CSR error log of a pathology service supporting three Sydney hospitals were collected for a six-month period (January to June 2009). A researcher with laboratory experience, in consultation with CSR staff, audited the error log. Process maps of workflow were generated to identify the impact of errors. Regular iterative feedback sessions were held with senior staff to confirm the validity of the findings.

Results
Errors were divided into two broad classes. 1) Incident Information Management System (IIMS) errors which pose a risk to patient safety; these occurred at a rate of 2.43 per 1000 test order episodes. 2) Efficiency and effectiveness errors which may delay or hamper the availability of a validated laboratory result; these occurred at a rate of 2.80 per 1000 test order episodes.

Conclusion
The classification of errors into a patient safety and laboratory performance nomenclature facilitated the generation of benchmark rates for different categories of errors. These base-rates are valuable in quality monitoring and for the evaluation of changes within the pathology service e.g. the implementation of an electronic medical record.
P1 POPULATION BASED OPPORTUNISTIC SCREENING FOR TYPE 2 DIABETES

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Introduction
Diabetes is a common disease with significant morbidity and mortality and its prevalence is steadily increasing. Because of the insidious nature of its onset it may remain undiagnosed for years. This study investigated the prevalence of undiagnosed type 2 diabetes at The Canberra Hospital. This study aimed to identify the optimal age and clinical setting for implementing a cost effective screening program.

Methods
Any person with samples suitable for glycated haemoglobin measurement (K-EDTA) was considered for this study. Samples were identified as emergency department (ED) and in-patient (IP) groups based on collection location. Exclusions were made based on electronic patient history of: previous diabetes diagnosis; query for diabetes status in the past 12 months; evidence of pregnancy; sample collected post surgery or transfusion. Samples were collected and stored at -80 °C before testing with Biorad Variant II Turbo.

Undiagnosed diabetes was classified as a result ≥6.5% (46 mmol/mol) and phone calls were made to General Practitioners to confirm undiagnosed status.

Results
109 persons (21 ED, 88 IP) of the 3172 tested (3.4%) were found to have HbA1c ≥6.5% (36 mmol/mol), indicative of type II diabetes. HbA1c results were found to increase linearly with age (P<0.001). The prevalence was substantially higher (>5%) in IP aged over 54 years. In our study the overall cost per new case diagnosed was AUD$242 but if limited to hospitalised persons >54 years old, was substantially lower (AUD$155).

Conclusion
Opportunistic testing of referred pathology samples from selected populations is a cost effective method of screening for diabetes especially when also selecting for age >54 years.

P2 COMPARISON OF LIAISON DIRECT RENIN ASSAY TO DIASORIN RIA RENIN ACTIVITY ASSAY AND EVALUATION FOR ROUTINE USE IN A HOSPITAL LABORATORY

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Introduction
Plasma renin, measured either as activity (PRA) or concentration (DRC), is used to monitor adrenal function and in screening for primary hyperaldosteronism (PHA). A suppressed renin activity is particularly suspicious for PHA but calculation of the aldosterone-to-renin ratio (ARR) using either PRA or DRC, is the preferred screening tool. We evaluated the automated direct renin immunoassay on the Diasorin Liaison against our current Diasorin Gamma Coat plasma renin activity radioimmunoassay (RIA) for routine use in our hospital-based laboratory.

Methods
Plasma from >90 hospital patients and 20 volunteers were analysed for this study. In addition to a direct method correlation, we conducted serum-plasma correlations and investigated the effect of posture. PRA was measured using the Diasorin Gamma Coat RIA and DRC using the Diasorin chemiluminescent immunoassay on the Liaison. Aldosterone was assayed by the Siemens Coat-A-Count RIA.

Results
Although numerically different, there was agreement between PRA and DRC with a correlation coefficient on Passing-Bablok regression analysis of 0.891 (slope=13.077, intercept=.078). Of the 70 renin results with a corresponding aldosterone, 7% (5/70) had an abnormal ARR using PRA (cut-off >750), and 19% (13/70) by DRC (cut-off >35). These were reduced to 4% (3/70) and 9% (6/70) respectively if the additional criteria of aldosterone >300 pmol/L was used. Serum DRC was significantly lower than plasma DRC (average difference -48%) while DRCs obtained sitting were on average 36% higher than the paired sample collected supine.

Conclusion
The automated DRC assay on the Diasorin Liaison simplifies renin measurement when compared to PRA measurement by RIA. However care must still be taken with sample collection especially if results are to be used in the ARR.

P3 SERUM INSULIN AND C-PEPTIDE STABILITY OVER SEVEN DAYS

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Introduction
Information on the stability of serum insulin is inconsistent. While the RCPA Manual recommends that serum must be separated and frozen immediately, other studies suggest that this is not necessary if analysis is performed within 24 h. C-peptide is generally considered stable at room temperature for 24 h. Information on the stability of insulin and C-peptide stored at 2–8 °C beyond 24 h is inconsistent. To facilitate add-on requests, we evaluated the stability of serum insulin and C-peptide stored at 2–8 °C for up to seven days for our methods.

Methods
Blood was collected from 15 laboratory staff into serum tubes and processed within two hours. After centrifugation, one aliquot of serum was received immediately for insulin and C-peptide by Roche e602 assays (Roche Diagnostics, Sydney, Australia), while multiple set of aliquots were stored at 2–8 °C for up to seven days for subsequent analysis on Days 2, 3, 4 and 7. A separate set of specimens were used for each run. Significant concentration change was defined as a value exceeding the initial value ±2.77CVa (CVa is 2.9% for insulin and 2.0% for C-peptide).

Results
A statistically significant decrease of 20.7% in mean insulin concentration from baseline was observed at Day 2 (mean±SD: 15.3±13.7 vs 12.0±11.6 mU/L, respectively, p<0.05). Interestingly, insulin concentration remained unchanged (p=0.92) from Day 2 to 7. For C-peptide, a gradual decrease from 5.4% to 11.8% was observed from Day 2 to 7. The change, however, was not clinically significant until Day 3.

Conclusion
Insulin appears to be unstable after the first 24 h, presumably due to degradation of pro-insulin. Other studies have shown that pro-insulin in serum is unstable and the Roche insulin assay has 32.5% cross reactivity with pro-insulin. Hence serum insulin results would be 20–25% lower for add-on testing up to seven days. Add-ons for serum C-peptide are acceptable for up to three days.

P4 STABILITY OF B2-TRANSFERRIN AND B-TRACE PROTEIN

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Introduction
B2-transferrin (B2T) and β-trace protein (BTP) are useful markers for the diagnosis of cerebrospinal fluid (CSF) leakage. Specimens received for analysis are often heavily contaminated with other substances and stored under non-ideal conditions. The aim of this study was to investigate the stability of B2T and BTP in the presence of potential contaminants.

Methods
CSF specimens received into the laboratory for routine analysis were used. CSF was incubated with saliva as a source of stialidase and red cell haemolysate as a source of proteolytic enzymes at room temperature (RT) and 4 °C for up to 1 month. Aliquots were then frozen at -27 °C prior to batch analysis. BTP
was measured using the NLatex βT on the Siemens BNProSpec. B2T was detected by isoelectric focusing and western blotting.

**Results**

Mean recovery of BTP was 94% for CSF (n=10) and 98% for CSF with saliva (n=5) when stored at RT for 10–30 days. There was 94% recovery of BTP following 10 days incubation at RT with haemolyse (n=2). The B2T isoform pattern was not altered following 10-30 days incubation at RT with haemolyse. Presence of saliva resulted in an increase in the desialated forms of transferrin after 0.5 days storage at RT and then the complete disappearance of normal transferrin after 1 day.

**Conclusion**

BTP and B2T in untreated CSF are stable for at least 10 days at RT. The proteolytic enzymes in haemolyse do not affect transferrin isoforms or the BTP level. The presence of sialidase in the specimen does not alter the BTP concentration but can lead to a misleading interpretation for B2T. In situations where sialidase contamination arising from bacterial or viral sources invalidates the B2T interpretation, BTP measurement remains valid.

**P5 ENDOCRINE WORKING PARTY – REVIEW OF QAP PERFORMANCE AT LOW ANALYTE CONCENTRATIONS**

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**Introduction**

Over the past few years the AACB Endocrine Working Party (EWP) has been reducing the concentration of the lowest level of the quality assurance program (QAP) material for some analytes in the Endocrine and Tumour Marker RCPA Chemical Pathology QAPs to improve coverage of clinically relevant concentrations. The aim of this study was to review analytical performance following these changes.

**Methods**

Mean and CV data for all participants and for the main method groups were extracted from the Endocrine (cycle 37) and Tumour Marker (cycle 39) program results. Analytes where the low level had been reduced were reviewed (cortisol, growth hormone, insulin, human chorionic gonadotrophin, oestradiol, testosterone, thyroglobulin).

**Results**

CVs were >20% for all analytes apart from insulin (18.5%). Between-assay bias account for part of this e.g. thyroglobulin (all participant CV 57%, within-method CVs 4.1% to 12%. All mean thyroglobulin 1.7 μg/L, assay specific means 0.7 to 2.9 μg/L). Reporting to whole numbers has contributed to the high CV for growth hormone (23%). Precision was <10% for some methods (CV range for different methods: cortisol 7.8–17%, insulin 4–34%, thyroglobulin). The difference between the highest and lowest method mean compared to the all participant mean for each analyte ranged from 47% to 163%.

**Conclusion**

Review of QAP results indicates that suitable precision at the low levels tested was only achieved by a small number of methods. The impact of sample matrix on between-method performance is unknown highlighting the need for commutability studies of the QAP material. The between-method differences have implications for assay harmonisation and the use of defined clinical decision points.

**P6 ENDOCRINE WORKING PARTY – MACROPROLACTIN: WHAT DO YOU DO?**

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**Introduction**

Falsely elevated prolactin due to macroprolactin interference is a potential problem for all laboratories measuring prolactin. The laboratories task is to report a clinically useful measurement of prolactin in the presence of macroprolactin. The aim of this study was to review current practices with regard to the investigation of macroprolactin.

**Methods**

A survey covering many aspects of macroprolactin investigation including screening procedure, screening criteria, testing frequency, location of testing, technical aspects of the polyethylene glycol (PEG) procedure, reporting and interest in a quality assurance program (QAP), was circulated to all participants of the RCPA Chemical Pathology Endocrine and Tumour Marker QAPs.

**Results**

Fifteen laboratories have responded so far (80% public, 20% private). All laboratories screen for macroprolactin (80% in-house, 20% referred) generally when prolactin is above a certain level (60% when above the reference interval, 20% above a higher level, 20% on request only). All laboratories use the PEG method for the initial investigation of macroprolactin although there are differences in the technical details of all steps of the procedures even between laboratories using the same prolactin assay. The percentage recovery of prolactin after PEG precipitation used to indicate macroprolactin presence ranged from <40% to <70%. When macroprolactin is present 100% report the total prolactin with a comment but only 42% reported the active prolactin level. All laboratories indicated that a macroprolactin QAP would be beneficial.

**Conclusion**

Macroprolactin investigation using PEG precipitation is widespread however all aspects of the procedure differ between laboratories. There is significant interest in the development of a macroprolactin QAP and such a program would help assess the impact of variability in the procedure on the result reported.

**P7 ENDOCRINE WORKING PARTY – USE OF COMMERCIAL PROLACTIN ANTIBODIES FOR A MACROPROLACTIN QAP**

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**Introduction**

Macroprolactin interference is a potential problem for all laboratories measuring prolactin. While many laboratories have processes in place to identify samples where interference is occurring and to estimate the free or active prolactin level there are no quality assurance programs (QAP) available for macroprolactin. The aim of this study was to investigate the suitability of commercial prolactin antibodies for use in a quality assurance material for macroprolactin.

**Methods**

Two murine monoclonal anti-prolactin antibodies recognising different epitopes were used. Antibody was incubated in excess with prolactin containing serum (human serum and RCPA Endocrine Program material) and without I-125-prolactin. Prolactin was measured using the Roche ProlactinII assay before and after polyethylene glycol (PEG) treatment for removal of macroprolactin and the percentage of both prolactin and I-125-prolactin in the PEG precipitate was determined. Incubate containing I-125-prolactin was analysed by gel filtration chromatography using Ultragel ACA44.

**Results**

Following incubation with antibody 94–99% of the unlabelled and 76–91% of the added I-125-prolactin was precipitated with PEG compared to 17–19% in the absence of antibody. Gel filtration results indicated that I-125-prolactin incubated with antibody was in the form of macroprolactin. The measured prolactin level in the presence of antibody was 85% and 47% for antibody 1 and 2 respectively of the value obtained in the absence of antibody.

**Conclusion**

Both antibodies were able to form macroprolactin complexes in both matrices tested and gave measurable prolactin values using the Roche assay. Detection of this macroprolactin in other assays requires investigation. Use of commercial prolactin antibodies would overcome the difficulty of obtaining sufficient quantities of human macroprolactin for a QAP or QC material and could also be used with the current RCPA Endocrine QAP material.
P8 VARIABILITY OF ANTI-MULLERIAN HORMONE DURING UNSTIMULATED CYCLES OF WOMEN REFERRED FOR FERTILITY MANAGEMENT

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Introduction
Anti-Müllerian hormone (AMH) is a marker of ovarian reserve and is useful for optimising fertility therapy. AMH is believed not to vary throughout menstrual cycle however recent research challenges this. Various clinical cut points for AMH have been suggested to predict likely reduced ovarian reserve or increased risk of hyperstimulation.

Methods
We studied 14 women referred for fertility management throughout their cycle to assess variability of AMH. Between 6 and 9 samples per woman were collected (total 96 samples) in early follicular, later follicular, midcycle and luteal phase in unstimulated cycles. Samples were analysed for AMH in duplicate on the Beckman II AMH assay and for oestradiol, progesterone, luteinising hormone and follicle-stimulating hormone to confirm phase of cycle.

Results
Each individual’s AMH results throughout the menstrual cycle were compared to five different published clinical cut offs and the proportion of women crossing one or more cut points throughout cycle was determined. Between 28.5 and 50% of women crossed clinical cut points and would be categorised differently by different samples throughout menstrual cycle. The difference in AMH results throughout the cycle ranged from 3.2 to 16.9 pmol/L in individual women with an average 6.7 pmol/L difference. The average AMH was higher in follicular phase than luteal phase.

Conclusion
This study found clinically significant changes in AMH throughout the menstrual cycle in women presenting to a fertility clinic. Depending on the cut-offs used for assessment of likely poor response or excessive response to IVF therapy, between 28.5 and 50% of women crossed clinically relevant decision points throughout an unstimulated spontaneous menstrual cycle.

P9 DOES WEIGHT OR BMI AFFECT SERUM CORTISOL LEVELS?

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Introduction
There are some reports of lower cortisol levels in obesity however this is not a well-recognised phenomenon and limited subjects have been studied. Low cortisol levels generate concern over adrenal reserve and necessitate further investigations such as Synacthen stimulation. This study assessed relationship between serum cortisol levels, weight and body mass index (BMI).

Methods
Subjects attending community pathology having assessment of serum cortisol at their GP request were offered participation in this study (n=67). Participants provided information for a questionnaire including medications, height and weight. Exclusions included those <18 years, history of adrenal/pituitary disease or medications altering cortisol. BMI was calculated from participant provided data. Cortisol was assayed (Siemens Centaur XP) and results converted to Multiple of Medians (MoM) (to control for time of collection) using previously derived data. BMI and weight were correlated with cortisol and cortisol MoMs.

Results
A total 67 subjects, 41 females (mean age 39.7), 26 males (mean age 50.6), with BMI levels ranging from 16.6–46.4 were included. A left hand shift (to lower levels) in the distribution of cortisol and cortisol MoM was found in those with higher BMI (>25) compared to those with lower BMI (<25). Cortisol results (p <0.01) and cortisol MoM (p <0.01) were lower in both those with BMI >25 compared with those with BMI <25.

Conclusion
This study demonstrated lower levels of cortisol and cortisol MoM in obese subjects with a BMI >25 compared to those with BMI <25. This study raises issues about interpretation of serum cortisol in obese patients.

P10 VARIATION OF SERUM CORTISOL WITH SEASON AND DAYLIGHT SAVINGS

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Introduction
Studies on effects of season and daylight savings on cortisol are limited by small numbers and contradictory findings.

Methods
Serum cortisol tests (n=35,802) performed from 2000–2011 at Western Diagnostic Pathology were extracted. Results are reviewed by a Pathologist and history of medications or hypothalamic-pituitary-adenal (HPA) axis disease annotated to results. After exclusions, 33,362 records were partitioned into 5 year age bands. The mean, median, standard deviation and 2.5th and 97.5th centiles were determined and analysed in 15 min time bands. The pattern of median cortisol over months, seasons and daylight savings and non daylight savings periods were assessed.

Results
Median cortisol increased from December nadir (319 nmol/L) to peak in July (357 nmol/L), a difference of 36 nmol/L. The warmer months (spring/summer) had a lower curve for cortisol than autumn and winter (p<0.01) with similar cortisol by 11 am for all seasons. Median cortisol was consistently <450 nmol/L from 7:30 am in spring, 7:15 am summer, 8:15 am autumn and 8 am in winter. The overall median cortisol was 331 nmol/L in non-daylight saving (DST) years and 362 nmol/L in DST years, a difference of 31 nmol/L (p=0.001). Cortisol was consistently <450 nmol/L from 7:15 am in non-DST weeks compared to 8:15 am in DST weeks. A time shift in cortisol of ~45 mins with the curve for DST trial behind non-DST period was observed.

Conclusion
Median cortisol varies with months, seasons and daylight savings across the day in a large population and may reflect the known dependence of the HPA rhythm on light.

P11 VARIATION OF SERUM CORTISOL WITH AGE AND GENDER

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Introduction
There are few studies on effects of ageing and gender on cortisol. Some studies demonstrate increased basal cortisol in older healthy subjects, particularly higher levels in women.

Methods
All serum cortisol tests (n=35,802) performed from 2000–2011 at Western Diagnostic Pathology were extracted. Results are reviewed by a Pathologist and history of medications (inhaled, oral, joint steroid) or HPA-axis disease annotated to results. After exclusions for history/medications (n=517) or missing data (1,830) including time of collection, 33,362 records were partitioned into 5 year age bands. The mean, median, standard deviation and 2.5th and 97.5th centiles were determined for age group. Cortisol was analysed in 15 minute time bands with a minimum of 100 records from 7.15am to 5.30pm and the median, 2.5 and 97.5 centile graphed.

Results
The population included 64.3% women (mean age 44.9 years) and 35.7% men (mean age 47.5 years). Median cortisol was slightly higher in women (351 nmol/L) than men (337 nmol/L). Median cortisol rose throughout puberty and peaked in the 15–25 year age bands initially before a decrease and plateau in those aged between 30 and 60 years of age. The nadir median cortisol was 325 nmol/L at ages 35–40 years. Thereafter median cortisol rose.
steadily by ~160 nmol/L to reach the maximum median levels of 488 nmol/L in the oldest subjects. Examining the span of ages and trends in males and female separately where median cortisol was >350 nmol/L, women had higher cortisol than men.

Conclusion
Median serum cortisol varies significantly with age (p<0.01) and gender (p<0.01) across the day in a large population.

P12 THE RELATIONSHIP BETWEEN TSH AND FREE T4 IS NOT LOG LINEAR AND DIFFERS BETWEEN GENDERS AND AGE GROUPS
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Background
A central tenet of thyroid physiology is the inverse, log-linear relationship between thyroid-stimulating hormone (TSH) and free T4 (fT4). This study evaluated the TSH-fT4 relationship in a large population.

Methods
We examined records with concurrent TSH and fT4 over 12 years by a single, predominantly community-based, pathology provider. After applying exclusions, 445,918 records from 152,261 patients were available for analysis and TSH-fT4 relationship was examined in cross-sectional analysis.

Results
In cross-sectional analysis, the relationship between TSH and fT4 was not log-linear but a combination of sigmoidal curves which differed between genders and changed with aging. This suggests that there are gender-specific and age-related differences in hypothalamic-pituitary-thyroid function.

Conclusion
The relationship between TSH and fT4 is not log-linear but a complex combination of curves which differs between genders and changes with aging.

P13 WAITING FOR AN ELEVATED FSH – TOO LATE A PREDICTOR OF REDUCED OVARIAN RESERVE?
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Introduction
Fertility decreases from ~30 years with sensitive markers such as anti-Müllerian hormone (AMH) falling from this age. Basal or day 2–3 follicle stimulating hormone (FSH) >10 U/L is used as a clinical cut point.

Methods
Women referred for ‘hormone testing’ including FSH levels (n=46,063) were included in a retrospective analysis. Exclusions included those with suppressed FSH (<1 U/L) who were likely on the oral contraceptive pill or pregnant, increased oestradiol (>500 pmol/L) who were likely in late follicular phase or midcycle or pregnant. Remaining cases (n=32,445) were analysed in pregnant, increased oestradiol (>500 pmol/L) who were likely in late follicular phase or midcycle or pregnant. Remaining cases (n=32,445) were analysed in a retrospective analysis. Exclusions included those with

Results
FSH is a late indicator of known reducing ovarian reserve and median FSH does not increase significantly over 10 U/L until >45 years. This is approximately 15 years later than the known reduction in fertility that occurs in the early thirties. If fertility is a concern, FSH levels persistently above the median of 5–6 U/L in women <40 years may prompt earlier follow-up with more sensitive tests such as AMH. FSH levels of >9 U/L are outside the 97.5th centile in women <25 years and should prompt early follow-up.

P14 DISCREPANT PROLONGED FAST RESULTS DUE TO LOW END BIAS OF IMMULITE 2000 INSULIN
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Introduction
Ability to assess insulin at low concentrations is important in the investigation of unexplained hypoglycaemia. Clinical concern has been raised when patients subjected to prolonged fast returned undetectable insulin with relatively high c-peptide. Siemens acknowledge a low-end negative bias with reagent lots 290+, claiming correction with lot 401+ and re-standardisation against WHO-IRP 66/304 for a 20% upward shift. We compared pre-corrected reagent with lot 403 and reviewed dynamic test results with paired fasting insulin and c-peptide performed during the period of suspected low bias.

Methods
40 duplicate frozen patient serum aliquots were assayed using reagent lots 324 and 403. A recovery and imprecision study were also undertaken on lot 403. Dynamic test results with paired fasting insulin and c-peptide run using pre-corrected reagent were extracted and reviewed.

Results
All 7 samples with lot 324 insulin <2 mU/L returned measured values with lot 403 (range 2.5–3.8). Linear regression comparison of lot 403 to 324 was y=1.1098x+1.6706, R²=0.9706 for 2–50 mU/L (n=31), and y = 0.8878x + 2.7932, R²=0.7714 for <10 mU/L (n=18). Recovery for lot 403 ranged from 104% at 2.1 mU/L to 72% at 275 mU/L. Within-run CV for lot 403 was 2.2% at 15.5 mU/L (n=9). We identified 16 episodes of undetectable fasting insulin with detectable-paired c-peptide levels (0.43 nmol/L ± 0.29, reference interval 0.43–1.00).

Conclusion
Our findings confirm the suspected negative bias and indicate a 10% correction in lot 403. Whilst the reference interval for fasting insulin depends on the reference population chosen, low-end sensitivity of the insulin assay is of paramount importance in the diagnosis of insulinoma and assessment of pancreatic reserve.

P15 CRITICAL RESULTS NOTIFICATION AT A TERTIARY PAEDIATRIC HOSPITAL
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Introduction
The critical results notification protocol was recently changed as ward nurses felt that they should be communicated directly to the medical team. Under the new protocol, critical results for patients in a general ward were notified via a call back page to doctors in the treating team. The aim of this study was to audit the number and type of critical notifications made, and evaluate the new paging protocol.

Methods
Data was collected on all critical results notified during the first 8-week period using the new protocol.

Results
226 critical result notifications were made. Most patients were in ICU (24%), emergency (14%) or the oncology ward (12%) and were under the care of oncology (20%), general medical (15%), cardiac surgery (14%) or nephrology (12%) teams. The most common notifications were for sodium <127 mmol/L (12%), potassium <6 mmol/L (7%), calcium <1.7 mmol/L (7%), vancomycin (trough) >20 mg/L (11%) and >1 critical result (12%). Pages were answered
Thirty-nine (39) patient samples (age range 14–65) were assayed on Siemens Immulite 2000 before Immulite immunoassay is assessed. Further, the effect of sample treatment with polyethylene glycol (PEG) since the introduction of the Siemens Immulite 2000 androstenedione assay to estimate haemoglobin concentration. The total peak area was compared to a formal haemoglobin measurement.

**Results**

1. Using the VII, the mean difference between FIOx and EDTA blood with a HbA1c of 4.7–7.5% (28–58 mmol/mol) was -0.02% (-0.2 mmol/mol) [range -0.2 to 0.2% (-2 to 2 mmol/mol)]. Using the Adams, the mean difference between FIOx and EDTA blood with a HbA1c of 5.0–10.3% (31–89 mmol/mol) was 0.02% (0.2 mmol/mol) [range -0.1 to 0.2% (-1 to 2 mmol/mol)]. These differences were within the uncertainty of the measurements. 2. The total peak area for EDTA blood mixed thoroughly then manually sampled highly correlated with measured haemoglobin ($r^2=0.97$). Blood that was unmixed or mixed then automatically sampled immediately or up to 1.5 hours later did not correlate as well ($r^2=0.39$ to 0.76).

**Conclusion**

FIOx blood is suitable for HbA1c measurement using the VII and Adams analysers. Total peak area may be used to estimate haemoglobin concentration only when samples have been thoroughly mixed and sampled manually. This may not be practical for most labs due to high sample numbers.

**Method**

1. HbA1c was measured on paired FIOx and EDTA blood using the Biorad Variant II (VII) and Arkay Adams HA-8160 (Adams).
2. EDTA blood was mixed and manually or automatically sampled for HbA1c analysis using the VII. Data from women who had a 75 g oral glucose tolerance test (OGTT) when appropriate (glucose ≥8.0 mmol/L following GCT) were reviewed. GDM prior to Immulite immunoassay is assessed.

**Method**

Thirty-nine (39) patient samples (age range 14–65) were assayed on Siemens Immulite 2000, Siemens Radioimmunoassay (RIA), Immunotech RIA, Siemens Immulite 2000 after sample pre-treatment with 25% PEG and LC-MS/MS. In a median time of two minutes. Average time to next sample collection for critical potassium, calcium and glucose results remained the same before and after the new protocol was introduced.

**Conclusion**

The call back page system is effective in rapidly notifying the doctor of a critical result. Critical analyte levels were reassessed in view of the number of notifications made, with a change in the vancomycin critical level to 25 mg/L.

**Method**

<table>
<thead>
<tr>
<th>Method vs. LC-MS/MS</th>
<th>Slope</th>
<th>Intercept</th>
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<tr>
<td>Immulite 2000</td>
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<td>36</td>
</tr>
<tr>
<td>Immulite 2000 post PEG</td>
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<td>39</td>
</tr>
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<td>Siemens RIA</td>
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<td>2.44</td>
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<tr>
<td>Immunotech RIA</td>
<td>1.47</td>
<td>0.83</td>
<td>39</td>
</tr>
</tbody>
</table>

*Note 3 data points were excluded from the untreated Immulite 2000 correlation as the Immulite results were considered outliers with results greater than 15 times that of LCMS.

**Discussion**

All immunoassays have reasonable correlation with LC-MS/MS but results are ~47–195% higher than LC-MS/MS. PEG pre-treatment of samples eliminates outliers from the Immulite androstenedione method and improved agreement with LC-MS/MS such that the positive bias was reduced to ~28%. One inference from the PEG study is that the difference in matrix between serum and standards for immunoassay may be a significant contributor to the observed difference between steroid immunoassays and LC-MS/MS. Matrix effects are likely to be a significant challenge for harmonisation of steroid immunoassays with LCMS.
screen for hypoglycaemia in neonates with galactosaemia. We evaluated two glucometers (Nova Biomedical Statstrip and Abbott Optium Xceed) and a blood gas analyser (Radiometer ABL800) for galactose cross reactivity. We also determined whether the galactose interference on ABL800 depends on glucose electrode membrane age.

**Method**

**Galactose interference:** Venous heparinised whole blood was spiked with galactose to achieve final galactose concentration of 2.5, 5, 10 and 20 mmol/L. Specimens were prepared with three different glucose concentrations (2.0, 3.4 and 5.3 mmol/L). Results were compared to Beckman DxC analyser.

**Glucose electrode membrane aging effect:** A pooled serum with final glucose concentration of 4.1 mmol/L, spiked with galactose to achieve final galactose concentrations of 2.5, 5, 10 and 20 mmol/L, were measured for glucose on day 1, 7 and 14 after a glucose electrode membrane change.

**Results**

**Galactose interference:** No significant galactose interference was seen on the two glucometers or the Beckman DxC. The ABL 800 showed bias of +0.3, +0.7, +1.7 and +3.7 mmol/L for galactose concentrations of 2.5, 5, 10 and 20 mmol/L, respectively. This is independent of the initial glucose concentration.

**Glucose electrode membrane aging effect:** The galactose interference was membrane age dependent. Compared to Beckman DxC, the maximum interference was seen on day 1 with a bias of +6.2 mmol/L at galactose of 20 mmol/L. This decreased to +3.95 mmol/L on day 14.

**Conclusion**

The Statstrip and Optium Xceed meters do not cross react with galactose. The Radiometer ABL800 analyser is not reliable for the detection of hypoglycaemia in the presence of galactosaemia. The effect is worst immediately following a glucose membrane change.

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**P21 EVALUATION OF 1, 25-DIHYDROXY VITAMIN D ASSAY ON THE IDS-ISYS AUTOMATED SYSTEM**

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**Introduction**

1,25-Dihydroxy vitamin D (1,25D) is the biologically active form of 25-hydroxy vitamin D. Along with its major roles in calcium metabolism and bone resorption, 1,25D inhibits parathyroid hormone production. In renal disease the failure to produce enough 1,25D leads to secondary hyperparathyroidism. The IDS-ISYS 1,25-Dihydroxy Vitamin D assay is the first automated immunoaassay 1,25D kit on the market. It incorporates a manual extraction followed by quantitative analysis onboard the IDS-ISYS automated system. Here we compared the newly released IDS-ISYS 1,25D method against the IDS RIA method.

**Methods**

120 serum samples were compared against the IDS-RIA method. Precision was assessed using 4 levels of QC material and 2 serum pools, over 15 days. Linearity was assessed by mixing sera with high and low concentrations of 1,25D. Samples from 5 cycles of the DEQAS proficiency survey were analysed. Limit of quantification (LOQ) was verified according to CLSI guideline EP17-A2.

**Results**

Regression studies between the RIA and iSYS methods gave a Passing-Bablok fit of 1.69 + 0.96x, with a bias of -0.531 nmol/L (R² 0.91). Four levels of IDS QC material showed CVs<10% at 72, 116, 216 and 278 mmol/L; two serum pools showed CVs<11% at 65 and 220 mmol/L. Linearity gave 100–111% recovery between 20 and 450 nmol/L. Results from five DEQAS cycles were within 11% of the all laboratory trimmed mean (ALTM), well inside the current performance target of ±30%. Reported limit of quantification of 29.3 mmol/L was verified with 95.5% of measurements within the 20% accuracy goal.

**Conclusion**

The IDS-ISYS assay’s performance is suitable for routine estimation of 1,25D status, removing the need for handling radioactive isotopes within our laboratory.
Vitamin D deficiency is associated with a significant increase in the mean PTH across all stages of mild to moderate CKD. This study highlights the importance of achieving adequate serum 25(OH)D even in people with CKD.

Conclusion

There is significant decline in both TB12 and HoloTC in pregnancy from the 1st to the 3rd trimester. The absolute decline in TB12 (<79 pmol/L) is larger than the decline in HoloTC (<14.2 pmol/L), implying most of the TB12 decline is due to a reduction in HoloHC, the inactive fraction. In conclusion, HoloTC is the best indicator of B12 status during pregnancy.

Postpartum

TB12 415±145a<0.001
HoloTC 42.4±13.5b 0.001

Tukey’s post Hoc: Means with the same letters were not different.

Introduction

Low serum total vitamin B12 (TB12) is often observed in pregnant women without complications. Vitamin B12 in blood is bound to haptocorrin (HoloHC) or transcobalamin (HoloTC). HoloTC is the active fraction which gets into most cells (including placental) for metabolic activities. We aimed to examine the changes in TB12 and HoloTC across pregnancy.

Methods

Stored serum from 65 women with bloods available at each trimester and postpartum were analysed for TB12 and HoloTC (both on Abbott Architect) at Melbourne Pathology. These women were originally enrolled in a prospective study for thyroid function reference intervals. After excluding women with HoloTC above the analytical limit at any time point, data from 44 women were used in the analysis.

Results

TB12 levels were significantly lower in pregnancy. The lowest TB12 levels were seen in the 2nd and 3rd trimesters and the means were approximately half of that seen postpartum. In contrast, the mean HoloTC was the lowest in the 3rd trimester and postpartum, and highest in the 1st trimester. The TB12 and HoloTC concentrations (pmol/L) (Mean±SD) in different trimesters and postpartum were:

<table>
<thead>
<tr>
<th>Trimester 1 (9-13/40)</th>
<th>Trimester 2 (22-26/40)</th>
<th>Trimester 3 (35-39/40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TB12 302±100a</td>
<td>237±74a</td>
<td>223±147b</td>
</tr>
<tr>
<td>HoloTC 58.6±20.3a</td>
<td>51.0±20.8a</td>
<td>44.4±22.0a</td>
</tr>
</tbody>
</table>

Postpartum p value (ANOVA)

| TB12 415±145a | <0.001 |
| HoloTC 42.4±13.5b | 0.001 |

Tukey’s post Hoc: Means with the same letters were not different.

Conclusion

Parathyroid hormone (PTH) increases with vitamin D deficiency and impaired kidney functions. However, this information for the population used in PTH reference interval determination are often not provided. We aimed to evaluate PTH reference interval in individuals with normal kidney function and sufficient vitamin D.

Methods

As part of the annual health promotion, staff were offered free blood test including 25-hydroxyvitamin D [25(OH)D], PTH (EDTA plasma), albumin, calcium and creatinine. Serum 25(OH)D was analysed using Diasorin Liaison XL, all others using Roche instruments.

Results

After excluding five with hypercalcemia, analysis was performed in 487 people (84.4% female) with age (mean±SD) of 45.3±12.1 years. Their 25(OH)D were ranged <10 to 139 nmol/L and PTH ranged 1.7 to 15 pmol/L. The quartile values for 25(OH)D were 43, 57 and 71 nmol/L. Selecting eGFR (by CKD-Epi equation) >90 mL/min/1.73m², PTH in people with different levels of 25(OH)D were:

<table>
<thead>
<tr>
<th>25(OH)D level n</th>
<th>Plasma PTH, pmol/L (centiles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;50 nmol/L</td>
<td>2.5a</td>
</tr>
<tr>
<td>≤50 nmol/L</td>
<td>2.1</td>
</tr>
<tr>
<td>≥50 nmol/L</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Even in people with higher 25(OH)D ≥75 nmol/L and an eGFR >90 mL/min/1.73m², PTH was normally distributed, and according to the parametric analysis the lower normal limit (95%CI) for PTH was 1.8 (1.3–2.3) and the upper normal limit was 7.1 (6.6–7.6) pmol/L.

Conclusion

PTH concentrations are vitamin D dependent. In people with 25(OH)D ≥75 nmol/L, the reference interval for plasma PTH obtained in our population is 1.8–7.1 pmol/L. Higher PTH reference intervals could result when including people with insufficient vitamin D levels and impaired kidney function.

Introduction

On a day to day basis, 0.5 to 1% of all samples received in our laboratory contain some level of visible lipaemia. This relatively common interferant has adverse effects on many of our analytical systems. Many laboratories resolve this problem by using a lipid clearing agent to remove the interfering lipids. We investigated the effect of lipaemia and use of lipid clearing agents on the measurement of 25 OH vitamin D (25D) on the Liaison as the manufacturer provided limited information on this subject.

Methods

Using ‘Intralipid’ we prepared ten standards, ranging from 1.29 to 81.86 mmol/L of triglyceride. 25D was measured before and after processing these samples with a lipid clearing agent.

Results

We found a significant drop in 25D levels with increasing lipaemia (Table).
We verified the use of lipid clearing agents which had no adverse effects on 25D measurement and brought results back to their expected level.

<table>
<thead>
<tr>
<th>Standard</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trig mmol/L</td>
<td>1.29</td>
<td>5.25</td>
<td>11.26</td>
<td>14.91</td>
<td>19.35</td>
</tr>
<tr>
<td>Baseline 25D mmol/L</td>
<td>73.3</td>
<td>66.9</td>
<td>60.8</td>
<td>58.3</td>
<td>54.14</td>
</tr>
<tr>
<td>% Change post Intralipid</td>
<td>0</td>
<td>8.7</td>
<td>17.1</td>
<td>20.5</td>
<td>26.1</td>
</tr>
<tr>
<td>25D post lipid clearing</td>
<td>78.7</td>
<td>74.3</td>
<td></td>
<td>73.5</td>
<td></td>
</tr>
<tr>
<td>% Change post lipid clearing</td>
<td>-7.4</td>
<td>-1.4</td>
<td></td>
<td>-0.3</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion**

As 25D is a fat soluble vitamin, we suspect lipaemia may affect the dissociation from Vitamin D binding protein and binding of the reagent antibody, resulting in falsely low results. As a result of this study, we have implemented a protocol for using lipid clearing agents on any 25D requested with a triglyceride level greater than 5 mmol/L.

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**P27 PHOSPHOLIPIDS CAUSE SIGNIFICANT MATRIX SUPPRESSION AND LOSS OF ASSAY SENSITIVITY WHEN MEASURING 25 HYDROXYVITAMIN D BY ISOTOPE-DILUTION, LIQUID CHROMATOGRAPHY MASS SPECTROMETRY**

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**Introduction**

25 hydroxyvitamin D (25OHD) automated immunoassay method disagreement is a recognised problem. Contributing factors include assay insensitivity, variation in metabolite recognition, heterophilic antibody interference and differences in extraction efficiency from vitamin D binding protein. Consequently, these problems have stimulated the development of referenced based isotope-dilution, liquid chromatography tandem mass spectrometry (LC-MSMS) methods for 25OHD analysis. LC-MSMS resolves these problems and demonstrates improvements in assay specificity and accuracy. However, apparent recovery values have obscured the insensitivity of reference based methods when standard addition recovery is used to assess analyte recovery. This method fails to detect matrix suppression effects.

**Methods**

d6-25OHD, was spiked at a concentration of 100 nmol/L in commercially delipidated stripped serum and compared with a patient plasma pool following serial dilution in the absence of phospholipids. Samples underwent liquid liquid extraction (LLE) followed by LC-MSMS analysis. Phospholipid concentration was quantified and compared with d6-25OHD, recovery.

**Results**

Endogenous phospholipids have been shown to co-elute with 25OHD under the gradient conditions used when patient samples are prepared by LLE. Significant matrix suppression issues were demonstrated as levels of d6-25OHD increased when the concentration of phospholipids was progressively diluted.

**Conclusion**

Phospholipids interfere with analyte ionisation, and in the case of 25OHD produce significant matrix suppression with a resultant loss of assay sensitivity. Further optimisation is required in the selection of extraction method, solvent choice and chromatographic conditions to resolve this issue and improve the sensitivity of LC-MSMS methods used to quantify 25OHD.

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**P28 MEASUREMENT OF 25-HYDROXYVITAMIN D BY HIGH THROUGHPUT LIQUID CHROMATOGRAPHY TANDEM MASS SPECTROCOPY**

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**Introduction**

The demand for vitamin D measurements continues to increase. High-throughput tandem mass spectroscopy using on-line sample preparation is a cost effective alternative to automated immunoassay methods. Performed well, it has the potential to confer significant advantages in accuracy, precision and freedom from interference.

**Methods**

A multiplexed LC system (TLX-4) coupled with a single mass spectrometer (TSQ Access MAX) was obtained from Thermo. Sample preparation was a simple protein precipitation with acetonitrile containing internal standard ([2H6]-25-OH-vitaminD3), performed by a Hamilton STARlet. Turboflow columns on the TLX-4 provided sample cleanup, and the analytical column was Hypersil GOLD c18 (Thermo) with a methanol mobile phase. The mass spectrometer used APCl ionisation in positive mode and three SRM transitions were monitored per analyte. The calibrators were from Recipex. Patient samples were compared to the iSYS (IDL) immunoassay method. Precision was evaluated using four levels of QC (UTAK) and serum pools at three concentrations. Four cycles of external quality control from the DEQAS program were performed.

**Results**

Results from 88 patient samples showed an acceptable correlation (0.91x -0.46 R 0.85). Within-laboratory precision was CV% 9.9, 7.3, 7.4, 6.6 for QC at levels of 27.5, 34.9, 74.5, 178 nmol/L and 21.6, 8.5, 10.4 for serum pools of 8.6, 63.2, 150 nmol/L. DEQAS samples were within 10% of the ALTM except pool 405 which contained a significant amount of 3-epi 25OH vitamin D.

**Conclusion**

The fast (six minute) application and multiplexing has given our laboratory the daily throughput in excess of 600 samples that we require. The method is accurate and reproducible. However as yet we do not chromatographically separate potential interference from 3-epi 25OH vitamin D.

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**P29 APPRAISAL OF OPTIMAL VITAMIN D LEVELS FOR BONE HEALTH AS MEASURED BY MASS SPECTROMETRY**

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**Introduction**

Vitamin D is recognised as an important determinant of bone health. 25-hydroxyvitamin D (25OHD) is thought to be the best clinically measurable marker, with adequate levels being associated with physiological parathyroid hormone (PTH) levels and bone resorption. Previous attempts to quantify a threshold level of 25OHD for optimal bone health have yielded a general consensus around 75-80 nmol/L, although results were mixed. This study aims to quantify this threshold based on data obtained from mass spectrometry, thought to be the most accurate and precise method of measurement.

**Method**

Between October 2008 and March 2012, 28532 adults at Mater Health Services had 25OHD levels measured by mass spectrometry. Of these, PTH was measured in 863 patients with satisfactory renal function. An Excel scatter plot with logarithmic trend line and a grouped column graph of 25OHD versus PTH were constructed.

**Results**

Logarithmic trendline estimates that PTH falls to reference levels at 25OHD levels of 70 nmol/L. Graphing mean PTH levels after grouping levels of 25OHD in increments of 15 nmol/L suggests that PTH continues to decline with increasing serum 25OHD levels up to 110 nmol/L, with median PTH ranging from 7.2 pmol/L in patients with 25OHD <20 nmol/L to 3.6 pmol/L in those with 25OHD >110 nmol/L.

**Conclusion**

25OHD levels >80 nmol/L are associated with PTH levels within the reference
range in most subjects, although higher levels show an additional suppressive effect. The study may be affected by selection bias and not represent a general population. Studies involving healthy volunteers investigating 25OHD and PTH levels would yield more conclusive estimates of optimal vitamin D levels for bone health.

P30 MEASUREMENT OF CORTICOSTERONE AND 11-DEOXYCORTICOSTERONE BY TANDEM MASS SPECTROMETRY: EXPANDING THE DIAGNOSTIC RANGE OF TESTS FOR ADRENAL ENZYME DEFECTS

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Introduction
Corticosterone (B) and 11-deoxycorticosterone (DOC) are steroid precursors of the mineralocorticoid, aldosterone. Isolated defects of aldosterone biosynthesis are rare. However, measurement of these steroids may contribute to diagnosis of enzyme defects in other adrenal steroid pathways. We have developed an LC-MS/MS assay for the measurement of B and DOC.

Methods
A Waters Premier Tandem Mass Spectrometer coupled to an Acquity UPLC™ was used for all analyses. Plasma was mixed with ethyl acetate and internal standards (d8-corticosterone and d8-deoxycorticosterone), vortexed and centrifuged. The supernatant was dried under nitrogen, reconstituted in mobile phase and injected onto the UPLC-MS/MS. The assay time was 3 min/sample. Calibration curves were linear over the concentration range of 0.1 to 50.0 nmol/L; r² = 0.998. Uncertainty of measurement was 6% across the assay range. The percentage observed difference for the commercial calibrators was calculated from the observed mean (±SEM) against the given value of the calibrator. Bio-Rad [bias +1.3% i.e. observed mean 43.6 μmol/L (+/-0.4) and expected 43.0 μmol/L], Chromsystems [bias +5.4% i.e. observed mean 31.5 μmol/L (+/-0.3) and expected 29.9 μmol/L]; and RECIP [bias -8.9% i.e. observed mean 51.4 μmol/L (+/-0.6) and expected 56.4 μmol/L].

Conclusion
Our results demonstrate that the Bio-Rad calibrator closely agrees with the in-house Sigma based calibrator set and that there is a discordance between the commercial calibrators greater than the expected assay uncertainty. This lack of harmonisation means that results from different laboratories may not be commutable.

P32 COMPARISON OF COMMERCIAL CALIBRATORS FOR ALPHA-TOCOPHEROL

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Introduction
Alpha-tocopherol is the predominant form of vitamin E in plasma and is routinely measured to assess vitamin E status. Agreement between vitamin E assays is essential to provide consistent clinical interpretation of results. Lack of agreement between calibrators is potentially a significant obstacle to method harmonisation. The aim of this study was to investigate the deviation between the available commercial calibrators for analysis of serum/plasma alpha-tocopherol.

Method
Three commercial single level calibrators (Bio-Rad Laboratories, Chromsystems Diagnostics and RECIP) were prepared in quintuplicate in conjunction with a seven level in-house calibrator set for vitamin E. The in-house calibrator set was prepared using SeraCon-H-Striped-delipidated (Seracare Life Sciences) spiked with alpha-tocopherol (Sigma Diagnostics). Samples were analysed by isotope dilution LC-MSMS (Agilent 6490-ESI positive) with multiple reaction monitoring for alpha-tocopherol (431.49→165.0) and hexa-deuterated-alpha-tocopherol (437.4→171.0).

Results
The calibration curve ranged from 6–50 μmol/L; r²=0.998. Uncertainty of measurement was 6% across the assay range. The percentage observed difference for the commercial calibrators was calculated from the observed mean (±SEM) against the given value of the calibrator. Bio-Rad [bias +1.3% i.e. observed mean 43.6 μmol/L (+/-0.4) and expected 43.0 μmol/L], Chromsystems [bias +5.4% i.e. observed mean 31.5 μmol/L (+/-0.3) and expected 29.9 μmol/L]; and RECIP [bias -8.9% i.e. observed mean 51.4 μmol/L (+/-0.6) and expected 56.4 μmol/L].

Conclusion
Our results demonstrate that the Bio-Rad calibrator closely agrees with the in-house Sigma based calibrator set and that there is a discordance between the commercial calibrators greater than the expected assay uncertainty. This lack of harmonisation means that results from different laboratories may not be commutable.
P33 BETA-LACTAM ANTIBIOTIC THERAPEUTIC DRUG MONITORING IN CRITICALLY ILL PATIENTS – SHOULD WE MEASURE UNBOUND CONCENTRATIONS?
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Introduction
Protein binding for antibiotics may not be predictable in critically ill patients thereby complicating therapeutic drug monitoring (TDM) based on total concentrations. This study aimed to describe variability of the pharmocologically active unbound concentration and total concentrations of beta-lactam antibiotics as part of a TDM program in an intensive care unit.

Methods
Total and unbound beta-lactam antibiotics concentrations of 190 plasma samples collected at trough (n=93) and mid-dosing interval (n=97) from 72 critically ill patients were measured using a validated HPLC-UV method.

The variation in total and unbound antibiotic concentrations between patients was also determined.

Results
Unbound trough and mid-dosing concentrations were highly variable between patients. Trough unbound antibiotic concentrations ranged from 0.2 to 1.74 mg/L for piperacillin (n=43, median=0.10 mg/L), 0.2 to 17 mg/L for meropenem (n=52, median=5.1 mg/L), 2.7 to 12 mg/L for ceftriaxone (n=8, median=5.9 mg/L) and 0.3 to 23 mg/L for ampicillin (n=6, median=1 mg/L).

Percentage protein binding (versus published value) of piperacillin ranged from 5–60% (30%), 0–25% (2%) for meropenem, 34–91% (85–95%) for ceftriaxone and 5–18% (15–20%) for ampicillin.

Conclusion
This study is the first to utilise an assay that directly measures unbound concentration of selected beta-lactam antibiotics in a clinical setting. Large variations in percentage protein binding were observed, suggesting that correctly predicting unbound concentrations from total concentrations is not possible. An approach that measures the unbound concentration is necessary for optimal clinical beta-lactam TDM.

P34 LC-MSMS PROFILING OF URINARY BIOGENIC AMINES AND THEIR METABOLITES FOR NEUROBLASTOMA SCREENING IN CHILDREN
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Introduction
A combination of catecholamines and their metabolites is usually measured for biochemical diagnosis of neuroblastoma because of variability in production and metabolism. The aim of this work was to evaluate a rapid LC-MSMS biogenic amine profiling method with urines from paediatric patients to screen for neuroblastoma and other neuroendocrine tumours.

Methods
Spot urines from 38 paediatric patients (age range 0.25–17 y; urine creatinine 0.7–23.6 mmol/L) were submitted to the laboratory over a 6-month period. They were analysed by isotope-dilution LC-MSMS with polarity-switching to measure free catecholamines (noradrenaline-adrenaline-dopamine), metanephrines (normetanephrine-metanephrine-3-MT) and their acid metabolites (HMMA-HVA) on the same 8 minute chromatogram. Quantiﬁcation used isotope mass ratios and Analyst software.

Results
The concentrations of free catecholamines, metanephrines and acidic metabolites were calculated as mmol/mol creatinine to allow comparison with recently published age-related reference ranges for seven paediatric age groups. 32 patient urines had normal concentrations of all 8 analytes, including 2 patients with neuroblastoma in post-treatment remission and 1 with Wilm’s tumour. Two new cases of neuroblastoma were identiﬁed with raised urine excretion of dopamine, 3-MT, HMMA and HVA. In addition, a rare abdominal paraganglioma in a 12-year-old girl was found with raised noradrenaline, normetanephrine, and HMMA. Three patients were observed to have a single raised result of <2x ULN of unknown signiﬁcance [adrenaline (1), HMMA (2)].

Conclusion
LC-MSMS profiling for a panel of biogenic amines and their metabolites can be usefully applied to spot urine samples collected from children for screening for neuroblastoma and other neuroendocrine tumours.

P35 REFERENCE CHANGE VALUE (RCV) FOR TROPONIN – LESSONS FROM HEALTHY CHILDREN
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Introduction
It has been suggested that a delta change in troponin may be important in defining a patient at risk of cardiac death. A change in troponin concentration may be as a result of all of analytical imprecision, biological variation and pathological change. We have collected longitudinal samples on healthy children over 4 years between the ages of 8 and 12 years, and measured cTnI using a highly sensitive assay from Abbott Diagnostics. Cardiac disease has been excluded with each child having echocardiography performed three times.

Methods
Where a child had >1 sample collected, a mean, SD and CV was calculated. This CV was total CV and comprised analytical and biological variation, ie CV = √(CVa2 + CVb2). We fitted a power function to our imprecision profile (r²=0.92) and calculated long-term (4 years) CVₜ. To be 95% conﬁdent that a change in troponin concentration is real the change must be 2.77*CVₜ.

Results
TnI was above the limit of detection in 87% (n=337/386) of 8 year olds and 98% (n=444/451) of 12 year olds. Over this time period left ventricular mass increased by 65%. CVₜ ranged from 0% to 136% (median 33%). The median reference change value (RCV) varied between 92 and 107% (depending upon the mean TnI concentration and CVₜ at that concentration) and could be as low as 14% and as high as 380% depending upon the mean TnI concentration and the biological variation.

Conclusion
Long-term CVₜ in children may be very high. We have previously demonstrated that cTnI increase in this population may be transient and associated with low-grade intercurrent illness. Whilst RCV is usually applied in a short-term setting, our data indicates that caution is required in interpreting changes in troponin concentration.

P36 OVER TIME, HOW REPEATABLE ARE TROPONIN RESULTS ABOVE THE 99TH PERCENTILE?
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Introduction
In apparently healthy adult populations, a troponin concentration above the 99th percentile is associated with an increased risk of cardiovascular death. All studies have been cross-sectional with only single samples collected.

Methods
Serial samples were collected from 800 healthy children on up to 3 occasions at the ages of 8, 10 and 12 y. All children were in excellent health and every child had echocardiography performed 3 times at 2 year intervals. At each period of collection cTnI was measured using the new Abbott ARCHITECT i2000 high sensitive cTnI assay which has a limit of detection of 1.0 ng/L. 99th percentiles were calculated for each age group.

Results
A total of 11 children had at least one result above the adult 99th percentile and at least one other sample collected (highest TnI = 59.5 ng/L). No child had a high result that was repeatable. The kappa statistic was 0.00 indicating that having a high cTnI concentration on one occasion had no predictive value for having another high result.

**Conclusion**

This population of children had no, or extremely low risk of cardiac disease, and 99th percentiles in this cohort might not be expected to have the same predictive power as in an adult population. Nevertheless, this is the only cTnI study with longitudinal sampling and it suggests that there is substantial analytical and biological ‘noise’ causing variation in cTnI results for any individual. In adults, predictive power for cardiovascular disease may be enhanced by repeat sampling as recommended with C-reactive protein.

**Introduction**

Troponin is a core element of the diagnosis of MI. However, high-sensitivity assays have shown that most normal persons have detectable troponin present in their blood, indicating that troponin is not always an index of myocardial necrosis. Data is available on troponin concentrations in healthy persons, but none on troponin concentration in persons who are ill with non-cardiac illnesses.

**Methods**

For a 24h period we collected all blood samples submitted to ACT Pathology from The Canberra Hospital and community collection centres and measured cTnI using the Abbott ARCHITECT STAT hs-cTnI assay.

**Results**

844 blood samples were analysed for TnI. The range and median TnI concentrations were: 0.6–2615 ng/L, 30.0 ng/L (30 CCU patients); 1.5–29500 ng/L, 15.6 ng/L (37 ICU patients); 3.7–25560 ng/L, 3.7 ng/L (95 ED patients); <0.5–296 ng/L, 12.5 ng/L (269 medical patients); <0.5–332 ng/L, 12.5 ng/L (272 surgical patients); <0.5–144 (41 oncology patients) and <0.5–32.2 ng/L, 1.6 ng/L (103 community patients). 81.3% of all persons tested had cTnI above the LOD (1.0 ng/L). 69.2% in community and 98.5% in seriously ill patients. The 99th percentile URL for a healthy population is 13.6 ng/L. 54% of ICU, 63.3% of CCU, 28.4% of ED and 46.7% of medical patients had TnI concentrations above this level but only 2.0% of community patients.

**Conclusion**

These data indicate that troponin raised to a concentration above that corresponding to the 99th percentile of a healthy population is common in persons with non-cardiac illness, though certainly some of these may have unsuspected cardiac disease as well. Careful clinical assessment of patients is now essential for the interpretation of troponin concentrations.

**P39 CAN LABORATORIES USE A COMMON REFERENCE INTERVAL, WHEN SERUM ALBUMIN CONCENTRATION IS QUANTITATED BY BOTH BCG AND BCP METHODS?**

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**Introduction**

Automated quantitation of serum albumin has been dominated by two dye binding methods, Bromocresol Green (BCG) and Bromocresol Purple (BCP). Unfavourable reaction times seen on automated platforms increase alpha 1 and 2 being additionally quantitated in the resultant albumin measured in current BCG methods. This study explored the concept of a harmonised albumin reference interval, including the effects on dialysis results, paraprotein and corrected calcium calculations.

**Methods**

A total of 606 serum samples (including 25 dialysis patients, 110 <35 g/L, 77 paraprotein patients, 11 >50 g/L) had albumin quantitated by both the comparison method Siemens ALB reagent (BCG) and test method Randox ALB2 (BCP) on the Siemens ADVIA 2400.

**Results**

Passing & Bablok (I) fit y = 1.27x – 14.96, bias at medical decision levels 20, 35 and 52 g/L = -9.5, -5.4, -0.8 g/L respectively. Bland-Altman difference plot: -3.5 bias, -0.42 correlation – absolute difference v average and 0.11 SE. Range 21.0 to 55.9.

**Conclusion**

The study showed that the lower the concentration of albumin, the larger the discrepancy between the methods. Using factors to correlate results to fit within the Siemens reagent reference interval did not fit the entire analytical range of the Siemens assay. These differences were magnified at the clinically significant lower end of the assay range. Decreasing the reaction time on BCG method platforms may allow a better correlation between the two dye binding methods, thereby strengthening clinicians’ confidence in a harmonisation of the respective reference ranges.
P40 LOW LEVEL TROPOinin T SURVEY – TOWARDS HARMONISATION OF THE LOWER LIMIT OF REPORTING

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Introduction
Troponin T above the 99th centile is a critical component of the universal definition of myocardial infarction. The highly sensitive troponin assay, with its ability to measure troponin to approximately 10 fold lower levels compared to the 4th generation assay, allowed redefinition of the 99th centile to 14 ng/L. Following the introduction of this assay across most South Australian laboratories, we sought to determine interlaboratory variation at this clinically important decision point.

Methods
Two pooled patient samples were created. Sample A had a troponin T concentration approximately 10 ng/L and sample B approximately 15 ng/L. Four aliquots of each sample were frozen and distributed to 20 laboratories across South Australia. Samples were run on Roche e411, c2010 and e170 analysers. One pair of samples was run once every two months.

Results
The standardisation curve for this assay was modified in May this year, impacting the results of the survey as each laboratory moved onto the new reagent lot. The 99th percentile of values remained unchanged at 14 ng/L according to the Roche package insert. The first 2 returns showed a larger than expected interlaboratory CV of 32% at a mean of 9.7 ng/L and CV of 14.6% at a mean of 15.5 ng/L. The survey is still ongoing.

Conclusion
Current results do not meet the recommended CV of 10% at the 99th percentile. Restandardisation of the assay during the study period and lot-to-lot variation may have contributed to the total imprecision. Clinical studies are underway in SA to establish the effect of lowered decision limits on patient outcomes.

P41 DEVELOPING CRITERIA TO VALIDATE THE USE OF COMMON REFERENCE INTERVALS WITHIN A LABORATORY NETWORK

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Introduction
Common reference intervals (CRI) are emerging as a vital component in the pathology-clinician-patient chain of care. Within our organisation’s South Australian network, a need was identified to perform regular ongoing patient comparisons to validate the use of CRI across sites. This data will be used to support the use of CRI defined for the central laboratory population (via a defined methodology) across the laboratory network. Our intent was to develop criteria assessing concordance of results generated across different analyser platforms, from laboratories within the network, against those generated at the central laboratory.

Methods
Every four months, five patient samples from each satellite laboratory are analysed for routine biochemical markers, specific to that site, and sent to the central laboratory for re-analysis. Results from each site are compared against the mean of results for a particular sample (assumes equal analytical error contributed from each platform). A laboratory’s results are deemed acceptable, compared with the central laboratory, if their difference from the mean is less than one RCPA-QAP allowable limit of performance.

Results
To date 120 data points have been generated per analyte. Discrepant results are reviewed to identify those affected by common, non-analytical errors (e.g. haemolysis, transport or processing delays and recognised reagent lot stability issues). The low incidence of analytically discordant examples found in patient data generated to this point supports the use of CRI within our organisation.

Conclusion
The authors feel the data generated validates the use of CRI within our organisation’s laboratory network. Furthermore, results from this study support the utilisation of the central laboratory as a backup, providing contingency to disruptions in service provision.

P42 REFERENCE INTERVALS FOR BCP AND BCG ALBUMIN IN PREGNANCY

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Introduction
Albumin levels are well known to be lower in pregnancy. Bromocresol Green (BCG) based albumin measurements are known to be less specific because of globulin cross reactivity. The globulins are also known to be altered in pregnancy, which may further complicate BCG albumin measurements in pregnancy. Therefore, Bromocresol Purple (BCP) albumin measurements may be preferred in pregnancy. We sought to define trimester specific reference intervals for BCP albumin in pregnancy and compare these with BCG albumin values.

Methods
145 healthy women were followed prospectively at each trimester throughout pregnancy. They were originally recruited for a thyroid reference interval study. Albumin measurements were performed using Beckman BCP on a DxC analyser and both Roche BCG and BCP reagents on a c701 analyser. The table below gives the 2.5th to 97.5th reference interval.

<table>
<thead>
<tr>
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<th>1st Trimester</th>
<th>2nd Trimester</th>
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<tbody>
<tr>
<td></td>
<td>(all values in g/L)</td>
<td>(all values in g/L)</td>
</tr>
<tr>
<td>BCP–Alb (Beckman)</td>
<td>32–44</td>
<td>28–37</td>
</tr>
<tr>
<td>BCP–Alb (Roche)</td>
<td>33–45</td>
<td>27–37</td>
</tr>
<tr>
<td>BCG–Alb (Roche)</td>
<td>39–49</td>
<td>34–43</td>
</tr>
</tbody>
</table>

Conclusion
BCP albumin values were similar and consistent between the two BCP albumin methods but were typically 6 g/L lower than Roche BCG albumin estimates. As albumin estimation will impact on globulin calculations, globulin values for pregnancy will vary depending on both the albumin and total protein methods used.

P43 REFERENCE INTERVALS FOR JAFFE AND ENZYMATIC CREATININE IN PREGNANCY

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Introduction
As glomerular filtration is known to increase in pregnancy, creatinine levels are reviewed to identify those affected by common, non-analytical errors (e.g. haemolysis, transport or processing delays and recognised reagent lot stability issues). The low incidence of analytically discordant examples found in patient data generated to this point supports the use of CRI within our organisation.
Jaffe calculation may be incorrect for pregnant women. We sought to define the reference intervals for Jaffe and enzymatic creatinine to investigate these potential errors.

**Method**

145 healthy women were followed prospectively in pregnancy and postpartum. Serum creatinine were analysed using Beckman Jaffe on a DxC analyser or Roche Jaffe and enzymatic on a c701 analyser. The distributions were Gaussian so parametric 95% reference intervals were calculated.

**Results**

<table>
<thead>
<tr>
<th></th>
<th>1st Trimester</th>
<th>2nd Trimester</th>
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<tr>
<td></td>
<td>(n=144)</td>
<td>(n=96)</td>
</tr>
<tr>
<td>Modified Jaffe (Beckman)</td>
<td>29–58</td>
<td>27–57</td>
</tr>
<tr>
<td>Modified Jaffe (Roche)</td>
<td>35–65</td>
<td>31–61</td>
</tr>
<tr>
<td>Enzymatic (Roche)</td>
<td>36–64</td>
<td>34–63</td>
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<tr>
<th></th>
<th>3rd Trimester</th>
<th>Postpartum</th>
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<tr>
<td></td>
<td>(n=79)</td>
<td>(n=144)</td>
</tr>
<tr>
<td>Modified Jaffe (Beckman)</td>
<td>29–63</td>
<td>39–79</td>
</tr>
<tr>
<td>Modified Jaffe (Roche)</td>
<td>32–64</td>
<td>48–82</td>
</tr>
<tr>
<td>Enzymatic (Roche)</td>
<td>35–68</td>
<td>47–83</td>
</tr>
</tbody>
</table>

**Conclusion**

Enzymatic creatinine values were higher than either of the modified Jaffe creatinine estimates in pregnancy. This suggests an underestimation of creatinine by the Jaffe method in pregnancy due to the inherent overestimation of albumin in pregnancy in the compensated formulae. Large differences were also observed between the two Jaffe reagents suggesting calibration differences may be the more significant confounding variable at the lower creatinine levels observed in pregnancy. Harmonisation for creatinine reference interval in pregnancy may be difficult when using the standard rate blanked modified Jaffe methods. Enzymatic creatinine is recommended for the lower creatinine levels seen in children and this is probably also desirable in pregnancy.

**P44 IS THERE HARMONY IN REPORTING UNITS OF BIOCHEMISTRY AND HAEMATOLOGY IN ACCREDITED LABORATORIES OF SRI LANKA?**

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**Introduction**

The Sri Lanka Accreditation Board for Conformity Assessment (SLAB) commenced accreditation of medical laboratories in 2008. The laboratories are assessed for conformity to the ISO 15189:2007. This standard requires the results of examinations to be reported in SI units or units traceable to SI units. A survey was undertaken to assess harmonisation in reporting units for common biochemical and haematological tests in the scopes of accredited laboratories.

**Methods**

The data were obtained from the scopes of accredited laboratories published in the SLAB website. Tests which were performed by four or more laboratories were included in the survey.

**Results**

Of the eleven accredited laboratories, nine have biochemistry and haematology tests in their repertoires. Serum bilirubin, urea, creatinine, phosphate, total cholesterol, HDL-cholesterol, triglycerides and plasma glucose are reported using mg/dL or mg/dl. Units for albumin and protein are g/dL, g/dl and g/L. Serum enzymes (ALT, AST, ALP, and GGT) are reported in IU/L, U/L, U/l, and u/l. For electrolytes SI units (mmol/L and mmol/l) are used except one laboratory using mEq/L for chloride. Units for calcium are mg/dL(1), mg/dl(2) and mmol/L(1).

Six different units are used for WBC and platelet counts and five for RBC. Hb is reported in g/dL(5), g/dL(2) and g/L(1). Units for haematocrit and MCHC are percentage and g/dl respectively. MCH is reported using pg(3) and Pg(1). Units for MCV are fl(4), fl(1) and FL(1).

**Conclusion**

There is harmony in reporting in biochemistry, though conventional units are used with variation in symbols. The diversity in reporting units in haematology and the use of SI units for both disciplines need to be addressed.

**P45 THE AACB WORKSHOP ON HARMONISED REFERENCE LIMITS – RECOMMENDATIONS FOR PAEDIATRIC REFERENCE INTERVALS**

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**Introduction**

In 2012 a Paediatric Biochemistry Special Interest Group was formed to oversee the harmonisation of paediatric reference intervals according to the AACB’s strategic plan. A prerequisite for harmonised reference intervals is calibration traceability and method agreement within accepted limits of performance for common analytes.

**Methods**

Published data exists for paediatric reference intervals but no single study is sufficiently complete or has the analytical rigour to implement as the CRI (common reference intervals) in paediatrics. Hence a range of source material was examined including the LOOK study (Southcott et al 2010) which employed direct sampling for the reference population, the CALIPER (Canada) and KiGGs (Germany) studies, and UK Harmony’s paediatric reference intervals. The reference intervals used by the 9 specialised paediatric laboratories, Sonic Australasia’s paediatric reference ranges (both derived by indirect sampling procedures) and the paediatric reference intervals kindly provided by colleagues from 5 other large pathology services (non paediatric institutions) were also tabulated and compared. Finally Soldini’s Pediatric Reference Intervals was included.

**Results**

Reference intervals were defined for plasma sodium, potassium, chloride, bicarbonate, total calcium, magnesium and phosphate - these were by consensus agreement. Neonatal bilirubin will have clinical decision points within the next 6 months. Areas for further discussion are urea, creatinine, LFTs and lipids. The group also agreed to standardise age terminology and define partitions according to physiological transitions rather than statistical criteria or LIS convenience (eg. 0–5, 5–10, 5–15 years).

**Conclusion**

The group thanks all who contributed to the symposium and continues to seek input from colleagues and clinicians to improve and progress this work.

**P47 VIEWING PATHOLOGY RESULTS – WHAT IS THE REAL TURN-AROUND TIME?**

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**Background**

Laboratory turn around time (TAT) is seen as a key parameter for performance of pathology laboratories in the acute care setting. TAT is commonly viewed from the time of sample collection to the time the result is validated (TATlab). The real TAT for doctors is the time from collection to the time the result is validated (TATv). In this study we measure TATlab, TATv and TATtot in a teaching hospital with web browser viewing of results.

**Methods**

Potassium was used as an example analyte; 9340 results were included in the study. Times collected on each request were collection, result validation (TATv) and result transmission to the clinician (TATtot). TATv and TATtot were compared to real TAT (TATlab) recorded using an electronic log book.

**Results**

There was no significant difference between collection time (TATlab) and real TAT (TATv). The time from web submission to result validation (TATtot) was a significant factor in determining the overall TAT. The median TATv was 40.0 minutes and TATtot was 140.4 minutes. Only 24% of results were validated within 90 minutes.

**Conclusion**

There is a significant difference between real TAT and TATv. TATtot is the only reliable indicator of pathology TAT in a teaching hospital with web browser viewing of results.
Poster Abstracts

and viewing the results web page. The source of the request (ward) was also recorded.

Results
The 50th and 90th centiles for TATlab were 70 and 130 min respectively, for TATv were 45 and 330 min (4.5 h) and for TATtot 140 and 450 min (2.3 and 7.5 h). For the Emergency Department TATv was faster (25 and 180 min) as it was intensive care TATv (40 and 160 min). A 15 minute delay in producing results would affect 20% of doctors viewing results. It was also noted that doctors started attempting to view results up to 40 minute prior to result availability.

Conclusion
The time taking to view results in the web system adds significantly to the TAT experienced by the doctor. Delays in the laboratory can affect a high percentage of doctors reviewing results. TAT in the viewing phase may be a target for improved TATtot.

P49 INFLUENCE OF TRIGLYCERIDE CONCENTRATION ON HDL AND LDL CHOLESTEROL MEASUREMENT – A QAP STUDY
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Introduction
Low HDL cholesterol (HDLc) is commonly associated with elevated triglycerides and so is important to consider interference of triglycerides on HDLc measurement. In this study samples in the RCPA QAP Special Lipid Program were designed to assess this effect.

Methods
In the Special Lipid Program of the RCPA QAP in 2011 and 2012 samples were prepared with one of the samples containing low concentrations of HDLc, LDLc and triglycerides, and another sample with similar concentrations of HDLc and LDLc but elevated triglycerides. The HDLc was near 0.6 mmol/L and LDLc near 2.0 mmol/L in each sample and triglycerides were 0.5 and 3.6 mmol/L respectively. Samples were prepared by mixing patient samples to achieve target levels. Data from enrolled laboratories was analysed to compare the between-manufacturer differences of HDLc and LDLc with changes in triglycerides.

Results
There were significantly larger between-method differences for HDLc and LDLc with higher triglycerides. In 2011 the difference between the highest and lowest HDLc methods changed from 0.14 to 0.33 mmol/L. For LDLc the difference increased from 0.39 to 1.05 mmol/L.

Conclusion
This study indicates that the concentration of triglycerides has different effects on different assays for HDLc and LDLc indicating differences in analytical specificity. We are unable to determine which methods are most accurate due to lack of a reference standard and possible matrix effects. Detailed studies on the effect of triglycerides on HDLc and LDLc measurement are warranted given the importance and frequency of these lipid patterns. As the assays included are from global suppliers this issue is likely to affect many countries and require global solutions.

P50 CLINICAL COMPARISON OF THE FREELITE AND N LATEX SERUM FREE LIGHT CHAIN (FLC) ASSAYS IN THE DIAGNOSIS AND MONITORING OF AL AMYLOIDOSIS
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Introduction
We compared free light chain (FLC) quantification based on monoclonal antibodies (N Latex) to the established polyclonal antibody-based assay (Freelite) in AL amyloidosis (AL).

Methods
Sixty-one diagnostic samples, 31 of which also had a post-treatment sample were analysed. FLC concentration was measured by Freelite (The Binding Site, UK) and N Latex (Siemens, Germany) immunossays and BNII nephelometry. Serum and urine immunofixation (IFE) were performed on Hydrasys gel systems (Sebia, France).

Results
For diagnostic kappa AL samples, median involved FLC (iFLC) concentration was significantly lower by N Latex (354 vs 808 mg/L, p=0.0003) whereas for diagnostic lambda AL samples concentrations were similar (148 vs 161 mg/L, p=0.84). Measurable disease is the difference between involved and uninvolved FLC, (dFLC) of >50 mg/L and resulted in 82% AL measurable by N Latex versus 89% by Freelite. Diagnostic sensitivity of FLC ratio was normal in 21% and 15% of patients by N Latex and Freelite, respectively. Serum and urine IFE with either FLC assay, however, identified the amyloidogenic clone in 98% for both assays. In the monitoring samples median reduction in dFLC was 48% for N Latex and 79% for Freelite (p=0.03). Response categories predicted overall survival (N Latex p=0.0027, Freelite p=0.0275).

Conclusion
There are significant differences between iFLC concentration measured by N Latex and Freelite immunossays, but overall the assays have similar diagnostic sensitivity. In the monitoring context, disease response as calculated by both assays predicts overall survival. Because of the assay differences in iFLC concentrations, consensus criteria may need to be reconsidered.
**P51 ANALYTICAL PERFORMANCE CHARACTERISTICS OF THE DIMENSION EXL LOCI TROPNIN I (CTNI) ASSAY**

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**Introduction**

The Dimension® EXL™ LOCITM cTn assay (Siemens Healthcare Diagnostics, US) was evaluated for imprecision, method comparison versus the AccuTnI (Beckman, US) cTn assay, and the 99th percentile upper reference limit (URL) was determined in a cardio-healthy population of 108 Queenslanders.

**Methods**

Imprecision was assessed over 10 days using six serum pools. cTn concentration was measured in 1436 samples from an Emergency Department (ED) acute coronary syndrome study.

**Results**

Imprecision was 10% CV at 0.057 μg/L cTn and 20% CV at 0.027 μg/L cTn. The 99th percentile URL was 0.037 μg/L and 0.036 μg/L cTn in serum and plasma, respectively (~15% CV). By Passing-Bablok analysis of LOCIT cTn versus AccuTnI the regression slope was 0.958 (95% C.I. 0.888 to 1.000) and y-intercept -0.0027 (95% C.I. -0.0030 to -0.0018). In 194 samples (13.5%) AccuTnI was >0.04 μg/L URL compared to 181 samples (12.6%) above the study URL of 0.037 μg/L cTn for the LOCIT assay and 151 (10.5%) above the manufacturer’s URL of 0.056 μg/L cTn.

**Conclusion**

Between-day imprecision of 10% CV at 0.057 μg/L cTn was close to the manufacturer’s claim (0.056 μg/L). In the ED study, depending on whether the cardio-healthy or the manufacturer’s 99th percentile was used as the LOCIT cTn URL, between 13 (6.7% of 194 positive AccuTnI) and 43 (22%) more patients samples were identified as above the 99th percentile by AccuTnI than by Dimension EXL LOCI assay.

**P52 USE (AND MISUSE) OF MEASUREMENT OF SERUM FREE LIGHT CHAINS**

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**Introduction**

Studies with serum free light chain (FLC) assays have demonstrated their clinical usefulness. However, antigen excess may cause FLC underestimation misleading result interpretation in plasma cell diseases.

**Methods**

Kappa (K) and Lambda (L) FLC were measured by BNII nephelometer (Siemens, Germany) using Freeelite (The Binding Site, UK), and N Latex (Siemens, Germany) assays. Serum and urine protein electrophoresis and immunofixation electrophoresis were performed on Hydrasys gel systems (Sebia, France).

**Results**

**Case 1:** Non-secretory multiple myeloma (NSMM) with trace monoclonal KFLC: Freeelite (N Latex) KFLC 0.6 (0.420); post-transplantation KFLC 637 (374) mg/L.

**Case 2:** MM with serum Beta+IgAK paraprotein of 71 g/L and trace monoclonal KFLC: Freeelite KFLC 16 mg/L (RR 3-19). At 12 months: serum Beta+IgAK paraprotein 12 g/L and trace monoclonal KFLC. One month later: serum IgAK paraprotein unchanged, monoclonal KFLC 2 g/L, Freeelite KFLC 16,700 mg/L.

**Case 3:** MM with serum monoclonal LFLC of 8 g/L: Freeelite (N Latex) LFLC 900 (2,300) mg/L.

**Case 4:** IgAK MM with light chain cast nephropathy: Freeelite (N Latex) KFLC 56 (2,610) mg/L. Freeelite KFLC concentration increased post haemodialfiltration whereas N Latex KFLC concentration decreased.

**Case 5:** MM with serum Beta+monoclonal KFLC of 26 g/L: Freeelite (N Latex) KFLC <1 (59,000) mg/L.

**Conclusion**

FLC measurement is clinically useful in diagnosis and monitoring of NSMM (Case 1), light chain escape (Case 2); co-migrating paraproteins (Case 3); light chain cast nephropathy (Case 4). Caution is advised when using Freeelite assays without automatic antigen excess testing as FLC may be underestimated (Cases 2, 4, 5).

**P53 COMPARISON OF THE FREEElite AND N LATEX SERUM FREE LIGHT CHAIN (FLC) ASSAYS IN CHRONIC KIDNEY DISEASE**

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**Introduction**

Elevated FLC can occur not only in monoclonal light chain disease entities but also in chronic kidney disease (CKD) where Kappa/Lambda FLC ratios up to 3.1 are reported. We compared results for two FLC assays in a CKD dialysis-dependent cohort.

**Methods**

FLC concentration in 29 CKD patients on haemodialysis (HD) (low flux HD (LFHD) [N=18]; high-flux HD (HFHD) [N=11]) was measured by Freeelite (The Binding Site, UK) and N Latex (Siemens, Germany) immunosassays on a BNII nephelometer.

**Results**

Mean Kappa FLC concentration was similar for pre-HD samples by N Latex (196 mg/L) and Freeelite (195 mg/L) whereas mean Lambda FLC concentration was significantly higher by N Latex (243 mg/L) than by Freeelite (166 mg/L). This resulted in all Kappa/Lambda ratios being in the normal range by N Latex (0.48–1.35) and higher by Freeelite (0.79–2.38). Post haemodialysis, however, further differences in FLC measurement between the N Latex and Freeelite assays emerged. Mean FLC concentrations for N Latex (Freeelite) assays were: Kappa FLC in HFHD group 118 (110) mg/L and LFHD group 180 (149) mg/L; Lambda FLC in HFHD group 146 (145) mg/L and LFHD group 173 (147) mg/L.

**Conclusion**

All calculated Kappa/Lambda ratios were normal by N Latex whereas the Freeelite assay requires a separate renal reference range. Different types of haemodialysis have differing effects on FLC measurement by the two assays suggesting a degree of interference with the assays not previously described. This has implications for FLC interpretation and further investigation is warranted.

**P54 CORRELATION OF TNI ASSAYS ON THE ABBOTT ARCHITECT AND THE RADIOIMETER AQT90**

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**Introduction**

The Radiometer AQT90 has potential for use in a point-of-care (POC) setting. This analyser is easy to use and has a broad menu so will be potentially useful in a large number of remote and acute care sites. It is critical that the results of key assays are comparable with those obtained in central laboratories. This analyser is easy to use and has a broad menu so will be potentially useful in a large number of remote and acute care sites.

**Methods**

Based on previous studies, we have investigated using a slope correction to harmonise the AQT90 results with the Abbott Architect TnI method. Results from these methods and an Abbott iStat were compared.
Results
Without adjustment the Radiometer AQT90 gives Troponin-I results about 5 to 6-fold lower than the Abbott Architect, although the factor varies throughout the clinical range. Using a factor of 5 to adjust the Radiometer calibration regression analysis revealed y (Abbott) = -0.025 + 1.429 x (AQT90), with r = 0.9626, in the Troponin-I range 0 to 1.0 μg/l. Precision with duplicates was 11 and 4% for AQT90 and Abbott respectively. Similar agreement was found between the Architect and iStat, with y (Architect) = -0.012 + 1.3440 x (iStat) (r = 0.9812).

Conclusion
After harmonisation, by slope adjustment, the Radiometer AQT90 Troponin-I assay is suitable for use in POCl situations. This assay is apparently less affected, than other commercial assays, by auto-antibodies to Troponin-I. The potential significance of these interfering antibodies on patient results obtained by the two assays has also been evaluated and will be presented.

P55 EVALUATION OF THE BG MEDICINE GALECTIN-3™ ELISA
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Introduction
Galectins are a family of soluble β-galactoside-binding lectins that play many important regulatory roles in inflammation, immunologic response and cancer. Galectin-3 has a known role in the promotion of fibrosis. Elevated Galectin-3 levels identify a subset of patients with chronic heart failure who suffer from an inherently progressive form of heart failure due to galectin-3-mediated fibrosis and adverse remodelling. Galectin-3 testing is indicated for use in patients previously diagnosed with chronic heart failure and cannot be used to diagnose heart failure. Here, we investigate the ease of use and performance of the BG Medicine Galectin-3 ELISA in a routine clinical diagnostic laboratory.

Methods
Two scientists performed the Galectin-3 ELISA on 19 separate occasions. The Galectin-3 ELISA is a 96-well microtiter plate assay, utilising two monoclonal antibodies against galectin-3. One immobilised to the plate and another labelled with HRP. It was run according to the manufacturer’s instructions. Plates were washed using an Anthos Fluido, automated EIA washer. Absorbances were read using an ELX808 microplate reader (BioTek) at 450 nm. Standard curves were generated using a four parameter logistic fit, using the KC4 v3.0 software (BioTek).

Results
The analytical evaluation of Galectin-3 ELISA assay showed good precision, with intra-assay CVs of 3.2 and 3.4% for Galectin-3 values of 17.3 and 65.0 μg/L, and inter-assay CVs of 5.3 and 5.6% for Galectin-3 values of 18.5 and 67.4 μg/L. All Standard curves had an r2 value >0.99 (n=19), and a measuring range of 1.6–100 μg/L. The average run time of the assay was approximately 4 hours.

Conclusion
These results demonstrate that the BG Medicine Galectin-3 ELISA assay is a precise, reproducible method for determining galectin-3 concentrations in a routine setting.

P56 COMPARISON OF TWO LACTATE DEHYDROGENASE (LDH) METHODS ON BECKMAN COULTER AU680 ANALYSER
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Introduction
Globally, two assays are used for LDH analysis, pyruvate to lactate (P-L), as recommended by Scandinavian Committee on Enzymes, and lactate to pyruvate (L-P), by International Federation of Clinical Chemistry, assays. Data from the 2012 Royal College of Pathologists of Australasia and College of American Pathologists External Quality Assurance General Chemistry and Therapeutic Drugs C-A Series Surveys, showed 83% and 73% of the participants use the L-P method while 17% and 27% use the P-L. We evaluated these methods using Beckman Coulter AU680 analyser (California, USA).

Methods
323 patient samples were used for method comparison and bias estimation. Linear regression analysis was performed. Within-day and between-day precisions were assessed using aliquots of four pooled serum samples kept at 4 °C and -20 °C, brought to room temperature before analysis. Total imprecision (CV) was determined. Quality controls (QC) were run concurrently.

Results
The two methods demonstrated poor correlation, with a regression slope of 0.5318 and intercept of -5.5521 respectively. A positive bias of 43 to 77% was observed for P-L when compared to L-P method. Total imprecision for L-P, ranged from 11.5 to 17.3% for samples stored at 4 °C and 5.7 to 10.9% at -20 °C, and for P-L, 11.5 to 16.3% for samples at 4 °C and 4.8 to 8.9% at -20 °C respectively. QC performance also demonstrated that the L-P method showed poorer stability within 30 days reagent on-board stability.

Conclusion
Imprecision may be contributed significantly by the different LDH isoenzymes’ stability and storage of samples at different temperatures. Global harmonisation of LDH assays, either L-P or P-L, would be valuable for meaningful monitoring of LDH results between laboratories.

P57 ALLOWABLE ERROR FOR ELECTROLYTE TESTING ON BECKMAN COULTER AU680 ANALYSER
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Introduction
Beckman Coulter AU680 Analyser is a fully automated, random-access chemistry system to increase productivity for medium to high throughput laboratories. We looked at its assay performance for electrolyte testing.

Methods
The assays evaluated were sodium, potassium, chloride and creatinine. 120 patient samples were used for correlation with ADVIA2400 (SIEMENS Pte Ltd, Germany) and VITROS5600 Analysers (Ortho Clinical Diagnostics, USA). Within day (4 runs) and between day (10 days) precision were assessed using four pooled sample concentrations across analytical ranges. The mean and percentage of coefficient of variation (CV) were determined and used in conjunction with bias calculated from correlation regression equations to calculate the total error (TE = 2xCV+bias), compared to ADVIA2400 and VITROS5600 instruments.

Results
Correlation results showed slopes and intercepts between 0.94 to 1.01 and -2.72 to 4.43 for ADVIA2400; 0.94 to 1.02 and -1.13 to 8.49 for VITROS5600 respectively. Total imprecision was 0.7–2.1%, giving total errors of 3.22–12.53% when compared to ADVIA2400 and 0.01–4.69% compared to VITROS5600. However, using 2010 RCPA allowable limits, sodium, potassium and chloride assays exceeded the limits at higher analytical concentrations when compared to ADVIA2400. This is due to poorer correlation of AU680 to ADVIA2400 compared to VITROS5600.

Conclusion
There is good comparability of electrolyte testing on AU680 compared to ADVIA2400 and VITROS5600. Beckman Coulter AU680 Analyser provides a reliable and reproducible platform for electrolyte testing. To determine its Sigma Metrics performance, it is more appropriate to use external quality materials and compare to gold standard methods rather than to routine instruments, however, this evaluation provides a quick guide to the instrument operation.
P58 EVALUATION OF ANALYSERS USED FOR FIRST TRIMESTER SCREENING FOR DOWN SYNDROME
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Introduction
First trimester screening (FTS) involves measuring nuchal translucency (obstetric ultrasound), free beta human chorionic gonadotropin (free βhCG) and pregnancy associated plasma protein A (PAPP-A). Free βhCG and PAPP-A are measured by only four immunoassay analysers. Comparisons were performed for both biochemical markers using the Siemens Immulite 2000 (Immulite), the Perkin Elmer DELFIA Xpress (Delfia) and the Roche E170 (E170), to determine overall correlation and analytical precision as well as to establish method specific gestational regression equations.

Methods
Between 13/07/2010 to 22/10/10, 831 patients were measured using the Immulite and the Delfia. Between 18/11/10 to 11/01/11, 863 patients were measured using the Immulite and the E170. Precision data was determined using the coefficient of variation (CV) and was generated using similar in house serum quality controls (QC) for all assessed methods.

Results
PAPP-A showed a good but non-linear correlation when the Immulite and Delfia were compared, whilst free βhCG was well correlated using the two analysers. The linear correlation between the Immulite and the E170 was good for both PAPP-A and free βhCG. In all cases PAPP-A concentration data differed analyser to analyser. Overall CVs across the analytical range, using in house QC’s were 4–7% (Immulite) 2–7% (Delfia) and 1–2% (E170) for PAPP-A and 4–6% (Immulite) 3–8% (Delfia) and 2–3% (E170) for free βhCG.

Conclusion
A non-linear correlation for PAPP-A between Immulite and Delfia makes method comparison difficult. PAPP-A was well correlated between the Immulite and E170. In the case of free βhCG the Immulite data correlated well with either the Delfia or E170. All three analysers provide adequate precision for FTS. All three analysers require individual method specific gestation regression equations to be established.

P59 SHOULD ASSAY EVALUATIONS INCLUDE SAMPLES ABOVE THE ASSAY DYNAMIC RANGE?
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Introduction
CLSI guidelines for determining assay suitability do not implicitly suggest that patient results beyond the dynamic range should be included in an evaluation. Progesterone testing is routinely performed to monitor at risk pregnancies and is performed throughout the pregnancy at approximately two week intervals. These progesterones routinely require dilution.

Methods
Forty patient samples analysed on our current platform Immulite 2000 (Siemens) and the Architect i4000SR (Abbott) were assessed for bias and scatter. On the Architect, linearity was assessed using a high patient pool well with either the Delfia or E170. All three analysers provide adequate precision for FTS. All three analysers require individual method specific gestation regression equations to be established.

Results
Initial evaluation (40 females, 8–67 y, progesterone 0.7–114 nmol/L) yielded a Passing and Bablok regression of y = 0.93x + 0.4. The linearity study demonstrated a linear fit of y = 0.98x - 0.4 (recoveries 93.2–109.8%). Combined imprecision was acceptable (CV 3.8% at 6.0 nmol/L, CV 3.2% at 42.8 nmol/L). Samples requiring dilution (dilution point 127 nmol/L for both methods) demonstrated a linear regression of y = 1.49x - 3.56 using on-board dilutions (Architect 1/10, Immulite 1/5). However, the correlation between manual 1/5 dilutions on the Architect and on-board 1/5 dilutions on the Immulite yielded a regression of y = 1.17x - 3.57. Due to the tracking and dosing of progesterone support in this group of patients, the on-board dilution results from the Architect were deemed unacceptable. An appropriate clinical work-around was needed before the Architect assay could go live, whilst further investigations were undertaken.

Conclusion
Careful consideration should be given to evaluation of assays routinely requiring dilution to meet clinical needs. The addition of diluents, the size of the dilution and other variants that occur during on-board dilutions may cause clinically significant differences in results.

P60 EVALUATION OF THERMO SCIENTIFIC B.R.A.H.M.S KRYPTOR ASSAY FOR CHROMOGRANIN A
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Introduction
Chromogranin A (CgA) is an important marker for neuroendocrine tumours and until recently the only methods available were either manual enzyme linked immunonoassays (ELISA) or manual radio-immunoassays (RIA). The Kryptor assay utilises homogeneous Time Resolved Amplified Cryptate Emission (TRACE) technology, a low sample volume (8 µL), wide measuring range with automatic dilution (7–100000 µg/L) in a 29 minute assay. This study reports the suitability of the Kryptor assay for routine measurement of CgA.

Methods
53 serum samples from patients referred for CgA were split into two aliquots and frozen immediately after collection at -20 °C and stored frozen until analysis. One aliquot was referred to an outside laboratory for analysis using DAKO ELISA (DAKO Australia) with other aliquot being analysed on B.R.A.HMS Kryptor Compact analyser (Thermo Fisher Scientific).

Results
The CgA results from both methods were compared using Deming regression with correlation showing Kryptor CgA (µg/L) = 3.26*Dako CgA (U/L) + 18.11. Between run precision using QC material was 4.8 %CV and 2.5 %CV at 102 µg/L and 507 µg/L respectively over 28 days using three different reagent lots. Eight patients were excluded as their results were deemed to be outliers.

Conclusion
There was an acceptable correlation between the DAKO and B.R.A.HMS Kryptor assay with Kryptor assay giving results 3 to 4 times higher than the DAKO and this is reflected in the reference intervals quoted <21.8 U/L for males or <17.2 U/L for female and <85 µg/L for the DAKO and Kryptor respectively. With differences in the antigenic epitopes targeted in each assay we expected some outliers. However, all the outliers were still clinically concordant.

P61 WHICH BILIRUBIN METHOD IS THE TEST OF CHOICE?
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Introduction
Bilirubin measurement has long been performed using a Diazo associated method and until recently this has occupied a major place in method selection by pathology services and instrument providers. The presence in the market of a spectrophotometric based method in a blood gas analyser has provided another option for rapid, POCT at the ‘cot side’ with subsequent improvement in turn-around times for bilirubin results.

Methods
Eighteen patients were recruited and samples were obtained, which were tested on a GEM Premier 4000 (Immulite), the Perkin Elmer DELFIA Xpress (Delfia) and the Roche E1800 (E1800). Eighteen samples were measured using in house serum quality controls (QC) for all assessed methods.

Results
Using 26 samples across the range of 102 to 394 umol/l for Correlation results using 26 samples across the range of 102 to 394 umol/l for bilirubin, showed good agreement between the two methods. PAPP-A showed a good but non-linear correlation when the Immulite and the Roche E170 had a passing and bablok regression of y = 0.93x - 0.4. The linearity data was determined using using the coefficient of variation (CV) and was generated using similar in house serum quality controls (QC) for all assessed methods.

Conclusion
There was an acceptable correlation between the DAKO and B.R.A.HMS Kryptor assay with Kryptor assay giving results 3 to 4 times higher than the DAKO and this is reflected in the reference intervals quoted <21.8 U/L for males or <17.2 U/L for female and <85 µg/L for the DAKO and Kryptor respectively. With differences in the antigenic epitopes targeted in each assay we expected some outliers. However, all the outliers were still clinically concordant.
such agreement was not found using the Biliscan device which estimated skin colour in the same neonates. Values obtained showed considerable variation from other results.

**Conclusion**

Gemi Premier 4000 provides a rapid POCT bilirubin result which shows good correlation to the classical Diaz method for estimating this compound. Selection of neonates for testing may prove to be the next hurdle to overcome as this three way comparison of bilirubin results between a GEM Premier 4000, Advia 1800 and ‘Biliscan’ has shown.

P62 **METHOD COMPARISON BETWEEN SIEMENS ADVIA PLASMA LACTATE AND ABBOTT ISTAT (POCT) WHOLE BLOOD LACTATE**

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**Introduction**

Measurement of lactate levels is important in patient assessment in several clinical settings. Point of Care Testing (POCT) can provide whole blood lactate results at the patient bedside to guide clinical decisions in a relevant timeframe. It is known that a rapid turnaround time of lactate results can improve clinical outcomes. We compared SIEMENS ADVIA Plasma Lactate with ABBOTT iSTAT (POCT) whole blood lactate to assess its suitability in ICU and ED settings.

**Methods**

Lactate requests on 33 patient samples were analysed using whole blood on the ABBOTT iSTAT immediately prior to analysis of plasma lactate on the SIEMENS ADVIA over a wide range of values. Method comparison analysis was done using Bland-Altman difference for bias and Passing and Bablok regression. We also performed a precision study using high (8.15 and 7.86 mmol/L) and low (0.81 and 0.82 mmol/L) level manufacturers QC, using the CLSI EP5-A2 protocol on the ISTAT instrument.

**Results**

There was no significant bias between ABBOTT iSTAT whole blood lactate and SIEMENS ADVIA plasma lactate measurements Mean bias -0.03mmol/L (95% CI -0.137 to + 0.077). Passing and Bablok evaluation gave a regression equation, $y = 1.07x - 0.16$, where $y =$ iSTAT whole blood lactate and $x =$ ADVIA plasma lactate. The coefficients of variation (CVs) for iSTAT lactate at 7.86 mmol/l and 0.82 mmol/l were 1.37% and 1.88% respectively.

**Conclusion**

There was no significant bias between ABBOTT iSTAT whole blood lactate and SIEMENS ADVIA plasma lactate measurements. iSTAT lactate measurement has acceptable precision at both low and high concentrations tested. iSTAT lactate measurements have acceptable performance for clinical use.

P63 **AUDIT OF A TWO TIER BIOCHEMICAL PHONE LIST FOR A COMMUNITY LABORATORY**

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**Introduction**

Critical values require immediate communication. Contacting a community requestor out of office hours requires substantial staff resource and locating requestors can be difficult. We devised a two tier phone list, which distinguishes a critical value and non-emergency abnormal result for action during the daytime. This is the first audit of a two tier list.

**Methods**

The literature on critical values was reviewed. Paediatric and pregnancy critical values were adopted. Change of an analyte within the previous 7–30 days was considered. A two tier critical phoning list agreed. The audit covers two months results.

**Results**

Total critical values 1469. Some examples: ALT total requests 99000: 16 >4000 U/L; pregnant n=2600, 26 >45 U/L, range 47–509 U/L.

Amylase total requests 2700: 22 >400 U/L: 6 increment <150 U/L. 16 critical: 4 admitted, 3 chronic pancreatitis, 5 community follow up, 4 no follow up test. Creatinine total requests 107000: creatinine >400 μmol/L. Not phoned 895 (previously known or creatinine increment <200 μmol/L); phoned 40: 8 previous creatinine >165 μmol/L(eGFR >34), age 32–87 years, creatinine range 414–1342 μmol/L(eGFR 3–10); 13 previous creatinine range 213–949 μmol/L(eGFR 7–14), age 42–80 years, creatinine range 408–1096 μmol/L(eGFR 3–14), incremental creatinine range 186–621 μmol/L(eGFR 3–25); 6 new to IT system but previously known under hospital; 13 did not fulfil requirements (previous creatinine >400 μmol/L with maximum increment 88 μmol/L).

**Conclusion**

The concept of critical values is different in the community and only life-threatening results should be communicated out of hours. A two tier phone list enhanced identification of critical values. Use of eGFR may further enhance identification. This avoids disturbing requestors out of hours with non-emergency abnormal results and saves staff resources at night.

P64 **WHOLE BLOOD PORPHYRIN CLINICAL EVALUATION – ENHANCING EXTERNAL QUALITY ASSURANCE**

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**Introduction**

The RCPA QAP Porphyrin program has 49 participants from 14 countries. 20 submit results for whole blood total porphyrin and concordance is generally poor. A large range of methods, analytical conditions and reference intervals (RI) is in use. In 2009 a clinical evaluation component was added to enhance diagnostic feedback. We present 3 years of data to assess the value of this addition.

**Methods**

Participants classify each sample as normal (within RI), slightly elevated (not clinically significant) or elevated (further investigation required), in addition to reporting a quantitative result. Results from three cycles were examined to assess uptake and to compare clinical evaluation with analytical performance.

**Results**

Clinical evaluation agreement has generally been good at normal (median <1.5 μmol/L) and highly elevated (median >10.0 μmol/L) levels, with 96 and 98% of results respectively correctly assigned. In comparison, quantitative results varied by 22–55%. Interpretation of slightly to moderately elevated levels varied more widely. Participation in this component has increased from 60–90% over three cycles.

**Conclusion**

The results indicate good concordance at normal and highly elevated levels. Variability at other levels may reflect analytical performance, RI variation or individual interpretation. Increased uptake suggests participants find this component of value. International RI harmonisation is problematic. This program addition allows participants to compare clinical assessment independently of quantitative results obtained. While standardisation of methodology is ideal, ‘pseudoharmonisation’ relating results to RI provides participants with valuable diagnostic information.
P65 MANAGING QUALITY WITH KIMMS (KEY INCIDENT MONITORING AND MANAGEMENT SYSTEMS): A UK PERSPECTIVE

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Introduction
Pre-analytical errors constitute a large proportion of the total faults in the
dumping-result pathway, reportedly up to 68%. Whilst the laboratory tightly
controls areas of analytical performance, in the UK pre- and post-analytical
errors are not formally monitored despite their subsequent impact on patients,
the laboratory and the clinical service.

Methods
Our laboratory was the first in the UK to enrol in the Australian Key Incident
Monitoring and Management Systems QA scheme (KIMMS). We designed
and implemented a quality system aligned to KIMMS criteria to capture error
information directly from the LIS. The data are available for return to the
scheme and are also grouped by location and type for feedback to service users.

Results
Since September 2011 our laboratory has received an average of 3712
errors/month; potentially 44,533 patients/year need to be re-bled. 93% of
the errors were outside laboratory control. In June 2012 the major error was
not receiving a required sample type (1002), closely followed by haemolysis
(849) and collection errors (430).

Conclusion
Building error data collection into standard laboratory working practice with
the LIS has ensured that data quality is of high integrity. Implementation
of an Australian scheme in the UK met a number of problems including a
difference in the allocation of accession numbers, crossover of some error
categories and minor differences in working patterns. These difficulties
were overcome to produce a reliable robust system, with training targeted at
areas of concern. This work illustrates the need for total quality systems to
minimise errors and improve patient safety in both primary and secondary care.

P66 CLOSING THE GAP BETWEEN CHEMICAL PATHOLOGY LABS IN A DEVELOPING AND A DEVELOPED COUNTRY

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Introduction
Pathology services in developing countries are similar to laboratories in
developed countries approximately 30 years ago. We have analysed the
specific deficiencies and hurdles to addressing them in a teaching hospital in
Sri Lanka. We propose a multifaceted approach to fast tracking change in a
cost effective manner to minimise the gap and improve services.

Method
After local postgraduate training in Chemical Pathology at the National
Hospital of Sri Lanka and foreign training at Monash Medical Centre the first
author was appointed as the first Chemical Pathologist in a regional teaching
hospital of 1700 beds in Sri Lanka. The range of services, analytical systems,
quality systems, staff training and industrial relations issues were reviewed
and deficiencies identified. Desirable changes were implemented according
to standard change management principles learned during foreign training.

Results
In February 2010 there were only five analytes available and no fully
automated instruments. There was no IQC and response to EQA was poor.
There was poor local understanding of procedure to acquire new instruments
automated instruments. There was no IQC and response to EQA was poor.
In February 2010 there were only five analytes available and no fully
capable to enable parallel chemistry and immunoassay analysis. We evaluated the effect of time from aliquotting to
processing, on the quality of the results.

Methods
Five pools were prepared and multiple aliquots (500 µL) of each were
analysed in duplicate. (Set-A) stored in the Cobas Line Buffer (CLB) and
analysed at 10 min intervals from 0–50 min then at 80 min (to evaluate
evacuation effects online); (Set-B) stored in the CLB for 30 min, then
para-filmed and stored at room temperature for another 50–140 min before
analysis (to simulate instrument breakdown). (Set-C) capped and stored
at room temperature until analysis in 140 min (to assess drift).

Results
Tests assessed were electrolytes, urea, creatinine, liver function tests, lipids,
glucose, calcium, phosphate, magnesium, creatinine kinase and uric acid.
Significant evaporation was assessed as percentage deviation from baseline
concentration >2.77CVa (where CVa = analytical CV).

Conclusion
As a result of this study, we limit the sample processing rate to assure aliquots
stay on the CLB for ≤30 mins before analysis. Also, when the line crashes,
we remove the racks from the line, para-film them and assure analysis within
90 min. In addition we have monitored the monitoring of patient moving
medians to assist with detecting pre-analytical aliquot evaporation as well as
analytical error.

P67 EVALUATION OF PRE-ANALYTICAL SAMPLE ALIQUOT EVAPORATION ON THE ROCHE COBAS 8800
USING MODULAR PREANALYTICS

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Introduction
The Roche Modular Pre-Analyses (MPA) takes separate aliquots from
a primary tube into small sample cups, to enable parallel chemistry and
immunoassay analysis. We evaluated the effect of time from aliquotting to
processing, on the quality of the results.

Methods
Five pools were prepared and multiple aliquots (500 µL) of each were
analysed in duplicate. (Set-A) stored in the Cobas Line Buffer (CLB) and
analysed at 10 min intervals from 0–50 min then at 80 min (to evaluate
evacuation effects online); (Set-B) stored in the CLB for 30 min, then
para-filmed and stored at room temperature for another 50–140 min before
analysis (to simulate instrument breakdown). (Set-C) capped and stored
at room temperature until analysis in 140 min (to assess drift).

Results
Tests assessed were electrolytes, urea, creatinine, liver function tests, lipids,
glucose, calcium, phosphate, magnesium, creatinine kinase and uric acid.
Significant evaporation was assessed as percentage deviation from baseline
concentration >2.77CVa (where CVa = analytical CV).

Conclusion
As a result of this study, we limit the sample processing rate to assure aliquots
stay on the CLB for ≤30 mins before analysis. Also, when the line crashes,
we remove the racks from the line, para-film them and assure analysis within
90 min. In addition we have monitored the monitoring of patient moving
medians to assist with detecting pre-analytical aliquot evaporation as well as
analytical error.

P68 CORRELATION BETWEEN ANALYTES IN URINE FROM PREGNANT WOMEN

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Introduction
Several analytes can be measured in urine during pregnancy and since spot
urines are easier to collect, analyte/creatinine ratios are assumed to be an
appropriate correction for patient hydration. We measured a number of
urinary analytes in pregnancy and used the opportunity to investigate the
correlation between analytes including creatinine.

Method
150 spot urine samples in the first trimester (9-13/40) were obtained from
healthy women enrolled in a thyroid function reference interval study.
Routine chemistry assays (Na, K, Cl, creatinine, calcium, protein, albumin)
were measured on a Cobas Integra 800. Seventeen trace elements were measured concurrently on Agilent 7500 CE with octopole reaction cell. The distributions were non-Gaussian so Spearman rank correlation (r) was used.

**Results**

Creatinine, protein, selenium, copper were highly correlated (r>0.7) with each other. Creatinine was also highly correlated with potassium and calcium. Other high correlations were calcium/sodium; strontium/barium, potassium/chloride, vanadium/manganese and the strongest correlation amongst all analytes was (unsurprisingly) sodium/chloride (r=0.91).

Iodine/creatinine had a correlation of 0.49 which was amongst the highest correlations for iodine. Other high iodine correlations were with calcium (r=0.53), selenium (r=0.52) and cobalt (r=0.50). Albumin had low correlation with most analytes, the best of which were albumin/protein (r=0.53) and albumin/copper (r=0.52) and even albumin/aluminium (r=0.36) was better than the albumin/creatinine correlation (r=0.28). The only poorer correlations with creatinine were for nickel, arsenic, bismuth, vanadium and manganese (all r<0.14).

**Conclusion**

The assumption that creatinine correction is appropriate for all analytes needs to be considered against the different mechanisms of renal handling. The higher GFR in pregnancy may potentially alter renal handling for some analytes. Where correlations are poor, there is a distinct possibility that analyte ratios may add noise rather than reduce variability.

**P70 TOURNIQUET APPLICATION TIME DURING PHLEBOTOMY AFFECTS BIOCHEMICAL TESTING**

**Poster Abstracts**

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**Introduction**

Venous blood sampling is usually performed using a tourniquet to help locate and define peripheral veins to achieve successful and safe venepuncture. In developing countries like India, there is lack of understanding about good laboratory practices and inadequate training to phlebotomists, compelling them to make errors during phlebotomy. The improper venous accesses or prolonged venous stasis created by tourniquet application will result in collection of unsuitable blood sample.

**Methods**

The present study was conducted at one of the tertiary care hospital at State Capital to find out the effect of tourniquet application time on 17 common biochemical analytes in 20 fasting healthy adult volunteers. Sequential venepunctures were performed by a single expert phlebotomist either without venous stasis or following the application of standardized external pressure of 60 mm Hg using a sphygmomanometer for 1, 3 and 6 minutes. Biochemical parameters were analysed on Fully Automated Analyzer Olympus AU 400 by using standard protocol of commercially available kits.

**Results**

ALT concentration was significantly high in samples collected after application of external pressure for 3 min (P<0.05) and 6 min (P<0.01). Alkaline phosphatase, LDH, creatine kinase, total cholesterol, triglyceride, total protein, albumin and calcium concentrations were significantly high in samples collected after application of external pressure for 6 min (P<0.05) as compared to samples collected without venous stasis. There were no significant alterations in concentrations of the other biochemical analytes (glucose, urea, creatinine, AST, uric acid, phosphorus, sodium, and potassium), even after 6 min venous stasis.

**Conclusion**

Venous stasis from tourniquet placement during venepuncture should be minimised, as it accounts for spurious and significant variations for some biochemical analytes.

**P71 CREATININE AND EGFR – STRANGE RELATIONS**

**Poster Abstracts**

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**Introduction**

The eGFR calculation is widely used to diagnose and monitor kidney disease and was introduced because of the limitations of plasma creatinine alone. As creatinine is effectively the only measured parameter in the eGFR equation, errors in the plasma creatinine will produce errors in the eGFR. We assessed the impact of the error in serum creatinine on eGFR estimates. The Acute Kidney Injury Network (AKIN) criteria for the diagnosis of acute kidney injury is based on the Risk Injury Failure Loss End-stage renal disease (RIFLE) study and requires an increase in creatinine of 3 mg/L (approx 26 μmol/L) in 48 hours for the diagnosis of acute kidney injury (AKI). We will consider the effect of uncertainty of measurement (UM) of serum creatinine in the diagnosis of AKI.

**Methods**

We calculate the uncertainty of measurement and the reference change values (RCV) of serum creatinine and eGFR at different serum creatinine levels.

**Results**

From Cycle 88 of the RCPA QAP the median and worst performing laboratory creatinine results had CVs of 3 and 4.7%. This corresponds to an eGFR UM of 7 and 10.8% and an RCV of 14.5 and 17.6%.

**Conclusion**

eGFR estimates are not without error and the UM should be determined for different laboratories. This error varies at different eGFR levels. It is suggested that eGFR be measured twice before any intervention is undertaken. It is not possible for laboratories to detect consistently AKI using delta check methods.
P72 IN VITRO STABILITY OF HIGH SENSITIVE CARDIAC TROPONIN
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Introduction
Cardiac troponins (cTn) are structural components of the contractile apparatus of cardiomyocyte and the recommended biochemical markers for diagnosing acute myocardial infarction (AMI). Cardiac troponin molecules appear in the circulation after cardiac ischemia and myocardial infarction in different forms; free cTnT, binary cTnI-TnC (IC) complex in the early phase and ternary cTnT-TnI-TnC (TIC) complex later. We investigated the stability of these molecules in vitro taking into account the expected release profile.

Methods
Serum separator tube (SST) and K2EDTA samples were collected at two different time intervals from six patients who were diagnosed with myocardial infarction; three within 24 hours after chest pain and another three after 48 hours following chest pain. Samples were stored under different storage conditions for varying time periods up to one week. Roche high sensitivity cTnT (hs-cTnT) assay was used to analyse the samples on Elecsys 2010 platform.

Results
hs-cTnT levels were lower in K2EDTA samples than in SST samples with up to 10% negative bias. K2EDTA samples also showed deterioration and significant drop in hs-cTnT concentration with time. Measured concentrations of hs-cTnT showed good stability on SST tubes up to 168 hours at 4°C and for both SST groups (within 24 hours versus after 48 hours following chest pain) the fluctuation in hs-cTnT was within assay imprecision.

Conclusion
We demonstrate that there were no analytically significant differences between hs-cTnT in SST samples collected from patients within 24 hours or after 48 hours following chest pain onset at varying storage conditions up to one week. SST samples are more stable than K2EDTA samples after 24 hours storage at room temperature or 4°C.

P73 SERUM URIC ACID LEVELS AND ITS ASSOCIATION WITH CORONARY ARTERY DISEASE: AN INDIAN COHORT STUDY
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Introduction
The role of high uric acid levels as a risk factor for coronary artery disease (CAD) is highly debated. There are very few studies assessing the role of uric acid levels with increasing severity of CAD. The aim of our study was to study the association between high uric acid levels with CAD in an Indian population.

Methods
100 patients with angiographically proven CAD were studied of which there were 50 patients with stable angina (Group I), and 50 patients with Acute Coronary Syndrome (Group II), (comprising 35 patients with unstable angina and 15 MI patients) from a tertiary health center in New Delhi. A third group comprising 50 age and sex matched healthy controls were also studied over a period of 1 year. Angiographic clinical vessel scoring was done for all patients.

Results
The mean age of the patients was 49 ± 8.8 years (84% men, 16% women). The mean uric acid values for stable angina (Group I, 441 ± 86 μmol/L) and acute coronary syndrome (Group II, 444 ± 89 μmol/L) were significantly higher in CAD patients than controls (283 ± 47 μmol/L, p<0.01). High serum uric acid values were associated with higher vessel scores indicating a more severe CAD (r=0.580, p<0.001).

Conclusion
Significant correlations were found between serum uric acid levels and the established risk factors for CAD and the angiographic clinical vessel score. Asymptomatic hyperuricemia is associated with both the presence and the severity of angiographically proven CAD.

P74 PLASMA HOMOCYSTEINE AND THE RISK OF VENOUS THROMBOEMBOLISM: INSIGHTS FROM THE FIELD STUDY
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Introduction
The lipid-lowering effect of fenofibrate is accompanied by a rise in plasma homocysteine (Hcy), a potential risk factor for venous thromboembolism (VTE). This study investigated the relationship between Hcy and the risk of VTE in patients treated with fenofibrate.

Methods
The relationship between Hcy and deep-vein thrombosis or pulmonary embolism was investigated in 9522 participants of the 5-year Fenofibrate Intervention and Event Lowering in Diabetes (FIELD) trial. All subjects received fenofibrate during a 6-week active run-in phase before randomization. A Cox proportional-hazards model was used to assess the effect of Hcy on risk of VTE events.

Results
During active-drug run-in, Hcy rose on average by 6.5 μmol/L, accompanied by a substantial rise in plasma creatinine (+12%). Fenofibrate-induced changes in Hcy and creatinine were fully reversible in the placebo group but persisted in the treatment group until reverting at the end of therapy. During follow-up, 1.8% had at least one episode of deep-vein thrombosis or pulmonary embolism: 103 on fenofibrate and 68 on placebo (log-rank P=0.006). In multivariate analysis, every 5 μmol/L higher baseline Hcy was associated with 19% higher risk of VTE. Fenofibrate treatment was associated with 52% higher risk, but the change in Hcy with fenofibrate was not significantly associated with VTE after adjustment for baseline Hcy.

Conclusion
Hyperhomocysteinemia is prospectively associated with VTE. Fenofibrate may predispose individuals with high pretreatment Hcy towards VTE. The fenofibrate-induced increase in Hcy did not, however, explain the risk associated with fenofibrate therapy.

P75 POSSIBLE MACRO-TROPONIN I (TROPONIN I-IGG COMPLEX) INTERFERENCE IN A PATIENT WITH SEVERE AORTIC STENOSIS
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Introduction
A series of laboratory investigations were initiated into possibility of antibody related positive interference in plasma troponin I results (Abbott stat TnI, Abbott Architect Ci8200) from a 90-year-old female with severe aortic stenosis, atrial fibrillation but normal coronary arteries from angiography. She had multiple admissions for chest pain over a three year period - each presentation was associated with a sharp rise and fall in TnI levels but TnI never went below 290 ng/L (ref limit <40 ng/L) even in her recovery bloods.

Methods
Patient’s admission plasma together with two controls (at similar TnI level) were subjected to: a. Heterophile Blocking Tube (HBT) incubation (Scantibodies Laboratory) before retest, b. 25% Polyethylene glycol (PEG) , then 3000g 10 mins centrifugation before retest, c. Protein G affinity column
**Poster Abstracts**

(GE Healthcare MAbTrap® cartridge kit) pre-treatment, and unbound TnI/Albumin to Eluate TnI/IgG ratio calculated.

### Results

**Patient sample (neat):** TnI: 560 ng/L (<40); TnT: 12 ng/L (<14)

(Roche Modular E170)

<table>
<thead>
<tr>
<th>Patient Control 1 Control 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>560</td>
</tr>
</tbody>
</table>

Pretreatment TnI (ng/L)

| Post HBT incubation(ng/L) | 581 | 628 | 565 |
|---------------------------|
| Post PEG: TnI recovery | 4% | 51% | 42% |

Protein G column: Ratio

<table>
<thead>
<tr>
<th>Unbound Troponin I/Albumin to Eluate Troponin I/IgG</th>
</tr>
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<tbody>
<tr>
<td>0:61</td>
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</table>

**Conclusion**

The presence of macro-troponin I (with an IgG component) was likely to have contributed to positive interference on the Abbott Architect ci8200 stat TnI assay in our patient with severe aortic stenosis.

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**P76** **ANALYTICAL EVALUATION OF A NEW 5-FU METHOD ON ADVIA 1200 ANALYSER - A STEP TOWARDS PROVISION OF REAL-TIME PHARMACOKINETICALLY GUIDED DOSE ADJUSTMENT**

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**Introduction**

5-Fluorouracil (5-FU) is a commonly used chemotherapeutic agent used at Peter MacCallum Cancer Centre (Peter Mac). Dose administration based on Body Surface Area (BSA) has been known to result in severe toxicity or even death, whilst inadequate doses will be sub-therapeutic. We adapted and evaluated a newly available 5-Fluorouracil assay (My5-FU™) as the first stage in providing dose management information to the treating clinicians.

**Methods**

The Salada Biomedical 5-FU assay is a homogenous, two reagent nanoparticle assay. Parameters supplied by the manufacturer were modified to suit the Advia 1200. A series of samples provided by Salada Biomedical was then analysed. 5-FU values for these samples had previously been obtained by Salada using LC-MSMS and an Olympus AU400 analyser. Precision studies were determined using 3 levels of pooled samples created from Peter Mac patients receiving 5-FU chemotherapy.

**Results**

Within-run imprecision was 1.9%, 0.6% and 1.2% at concentrations 365 ng/mL, 758 ng/mL and 1470 ng/mL. Between run imprecision was 1.4% at 768 ng/mL. Limit of quantitation (CV≤ 10%) was 84 ng/mL and limit of detection was 15 ng/mL. Passing-Bablok correlation against LC-MSMS and AU400 methods gave slopes of 1.004 and 1.005 respectively, with intercepts of 36ng/mL and 35ng/mL and correlation coefficients (R) of 0.995 and 0.997. Recoveries for dilutions in human serum were 99–103%.

**Conclusion**

Salada 5-FU assay has excellent performance characteristics on the Siemens Advia 1200 analyser and is suitable for the provision of real-time 5-FU results to be used for dose adjustment on Peter Mac patients and samples referred from surrounding hospitals.

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**P77** **A HETEROHILE ANTIBODY TO VANCOMYCIN – ACROSS THREE ASSAYS**

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**Introduction**

Heterophile antibodies are a significant cause of inaccurate results and/or the inability to report patient results. Using heterophile blocking tubes and alternative methodologies are two approaches to determining the presence of heterophile antibodies and to potentially report accurate results. Laboratories should develop rational protocols in their approach to this problem and may need to use multiple approaches to determine the presence of interfering antibodies.

**Materials and Method**

The serum of a patient with suspected heterophile antibody interference to the Abbott Multigent Vancomycin assay was analysed by three methods and platforms. Abbott ARCHITECT c16000 Multigent Vancomycin assay (PETINIA), Abbott ARCHITECT i2000 Vancomycin assay (CLIA) and the Beckman Coulter Vancomycin assay (PETINIA). It was then rerun using the two Abbott ARCHITECT systems after pre-treatment with heterophile blocking tubes (Scantibodies Heterophile Blocking Tubes).

**Results**

With the C16000 vancomycin assay, the concentration could not be quantified due to the presence of the heterophile antibody. The presence of the heterophile antibody was overcome with the use of blocking tubes. Variable concentrations were obtained using the i2000 vancomycin CLIA assay. This variability was not overcome with the use of blocking tubes. No interference was seen with the use of the Beckman Coulter assay.

**Conclusion**

Interference is variable across methods even when the same animal is used for the production of antibodies. The efficacy of blocking tubes is also variable across methodologies. Laboratories should develop protocols using multiple approaches to determine the presence of heterophile antibody interference when it is suspected.

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**P78** **THE REACTIVITY OF THE ABBOTT I2000 INSULIN ASSAY WITH THE INSULIN ANALOGUES LEVEMIR AND GLARGINE**

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**Introduction**

Previously published papers have investigated the cross-reactivity of various insulin analogues across a number of methods. However the cross-reactivity of the long acting insulin analogue Levemir with the Abbott ARCHITECT insulin method has not been determined. To verify our protocol we also measured the recovery of the analogue Glargine and the human sequence preparation Actrapid, which have been studied in previous studies.

**Materials and Method**

A pooled patient serum with a low insulin concentration (6 mU/L) was spiked with the two insulin analogues, Levemir (Novo Nordisk) and Glargine (Novo Nordisk), as well as Actrapid (Novo Nordisk). Insulin was measured using the Abbott ARCHITECT i2000 method (Abbott Diagnostics, Sydney, Australia). To spike the patient serum a serial dilution was performed (40x, 40x, 25x, 25x) to achieve a concentration of 100 mU/L. Further dilution was performed to achieve concentrations of 20 mU/L and 33 mU/L.

**Results**

At expected concentrations of 20 mU/L, 33 mU/L and 100 mU/L Actrapid showed recovery of 80%, 90% and 85%, respectively. At the same concentrations Glargine showed recovery of 120%, 110% and 110% and Levemir showed recovery of 100%, 125% and 135%.

**Conclusion**

The Abbott ARCHITECT assay demonstrates cross-reactivity to the insulin analogues Glargine and Levemir, although physicians should be made aware of the possibility of over estimation of the true serum concentration.

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**P79** **A QUALITY INITIATIVE FOR ‘BOUTIQUE’ ASSAYS**

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**Introduction**

Australia is fortunate to have a comprehensive and well run external quality assurance program. However occasionally there are assays that do not have the usage to justify a program. Two assays in our laboratories fell within this...
Methods
Twenty patient samples of varying concentrations of CTx and P1NP were pooled to create three by four duplicate samples of concentrations across the measurement range. Four duplicates were sent to each participating laboratory on dry ice. These samples were stored in -20 °C prior to analysis. Analysis of two samples took place on the 15th of each month for a three month cycle. The results were then collated and distributed to each lab. Analysis was performed on the Roche Cobas e411 using Roche Crosslaps Reagent and calibrators and Roche P1NP Reagent and calibrators.

Results
The three laboratories were within 5% CV for both assays except on two occasions where one series of CTx results exceeded this CV.

Conclusion
With only three labs statistical analysis is somewhat limited and, with all three laboratories using the same instrumentation and reagent, agreement would be expected to be good. For the assays concerned there were no convenient alternatives. The purpose of a program like this is to provide the participant with an indication of within method bias. This allows for the participant to assess their own laboratory’s performance over time and provide compliance with the NATA requirement for the participation in a regular external quality control program.

P80 A COMPARISON OF THE NEW ARK METHOTREXATE ASSAY RUN ON THE ABBOTT C16000 WITH THE ABBOTT TDX ASSAY
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Introduction
Measurement of methotrexate is important and the most common platform for analysis, the Abbott TDx is ageing. Laboratories are looking for a robust assay that is able to be placed on their high throughput platforms. ARK Diagnostics have produced a candidate method.

Methods
A comparison of the ARK Diagnostics methotrexate method on the Abbott ARCHITECT c16000 with the current ABBOTT TDX method using 40 patient samples was undertaken. Agreement with our current method, functional sensitivity and linearity were determined.

Results
Agreement was acceptable within the desired range although a slight positive bias was seen. The method achieved a CV <20% at a level of 0.01 µmol/L and acceptable linearity across the measuring range.

Conclusion
The ARK Diagnostics methotrexate assay is an acceptable replacement for our current TDX method.

P81 DEMONSTRATION OF COMPETITIVE AND NON-COMPETITIVE BINDING OF AN ENZYME: A MODEL FOR DIGOXIN
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Introduction
Cardiotoxic steroids bind to the plasma membrane component of Na+-K+ ATPase (NKA), inhibiting the exchange of Na+ and K+ ions in a competitive manner. The reaction is complex; phosphorylation of the enzyme is essential for Na+ -K+ exchange. The site of steroid binding shows competitive binding but the ion exchange is itself non-competitive. Understanding these complex interactions and rates of inhibition may give new insights into methods of testing interventions for enzyme inhibition. Therefore our aim is to characterise the competitive and non-competitive binding of NKA to further understand digoxin therapy and its toxicity.

Methods
Purified porcine NKA was purchased from Sigma (A7510-5U). The porcine material is a close match to human heart NKA alpha subunits. In our experimental model, enzyme was incubated at 37°C with and without digoxin. Activity was measured by the release of free inorganic phosphate (Pi) from ATP. Pi was quantified colorimetrically at 650nm following reaction with ammonium molybdate and malachite in an acid pH.

Results
Optimal NKA activity was dependent upon several factors including ATP concentration. As the native enzyme complex is usually in plasma membrane, albumin was used as a surrogate to enable NKA confirmation in solution and optimise its activity. Double reciprocal plots of enzyme activity and ATP (1.57-12.6 mM) were constructed using the Lineweaver-Burk method. Enzyme activity decreased significantly with substrate incubation time, due to the non-competitive binding of Pi. This makes it challenging to measure the competitive inhibition of NKA in the in vitro system. We estimate digoxin to have an IC50 (50% inhibitory concentration) of approximately 0.058 mmol/L/unit activity of NKA.

Conclusion
Our in vitro model has been characterised to enable its utilisation in comparative studies of other cardio active steroids such as oleandrin.

P82 IS THIS A JOB FOR HIGHLY TRAINED SCIENTISTS?
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Introduction
Notification of ‘critical’ analytical patient results to the requesting clinician is deemed the responsibility of the laboratory. Traditionally contact by phone has been used. With increasing demands on skilled staff and workforce shortages, it is timely to review this task and consider alternative communication strategies in a tertiary teaching hospital.

Methods
The laboratory information system was interrogated to identify all logged calls to clinical areas within the hospital. Data included clinical area, tests, date and time. Data for out of hospital calls to medical practices were not included (~350 per month).

Results
In the two months in 2011 (June and November) approximately 7% of all episodes of requested pathology tests resulted in phone contact with clinical areas (~2000 per month) with a further 1000 calls related to Blood Banking. Considering non – Blood Banking calls, Emergency Department (ED), Intensive Care and Oncology orders accounted for >40%; >10% of episodes required multiple phone calls, either because of complex results from different disciplines or non-availability of clinical staff. The heaviest individual discipline load was sustained by Clinical Chemistry, approximately twice that of Haematology. Generally less than half to one third the numbers of calls were between 2000 h and 0800 h.

Conclusion
This laboratory serves a 600 bed tertiary teaching hospital providing most major clinical services including trauma. Using a very conservative translation of two minutes per phone call, the contacts identified above equate to >2 FTE staff (>3 FTE including Blood Banking). These data provide baseline information against which to plan. Whatever options are considered (e.g. Airport Screens in ED, SMS notifications to smart phones) the process must take into account safety and quality as well as cost and efficiency.

P83 ASSOCIATION OF HLA-B27, IL-23R AND ERAP1 SINGLE NUCLEOTIDE POLYMORPHISMS IN PATIENTS WITH ANKYLOSING SPONDYLITIS
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Background
HLA-B27 is recognised to be the major gene associated with ankylosing
spondylitis (AS). A role for genes outside the HLA regions, such as IL23R and ERAP1, has also been recognised. We investigated the relationship between HLA-B27, IL23R and ERAP1 polymorphism in Chinese AS patients.

Methods
A total of 248 patients attending orthopaedics, rheumatology, and physiotherapy clinic of Union Hospital and Tongji Medical College were selected. Among these 248, 84 (74 male/ 10 female) patients that satisfied the modified New York criteria of AS.360 ethnically related healthy controls and that did not have any previous autoimmune diseases were also included for our study. The mean age of the AS group (n=84) was 35±8.79 years. The mean BASDAI Score and BASFI was 3.7 Years (SD 2.0) and 2.3 (SD 2.2) respectively. The mean (SD) BASDAI, BASFI, and ESR and CRP for as patients were 5.4(1.7), 4.7(2.5), 56.97 (11.45) mm/h and 38.33 mg/L (27.03) respectively.

Results
The 6 types of HLA-B27 found were (B*2702, 03,04,05,06 and B* 2713). Four alleles were detected both in AS patients and in controls (B*2702, 03, 04 and B*2705).B*2704 and B*2705 were predominant alleles in the AS group and controls. In total, five SNPs within the IL23R were genotyped.

Conclusion
Our results confirm that the IL23R polymorphism is not associated with AS, while the ERAP1 polymorphism is associated with AS in Chinese patients.

P85 AUTOMATED CHROMOGRANIN A : IS KRYPTOR THE WAY TO GO?
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Introduction
Recent major advances using targeted radio-peptide therapy in treatment of metastatic neuroendocrine tumours mandate an automated chromogranin A (CgA) assay that yields accurate results beyond the assay’s working range. We evaluated a fully automated immunofluorescent assay (IFA) for determination of CgA (Thermo Fisher Scientific B.R.A.H.M.S. Kryptor).

Method
All samples were stored at -80 °C and run in duplicate on the in use Chromogranin A Dako ELISA assay (ELISA) and in singleton on the IFA. Patient’s serum samples were concurrently assayed by both methods over four months; manual dilutions in 4-fold series (1, 1/4, 1/16, 1/64) were performed on eleven selected samples with elevated results. Between run imprecision was assessed on two patients’ stored serum aliquots. Within run imprecision was performed using twenty patient samples, each assayed in duplicate.

Results
Passing and Bablok regression for samples not requiring dilution by the ELISA (CgA <403 U/L) showed IFA(ug/L)=3.60.ELISA(U/L)-13; r=0.84, (n=160). The difference between the least and next least diluted samples yielded a mean percent difference of 1.9% (range -11% - +13%), range 276-30466 μg/L. Between run imprecision (coefficient of variation) was 5.6% at 44 μg/L (n=12) and 7.7% at 257 μg/L (n=24). Mean within-run imprecision was 1.9%, range 0–4.5% on samples with CgA 30–7289 μg/L.

Conclusion
The automated IFA platform provides reproducible results and is significantly less labour intensive than the ELISA. The broad measuring range provides clinically useful results for patients with elevated levels. Diluted samples showed acceptable linearity in all cases. We can now provide a reliable monitoring indicator for response to targeted radio-peptide therapy of neuroendocrine tumours.
P87 UNDERGRADUATE CLINICAL BIOCHEMISTRY: CONTEXTUALISING SCIENTIFIC COMPETENCIES FOR THE MODERN LABORATORY

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Introduction
In Australia specialised undergraduate teaching of Medical Scientists occurs within AIMS accredited courses that emphasise scientific techniques and skills required in the modern clinical laboratory. Contextualising the requisite skills is difficult in a tertiary education institution, particularly those involving modern instrumentation and QA principles for implementation of methods in the laboratory. To this end the third year unit Clinical Chemistry 2 was redesigned to include a method evaluation project using a Kone 20XT analyser.

Methods
Over an 8 week period, students conducted a method evaluation project on the Kone 20XT analyser for an assay from a defined list of analytes studied in the curriculum. Students were provided with ThermoFisher or in-house reagents and documentation, Roche CFAS calibrator, BioRad Lyphocheck® QC and a cycle of RCPA QAP General Serum Chemistry samples. Comparison with an Abbott Architect c8000, definition of reference intervals and interference testing were conducted according to CLSI guidelines. Data analysis was completed using Analyse-it® for Excel. Students prepared method documentation according to ISO15189 requirements and a poster describing the process and results. Comparison of grades to previous student cohorts and student evaluation questionnaires (SEQ) were used assess the project.

Results
Method evaluations were completed for all 14 analytes studied. After three weeks of initial implementation and familiarisation, students were able to plan and conduct experiments according to guidelines and were able to analyse the data correctly to obtain operational characteristics for their assays. Student grades compared favourably to previous cohorts and SEQs scored highly for learning outcomes and understanding of the procedures.

Conclusion
The method evaluation project successfully contextualised the undergraduate teaching of important scientific skills relevant to the modern clinical biochemistry laboratory.

P88 DIETARY INTERFERENCE OF THE CLINREP® URINARY METANEPHRINE KITSET BY A COMPONENT IN INDIAN FOOD

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Introduction
Urinary metanephrines are useful for detection of neuroendocrine tumours. When using a ClinRep® complete kitset from Recipe it was noticed that the internal standard was higher than expected in certain chromatograms. Patients with a particular ethnic group were more often affected. This also occurred in the BioRad control material. We hypothesised that the interference originates from the consumption of certain Indian foods.

Methods
The chromatographic system was Dionex Ultimate 3000 system with ESA Coulochem III detection. The sample preparation was performed as directed and mobile phase was used as supplied. Detection was oxidative at +450mV with upstream reductive guard cell protection at -650mV. The guard cell was essential to maximise detection. The origin of the interference was tested by dietary challenge on healthy volunteers.

Results
The interference was chromatographically and electrochemically indistinguishable from the internal standard. The two compounds co-eluted at all mobile phase pH between 3.5 and 7.5 and their voltammograms were super-imposable. The interfering compound was conjugated and released by hydrolysis. It is not produced in-situ by the action of the Coulochrome electrodes and it persists in reductive mode. A number of volunteers known to be eating Indian foods showed the interference. Dietary exclusion and subsequent dietary challenge by the volunteers showed the disappearance and reappearance of this compound.

Conclusion
The component co-elutes exactly with internal standard and artifactually decreases the metanephrine and normetanephrine results. It is surprising that it has not been described previously.

P89 INDIRECT ISE SODIUM – CAN WE CORRECT FOR THE EFFECT OF PROTEIN?

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Background
Sodium measurements by indirect ion-sensitive electrodes (ISE) are known to be affected by total protein (TP). High TP causes pseudohyponatraemia and low TP causes pseudohypernatraemia. The use of direct ISEs avoids this effect. We aimed to see whether the sodium results by indirect ISE could be corrected for the TP effect without addition of unacceptable uncertainty to the measurements.

Methods
Two forms of assessment were made. In the laboratory samples with a range of TP values were analysed for sodium on both direct and indirect ISE. Results were also extracted from the pathology database where blood gas measurements of sodium on a direct ISE from two locations were taken within one hour of a venous sample with indirect ISE measurement of sodium and a TP measurement.

Results
Based on laboratory experiments the slope of the TP effect was: NA(indirect) - NA(direct) = -0.105 x TP +7.36. The database extractions gave very similar equations. A simplified equation was applied to the extracted data and the average difference between corrected indirect ISE and measured direct ISE was 0.1 mmol/L (SD 1.4) from one location and 0.8 mmol/L (SD 1.7) from another. Most importantly the SD of the differences were close to those predicted from combined analytical imprecision of the two measurements.

Conclusion
Consistent results were seen in different settings and multiple direct ISE analysers. A correction algorithm for indirect ISE sodium measurements can remove the effect of changes in TP without affecting the uncertainty of the measurements. The cost benefit of routine use of this approach will require assessment of the frequency of significant abnormalities of total protein and the clinical risk associated with these changes.

P90 MESOTHELIOMA TUMOURS MODULATE DENDRITIC CELL LIPID CONTENT, PHENOTYPE AND FUNCTION

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Introduction
Dendritic cells (DCs) are antigen-presenting cells that play an important role in anti-cancer immune responses by activating tumour-specific cytotoxic T cells, which mediate tumour destruction. However, there is evidence that DCs in cancer patients are dysfunctional, impairing elimination of tumours by T cells. Recently, lipid acquisition driven by tumour-derived factors has been shown to cause DC dysfunction in several human cancers and animal cancer models, but this has not yet been studied in mesothelioma. This study aimed to investigate if mesothelioma cells and/or their secreted factors promote increases in DC lipid content and modulate DC function.
Methods and Results

Human monocyte-derived DCs (MoDCs) from healthy donors were exposed to tumour cells and tumour-derived factors from a human mesothelioma cell line (JU77). Exposure of immature MoDCs to mesothelioma cells resulted in an increase in their lipid content and was associated with reduced MoDC antigen processing ability, measured using a DQ-ovalbumin assay. Immature MoDCs exposed to tumour cells also demonstrated reduced CD1a expression, upregulation of the maturation marker CD86 and production of the anti-inflammatory cytokine, IL-10 (assessed by flow cytometry). In vivo studies using a murine mesothelioma model (AE17) examined DC lipid content during tumour progression. The results showed that tumour-infiltrating DCs contained higher lipid levels with tumour progression, which may contribute to DC dysfunction.

Conclusion

This study shows that mesothelioma promotes DC lipid acquisition and alters DC antigen processing function, thereby impairing the ability of DCs to generate effective anti-mesothelioma immunity. This study also identifies a potential therapeutic target for mesothelioma: the use of lipid-lowering agents to reduce DC lipid content and restore DC function.

P92 TESTING FOR HELICOBACTER INFECTION IN CHILDREN USING SEROLOGY AND THE UREA BREATH TEST

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Introduction

A six year old boy had a positive urea breath test (UBT) and negative Helicobacter serology. This stimulated review of the frequency of Helicobacter testing in children and the relation between serology and breath test results in general.

Methods

16,217 Carbon-14 UBTs and 9,904 Helicobacter serology results from Jan 2009 to Dec 2010 were reviewed. Both tests were requested in 393 episodes.

Results

Three percent (496) of the UBTs and 6% (613) of the Helicobacter serology results were from people under 18 years old. The youngest child having a breath test was 4 years old and the youngest positive was 6 years old. The youngest child with a positive Helicobacter serology was aged 18 months. 24% of all UBTs were positive with little change with age and no difference between men and women. The proportion with positive Helicobacter serology was similar in men and women and rose from approximately 20% in 20 year olds to 40% in people over 70 years. In most people having the two tests the results were both negative (233=60%) or both positive (76=19%). Discordant results included 41 (10%) with positive serology and negative UBT (indicating past infection or false negative breath test) and 9 (2%) with positive UBT and negative serology (early infection).

Conclusion

Symptomatic Helicobacter infection may be seen in children under 10 years of age. Even though Carbon-14 UBTs are not usually recommended in this group, infection was detected in 17% of cases. Serological testing involves no radiation exposure and usually gives the same result as the UBT unless the infection is very early or has already been treated.

P93 RESISTANCE OF METHICILLIN STAPHYLOCOCCUS AUREUS (MRSA) STRAINS PREVALENCE RATE IN MEDICAL STAFFS AND RAPID IDENTIFICATION

METHODS OF MRSA

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Introduction

Healthcare associated infections (HAIs) have become an important global health issue. Methicillin-resistant Staphylococcus aureus (MRSA) caused the main source of infection in patients during hospitalisation, especially in those with poor immunity to disease such as the intensive care unit, with infection rates of over 60%. If MRSA can be rapidly identified in laboratory, this will improve workflow and reduce laboratory costs.

Methods

A total of 95 nasopharyngeal swab samples from acute medical ward clinical staff (including physicians, medical assistants, nurses, ward workers) and their caregivers were cultured in BBL CHROMagar MRSA and BBL 5% Sheep Blood Agar (SBA) medium (BD), CO2, and incubated at 35–37 °C in a dark environment for 24 ± 4 hours. The traditional identification methods were coupled with oxacillin and ceftoxitin disc diffusion methods and the BD Phoenix PID Panel to confirm. Final confirmation was by detection of the mecA gene.

Results

Of the 95 clinical staff, 18 were MRSA-positive (18.9%). One-third (4/12) of physicians, 20% (2/10) of medical assistance staff, 17% (8/47) of nurses, and 11% (4/37) of ward workers were MRSA-positive. Within 24 hours, the accuracy of CHROMagar MRSA w as 98.9% (94/95). Detection of MRSA using SBA took 48 hours, with 96.8% accuracy (92 /95).

Conclusion

The fast and accurate identification of MRSA is of great importance to the clinical physician, as a rapid diagnosis can enable the proper use of antibiotics to control the infection and improve overall hospital efficiency.

P94 THE DIAGNOSTIC, PROGNOSTIC, AND CLINICAL UTILITY OF SERUM S100B FOLLOWING TRAUMATIC BRAIN INJURY

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Introduction

Diagnostic classifications of traumatic brain injury (TBI) are made based on the patient’s depth of coma, and the duration of their post-traumatic amnesia. However, these diagnostic classification systems offer poor prognostic accuracy for neuropsychological outcomes such as cognitive impairment and post-concussion syndrome symptomatology. The associated literature has begun to investigate the role of specific serum biomarkers following injury to assist prognostic accuracy. Unfortunately, the majority of these studies have utilised either limited outcome measures, or merely survivorship as the dependent variable in research design.

Methods

Serum samples from 93 TBI patients were collected and stored, and batch analyses of liaison S100B assays were conducted. Patients underwent neuropsychological evaluations during the first three months post-injury. The presence and severity of post-concussion symptomatology was evaluated at six months post-injury.

Results

Moderate correlations (r=0.6) were found between acute serum S100B levels and existing diagnostic classification measures – however, bayesian analyses indicated that it cannot be used in isolation as an indicator of severity. Post-hoc ANOVAs confirmed an inverse prognostic trajectory for S100B with ipsative cognitive impairment and PCS symptomatology. Linear regression analyses indicated that S100B accounts for a unique proportion of variance in neuropsychological outcome beyond that of the existing diagnostic measures of injury.

Conclusion

Diagnostically, S100B correlates with severity of injury – but not sufficiently to be used in isolation. Prognostically, S100B accounts for unique variance in neuropsychological outcome, however, the contribution that is made is not large enough to result in acceptable prognostic confidence. Clinically, the function of acute serum S100B in providing post-trauma neuropsychological prognosis is one that should be utilised cautiously, and in concert with a comprehensive evaluation.
DECIDING THE ORDER OF UNLABELLED GLUCOSE TOLERANCE TEST TUBES

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Introduction
Laboratories sometimes receive unlabelled glucose tolerance test (GTT) tubes and cannot produce a meaningful report or easily repeat the test. The aim of this study was to describe the most likely order of results in an unlabelled GTT through the analysis of previous tests.

Methods
20,402 GTTs from non-pregnant adults from one year were analysed to define the most common patterns of results as well as the most likely position of a specimen with a given glucose concentration.

Results
19,760 (97%) of GTTs were ‘scalene’ with three different results and 642 (3%) were ‘isosceles’. For the ‘scalene’ GTTs the minimum result was most likely the fasting specimen (75%) and rarely at 60 minutes (2%). The maximum was most commonly at 60 minutes (87%) and least often at zero minutes (3%). The most common GTT pattern was low/high/medium (65%) followed by medium/high/low (21%) and low/medium/high (10%). Results in the range 5–7 mmol/L were most commonly fasting whilst those below 4 mmol/L were predominantly collected at 120 minutes (probability >50%). Glucose results over 9 mmol/L were usually collected at 60 minutes (probability 70%) or less commonly collected at 120 minutes (probability 30%).

Conclusion
Unlabelled GTTs can sometimes be given provisional results based on common GTT patterns, the likelihood that certain glucose results will occur at a particular point in a GTT and previous fasting glucose results for that patient.

HOW MANY BLOOD SPECIMENS ARE REQUIRED FOR A LACTOSE TOLERANCE TEST?

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Introduction
The number of glucose measurements recommended for the oral lactose tolerance test varies from three to seven over 120 minutes.

Methods
1,422 seven-tube, two-hour lactose tolerance tests from a 10 year period were reviewed to determine whether the same diagnosis could be achieved using a shorter test with fewer blood specimens.

Results
39% of women and 35% of men were deemed lactose intolerant on the basis of the complete two-hour test. 69% of people with normal lactose absorption had demonstrated an acceptable rise in glucose concentration by 15 minutes, 91% by 30 minutes and 99% by one hour. Omission of later specimens had little effect on the sensitivity of the test. Shortening the test to only 45 minutes resulted in only a 3% reduction in those deemed normal (884 to 859 people) and 5% increase in those deemed abnormal (538 to 563). The number of people falsely labelled as lactose intolerant was increased by approximately 30% if the 15 minute specimen was omitted and by 10% if either the 45 minute or 30 minute specimens were omitted. The number of people deemed lactose intolerant almost doubled (from 538 to 1051) if blood was only collected at 60 minute intervals as it would be for a glucose tolerance test.

Conclusion
The lactose tolerance test can be safely shortened to 60 minutes as the glucose concentration has peaked before then in most normal people. It is important that blood specimens are collected at 15 and 30 minutes because failure to do so will lead to many healthy people being falsely labelled as lactose intolerant.
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