University of Otago, Christchurch
Summer Studentship Programme
2014/2015
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Introduction

Rau Rangatira ma, tena koutou, tena koutou, tena koutou katoa.
Nau mai haere mai Te Whare Wananga o Otago ki Otautahi. Piki mai kaki mai.

Each year the University of Otago, Christchurch (UOC) hosts a Summer Studentship Programme, allowing participating students to be introduced to the excitement and challenge of research in a field of interest to them.

Over the summer of 2014/2015, we hosted 48 projects in a wide range of areas. After several earthquake disrupted years, the laboratory category of projects was larger than usual, as our research staff re-gathered momentum on our return to our home building and laboratories.

This book is a compilation of the reports submitted by the student participants in the 2014/2015 Summer Studentship Programme. There were many highlights in the programme, with significant findings in all categories – from clinical to basic science, to community health – and we trust you will enjoy reading the reports.

The summer studentship programme is heavily dependent on the financial generosity of external organisations that contribute an educational grant for each student. We offer our thanks to these sponsors, and they are listed in this report book.

This programme is supported by a significant infrastructure within the UOC. In addition to the supervision, the Research Office provides administration of the programme and organises formal presentations at the beginning and end of the study period. The final showcase is a well-attended event that gives each student the opportunity to present their findings and to share their enthusiasm with their peers. Thanks go to Carole Acheson, Professional Practice Fellow – Christchurch, for providing the students with the seminar ‘Presentation Skills and Dealing with the Media’ in preparation for this day. We are also grateful to Jenny Jordan, Gabi Dachs, Andrew Day and Madhav Bhatia who undertook the difficult task of assessing the project applications and judging the students' presentations.

From the final showcase day, three prizes of $500 each for outstanding student presentations were awarded. In addition, a fourth prize of $500 for the ‘Best Overall Project’ was awarded this year. The awards went to:

- Helena Trollope - Best oral presentation in the ‘Laboratory’ category. The project “Reactions of urate hydroperoxide with biological targets” was sponsored by Canterbury Scientific Limited.

- Anshuman Gupta - Best oral presentation in the ‘Clinical’ category. The project “Determining the prevalence of normal and sub aneurysmal aortic diameters in patients undergoing CT colonography” was sponsored by Pacific Radiology Group.
• Erika Stark - Best oral presentation in the ‘Community’ category. The project “Decision aids for cardiovascular risk management in primary care” was sponsored by Pegasus Health (Charitable) Ltd.

• Sam Hall-McMaster - Best Overall Project The project “Are breast tumour cells and adipocytes co-consiprators in aggressive breast tumours?” was supervised by Dr Elizabeth Philips of the McKenzie Cancer Research Group and was sponsored by the New Zealand Breast Cancer Foundation. The prize was sponsored by the Lions Club of Selwyn.

We wish to offer our congratulations to the prize winners and our thanks to all the students whose fine efforts made the selection process such a difficult one. Once again, our particular thanks go to all the sponsors for their support of this programme.

M.C. Vissers

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Associate Dean (Research)		Research and Development Manager

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About the University of Otago, Christchurch

The University of Otago, Christchurch (UOC) is a division of Health Sciences within the University of Otago and is New Zealand’s best performing Medical School for Health Research in New Zealand. Based upon Performance Based Research Funding (PBRF) criteria, UOC staff with international reputations for excellence are involved in the following research areas:

- Cardioendocrine research; clinical and laboratory
- Oxidative stress and antioxidant protection
- Clinical pharmacology
- Cancer biology and genetics
- Neonatal paediatrics
- Longitudinal studies of health and wellbeing
- Psychology, depression, bipolar disorder and attempted suicide
- Infectious diseases
- Orthopaedics and joint regeneration
- Radiology and medical imaging

The University of Otago, Christchurch has 26 Professors across a wide range of Clinical, Biomedical and Public Health disciplines. In addition, there are a further 60 clinical academic staff, over 100 research staff, and over 300 clinical staff employed by the Canterbury District Health Board who contribute to teaching. There is a close collaboration between the Campus, the Canterbury District Health Board, the region’s hospitals, general practitioners and other health and community agencies.

In addition to the 300+ medical students, there are approximately 450 postgraduate health sciences students and over 70 PhD students.

The central Campus building houses most of the research laboratories, the teaching spaces, the library and the administration. Most academic department headquarters; Medicine, Surgery, Anaesthesia, Orthopaedics and MSM, Radiology, Paediatrics, Obstetrics and Gynaecology, Health Care of the Elderly, Psychological Medicine and the Centre for Postgraduate Nursing Studies are located in one of the main Christchurch Hospitals or in buildings in close vicinity.
History of the University of Otago, Christchurch

History of the School

The University of Otago, Christchurch dates back to the 1850’s when the Canterbury Association included the vision of a School of Medicine in plans for the new settlement. The UOC was formally established in 1972 as part of the Faculty of Medicine of the University of Otago, to provide training across all three clinical years of the undergraduate medical course.

Timeline 1850 - 2007

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
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<tr>
<td>1850</td>
<td>Canterbury Association proposes Medical school in Canterbury</td>
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<tr>
<td>1875</td>
<td>Dunedin Medical School opens</td>
</tr>
<tr>
<td>1923</td>
<td>Otago lengthens its undergraduate course from 5 to 6 years</td>
</tr>
<tr>
<td>1924</td>
<td>A trial class of students is sent to Christchurch Hospital</td>
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<tr>
<td>1926</td>
<td>Final year class formally sent to Christchurch</td>
</tr>
<tr>
<td>1927</td>
<td>Classes now sent to Wellington and Auckland</td>
</tr>
<tr>
<td>1937</td>
<td>Joint hospital/university committees appointed to the four centres.</td>
</tr>
<tr>
<td>1966</td>
<td>Auckland Medical School approved</td>
</tr>
<tr>
<td>1970</td>
<td>University agrees to build and equip &quot;Medical Centre&quot; in Christchurch</td>
</tr>
<tr>
<td>1972</td>
<td>Architects provide design report</td>
</tr>
<tr>
<td>1973</td>
<td>University of Otago, Christchurch established</td>
</tr>
<tr>
<td>1972</td>
<td>Construction complete, first 4th year intake arrives</td>
</tr>
<tr>
<td>1973</td>
<td>Official opening</td>
</tr>
<tr>
<td>1988</td>
<td>Number of postgraduate students exceeds medical students</td>
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<tr>
<td>2007</td>
<td>Name changed to University of Otago, Christchurch</td>
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Postgraduate Education Opportunities

University of Otago, Christchurch campus offers:

- PhD supervision
  *in the biomedical sciences and a range of health related areas*
- Honours degree in Biomedical Sciences
- Masters’s Degrees
- Postgraduate Diplomas
- Postgraduate Certificates

*for health professionals including the following specialty areas:*

- Public Health
- Nursing
- Mental Health
- Pain
- Musculoskeletal Management
- Addiction
- Health Management
- Medical Laboratory Science

For further information contact:

**Ruth Helms**
Manager, Academic Programmes
University of Otago, Christchurch
Email [ruth.helms@otago.ac.nz](mailto:ruth.helms@otago.ac.nz)
Sponsors

This programme could not happen without the generous sponsorship from the following individuals and organisations.

- Age Concern Canterbury Trust
- Anaesthetists' Instrument Pool Limited
- Arthritis New Zealand
- Bowel and Liver Trust
- Cancer Society Amberley Group
- Cancer Society Ashburton Group
- Cancer Society Diamond Harbour Group
- Cancer Society Ellesmere Group
- Cancer Society Kaiapoi Group
- Cancer Society of New Zealand Canterbury/West Coast Division
- Cancer Society Oxford Group
- Cancer Society Rangiora Group
- Canterbury Branch of New Zealand Federation of Graduate Women Trust
- Canterbury District Health Board
- Canterbury District Health Board, CEO Corporate
- Canterbury District Health Board, GM Trust Funds (Medical and Surgical Division)
- Canterbury Health Care of the Elderly Education Trust
- Canterbury Medical Research Foundation
- Canterbury Orthopedic Services
- Canterbury Scientific Limited
- Centre for Translational Cancer Research
- Christchurch Gastroenterology Research Trust
- Cure Kids
- Diabetes Research and Training Trust
- Douglas Pharmaceuticals Limited
- Edith Tripp Summer Studentship
- Elaine Jensen and the late Janet Collerton
- Fisher and Paykel Healthcare Limited
- Helen Poole and Ian McDonald Memorial Trust
- Lions Club of Selwyn
- Maurice and Phyllis Paykel Trust
- New Zealand Breast Cancer Foundation
- New Zealand Heart Foundation
- Pacific Leprosy Foundation
- Pacific Radiology Group
- Pegasus Health (Charitable) Limited
- Roland Stead Summer Studentship
- Rural Canterbury PHO
- The Govan Family Trust
- SJ Charitable Trust
- University of Otago, Division of Health Sciences
- University of Otago Christchurch, Pathology Department
- Urology Research Foundation Board
- WH Travis Trust
List of Summer Student Lead Supervisors for 2014/2015

- Dr Aamir Younis Raja, PhD (Otago)
- Dr Andree Pearson, PhD (Auckland)
- Dr Anitra Carr, BSc(Hons)(Cant), PhD(Otago)
- Dr Anna Pilbrow, BSc(Hons) PhD(Otago)
- Professor Brian Darlow, MA MB BChir MD (Cantab) FRCP FRCPC
- Professor Bridget Robinson, BMedSc MD(Otago) FRACP
- Dr Carl Hanger, MB ChB(Dist)(Otago) FRACP
- Charlotte Matthews, BPhty
- Dr David Cole, MB ChB MD(Sheff) MRCP
- Clinical Associate Professor David Jardine, BSc MB ChB(Otago) DCH(Lond) FRACP
- Dr Dean Harris, MBChB(Otago) FRACP
- Professor Douglas Sellman, MB ChB PhD (Otago) FRANZCP FAcHAm
- Dr Elisabeth Phillips, BSc(Hons)(Sheffield), PhD(Birmingham)
- Professor Frank Frizelle, MB ChB MMedSc(Otago) FACS FRACS FANZCA
- Professor Gary Hooper, MB ChB, FRACS, FRNZOA
- Dr Geoffrey Shaw, MBChB (Otago), FANZCA, FCICM
- Dr Geraldine Wilson, MB ChB (Otago), PG Cert Women’s Health, FRNZCGP
- Dr Greg Frazer, MB ChB(Otago) FRACP
- Dr Hamish Jamieson, B Med Sci, MB ChB (Otago), PhD(Sydney), FRACP
- Dr Helen Lunt, MB ChB(Brist) DM(S’ton) FRACP
- Dr Jacqui Keenan, MAppSci (1st Class Hons), PhD
- Dr Jo Gullam, MB ChB (Leic), MD (Warw), DFFP FRANZCOG, MRCOG
- Dr Kenny Chitcholtan, BSc (N Territory), PhD PGDipSc (Cant)
- Leigh Aston, PGCert (Cant)
- Professor Lisa Stamp, MB ChB (Otago) FRACP PhD (Adelaide) DipMus (Auckland)
- Dr Logan Walker, MSc(Hons) (Canterbury), PhD (Otago)
- Lynley Cook
- Dr Manar Khashram, MB ChB
- Dr Margaret Currie, MSc(Hons)(Cant), PhD(Auck)
- Professor Margreet Vissers, BSc(Hons)(Cant), MSc, PhD(Otago)
- Professor Mark Hampton, PhD (Otago), MSc Hons (Canterbury)
- Dr Matt Doogue, BSc, MB ChB (Otago), DipPaed (Auck) FRACP
- Dr Melissa James, BSc, MB BS (NSW) FRANZCR
- Associate Professor Nigel Anderson, MB ChB FRANZCR
- Associate Professor Peter Sykes, MBChB(Bristol) FRANZCOG DGO
- Pip Mason
- Dr Pippa Scott, MSc(Lond), PhD(Switz)
- Professor Richard Gearry, MB ChB(Otago) PhD(Otago) FRACP
- Associate Professor Ross Kennedy, MB, ChB PhD (Otago) FANZCA
- Dr Sally Keeling, BA(Hons) PhD(Otago)
- Dr Sarah Metcalf, MB ChB (Otago), DTM&H (Liv), FRACP
- Associate Professor Simon Adamson, DipClinPsych MSc (Dist) (Cant) PhD (Otago)
- Professor Stephen Chambers, MB ChB, MD(Otago), MSc(Lond), FRACP
- Dr Susan Gee, PhD (Otago)
- Dr Tim Woodfield, BE Mech Hons (Canterbury), MASc (Toronto), PhD (Twente)
- Professor Tony Kettle, FRSNZ (elected 2012, PhD (Biochemistry) Otago University, MSc (Biochemistry) Simon Fraser University, BSc Hons (Chemistry) Otago University
## List of Students and Project Title

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Student: Tom Moore

Project: Prognostication in hepatic resection for colorectal metastases in Christchurch, New Zealand

Student: Amy Thomas

Project: Systematic literature review of the effects of urate lowering on clinical outcomes in gout

Student: Sam Wilkinson

Project: The clinical assessment of acoustic monitoring in revision total hip replacement

Student: Ann Jun

Project: The effect of high flow, humidified air via Airo on oxygen content, humidity and temperature

Student: Alex Barron

Project: Validity of the InterRAI outcomes scales for older adults in specialist mental health services

Community Category

Student: Katelyn Thorn

Project: Breastfeeding in primary care - The experience of mothers who seek breastfeeding support

Student: Erika Stark

Project: Decision aids for cardiovascular risk management in primary care

Student: Sophie Bang

Project: Developing practice managers: Understanding the general practice management workforce

Student: Abigail Boyer

Project: Evaluation of Pegasus Health’s "Stop Smoking Support Options" programme

Student: Sela Sikaleti

Project: Knowledge and attitudes to leprosy among Pacific Peoples

Student: Arthi Veerasamy

Project: Outcomes in cognitive impairment in Canterbury

Student: Juno Pyun

Project: Pilot study - The long term effects of incontinence in older people

Student: Vicki Cho

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Clinical Category

Student: Jonathan Wong
Project: A real time system to warn to carers that a patient, at risk of falling, is leaving the bed
Supervisors: Nigel Millar, Geoff Shaw and Geoffrey Chase
Sponsor: Canterbury District Health Board, CEO

Introduction:
Primum non nocere. “First, do no harm”. It is a principle deeply engrained into the minds of those in the medical profession, yet, unfortunately, some patients admitted to hospital suffer a ‘serious adverse event’ and end up worse off. While some of these events aren’t avoidable, some can be prevented - notably the incidence of patient falls.

Patient fall injuries account for 52% of serious adverse events in hospitals and present a significant problem for all district health boards. It mainly affects older people, causing psychological trauma, physical injury and occasionally death. As well as affecting the patient, it is also a burden on our healthcare system - with longer hospital stays and extra medical attention a result of most falls.

While there are various fall detection systems available on the market, a system which can effectively prevent a fall event before it happens has yet to be developed. With 80% of falls occurring around the hospital bed, developing a solution targeting this hotspot is an appropriate place to start.

Aim:
We developed a real-time system to predict when a patient is leaving the bed, warning support staff of an imminent fall event. This project is part of a larger initiative which is broken down into three stages;

I. Background research and proof of concept
   - In this stage we review the range of fall management systems currently available and evaluate the risk factors involved in a fall. We will then propose and develop working prototypes as a proof of concept.

II. Design cycle
   - In stage II we assess our prototype iterations, testing the performance and refining its capabilities into a fully functional system.

III. Trial and testing
   - In the latter stage we will evaluate our prototype performance in a real world setting and measure its effectiveness in preventing patient fall events.

Method:
For the initial phase we identified the risk factors involved in a fall and reviewed the prevention strategies currently available. Subsequently, we conducted interviews with staff at Christchurch Hospital, focusing on those working in departments identified as having a high risk of patient falls. We then proposed a range of systems able to track a patient’s position on a bed and with the engineering department at Canterbury University an initial ‘proof-of-concept’ prototype was developed. Further prototype development into a robust system able to monitor a patient’s movement and orientation on a hospital bed is underway.
**Results:**
From our interviews we identified the major criteria required to guide the development of a novel fall prevention system. These include a system which:

- is simple to use
- can be easily integrated into the current hospital setup
- is able to alert specific support staff, as well as those around the patient
- has a low rate of false alarms

Taking into account the above criteria, we decided to implement a system using a wireless technology called Bluetooth (BLE). By measuring the strength of a wireless Bluetooth signal we are able to get a value, called the RSSI (received signal strength indicator) value. This value varies with the distance from the transmitting source, thus we can determine the distance between two sensors.

By placing a sensor on the patient’s feet (like an ankle bracelet) and another on a fixed point of their bed, we can monitor the patient’s movement and predict if they are trying to get out of the bed - alerting nurses to provide assistance and avoiding the risk of a fall.

Our early prototype was developed using open-sourced hardware (an Arduino Uno-compatible microcontroller with a Bluetooth module). For monitoring we created a mobile application on the Android operating system to process the Bluetooth signal.

Early performance tests showed a detectable change in RSSI value up to a range of 2 meters from the transmitting device, with a percentage error ranging from 3-4% - its accuracy fluctuating when exposed to a physical obstruction between the sensors.

**Conclusion:**
Future plans include improving the algorithms used to obtain the RSSI value and the implementation of additional sensors, e.g. a gyroscope and accelerometer, to provide a dynamic detection system able to warn carers of an approaching fall event.

While there may be limitations to the technology, the measure of RSSI value has shown to be an effective indicator of distance and the integration of Bluetooth sensors in a fall prevention system has shown promising potential.
Introduction:
An Adverse Drug Reaction (ADR) is a response to a drug that is noxious and unintended which occurs at doses normally used in people. ADRs are a common cause of hospital admission and occur frequently in hospital. Many ADRs are avoidable and valuable healthcare resources are used to treat ADRs. Every patient admitted to hospital in New Zealand has information about their stay coded using an international coding system, the “International Statistical Classification of Diseases and Related Health Problems” (ICD-10). ADRs are coded in this process, but this information is not generally analysed separately. This project was to summarise the information about ADRs recorded in hospital coding data.

Aim:
To describe and quantify the adverse drug reactions recorded in Canterbury District Health Board (CDHB) coding data.

Method:
All hospital discharges for four years (1 July 2010 to 30 June 2014) in Canterbury were studied. We extracted all the coding data related to ADRs. For each case we also recorded patient age, sex, length of stay, specialty service and the primary reason for admission.

For each hospital ADR the codes for both the ADR (the event) and the perpetrator drug were obtained and then grouped by diagnosis and by drug class. The data were analysed using Microsoft Excel.

Results:
There were 20,826 hospital ADRs recorded in CDHB coding data in four years (5,207 ADRs per year) from a population of 521,832 people in the Canterbury region. This is an incidence of one hospital ADR per hundred people per year. In a fifth of these (4304/20,826) the ADR was the primary cause of admission to hospital, about 20 hospital admissions per week in Canterbury. The most common perpetrator drugs were opioids (2,419 cases), anticoagulants (1,950 cases) and cytotoxic drugs (1,253 cases). The 3 most common ADRs were hypotension (low blood pressure and faints - 3,629 cases), bleeding disorders (1,744 cases) and nausea and vomiting (1,088 cases).

Conclusion:
Adverse drug reactions are common and coding data is accessible and less resource intensive to analyse than other methods of ADR analysis. However, coding data has limitations - some coding is incorrect; the severity and preventability of ADRs are not recorded and ADRs in the community are not recorded. By analysing CDHB coding data, the ADRs occurring in Canterbury hospitals were described and common ADRs and perpetrator drugs were identified. This information can be combined with information from other sources to help reduce the risk of future ADRs.
Introduction:
Endometrial cancer (also known as uterine cancer) is the most common gynaecological cancer in New Zealand. Fortunately when detected in its early stages it has a good prognosis. The basis of this project stems from recent literature which has found that overall women are actually more likely to die from cardiovascular disease (CVD) than endometrial cancer itself. This is reflective of the high probability of curative cancer treatment along with high prevalence of cardiovascular disease in the New Zealand (NZ) population. Additionally endometrial cancer is associated with factors (e.g. obesity, dyslipidaemia, diabetes) that also increase the risk of developing CVD.

Current follow up of these patients is not only aimed at detecting recurrence of cancer but also to provide guidance on improving their overall wellbeing. With rising numbers of endometrial cancer survivors there is a need to assess whether this groups increased risk of death from CVD is being addressed during follow up.

Aim:
This project aims to document known risk factors for cardiovascular morbidity in women undergoing follow up for low risk endometrial cancer. In addition we will document whether appropriate medical interventions (e.g. treatment of hypertension) are being undertaken during follow up to reduce cardiovascular risk.

Method:
Data concerning cardiovascular risk factors was collected from electronic and hard copy clinical records in a cohort of 100 patients undergoing follow up for low risk endometrial cancer. Analysis was restricted to patients with grade 1 or 2, stage Ia or Ib endometrial cancer. These patients were identified from an existing CDHB database and were consecutively included into the study from November 2009 through to December 2014.

Data was collected from the time of diagnosis. The patient’s cardiovascular risk score was then calculated using the NZ cardiovascular risk chart. Other relevant factors not required to calculate cardiovascular risk (e.g. body mass index [BMI], cardiovascular medication use) were also collected. Furthermore, we also documented any recorded medical interventions aimed to reduce cardiovascular risk during follow up.

Results:
The mean age at diagnosis is 61 with 70% of women aged 55 years and older. The prevalence of diabetes was 14%, higher than the diagnosed diabetic prevalence of 5.8% in New Zealand. Women who smoked made up only 9% of the cohort, below the general population at 17.6%. Known hypertension prevalence was 46%, with over 90% of these women already being treated with anti-hypertensive medication(s). This is significantly greater than 15.9% of New Zealand adults who report being on medication for hypertension.

Blood pressure measurements revealed 19 patients with systolic BP >140mmHg who were not reported to have hypertension or be on anti-hypertensive medication. Two of the 19 had a systolic BP >170mmHg, indicating a need to start medication irrespective of their cardiovascular risk score. Data to calculate BMI was available in 83 patients. Mean BMI was 35 (obese category). Two thirds of the women (66%) had a BMI ≥30, with nearly a third (29%) having a BMI in the morbidly obese category of ≥40. Despite obesity levels being on the rise, these results are well above the New Zealand population with obesity rates (BMI
≥30) at 30%. Interestingly those aged <45 years had a higher mean BMI than those in the age bracket 45-54 (43.3 vs. 33.5).

Cardiovascular risk scores could only be calculated in 69 patients. The remaining patients could not have their score calculated primarily due to lack of data on cholesterol levels. The median cardiovascular risk score was 10-15% or moderate 5 year CVD risk. This median score remained at 10-15% across New Zealand Europeans, New Zealand Maori and Pacific Islanders. There was a notable increase in scores from 45-54 year to 55-64 year age group, rising two risk categories from mild (2.5-5%) to moderate risk (10-15%).

For those with cardiovascular risk scores >20%, there is strong evidence of benefit from BP lowering, statin and anticoagulant therapy. 19 patients scored >20%, 12 of whom had a cardiovascular comorbidity. Most were already on anti-hypertensives (13 patients, 68%), close to half (8 patients, 42%) were on anticoagulant (aspirin and/or warfarin) therapy and 37% (7 patients) were on a statin. Three patients were not on any cardiovascular medications.

Throughout follow up, some women with particularly low cancer recurrence risk are eligible to become a part of a Survivorship Programme. The focuses of the programme are on healthy lifestyle modifications, management of problem symptoms and support. Half of the cohort is part of this initiative. Over 80% of those in the programme have discussed or been advised about their weight with eight dietitian referrals being offered. In total 28 dietitian referrals were offered to all patients (programme or non-programme). Documented green prescription referrals were offered to 16 programme patients. These were almost only solely offered to those as part of the Survivorship Programme with only one non-programme patient receiving a referral. Smoking cessation has become routine part of medical care with advice given to seven of the nine smoker patients.

16% of the cohort already had CVD at the time of endometrial cancer diagnosis. During follow up there were seven cardiac related admissions to Christchurch Public Hospital with another three patients then being diagnosed with CVD. This indicates that CVD is already beginning to manifest itself within four years of follow up.

Conclusion:

We have found that women with low risk endometrial cancer have a moderate (10-15%) 5 year risk of developing CVD. Lack of cholesterol levels was the primary reason we were unable to calculate a patient’s risk score. This could potentially become a factor included as a part of routine follow-up, because knowing the CVD risk influences which lifestyle changes and medications should be implemented.

Other key findings included the high prevalence of hypertension, both known and unknown (systolic BP measurement ≥140mmHg). While BMI is not required in calculating 5 year cardiovascular risk using the NZ chart, it is a significant contributor to CVD. Prevalence of obesity is more than twice that of the general population, not only affecting cardiovascular risk, but putting the patient at increased risk during surgical treatment of the endometrial cancer. Reflective of these high obesity levels is the number of weight related interventions; over one in four of women were offered dietitian referrals and one in six offered a green prescription.

From this data, areas for future focus include;

- Adequate hypertension management
- Conducting cholesterol level measurements
- Reducing elevated BMIs
• Assessing whether BP and lipid lowering, along with antiplatelet therapy are required
Introduction:
Guidelines for disease management recommend when to use medications to treat health problems and what medications to use. Guidelines usually focus on starting medications for single diseases and few guidelines recommend when to stop medications or how to treat people with multiple medical problems. Patients with multiple problems are increasingly complex as there are many guidelines that could be applied. Complex patients usually take multiple medications (polypharmacy) and are at increased risk of adverse drug effects and drug interactions. This study explores if applying guidelines to these patients increases polypharmacy.

Aim:
To investigate the difference between the medications prescribed to complex patients and those recommended by guidelines.

Method:
Eighty-nine consecutive patients acutely admitted to Christchurch Hospital under two general medicine teams were studied. For each patient the clinical notes were reviewed to compile lists of current medical problems and “current medications” at discharge.

For each medical problem the appropriate local, national or international management guideline was selected with the advice of relevant specialists and used to compile a list of “recommended medications” for each patient. The lists of current and recommended medications for each patient were compared to create three medication lists - taken and recommended; taken but not recommended; recommended but not taken.

Results:
One patient died while in hospital leaving 88 patients - 51 male, 36 female and 1 trans-gender. Their average age was 71 years and the average number of current medical problems was 8, of which 6 were amenable to treatment with medication.

The average number of medications taken was 9 and the average number of medications recommended by guidelines was 10. On average one medication (95%CI 0.75-1.19) was taken but not recommended, most commonly vitamin D, benzodiazepines or proton pump inhibitors. Conversely, on average two medications (95%CI 1.57-2.41) were recommended but not taken, most commonly cholesterol lowering medications, blood pressure medications and fibre for constipation.

Conclusion:
Application of the guidelines would have resulted in adding two medications and stopping one on average in this group. This was less than expected but was statistically and clinically significant. Existing guidelines should be applied to complex patients with caution and future guidelines should include recommendations for stopping medications and adaptations for patients with multiple medical problems.
Introduction:
Colorectal cancer in 2010 was the second most common cause of cancer mortality and is a major health burden in New Zealand. As the incidence of colorectal cancer increases with age, 90% of cases occurring after 50 and our ‘baby boomers’ age, the Ministry of Health (2011) predicts a rise in colorectal cancer by 15% in men and 19% in women by 2016. Maintaining quality and efficiency in treating this cancer is likely to be one of the defining health issues of the next decade.

The multi-disciplinary meeting (MDM) has emerged as a key tool in the management of cancer. The colorectal cancer MDM typically includes input from radiology, pathology, surgery, medical and radiation oncology, nurse specialists and cancer nurse coordinators. The MDM provides a forum for co-ordination, communication and decision making by healthcare team members.

Aim:
The Ministry of Health require that “all new cases of cancer’ be discussed in a MDM. During 2014 there was clinical concern as to whether patients were being missed and the Ministry relaxed the requirement to discuss “all cases”, which prompted us to carry out this audit. This targeted audit set out to establish;

1) The number of patients referred appropriately to the MDM
2) The number of colorectal carcinoma patients not referred and if these patients were subsequently disadvantaged
3) If, how often and how the MDM changed the management plan already formulated by the referrer

Method:
A database of colorectal carcinoma patients was established and a wide range of clinicopathological factors recorded. This included demographic data, carcinoma staging before and after MDM, imaging studies and treatment offered and instituted.

Patients included in the study were as follows;
1. The MDM group: Patients treated and/or diagnosed in the public system discussed at MDM from 1st November 2013 to 1st November 2014.
2. The non-discussed group: Patients not discussed at the MDM were identified through the ICD discharge codes in the CDHB PMS using the start date of 1 September 2013, to allow for referral into the MDM, and the end date of 1st November 2014.

In the latter six months of the study period the MDM subset formed the “referrer subset group”. For these patients, clinicians were required to fill out a pre-MDM treatment plan. If this was not available a concerted effort was made to obtain the plan from clinic letters. This pre-MDM plan was compared to the MDM management recommendation to assess how often the MDM changed management. The data base permitted comparison between the subsets of all the recorded parameters.
**Results:**
The study comprised of 641 patients, of whom 459 (70%) were discussed in the MDM. Non-discussed patients and those included in the MDM did not vary greatly in the proportionate distribution of gender, ethnicity, or the majority of investigations. Those in the non-discussed group were on average 8 years older with an average age of 75 years compared with 67 years with their MDM counterparts.

Of the total rectal tumors, 98.3% were discussed in the MDM, along with 96.3% and 95% of the anal and other category tumors respectively. 62% of rectosigmoid (upper rectal) cases were discussed compared with 31.7% non-discussed. Colon cancer was the only location in which the majority was non-discussed (60.8%).

The staging of a cancer describes the severity of the disease based on size and degree of spread. A greater proportion of non-discussed cancers were found to be a lower stage, with 56.8% of cases being either stage I or II compared with 34.6% in the MDM group. 65.4% of MDM patients were stage III or IV compared to 43.2% in the non-discussed. MDM patients were more likely to receive a combined surgical and oncology treatment (46.6% vs 21.2%) or a standalone oncology treatment (7.9% vs 1.1%). MDM patients were also more likely to receive an oncological palliative treatment (16.1% vs 4.4%). 66.3% of non-discussed cases received surgery alone compared to 23.2% with those in the MDM group. Non-discussed patients also had a slightly higher rate of best supportive care implemented with 8.9% compared with 6.3%. MDM patients were more likely than non-discussed patients to undergo CT-Chest scanning (49.5% vs 23.6%) and conversely less likely to receive a chest x-ray (43.4% vs 75.3%). MRI scans were substantially more prevalent in the MDM group with 67.5% having the investigation compared with 9.3% in the non-discussed group.

In the referrer subset group (n=138) a clear pre-MDM plan was ascertained 68.1% of the time. Management was changed in 22.3% of these cases. When a clear referrer pre-MDM plan was not established, 38.6% of the time it was due to the referrer being uncertain and seeking guidance over several possible treatment options. The MDM reviewed and changed the staging in 4.4% of all cases in the study period with the majority (77.3%) being upstaged.

**Discussion:**
*Who is not being discussed? Are they missing potential benefit?*
Almost all rectal and anal cancers were discussed by the MDM, with the few non-discussed cases either very early stage or late presentations, which would not have benefited from discussion. National tumor standards set by the Ministry of Health state that, where possible, all rectal cancers should receive a staging MRI. Our audit found that 93.5% of rectal cancers got the investigation.

Colon and rectosigmoid cancers were analysed looking for patients that potentially missed benefit from discussion. A greater proportion of the non-discussed colon cancer stage III and IV received only surgery when compared the MDM patients but half these patients were referred to oncology and were not treated either due to patient choice or medical co-morbidities. The other half were not referred to oncology as the surgeon deemed them unfit for further treatment or by patient choice. Analysis of rectosigmoid cases was similar leading to the conclusion that non-discussed patients were not disadvantaged.

*How often did the MDM discussion change management already formulated by the referrer?*
The MDM directly changed management in 22.3% of patients, but more commonly leads to confirmation of the proposed treatment plan. The MDM altered the tumour stage in 4.4% of cases.

**Conclusion:**
This has been a reassuring investigation showing it is unlikely that patients that are not discussed in the MDM are disadvantaged. A database has been established for colorectal carcinoma patients which will enable an ongoing audit of MDM function in colorectal carcinoma treatment.
Introduction:
Abdominal aortic aneurysm (AAA) is a dilatation of the main artery in the abdomen. It is the most common site of aneurysms in the body, affecting 5% of men aged between 65 and 75 years old. As the AAA grows with time, the risk of rupture increases. The chance of death from AAA rupture is greater than 80% compared to less than 5% chance of death if AAA is repaired electively. This highlights the importance of early detection and intervention to prevent rupture.

Internationally, seven countries have started national AAA screening programmes to reduce the chance of AAA rupture. However, a national AAA screening programme does not exist in New Zealand. One of the main reasons for this is the lack of AAA population prevalence studies. Currently no evidence relating the size of the aorta to mortality in patients exists in New Zealand. Although standardised cutoffs of 2.5-2.9cm and greater than 3cm and 5.5cm define the presence a sub-aneurysmal aorta, presence of an AAA and those patients requiring intervention respectively.

Aim:
The objective of this study was to determine the relationship between aortic size and mortality in patients with normal, sub aneurysmal and aneurysmal aortic diameters.

Method:
In this study a database of all patients who underwent CT colonography (CTC) from 2009-2013 in the Canterbury region was retrieved. CT scans of all individuals were reviewed and measurements of the aorta were recorded and measured across 5 points - supraceliac, suprarenal, infrarenal, mid aorta and aortic bifurcation. A survival analysis was performed to determine the relationship between 1) presence of AAA and mortality and 2) size of aorta and mortality.

Results:
The scans of 2,964 individuals were reviewed during the study period. The average age was 72 years old and 64% were females. The average aortic diameter at the 5 different points was 2.5cm at the supraceliac level, 2.13cm at the suprarenal level, 1.94cm at the infrarenal level, 1.91cm at the mid aortic level and 1.81cm at the bifurcation point. Of the 2694 patients, 3.3% had an AAA. In terms of cardiovascular risk factors, 15.5% had cardiovascular disease, 38.9% had a high blood pressure, 30.9% were smokers and 9.4% individuals had diabetes. At 5 years follow up, 80% of people with a normal aorta were alive, 60% of people with sub aneurysmal aortas were alive and 50% of people with an AAA were alive.

Conclusion:
Our results suggest that patients with AAA have a decreased chance of surviving and when this data was broken down into categorical aortic measurements, it was shown that those with larger aortic measurements had a decreased chance at survival compared to individuals with a normal aortic diameter. This has implications for targeting cardiovascular risk factors if an abnormal aortic size was found on imaging.
Introduction:
Falls are a common occurrence in hospital within the elderly population. Between 35-42% result in injury, however only 1-2% result in fractures. Current fall protection strategies are limited in their effectiveness therefore injury minimisation is what is commonly used. Hip protectors are one solution for patients with a high falls risk, however compliance is an issue, along with only protecting when the patient falls onto their side. A second option is the Low Impact Flooring (LIF) as it targets the whole population and can minimise the risk of injury by absorbing the impact. Current research on low impact flooring has been done in healthy elderly patients so this study looked at the ease of walking in patients with motor or proprioceptive deficits.

Aim:
The aim of this study is to explore differences in gait (walking) on these floors in patients with stroke, with Parkinson’s and a control group. We hypothesise that older patients with stroke or Parkinson’s disease will not have any differences in their walking on the low impact floors compared to standard hospital flooring.

Method:
Each participant underwent a total of six “timed up and go” tests (TUG test), twice on each of three flooring surfaces, two low impact flooring options (Omnisports Excel and SmartCells) and standard vinyl control. The TUG test involves the patient sitting in a chair, standing, walking 3m and returning back and sitting down in the chair while being timed. Patients were randomised to the order the floors were tested and to minimise fatigue were given rest between trials and different floors. Patients were video recorded for more in-depth gait analysis. Participants were also asked to comment on how stable and comfortable they found the different surfaces using a visual analogue scale.

Results:
14 patients participated. 11 of these were stroke and 3 were Parkinson’s patients (9 male, 5 female). We had a response rate of 37.8% of patients approached. This does not include those patients who were discharged before they could be approached. The average “Timed Up and Go” test for all patients were Omnisports Excel floor (19.1 seconds (range 9.2-32.7 seconds)), SmartCells floor (18.2 seconds (range 8.7-28.7 seconds)) and the control vinyl floor was 18.6 seconds (range 9.1-32.0 seconds). Differences between the LIFs and the control were non-significant. Patients were also asked about their perceived comfort and stability on each floor.

The comfort rating was highest on the Omnisports Excel, but differences between both LIF’s and the standard vinyl were not statistically significant. Stability was also highest for the Omnisports Excel but again was not statistically significant.

Conclusion:
There is no difference in walking (gait) between the low impact floors and standard vinyl so far when looking at the average “Timed Up and Go” results.

Patient comfort and stability are also acceptable on the low impact floors, which along with no statistically significant difference in walking seem to be an appropriate alternative to the current standard vinyl flooring.

If the low impact floors are shown to reduce injury in studies currently under way, then it is likely that they would be appropriate to help minimise fall related injuries in a hospital setting. This neutral result can be interpreted positively, as it shows that patients with pre-existing gait difficulties manage on LIFs equally well as on standard flooring. However due to low participation numbers the clinical impact of these results are limited. More participants are needed (and will continue being recruited) to fully be able to determine if the low impact floors are any more difficult to walk on than vinyl.

The low numbers of participants was due to multiple factors. Firstly there were restrictions on when the floors could be used for testing as they were in patient rooms. As a result of this, testing was not possible during scheduled ward rounds and rest periods. This combined with trying to fit the testing into the participants’ rehabilitation schedule posed a challenge. Secondly, due to our mobility criteria stating that patients’ had to be either independently mobile or mobile with supervision meant that some patients’ were discharged before they could be invited to participate. On many occasions patients’ were discharged home once their mobility was sufficient which meant they were unable to be tested.

Finally the other main obstacle faced was a lack of mobile Parkinson’s patients. This is partly due to the Parkinson’s patients who were admitted being the more frail Parkinson’s disease patients. Due to this we began recruiting Parkinson’s patients from outpatient clinics. As a result, future Parkinson’s participants will be periodically recruited from outpatient clinics to get the desired 20 participants.
Introduction:
Cannabis is the most widely used illicit drug in New Zealand. A significant number of cannabis users experience problems related to their use, yet they remain difficult to recruit into treatment. One reason for this may be that many users do not wish to stop using and would rather moderate their use. Users who reduce their use are likely to experience a reduction in cannabis related harms. Moderation is not widely explored in the area of cannabis abuse treatment and very few studies explore the effect that moderation goals have on treatment engagement or outcome.

Aim:
This study aims to explore the viability of moderation as a supported treatment outcome by examining existing literature and exploring the moderation experiences of current cannabis users.

Method:
A brief literature review examined cannabis treatment trials, user surveys, user cohorts and qualitative analysis of cannabis users’ experiences with regards to moderate use or treatment barriers. Advertisements targeting ‘current cannabis users aged 18+ who had ever attempted to reduce their cannabis use’ were dispersed at tertiary institutes through Christchurch, 298 Youth Health Centre, and Cosmic Corner shops. Due to recruitment difficulties, advertising was extended to local members of NORML and online forum TRIPME. Participants were given information (verbal and written) outlining the key details of the study. Confidentiality and storage of information and recordings were outlined. Verbal consent was gained prior to each interview. Semi-structured interviews were recorded, transcribed, coded and analysed for themes. Participants had the chance to review and comment on transcripts. Immediate interim analysis of interviews enabled unexpected concepts to be identified and explored in subsequent interviews. Recruitment is ongoing, current sample size is nine. Four participants were male, six were under 25 years of age (range 19 to 54 years) and five were students.

Results:
Literature: Search results confirmed that moderation is poorly explored in regards to cannabis. While non-abstinence outcomes are often presented, the change goals of cannabis users are rarely recorded, so the prevalence of moderation goals was difficult to estimate. Two studies that recorded goals in a non-treatment seeking population, suggest moderation goals are at least as common as quit goals. But, generalisability is questionable as one study recruited from a pediatric emergency ward and the other required subjects to meet DSM-IV cannabis dependence criteria and sample sizes were small. ‘Not ready to stop using’ was identified as a treatment barrier in one of two qualitative studies exploring barriers. Definitions of moderation were inconsistent. Definitions included ‘less than 3 times a week’ and ‘more than a 50% reduction in use’.
Interviews: Below are the common threads relating to the key study questions that have emerged so far.

Thoughts on abstinence or moderation of use as options for change
Moderating was commonly thought to be easier than quitting. Three participants partially attributed this to a lower requirement for change in social circumstances. Some recognised that moderation would not work for everyone and in these cases the inability to control use was seen as an inherent ‘personality factor’, or a sign of addiction. In line with this idea, some viewed moderation as a demonstration of control over substance use.

As the perceived harms of moderate use (self defined) were low, moderation was a viable long-term goal for the majority of participants. Three participants mentioned that they viewed quitting as unnecessary (in their situation). Two participants saw moderation as a possible step towards abstinence.

Perceptions of treatment: Treatment seeking behaviours and barriers
None of the nine participants actively sought assistance from health services about their cannabis use. Most commonly this was because of a lack of perceived need for treatment. Lack of treatment seeking also aligned with the participants’ view that cannabis is a comparatively low risk drug and not addictive. More often, participants referred to their use as a habit rather than an addiction. Other common reasons for not seeking treatment stemmed from a lack of faith in the ability of services to be helpful. Reasons commonly mentioned for this were a perceived inability of health professionals to relate to the users’ perspective on their cannabis use, biased information that focuses too heavily on the physical health effects and lacks consideration of benefits, inconsistency within the health services or a belief that changing your use must be self-driven. These views tended to be expressed regardless of perceived need for treatment. Three participants said they expected health professionals would want them to quit; others felt that expectations about changing behaviour would vary.

The moderation experiences of cannabis users: Strategies and rules used and challenges faced
Participants all used multiple strategies to achieve moderation. Common strategies included: distraction by ‘keeping busy’ (mentioned by 9); substitution (i.e. replacing cannabis use with an alternative that achieves the same purpose (mentioned by 5); forgiving lapses and allowing exceptions (mentioned by 5); reflecting on motivations to quit (mentioned by 5); and to a lesser extent avoidance (avoiding purchasing and social exposures to use). In regards to substitution, both healthy forms (e.g. meditation) and unhealthy forms (e.g. increased cigarette smoking) were utilised. Most participants set ‘rules’ around use when moderating. These were either context specific (e.g. ‘special events like a concert’), quantity specific (e.g. ‘$50 bag a week’, ‘2-3 joints a week’), time specific (e.g. ‘after 6pm’) or conditional (e.g. ‘only if I’ve done exercise that day’). Common challenges included influence or pressure from others to use and ‘breaking the habit’. These were on occasions handled by ‘avoidance’ and ‘keeping busy’ respectively.
Two participants mentioned support assisted their moderation efforts, while three participants mentioned a lack of support as one of the factors that made the process more challenging. Those who did discuss use of support all suggested talking to others while still at the contemplation stage of change.
Four participants indicated they found moderation easy. Two participants, who stated it was very challenging, also reported a perceived lack of support.
What level of cannabis use would users regard as being low risk?
All participants recognised that defining ‘low risk’ was subject to individual variation. On the whole, qualitative rather than quantitative indicators were discussed however it was not possible to gain a clear consensus on what these multiple factors were. Only four indicated that they were not happy with their current level of use (three wanted to cut back further, one wanted to use more) yet the range of current use patterns ranged from daily to once a week. One man quantified his ideal use as morning and night, while another said her ideal use was once a fortnight. Cost was a limiting factor for four participants.

Conclusion:
Moderation is viewed as a preferable method of addressing cannabis related concerns by a number of users. However, within the wider population, the frequency of moderation goals is unable to be determined due to lack of data (measures of participant goals are scarce), although a few studies suggest moderation is as common as abstinence. In the current sample, difficulty achieving moderation and perceived formal treatment need was low, although users highlighted the value of support and accurate information. It was also perceived that health services would be unreliable in their ability to meet needs, regardless of the individuals’ own perceived level of need and would have an expectation of abstinence rather than moderation. Commonly employed strategies to assist moderation involved ‘keeping busy’, ‘substitution’ ‘avoidance’ ‘reflection on motives’ and ‘forgiving lapses and allowing exceptions’. In each case, multiple strategies were used. The influence of others and the habitual nature of use were seen to hinder efforts, while support was seen to aid efforts. ‘Low risk’ use is difficult to determine and depends on individual factors, which is reflected in the scarcity and inconsistency of existing definitions of moderation.
Introduction:
Gestational diabetes mellitus (GDM), affecting around 5% of pregnancies, is defined by the World Health Organisation as ‘carbohydrate intolerance resulting in hyperglycaemia of variable severity with onset or recognition during pregnancy’. In plain English, GDM is a recognition of excess blood sugar levels during pregnancy, whether this be a pre-existing condition or as a result of the pregnancy.

GDM usually resolves following delivery, with blood sugar levels returning to normal in the first 24–48 hours postpartum. However, all women with GDM are routinely screened for persistent elevated blood sugar postpartum, as GDM is inclusive of previously undiagnosed diabetes. Local practice is to screen women at 6 weeks after delivery using the 2 hour oral glucose tolerance test (OGTT), which measures blood sugar levels in response to a carbohydrate load. If the test is abnormal, the woman is referred back to her GP for management of her pre-diabetes or diabetes. In November 2014, the New Zealand Ministry of Health introduced new guidelines, which recommended that the OGTT, a time consuming test with around 75-85% attendance locally, be replaced with a simple HbA1c screening test at 12 weeks postpartum.

There is, however, very little evidence to suggest that HbA1c is an appropriate postpartum screening test for diabetes. HbA1c is a protein found in red blood cells, which can be used to assess the average blood glucose levels over the life span of a red blood cell (roughly 12 weeks). There are significant changes to red blood cell turnover at the time of delivery with blood loss, iron deficiency and blood and/or iron transfusions all contributing factors. This in turn has a direct effect on HbA1c measurement. The evidence thus far suggests that there is no correlation between the ‘gold standard’ OGTT and HbA1c at 6 weeks postpartum, with HbA1c tests tending to under-diagnose the true prevalence of ‘pre-diabetes’. We might expect to see better correlation between the two tests at 12 weeks postpartum, once the confounding effects of delivery have been controlled for, but as yet there is no evidence to support the new recommendations.

Aim:
The aim of this study was therefore to evaluate the correlation between HbA1c and OGTT at 12 weeks postpartum, with the 10 week summer studentship period forming the pilot stage of the study.

Method:
Women with a diagnosis of GDM were identified through antenatal clinics with the diabetes midwives at Christchurch Women’s Hospital. They were booked as per usual care for a postpartum OGTT together with an HbA1c, but this test was delayed until 12 weeks postpartum (c.f. the usual 6 weeks). Clinical records were used to collect data on maternal characteristics (age, ethnicity, BMI), diagnosis and
treatment of GDM, family history of Type II diabetes, delivery method ± complications and transfusions received.

Health Connect South was used to determine whether there was a diagnosis of/treatment for iron deficiency and anaemia throughout the pregnancy. This information was used to establish a database that, in the longer term, will be used for statistical analysis by a biostatistician to determine the correlation between OGTT and HbA1c after adjustment for confounding factors.

At this stage of the study, the correlation between OGTT and HbA1c results was crudely evaluated as n=13 was not sufficient for statistical analysis.

Results:
At the time of writing, full datasets were available for 13 women who had been diagnosed with GDM. Of these 13 women, 9 returned normal results for both the OGTT and the HbA1c tests. The remaining 4 had OGTT results indicative of pre-diabetes, yet normal HbA1c results.

Conclusion:
I successfully set-up this study to evaluate the correlation between HbA1c and OGTT at 12 weeks postpartum for women with GDM. It is too early to draw meaningful conclusions from the study at this stage, with just 13 datasets completed. The full study will continue until 140 women have participated, which is the minimum number recommended by a biostatistician for statistical analysis.

Tentatively, the results thus far appear to reflect previous studies, which have found that HbA1c tests tend to under-diagnose cases of pre-diabetes. If this indeed is the case then, under the new recommendations from the Ministry of Health, some women with pre-diabetes will be falsely reassured and potentially miss an opportunity to implement lifestyle modifications to reverse their pre-diabetes and prevent a diagnosis of Type II diabetes. Around 30-40% of women with GDM have persistent excess blood sugar levels and it is important that these women are identified and appropriate management strategies be put in place to reduce long-term risks to their health.
Student: Vikesh Gupta  
Project: IBD incidence in Canterbury, New Zealand  
Supervisors: Richard Garry and Andrew Day  
Sponsors: Christchurch Gastroenterology Research Trust

Introduction:
Inflammatory Bowel Disease (IBD) is a complex collection of disorders which present with inflammation of the bowel. The bowel wall becomes red, swollen and ulcers may be present, all of which lead to disruption of the normal digestive processes. Patients diagnosed with IBD often suffer from diarrhoea, abdominal pain, abdominal bleeding and may have severe weight loss.

Crohn’s disease (CD), ulcerative colitis (UC) and IBD unclassified (IBDU) are all encompassed under the definition of IBD. Although CD and UC share common features, both have unique characteristics that are used to differentiate between them. CD can occur anywhere from the mouth to the anus, whereas UC is found only in the colon. IBDU represents a form of IBD where initial findings do not distinguish between CD and UC.

IBD are increasingly significant health problems worldwide, with many studies showing increasing rates in recent years. A landmark study completed in 2004 found that Canterbury, New Zealand, had one of the highest incidence rates in the world. The incidence (number of new cases per population in a given time period) of CD in Canterbury in 2004 was 16.5/100,000 population. However, there are no longitudinal data concerning IBD incidence from any population based centre in the southern hemisphere.

Canterbury is well positioned to perform population based epidemiological studies due to the geography and nature of healthcare delivery. The timing of this study is also opportune given a national census was performed in 2013. This is an essential piece of data due to population changes that may have occurred in Canterbury following the 2010/2011 earthquakes.

Aim:
We aimed to identify all new diagnoses of IBD in the CDHB catchment between 1 January and 31 December 2014. In addition, we aimed to characterise these patients further in terms of key factors such as age at diagnosis, gender and disease location to enable the analysis of trends in incidence changes over the decade since the initial study was performed in 2004.

Method:
The Canterbury region was defined using the Canterbury District Health Board (CDHB) boundaries as stipulated by the territorial authorities’ in the 2013 census from Statistics New Zealand. Because the New Zealand health system has no diagnostic or therapeutic registry data, patients attending both public and private clinics and hospitals need to be identified for epidemiologic studies. To accumulate all new cases in the public system, all colonoscopy reports from the endoscopy database, Provation, were read. Those indicative of a new IBD diagnosis were followed up through examination of the histology reports to confirm if a diagnosis had been given. Furthermore, all capsule endoscopy reports were viewed in the public system. Those patients being considered for new IBD diagnoses had their clinic letters followed up to determine if a diagnosis had been finalised.
Computer records from all private clinics in Canterbury were screened using text searches for the words “Crohn” and “colitis”. Case notes were reviewed and those with new IBD diagnoses were included in the study.

To help with recruitment of incident cases prospectively, gastroenterologists and surgeons were informed of the study both by letter and meetings. Any patient with a new IBD diagnosis would have their details forwarded onto investigators so specific clinical information could be extracted.

The diagnosis was confirmed according to recognised and accepted criteria. Other diagnoses were rigorously excluded. Participants who did not live in Canterbury were excluded from the study, as were participants who did not have IBD confirmed by standard criteria. If there was doubt as to the diagnosis or if insufficient data was available to confirm the diagnosis, the case was discussed with the patient’s clinician. All results were reviewed before a final decision on inclusion in the study. If there was still doubt concerning the diagnosis, then the patient was excluded. In addition to fulfilling these diagnostic criteria, patients were phenotyped according to the Montreal Classification.

Incidence rates were calculated for CD, UC and IBDU for the period January 1 2014 to December 31 2014. Projected population data for age and sex were obtained from the Department of Statistics. Annual incidence rates for 2014 for both sexes were calculated based on the number of patients diagnosed and the population size. Incidence rates were then age standardised using the World Health Organisation (WHO) Standard Population to allow comparison with other regions.

Results:
Overall 205 patients were diagnosed with IBD in Canterbury in 2014. 134 patients were diagnosed with CD, 69 with UC and 2 with IBDU. 100 (49%) of the patients were male. For 2014, the crude incidence rate for IBD per 100,000 was 39.8 (95% CI, 34.4 – 45.3), for CD 26.0 (95% CI, 21.6 – 30.4), for UC 13.4 (95% CI, 10.2 – 16.6) and for IBDU 0.39 (95% CI, -0.15 – 0.93). There was a peak of incidence for both CD and UC between 20 and 54 years of age. The age specific IBD incidence rates were standardised, peaking in the 20-24 year old age bracket and remaining relatively stable up to 54 years old before gradually declining with age. The majority of patients diagnosed with Crohn’s disease had ileocolonic disease that was non-stricturing and non-penetrating. Most patients diagnosed with Ulcerative Colitis had pancolonic disease.

Conclusion:
Overall, this study has prospectively defined the descriptive epidemiology of IBD in the Canterbury region of New Zealand in 2014. IBD, CD and UC incidence rates were 39.8, 26.0 and 13.4/100,000 respectively. These results indicate substantial increases in the incidence of these chronic conditions in the Canterbury region. Rates of IBD have risen by approximately 150% over the last decade. This Canterbury IBD Project will be a valuable tool for future population based IBD epidemiology and outcomes research.
**Introduction:**
In routine clinical care, it is notoriously difficult to obtain a laboratory glucose measurement, which accurately reflects a patient’s true glucose value. The laboratory itself can measure glucose accurately, the issue is with how the blood sample is collected and what happens before it gets to the laboratory. Currently laboratories across New Zealand use fluoride tubes to collect blood samples for the measurement of glucose. Previous studies have shown that blood left in these tubes i.e. not processed immediately, results in loss of glucose in the first hour after the samples have been taken. This glucose loss is due to a process called glycolysis, where the red blood cells continue to use glucose for fuel. This results in a lower glucose value than would have occurred if the sample had been processed straight away by the laboratory. It is impractical to process blood samples straight away, therefore most glucose measurements in New Zealand are under-recorded. In Europe, new blood tubes containing citrate and fluoride (citrate/fluoride) have replaced fluoride tubes in many hospitals. Studies in healthy participants have shown that these new tubes give readings that are approximately 0.3 mmol/L higher than those processed in standard tubes. Although this 0.3mmol/L value might seem small, it is enough to have a significant impact on the diagnosis of diabetes. In particular the diagnosis of gestational diabetes, a form of diabetes in pregnancy, is sensitive to small deviations between real and measured glucose values. Undiagnosed and therefore untreated gestational diabetes can lead to issues for the mother and for the baby. Of particular concern, it can result in an unhealthily large baby that might have a difficult journey through the birth canal and will also need extra monitoring after birth.

**Aim:**
We are considering introducing the citrate/fluoride tubes into Christchurch, then potentially into New Zealand. As part of my summer studentship project, we set up two studies to investigate the effectiveness of these new citrate/fluoride tubes.

The aim for the pregnancy study was to determine if blood collected into the new citrate/fluoride tubes show results similar to the “gold standard” test (immediate separation of plasma and red cells using “gel” tubes) and if they are higher than the results obtained using the old fluoride tubes.

The aims for the second study were;

a) Explore the differences in glucose loss between the citrate/fluoride tubes and the fluoride tubes in a diabetic population and a non-diabetic population

b) Explore the hypothesis that different individuals have different rates of glucose loss, which persists across time. (A positive finding could have an impact on interpretation of previous diabetes research)

c) To investigate the effect that these citrate/fluoride tubes have on lactate readings. (This is because if these tubes are introduced in Christchurch, the laboratory will also use them for lactate readings)
**Method:**
Pregnancy study: We recruited pregnant women who had been found to be at risk of developing diabetes and were booked in for their 75gm oral glucose tolerance test (OGTT) for this study, typically at around 28 weeks into their pregnancy. This test requires the women to fast for 12 hours and then have their blood taken. A blood test is taken on arrival, followed by a drink of glucose and then a period of rest sitting in the waiting room. One hour after they finished their drink, they have their blood taken again and blood collection is repeated at two hours.

For this study at each time point we took off 2 extra tubes (citrate/fluoride and a gel tube (PST)) in addition to the usual fluoride tube. We used the gel tube as our gold standard and separated the plasma from the red cells immediately (this is done by a process of centrifugation). The citrate/fluoride tubes and the fluoride tubes were left standing at room temperature and processed as per the routine ‘everyday’ procedure. The results from all 3 tubes at each of the three time points were then obtained and compared.

Second study: Diabetic and non-diabetic volunteers were approached to take part in this study. They were required to come to the Diabetes Centre twice. At each visit 11 vials of blood were obtained (3 gel tubes, 3 citrate/fluoride tubes, 3 fluoride tubes, 2 waste tubes). One of the gel tubes and one of the fluoride tubes were used as the gold standard for the glucose readings and the lactate readings respectively. These were put on ice slurry and put into a refrigerated centrifuge immediately. (This method is thought to be the best but also the most impractical way of producing accurate glucose results). The citrate/fluoride tube was put into a non-refrigerated centrifuge immediately. Once these were spun down the plasma was taken off and put into a small tube so that it could be frozen and stored, then analysed in the laboratory at a later date.

The remaining tubes were left upright at room temperature. Two hours after the blood samples were taken one of each (citrate/fluoride, fluoride and gel) were put into the non-refrigerated centrifuge and spun. The plasma was then taken off and put into tubes and frozen. Twenty four hours after the blood samples were taken the remaining samples were put into the centrifuge, spun, had the plasma taken off and then frozen.

The vials of blood taken from the second visit were treated in the same way. Once all the samples were frozen they were put through the laboratory analysers at the same time, so that the amount of glucose lost, across different collection and storage conditions could be compared.

**Results:**
The main aim of my summer studentship project was to design and organise the logistics of both of these studies. The inevitable time constraints imposed by a 10 week studentship meant that both studies need to continue once my studentship finishes, to ensure sufficient numbers of participants are recruited. At this point in time, the preliminary results show that the new citrate/fluoride tube produces higher glucose readings than the fluoride tube and the gel tube. For the pregnancy study the general trend appears to be that the citrate/fluoride tubes give a reading that is approximately 0.4 mmol/L higher than the fluoride tubes. The difference between the citrate and the PST tubes (the gold standard) at this stage does not seem to show a constant difference.

The second study is also showing promising results in that the new citrate/fluoride tube not only produces higher results than the other two tubes but it also loses less glucose over time (i.e. is more stable).
The results also show that each individual has different rates of glucose loss (i.e. the rate of glucose loss is not the same for everyone). Our results indicate that the new tubes are producing lower readings of lactate than both the PST tube and the fluoride tube.

**Conclusion:**
At this stage we have not had enough study participants to be able to give formal conclusions. However, the preliminary results are extremely promising. As the new citrate/fluoride tubes are producing higher readings than the old fluoride tubes, this suggests they are not causing glucose loss and they may be a better option for future glucose testing. The fact that they are more stable over longer periods of time would also make them suitable for community (rural) use as there is often a long period of time between when the blood is taken and when the samples get to the lab. The fact that each individual has different rates of glucose loss means that it is difficult to generalise about glucose loss, for example when interpreting results from previous research studies. The main way in which this will happen is if there is a study currently occurring and they switch to the new tubes. If this happens they will not be able to apply a correction factor to their old results (i.e. add on a certain amount to their old results to make them comparable to their new results).

Preliminary results suggest that lactate readings in the new test tubes may be unreliable. If this turns out to be correct, it is unlikely that if these new tubes are introduced in Christchurch for glucose that they will be used to record lactate levels. More study participants will be required before we can make a formal recommendation regarding these new tubes, but at the moment we are heading towards considering them for glucose, but not for lactate.
Introduction:
Prostate cancer is the most commonly diagnosed cancer of New Zealand men and is the third largest cause of death. Around 3,000 men every year are diagnosed with Prostate cancer. The options for treatment include active surveillance, surgery (prostatectomy), radiotherapy/radiation treatment, hormone therapy or a combination of them.

Radiation treatment for prostate cancer is a very effective treatment for early prostate cancer and local control and survival outcomes are excellent and well documented in the literature. Radiation however does have side effects and these are less well described in the literature. Most of the side effects are related to the surrounding anatomy of the prostate. The prostate gland sits just beneath the bladder, in front of the rectum. Therefore radiation that is delivered to this region may inevitably also be delivered to parts of the bladder and rectum in order to ensure that the whole prostate receives the desired dose of radiation so that there is the highest chance of cure.

Recently there has been a study published in a medical journal, the Lancet, which reported the incidence of secondary complications after prostatectomy and radiation treatment for treatment centres in Ontario, Canada. The results showed a higher incidence for secondary complications from radiation treatment than what was thought to occur at Christchurch Public Hospital.

Aim:
To study the incidence of radiation treatment related secondary urological complications (including the incidence of, minimally invasive complications, urological hospital admission and open surgical procedures) post radiation treatment and secondary radiation induced malignancies, for patients treated with curative radiation therapy for prostate cancer in Christchurch hospital. We then aim to compare these with outcomes published in the Canadian paper.

Method:
We performed an audit of patients who reside in Christchurch and received curative radiation treatment for prostate cancer at Christchurch Oncology service during 2002-2009. We created a database of the patients, which included information on their prostate cancer, their radiation treatment and any other treatment they may have had as well e.g. hormone therapy. We excluded those who had follow-up outside of Christchurch, a radical prostatectomy, metastatic disease at diagnosis and/or received radiotherapy with palliative intent. We then sought data regarding the outcomes from the Ministry of Health Cancer registry and by searching the hospital coding database. This information was then independently reviewed by two clinicians to ascertain which entries were radiation treatment related. The time frame of interest for urological complications was from the patient’s last day of radiation treatment, till death or the start of the audit (10 Nov 2014). We measured the development of secondary malignancies 5-9 years after their radiation treatment, this allows for sufficient time for any radiation induced malignancy to develop. Malignancies that were diagnosed earlier were not included as they were unlikely to be related to their radiation treatment. This is in concordance with the Canadian study.
Results:
439 patients received radiotherapy for prostate cancer between 2002 and 2009 and had follow-up at Christchurch Public Hospital. The age distribution of Christchurch patients (compared to Ontario, Canada) was 12% (13%) aged less than 60 and 45% (37%) aged between 60 and 70 and 43% (49%) aged more than 70 years old.

Using D’Amico scores (a risk classification method that is used to estimate the likelihood of the prostate cancer recurring) we classified Christchurch patients’ prostate cancer using their pathology. Of the 439 patients, 85 were low risk, 209 were intermediate risk, 142 were high risk and 3 were unknown.

There were 30 patients that developed secondary malignancies. As seen in the Canadian study, we reported the 1st malignancy that was diagnosed in the 5-9 year time frame. Of those, skin cancers made up 56.7%, lung 13.3%, genitourinary 10%, gastrointestinal 10% and haematological 10%. Because of our smaller sample size (439 compared to 16595 in Ontario, Canada) and therefore small number of diagnoses, it would not be statistically appropriate to compare our results with Ontario, Canada. Our levels of skin cancer are however undeniably higher than Ontario, Canada – which is consistent with existing data on skin cancer. There were 47 secondary malignancies in total (30 initial and 17 subsequent diagnoses) that were reported during the 5-9 year time frame.

102 first presentations of urological complications were recorded. 54 of those were for minimally invasive urological procedures and 48 were classed as admission to hospital. No open surgical procedures were found. Therefore 12.3% of the Christchurch patients had a minimally invasive urological procedure, 10.9% an admission to hospital and 0% an open surgical procedure. Compared to Ontario, Canada who had 27.8%, 24.2% and 0.8% of their patients undergo those outcomes, respectively.

Conclusion:
Through this audit on those prostate cancer patients who received radiation treatment during 2002-2009, we can gain some more insight into the incidence of potential complications of the particular treatment modality. We performed our audit using a method that was consistent with the Canadian protocol in order to obtain the consistency required for comparison. There was a relatively high level of secondary malignancies that were picked up when compared to Canada, but this may be due to differences in sample size, reporting of early stages of skin cancer and environmental factors. Further investigation of the prostate cancer patients who did not receive radiation treatment is planned. This further investigation will help to better understand the influence of radiation alone on the development of secondary malignancies. The proportion of Christchurch Public Hospital patients who had urological complications was significantly lower in all three categories, compared to Ontario, Canada.

Accurate knowledge of the likelihood of these complications in the local setting will help to better inform the decision making process for the patients, so that they can choose a treatment modality with a better understanding of the complications that may occur.
Introduction:
Recent Canterbury District Health Board (CDHB) guideline changes around the use of macrolides (clarithromycin, azithromycin, roxithromycin and erythromycin) in the treatment of Community Acquired Pneumonia (CAP) kicked off a campaign in December 2013 to encourage the use of oral azithromycin instead of intravenous (IV) clarithromycin and if used an early switch to azithromycin after a single stat dose. The campaign comprised of 20 CDHB wide presentations to doctors, pharmacists and nurses as well as bulletins, posters and a change in macrolide ward stock. This campaign aimed to bring the CDHB in line with PHARMAC’s Hospital Medicines List (HML) and in addition azithromycin has been shown to have many superior advantages over other macrolides including better tissue penetration, shorter duration of treatment required, less adverse reactions and drug interactions as well as being more cost effective.

The use of macrolide antibiotics in CAP are usually limited to suspected atypical pneumonias or those with high severity scores. Severity scores are important in guiding clinical decision making in the treatment of CAP. The CURB-A score is the primary severity estimator in CAP and measures the following parameters - confusion, urea, respiratory rate, blood pressure and age, with a maximum score of 5 indicating very severe pneumonia. If prescribing a macrolide antibiotic, CDHB guidelines now recommend that patients with mild to moderate CAP (CURB-A: 0 – 2) receive oral azithromycin and the use of IV clarithromycin be reserved for those with severe to very severe CAP (CURB-A: 3 – 5).

Systemic Inflammatory Response Syndrome (SIRS) is a more general severity indicator that measures temperature, heart rate, respiratory rate and white blood cell count; a patient must meet at least two of these criteria. While SIRS is not a severity indicator tool specific for CAP it also provides the clinician useful information about the severity of the illness, and may be used to guide clinical decision making.

Aim:
To investigate the pattern of Macrolide use in patients with CAP both pre (May/June 2013) and post (May/June 2014) CDHB Macrolide campaign (Dec 2013 – April 2014).

Method:
Patients with a discharge diagnosis of CAP during the periods May/June 2013 and 2014 were identified using the CDHB decision support system prior to commencement of this project. Patients were included if they had a primary discharge diagnosis of CAP (as reported on the relevant discharge summary), were aged 15 years or older and received a macrolide antibiotic during their admission. This information was gathered from electronic (Health Connect South) and hard copy patient files. If included in the study the following parameters were also collected and recorded in an excel spreadsheet: demographics, hospital admission information, macrolide(s) including duration and time to treatment, CURB-A parameters, SIRS criteria and investigations. Data was then analysed using Microsoft Excel.
Results:

The Cohorts: In 2013 a total of 272 patients were identified from the CDHB decision support system; of these 206 were excluded from the study as they did not meet the inclusion criteria (Primary diagnosis of CAP, aged at least 15 years and treated with a macrolide) or their hard copy notes were unobtainable (n = 3). This left a total of 66 patients who were included in the 2013 cohort for analysis. In 2014 there were 395 CAP patients identified of which 285 were excluded as they did not meet the inclusion criteria or their files were unobtainable (n= 2), resulting in a cohort of 110 patients for analysis.

Demographics: Patient demographics between the 2013 and 2014 cohorts were similar with the average patient age at admission being 67 years (2013) and 68 years (2013), close to a 1:1 ratio of male and female patients and the majority of patients were of New Zealand European ethnicity in both cohorts (2013: 60.6%, 2014: 58.2%).

Investigations: Chest x-rays were completed in all but one patient in 2013, a small minority of these found no radiological evidence of pneumonia (2013: 7.2%, 2014: 10.9%), these patients were treated on clinical grounds. Bacterial pathogens were identified in 27% of patients in 2013 and 33% of patients in 2014, with the most common pathogen being *Streptococcus pneumonia* (32% of all patients).

Antibiotic use: The use of oral macrolides changed dramatically from 2013 to 2014; in 2013 there was a greater variety used with 54.5% of patients receiving oral clarithromycin and 40.9% receiving roxithromycin compared to 2014 where the vast majority of patients were treated with oral azithromycin (93.6%). Intravenous clarithromycin use showed a dramatic 36.3% reduction in use from 54.5% (2013) to 18.2% (2014) pre and post campaign. The way in which IV clarithromycin was used also changed between cohorts; there was in increase in those who received a single stat dose in 2014 from 34% to 50% and the average duration of treatment decreased from 2.27 days (range 1 – 6) to 1.55 days (1 – 3) in the post campaign cohort. Of those that were treated with a single stat dose 58% (2013) and 80% (2014) were then switched to an oral macrolide (2013: 42.9% oral clarithromycin, 57.1% roxithromycin; 2014: 100% azithromycin). When analysed by CURB-A score, IV clarithromycin use increased with severity in both cohorts as expected. However in 2013, 46.9% of patients with mild to moderate CAP (CURB-A 0 – 2) were treated with IV clarithromycin compared to only 13.6% in 2014; a 33.3% reduction. Likewise in 2014 53.1% of patients with severe to very severe CAP received IV clarithromycin compared to 36.4% in 2014.

Conclusion:

A CDHB wide guideline change for the use of macrolide antibiotics and a campaign to drive this change in December 2013 encouraged the use of oral azithromycin to treat CAP instead of IV clarithromycin which would be reserved for severe cases. This shift in macrolide use aimed to bring the CDHB into line with PHARMAC’s Hospital Medicines List (HML), while promoting the superior advantages of azithromycin compared to other oral macrolides and IV clarithromycin. As a result this campaign 2014 saw a shift in oral macrolide use; from a variety of macrolides to azithromycin being the macrolide of choice, used in 93.6% of CAP patients in 2014. It also saw a 36.3% reduction in the use of IV clarithromycin and a 33.3% reduction of IV clarithromycin use in those with mild to moderate CAP. In addition to this in 2014 of the 50% of patients treated with a single stat dose of IV clarithromycin 80% were switched to oral azithromycin keeping in line with guideline changes. In conclusion this study has shown the CDHB wide campaign to be effective in changing the use of macrolide antibiotics in the treatment of CAP, which may result in cost saving and better patient outcomes.
Introduction:

Positive End Expiratory Pressure (PEEP) is the pressure applied to the lungs after breathing out. It is one of the factors that enables small clusters of air sacs in the lungs called alveoli to remain open. Alveoli are where gases, such as oxygen and carbon dioxide, enter and exit the blood. Patients with Acute Respiratory Distress Syndrome (ARDS), accumulate fluid in their alveoli which cause the alveoli to collapse. This collapse results in stiffer lungs and the reduced ability to transfer oxygen into the blood. In response to this, clinicians may use a machine called a mechanical ventilator to support the patients breathing until their lungs heal. One of the settings on the ventilator is PEEP. However, because the lungs of patients who have ARDS are very heterogeneous it is difficult to know what to set the PEEP as. It is thought that the optimum PEEP, when the alveoli are neither over nor under-inflated, occurs when the lungs are at minimum elastance. Elastance is the stiffness of the lungs and both over and under-inflated lungs are stiffer. Researchers from the University Of Canterbury Centre Of BioEngineering have created a non-invasive model-based programme called CUREsoft which uses real time data collected from patients’ ventilators and mathematics to recommend a PEEP based on the lowest elastance. A randomised control trial (RCT) to test the minimal elastance PEEP concept is set to take place soon in the Christchurch Hospital Intensive Care Unit (ICU) with invasively mechanically ventilated patients randomised to either the CUREsoft programme or to Usual Care.

Aim:

To ensure the RCT is conducted as smoothly as possible and to minimise confounding factors which could negatively influence the data collected from the RCT, it is important to standardise how patients are weaned from the ventilator. Weaning is the process when patients transition from a ventilation mode where the ventilator supports most of the patients breathing, to a spontaneous breathing ventilation mode where patients breathe by themselves with minimal support from the ventilator, to finally breathing without the aid of a ventilator (full support → minimal support → no support). This project focused on defining the ventilator settings and measurements currently used in the ICU which were likely to result in a successful wean, with the aim of supplying some guidelines for the upcoming RCT protocol.

Method:

Data surrounding the transitions from mandatory supported breathing ventilation modes (Synchronised Intermittent Mandatory Ventilation (SIMV) and Bi-Level (BL)) to supported spontaneous breathing ventilation modes (Assisted Spontaneous Breathing (ASB) and (Proportional Assist Ventilation (PAV)) was retrospectively collected from 50 patients who were diagnosed with pneumonia during 2012 and 2013. This resulted in 111 data sets. The data sets were then split into “successful” and “unsuccessful” transitions. A successful transition was defined as > 36 hours after a transition to ASB or PAV from SIMV or BL without reverting back to SIMV or BL. The definition also included patients who were extubated (taken off the ventilator) within 36 hours. An unsuccessful transition was a transition to ASB or PAV from SIMV or BL that did not satisfy the successful transition criteria.
**Results:**
The respiratory rate, minute volume (how much the patient breathes per minute), FiO2 (fraction of inspired oxygen) and tidal volume (volume of each breath) were found to be significantly different between the “successful” and “unsuccessful” groups before transition to ASB or PAV. Meanwhile, SpO2 (peripheral capillary oxygen saturation), set respiratory rate, pressure support (pressure applied during inspiration) and heart rate did not vary significantly between “successful” and “unsuccessful” groups. Therefore, total respiratory rate, minute volume, FiO2 and tidal volume may potentially be used to indicate when patients are ready to be weaned.

Currently ventilator practice is highly dependent on staff experience, thus it is quite variable within and between ICUs. There is no overarching standard practice and only limited guidance from the medical literature regarding how to transition patients from full mechanical ventilation to assisted ventilation. Therefore, it is important to define local current ICU practice so that the variability of factors during the transition from mechanical ventilation and their associated outcomes may be better understood. For example, an increase in minute volume may not have been a conscious indicator for an unsuccessful wean to ICU staff prior to the results of this project.

**Conclusion:**
The results contributed useful information towards writing the protocol for the upcoming RCT and gave a valuable reflection on current practice in weaning in the ICU. The use of the guidelines for the RCT based on this knowledge is not restricted to the trial situation and has practical applications regarding ventilator practice.
Introduction:
Lung cancer is the fifth most common type of cancer in New Zealand, but the leading cause of cancer death, with approximately 1700 deaths each year. The rate of death from lung cancer is equal to the deaths from breast, bowel and prostate cancers combined. Lung cancer can be broadly classified by cell type into small cell (SCLC) and non-small cell (NSCLC). The degree to which the cancer has advanced is measured by staging the cancer from stage I, with the best prognosis, to stage IV, which indicates that there are distant metastases.

Unfortunately New Zealand has a lower lung cancer survival rate than comparable countries. Five-year survival in New Zealand is only 10.2% - and this number has not improved over the last 15 years. In comparison, 5-year survival in Australia is 13%, and it is nearing 17% in both Canada and the USA. One factor which contributes to our lower survival rate is that many patients have advanced disease on presentation. In addition, New Zealand has lower treatment rates than many other countries and delays in receiving treatment are common.

There are ethnic disparities among lung cancer outcomes in New Zealand. Both Maori and Pacific Islanders have higher rates of lung cancer and higher mortality among patients with lung cancer. They are also more likely to have locally advanced disease at diagnosis.

Aim:
To develop a more accurate picture of current practice and outcomes for lung cancer patients in the Upper South Island region and to identify barriers in the patient journey that can be targeted to improve implementation of National Service Standards, leading to improved patient outcomes in the future.

Method:
Outcome data was audited from patients from Upper South Island DHBs with a diagnosis of lung cancer who were discussed at a Christchurch Hospital Lung Cancer MDM (multi-disciplinary meeting) in 2012. Only cases of primary lung cancer were included. Data was collected by accessing patient notes on Concerto. Information gathered included demographics, diagnosis, MDM outcome, treatment and survival. Survival was calculated from referral date where possible. Once the data was collated, statistical analysis was performed using IBM SPSS Statistics Version 22. A total of 33 patients discussed at an MDM were excluded from analysis. Reasons for this included having a diagnosis which was not primary lung cancer, no evidence of cancer, or indeterminate lung nodule(s) which did not progress in a way consistent with cancer.

Results:
In total, 279 patients with primary lung cancer were included. The majority (65%) were New Zealand European, with 16 NZ Maori patients (6%). Nearly all had a smoking history – 30% were current smokers and 62% were ex-smokers. The average age was 70 years, with the majority of patients aged between 50 and 89. In terms of diagnosis, 79% had NSCLC and 10% had SCLC, with the remaining having no tissue diagnosis or other lung cancer types. Of those with NSCLC, 62% had adenocarcinoma and 30% had
squamous cell carcinoma. Nearly half of the patients had metastatic disease (stage IV cancer) at the time of their MDM.

At the MDM, approximately one-third of the patients were classified as curative and two-thirds as palliative. Significantly more SCLC than NSCLC patients were classified as palliative. In total two-thirds of patients were recommended by the MDM to be referred for treatment. Of these patients, a quarter did not receive the treatment recommended. This was most often due to decisions by cardiothoracic or oncology specialists, but patient decision was also a common reason. Patients who were determined to be for curative treatment were 80% likely to receive the same treatment as that recommended by the MDM.

Overall 80% of patients received treatment – 22% received medical oncology, 61% received radiation therapy, and 17% received surgery. Of those treated, three-quarters received a single treatment modality and one-quarter received two or more modalities. SCLC patients were significantly more likely to be treated by medical oncology. Stage IV cancers were significantly more likely than lower stages to be treated with medical and radiation oncology.

Total 1 year survival was 46.6% and 2 year survival was 32.6%. Survival rates at both 1 and 2 years was significantly lower for SCLC patients compared to NSCLC patients. Survival also decreased significantly with increasing cancer stage, as expected. The New Zealand Maori patients had an average age of 65, so were significantly younger than the New Zealand European patients. There were no significant differences between New Zealand Maori and New Zealand Europeans in smoking history, tumour type or staging. New Zealand Maori were significantly more likely to be treated with medical oncology. There was no significant difference in survival rates at 1 and 2 years.

Conclusion:
This study revealed the characteristics of lung cancer patients in the Upper South Island. The main goal was to develop a better picture of current patient outcomes in order to identify barriers in the patient journey. Overall the results were consistent with previous studies done within New Zealand and worldwide. Results suggest that intervention rates for patients with potentially curable disease do appear to have improved in our region.

A key barrier which was identified was lack of early detection. Nearly half the patients had stage IV cancer at diagnosis. This confirms what previous studies have shown, which is that lung cancer often presents late with incurable disease. However this study did not specifically look at reasons why early detection did not occur. A two-pronged approach for future research is required. There needs to be further studies into how to identify patients at earlier stages of disease, so that they have a better chance of survival with current treatment modalities. In addition, research is needed into treatments that might increase survival in late stage disease.

There were few significant differences found between New Zealand Europeans and New Zealand Maori. This is encouraging, because previous studies have shown New Zealand Maori to present later and have worse outcomes. However it is limited by the low numbers of patients who identified as New Zealand Maori (N = 16). Factors contributing to this include the demographics of the Upper South Island region, with Maori making up only 7.8% of the population (2013 Census) and the large percentage of patients
with no ethnicity identified (19%). This means that few conclusions can be drawn from this study regarding New Zealand Maori lung cancer outcomes in comparison to New Zealand Europeans.
Introduction:
Bowel cancer (colorectal cancer) is a major health problem in New Zealand as we have one of the highest rates in the world. The Ministry of Health reported in 2009 that bowel cancer was the 2\textsuperscript{nd} most commonly diagnosed cancer for women, men and overall, with 2787 patient diagnosed that year. There were 1219 deaths due to bowel cancer during 2009, the 2\textsuperscript{nd} highest number of deaths of any cancer.

In 2013 a study looked at previous cohorts of patients diagnosed with colorectal cancer - 355 from January 1993 to December 1994, 317 from January 1998 to June 1999 and 419 from January 2004 to December 2005. This recorded diagnostic and treatment variables and found that patients had both earlier stage disease and were more likely to receive adjuvant treatment (radiotherapy or chemotherapy) in the 2004/2005 cohort compared to earlier cohorts.

Aim:
Our aim was to replicate the 2013 study comparing the previous cohorts 1993, 1998 and 2004 cohort. The purpose of this was to identify trends and changes between the four cohorts’ disease characteristics, management and survival time.

Method:
The methods used in the 2013 study were replicated in this study to ensure consistency in data collection and analysis.

The new cohort of patients included those who had been diagnosed for the first time with adenocarcinoma, the most common type of bowel cancer, in 2009 (1-1-2009 to 31-12-2009) and had also received at least part of their treatment at Christchurch Hospital. Patients who had surgery at a private hospital were also included if they were referred to the oncology department for further treatment. Patients were identified from Christchurch Hospital discharge records, oncology records and pathology records, to form a study population of 300 (229 colonic and 71 rectal patients).

Data was collected using electronic medical records. Demographics such as gender and age were collected as well as dates of surgery, the date last seen or of death, type of operation, features of the cancer such as stage, location and spread, as well as oncological treatment. A statistical analysis was undertaken comparing a variety of the variables to the survival of the patients over time.

Results:
The data from the 2009 cohort was of 296 patients, of which 150 were male and 146 female. The median age was 71 with an age range from 32 to 94.
Initial results from the comparison of cohorts show that the proportions of each surgical procedure (type of operation) used is similar in each cohort. The first two cohorts show a decrease in the number of permanent stomas with 50% in the initial cohort, dropping to 37%, then 33% and now 32% in patients with rectal cancer.

There has been an increase in the proportion of both colonic and rectal cancer patients referred to oncology, with colon cancer referrals increasing from 32% of patients to 70% over the 4 cohorts and rectal cancer referrals increasing from 54% to 92 over the same period.

With this increased referral rate to oncology there has been an increase in use of oncology services, with an increase in the number of patients with colon cancer receiving chemotherapy over the 4 cohorts from 8% to 40%. Levels of pre-operative radiation for rectal patients have also steadily increased from 27% in the first cohort to 82% in the latest.

Survival appears to be improving over the 4 cohorts. Overall, 56% of patients in the 2009 cohort were alive at 5 years. There was no significant (p>0.05) improvement in survival related to gender. However, the 5 year survival was related to the disease stage, with stage 1 (early stage) 5 year survival being 80%, stage 2 being 66%, stage 3 being 56% and stage 4 (advanced and metastatic disease) being 14%.

Surprisingly patients with rectal cancer had a significantly (p<0.05) better 5 year survival than those with colon cancer. 52.4% of patients with colon cancer were alive at 5 years while for patients with rectal cancer it was 66.2%.

Survival curves are being developed to compare survival outcome between cohorts and how this is related to stage of disease.

**Conclusion:**
To conclude, the proportion of bowel cancer patients being referred and utilising oncology services is increasing. Survival appears to be improving overall, however further analysis is required to compare the outcomes of comparative stages over the 4 cohorts.
Introduction:
Painful stimuli cause arousal of the central nervous system (CNS), which the brain then interprets as pain. Analgesia (pain-relief) can reduce arousal of the CNS through a number of different mechanisms. As every person is unique, analgesic agents have different potency and side effects in different individuals, which makes pain management complex. This is further complicated as there is no direct relationship between dose and effect. The concept of effect-site concentration has been developed to estimate the pain-relieving effect.

Previous research indicates a relationship between intra-operative and post-operative analgesic requirements (as represented by effect-site opioid levels) and that there is variation in modelled opioid levels when comparing laparoscopic and orthopaedic surgery. We also know that suboptimal treatment of acute pain is a significant predictor of chronic pain.

Aim:
This study explored two surgical groups: orthopaedic and laparoscopic. The primary purpose was investigating peri-operative pain where fentanyl was the primary opioid. As pain relief beyond PACU (the post-anaesthetic care unit) is important we also employed a standard questionnaire as a marker of recovery, which simultaneously allowed investigation of possible situations where acute pain from an operation could develop into chronic pain.

Method:
With Ethics Committee approval, suitable subjects were identified and verbal consent acquired from the consulting anaesthetist. Written consent was obtained from 47 subjects aged 15 to 65 with an American Society of Anaesthesiologists (ASA) physical status of I, II, or III scheduled for orthopaedic or laparoscopic surgery. Subjects in the laparoscopic study group were scheduled for abdominal surgery, hysterectomy or a diagnostic procedure. Orthopaedic subjects were scheduled for any bony surgery excluding total hip replacements and operations involving the neck of the femur.

Effect-site opioid levels were calculated at one minute intervals from the start of surgery to PACU discharge from doses and times of opioids administered using standard models. For analysis we used the mean intra-operative, PACU arrival, mean PACU and PACU discharge ready values.

Subject quality of recovery was derived from Postoperative Quality of Recovery Scale (PQRS) questionnaires, designed to assess quality of recovery in a variety of different domains (physiological, nociceptive, emotional, activities of daily living and cognitive) over an extended period. Subjects completed a baseline questionnaire before the operation, which was then repeated post-operatively at 30 minutes, one day, one week and one month. This was either face-to-face or over the phone. We assessed recovery by calculating the percentage of subjects who had recovered to baseline at each assessment time point.
Data was compared using paired, two-tailed t-tests with 95% confidence intervals. Statistically significant results had a p-value <0.01, to correct for multiple comparisons.

**Results:**

47 subjects were included in the study - 20 in the orthopaedic group and 27 in the laproscopic group. There was no significant difference between the two surgical groups for any of the derived values. Mean intra-operative opioid levels for the orthopaedic group were 1.19ng/mL and for the laproscopic group were 1.31ng/mL, with a difference of -0.12ng/mL (95% CI, -0.34 – 0.086; p-value 0.24). PACU arrival values were 0.91ng/mL (orthopaedic), 0.79ng/mL (laproscopic) with a difference of 0.12ng/mL (CI, -0.073 – 0.31; p 0.22). PACU mean 0.93, 0.91, difference 0.025 (CI, -0.13 – 0.18; p 0.75). PACU discharge ready 0.82, 0.87, difference -0.046 (CI, -0.25 – 0.16; p 0.65). In the laproscopic group the slope of the regression line for the relationship between mean intra-operative and mean PACU opioid levels was 0.31, with a correlation co-efficient of 0.15, while the orthopaedic regression line was essentially flat; slope of 0.004, correlation co-efficient of 3.29e-005.

The percentage of subjects who had recovered to baseline PQRS at 30 minutes post-operatively were - physiological 45%, nociceptive (pain) 34%, emotional 93% and cognitive 26%. 6% had recovered in all domains. At one month, recovery by domain was - nociceptive (pain) 90%, emotional 100%, activities of daily living 85%, and cognitive 57%. 54% had recovered in all domains. Physiological recovery was better in the laproscopic group - 52% recovered at 30 minutes and 100% recovered at day one, where orthopaedic had 36% and 83% recovery. The orthopaedic group had better nociceptive results for late and long-term recovery - 79% recovery at one week and 94% at one month, compared to 57% and 86% in the laproscopic group. Emotional recovery decreased in the orthopaedic study group between 30 minutes, one day, and one week (84%, 83%, 79%), then increased at one month (100%), while the laproscopic study group maintained 100% recovery after 30 minutes. Activities of daily living were comparable between the surgical groups, except at day one – the laproscopic group was significantly worse (35%) compared to orthopaedic (67%). Cognitive recovery was more stable in the orthopaedic group – 30 minutes 24%, one day 69%, one week 69%, one month 71% – compared to the laproscopic group (27%, 75%, 89%, 55%).

**Conclusion:**

The surgical groups had no significant difference in modelled opioid levels at any of the four chosen points of comparison. In laproscopic subjects the correlation between intra-operative and PACU needs of 0.3 is less than seen in previous summer research and the literature (0.7). The lack of relationship between intra-operative and PACU needs in the orthopaedic group could be due to the variation in anaesthetic and surgical technique.

Most subjects had fully recovered by one month, with no significant difference between the surgical groups. Between 30 minutes and one month, the laproscopic group had better physiological and emotional recovery, while the orthopaedic group had better nociceptive recovery. The longer recovery time experienced by the orthopaedic subjects may have affected their emotional recovery.

The PQRS questionnaires appear to be a good measure of recovery, although variation in overall subject health when the baseline measurement was taken may have affected results - the orthopaedic subjects tended to have been injured for the preceding weeks and the laproscopic were a mix of individuals with acute, chronic or no symptoms. I would recommend more research into the different kinds of anaesthetic
technique used within the orthopaedic group, as it may aid predictions of post-operative needs for those patients.
Introduction:
Bedridden patients who have recently had surgery are at high risk (20-70%) of developing clots in their legs (Deep Vein Thrombosis, DVT) which have the potential to cause leg swelling or to break up and travel to the lungs where they can block a major artery (Pulmonary Embolism, PE). These two conditions fall under the umbrella of Venous Thromboembolism (VTE). In the last 15 years, heparin injections have been recommended as the best means of prevention in surgical patients. Heparin prevents the formation of new clots while the body breaks down existing clots, thus reducing the incidence of VTEs. When the risk of bleeding is high, various mechanical methods may be used instead of heparin, including compression stockings and mechanical foot pumps. Both of these methods serve to increase venous blood flow from the legs, thereby decreasing risk of stasis and clot formation.

Aim:
We aimed to identify patients admitted to CDHB for either DVT or PE within 3 months of a surgical procedure and then to analyse whatever VTE preventative treatment they had at the time of their surgery.

Method:
• We generated a list of all the inpatients admitted to CHDB with PE or DVT during 2013 using our electronic Decision Support System
• From this list we selected those who had also had a surgical procedure performed in the 3 months prior to their admission for PE or DVT
• Using a combination of handwritten drug charts and electronic discharge summaries we recorded the surgical procedure performed and whether preventative heparin injections or mechanical methods were used. This included the dose and duration of heparin treatment.
• Data was entered into a spreadsheet and analysed using Microsoft Excel

Results:
In 2013, 97 patients were admitted to CDHB for PE and/or DVT, [PE 87%, DVT 11% both 2%]. 37% of these patients were admitted to General Medicine, 30% to Orthopaedics and the remainder to other wards (mainly Older Persons’ Health and Oncology). Previously, 52% had Orthopaedic surgery [mainly elective knee and hip replacements]; 16% had General surgery and the remainder had Specialty surgery (Urology, Neurosurgery, Gynecology and Vascular). Some had their surgery privately (13%), but the majority had their surgery at Christchurch, Burwood and The Princess Margaret Hospitals (76%, 11% and 1% respectively).

Out of 97 patients, 81 had accessible notes and drug information.
• 58% received preventative heparin treatment
• 9% received only mechanical prevention, 9% received both heparin injections and mechanical prevention
• The average dose of preventative heparin was 40 mg daily
• Patients were treated with heparin injections for an average of 7.5 days at which point they were either mobile or had already developed VTE
Conclusion:
Surgery is the most important preventable risk factor for VTE. PE following surgery is relatively rare (2%) but can be life-threatening even in young patients and research has demonstrated that heparin is the most effective preventative treatment. This data gives us information on our local surgeons’ compliance with the current international guidelines and also how effective heparin is for preventing VTE. 60% of our patients received heparin at the time of surgery, suggesting that it was not effective or that the dose and duration of treatment were insufficient. The remaining 40% of patients did not receive heparin at all which suggests that many of them had a contra-indication to this treatment (eg. bleeding risk) at the time of surgery.
Introduction:

Colorectal cancer is the second highest cause of cancer related death in New Zealand and along with Australia we have the highest rate of bowel cancer death in the developed world. Each year 43 in every 100,000 New Zealanders are diagnosed with colon cancer. The liver represents the most frequent site of metastatic spread with 25% of patients having evidence of spread to the liver at the time of presentation, with a further 40-50% of patients developing liver metastases after resection of the primary tumour.

The 5-year survival rate for all patients diagnosed with a colorectal cancer is estimated at 65%, dropping to 11% if distant metastases are present. Only about 10-20% of patients with metastatic spread to the liver have disease that is amenable to resection. For these patients surgical resection with curative intent is the treatment of choice and improves 5-year survival rates in the range of 38-58%.

There are many prognostic scores in use worldwide that look to predict survival after liver resection and not only are they important from a patient point of view, but they also allow clinicians to stratify patients into risk categories, which aids in deciding the best management plan for each patient. This is particularly useful because they can help to predict which patients are most likely to benefit from liver resection of colorectal cancer metastases.

Aim:

The aim of this research was to:

1. Audit the outcomes of all patients with colorectal cancer who had liver metastases resected at Christchurch Hospital from 2005-2014.
2. Evaluate the Fong, Nordlinger, Basingstoke, and Memorial Sloan-Kettering Cancer Center (MSKCC) Nomogram prognostic tools to stratify patient’s outcomes after resection of liver metastases in our population.

By validating the scores in our population we hope that they can then be used to guide patient management and provide insight into which patients are most likely to benefit from resection of their liver metastases.

Method:

Patients were identified from a prospectively collected database from the Department of Surgery, who underwent resection for radiological evidence of liver metastases from colorectal cancer at Christchurch Hospital from 2005-2014. Patient notes were reviewed for additional data including, age at operation, pre and post-operative blood results, blood tumour marker (CEA), stage and differentiation of the primary bowel tumour, size and number of liver metastases, time interval from primary resection to liver resection and use of chemotherapy within 8 weeks either side of hepatic resection as well as the chemotherapy used. The Fong, Nordlinger and Basingstoke prognostic scores were calculated and the MSKCC nomogram was used to calculate survival probabilities.
The date of death was identified from records and the time of last contact was identified from the date of last clinical letter to permit assessment of overall survival with a Kaplan-Meier survival analysis. The date of recurrence was taken as that of the radiological study first identifying new lesions. Cancer specific survival was not able to be assessed due to the time constraints of the project precluded analysis of death certificates for cause of death. The data was analysed by a statistician for overall survival and disease free survival as well as outcomes for each stratification of the respective prognostic scores.

**Results:**

132 patients underwent liver resection for colorectal metastases between 2005 and 2014. The overall survival in our population was measured from the date of liver resection. The 2-year survival was 87.4% and the overall 5-year survival was 53.8%. These results place our patient population at the upper end of overall survival range compared to recent studies.

The Fong Score places patients into one of six categories based on prognosis. Our population compares favourably with the Fong Score original outcomes. For example, in risk category four, the second worst prognostic category and the poorest category any patient in our population made it into, predicts 3 and 5-year overall survival at 38% and 25% respectively with our population showing survival rates at 63% and 24% respectively. The trend in the Fong Score is consistent with our population, however the statistical assessment suggested no clear difference between the scores.

The Nordlinger Score provided similar results to that of the Fong Score, with each patient placed into a low, intermediate or high-risk category. The Nordlinger score predicts overall 2-year survival for low, intermediate and high risk groups at 79, 60 and 43% respectively. For each of these categories the overall 2-year survival in our population was, 91, 91 and 72% respectively.

The Basingstoke score does however separate our population into 3 statistically significant groups with the intermediate and high risk groups having median survivals of 6 and 3.5 years respectively with the median survival not yet reached at 6 years follow up for the low risk group.

**Conclusion:**

Several prognostic models have been developed to predict survival or recurrence in after liver resection in the setting of colorectal cancer metastases. We successfully applied 4 approaches and validated them in our patient population. The outcomes from the population exceeded our expectations and place our unit’s outcomes at the upper end of the published literature with regard to colon cancer free survival and the chances of being alive 5 years on from a diagnosis of advanced liver metastatic colorectal cancer.

We identified that the Fong score was able to separate our population but the differences did not reach significance, though this may relate to the small numbers of patients included in the study and the very small numbers in some of the categories. The Nordlinger score however was able to separate with statistical significance those with low and intermediate score and those with a high risk of recurrence. Those in the high-risk group had a median survival of 2.5 years as opposed to 6 years in the intermediate group. The Basingstoke prognostic index did separate 3 clear groups with widely disparate survival.

This has successfully validated and identified the score most clinically useful for our population for preoperative assessment of prognosis. This will enable us to identify a number of patients who may not have minimal benefit from liver resection, avoiding them having unnecessary surgery, those likely to have a very good out come and a group who may benefit from additional treatment such as chemotherapy or more advanced staging.

In the future we hope to assess our data for additional simpler prognostic scores such as the neutrophil/lymphocyte ratio to see if this will add further insight to outcome. The data will also allow clinical outcomes in detail to be linked with a current translational project assessing the use of cell free
tumour DNA in the blood stream (liquid biopsy). We hope this will further enhance the very high outcomes from liver resection that Christchurch has.
Introduction:
Gout is a common form of arthritis which most often affects men, with particularly high rates in Maori and Pacific Island people. It involves extremely painful recurring attacks of joint tenderness and swelling which can lead to joint damage and collections of urate crystals under the skin (tophi) in the longer term. Gout is caused by the deposition of monosodium urate crystals within the joints and surrounding tissues as a result of high concentrations of uric acid in the blood. These crystals set off an inflammatory response which results in a gout attack. Treatment revolves around decreasing and maintaining low blood uric acid levels over time, with a target serum urate of < 6mg/dl as at this concentration further crystals cannot form and those present can dissolve.

While there are medications that are effective at decreasing blood uric acid it has not yet been shown that this reduction results in an improvement in outcomes that are important to patients, such as the number of gout flares, physical functioning and tophi resolution. This is key as improving people’s quality of life is the major reason for treatment. An association with clinical outcomes is also the final requirement for uric acid to be validated as a biomarker by an international body called OMERACT.

A biomarker is a characteristic that can be measured as an indicator of biological processes and as such can be used to evaluate the presence or progression of disease. The benefit of biomarkers is that they can be used by clinicians and patients as an aid in decision making regarding disease activity and treatment efficacy. However their use depends on the quality of the data that supports their application in clinical practice. Previous research has shown that blood uric acid fulfils all of the other OMERACT criteria for a biomarker and so the last component is investigating its link with clinical outcomes.

Aim:
The aim of this study is to undertake a systematic literature review of the existing data available regarding the association between a reduction in blood uric acid and an improvement in outcomes important to gout patients. This will provide evidence supporting the validation of blood uric acid as a biomarker, which would make it the first accepted biomarker in the field of rheumatology.

Method:
A systematic literature review was done in order to search for the studies currently available in regard to this topic. A literature review involves using a structured approach to identify, analyse and summarise all of the evidence relating to a particular question. A variety of different statistical methods can then be used to synthesise these study findings. For this review the papers of interest were randomised controlled clinical trials (RCTs) of adults with gout on urate-lowering medication which measured at least one patient-relevant outcome and were of duration of 3 months or more.
Five major electronic databases, paper references and abstracts of rheumatology conferences were searched up to November 2014. Searches involved using the term “gout” in conjunction with “uric acid” or “serum urate”, various medications or clinical outcomes such as gout flares, tophi and quality of life.

The papers were assessed for suitability and data from the selected studies was then extracted using a pre-formed spreadsheet.

**Results:**
In total 1,538 unique papers were identified, of which 1,351 were excluded as irrelevant by title. 187 abstracts were reviewed, resulting in the assessment of 66 full papers for their suitability. The review considered factors such as study design, data available and outcomes measured. 13 papers which fulfilled the requirements were selected, covering a total of 11 studies. These studies were RCTs and their extensions, with durations between 3 months and 5 years and involving multiple different urate-lowering medications.

Although statistical analysis had not been finished by the completion of this studentship, preliminary descriptive analysis suggests that there is an association between blood uric acid levels and various patient-centred outcomes. There is currently limited RCT data on clinical outcomes in gout; however there is more extensive evidence from observational trials.

Some RCTs, particularly those of shorter duration, were not able to find significant differences in gout flares and tophi resolution across treatment groups which achieved varying blood uric acid levels. The authors suggested additional longer studies were required as it takes several months for medication effects to become apparent and the data was becoming more convincing towards the ends of the trials. One study demonstrated that patients treated with urate-lowering medication did experience a decreased number of flares and tender joints as well as a greater likelihood of tophi regression. These participants also reported a meaningful improvement in their pain levels and quality of life. The longer extension studies were able to show an association between a lowered blood uric acid and better patient-relevant outcomes. Patients who responded to treatment and were able to maintain blood uric acid within the target range (< 6mg/dl) showed continued improvement over time with significantly lower flare rates and greater tophi reduction and resolution.

These clinical trial findings are supported by observational studies which track people over time. It has been demonstrated that the speed of tophi reduction is inversely proportional to the blood uric acid concentration, meaning the lower the uric acid level achieved the faster the tophi resolution. Other large studies have shown that patients achieving the target blood uric acid level of < 6mg/dl were significantly less likely to have gout flares. In turn, the number of flares and presence of tophi is associated with quality of life and physical function, which provides the link between blood uric acid and patient experience.

**Conclusion:**
This systematic review found only a moderate amount of research regarding the relationship between blood uric acid and clinical outcomes such as flare and tophi resolution in people with gout. Statistical analysis is pending, however the available evidence indicates that there is an association between a reduction in blood uric acid and an improvement in patient-centred outcomes. The RCT and extension findings are supported by observational data and what is already known about the role of uric acid in gout. By confirming the link between uric acid and clinical outcomes the requirements for serum urate to
be validated as a biomarker can be met and hopefully this will be verified by OMERACT in 2016. The use of blood uric acid levels may be able to further improve the treatment of patients with gout, as clinicians could estimate the potential benefit of a certain decrease in urate. This could also pave the way for the validation of other biomarkers in the future, with the aim of providing the best patient care.
Introduction:
Total joint replacement (TJR) surgery is the last surgical resort for people with degenerative joint disease. By the year 2030, total hip replacements (THR) in NZ will increase by 174%, largely due to the ageing population and the increased functional demands of this cohort. THR surgery is extremely successful, but these joints undergo wear and often need to be revised after 10-15 years. The more primary TJR surgeries there are, the more revision surgeries there will be, creating a significant and increasing burden to health funding agencies.

Therefore, there is a huge challenge to find and implement effective screening programmes for detecting early THR wear or failure so that orthopaedic surgeons can properly manage revision surgery. Early diagnosis of impending failure can save significant time, cost and more serious surgery. Currently THR can be monitored with serial radiographs but they are not absolutely reliable in detecting wear or a failing prosthesis.

Aim:
Our research group (involving an orthopaedic surgeon, mechanical/bio engineers and a medical student) is investigating abnormal sounds produced by THRs as a method to provide insight into implant condition and provide early detection of wear and loosening.

Method:
Implants are tested preoperatively (in vivo, using a custom-built sensor-device) and postoperatively (in vitro; lab-tested) for abnormal acoustic emissions (AE) data. Currently, 71 patients requiring a revision procedure for a failing hip replacement have been enrolled in this study plus 11 controls (people with natural, healthy hips). In vivo testing is carried out in the weeks leading up to revision surgery, so that the AE and clinical data can be more accurately compared. At the time of writing, 38 of the enrolled patients have had their revision surgery. For this report I have focused on these 38 patients, as the most relevant and detailed clinical information is recorded just before and during revision surgery.

I have attempted to sort patients into groups, according to the implant failure method(s), so that the AE data can be examined, with respect to these groups, to see if any common themes emerge. I combined the pre-operative indications (the reasons for surgery) together with the operative notes, as surgery revealed many previously unforeseen abnormalities. This ‘grouping’ task has proved difficult because 20 of the 38 patients fit into 2 or more failure ‘categories’ (unsurprisingly, because implant failure is produced by a web of contributing factors, rather than one discreet problem).

Hip implants typically consist of 4 components: stem, head, liner and cup. The stem is inserted into the shaft of the femur and the cup into the pelvis. The head is connected to the stem via a Morse Taper and articulates with the liner. The liner and the cup form the acetabular component. The materials used are a combination of ceramic, metal and polyethylene.

Results:
The main failure methods were: loosening (18 patients), wear (19), noise (7) and fracture (4). 2 patients suffered dislocation and 1 had a chronic infection.

The acetabular component was the most common source of loosening, involved in 12 of the 18 cases. 5 stems were loose and 1 of the ‘loose’ cases concerned both stem and acetabulum.

Polyethylene liners were the most common source of wear. Of the 19 ‘worn’ implants, 14 liners were worn, 2 tapers, 1 stem, 1 involved both head and liner and in 1 case the worn component(s) was unspecified. 11 of the worn liners were made of polyethylene (PE), 2 were ceramic and 1 metal. 8 of the worn implants had metal heads and 4 had ceramic heads. It should be noted that this ‘wear’ is only what was seen via radiology and the surgeon’s naked eye; microscopy would undoubtedly reveal many more cases.

Ceramic on ceramic (CoC) interfaces were most prone to squeaking. Of the 7 implants revised for noise (squeaking), 6 involved a CoC interface and 1 metal on metal (MoM). Of the 4 fractured components, 2 were stem and 2 were liner. Pain was indicated for 7 of the patients, but as it is a symptom, not a cause, of implant failure, I did not include a group for ‘pain’.

For acoustic testing to be a useful diagnostic tool, the acoustic ‘profile’ of patients with noisy (usually squeaking) implants (‘squeakers’) would appear differently to patients with worn, or loose, components (‘non-squeakers’). For instance, a ‘squeak’ can be distinguished (as a large amplitude, long duration acoustic event) from a ‘click’ (large amplitude, short duration). This difference was observed for the majority of ‘squeakers’ compared to ‘non-squeakers.’

The ‘non-squeakers’ generally showed more ‘high amplitude, short duration’ events than the control group. This indicates that an artificial hip usually makes more noise than a natural hip. Greater implant wear was found to produce more frequent acoustic events, which may also be of increased amplitude, but further analysis is required. The most conclusive result found (so far) was that squeaking from the Morse Taper shows a markedly different response to squeaks induced by the articulating surface. Making this kind of distinction for the different failure types is key for the validation of the device.

Discussion:
The ‘wear’ and ‘loosening’ categories could be merged, as implant wear causes osteolysis (the resorption of bone) due to an autoimmune reaction to wear debris, leading to the loosening of components (where loosening was indicated, osteolysis was usually noted too). Conversely, if loosening is an advanced stage of wear, then it would be useful to keep the two groups separate, to see if the AE data can expose differences.

Many variables are involved that alter the detected frequencies and amplitudes, and need to be accounted for, such as: the force through the implant, the type of movement, surface temperatures, and the presence of lubrication. AE data from patients with well-functioning prosthetic hips is needed, to establish baseline profiles, so that deviations from the norm can be identified. The sound processing techniques are currently being revisited in an attempt to distinguish high-frequency content from background noise (in vivo). I have collected hundreds of x-rays, referral letters, and clinical notes, from orthopaedic surgeons, radiologists and GP’s; from both private and public databases, and the national joint registry. In addition to classifying patients according to their implant failure type, I am able to present a detailed “case study” of each patient’s ‘hip history.’ When the AE data can be confidently interpreted, the more detailed clinical information will assist in explaining specific events and deviations.

Conclusion:
Although my work forms just a small part of an ambitious ongoing project, having the clinical and surgical information at hand will greatly assist the engineers in making comparisons and conclusions. This brings the team a step closer to the ultimate goal: the clinical validation of AE testing.
Introduction:
Supplemental oxygen is one of the most commonly prescribed treatments in medical care. At any given time, up to a quarter of patients in hospital receive additional oxygen. Data from the UK suggests that up to 34% of all ambulance transports involve the delivery of oxygen.

Nasal cannula is the most common method of oxygen delivery today. We have recently demonstrated that the fraction of inspired oxygen concentration with this delivery method varies depending on the rate of breathing or whether breathing with mouth open or closed. The oxygen delivered is also a dry gas. Humidified, heated, high flow air with supplemental oxygen via a specialist apparatus is an alternative way of providing oxygen therapy. A relatively newer device delivers oxygen via a heated, humidifier, high flow machine, the Airvo 2. It is portable, easy to use and comfortable to wear. It has been shown to be cost effective in the management of COPD (Chronic Obstructive Pulmonary Disease) and is widely used on the medical and respiratory wards. The increased humidity and inhaled temperature may increase patient comfort and compliance when compared to oxygen delivered via nasal cannula.

We are investigating, if we can deliver more precise levels of oxygen with a high flow system (i.e with the Airvo 2) than a low flow oxygen system (nasal cannula). With a low flow system the flow of oxygen only makes up a small portion of the gas that is inhaled, because the patient is still breathing room air as well. The ratio of air from the room and oxygen supplied is generally unknown as it is dependent on how the patient is breathing. The fraction of inhaled oxygen will be higher with a small breath and lower with a big breath, because as the patient breathes more the room air dilutes the oxygen. Hence, it is difficult to know how much oxygen is being delivered to the patient. In a high flow system such as the Airvo 2, the air flow (oxygen mix) is too great for the patient to breath in much extra air. Air and oxygen are premixed in this machine and the oxygen fraction of the mixture is measured before it is delivered to the patient. We believe the oxygen inhaled by the patient will be the same as the oxygen fraction displayed on the Airvo 2 screen, thus, delivering a known amount of oxygen to the patient. This leads us to the hypothesis that high flow systems are more predictable in the amount of oxygen they deliver to the trachea. This is why we are using an intratracheal (inside the windpipe) tube to sample the air when the machines are active, to measure the oxygen delivery.

Also we want to investigate if there is any difference in trachea air temperature when delivering unheated low flow oxygen therapy or heated humidified high flow therapy. If the temperature of the air breathed in changes the temperature inside the airways, this may be able to be used to ‘warm up’ the airways with warm air which may increase comfort.

Aim:
My project’s aim was to compare the effectiveness of nasal cannula to that of the AIRVO 2 system. There’s been no previous research on how the oxygen delivery differs between the two methods of oxygen delivery. We are exploring the effect of different settings on the oxygen concentration, carbon dioxide concentration and temperature inside the airways.
Method:
We tested out the actual output of the Airvo 2 against the display on the machine. In order to do this, we used the Powerlab and the Center 301 thermometer-type K. We measured flow, oxygen and temperature. These variables were measured at three respective points along the air conducting mechanism of the Airvo.

Nasal delivery of Airvo 2 was measured using Powerlab during normal breathing. A volunteer was recruited to receive supplemental oxygen through the Airvo 2 via nasal delivery. The volunteer was asked to change her respiratory rate in time with the metronome, 10, 15 and 25 breaths per minute. Each treatment lasted five minutes. Oxygen and carbon dioxide were measured at the level of the nose using Powerlab.

Phase 2 of this study is to measure the intra tracheal concentration of oxygen, carbon dioxide and temperature, with results pending.

Results:
According to the results that we collected, Airvo 2 delivers oxygen and carbon dioxide at the levels to be expected. For each litre of oxygen we increased, the percentage of oxygen increased by 2.5% (2sf). As the flow of oxygen increased, Airvo had a tendency to underestimate the % of oxygen delivered by an average of 1.9 percentage point. Temperature stayed constant between treatments at 38 degrees Celsius (2sf).

The results obtained using real breathing rate showed the following: at a breathing rate of 10 breaths per minute, the oxygen concentration was 21% and carbon dioxide 0.03%. At a breathing rate of 15, oxygen concentration was 19% and carbon dioxide 1.5%. The third treatment, with respiratory rate of 25, oxygen concentration was 16% and carbon dioxide 4.0%.

Conclusion:
The Airvo 2 is accurate in displaying the amount of oxygen it is delivering to within 2%. The results of real breathing showed a decrease in oxygen and increase in carbon dioxide with increase in respiratory rate at the level of the nose. This is consistent due to increase in respiratory rate. The more somebody breathes, the more entrapment of room air, leading to decreased oxygen in the nose. Carbon dioxide is breathed out more, therefore there is increased level of carbon dioxide detected in the nose.
Introduction:
Depression and dementia are common mental health problems in later life which can often go undiagnosed. Robust, reliable measures for dementia and depression in older people are vital for ensuring technical identification of new cases.

New Zealand has recently mandated the use of InterRAI, a comprehensive assessment tool designed to identify the needs of elderly people to develop tailor made care plans. The InterRAI was originally designed for use in nursing homes but now other versions are available. The “home-care” version is being used to assess the needs of community care patients in several DHBs. Embedded within the InterRAI are several outcome scales which determine a score for a specific area of assessment of particular interest by compiling the answers from several questions. Two of these scales are the cognitive performance scale (CPS), which assesses mental functioning, and the depression rating scale (DRS), which assesses depressed mood.

Because these data are routinely collected, these scales could possibly be used as screening tools for dementia and depression. There is very little research on either scale, particularly in community samples. Initial studies on the CPS delivered promising results but more recent studies are at odds with each other and indicate a lower overall validity. Studies that have examined the DRS indicated that it did not perform very well. However these studies used a 30 day period for mood questions which may be problematic for people with memory problems, whereas the New Zealand version of InterRAI elicits data covering a 3 day interval. Before this study, there were no New Zealand studies on the effectiveness of these scales in a New Zealand population.

Aim:
The aim of this study was to assess the validity of the CPS and DRS in a sample of community-dwelling New Zealanders who use psychiatry of old age services and also to determine if the DRS could be improved by including additional InterRAI items.

Method:
Records of patients who were discharged from acute specialist psychogeriatric inpatient units and memory clinics in Canterbury DHB and Auckland DHB who had recently had an InterRAI assessment were examined to determine if diagnoses of dementia and depression had been made. These specialist diagnoses were used as a gold standard to determine the accuracy of the CPS and DRS. Boundary cases were discussed with a consultant psychiatrist of old age for conservative categorisation. The scales were also compared HoNOS 65+ questions which measure cognitive problems and depressed mood; this is also a mandated outcome measurement tool in New Zealand. Data from the subset of participants who had Addenbrooke’s Cognitive Examination - Revised (ACE-R) scores was also used for comparison with CPS; this is a validated cognitive performance screening tool.
Results:
For the CPS analyses, participants were included if their InterRAI assessment was 90 days either side of their discharge from psychogeriatric services, providing a sample of 134. 72 participants had clinical a diagnosis of dementia. Of these 72, the CPS detected that 65 were cognitively impaired (sensitivity = 90.3%). Of the 62 participants that were considered to not have dementia, the CPS only determined 37 to not have dementia (specificity = 59.7%). The CPS was moderately correlated with HoNOS65+ (ρ = 0.556) and ACE-R (ρ = -0.509), that is, people with CPS scores indicating impairment tended to also have scores that indicated impairment on these scales.

For the DRS, a 14 day cut off was used instead of 90 days, because depression symptoms can vary more rapidly than dementia symptoms, providing a sample of 92. 35 participants (38%) had significant depressed mood. Of these 35, the DRS detected that 21 were depressed (sensitivity = 60%). Of the 57 who did not have depressed mood symptoms, the DRS determined 40 to not have depressed mood (specificity = 70.2%). The DRS correlated very poorly with the HoNOS 65+ depression question (ρ = 0.317.), however the HoNOS 65+ question was only slightly more accurate at detecting depression than the DRS. Analyses were repeated, including extra depression-related questions from the InterRAI with reasonable face validity to determine if the DRS could be improved but these showed no improvement in the scale’s performance.

Conclusion:
Overall, the CPS was good at detecting when people who had required specialist psychiatric service input did have a dementia syndrome (high sensitivity) but was poorer at identifying those people who did not have dementia (moderate specificity). This suggests that the CPS may be a reasonable supplementary screening tool if the aim is to identify as many cases as possible so they can be “red flagged” and referred for diagnostic assessment. However, these results were at odds with previous research where the CPS was found to have high specificity and low sensitivity. It is possible that sensitivity was high due to the particular sample used in this study - the participants were recruited from psychogeriatric inpatient and memory clinic services so the assessors, carers and the patients themselves may have been more aware of their cognitive functioning. The DRS was found to have low validity overall in this sample, in line with previous research on the scale, and our efforts to improve the scale by adding additional questions from the InterRAI were not successful.

This study allows us to make some cautious recommendations in respect of the use of these InterRAI outcome scales. The CPS may have potential as a screening tool to “red flag” community care patients that should be referred for a comprehensive cognitive assessment. However, caution should be exercised especially for “negative” findings and because the CPS may not perform as effectively in an outpatient population. The DRS has not performed well enough to be used as a screening tool and we do not recommend its use in this regard.

Because InterRAI data is routinely collected, another possible application for the scale would be to estimate the prevalence of dementia or depression in a population without the need for administering a separate test. However, we are not confident in the accuracy of the scales to recommend their use in this regard.
We did not examine the scales’ sensitivity to change (can the scales detect changes over time?) or inter-rater reliability (do different people administering the test get the same result?). These could be areas of interest for further research.
Community Category

Student: Katelyn Thorn
Project: Breastfeeding in primary care - The experience of mothers who seek breastfeeding support
Supervisors: Geraldine Wilson, Janetta Skiba
Sponsor: Rural Canterbury PHO

Introduction:
Breastfeeding has widespread benefits for infants, mothers and society and helps to support a healthy start in life. Although it is often thought to be ‘natural’ and ‘normal’, for many mothers it can feel quite the opposite. The importance of giving appropriate support and advice to those mothers with breastfeeding challenges is vital to help them to reach their own personal breastfeeding goals, as well as national and international recommendations. Mothers who have had difficulties breastfeeding and received further support are the target of this research.

Aim:
The major aims of this study are to identify and understand the barriers and facilitators to breastfeeding and what influences a mother’s decision to continue to breastfeed or not, in the subgroup of women who have received breastfeeding support. It will also evaluate mother’s intentions for the duration of breastfeeding and see if their antenatal goals were met. Finally it will assess what breastfeeding supports and education mothers identify as being integral to the continuation of breastfeeding.

Method:
A questionnaire was developed using information from a literature review and consultations with local lactation consultants, mothers who had recently breastfed and Māori health advisors. The questionnaire was then piloted and ethics approval was obtained from the University of Otago. Following this, the questionnaire was distributed to 449 mothers who had recently accessed the Rural Canterbury Primary Health Organisation (RCPHO) Community Lactation Service. Of these, 384 were sent an online questionnaire via email and the remaining 65, who did not have verified email addresses, were sent the same survey by post. The data from the online and postal surveys was then collated and descriptive statistical analysis was performed.

Results:
A total of 138 of 449 surveys were returned, giving an overall response rate of 31%. The median age of mothers was 33 years. It appears that the majority of women in the survey had breastfeed for at least 6 months as 105 (76%) mothers were still breastfeeding at the time of the survey and the average age of the babies in the survey was 7.77 months.

39% (54) of participants planned to exclusively breastfeed until baby was around 6 months old (i.e following World Health Organisation (WHO) recommendations). Of those participants, 48% (26) managed to achieve this goal and one other mother was on her way to achieving this.

From prior research, it has been found that a mother’s decision to breastfeed is often made in the antenatal period. In this study, the biggest influences on the mother’s pre-natal decision to breastfeed or not were awareness of breastfeeding benefits (94% of participants) and supporting the health of my baby (83%).
The main facilitators of breastfeeding in this group were having help from lactation consultants (84%) and having supportive healthcare professionals (69%). Some mothers commented that they particularly liked having personalised help and practical advice for breastfeeding techniques.

Barriers to breastfeeding were grouped into three separate categories of ‘maternal issues’, ‘baby issues’ and ‘other issues’. Nipple pain and self-reported insufficient breast milk supply were the two most common maternal issues affecting breastfeeding duration. Interestingly, in regards to baby issues in this subgroup of mothers, it was more common to have an issue such as latching difficulties or tongue tie than to have no issues at all. From the ‘other issues’ category, receiving conflicting advice about breastfeeding and returning to work were ranked top equal for other factors that affected breastfeeding duration. Returning to work was also one of the main reasons commented by the mothers that felt the WHO recommendation for 2 years of partial breastfeeding is unrealistic. Receiving conflicting advice on breastfeeding was also regularly expressed by the women in various comment boxes.

Self-reported lack of breast milk supply was by far the top reason given by mothers for stopping breastfeeding (61%). This was also the main reason why many mothers used formula feeding. Canterbury offers a wide range of community breastfeeding services. If the participant had accessed one of these services, they were asked to rate how effective they found the service to be. Lactation consultants were rated the highest, followed by midwife or other lead maternity carer. However, this group of women had all received support from lactation consultants. Interestingly, social media (e.g. Facebook groups) was ranked the third most effective source for breastfeeding information and support. Many mothers commented that they felt the help they received was often too late and would have been better earlier. Some mothers also commented that they found there was not enough support for bottle feeding from any breastfeeding service.

Nearly every participant said they would have liked more support from at least one service in regards to breastfeeding. Over half of all participants said they would have liked more support from their maternity hospital and approximately 40% of participants wanted more support from antenatal classes and midwives. However, it is important to remember that the participants are only a subset of women who have received support for breastfeeding problems. Although General Practitioners (GP) were ranked as the least effective source of breastfeeding support and information, only 22% of participants would have liked more support from them. Throughout the survey, women commented on a range of experiences with breastfeeding support services; both positive and negative.

Conclusion:
This study has shown that a mother’s decision to breastfeed is highly influenced by the knowledge of breastfeeding benefits, in particular supporting their baby’s health. During breastfeeding, help from lactation consultants and healthcare professionals were deemed to be the most important facilitators to breastfeeding.

It appears that self-reported lack of breast milk supply is a common problem for this group of mothers. Consistent and ongoing education around what is considered ‘normal’ or ‘sufficient’ breast milk supply is vital to enable more women to reach their breastfeeding goals. Latching difficulties and the increase in recognition of tongue-tie in babies is another important issue that needs to be addressed by all breastfeeding services. It is also evident that conflicting advice plays a major role in mothers’ frustrations with breastfeeding. It is vital to have consistency in advice between services, as well as access to support services earlier in the breastfeeding period. Social media groups (e.g. Facebook) may also be another avenue that should be explored for delivering breastfeeding support.

It is hoped that the results of this study will now help to enhance the delivery of breastfeeding services, especially to those mothers who seek support. The ultimate outcome is to improve a mother’s experience
of breastfeeding, thereby increasing population participation rates and extending the duration of breastfeeding.

Student: Erika Stark
Project: Decision aids for cardiovascular risk management in primary care
Supervisors: Pip Mason and Ben Hudson
Sponsor: Pegasus Health (Charitable) Limited

Introduction:
Cardiovascular disease risk (CVDR) management is an important part of primary care. Managing CVDR involves estimating a patient’s risk of CVDR, presenting the risk to the patient and discussing ways to reduce the risk. This process requires the clinician to present numerical information clearly to the patient and then engage the patient in a discussion about potential interventions. This is a complex task and the outcome of these consultations will vary between patients due to differences in individual patients’ circumstances and preferences. Clinicians are therefore encouraged to adopt a shared decision making (SDM) approach.

“SDM is a collaborative process that allows patients and their providers to make health care decisions together, taking into account the best scientific evidence available, as well as the patient's values and preferences.” SDM helps achieve person-centered medicine and supports patients’ ability to make informed choices about their treatment. Decision aids are tools that are designed to promote SDM in consultations. They have been shown to better inform patients of their management options and reduce conflict between patients and clinicians in making these decisions. Additionally, they have been shown to reduce inappropriate use of tests and treatments. Both patients and clinicians can benefit when effective and time efficient tools are available and used to assist a shared decision making (SDM) discussion.

Little is known about how Pegasus Health general practitioners (GPs) and practice nurses (PNs) approach the task of CVDR management, how decision aids are used in these consultations, how useful they and their patients find them, nor how they influence management decisions.

Aim:
To explore Pegasus Health clinicians’ approach to CVDR management and their use of and attitudes towards SDM and decision aids. We also sought to identify GPs’ and PNs’ preferences for decision aid format and barriers to their use.

Method:
Phase 1: One-to-one interviews with six GPs and six PNs in Pegasus Health.
Phase 2: A questionnaire was designed based on the information gathered in Phase 1. The questionnaire was sent via email to all Pegasus Health GPs (278) and PNs (383)

Results:
270 surveys were completed, 118 GPs and 152 PNs, (response rates of 42% GPs and 39% PNs, overall 41%). 90% of respondents believe they use a SDM approach to CVDR discussions sometimes/often. 29%
of respondents answered that they currently use a decision aid when discussing CVDR. 40% of those who do not currently use a decision aid said they would use one often/frequently if an ideal one was available (47% GPs and 42% PNs). Furthermore, 90% of respondents, regardless of whether or not they currently use a decision aid, believe that decision aids are effective in assisting both a SDM process and patient understanding.

Significant findings in regards to barriers encountered to decision aid use were that decision aids are hard to find, they are time consuming to use, they do not auto-populate with patient data and that some practitioners do not always have access to a computer.

The top five preferences from the respondents in regards to their ideal decision aid were;

- Auto-populating with patient data
- Able to print individualised information for patients to take home
- CVDR estimates based on New Zealand specific data
- Interactive [can manually change risk factors to communicate with the patient]
- Available to patients online at home

Conclusion:
This study reveals both good practice and an opportunity to better support Canterbury’s primary care workforce in managing their patients’ CVDR. Our results indicate that most clinicians currently use a SDM approach to CVDR management and that they recognise the potential benefits of using a CVDR decision aid. However decision aids are not widely used. We identified a range of barriers to their use and a number of desirable features of a CVDR decision aid. We believe these findings could be used to inform the development of a decision aid tailored to the needs of the local primary care workforce and that such a tool will improve CVDR management in Canterbury.
Introduction:
Practice managers are an integral part of the primary care workforce. They are responsible for most non-clinical functions that occur in everyday running of the medical practice and also for attending to the business aspects of running a practice. My project builds on a 2010/2011 summer studentship project which looked at the learning needs of administrative staff in Pegasus practices.

Currently several support structures are available for practice managers. Pegasus Health plays a large role in this through the Practice Support Liaison team and a helpdesk, both of which practice managers can go to for advice. Pegasus Health has also run several education sessions for practice managers and administrative staff, with each session focusing on a topic relevant to the job e.g. ethnicity data. Aside from Pegasus Health, practice managers can receive support from PMAANZ (Practice Managers and Administrators Association of New Zealand) or through use of a website “HealthyPractice” but these are only available through a subscription and therefore are not accessed by all.

Aim:
My project aims to gain a better understanding of the general practice management workforce;
- To explore the variety in experience, scopes of practice and background of practice managers
- To explore the ongoing educational needs of practice managers and resources they access for professional development
- To explore factors that influence job satisfaction for practice managers

Method:
The first stage of my research involved conducting preliminary interviews with practice staff. Different aspects of practice management were discussed, including the role of a practice manager, the ways a general practice can be run and the role of external organisations such as PMAANZ on practice management.

An online questionnaire was developed with Surveymonkey and was sent to practice managers at the ninety-four Pegasus practices. The questionnaire consisted of three sections: background of practice managers, ongoing education needs and job satisfaction. Questionnaire findings were analysed on Surveymonkey with simple tabulation.

A focus group was conducted, with discussion points informed by questionnaire responses. There were eleven participants, six of whom were practice managers. The focus group was recorded, transcribed and thematic analysis was performed on this qualitative data.

Results:
The online questionnaire had a response rate of 54%. The practice management workforce was found to be made up of a great variety of people, in terms of previous occupation, the number of years worked in a
general practice and tasks they consider to be part of their role. The task respondents most wished to exclude from their role was reception duties and the tasks they most wished to include were staff performance appraisals and strategic planning for business growth.

In the past year, 78% of respondents had attended at least one of the Pegasus education sessions. Respondents indicated that such large group sessions were the most favoured method of receiving ongoing education, followed by peer/cluster groups. Just over 70% of respondents indicated that they felt that they were working to their full potential most or all of the time in their current workplace. Management contribution being valued in the practice team was the factor identified to have the greatest influence on job satisfaction.

The focus group found that the support and education services required by practice managers fall into two broad categories: skills training to equip practice managers to do their job well and providing ‘on-the-day’ support as different issues arise. Participants reported that the large group education sessions have been valuable and in the future, it would be helpful if sessions about legislative change occurred before the change itself so staff knew how to prepare for the change. Participants spoke of the benefits of PMAANZ and “HealthyPractice” in performing their jobs well, but also mentioned that it is often difficult to convince business owners that these resources are worth investing in. People talked about the need for a career pathway into practice management and also how it would be valuable to have guidelines/pathways on how to perform specific tasks.

**Conclusion:**
The research found that those in practice manager roles vary greatly in their experience, background and scope of practice. This suggests that when support services are being developed, careful consideration needs to take place to ensure staff at all levels are adequately supported.

People expressed an interest in being in smaller peer groups which would allow participants to discuss specific cases in more detail, and also to foster collegiality. Such groups could be formal in nature i.e. where education material is provided, or they could be informal where members bring forth any issues they want to talk about. It was suggested that perhaps Pegasus Health could facilitate the initial formation of such groups.

One way of providing a career pathway into practice management could be through the development of a placement/apprenticeship programme. This would involve advanced practice managers mentoring those new to the workforce, allowing those starting out to have practical on-the-job experience.

Developing ‘pathways’ for practice management tasks would be valuable and it would work similarly to how GPs and nurses can refer to Health Pathways to aid decision-making. Those new to practice management could refer to these ‘pathways’ to perform everyday tasks and those in advanced roles can use them for more complex tasks that occur infrequently.

There are tasks in practice management which were deemed to be more difficult than others e.g. staff hiring/firing and people felt they needed more support in these areas. This could be provided through skill-training sessions, establishing a pathway to perform these tasks or for Pegasus Health perform tasks on behalf of the practice.
Introduction:
Pegasus Health (Charitable) Limited is a primary healthcare organisation in Canterbury, New Zealand which for the last 15 years has been running an in-house smoking cessation programme called PEGS. Under this programme support to quit smoking and nicotine replacement therapy (NRT) were provided to patients by their own general practice team. Last year an evaluation was done which identified ways that the PEGS programme could be revised to align it with scientific evidence. It was also noted that there are now many smoking cessation programmes and resources available for Cantabrians outside of general practices. As a way to incorporate all of these findings the “Stop Smoking Support Options” programme was designed and launched on October 1 2014.

The “Stop Smoking Support Options” programme aims to increase referrals to other smoking cessation services in Canterbury, while a revised version of PEGS remains as one of the options. The revisions to PEGS included a quota being introduced for how many patients each practice may register and increased expectations and funding to follow-up patients.

A summer studentship was commissioned by Pegasus Health to complete an evaluation of the early implementation of the “Stop Smoking Support Options” programme over the period of November 2014 to January 2015.

Aim:
The purpose of undertaking the evaluation was two-fold. Firstly, it was to help improve the quality of the “Stop Smoking Support Options” programme. Secondly, it was to help Pegasus Health understand how they can better implement new and revised programmes within their general practices in the future.

Method:
The evaluation of the “Stop Smoking Support Options” programme included a mix of both qualitative and quantitative methods:

- Key informant interviews of;
  - Ten practice nurses participating in the programme
  - Two Pegasus Health practice support liaisons (PSLs)
  - Each member of the project team
- Analysis of referral patterns to stop smoking options providers
- Analysis of evaluations and attendance records from the programme’s education sessions

Results:
The number of electronic referrals made to stop smoking providers increased two-fold in the the “Stop Smoking Support Options” programme’s first quarter, quarter two (Q2). The nurses interviewed are now more aware of and confident in the other providers.
In Q2 408 of the 665 available PEGS registrations across all practices were used and 169 follow-ups were logged. Both of these figures are lower than what was anticipated and budgeted for.

Across these registrations, electronic referrals and Quitline’s referrals Pacific Peoples are receiving a disproportionately low amount of support. In a similar situation is the 20 – 29 years age group, which has the highest regular smoker rate in New Zealand.

Acceptance and uptake of the “Stop Smoking Support Options” programme was variable across practices, depending on many factors including attendance at the education sessions, internal communications, practice structure and previous use of PEGS. The PEGS quota is the aspect of the new programme that caused the greatest resistance. The implementation was aided by well received education sessions and a well functioning IT system. Barriers were identified as inconsistencies in who received different forms of communication, a rushed timeline due to delays and the stop smoking providers not feeding back to the practices.

Conclusion:
Overall, good progress has been made in the implementation of the “Stop Smoking Support Options” programme to date. Continuing to communicate with and educate practices will advance this process and hopefully cause a further rise in referral and PEGS registration numbers. There are certain aspects of the programme that need particular attention to maximise its effectiveness, such as increasing PEGS follow-ups and developing communication links between providers and practices.

The evaluation also provided valuable insight into how diverse Pegasus Health general practices are in terms of their structure and operations. The variability in the uptake and acceptability of the “Stop Smoking Support Options” programme highlights the importance of designing and implementing programmes in a way that allows for maximum flexibility so as to accommodate as many practices as possible.

The other main learning from the implementation of the “Stop Smoking Support Options” programme is the need within Pegasus Health for a standard project plan for the design and implementation of health service programmes. Defining the roles and tasks required for these processes would strengthen the leadership that projects receive and ensure that tasks are not left out of the timeline. Pegasus Health stands to gain a great deal by learning from each programme and continually improving the project plan so that it is both effective and tailored to the organisation.
Introduction:
Many think leprosy is an issue of the past, yet the disease persists in many Pacific Island countries where cases are stable or rising. Hotspots around the Pacific include Kiribati where over 100 new cases are reported each year and in the Solomon Islands after the recent civil war. Western Samoa reports 10 cases per year which has remained stable for the past decade.

Stigma is a major barrier that may counteract uptake of any prevention approach that may reveal the identity of a leprosy patient to members outside their family causing further distress and discrimination to the patient and their families. Currently there is no evidence of how Pacific communities perceive, view and know about leprosy. The Pacific Leprosy Foundation (PLF), my sponsor, aims to eradicate leprosy in the Pacific. Therefore, it is necessary to tailor community-specific prevention approaches and to produce relevant educational tools.

Aim:
This project aims to assess the perceptions, attitudes and knowledge of leprosy among Pacific adults living in Christchurch. The objectives of this project are to;
1. Conduct a literature review on methods used to assess perceptions and attitudes to leprosy
2. Develop a survey to assess attitudes and knowledge to leprosy
3. Pilot the survey data with a total of 100 Pacific participants living in Christchurch

Method:
Keyword searches using the terms “Leprosy”, “Attitudes”, “Stigma” and “Pacific” were performed using online databases for the literature review. One key method for measuring stigma associated with leprosy is the Explanatory Model Interview Catalogue which has been validated and recommended by The International Federation of Anti-Leprosy Association and the Stigma Research Workshop (Amsterdam, 2010). A recent study in Western Nepal used this method to survey people affected by leprosy and non-sufferers to understand how these groups perceived leprosy, their attitudes towards leprosy and gauge their knowledge of the disease. We gained permission by the Western Nepal researchers (lead investigator, Bipin Adhikari), to use the same questionnaire with our own questions added in addressing a single-dose antibiotic prevention treatment proposed by PLF.

The questionnaire was changed to make it easy for people with English as a second language to understand after piloting it among volunteers. The final version of the questionnaire covered demographics, perceptions towards leprosy and their knowledge about leprosy. It was available to be completed on-line using Research Electronic Data Capture software or as an interview. We received Ethics approval from the University of Otago. Anyone who suffered from leprosy was excluded from participating. All participants were aged 16 years and over, of Pacific ethnicity and gave informed consent to participate. Participants were then approached through known networks.

Results:
A total of 64 Pacific people completed this study and the average age of participants was 43 years. The majority (73%) were born in the Pacific Islands and had lived in NZ an average of 23 years. Approximately 90% were in a relationship (married or de facto) and 16% of participants had attended University.

Leprosy was perceived to cause stress on families, particularly the shame associated with having a family member with leprosy (41%) and that this would cause problems for the family (56%). Over half thought that families would be concerned about revealing that a family member had leprosy (62%). This was also thought to have an effect on the community where leprosy sufferers lived. It was perceived that communities associated leprosy with shame (61%), that communities would avoid leprosy sufferers (46%) and families with leprosy sufferers would not be thought highly of (42%). Almost half of participants thought that leprosy will affect their ability to get married and that it would cause problems for on-going marriage.

Interestingly, less than 10% of participants had received information on leprosy. Many did not know what caused leprosy (78%), were not aware of how leprosy is spread (55%) and had no knowledge of the signs and symptoms of this disease (75%). The majority surveyed thought that the disease was difficult to treat (75%), that leprosy was a severe disease (88%) and that it was spread through close contact with leprosy sufferers (88%).

The majority of participants agreed that offering a single-dose antibiotic preventative treatment to unaffected family members was appropriate (92%). Less than 20% thought that neighbours and other potential close contacts who were in contact with leprosy sufferers at least 4 hours, 5 days a week (eg. school friends, work colleagues) should be offered preventative treatment.

**Conclusion:**
Stigma associated with leprosy and the perceived effect on Pacific families with leprosy sufferers and communities in which they live is deep-seated. There is a need for education resources to be developed focussing on the cause of the disease, how leprosy is transmitted and its signs and symptoms. Being able to identify cases of leprosy in the early stages is important for effective treatment of a leprosy sufferer, but also the early uptake of a proposed single-dose antibiotic treatment to unaffected family members and those in close contact. In order to dissolve the strong stigma towards leprosy among Pacific communities requires a careful cultural-specific approach. This study gives valuable direction for the Pacific Leprosy Foundation and their aim to eradicate leprosy from the Pacific Islands.
Introduction:
Dementia is a clinical syndrome very common in the elderly and symptoms progress as people age. It is common for them to experience a decline in cognitive mental ability but it is not a normal part of growing older. Symptoms of dementia can vary depending on underlying causes and various factors. The most common characteristics of cognitive impairment involve memory lapses, repeating stories, disorganised speech, mood swings, placing things in inappropriate places and poor hygiene. Dementia causes short-term memory loss which affects everyday activities of life such as managing finances or medications. The main cause of dementia is Alzheimer’s in 60% of cases and another 40% includes vascular dementia, Fronto-temporal dementia, Lewy body dementia, alcohol related dementia and dementia with Creutz-Jakob disease. Acute cognitive decline is often the first indicator of an underlying somatic imbalance such as dehydration and urinary incontinence. Cognitive impairment due to dementia may impact negatively on the effectiveness of treatments and interventions for other aging related diseases and also increases the length of hospital stays.

In New Zealand, 44,000 people have been diagnosed with dementia and this figure is likely to represent only 60% of actual cases. Equally as with most industrialised countries, New Zealand is expected to experience a significant increase in the aging population. The percentage of people aged 65 and over is expected to increase from 13% in 2009 to 21% in 2031. There will be one million people over the age of 65 in 2020, when they will outnumber the child population. As the aging population increases in New Zealand, the emotional, social and economic costs of dementia are expected to increase. It is crucial to understand the level of cognitive impairment due to dementia and the outcomes of cognitive impairment in the elderly population so as to help New Zealand population to grow healthier.

Aim:
To determine the effect of cognitive performance scale results on outcomes for elderly people with dementia in Canterbury.

Method:
In this project, the data on elderly Canterbury residents with full interRAI MDS home care assessments and data on medium term outcomes using National Minimum Data Set (NMDS) were used.

The InterRAI assessment was developed by a multi-disciplinary collaborative network of academics and clinicians in over thirty countries committed to improving the care of older people. In 2008, the Ministry of Health in New Zealand implemented the interRAI assessments in 21 districts and assessments became compulsory for all applying to use care services or to enter residential care. NMDS is a national collection of public and private hospital discharge information, including coded clinical data for in-patients and day-patients.
Three thousand Canterbury residents had full interRAI MDS assessments, of these, 1846 gave informed consent to use their data for research purposes. After removing missing data and repeated entries, 1772 cases were used for final analyses.

The data on interRAI and national minimum dataset were linked using the NHI number. The outcomes such as requirements for residential care and mortality data were established for patients with different levels of cognitive performance. The elders’ level of cognitive performance was derived from cognitive performance scale based on interRAI assessment. The association of cognitive impairment due to dementia with age, sex and ethnicity was assessed.

Results:
About 10% (n=179) of the sample population was diagnosed with dementia in the Canterbury region. Dementia was most commonly present in the elderly aged 75 and above. There is no significant difference between rates of dementia between Maoris and non-Maoris. However, prevalence of dementia was higher among females (11.5%) when compared to males (7.7%). The activity of daily living and cognitive performance scales were strongly associated with dementia. Almost 82% of dementia patients had moderate or severe cognitive impairment. The statistical analyses indicated that dementia with mild to severe cognitive impairment and urinary and bowel incontinences were the major predictors of early admissions to residential care, when controlling for age, sex and ethnicity.

Conclusion:
The study results indicate that the prevalence of dementia is common among elderly in Canterbury and it was associated with mild to severe cognitive impairment. Dementia is one of the major causes of early institutionalisation. The results imply that the cognitive performance scale measured using interRAI assessment could be used as an indicator of early admission to residential care. The result also implies that interRAI assessments could be used to identify dementia patients with cognitive impairment. Those who identified with mild or severe cognitive impairment should be targeted for appropriate intervention to prevent early admission to residential care. This information will be used to help improve the care of elders with dementia.
Introduction:
Incontinence of the bladder and bowel represent a significant burden to the health of an older person and the resources of the health system. Urinary incontinence (UI) has been previously associated with depression and decreased quality of life. From the available literature it is unclear whether UI is a predictor of mortality and residential care admissions (RCA) independent of other factors such as disability and frailty. The number of studies looking into the relationship between faecal incontinence (FI) and mortality and RCA is small and the results again have been inconclusive.

Establishing a relationship (or a non-relationship) between incontinence, mortality and RCA will inform future management in Older Persons Health and allow allocation of resources to factors that make real differences to outcomes.

Since 2008 Canterbury District Health Board (CDBH) has been undertaking interRAI home care assessments for patients (aged 65+) being considered for access to home and community support services as well as access to residential care. An interRAI assessment is designed to be comprehensive, comprising of more than 200 questions including those on UI, FI and potential confounding factors. In 2013/14, 96% of those entering aged residential care have had a clinical assessment of need using interRAI.

Aim:
To evaluate whether incontinence, both urinary and faecal are predictors of outcomes such as mortality and residential care admissions in the Canterbury region.

Methods:
1) Results from 1846 CDHB interRAI assessments between February 2008 to June 2013 were obtained. Outcome data were taken as one year beyond this range.
2) Using the NHI linkage, data on utilisation of residential care subsidies and death were obtained.
3) Impact of UI and FI on these outcomes was analysed and was adjusted for potential confounding factors (e.g. age, gender, frailty, disability, dementia).

Results:
Mortality
A total of 787 deaths occurred in our study population between the date of interRAI assessment and the end of follow up.

The hazard ratio (HR) for death for the UI group compared to non-UI group was 1.17 (95% CI 1.01-1.36), increasing with higher frequency of UI. However adjustment for confounders revealed a non-significant result.
HR for death for the FI group was 1.72 (95% CI 1.43 - 2.06), increasing also with higher frequency of FI. In contrast to UI, this relationship persisted after adjusting for confounders. (HR 1.30, 95% CI 1.06 -1.58)

Residential Care Admissions
A total of 565 residential care admissions (RCA) occurred in our study population between the date of interRAI assessment and the end of follow up.

HR for RCA for the UI group was 1.35 (95%CI 1.13 – 1.61) but this association was not statistically detectable after adjustment.

HR for RCA for the FI group was 1.61 (95%CI 1.28 – 2.02), after adjustment the HR remained statistically detectable at 1.35 (95% CI 1.06 – 1.72).

Relationship between UI and FI
We found a high degree of concurrence between UI and FI. Increasing frequency of UI was related to increasing frequency of FI. When UI is added to the statistical model with FI already in it, the resulting improvement in the model is not statistically detectable for both mortality and RCA.

Conclusion:
In our study population we found that faecal incontinence was an independent predictor of mortality and residential care admissions. The apparent relationship between UI and the above outcomes prior to adjustment appears to be driven by the frequent concurrence of UI and FI. Urinary incontinence itself was not an independent predictor of mortality or RCA.

The potential uses for the accumulated interRAI assessment data are substantial. It represents a comprehensive description of variables relevant to an older person’s health which is readily available for future research.

One possible future project (which would need larger numbers possibly from a national study) is to evaluate whether indwelling catheters have an impact on mortality and RCA in our study population.
Introduction:
Legionnaires’ Disease is a severe type of pneumonia caused by mainly two species of legionella bacteria in New Zealand; *Legionella pneumophila*, which is commonly found in aerosols (e.g. air conditioning) and *Legionella longbeachae*, which is found in compost, potting mix and soil. About 20% of hospitalised cases of community-acquired pneumonia in Canterbury during the spring and summer are caused by *L. longbeachae*. The majority of cases of Legionnaires’ Disease caused by *L. longbeachae* in Christchurch arise in the spring and summer, with the peak number of cases occurring between November and January.

In New Zealand, bags of purchased potting mix and compost have guidance on how to prevent Legionnaires’ Disease printed on them. However, this guidance is based on limited information about risk factors from small amount of data.

A case-control study was begun in 2013/2014, to identify risk factors for Legionnaires’ Disease caused by *L. longbeachae* in the Christchurch population. The sample size for this study was not large enough to give reliable information. We have thus expanded the case-control study in Christchurch to include the time period of November 2014 to January 2015, with the aim of increasing the sample size.

Aim:
To better characterise the risk factors for Legionnaires’ Disease caused by *L. longbeachae*, so that current prevention guidelines can be modified to decrease the number of future cases.

Method:
Our case-control study involves comparing the gardening habits and health of cases (who have the disease), to those of the controls (who do not have the disease), using our standard questionnaire. As Legionnaires’ Disease is a notifiable disease, cases are normally found and interviewed by Health Protection Officers (HPOs). If *L. longbeachae* is found in the samples from cases and they consent to participate in our case-control study, the HPOs interview these cases using our questionnaire.

We aimed to interview about 3 controls per case. From previous experience, we expected around 30 cases and a participation rate among controls of around 30%. Based on these figures, 300 potential controls were randomly selected from the electoral roll. They were age-matched to cases from previous years, so that our control group could reflect our case group as accurately as possible. We broke our group of 300 potential controls into 4 batches, so that we could send out their information packs and consent forms at the rate at which we expected to find cases. If consent was obtained from potential controls, we called them and arranged an interview time. Participants were interviewed at the arranged time and the data obtained was entered for analysis. If the potential controls did not respond to the first letter, we sent them a reminder letter, approximately two weeks after their first letters had been sent.
we still heard no response, we called the potential controls at the phone numbers listed in the Christchurch White Pages, if they could be found.

**Results:**
The study will continue beyond the period of the summer studentship and full statistical analysis will be performed in mid-2015. I performed preliminary descriptive analysis on a subset of data collected by 14/1/2015. Eighty-two controls had been interviewed by this date (inclusive).

Our response rate so far has been better than that of the previous year (39.4% have agreed to participate, compared to 30.1% from the previous year). Male participants made up 36.6% of the control population and females made up 63.4%; compared to 66.7% male and 33.3% female in the case population. Control participants who are at least 60 years old made up 36.7% of the control population, compared to 75% of the cases.

Data for 7 variables were analysed, revealing that 43.9% of the controls interviewed by 14/1/2015 had handled or used potting mix in the last 3 weeks, compared to 100% of the cases interviewed by that date. Of those who had used potting mix, 94.4% of the controls were aware of the risks associated with potting mix, compared to 88.9% of the cases. Participants who said they had worn gloves the last time they had handled potting mix made up 61.1% of the controls who had used potting mix in the last 3 weeks, compared to 77.8% of the cases having worn gloves the last time they had handled potting mix. Participants who wore a mask the last time they had handled potting mix made up 19.4% of the controls who had used potting mix, compared to 22.2% of the cases who had used potting mix.

Participants who had used or handled soil in the last 3 weeks made up 79.3% of the control population. Participants who had used or handled compost in the last 3 weeks made up 45.1% of the control population. In comparison, 66.7% of the cases had used or handled soil in the last three weeks and 55.6% had used or handled compost in the last three weeks. Among controls, 31.7% had smoked at least 100 cigarettes in their lives, compared to 66.7% of the cases.

**Conclusion:**
Full analyses are yet to be performed, but preliminary analyses show that response rates were not high and that there are potentially some differences between responses in cases and controls (these must, however, be better examined in full statistical analyses). Although our response rate has been an improvement from last year’s study, it is likely that there will still be a potential for bias in our results. The low response rate might be due to people misinterpreting the information that we sent out to them (e.g. many declined due to doing no gardening or being away for a few weeks, even though our information pack specified this would not be an issue; some thought they would have to come into the hospital for an interview; many filled out the consent form incorrectly).

Differences in responses to questions by cases and controls could be due to chance (this will be explored in later analyses) or recall bias. Recall bias is when the answers given by the cases are systematically different to those given by the controls, due to cases tending to think more and harder about the events which may have led to them acquiring the disease, compared to the controls.

However, despite these issues, the results of the full analysis will provide more information on risk factors for Legionnaires’ Disease. In particular, they will address the use of potting mix, compost and soil, touching one’s face, eating or having a drink whilst gardening, using gloves and masks and having contact
with birds or other animals. Our study has the potential to markedly improve the prevention of Legionnaires’ Disease in Christchurch.
Introduction:
Harm from alcohol consumption can be broadly divided into long term and short term harms. Short term harms are caused by the immediate effects of alcohol on the body and include intoxication related injuries and alcohol poisoning. Long term harms such as liver disease in comparison occur due to toxic effects of alcohol on the body over time from recurrent consumption of significant amounts of alcohol.

Drinking guidelines attempt to set an upper limit on the amount of alcohol that may be consumed in which both long and short term harms from alcohol are minimised. This project focussed on short term harms related to per occasion drinking. In 2011, the Health Promotion Agency (HPA) revised the drinking guidelines in New Zealand and referred to these as “low risk” drinking guidelines as follows;
- For women: no more than 4 standard drinks on any one occasion
- For men: no more than 5 standard drinks on any one occasion

In New Zealand, a standard drink is equivalent to 10 grams of pure alcohol.

Aim:
The purpose of this project is to explore the validity of the current HPA guidelines for per occasion low risk drinking.

Methods:
(1) Mathematical Modelling
The estimated blood alcohol concentration (EBAC) in grams per 100mL of blood was mathematically modelled for both men and women for a range of body weights (45-110kg in women, 50-120kg in men), range of standard drinks (1-5 in women, 1-6 in men) and range of drinking periods (1-5 hours) using the formula:
\[ EBAC = \frac{(0.806 \times \text{standard drinks} \times 1.2)}{(	ext{body water constant} \times \text{body weight})} - (\text{metabolism rate constant} \times \text{drinking period}) \]
This formula combines the key factors which influence a person’s blood alcohol concentration (BAC) such as weight and gender specific body water content. Some of these factors are subject to variability hence this study also modelled the uncertainty associated with these parameters in the formula for each result. This involved the use of the statistical software SPSS to run 2000 simulations for each combination of gender, weight, drinking period and number of standard drinks consumed. Additionally, statistical analysis identified the percentage of the population who would be either below or at a BAC of 0.04 for each combination as a BAC of 0.04 was chosen as representing an upper limit of “low risk” drinking.

(2) Community Survey
40 people aged 18 and above were randomly selected from the Christchurch Residential White Pages to complete a telephone survey. The participants were briefly questioned about the current HPA per occasion low risk drinking guidelines.
Additionally, participants undertook a thought experiment where women and men were to imagine drinking 4 and 5 standard drinks respectively over a 2 hour period and then asked to rate their level of functioning in 3 scenarios. Participants were asked again to rate their level of functioning for the same 3 scenarios if they had consumed no alcohol for comparison.

**Results:**
The average weights of men and women in New Zealand are around 90kg and 75kg respectively. The mathematical modelling showed that 11.7% of 90kg men who have consumed 5 standard drinks in a 2 hour drinking period would have a BAC of 0.04 or less. Extending the drinking period to 3 hours showed an increase to 44.5%. Lowering the number of standard drinks consumed to 4 and then 3 for a 2 hour drinking period showed that the proportion of 90kg men with a BAC of 0.04 or less would increase to 47.2% and 90.6% respectively. For women, the results revealed that 4.5% of 75kg females who have had 4 standard drinks in 2 hours would have a BAC of 0.04 or less. This increased to 25.1% if the drinking period was extended to 3 hours. Similarly to men, reducing the number of standard drinks consumed to 3 and then 2 for a 2 hour drinking period raised the figures to 37.1% and 87.9% respectively. The mathematical model further demonstrated that men and women below the average weights are even less likely to have a BAC of 0.04 or less than the numbers stated previously.

40 out of the 95 participants (42%) that were contacted completed the telephone survey. The thought experiment section of the survey revealed that the majority of people believed that they would function better in the 3 scenarios if they had consumed no alcohol compared to having 4 or 5 standard drinks in 2 hours. Around half the participants (49%) thought the current guidelines for per occasion drinking was at the right level. All the other participants except one thought the guidelines were either too high or far too high. However, when participants were initially invited to guess the number of standard drinks the current guidelines indicate for per occasion low risk drinking many stated a number below the 4 and 5 standard drinks with the median number being 2.5.

**Conclusion:**
This study identified that a large proportion of New Zealand men and women would reach BAC levels over 0.04 if they consumed 5 and 4 standard drinks respectively as stated by the HPA guidelines for per occasion drinking over 2 to 3 hours. The mathematical model suggests that the current per occasion drinking guidelines for both men and women are too high and should be lowered to match the description of “low risk” drinking as defined by a BAC of 0.04.

The community survey, although a small study, shows there is a perceived reduction in the ability to function under the influence of alcohol at levels stated by the drinking guidelines. Interestingly, the survey further revealed that a considerable proportion of people seemed to adjust their initial thoughts on what they believed would constitute “low risk” drinking from more conservative numbers of standard drinks to that of the guideline.
Introduction:
Continuing professional development (CPD) for physiotherapists, as with other health professionals, assists them to provide effective and efficient care to patients. There are mandatory requirements for the physiotherapy recertification programme, which is undertaken every three years to ensure necessary CPD is being carried out. The Pegasus Health small group education programme (SGEP) is a peer-led programme, which was initially established two decades ago for GPs (1993) and has further expanded to involve practice nurses (1998) and most recently, pharmacists (2010). The programme runs Canterbury wide and its underpinning philosophy is to promote a primary care team approach both to care and to continuing education. The SGEP aims to improve inter-professional collaboration and understanding of health professional roles, to identify where evidence based gaps exist and to explore and promote innovative ways of working to improve efficiency.

Aim:
The purpose of the study was to complete a learning needs analysis of Canterbury physiotherapists to establish the most effective modes of delivering ongoing CPD and whether the CPD currently available was meeting their needs and requirements. The study aimed to identify opportunities for further development of the Pegasus Health education programme in order to deliver sustainable professional development for community physiotherapists. The project also aimed to explore whether the potential addition of physiotherapy to the SGEP could help extend collegial working and learning relationships across multiple disciplines, improving communication and therefore providing better outcomes for patients.

Method:
A brief literature review on the learning needs and educational requirements of community physiotherapists was carried out, along with research to determine CPD available to physiotherapists. A questionnaire was developed and sent out to survey physiotherapists’ satisfaction and whether current engagement and level of available CPD meets their needs. The survey was sent out electronically to all Physiotherapy New Zealand registered physiotherapists in Canterbury and the West Coast. Following the questionnaire a focus group was carried out to explore ideas arising from the questionnaire and to discuss CPD needs in more depth. Formal invitations were sent out to 10 individuals to take part in the focus group discussion. The discussion was recorded and transcribed and themes were identified and explored in light of both the quantitative and qualitative data collected. A simple thematic analysis was then undertaken.

Results:
Ninety responses were received from the 477 questionnaires sent (response rate 19%). The learning needs analysis carried out from the questionnaire identified that respondents had no difficulty in achieving the necessary CPD hours. However, over half of the respondents indicated they did not think the CPD currently available was effective at meeting their professional development needs.
The survey indicated the greatest reasons for physiotherapists undertaking CPD was to review current evidence, to fill knowledge/skills gaps which may have been triggered by specific patient cases and for their personal interest.

There was a gap identified in both the formal education and professional activities categories. The survey results indicated respondents agreed time and cost to be the greatest barriers to meeting their CPD requirements. Some 94% of the respondents indicated they would be interested in peer-led education sessions and 87% of these said they would be able to attend sessions in Christchurch. Overall, 95% of respondents said they believed the sessions would be beneficial for their professional development. Many respondents felt peer-led education sessions would strongly help to improve physiotherapy collegial working and improve inter-disciplinary relationships and patient outcomes.

Four clear themes emerged from the focus group discussion and these correlated well with the results from the survey. The focus group attendees felt there were barriers to carrying out CPD, including: money, time, format of CPD information and motivation. It was suggested there is a need for greater intra and interdisciplinary collaboration and communication and a need for applicable and evidence based information in order to promote best practice. The idea of a more holistic approach to patients and their treatment was also brought up in the discussion and attendees felt this would be achievable with improved collaboration and inter-professional communication.

Conclusion:
Various conclusions can be drawn in relation to the aims of the project. It was found from the learning needs analysis carried out in both the survey and discussion that, although it was not difficult for physiotherapists to meet the recommended CPD, gaps may be present in the formal and professional categories currently provided in Canterbury. This may represent an opportunity for Pegasus Health to provide education in the form of large group sessions or workshops in the future. Physiotherapists felt the CPD was not fully meeting their professional development needs and a number of barriers were evident which prevented physiotherapists from maximising the benefits from their CPD, including time and cost. Themes emerging from the focus group discussion included the idea of greater collaboration and communication inter-professionally and a more holistic approach to patient care. The Pegasus Health SGEP encompassed these ideas and was well received by survey respondents and those who attended the focus group. An initial pilot of a peer-led education session in the future would also be useful to trial and gauge whether physiotherapists’ involvement in this programme would be a success.
Introduction:
The survival of very low birthweight (VLBW) infants (birthweight <1500g) has improved significantly since the 1980’s due to medical advancements, with current survival rates exceeding 90%. However, as increasing numbers of VLBW individuals are reaching adulthood, concerns have arisen that these individuals experience higher rates of health, disability and developmental problems than other young adults. Subsequently, there has been considerable interest in the long term outcomes of this group. The New Zealand VLBW study is a national study which has investigated a group of VLBW babies born in 1986 over time. The health, developmental and functional outcomes of these individuals have been assessed at several stages of the life course and compared against a group of other non-VLBW infants born in the same year (a control group). The next stage of this study is investigating the health and wellbeing of these individuals at 27/28 years and is currently in progress. This research project originates from the above study and is interested in how the parents of these young adults regard their long term outcomes.

Aim:
The primary objective of this study is to assess how parents of VLBW infants born in 1986 in New Zealand view the health, wellbeing and social functioning of their young adults at 27/28 years, compared to control parents. A second objective is to identify whether differences exist between parental and self-assessments of young adult health, wellbeing and function. Only a subset of the full group of VLBW and control parents could be contacted within the time frame of this studentship and the resulting sample size may be too small to detect significant findings. This research will however enable refinement of the study procedures/questions that will later be administered to the complete set of study parents, as well as generating some preliminary results and trends which can guide and inform ongoing research in the area.

Method:
40 parents of VLBW young adults (VLBW parents) and 30 parents of non-VLBW young adults (control parents) were asked a questionnaire over the telephone regarding their offspring’s health and quality of life, social functioning, employment/education, fitness/coordination, personality and behaviour. The questionnaire was mostly structured (e.g. answers on a scale from “very good” to “very poor”) but also included a few open format components which allowed parents to freely express their own ideas and thoughts. The answers, along with some self-assessment data from the NZ VLBW study, were entered into an electronic database. Structured components were then analysed under biostatistician direction using the statistical package SPSS. Open format components were transcribed and categorised based on topics discussed and the resulting emergent themes identified (thematic analysis).

Results:
There were several significant differences between VLBW and control parents’ responses across a number of areas, which are summarised below. For some items trends were found in the expected direction which may have reached significance with a larger sample size, however it was encouraging to note that for many variables no such trends emerged. This suggests that VLBW young adults may experience similar outcomes to controls for many measures.

Health
Parents of VLBW young adults reported that their child experienced poorer health at a young age, as well as a greater mean number of health problems throughout the life course.
VLBW young adults were more likely to be living with a significant physical disability at 27/28 years than controls and a greater proportion of VLBW young adults had been diagnosed with chronic wheeze/cough and certain bone/joint problems in their lifetime. Of the additional comments made by parents about their child’s health, poor airway/lung function was a common theme and was noted more frequently by VLBW parents than controls. Interestingly, across both groups more parental than self-reports described young adult health as fair/poor. 22.5% of VLBW parents felt their offspring’s current health was fair/poor compared with 7.5% of the young adults themselves.

**Education**

Parents of the VLBW group reported a higher number of childhood academic difficulties than control parents. Mathematics in particular was a problem area, with half of all VLBW children experiencing some difficulties, compared to 20% of control children. VLBW children were more likely to be diagnosed with a learning difficulty than were controls (25% and 6.7% respectively) and a greater proportion received extra help/support with schoolwork, behaviour or other difficulties.

**Behaviour and personality**

VLBW parents scored their children more poorly than controls for several personality/behavioural traits: attention/concentration, social maturity/responsibility and leadership. When asked about risk-taking behaviours, VLBW young adults were found more likely to have been arrested than controls, although the NZ VLBW study found that at 22/23 years the VLBW group were less likely to have been arrested.

**Social functioning**

The quality of parent-child relationships was slightly lower in the VLBW group and parental over-control marginally higher, a trend that was consistent across parental and self-reports. VLBW young adults had fewer friends than controls (based on self and parental assessment) and were also less likely to be in a current romantic relationship. Parental reports suggest the VLBW group are more likely to experience difficulties forming partner attachments and may be delayed in doing so.

**Physical fitness/co-ordination**

VLBW young adults struggled more than controls with certain aspects of physical coordination (e.g. catching a ball). Interestingly, engagement in regular physical activity was rated similarly by parents across both groups, however based on young adult self-reports, the VLBW group are less likely to participate in regular exercise.

**Quality of life/self esteem**

Parents rated overall quality of life slightly lower for VLBW young adults, but scored them higher than controls for self-esteem. This differs from self-reports where self-esteem was found to be poorer in the VLBW group. VLBW individuals were also more likely to experience lower overall life-satisfaction, which was consistent across self and parental reports.

**Conclusions:**

Parental assessment of young adult health and functioning has highlighted a number of areas where VLBW young adults experience poorer outcomes than their non-VLBW counterparts. Further trends have been implied by the data which lack significance but are largely consistent with previous findings. It is encouraging to note that for many of the outcomes investigated, no differences were suggested between the two groups. The findings from this study, along with comments regarding study questions/protocols, will be useful in informing ongoing research in the area and a source of interest in the future.
Introduction:
One of the aims of the Christchurch Regenerative Medicine and Tissue Engineering (CReaTE) group is to repair damaged or diseased human musculoskeletal tissues such as cartilage or bone by combining patients’ cells (e.g. stem cells) with degradable biomaterials in order to generate new functional tissues. Porous biomaterial scaffolds are central to tissue engineering strategies since they provide a carrier for cells and are responsible for promoting reparative tissue formation.

The CReaTE group has developed cutting edge 3D Printing technologies. Their in-house and commercial 3D BioPrinting machines are capable of printing biodegradable polymers, cells or micro-tissue units. Micro-tissues are small (1mm diameter) spheres consisting of human cells, grown in the lab which can be seeded or placed, into a porous 3D printed scaffold. A prototype micro-tissue handling system has been developed to aid in the seeding process. The automated handling system is designed to singularise micro-tissues. This is so that large numbers of micro-tissues can be individually selected and inserted into the scaffold without the micro-tissue being damaged. The singulation device uses fluidic valves connected to cell media under positive and negative (vacuum) pressure. These valves can be controlled electronically to add or remove media from the designed singulation chamber enabling the capture and then release of individual micro-tissues.

Aim:
The overall aim of this project was to use bioengineering and mechatronics principals to make further progress into developing a fully integrated and automated system capable of 3D printing scaffolds and inserting live micro-tissues into the scaffolds. Initially the singulation device had to be reconstructed and tested in order to determine what improvements needed to be made. From this the following key objectives were defined;
• Optimise and automate the singulation device
• Develop a micro-tissue sensing method
• Integrate the singulation device onto the 3D printer head
• Establishing a communication pathway between the singulation device control system and the 3D printer

Method:
In order to control the singulation device, a LabVIEW based controller was used. LabVIEW is a software tool that uses a graphical programming language to programme a microcontroller. A large amount of time was spent developing LabVIEW code in order to make the system function correctly. The system also had to be automated so once an external start command was received, a single micro-tissue would be delivered.
The sensing system was designed to detect the micro-tissue leaving the singulation chamber and travelling to be seeded into the scaffold. It was implemented with a simple photo-interrupter circuit that produced an electrical pulse whenever a micro-tissue passed through the sensor. This pulse was detectable by the microcontroller and software was used to process and display the results to the user. To ensure the sensing circuit worked reliably, it was tested by passing 100 micro-tissues through it and recording any failures. Integrating all the components of the singulation device onto the tool head required modification of numerous components to fit within the space confines of the 3D Printer. The Perspex blocks containing the fluidic valves were modified to add screw holes so it could be securely mounted and the block was altered into a manifold to minimise the number of connections required which saved space. Some components were also 3D printed to allow other components, such as the hopper, to be mounted in optimal locations.

Communication between the singulation device and the 3D printer enables the printer to ask the singulation device to seed a single micro-tissue and for the singulation device to reply with any errors. The intention was for this to be conducted using the spare inputs and outputs available on the 3D printer and to be interfaced to the singulation device controller. The interface between devices would be electrically isolated to prevent damage in the case of faults.

**Results:**

Improvements implemented during this project mean the system now operates more reliably from a software perspective. The control loops maintaining constant positive and negative pressure are significantly more stable and work over a larger range of input pressures. The system is fully automated and has software routines to automatically clear blocks and alert the user if the singulation process fails.

The results of testing the sensor system indicate it is highly reliable with a 96% success rate. The four failures were cases where the system detected two micro-tissues instead of one. Further investigation indicates this is probably due to air bubbles leading or following the micro-tissues. The source of the air bubbles has been determined and replacement seals have been ordered.

Mounting all the components of the singulation device onto the printer head was a success. All the components fit well and the head fits within the docking station. The tool changer can successfully pick up, replace and move the tool head without problems.

The communications system needs further work for it to interface and control the spare input and output pins correctly. In the meantime, we have developed a temporary method that allows for single direction communications to allow the printer to request a micro-tissue. This is currently in the testing stage.

**Conclusion:**

Significant progress has been made with the project. The singulation system is now fully automated and mounted onto the print head. The communications between the devices will allow true automation - where a whole scaffold can be printed and seeded with the press of a single button. These developments mean that we are close to realising our capability for the fully automated 3D printing and assembly of micro-tissues to form advanced tissue engineered grafts to repair patient’s damaged or diseased cartilage and bone.
OVER ALL WINNING PROJECT

Student: Sam Hall-McMaster
Project: Are breast tumour cells and adipocytes co-conspirators in aggressive breast tumours?
Supervisors: Elisabeth Phillips and Margaret Currie
Sponsor: The New Zealand Breast Cancer Foundation

Introduction:
Over 600 New Zealand women lose their lives to breast cancer every year. To reduce this figure, the need to further our understanding of breast cancer is paramount. A related medical concern is the rise of obesity in New Zealand, which has been shown to contribute to worse breast cancer outcomes. It is therefore important to investigate cross talk between fat cells (adipocytes) and tumour cells, as well as how one might change the other. It has been reported previously that adipocytes get smaller in the presence of breast cancer. To our knowledge, however, this has never been rigorously tested in patient samples. Furthermore, changes in adipocytes are part of a recent hypothesis into how fat cells may promote breast cancer metastasis. Thus, a rigorous, objective investigation of adipocyte change is needed to assess the validity of this hypothesis. In addition, it has been recently been shown the maturity of the stroma, or supportive tissue, can predict prognosis for colorectal cancer. Whether this is also the case for breast cancer is yet to be tested.

Aim:
Our main aim was to measure the size of adipocytes inside breast cancer (cancer-associated adipocytes or CAAs) and compare them with those in normal breast tissue. We aimed to test whether CAAs produce different proteins to normal fat cells and also aimed to measure stromal maturity. To gauge whether any changes were meaningful, we aimed to correlate our data with a predictive marker for patient outcome, the Nottingham Prognostic Index (NPI). Doing so would help us address whether changes in fat cells are associated with more aggressive breast tumours.

Method:
First an understanding of what breast cancer looks like and the cells involved, was gained to accurately distinguish CAAs from peripheral adipocytes. Immunohistochemistry procedures were optimised, in that the most effective antibody concentration was determined. Specifically, an antibody for the protein perilipin was optimised, which makes fat cells visible by staining the outside of the cell. Optimisation of the antibody for fibroblast specific protein-1, which may be produced by CAAs, was unsuccessful due to insufficient antibody binding.

A tissue microarray, with 90 patient samples, was stained for perilipin. Each sample was taken from the edge of a breast tumour, which was ideal for our purposes because it provided a selection of adipocytes both within and outside tumours. Ten samples were selected that contained both CAAs and peripheral adipocytes, which controlled for individual patient variation in adipocyte size. Adipocyte number and diameter were measured using a set of rules that were used consistently across the samples. Only adipocytes stained for perilipin were measured. Sample size was expanded to 31 by including samples with either CAAs or peripheral adipocytes. Statistical analysis was performed to test whether CAAs were significantly different from peripheral adipocytes. Data was correlated with the NPI, a prognostic tool that
incorporates tumour size, grade and whether cancer has spread to the lymph nodes. A NPI higher score indicates worse prognosis.

A scoring system for stromal maturity was created, based on consultation with a pathologist. This measured the stromal density, colour and fibroblast size for each sample. Scores from the three variables were combined to give an overall maturity score, which was correlated with NPI.

Results:
Adipocytes inside breast tumours were significantly smaller than those outside it. This was true for the 10 samples initially selected and the expanded adipocyte size list (n=31).

The strongest correlations came from samples containing both CAAs and peripheral adipocytes (n=9). In particular, significant negative correlations were found between NPI and CAA number, as well as between NPI and the ratio of CAA - peripheral adipocyte number. A negative trend was found between NPI and peripheral adipocyte size. Conversely, a positive trend was found between NPI and the ratio of CAA - peripheral adipocyte size. No correlations were found when sample size was increased, but variation in patients’ adipocyte size was not taken into account. No correlations were found between NPI and stromal maturity scores.

Conclusion:
Adipocytes are significantly smaller in breast cancer tumours than those adjacent to the tumour. To our knowledge, this is the first time this effect has been objectively tested and statistically confirmed in patient samples. It remains unclear whether changes in adipocyte size affect the proteins they produce and this should be further explored.

For samples containing both CAAs and peripheral adipocytes, worse prognosis seems to be associated with having fewer, larger CAAs. However, this conclusion is based on a relatively small sample size and further research is needed to assess its validity for the wider population.

Stromal maturity may not be predictive of patient prognosis in breast cancer. However, this may reflect differences in our definition of stromal maturity, compared with the definition applied to colorectal cancer.

Overall, we have clearly demonstrated that adipocytes are altered in the breast cancer process. While we cannot say whether they play an active role, the possibility remains that adipocytes may be co-conspiring with cancer cells to make breast tumours more aggressive.
**Introduction:**

Ovarian cancer is the second most common gynaecologic cancer and the leading cause of death from gynaecologic cancers. It is a difficult cancer to treat as it often goes undetected until the tumour has spread and current treatment involves surgery to remove large tumour masses, with chemotherapy given to try and eliminate the remaining tumour cells. Although most patients respond to chemotherapy initially, the disease recurs for the majority of patients and survival is poor.

Advanced ovarian cancer causes the accumulation of body fluid in the abdominal cavity, known as ascites. Tumour cells use ascitic fluid as a vehicle to move around in the abdominal cavity. Often, tumour cells form small clumps known as spheroids, which tend to deposit on the abdominal cavity walls and grow to form a separate tumour. This is one of the factors making ovarian cancer treatment difficult.

Recently, it has been found that the ascitic fluid taken from patients contains many cytokines and growth factors which create a favourable micro-environment in the abdominal cavity, in which the tumour cells survive and thrive. Therefore, it has been suggested that the cytokines and growth factors in the ascitic fluid play a vital role in facilitating tumour growth and spread. However, the effect of these cytokines and growth factors on ovarian cancer cells are not well understood and this is a current area of interest in ovarian cancer research.

Furthermore, there is a huge effort underway to develop a new treatment for ovarian cancer and a large number of new, “targeted drugs” (which target specific cell signal pathways, as opposed to chemotherapy which is toxic to all growing cells) being developed and tested and despite a number of them showing great promise in the laboratory, few have proven effective on their own. Given the range of cytokines and growth factors found in the ascitic fluid, it is possible that the failure of these new drugs may be related to the effect of the ascitic fluid on the tumour cells.

This project is a proof-of-concept study for using ascitic fluid collected from patients with advanced ovarian cancer as an important biological sample in ovarian cancer research. The study focuses on a class of cell signal receptors known as tyrosine kinase receptors (which are the targets of a class of drugs known as tyrosine kinase inhibitors) and sets out to determine how treatment with ascitic fluid alters the activation of these receptors. The study also investigates the effects of ascitic fluid on the growth activity of cultured ovarian cancer cells. Additionally, ascitic fluid was added to an experimental drug (canertinib) which inhibits two growth factor receptors found in some ovarian cancer cells (EGFR and Her-2) to study its effects on the growth activity of cultured ovarian cancer cells treated with the drug.
Aim:
- To identify the tyrosine kinase receptor activation profile in ovarian cancer cell lines stimulated with ascitic fluid
- To examine the growth activity of ovarian cancer cells in the presence of ascitic fluids
- To examine the growth activity of ovarian cancer cells stimulated by ascitic fluids in the presence of an EGFR/HER-2 inhibitor

Method:
This study used ovarian cancer cells from two established cell lines, OVCAR-5 and SK-OV-3’ as well as ascitic fluid samples collected from consenting patients with advanced ovarian cancer.

For each experiment, cells taken from the cultures were grown in wells coated with a polymer to stop cells adhering to the surface of the wells, forcing the cells to form clusters, which closely emulates the behaviour of ovarian cancer cells inside the abdominal cavity of patients. The cells were grown for 5 days in a culture medium which supports cell growth. They were then starved for 24 hours in “starvation medium”, a culture medium with only the essential nutrients for survival. The cells were then treated in the following possible conditions - (1) cells with starvation medium, (2) cells with canertinib, (3) cells with 50% patient A ascitic fluid, (4) cells with patient A ascitic fluid plus canertinib, (5) cells with 50% patients B ascitic fluid and (6) cells with patient B ascitic fluid plus canertinib. Cells were treated with the conditions described above for 24 hours before being collected for analysis.

For experiments investigating tyrosine kinase receptor activation, the cells were broken up and their contents (the cell lysate) were analysed using a commercial antibody array kit which detected the activated (phosphorylated) forms of a number of different tyrosine kinase receptors.

For experiments investigating growth activity, the cells were collected, treated with a dye which helps identify alive (viable) cells from dead ones and counted on a special microscope slide (a haemocytometer) under a microscope.

Results:
1) Cells treated with ascitic fluid showed a different profile of tyrosine kinase receptor activation compared to cells not treated with ascitic fluid and ascitic fluid from the two patients gave rise to two different activation profiles.
2) Cells treated with ascitic fluid had increased cell growth activity compared to cells which were not treated with ascitic fluid.
3) Both patients’ ascitic fluid were able to keep cells alive when treated with the experimental drug canertinib, whereas many cells not treated with ascitic fluid but treated with canertinib alone died (with clear evidence of cell death under the microscope and reflected in the number of surviving cells).

Conclusion:
The preliminary results gathered in the course of this project suggest that cytokines and growth factors in ascitic fluid play a key role in the survival, growth and possible increase of drug resistance of advanced ovarian cancer cells. The modest response of advanced ovarian cancer patients to EGFR/Her-2 inhibitor was well established in clinical trials, but there was no scientific rationale for that such ineffective treatment. The preliminary data from this project may shed the light on the basis of insensitivity of tyrosine kinase inhibitors in advanced ovarian cancer patients. Above all, this project has proven the concept of ascites research – it has shown that the study of ascitic fluid in ovarian cancer research is a promising area which will not only further our understanding of the biology of ovarian cancer, but also promises to reveal why so many experimental drugs have failed and how we can overcome those barriers to develop better treatment for ovarian cancer.
Student: Lucy de Jong  
Project: Human amylase gene copy number variation and breast cancer development  
Supervisor: Logan Walker  
Sponsors: Elaine Jensen and the late Janet Collerton, Cancer Society Oxford and Kaiapoi Groups  

Introduction:  
The enzyme amylase is produced by the salivary glands and the pancreas and its function is to break down starch into simpler sugar molecules, like glucose and maltose. The gene that codes for salivary amylase is called AMY1 and the number of copies of this gene ranges from 2 to ~17 copies between different people. A study in 2014 by Falchi et al. published in the journal Nature Genetics revealed an inverse relationship between copy number of amylase and Body Mass Index (BMI). This means that individuals with low copy number of AMY1, are more likely to have high BMI and develop obesity. The mechanism of action for this relationship remains unknown. The BMI of the New Zealand population has been increasing over the last few years and this puts our population at risk of diseases such as breast cancer. Furthermore, high BMI is associated with the risk of estrogen receptor (ER) negative and/or progesterone receptor (PR) negative breast tumours which have poor prognosis. ER and PR status may be influenced by changes in expression of various genes, however the molecular link between the expression of these receptors and BMI is unclear.

Aim:  
1. To establish a reliable method of measuring AMY1 copy number  
2. To identify gene(s) whose expression changes are associated with breast tumour subtype  
3. To measure AMY1 copy number of breast cancer patients and compare this with tumour subtype

Method:  
To measure copy number of AMY1 I used two quantitative Polymerase Chain Reaction (qPCR) techniques with SYBR Green and TaqMan chemistry. DNA from two cell lines with known AMY1 copy number were used as references to assess DNA from three further cell lines in which the copy number was unknown.

To explore gene expression changes in breast tumours from obese patients, I bioinformatically assessed data from a previously published study (Creighton et al. Breast Cancer Res Treat 2011) using the online data repository NextBio (http://www.nextbio.com/b/nextbio.nb). The top five genes that are differentially expressed in tumours from obese breast cancer patients were identified through this analysis. I then assessed the expression of these genes in a total of 401 breast tumours in relation to ER and PR status using data from The Cancer Genome Atlas and the online tool cBioPortal (http://www.cbioportal.org/).

Results:  
I found that the SYBR Green technique was more accurate for quantifying AMY1 copy number so used this approach to DNA from 25 breast cancer patients. Of these patients, one carried 4 copies of AMY1, three carried 5 copies, five carried 6 copies, eight carried 7 copies, two carried 8 copies, five carried 9 copies and one carried 11 copies. There was no clear association between AMY1 copy number and tumour grade, ER or PR status. A clearer picture may emerge with a larger sample size. Of the five genes tested for association, GRIA2 and AGTR1 were shown to be downregulated in obese patients compared with healthy weight patients and is associated with ER- (P=1x10^-11 for GRIA2, P=2x10^-33 for AGTR1 and PR-
(P=1x10^{-8} for GRIA2, P=1x10^{-21} for AGTR1) tumours. These results mean that a breast tumour from an obese patient is more likely to have lower GRIA2 and AGTR1 gene expression compared to a patient with normal weight and is more likely to be ER- and/or PR-, which makes the cancer more difficult to treat.

**Conclusion:**
This research project has successfully developed a reliable method of measuring gene copy number using qPCR, and subsequently used it to measure AMY1 copy number in 25 breast tumour samples. Using data from previous studies, we were able to predict that those patients with lower copy number are more likely to be overweight and therefore more likely to have ER- and/or PR- breast tumours with reduced expression of GRIA2 and AGTR1. This project opens up new questions to explore and may be the beginning of a much more comprehensive investigation into the role of genes, such as GRIA2 and AGTR1, in breast tumours from women with low AMY1 copy number and/or high BMI.
Introduction:
Breast cancer is the most commonly diagnosed cancer in New Zealand women. Poor outcomes for breast cancer patients have been linked with obesity in previous studies. Obese women have more distant metastases at diagnosis and higher mortality rates. For this project, I worked with the Mackenzie Cancer Research Group who developed an experimental co-culture system which grows breast tumour cells with adipocytes (fat cells). This changes how both the adipocytes and the breast tumour cells behave. Adipocytes become dedifferentiated, less lipid rich and secrete factors which enhance survival and migration of breast tumour cells. The breast tumour cells become more resistant to chemotherapy and display a more aggressive phenotype making them more likely to migrate.

MicroRNAs (miRNAs) are small non-coding lengths of RNA. They have a key role in the regulation of gene expression and are important in healthy individuals. Cancer is a complex genetic disease and so it is no surprise that miRNAs have been identified as having a role in cancer development. It is also thought that miRNAs have a role in the growth and maturity of adipocytes. There is no current literature reporting the identification and function of microRNAs in tumour cells when they are grown with adipocytes.

Aim:
Obesity rates around the world are climbing and the link of obesity to various forms of cancer is becoming a more important topic to understand. The aim of this project was to identify microRNAs that may be contributing to the changes seen in breast tumour cells co-cultured with adipocytes. This will give greater insight into the biology of adipocytes and breast tumour cells and their interactions.

Method:
Breast tumour cells (MCF7) were grown with and without adipocytes. Tumour cell RNA was then extracted and converted to cDNA. miRNAs were identified using a screening kit that allowed detection of 372 individual miRNAs. Data was analysed, based on detection limits only 226 of the miRNAs were included in the data set for further analysis. The differences between miRNAs in breast tumour cells grown with or without adipocytes were compared using one-way ANOVA analysis to identify miRNAs with significant differences in quantity between the conditions. Five candidate miRNAs were chosen for further validation. This was determined using a series of criteria. Candidate miRNAs had to show a significant difference in quantity between conditions, be detected at a reliable quantity and have a fold change of at least 2.

Results:
The miRNA screening had consistent results across the samples tested. Our results identified 31 miRNAs that showed significantly more or less miRNA in breast tumour cells grown with or without adipocytes. We found that of these 31 miRNAs, 16 increased and 15 decreased significantly when breast tumour cells were grown with adipocytes.
The five candidate miRNAs chosen for further validation were compared to a literature review conducted at the beginning of the study. It was found that all five candidate miRNAs have been implicated in breast cancer in previous studies. Two of the candidate miRNAs, miR-205 and miR-210, are well researched in the field of breast cancer and are promising candidates for further study.

**Conclusion:**
The discovery that numerous miRNAs vary their quantity between breast tumour cells grown with or without adipocytes is novel. No previous studies have investigated the effect of adipocytes on miRNAs in tumour cells. Evidence from this study suggests that miRNAs are part of the mechanism through which adipocytes promote changes in breast tumour cells. This adds to what is currently known about the interaction of adipocytes with breast cancer cells. This pilot study allows further investigation into this area - starting with validation of results using the candidate miRNAs.

The miRNAs we identified may prove to be important in the interaction between adipocytes and breast tumour cells. Further work is needed to see if they have a role to play the increased invasiveness of breast cancer cells and in worse outcomes for obese breast cancer patients.
Introduction:
Coronary heart disease can result in a heart attack and is a leading cause of death in New Zealand, accounting for over 40% of deaths per year. To screen patients for their risk of having a cardiovascular event such as a heart attack or stroke, a GP will refer to the New Zealand Cardiovascular Risk Charts. These charts use traditional risk factors associated with heart disease - age, sex, lipid levels, diabetes, smoking and blood pressure to estimate the likelihood of a cardiovascular event occurring in the next 5 years.

However, traditional risk factor profiling fails to identify many individuals who go on to have an event, with more than 50% of heart disease deaths occurring in people with no previous symptoms or warning signs and who, using current screening, would be considered to be at only moderate cardiovascular risk. There is a need to improve our screening model so that we can better identify people for whom an acute cardiovascular event is imminent.

A newer risk prediction model could include biomarkers that can be measured in blood in addition to traditional risk factors. To identify potential markers, we investigated proteins in blood that differ in abundance between individuals who are genetically susceptible to coronary heart disease, compared with those who aren’t.

Within the last decade, new genomics technologies have identified key regions of the human genome (the DNA carried on our chromosomes) associated with risk of coronary heart disease. One region of DNA on chromosome 9 (Chr9p21) is most strongly associated with inherited risk for coronary heart disease. The DNA at Chr9p21 comes in two forms - a high-risk form and a low-risk form. People who have inherited two copies of the high-risk form, one from each parent, are at a 60% greater risk of developing coronary heart disease than people who possess two copies of the low-risk form.

Based on previous work in our laboratory, we hypothesised that carrying the risk form of the Chr9p21 DNA region may be associated with altered blood levels of three proteins related to cardiovascular health - TGF-B, VCAM-1 and calreticulin. We also hypothesised that altered blood levels of these proteins may be associated with an increased risk of an impending cardiovascular event within the next 3 to 5 years.

My key resource for this study is a group of ~3000 blood samples taken from a cohort of healthy older people recruited for the Canterbury Healthy Volunteers study. At the time these participants donated blood they had no signs of cardiovascular disease. However, in the years following sample collection, some of these participants developed cardiovascular disease and experienced a cardiovascular event. Testing these samples retrospectively allows us to compare biomarker levels in blood between people who experienced an adverse cardiovascular event within 3 years and people who had remained event-free for at least 5 years.
Aim:
1. To determine whether genetic variation at the Chr9p21 risk region is associated with adverse cardiovascular outcomes in healthy volunteers with no previous history of heart disease
2. To determine whether genetic variation at the Chr9p21 risk region is associated with a differing level of TGF-B, VCAM-1 and calreticulin in blood, even in healthy volunteers with no previous history of heart disease
3. To determine whether variation in protein levels of TGF-B, VCAM-1 and calreticulin are associated with subsequent adverse cardiovascular outcomes in healthy volunteers with no previous history of heart disease

Method:
Genotyping for the Chr9p21 risk region in >1,500 healthy volunteers was carried out using real-time quantitative polymerase chain reaction (PCR), a method of amplifying the DNA region of interest to determine its sequence. From this cohort, 108 individuals were selected for biomarker analysis (54 with the low risk form of DNA and 54 with the high-risk form of DNA at Chr9p21). ELISA assays were optimised for three potential protein biomarkers (TGF-B, VCAM-1, calreticulin). Levels of these protein biomarkers were then analysed in healthy volunteer participants and tested for associations with Chr9p21 genotype and cardiovascular outcomes.

Results:
TGF-B levels were strongly associated with subsequent adverse cardiovascular events, independent of traditional risk factors (p=0.023) or Chr9p21 genotype, with lower levels of TGF-B associated with increased risk. Neither VCAM-1 or calreticulin levels were found to be associated with adverse cardiovascular events.

In this cohort of healthy older people, carrying the high-risk form of DNA at Chr9p21 was not associated with an increased risk of adverse cardiovascular events over a median 4.7 years of follow-up. Nor was genetic variation at Chr9p21 was associated with any changes in levels of TGF-B, VCAM-1 or calreticulin.

Discussion:
We have demonstrated that protein levels of TGF-B are strongly associated with adverse cardiovascular outcomes in previously asymptomatic individuals. We have also shown that TGF-B predicted heart disease risk independently of other established risk factors, such as age, gender, cigarette smoking and high blood pressure. These exciting findings suggest that adding TGF-B into existing risk factor scores may improve our ability to predict near-future adverse cardiovascular events.

TGF-B is an anti-inflammatory protein with numerous functions across the body. In blood vessels, low levels of TGF-B can promote atherosclerosis and in heart tissue low levels of TGF-B prevent cardiac repair. These processes might be the reason that low TGF-B levels in blood are associated with an increased likelihood of a person having an adverse cardiovascular event.

The next step for the research would be to analyse whether inclusion of TGF-B would add value to existing cardiovascular risk scores. If so, then testing levels of TGF-B could be performed using a blood sample taken at the GP’s office. Improving cardiovascular risk prediction will allow GPs to make better-informed decisions for individual patient care and allow people who are at a high-risk of an imminent cardiovascular event to be identified, so that precautionary interventions can be made to reduce possible harm.
In summary, our data suggests that measuring circulating protein levels of TGF-B may improve prediction of near-future cardiovascular events in the general population.
Introduction:
Crohn’s disease is a non-curable inflammatory condition of the intestinal tract. It is thought to be caused by an inappropriate and self-perpetuating reaction to intestinal bacteria. The severity of symptoms often fluctuates, with cycles of ‘flares’ and periods of remission. Treatment for most individuals involves high doses of drugs that suppress the immune system, but often these have significant side effects such as increased susceptibility to infection and hormone imbalances. Liquid diets are often used in children for this reason and they have been shown to be as effective as corticosteroid drugs in inducing remission. Polymeric formula is one type of liquid diet used frequently for children with Crohn’s disease. The rationale for its use is that it reduces the work required to digest and absorb food, as well as being hypoallergenic and containing all the necessary components of a healthy diet. However, our research suggests that polymeric formula may also have additional effects on the innate immune response that include dampening the expression of inflammatory messengers and inhibition of bacterial binding to the surface of gut epithelial cells. It is currently unclear whether this effect of PF relates to direct antibacterial activity and/or an indirect effect. Indirect mechanisms include enhanced cell differentiation that is associated with increased production of membrane vesicles from the cell surface. These membrane vesicles have the potential to act as releasable decoys, thereby limiting bacterial binding to the intestinal epithelium.

Aim:
1) To determine if polymeric formula has a direct effect on bacterial cell growth
2) To investigate whether membrane vesicles limit bacterial binding to the gut wall

Method:
Three bacterial species (adherent-invasive *Escherichia coli* (AIEC), *Campylobacter jejuni*, *Salmonella typhimurium*) were each cultured with and without increasing concentrations of polymeric formula, up to and including the likely physiological concentration (around 20%). Bacterial growth was measured over time as a change in absorbance.

In separate experiments, membrane vesicles (MVs) were harvested from the supernatant of Caco-2 cells following long-term culture. Negative staining Transmission Electron Microscopy (TEM) was used to confirm the presence of vesicles and fractions were dot blotted for CEACAM-6 (a protein found in MVs) following sucrose density gradient centrifugation to confirm that the vesicles have a similar density.

AIEC and *S. typhimurium* were incubated with MVs (200 µg/mL protein) for 30 minutes before being added to Caco-2 cells for 3 h at 37°C. Unbound bacteria were removed by extensive washing and remaining adherent bacteria were enumerated by serial dilution of cell lysates.

Results:
Polymeric formula was found to have a dose-dependent effect on the growth of bacteria, with 20% concentration consistently resulting in at least a 75% reduction in growth across all three species.
Membrane vesicles shed from the surface of Caco-2 cells and concentrated by ultracentrifugation were shown to have a ring structure, which is typical of the morphology of MVs. Moreover, the size of the MVs was consistent with previous measurements of MV size.

Fraction 5 (of 10) of the sucrose gradient showed high affinity for CEACAM-6 antibodies, suggesting that MVs are concentrated in this fraction.

MVs were shown to limit the association of bacteria with Caco-2 cells over 3 hours. This ranged from a 64% reduction in bacterial binding when MVs were incubated with *S. typhimurium*, to an 84% reduction when the same concentration of MVs were added to AIEC.

**Conclusion:**
These results indicate that inhibition of bacterial growth and/or inhibition of bacterial binding to the intestinal wall may play a significant role in the success of polymeric formula in managing Crohn’s disease. Better understanding of the mechanisms that underlie the host innate immune response to infection will allow exploitation of these in the prevention and/or management of gastrointestinal disease.
Introduction:
Approximately five percent of patients who get a hip replaced develop tumour-like growths. These growths are termed pseudo-tumours because of their structural similarity to cancerous tumours—they both have a hypoxic centre, where there is a lack of oxygen and a vascularised exterior. However, cancerous tumours grow uncontrollably due to mutations in the DNA whereas pseudo-tumours do not appear to carry any mutations. This makes the pseudo-tumours particularly interesting, because they could indicate factors that drive the growth of a tumour which do not stem from changes in the DNA.

Interestingly, pseudo-tumour formation only occurs to those who have failing metal hips. These metal hips are often made of a cobalt alloy and the daily grinding can cause micro-flakes of metal to be embedded in the surrounding tissue. So the main question is how does a failing hip cause this tumour-like growth? What proteins and factors are involved?

The hypothesis is that pseudo-tumour formation is due to the establishment of a pro-tumour characteristic in normal cells as a result of cobalt toxicity. Cobalt is known act as a hypoxia mimetic and increases the presence protein called HIF1a, which is a major cancer growth promoter. HIF1a generates VEGF which directs the formation of new blood vessels and allows for cell survival under stressful conditions.

We propose to investigate whether cobalt toxicity in pseudo-tumours results in HIF-1a expression that might explain the formation of these growths in hip-replacement patients and also provide insight into the role of HIF-1a in cancerous tumour formation.

Aim:
The aim of this project was to characterise the tissue from these pseudo-tumours, which was split into two parts;
1) To determine what method would provide the best way to characterise the protein expressed in the tissue
2) To use this method to determine whether HIF1a and any of the proteins under its control are present

Method:
Prior to any technical analysis, the tissue was ground up and DNA analysis to was used to determine the cellularity of the tissue (how much of the tissue was cells). Once this was complete several techniques were used to examine the presence of various factors in the tissue. These included western blotting (to visualise the presence of HIF1a and other proteins), ELISA (to determine the concentration of VEGF), high pressure liquid chromatography (HPLC; to measure the vitamin C levels in the tissue) and immunohistochemistry (to determine the organisation of the tissue, what types of cells are present and the localisation of certain proteins).

Results:
DNA analysis showed a content of 0.88ug per milligram of tissue (highest content in any of the samples). This was very low when compared to other tissues (e.g. cancerous tissues) that have used the same method and that have approximately three times more DNA.

Looking at the tissue under the microscope it was evident this was due to the high fat and collagen content, in conjunction with a high volume of dead tissue (or necrotic tissue). This made the use of western blotting as an analytical tool inappropriate.

More sensitive analyses (HPLC and ELISA) were able to determine the concentration of vitamin C and VEGF, respectively. The vitamin C content varied from no detectable levels to 6.34ug/100mg wet weight. This is not uncommon considering muscle cells have the lowest levels of vitamin C, which in itself is dependent on diet. The VEGF ranged from 0.44pg/ug to 3.9pg/ug, which is in the range for ‘normal’ tissue.

Therefore, immunohistochemistry is the most effective method to study HIF1α in this tissue. When stained with a morphological stain, the masses of fat and infiltrating immune cells become apparent. Using this method, we were able to demonstrate the presence of HIF-1α and to investigate the vascularity, immune cell infiltration and the properties of the fat bodies.

**Conclusion:**

In this study, it has become evident that the best analytical tool for this tissue is immunohistochemistry and this has demonstrated the presence of HIF-1α, a known tumour growth promoter, in the pseudo-tumour tissue. This information, together with the analysis of tumour-like morphology and the expression of downstream HIF proteins provides evidence that the characteristics of the pseudo-tumours are similar to cancerous tumours. This will be the subject of a future publication.
Introduction:
Vitamin C, also called ascorbate, is an essential vitamin for normal growth and development. It is water soluble so it is found in blood and (when it’s not needed) is excreted in urine. Because humans lack the ability to synthesise their own vitamin C they rely fully on dietary intake. Normal human vitamin C concentrations are between 50-80µM in plasma, while concentrations below 20µM are considered clinically deficient.

Vitamin C may help overcome many illnesses and infections and more recently links between vitamin C and cancer are being established. A previous study in our group reported concentrations of vitamin C in high grade tumours as suboptimal, another study suggested that vitamin C deficiency could progress tumour spread. Earlier studies had suggested that cancer patients may have lower plasma vitamin C levels compared to healthy controls. This highlights the need for vitamin C to be monitored and managed in a clinical setting, especially in cancer patients.

Currently vitamin C would be measured in the plasma component of whole blood, but plasma is susceptible to recent dietary intake, making it difficult to define the body’s true ascorbate status. It means that patients are required to fast, which may be particularly challenging for cancer patients. Unlike white blood cells which accumulate high levels of vitamin C via a vitamin C transporter in their membrane, red blood cells lack the transporter. Because of this, the vitamin C levels in red blood cells may be more stable and less influenced by recent dietary intakes.

Aim:
The aim of this study is to determine whether measuring vitamin C in red blood cells can provide a more stable indication of body vitamin C status, to monitor any kinetic effects such as a lag in the uptake of vitamin C into the red blood cells and to optimise a method of measuring vitamin C in red blood cells that may eventually bypass the need for fasting blood samples.

Method:
Ten healthy volunteers were recruited to each provide four blood samples throughout the day following a night of fasting. The first blood sample was to be the fasting sample so volunteers had to go without breakfast. They were then supplied with the daily recommended supplement of vitamin C (200 mg) and returned every 2 hours for further blood draws over a period of 6 hours. The blood samples were spun to separate the main components of blood isolating the red blood cells and plasma, which were stored frozen until further analysis. Vitamin C detection was done by HPLC, a technique that allows the biomolecules within the blood samples to be separated so that vitamin C concentrations can be measured.

Results:
We found higher levels of vitamin C in the plasma compared to the red blood cells at baseline. In addition, red blood cell levels showed less variance than plasma following the vitamin C intake.
Vitamin C concentrations tended to peak sooner in plasma than in the red blood cells indicating a delay in red blood cells vitamin C uptake. A reducing agent was required for the red blood cell samples to recover all the vitamin C, indicating that there were factors causing oxidation of vitamin C during the processing of samples. These factors may include too much free iron, temperatures above 4°C and light. Further optimisation of the method is underway, including addition of a metal chelator to the samples.

**Conclusion:**
Our study indicates that body ascorbate status may be better represented by red blood cells. There is potential for less variable readings though there may be some kinetic effects that need to be further investigated. Although red blood cells tend to have a lower concentration of vitamin C than plasma, they are likely to more closely reflect the trends of vitamin C around the body. This may be beneficial when measuring vitamin C levels in patients who are feeling poorly, so that they do not have to stop eating for 12 hours in order to have their ascorbate levels tested.
Introduction:
Mitochondria are discrete rod-shaped components of human cells, responsible for a plethora of critical metabolic activities. One principal activity is the generation of cellular energy through the synthesis of a chemical storage molecule, commonly known by its acronym as ATP. Generation of ATP occurs continuously in nearly all cells of our body, as the air we breathe and the food we consume is converted to this ‘biological currency’ to meet the perpetual energy demands of the system.

A critical step of ATP generation requires the consumption of molecular oxygen within the mitochondria, a process which depletes the oxygen component of the cell and its fluid surroundings. Precise measurement of mitochondrial oxygen consumption provides an important means of measuring mitochondrial activity. By using a newly-developed instrument called the Seahorse XF24 Extracellular Flux analyser, it is possible to measure oxygen consumption in a non-destructive manner, allowing dynamic alterations to the cellular environment to reveal information about mitochondrial bioenergetics, which may then be interpreted to allow insight into mitochondrial function as a whole. Such measurements of mitochondrial function constitute a burgeoning area of interest due to the multitude of disease conditions which are associated with altered metabolism and energy production.

Aim:
1. Use cell types present in blood samples to optimise a protocol for measuring mitochondrial bioenergetics
2. Measure mitochondrial bioenergetics in a selection of samples from different healthy donors

Method:
Cell Isolation and Preparation:
Cell types of interest, namely platelets, monocytes and lymphocytes were isolated and purified from whole-blood collected from healthy volunteers. A monolayer of each cell type was then carefully adhered to the wells of a cell-culture microplate in readiness for extracellular flux analysis.

Measuring Extracellular Flux using the Seahorse XF24:
Oxygen consumption and extracellular acidification rates were measured within a transient microchamber periodically formed above the cell monolayer. Initial measurements defined the basal oxygen consumption of the cell population. Molecular modulators – drugs which target components of the mitochondria - were subsequently introduced via the instruments own integrated drug delivery system to deliberately manipulate the mitochondrial bioenergetics. Oxygen consumption measurements are continually made to monitor the effects of these modulators ultimately measuring the desired bioenergetics parameters.

Results:
The isolation of monocytes and lymphocytes proved difficult. The cell preparations failed to produce samples of suitable purity and cell density required of the experiment. As such, no bioenergetic measurements were made for these two cell types. Platelet isolation, however, was successful and several bioenergetics profiles were determined for this cell type. The profiles revealed platelets to have a maximal respiration rate very similar to their basal respiration rate, showing a minimal spare respiratory capacity (reserve capacity). Optimisation experiments were conducted to ensure the parameters for measuring reserve capacity were optimal. These included determination of optimal inhibitor concentrations and that the cells had sufficient substrate concentrations. Experiments were conducted with blood from several donors from varying age groups. This age variation will provide scope for age-related analysis of mitochondrial function upon further data collection.

**Conclusion:**
Platelets generally responded in the expected manner, both at the basal level and in response to the molecular modulators. Some variation was observed in individual wells where mitochondrial function rapidly declined in what appeared to be the cessation of mitochondrial-based energy production. The cause of this particular activity is currently unknown. Platelets, as part of their normal biological function, can dynamically respond to various signals in order to stop bleeding.

It was hypothesised that metabolic change brought about by this activation may be the cause. Subsequent experiments to deliberately reproduce this phenomenon through the introduction of a known activating molecule failed to replicate the response. As such, it is not clear whether the biological activation of platelets is responsible for these aberrant results and further activation studies are needed. Upon optimisation of the protocol, measurement of the desired bioenergetic parameters such as basal oxygen consumption and reserve capacity proved successful. Platelets were shown to have characteristic low reserve capacity.

The accuracy of measuring this sensitive parameter will only be known once a larger population can be sampled. Likewise, a characteristic basal oxygen consumption rate will become evident once a larger sample size has been tested and upon normalisation of the data to account for experimental variation.
Introduction:
Osteoporotic and osteoarthritic diseases often greatly reduce quality of life for those inflicted. Disease progression can be insidious where intervention isn’t considered until late stages, by which time only the most extreme options such as joint replacement are left. Hence there is a need for early detection in changes in bone density or quality and a tool with which to monitor effectiveness of any treatments. Currently the most well established approach to imaging bone density for osteoporosis is dual energy x-ray absorptiometry (DEXA), but this technique has a number of shortcomings. DEXA only gives a 2D projected measure of density which assumes everyone is the same shape and size and the technique can’t be applied to specific remote regions of bone such as those at joints. Osteoarthritis on the other hand has no well-established early detection method, instead relying on late stage symptoms and advanced indicators on MRI or x-ray to diagnose.

With the advent of spectral computed tomography (CT), a new modality currently being developed by the MARS group, there is potential for the advancement of medical imaging capability. Spectral CT to regular CT is like colour TV to black and white film. Different materials indistinguishable on traditional CT due to showing the same shade of grey can be distinguished by virtue of the spectra, or ‘colour’, of the x-rays passing through them with spectral CT. With the ability to differentiate and quantify material through ‘colour’, there is great promise MARS spectral CT can overcome the shortfalls of current approaches to measuring bone density and one day become the new standard in clinical practice.

Aim:
To explore how MARS spectral CT can be used to improve quantification of bone health.

Method:
Bone mineral is mainly composed of calcium hydroxyapatite (CaHA) and one measure of bone quality would be to quantify the density of this material within bone. To achieve this, firstly a Perspex phantom with slots containing rods of known concentrations of CaHA (0, 50, 200, 800, and 1200 mg/mL) as well as sealed tubes of water and lipid was imaged with a prototype MARS spectral CT scanner. This scanner’s tungsten x-ray source peak kilovoltage was set to 120 kVp, the equipped cadmium telluride Medipix3RX detector was set to view x-rays of 4 energies (18, 27, 33, and 49 keV) and the gantry set to scan in continuous motion helical mode.

A second scan with the same parameters was then performed on a bovine tibia plug of 8 mm diameter - an excised biological sample containing cartilage, compact bone and spongy bone – enclosed within a plastic tube. Resulting raw data was processed and then used to reconstruct images of transverse slices through each object. The spectral response of each material in the phantom scan was then analysed and the data was used to identify which part of the image was similar to CaHA, which was similar to water and which was similar to lipid. This ‘material decomposition’ process was then applied to the images of the bone sample and with this, the mineral content of the bone sample can be isolated from other
components such as cartilage and fat and its density measured against the known densities of the CaHA within the phantom.

**Results:**
The unique spectral behaviour of each material included in the phantom showed that each material could be identified as different. Water was identified in every material except lipid and most strongly in the pure water sample. This was expected, as water or water-like substances were known to exist in every given material other than lipid. Lipid was mainly identified in the lipid slot of the phantom and calcium was identified in each sample containing it – with sensible differences associated with the different concentrations present.

This validated the method for identifying lipid, water, and bone-like material, distinguishing them from each other and also provided a means of measuring the CaHA concentration from the x-ray data. In turn this yielded a calibration curve given by the equation - \[ [HA] = 129.69x^2 + 822.36x + 2.5023 \]

\([HA]\) is the estimated density of CaHA within the bone in mg/mL and \(x\) can be found by isolating CaHA content within a bone image. From the data obtained in the biological bone scan, \(x\) in the equation above was determined to be 0.966. Therefore, the estimated CaHA concentration, or bone densitometry equivalent measurement, was 918 mg/mL.

**Discussion:**
This experiment demonstrated that by using a phantom containing various concentrations of calcium hydroxyapatite, MARS spectral CT has the capability to isolate the mineral component of bone. It was also shown that a quantity can be assigned to the CaHA density within scanned bone samples, which could potentially be indicative of bone health.

However this experiment falls short in terms of verification. It is still not known whether this measured value is truly the CaHA density within the biological sample, what the statistical uncertainty of this technique is and more importantly whether or not the MARS spectral CT has the sensitivity to distinguish healthy from unhealthy levels of CaHA density.

Future research needs to be done to investigate the repeatability of this technique and hence provide a measure of uncertainty. This can be done by repeating identical scans and observing variation. Also, confirmation is needed of whether or not the differences between bones from different body locations or bones of different levels of quality can be detected. This can be done by applying this approach to a variety of bone samples with some known attributes. Finally, a true analysis of bone health would need to include consideration of bone micro-architecture in addition to mineral density.

At the moment MARS spectral CT has not reached a stage where it can top current methods of quantifying bone health. Much more research needs to be done not only in refining the approach explored in this study, but in relating the results to clinically significant outcomes such as fracture risk. However this first step has shown promising results. There may yet come a day when spectral CT is integral to everyday clinical use and osteoporosis or osteoarthritis can be treated while they are still reversible – preventing fractures and the eliminating the need for joint replacement.
Introduction:
Macrophage migration inhibitory factor (MIF) is a protein involved in the immune system. If you scrape your knee, MIF is released from damaged cells, binds to its specific receptor called CD74 and helps maintain an immune response by encouraging inflammatory molecules to the site. Over-expression of MIF has been shown to lead to chronic inflammation in numerous diseases. MIF levels have been shown to correlate with the severity and invasiveness of several cancers, with over-expression increasing chance of both tumour growth and metastasis. Other diseases, such as heart disease and cystic fibrosis, have been associated with increased MIF serum levels. Clearly being able to inhibit MIF when it reaches certain concentrations could have numerous consequences for disease research.

As well as binding to CD74, MIF also has an enzyme activity. It seems the N-terminal proline residue is responsible for this activity, while it is also involved in recognition binding to the receptor. An important part of the immune response are white blood cells called neutrophils. They engulf and kill invading bacteria. In order to do this, neutrophils produce HOCl (bleach) which is a strong oxidant. We speculate that HOCl modifies MIF, altering the inflammatory response.

Aim:
The overall goal of this research is to determine if MIF is modified by HOCl in vivo. In order to achieve this, we would like to use a tagged form of MIF called HisMIF, which will enable us to pull MIF out of biological fluids and examine it.

Method:
To confirm that HisMIF is modified by HOCl in a similar fashion to MIF, both types were placed several different concentrations of HOCl. This was to test how much HOCl was required to inhibit both MIF and HisMIF functioning. We then repeated this experiment, this time using a fluorescent compound called FITC that is known to also inhibit MIF function. MIF modification can be measured by determining the amount of fluorescence incorporated into the protein. A mass spectrometer was used to measure MIF modification.

Results:
HOCl and FITC were effective at inhibiting both MIF and HisMIF at the same concentration therefore HisMIF will be useful in biological samples. When we measured the mass of these products, we found that only one molecule of FITC was bound per protein. This indicated that it was only bound at the N-terminal proline. MIF was also exposed to HOCl first and then incubated with FITC. In this experiment, there was no evidence that the fluorescent compound could bind. This confirmed that FITC could only bind to the N-terminal proline, which was modified when exposed to HOCl first.

Conclusion:
We have demonstrated that MIF reacts in the same way as our modified MIF, HisMIF, in the presence of both HOCl (oxidant) and FITC (tautomerase inhibitor). Therefore, HisMIF can confidently be used and the findings applied to MIF. The host lab now intends to introduce tagged MIF in complex biological fluids with activated neutrophils to determine if modification occurs.
Introduction:
Do you like beer, red meat, and seafood? If you do, you need to know about a big problem that these delicious foods can pose for you. When your body breaks them down, they produce a lot of uric acid. Normally uric acid dissolves in our blood and is readily excreted in our urine. However, when you eat too much meat and seafood, or drink too much beer, uric acid may precipitate and form sharp crystals your joints – particularly in your big toe. This condition is known as gout. High uric acid levels in blood are also associated with cardiovascular disease and diabetes.

I have spent my studentship working on the chemical reactions uric acid can undergo when it is at high concentrations in the blood. I have investigated the formation of urate hydroperoxide - a molecule thought to be produced during the body’s inflammatory response. This occurs during inflammation when urate reacts with superoxide - a chemical produced by inflammatory cells. Little is known about urate hydroperoxide and its role in the body so this project aimed to provide insight into the reactions of urate hydroperoxide. Ultimately, we want to know whether it acts as a signal to tell the body there is inflammation, is a reactive molecule that kills pathogens, or a toxin that promotes disease.

Aim:
The main aims in this project were to show that two enzymes, lactoperoxidase (LPO) and xanthine oxidase (XO), work together to form urate hydroperoxide and that this product could react with proteins and become attached to them.

Method:
I synthesised urate hydroperoxide with LPO and XO. In most experiments, I monitored formation of urate hydroperoxide using a spectrophotometer or by a chemical test known as the FOX assay. This assay was used to show that the formation of urate hydroperoxide required superoxide and the product was indeed a hydroperoxide. I also used mass spectrometry to confirm that urate hydroperoxide was produced by the enzymes. Preliminary experiments were conducted to determine the time required to form the maximal amount of product and whether the addition of vitamin C would slow or stop its production.

Results:
Experiments showed that formation of urate hydroperoxide was superoxide-dependent. This was proven by the full system producing a peak in the UV-visible spectra at 315 nm that was not present in the controls. The FOX assay was used to show that LPO and XO use urate to produce a superoxide-dependent hydroperoxide and mass spectrometry confirmed that this superoxide-dependent hydroperoxide was urate hydroperoxide. A preliminary experiment indicated that vitamin C significantly slowed/stopped the formation of the product. This finding, however, was not taken any further.

Conclusion:
The formation of urate hydroperoxide by LPO and XO could be an important cellular process used during an inflammatory disease. Urate hydroperoxide may form attachments on proteins in the blood. These attachments could be measured and could indicate the level of inflammatory disease in the body. The next step for this project is to work out why LPO and XO work together to create urate hydroperoxide. Does urate hydroperoxide act as a signal to tell the body there is inflammation? Is it a reactive molecule that can attack infecting microorganisms or is it toxic to our own cells?
Introduction:
MARS Spectral CT has shown remarkable results in clinical application studies, including imaging with functionalised gold nanoparticles to assess plaque vulnerability, soft tissue quantification with multiple contrast agents, tissue and bone engineering and other various research areas. Such studies have all used in vitro models, that is, the rodents being imaged are dead or the specimen has been excised. Future studies will require in vivo models, where the imaged small animals are living, giving a validation in using the methods and techniques that were successful in in vitro studies in human models. Measurement of physiological data such as respiration rates, temperature and pulse oximetry (heart rate and oxygen saturation) are necessary to ensure the welfare of the studied animal, but can also help improve the image quality e.g respiratory and cardiac image gating to reduce motion blur.

Aim:
To setup small animal monitoring equipment in the MARS scanner and provide recommendations for future integration of the simultaneously acquired physiological data. The experiment will be considered successful if physiological data, including respiration, temperature and pulse oximetry, are obtained for an anaesthetised mouse.

Method:
12 mice were used in this experiment, 6 to attempt simultaneous physiological data acquisition and 6 to test temperature stability over the duration of the tail vein procedure. Temperature stability was tested by measuring the rectal temperature change in the mice over a 10 minute period - 3 of the mice were heated via a heating pad set to 37°C, the other 3 were unheated.

Live mice were monitored as part of a tail vein injection procedure. Inhalant isoflurane was administered to the mice to keep them anaesthetised during the experiment. Once the mice were in the surgical plane of anesthesia (non-responsive to pain), saline solution was injected into both tail veins of the mice. After both injections were complete, the monitoring equipment was attached to the mice - respiration was measured via a pressure sensitive pillow placed under the mouse, temperature was measured via a fibre optic rectal temperature probe and pulse oximetry sensor was tried on both the ankle and tail, via a special-purpose ankle/tail holder and a general-purpose clip.

Retrospective respiratory gating was used to reduce the effects of motion blur in the reconstructed CT image. A simple logic gate was implemented in a Matlab code that would determine if a circular projection was captured while the mouse was breathing. Projections captured when the mouse was not breathing could then be reconstructed to produce an image less affected by motion blur. The program developed would only be a proof of concept, as a fully functional version could only be developed with a truly simultaneous MARS CT image data set and respiration data set available.
**Results:**
Small animal monitoring equipment uses sensitive electronics so it posed some challenges. The biggest difficulty in simultaneous measurement of physiological data came from the pulse oximeter placement. Of the 6 mice, only 1 was successfully monitored fully when the pulse oximeter was attached to the ankle with the special-purpose holder. Success came about by taping the paw to a piece of thread to pull through the holder, where the tape ensured that the toes could not get caught.

Measurement of the respiration data proved useful as an indicator of the level of anaesthetisation of the mouse. If the respiration dropped too low, ≤50 breaths per minute, anaesthetic dosage needed to be reduced to prevent harm to the mouse from oxygen deprivation. If the respiration rate got too high, ~100 breaths per minute, then the mouse became responsive to pain and the anaesthetic dosage needed to be increased. From the respiration data, a retrospective gating program was developed in Matlab, which could reject x-ray projections captured when the mouse is breathing and in principle, will reduce motion blur in the images. Testing the program on a previously acquired MARS spectral CT dataset, using the respiration data from this experiment showed that 55%-60% of circular projections are retained with the simple gating program.

Mice that were heated via a heating pad had much better temperature stability than the unheated mice. Mice that were supplied heat dropped by an average temperature of 0.63 °C, whereas the unheated mice dropped on average 2.8 °C in 10 minutes.

**Conclusion:**
Small animal monitoring equipment was set up and used to monitor several anesthetised mice, as part of a procedure preparing them for scanning with MARS CT. Several issues were identified with the experiment, such as the difficulty in attaching the pulse oximeter sensor and the need for careful control of the temperature of the mice. Respiration rate, temperature, heart rate and oxygen saturation was successfully acquired from 1 of the 6 mice and the respiration data from that mouse was used to develop a retrospective image gating program.

While the monitoring of live mice was successful in this experiment, the monitoring equipment was not set up in the MARS scanner. A method for getting the anaesthetic line and monitoring leads to the mouse, which will be immobilised by a holder in the temperature controlled imaging chamber, must be determined before a live mouse can be scanned. Scanning of a live mouse with MARS CT, while simultaneously measuring respiration data, is needed to show if the gated image is higher quality than one that is blurred by respiratory motion of the mouse. Results of this experiment will influence the design of both the new scanner models and the imaging bed, so that the monitoring equipment can be used in future studies requiring imaging of live mice.
Thank-you again to the generous sponsors.
Judges:

Jenny Jordan, Gabi Dachs, Andrew Day and Madhav Bhatia

Winners

- Helena Trollope - Best oral presentation in the 'Laboratory' category. The project “Reactions of urate hydroperoxide with biological targets” was sponsored by Canterbury Scientific Ltd.

- Anshuman Gupta - Best oral presentation in the ‘Clinical’ category. The project “Determining the Prevalance of Normal and Sub Aneurysmal Aortic Diameters in Patients Undergoing CT Colonography” was sponsored by Pacific Radiology Group.

- Erika Stark - Best oral presentation in the ‘Community’ category. The project “Decision aids for cardiovascular risk management in primary care” was sponsored by Pegasus Health (Charitable) Ltd.

- Sam Hall-McMaster - Best Overall Project The project “Are breast tumour cells and adipocytes co-consiprators in aggressive breast tumours?” was supervised by Dr Elizabeth Philips of the McKenzie Cancer research Group and was sponsored by the New Zealand Breast Cancer Foundation. The prize was sponsored by the Lions Club of Selwyn.