University of Malta

Dissertation Abstracts and Project Descriptions

Department of Pharmacy
Faculty of Medicine and Surgery
University of Malta

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Foreword

A Doctor of Pharmacy Programme

The students at the Department of Pharmacy celebrate their research achievements in this Annual Symposium. Students share and disseminate their research findings in the form of abstracts, posters and presentations. This year we have presenting their project the final year students following the new degree in Bachelor of Science (Hons) in Pharmaceutical Technology. This is the first group of students following a course designed to reach the highest academic standards for a three year Honours degree and meeting the needs of society in the health sector and pharmaceutical industry. The views and perspectives of the stakeholders on the course have been extremely positive from all aspects but especially from the opportunity to host the Pharmaceutical Technology students during their academic placements. It is envisaged that it will be sometime before all the needs of society in this area of pharmaceutical technology are satisfied and therefore there is need for encouragement and guidance to prospective students who possess the necessary qualifications to join this course.

The Department of Pharmacy is next October aiming to launch a new equally ambitious course and the first of its kind to be approved by the University Senate after four years of intensive discussions and preparations. This was achieved through the continuous effort and leadership of the Head of Department of Pharmacy, Professor Lilian M. Azzopardi, the Dean of the Faculty of Medicine and Surgery, Professor Godfrey LaFerla and the stimulus of the Rector of the University of Malta, Professor Juanito Camilleri. The new Professional Doctorate in Pharmacy is offered in collaboration with the University of Illinois in Chicago. A number of working visits between the academic staff of both universities led to the development of a curriculum which could serve as the benchmark for the evolvement of the Doctor of Pharmacy degrees in Europe. The course will be a three year course to obtain a Level 8 degree which is at the same level as the PhD but is designed for students pursuing professional careers and who are interested in the opportunity to reflect on best practice. Students opting to terminate their studies after successfully completing the first three semesters will be awarded the MSc in Advanced Clinical Pharmacy.

The PharmD programme is a means to develop professionals with a research-oriented approach and with skills in advanced clinical pharmacy practice. It will also provide the background required for those who aspire to become specialists in the management of clinical trials, in regulatory affairs aspects such as assessors for the registration of medicines in the European market, preparation of relevant documentation such as dossiers for marketing authorisation applications, in the administration of drug policy such as the national and hospital medicines formulary, and in performing advanced clinical practice and medicines research. The Doctor of Pharmacy graduate will be able to deliver a significant contribution to pharmacy practice, develop clinical pharmacy programmes and contribute and manage policies in pharmacy and related areas. These graduates will have the potential to lead the direction of new developments in the pharmaceutical profession and provide a significant impact in their respective fields to ensure medicine usage is undertaken in a rational and pharmacoeconomically sound way.

Professor Anthony Serracino-Inglott

Pharmacy Practice Projects Co-ordinator

Introduction

The Department of Pharmacy at the University of Malta has over the years established itself as a leader in the international setting in pharmacy education and research. These standards could be achieved and maintained in great part due to the collegial collaboration and drive shared amongst staff and students within the Department. The co-operation and support received from colleagues in the Faculty, the University and stakeholders in pharmacy is also a strong element in achieving this success. Testimony to these standards lies in a number of markers that include the success of graduates in taking up job positions locally and abroad, the dissemination of results from research led by the Department's research groups and the successful international networking.

During the last academic year, results of the Department's research groups led to 8 postgraduate dissertations published as a book by an international publisher, 12 research papers published in international pharmacy peer-reviewed journals and over 30 research presentations at international pharmacy fora. A Master of Pharmacy graduate of the Department is the 2014 recipient of the European Association of Hospital Pharmacists Best Research Article Award.

Every year, a large number of pharmacy students participate in the Erasmus mobility programme and follow a semester in a partner University. The Department hosts a number of students from Universities all over Europe to follow modules, take up experiential placements and carry out their dissertations within the research groups at the Department.

For a number of years, the Department has organised international clinical pharmacy courses for pharmacy students and pharmacists. This experience is now being taken to a new dimension. A professional doctorate in pharmacy in the area of clinical pharmacy is being launched. The post-graduate course is being offered in collaboration with the University of Illinois, Chicago. The course is intended to attract local and international pharmacists who would like to develop advanced clinical pharmacy skills and take up a post-graduate degree within a professional context.

Professor Lilian M. Azzopardi

Head, Department of Pharmacy

M.Pharm.
Dissertation Abstracts

Point-of-Care Testing

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Point-of-Care Testing for Hypercholesterolaemia in Community Pharmacies

Rodianne Conti

Background: Locally available devices for cholesterol point-of-care (POCT) testing, Accutrend® Plus and Multicare-In® were used to compare accuracy with the Cobas® 6000 Analyzer Series c501 module used at Mater Dei Hospital (MDH).

Objectives: To establish the accuracy of the identified cholesterol POCT devices.

Design: Patients were recruited according to established criteria by convenience sampling. Duplicate finger-prick tests for each device were taken following venous blood sample (n=21). Following unsatisfactory results obtained for the Multicare-In®, single finger-prick tests were again carried out (n=25). These results were combined with the previous 21 tests and finger-prick test results for the Multicare-In® over 6mmol/L (n=10) were excluded. Intra-device correlation and accuracy of devices with the laboratory were determined by generating a scatter plot, line of best fit and correlation coefficient.

Setting: Pathology Clinic, MDH.

Main Outcome Measures: Intra-device correlation and accuracy of POCT devices compared to laboratory results.

Results: Accutrend® Plus and Multicare-In® obtained an intra-device correlation coefficient of 0.821 and 0.697 respectively. Accuracy (n=21) was reflected by r^2=0.831 and r^2=0.179 respectively. Following another test with different subjects (n=25) for the Multicare-In®, accuracy of 16.4% was obtained. When combining the 2 Multicare-In® groups and excluding the 10 results above 6 mmol/L, an r^2 of 0.336 was obtained.

Conclusion: Accutrend® Plus correlates well with standard laboratory equipment. Results obtained in this study reflect the results obtained by Finderle et al in 2009 where a low correlation coefficient for the Multicare-In® (r^2=0.566; n=26) for the total cholesterol parameter was also obtained.[1]

Reference:

1. Finderle P, Krumpak MP, Prezelj M. Measurements of cholesterol and triglycerides by two POCT instruments: Accutrend GCT and Multicare. [Online]. 2009 [cited 2011 Jul 18]; [1 screen]. Available from: URL:http://www.imtek.de/content/pdf/public/2009/2009.418_beitrag_2.pdf.

Point-of-Care Testing for Urine Analysis and Microalbuminuria for Diabetic Patient Management

Shaun Ungaro

Background: Microalbuminuria is defined as the urinary albumin excretion (UAE) rate of 30-300mg/24hr[1] if the concentration of albumin is measured in an albumin to creatinine ratio (ACR).

Objectives: To implement point-of-care testing (POCT) in the community pharmacy setting for urine analysis of microalbuminuria and to study the accuracy and practicality of the service.

Design: Twenty five type 1 or 2 diabetic adult patients were recruited at random and asked to provide a urine sample which was analysed using the Siemens ClinitekStatus®Analyzer to yield results for the presence of microalbuminuria and glucose levels. Patients underwent a finger prick test to determine blood glucose levels using the Bionime® GM550 glucose meter. Patients who tested positive for microalbuminuria in the urine test underwent HbA1c testing using the Bayer DCA 2000+®Analyzer. A patient characteristics form containing patient demographic information and current drug therapy was completed.

Setting: Three community pharmacies.

Main Outcome Measures: Accuracy and practicality of POCT for microalbuminuria in community pharmacies and patient perception of this service.

Results: Out of the 25 patients tested (13 male, 12 female, mean age = 62.2 years), it was found that 6 had microalbuminuria with 4 patients having an HbA1c level above the normal range. Mean duration that the patients suffered from diabetes was 7 years, 11 patients suffered from hypertension and 24 were type 2 diabetics. The most common drug class taken were oral hypoglycaemics. Testing in pharmacies was deemed useful by 23 patients with easy accessibility being the most common reason, 22 would use the service citing a fee of 4-6 Euro for the strip test.

Conclusion: Results indicate that the introduction of POCT for microalbuminuria in community pharmacies would be feasible and useful.

Reference:

1. Basi S, Fesler P, Lewis J, Mimran A. Microalbuminuria in Type 2 Diabetes and Hypertension Diabetes Care. 2008; 31: 194-201.

Point-of-Care Testing for *Streptococcus pyogenes* in Community Pharmacies

Laura Scicluna

Background: *Streptococcus pyogenes* is a Gram-positive extracellular bacterial pathogen that causes pharyngitis. Point-of-care *Streptococcus pyogenes* testing allows availability of a fast test result to be used to make an instant, evidence-based clinical decision.[1]

Objectives: To determine Strep A Rapid Test Kit sensitivity and specificity characteristics, to determine patient acceptability of a pharmacist-run service and to evaluate pharmacist perception of such a service.

Design: Thirty-one subjects who showed symptoms of sore throat and fever were tested. The first throat swab was tested with the GIMA 24523 Strep A Rapid Test Kit, whilst the second throat swab was sent to the laboratory. Questionnaires were distributed to the 31 patients and to 36 pharmacists to assess their perception.

Setting: A health centre, 2 community pharmacies, a paediatric clinic, pathology laboratory at Mater Dei Hospital.

Main Outcome Measures: Point-of-care test specificity and sensitivity, patient and pharmacist perception.

Results: Out of 31 patients, only 3 tested positive with both tests. Five patients tested negative with the rapid test and positive with the laboratory culture, hence the sensitivity of the rapid test is 0.4 and the specificity is 1. The two most popular reasons why the patients would undergo the test were so as not to take unnecessary antibiotics and to identify the cause of infection. Thirty-two pharmacists would be willing to perform the test but only 18 said they would stock the test. Reasons given were that it is too expensive and that the shelf-life is too short. Six pharmacists stated that they would not have time to perform the test and 5 pharmacists stated that it should not be available in a pharmacy since it should be performed in the physician's clinic.

Conclusion: GIMA 24523 Strep A Rapid Test Kit is not sensitive enough and may lead to antibiotic under-treatment. Pharmacists would be willing to perform the test however felt that it was too expensive and time-consuming.

Reference:

1. Shephard M. Point-of-care testing comes of age in Australia. Aust Prescr 2010; 33:6-9.

Perception of Pharmacists and Patients of Point-of-Care Testing for Prostate Specific Antigen

Janica Mizzi

Background: Prostate Specific Antigen (PSA) point-of-care tests (POCT) provide the pharmacist with a rapid PSA result allowing patient monitoring by community pharmacists in between consultant appointments.

Objectives: Evaluation of pharmacist and patient perception of the feasibility of carrying out PSA POCT in community pharmacies.

Design: Thirty-three male patients with a mean age of 64 years participated in the study; 16 patients were recruited from community pharmacies and 17 patients were recruited from a Health Centre (HC). All patients were booked for intravenous (IV) laboratory-based PSA testing on the same day. POCT was undertaken using the 'On-Call PSA' device. The perception of pharmacists (n=80) and patients on PSA POCT was evaluated using questionnaires. Patients' symptoms were analysed using the International Prostate Symptom Score (IPSS).

Setting: Community Pharmacies and Health Centres.

Main Outcome Measures: Correlation between IV PSA and POCT results, IPSS levels, patient and pharmacists perception of PSA POCT.

Results: Seventy-one pharmacists were willing to offer PSA POCT to patients and 75 pharmacists agreed that it is beneficial and should be available in community pharmacies. Thirty patients were in favour of pharmacist-led PSA POCT testing and agreed that it is advantageous. A positive correlation between IPSS and laboratory blood test was obtained ($p=0.000$) and a correlation value of 0.761 was obtained indicating a positive correlation between symptoms and PSA levels. PSA laboratory blood tests and POCT results were compared. POCT did not detect 4 elevated (>4ng/ml) PSA readings. When the POCT device was further investigated, it was found that it was recalled in the EU and removed from US market in 2008. Malta was not informed since no Maltese clients were registered with the company at that time. A formal report was issued by the German Competent Authority and was distributed to all the countries in the European Economic Area.

Conclusion: Results indicate positive patient and pharmacist acceptance of carrying out POCT for PSA levels in community pharmacies.

Point-of-Care Testing for Cardiac Markers

Rebecca Theuma

Background: Cardiac marker point-of-care (POC) tests are available to test for the presence of creatine kinase-MB (CK-MB), myoglobin (MB) and troponin I (T) in myocardial infarction.

Objectives: To determine the applicability and reliability of cardiac marker POC tests in the clinical setting and to establish a cut-off point from the onset of symptoms.

Design: Patients (n=40) diagnosed with STEMI or NSTEMI were recruited. From previous studies it was established that not more than 5 days should have elapsed from the onset of MI for the test to be undertaken.[1] Heparinated blood samples were taken, 3 hanging drops were dropped on the sample well, 10 seconds were allowed to elapse from the application of each drop to allow absorption. The control line across the strip was an indication that the test strip was functioning; 3 lines denoted the presence of MB, CK-MB and T indicating a positive result and no lines denoted that the test was negative.

Setting: Critical Cardiac Care Unit, Mater Dei Hospital.

Main Outcome Measures: Evaluation of the cost-effectiveness, reliability and practicality of these POC tests in a clinical setting.

Results: The 5 negative results obtained were due to misdiagnosis of pulmonary oedema, B12 deficiency, anaemia and tachycardia, and because more than 5 days had elapsed from the onset of symptoms. The test is rapid taking a maximum of 10 minutes from blood collection to obtaining a result.

Conclusion: POC tests can be valuable in the clinical scenario since timely intervention is essential for patient survival[2], and costs may be reduced in the long-term when one considers the time and materials saved.

References:

1. Noora J, Ricci C, Hastings D, Hill S, Cybulsky I. Determination of troponin I release after CABG surgery. J Card Surg 2005;20(2):129-35.
2. Gershlick AH, Davies SW. Treatment of myocardial infarction. British Medical Journal (International Edition)1998;316 (7127):280.

Pharmacotherapy

Chronopharmacology in Type I Diabetes
Francesca Sammut

Neutropenia in Patients receiving Chemotherapy
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Proposing a Framework for Pharmacist Prescribing within a Multidisciplinary Team Context
Elena Maria Vella

Chronopharmacology in Type I Diabetes

Francesca Sammut

Background: 'Chronopharmacology' characterises the investigation of the effect of drugs such as insulin on biological timing and the effect of time on drug pharmacokinetics.[1]

Objectives: Establishing a relationship between 'timed' administration of short or intermediate/long-acting exogenous insulin and glycaemic control; Correlating the presence of Dawn and Somogyi Phenomena with glycaemic control, using a Continuous Glucose Monitoring System (CGMS); Establishing a relationship between blood glucose level and 'counselling' on 'timed' insulin administration, and/or changing the insulin administered appropriately, by re-assessment after 3 and 6 months, using HbA1C.

Design: Thirty, Type I diabetic patients aged 20-55 years were recruited from Mater Dei Hospital and studied over a period of 72 hours. A questionnaire, supported by a diary, were developed. Patients were divided into two groups; those who administer their exogenous insulin in a regular 'timed' manner in relation to their daily meals (Group 1, n=13) and those who did not (Group 2, n=17).

Setting: Diabetes and Endocrine Centre, Mater Dei Hospital.

Main Outcome Measures: Using CGMS to study blood glucose fluctuations.

Results: Timely administration of short or intermediate/long-acting insulin manifested in better glycaemic profiles with significant p values of 0.005 and 0.000 respectively. Presence of both Dawn (n=22) and Somogyi (n=11) Phenomena were evident in Type I diabetic patients. Following counselling to adopt a timed manner in relation to daily meals, Group 2 patients showed significant improvement in their HbA1C level, after 3 and 6 months, with p values of 0.0195 and 0.037 respectively.

Conclusion: 'Timed' insulin administration results in better blood glucose control in Type I diabetics.

Reference:

1. Krishna M, Semwal BC, Neelam S, Rugsana K, Shravan P, Bhowmik D. Chronopharmacology: As a therapy for cardiovascular disease. The Pharma Innovation. 2012;1(3):6-15.

Neutropenia in Patients Receiving Chemotherapy

Bernardette Blundell

Background: Chemotherapy-induced neutropenia is a common complication of chemotherapy which is addressed by the use of granulocyte colony-stimulating factor (G-CSF).

Objectives: To analyse the incidence of neutropenia in patients receiving chemotherapy, outlining factors such as age, gender and comorbidity that could increase a patient's predisposition to suffer from neutropenia. To evaluate effectiveness of G-CSF, amongst patients who are being treated for Hodgkin and non-Hodgkin lymphoma.

Design: A 'Patient Characteristics Checklist' was completed for 22 patients after each cycle for 4 chemotherapy cycles. A patient interview on the occurrence of side effects was performed after each cycle for 2 chemotherapy cycles. The administration of G-CSF during cycles was noted.

Setting: Medical Investigations and Treatment Unit, Mater Dei Hospital.

Main Outcome Measures: Incidence of neutropenia, treatment modifications, use of GCSF, patient demographics.

Results: Nine patients suffered from Hodgkin's lymphoma and 13 patients suffered from Non-Hodgkin's lymphoma. Nine of the patients were male while 13 were female. Eighty-eight chemo cycles were followed, 38 of these included the use of G-CSF. Patients not administered G-CSF experienced neutropenia hospitalisation in 20 out of 50 cycles, while when patients received G-CSF, a smaller number of cycles, 5 out of 38, required hospitalisation due to neutropenia (p-value 0.020). Patients receiving prophylactic G-CSF claimed that they experienced fewer side effects. The occurrence of fever and sore throat was high amongst patients who were not administered G-CSF.

Conclusion: G-CSF proved effective in preventing occurrence of neutropenia and the need for treatment changes.

Factors Influencing Haemoglobin Levels in Chronic Medicine Users

Rebecca Joslin

Background: Blood dyscrasias are pathological conditions in which any of the constituents of blood are abnormal in structure, function or quality.[1] Haemoglobin is one of the components which may be influenced resulting in a polycytaemic or anaemic blood count.[2]

Objectives: To investigate the effect of chronic medication use, illness, haematological, and dietary and lifestyle factors on haemoglobin levels within the Maltese population.

Design: The STAT Site® MHgb Haemoglobin Meter was used to analyse haemoglobin levels in patients recruited according to a specified list of chronic medications influencing blood levels. Patients were asked to attend the pharmacy for testing and contacted at a later date for a follow-up visit to establish changes in blood levels over time. After testing, patients completed a questionnaire to determine other factors influencing their overall blood count.

Setting: A community pharmacy.

Main Outcome Measures: Establishing the degree to which different factors affect haemoglobin levels and the impact on quality of life.

Results: Out of the 70 patients tested, 51 were female and 19 were male with ages ranging from 19 to 86 years (mean age of 36.8 for females and 57.8 for males). Lower than normal haemoglobin levels were obtained by 39.2% of females and 21.1% of males, with these abnormalities observed primarily in those on proton pump inhibitors (n = 8) and the oral contraceptive pill (n = 7).

Conclusion: Detailed patient history and understanding of lifestyle and dietary habits is fundamental for proper analysis of factors affecting haemoglobin levels.

References:

1. Mosby's Medical Dictionary. 9th ed. Missouri: Elsevier Health Sciences; 2013. Blood dyscrasias; 221.
2. McGhee MF. A Guide to Laboratory Investigations. 5th ed. United Kingdom: Radcliffe Publishing ltd. 2008; 4-5.

Proposing a Framework for Pharmacist Prescribing within a Multidisciplinary Team Context

Elena Maria Vella

Background: The introduction of pharmacist prescribing must be in line with local requirements whilst ensuring that the pharmacist is practising within a multidisciplinary context.

Objectives: To propose a framework for pharmacist prescribing locally and to determine the perception of pharmacists and general practitioners on prescribing authority.

Design: A draft discussion paper 'Implementing pharmacist prescribing in Malta' by Tabone[1] was updated with the objectives to define the perception of pharmacist prescribing locally and to propose areas for implementation. Proposed areas for implementation were identified and validated through focus group discussions composed of 5 pharmacists, 5 general practitioners, 2 pharmacy students and 2 members of the public.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Development and validation of two possible implementation activities for pharmacist prescribing.

Results: The two possible implementation activities developed and validated are: (1) 'Pharmacist prescribing in the management of minor ailments in the community setting' and (2) 'Repeat prescribing in the management of diabetes, hypertension and patients receiving oral anticoagulants through the Pharmacy Of Your Choice scheme'. During the validation exercise agreements were reached between members of the validation panel on the selection of the most appropriate minor conditions for which the community pharmacists will be able to prescribe medications. It was also agreed that defined frameworks of chronic conditions are essential in repeat prescribing and a proposed prescription form was also developed.

Conclusion: A clearer picture of pharmacists' and general practitioners' expectations on prescribing authority was obtained.

Reference:

1. Tabone F. Public perception of the pharmacist [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2011.

Pharmaceutical Care

Perception of Pharmacists and Patients of the POYC Scheme
Marjean Xuereb

Pharmacist Interventions in a Psychiatric Setting
Ann Bugeja

A Plan for Improving Pharmaceutical Care in Psychiatric Patients
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Compiling and Evaluating Guidelines on Medicine Use in Dialysis Patients
Christopher Tate

Perception of Pharmacists and Patients of the POYC Scheme

Marjean Xuereb

Background: The Pharmacy of Your Choice (POYC) scheme was implemented as a pilot project in December 2007. Through this scheme patients choose to collect their free medicines from their preferred community pharmacy and pharmacist.[1]

Objectives: To evaluate pharmacist and patient perception of the POYC scheme, investigate the problems encountered, assess the systems adopted by pharmacies registered in the scheme and propose improvements to the system.

Design: Two structured interviews were designed, developed and validated. The pharmacist interview was conducted with 25 pharmacists from different pharmacies. The patient interview was carried out with 5 patients registered with each pharmacy selected (125 patients). Data was analysed using Microsoft® Office Excel 2007 and SPSS® version 19.

Setting: Community pharmacies around Malta and Gozo.

Main Outcome Measures: Perception of pharmacists and patients of the POYC scheme.

Results: The average time to dispense a POYC prescription is 5 minutes. Pharmacists (n=25) listed the following problems with POYC: 23 found the IT system inefficient, 16 found the automated system for orders inefficient, 10 stated that the POYC Unit is unresponsive, 21 believed that financial compensation given per patient is inadequate and 18 stated that the attitude of POYC clients differ from that of private clients. The most common complaint about the POYC scheme from patients was the out-of-stock (OOS) medication, where 118 patients (n=125) have been affected at some point.

Conclusion: It is evident that the POYC scheme requires improvement. One of the main drawbacks of the system is the OOS problem where important medications are continually in short supply or in no supply at all. The large number of complaints by pharmacists indicates that the POYC scheme is presently inefficient.

Reference:

1. Briffa Rizzo G. Distribution of Free Medicine in Malta [project].Msida (Malta): Department of Pharmacy, University of Malta; 2010.

Pharmacist Interventions in a Psychiatric Setting

Ann Bugeja

Background: Psychiatric disorders account for around 12% of the global disease burden. It has been identified that these patients are amongst the most challenging to manage.[1]

Objectives: To introduce and evaluate pharmacist intervention when dealing with psychiatric patients and family members.

Design: Twenty psychiatric patients who self-administer their medication and 16 family members in charge of their relatives, were interviewed before and after the explanation of a medication chart, using the same validated questionnaire and an evaluation form post-intervention. Data was analysed using SPSS® v. 21.

Setting: Mount Carmel Hospital

Main Outcome Measures: Medication adherence, patient/family member knowledge on medications pre- and post- intervention

Results: The mean percentage score for knowledge of the dosage regimen after the intervention (97.74%) exceeded the score before the intervention (90.22%) ($p = 0.002$). The mean percentage score for knowledge about medicine indication after the intervention (90.09%) exceeded the score before the intervention (61.25%) ($p = 0.000$). Apart from forgetfulness (10/20), 12 patients revealed that their lack of adherence was due to: the annoyance of having to take medication (2), the wish for an alcoholic drink (1), side effects (4), out-of-stock medicines (2), not seeing beneficial outcomes (1), feeling that there was no more need of certain medications (1), and the medication's smell (1).

Conclusion: This study highlights the importance of the pharmacist's intervention as an educator about medications prescribed. The medication chart acted as an empowerment tool to improve medication awareness which was found to be crucial to increase medication adherence.

Reference:

1. Bell S, McLachlan AJ, Aslani P, Whitehead P, Chen TF. Community pharmacy services to optimize the use of medications for mental illness: a systematic review. Australia and New Zealand Health Policy. 2005; 2:2.

A Plan for Improving Pharmaceutical Care in Psychiatric Patients

Claire Bugeja

Background: Psychiatric care on an institutional level in the Maltese Islands is provided at Mount Carmel Hospital (MCH) with 1,278 patients being admitted in 2011.[1] No community services are found locally and MCH was granted 8% of the total state health expenditure in 2014 or €26 million.[2]

Objectives) To evaluate the level of care at MCH at ward level and draw up a list of deficiencies to develop solutions for the treatment gaps and suggest ways in which to integrate the concept of multidisciplinary care.

Design: Two wards at MCH were analysed via a survey of pharmaceutical care functionality and nursing staff interviews. Karin Grech Hospital was chosen as a control for a standard multidisciplinary approach and a side-by-side analysis was carried out. Forty-two patient files were accessed to obtain the relevant treatment schedules and a statistical overview of medication administration frequencies and costing was developed.

Setting: Mount Carmel Hospital

Main Outcome Measures: Deficiencies extracted from the comparison study,qualitative perceptions drawn from the interviews with ward staff, medication use frequency and costing.

Results: Nurses in one ward were 60% satisfied with the system at MCH compared with 26% in other wards. Hydroxyzine and lorazepam were the drugs most commonly used. A total of 120 drugs and 442 tablets were used in the two wards on a particular day. Patients tend to retain the same treatment over a period of time. A lack of multidisciplinary care integration and no IT system to enable comprehensive medication management were the two most critical deficiencies identified.

Conclusion: A proposed multidisciplinary system should maximise clinical effectiveness of mental health care at MCH, addressing both patients and costs, by providing continuity of care, support and an organised response to the issues at hand.

Reference:

1. National Statistics Office. Social Protection: Malta and the EU 2012 [Online]. 2012 [cited 2014 Jan 07]; Available from: URL: http://www.nso.gov.mt/statdoc/document_file.aspx?id=3538.
2. National Statistics Office (NSO). Social Protection: Malta and the EU. Malta: NSO Department of Economic Statistics; 2012.

Assessment of Monitoring of Patients with Rheumatoid Arthritis

Jessica Vella

Background: Drug therapies available to control disease progression in rheumatoid arthritis (RA) require continuous, rigorous monitoring due to potential unwanted effects or inadequate treatment response.[1] Algorithms produced act as guidance aiding healthcare professionals in a stepwise approach in patient treatment. Information leaflets increase patient knowledge on the importance of adequate treatment and monitoring.

Objectives: To develop evidence-based algorithms for healthcare professionals describing treatment and monitoring pathways for RA and to compile an RA information leaflet providing patients with an understanding of the condition.

Design: A literature review regarding treatment and monitoring tests carried out locally and abroad was conducted. Local treatment and monitoring algorithms were compiled and evaluated. A patient leaflet regarding RA was developed in English and Maltese. A pilot study evaluated the usefulness of the leaflet and patient awareness on the importance of monitoring. The leaflet was distributed after consenting patients filled in the first questionnaire. The second questionnaire was completed two weeks after.

Setting: Rheumatology Clinic, Mater Dei Hospital.

Main Outcome Measures: Development and online upload of treatment and monitoring algorithms; evaluation of usefulness of leaflets disseminated.

Results: Algorithms describing treatment and monitoring pathways for nine non-biologic and biologic disease modifying anti-rheumatic drugs (DMARDs) were finalised and published online. All 20 patients participating in the pilot study stated that the leaflet was a good source of information.

Conclusion: The algorithms produced provide guidance to support healthcare professionals, potentially reducing unwanted effects through adequate monitoring. Patient education through the information leaflet increases awareness on the importance of monitoring as a holistic treatment approach.

Reference:

1. Dudlera J, Möllerb B. Biologics in rheumatoid arthritis (RA). Swiss Med Wkly 2011; 141: w13189.

Compiling and Evaluating Guidelines on Medicine Use in Dialysis Patients

Christopher Tate

Background: Designing a set of protocols is an essential tool for healthcare professionals when prescribing medicines to patients on dialysis.

Objectives: To compile a booklet containing information on the individual drugs available on the local market for use in dialysis patients and distribute it to all the healthcare professionals in the renal unit (RU) at Mater Dei hospital (MDH).

Design: The list of medicines found in the protocols created by Bailie[1] was used to compile the list of medicines used in this project. The medicines were selected based on their availability on the local market according to the latest version of the Malta Medicines List. The medicines were categorised according to the British National Formulary sections and these sections were further categorised into subsections. Details included for all the medicinal products include the extent of dialysis of drugs which serve as a guideline for healthcare professionals when prescribing and administering drugs for patients on dialysis.

Setting: RU at MDH.

Main Outcome Measures: Compilation of booklet.

Results: Out of a total of 1340 medicines listed by Bailie, 642 medicines where chosen based on their availability on the local market, 29% of these medicines have no data available on drug dialisability and drug removal is unlikely for 27% of these medicines. In addition, 35% of the drugs do not have a clinically important effect on plasma clearance while only 15% have enhanced plasma clearance by 30% or more during dialysis. These drugs include drugs from every class except for the 'Obstetrics, gynaecology and urinary-tract disorders' class.

Conclusion: The developed booklet presents information on the impact of dialysis on drug administration and identifies drugs where additional intervention due to enhanced clearance is required.

Reference:

1. Bailie GR, Mason NA. 2012 Dialysis of drugs guidelines. Renal Pharmacy Consultants, LLC. Saline Michigan USA; 2012: 1-56.

Pharmacy Administration

A Review of Extemporaneous Preparations in the Past
Angelique Camilleri

Historical Appreciation of Pharmacy Processes
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Evaluation of an English-Maltese Dictionary for Pharmaceutical and Medical Terms
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A Review of Extemporaneous Preparations in the Past

Angelique Camilleri

Background: Compounding is the preparation, packaging and labelling of a drug tailored to an individual patient based upon a prescription, with the aid of pharmaceutical apparatus.[1]

Objectives: To compound pharmaceutical preparations and to reflect on the apparatus used.

Design: A literature review was carried out to identify the different drug formulations compounded and the apparatus used. A total of 220 participants attended the eleven re-enactment activities organised, during which, a leaflet and a qualitative questionnaire was given to each participant. Demonstrations included the compounding of extemporaneous preparations according to the British Pharmaceutical Codex, 1934. SPSS® was used to statistically analyse the completed questionnaires.

Setting: Santo Spirito Hospital in Rabat, University of Malta, Aula Magna.

Main Outcome Measures: Exhibition of the compounding of pharmaceutical preparations; qualitative evaluation of the activities and leaflet; outlining the types of apparatus used.

Results: The demonstrations were graded as most satisfactory by 68% of participants. The leaflet was informative according to all respondents. In the 1960's, the apothecary system of weight measurement with Roman numerals, and pound, ounce, scruple, grain, and drachm symbols were used for the dispensing of medicines which were mostly of herbal origin. These included sachets, liniments, creams, pills, mixtures, suppositories and ointments. The main apparatus used were pestles, mortars and weighing scales.[2]

Conclusion: The re-enactments proved to be useful, beneficial and cultural supporting the pharmacist position in society over the years.

References:

1. Pharmaceutical Inspection Convention: PIC/S Guide to good practices for the preparation of medicinal products in healthcare establishments, 2008.
2. Fiorini, S. A Prescriptions List of 1546. Maltese Medical Journal 1988; 1: 19-31.

Historical Appreciation of Pharmacy Processes

Rebecca Tonna

Background: The significance of pharmacy may be sustained in a more visual manner through the implementation of a pharmacy museum available for the benefit of the general public.

Objectives: To set up an educational display relating to the history of pharmacy and the pharmacy profession for the general public.

Design: The method includes the restoration and collection of several antiquities and original manuscripts and designing appropriate display cabinets.[1] The items and collections are put on display to highlight the historical role of the pharmacist and act as a visual aid in educating individuals on the history of pharmacy. The display was evaluated using a questionnaire[1]. This was done through a Powerpoint® presentation followed by the distribution of a questionnaire to the participants involved. The participants' interest in pharmacy prior to and after the presentation was evaluated.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Analysis of the perception of the general public of the display.

Results: The questionnaire was completed by 36 individuals (mean age = 20.5 years). All participants agreed that the issue of privacy and confidentiality between the pharmacist and the patient is amongst the most important factors linked to the pharmacy profession. An increase of 61% of the individuals stated to be more interested in the history of pharmacy and the profession following the presentation.

Conclusion: Through the display of collections of pharmaceutical interest and by providing stimulating information on the history of these exhibits the general public can appreciate the pharmacy profession.

Reference:

1. Seychell E. Pilot Study of Setting up a Museum related to the Healthcare Professions [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2010.

Evaluation of an English-Maltese Dictionary for Pharmaceutical and Medical Terms

Kirsty Camilleri

Background: The recognition of the Maltese language as a European language by the EU Commission generated the need for translating documents into Maltese.

Objectives: To finalise and evaluate the compilation of the dictionary initiated by Camilleri.[1] To validate and standardise all translations and publish the first English-Maltese dictionary of medical and pharmaceutical terms.

Design: Terms readily available in Maltese were attained from the Glossary of the Medicines Authority[2] and Aquilina's Dictionary[3]. Terms not yet translated were extracted from the Mosby's Dictionary[4] and translated. These were proofread by medical practitioners, a linguist and qualified proofreader, and by the first contributor of the dictionary. Translations were validated by interviewing 50 laypersons. All translations were disseminated with a validation questionnaire to 40 healthcare professionals.

Setting: Ten community pharmacies and doctors' clinics

Main Outcome Measures: Publication of a complete English-Maltese dictionary of medical and pharmaceutical terms

Results: A total of 4,028 terms starting with letters 'N' to 'Z' have been translated, out of which 2,314 terms were newly translated. Most (94%) of the terms selected for validation by laypersons were understood.

Conclusion: An English-Maltese Dictionary of Medical and Pharmaceutical Terms has been completed, evaluated, validated and published for healthcare professionals and laypersons.

References:

1. Camilleri E. An English-Maltese dictionary of medical and pharmaceutical terms [project]. Msida: University of Malta; 2007.
2. Medicines Authority. Glossary of terms [Online]. Malta: Medicines Authority; 2012 Jan 11 [cited 2013 Dec 4]. Available from: URL: www.medicinesauthority.gov.mt/qrd.html
3. Aquilina. J. English-Maltese Dictionary. Valletta: Midsea Books Ltd; 1999.
4. Mosby's Medical Nursing and Allied Health Dictionary. 6th ed. St, Louis: Mosby Inc.; 2002.

An Interactive Approach to the Newsletter for the Department of Pharmacy

Marion Sammut

Background: The Pharmacy Department e-newsletter was used to create a communication link between the Pharmacy Department, students, staff and pharmacists.

Objective: To develop an interactive e-newsletter that keeps the targeted audience up-to-date with news relating to the Pharmacy Department.

Design: The editor of the e-newsletter attended the Pharmacy Department Annual Symposium, conferences and seminars organised by the Pharmacy Department to compile the e-newsletter articles. The e-newsletter template was designed using Microsoft Office Publisher 2007® and Adobe InDesign CS6®. An evaluation questionnaire was adapted from Rossi[1] and Vella[2]. The publication was reviewed by a focus group and distributed to 725 pharmacists, 176 students and 27 Pharmacy Department staff members via e-mail and uploaded onto the Pharmacy Department website. The questionnaire responses were analysed using IBM SPSS® Version 21.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Publication and evaluation of the Pharmacy Department e-newsletter.

Results: Two hundred and twelve pharmacists (29%), 45 students (25%) and 10 staff members (36%) completed the questionnaire. Eighty percent (n=208) of the respondents stated that the e-newsletter content and design did not require improvements. Ninety percent (n=235) stated that the means of distribution was adequate. The section which ranked highest was 'Pharmacy-Related Information' (34%, n=69).

Conclusion: The readers stated that the e-newsletter was informative, easy to comprehend and enhanced communication between the Pharmacy Department and the targeted audience.

References:

1. Rossi B. The production and evaluation of a pharmacy department newsletter [project].Msida (Malta): Department of Pharmacy, University of Malta; 2002.
2. Vella A. Newsletter for Pharmacy Department [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2010.

Evaluating an Online Drug Information Bulletin

John Scicluna

Background: Drug bulletins are periodicals which provide health professionals with information in an impartial, objective and accessible way. Informing health professionals and the public about drugs and drug treatments is an important way to encourage the quality use of medicines.[1]

Objectives: To design a drug bulletin, assess its layout and content and evaluate its use as a source of information amongst health professionals.

Design: An extensive literature review and evaluation of sources of information available was carried out. This included evaluation of drug bulletins and journals available both locally and worldwide. A strategy for gathering the information required for the publication was developed. This was translated to a drug bulletin which was critically analysed and validated by a focus group of 8 participants including 3 pharmacists, 2 pharmacy students, 2 laypersons and a physician. Any changes and amendments proposed were effected and the bulletin issue was concluded.

Setting: Community pharmacies; Department of Pharmacy, University of Malta.

Main Outcome Measures: Evaluation of the format proposed and validation through face and content validity of the bulletin issue.

Results: The bulletin was well perceived and deemed useful, achieving a mean score of 4.47 on a 5-point Likert scale for different bulletin characteristics, such as format, length and practicality. All participants of the focus groups agreed that such bulletins provided valuable information for the pharmacy profession, with 7 out of 8 respondents stating that such bulletins are needed. Six respondents preferred a bulletin available online rather than as a hard copy.

Conclusion: The need and usefulness of a drug information bulletin was clearly identified, however an online bulletin is preferred. This would be easier to update and is more accessible by the targeted audience.

Reference:

1. Collier J. International Society of Drug Bulletins (ISDB), World Health Organisation (WHO). Starting or strengthening a drug bulletin: A practical manual. ISDB, WHO; 2005.

Risks Involved in Diminished Patient Access to Medication

Attilio Degiorgio

Background: Availability, accessibility and affordability have an impact on the ability of the patient to obtain the essential medication.[1] Locally, access to medications depends on two independent markets – public and private.

Objectives: To analyse Maltese patients' access to medicines including the insights of health care professionals, highlighting the associated risks involved; To consider the various measures used for access to medicines, such as existing web systems and free medicines entitlement schemes; To propose innovative ideas to improve the local scenario and to compare with international systems.

Design: Quantitative and qualitative data was collected following distribution of questionnaires and informal meetings with expertise in this area. The Chi-square test was used to statistically analyse the questionnaires distributed via a randomised sampling technique.

Setting: Outpatients section and day-care unit, Mater Dei Hospital.

Main Outcome Measures: Knowledge of experts and the general public regarding access to medicines.

Results: Out of a total of 133 respondents, 83 were female and 50 were male with the majority being between 41-50 years old. Patients benefiting from free medications amounted to 53.4% of the study population and the most commonly used drugs belonged to the cardiovascular classification. Subjects not familiar with generic medications amounted to 48.9% of the sample.

Conclusion: The study gave insights into the knowledge of stakeholders and general public regarding access to medicines and use of medicines.

Reference:

1. National Medicines Policy and Audit Unit. Health Division Unit; [cited 2013 November 18]. Available from: URL: http://www.sahha.gov.mt/pages.aspx?page=23.

Industrial Pharmacy and Clinical Analysis

Feasibility of a Set-up for Bioequivalence Studies
Nathaniel Farrugia

Analytical Methods for the Detection of Ciprofloxacin and Clindamycin
Francesca Busuttil

Perception of Use of Liquid Capsules
Lara Ann Brincat Ruffini

Feasibility of a Set-up for Bioequivalence Studies

Nathaniel Farrugia

Background: A laboratory that caters for bioequivalence testing is not available locally.

Objectives: To set up a lab in accordance to Good Laboratory Practice (GLP), to validate the relevant methods used to run the lab and to determine the feasibility of such a bioequivalence lab.

Design: The project workflow was divided into three core sections, namely; general lab design, HPLC-MS method validation using sample active pharmaceutical ingredients (APIs) and cost-benefit assessment of the running costs of the analytical bioavailability lab. Quotations for equipment, materials and furnishings were requested and interviews were carried out with eight local pharmaceutical industries. The lab design was dictated by GLP and carried out in line with BS/EN standards.

Setting: Institute of Cellular Pharmacology (ICP)

Main Outcome Measures: Standard Operating Proedures (SOPs) for the operation of equipment and general lab processes were identified, costings for laboratory set-up and running.

Results: A blueprint was designed around an area of 145m^2 which dictated the lab layout. The estimated initial cost for equipment, materials and instrumentation totalled €281,000 while the estimate yearly cost for the running and maintenance of the lab amounted to €92,000. Ten SOPs were created for the calibration and operation of equipment and the day to day running of the lab. Validation runs were carried out using APIs obtained. All companies interviewed obtained their bioequivalence data from their mother companies abroad, eliminating the need for outsourcing such tests to local laboratories.

Conclusion: After evaluating both the running costs and the needs of the local industry, an independent lab equipped to carry out bioavailability and bioequivalence testing could be feasible within the following scenarios: foreign investment in research and development, competition within a European framework and the need for niche testing.

Analytical Methods for the Detection of Ciprofloxacin and Clindamycin

Francesca Busuttil

Background: Foot infections are common in patients with diabetes and are associated with high morbidity. Such infections can be treated with a combination of ciprofloxacin and clindamycin.[1] Therapy may be ineffective due to sub-inhibitory site concentrations which do not eradicate the pathogen. This may be attributed to an impaired target site penetration due to peripheral arterial disease (PAD).[2]

Objectives: To develop and validate an innovative HPLC method for the quantification of ciprofloxacin and clindamycin in serum in patients with PAD.

Design: Analysis was carried out on a Varian® Prostar HPLC unit. An ACE® reversed phase C18 column (250x4.6mm; 5µm particle size) was used. The mobile phase consisted of disodium hydrogen phosphate and acetonitrile (74:26 v/v, pH 2.8) at a flow rate of 1.5ml/min. Ultraviolet detection was set at 277nm. Sulfadimidine sodium and phenobarbital were used as internal standards of ciprofloxacin and clindamycin respectively.

Setting: Research Laboratory, Department of Pharmacy, University of Malta; Toxicology Laboratory, Mater Dei Hospital.

Main Outcome Measures: Validated HPLC method for the determination of ciprofloxacin and clindamycin in human serum.

Results: Clindamycin, phenobarbital, ciprofloxacin and sulfadimidine eluted at 6.21, 9.40, 3.33 and 4.85 minutes respectively. The total run times for ciprofloxacin and clindamycin were 6 and 10 minutes respectively.

Conclusion: The key to successful antibiotic therapy is achieving a therapeutic drug concentration at the site of infection.[2] Sensitive and efficient methods for the determination of clindamycin and ciprofloxacin in serum allows the tailoring of dosage regimens to ensure that therapeutic drug concentrations are achieved at the site of infection in patients with PAD.

References:

1. Bader MS. Diabetic foot infection. Am Fam Physician 2008; 78(1): 71- 79.
2. Kosinski MA, Lipsky BA. Current medical management of diabetic foot infections. Expert Rev Anti Infect Ther 2010; 8(11):1293-305.

Perception of Use of Liquid Capsules

Lara Ann Brincat Ruffini

Background: Liquid-filled capsules are capsule containers filled with liquid and are classified either as soft gel or hard gel.[1]

Objectives: To compare hard liquid capsules with other oral solid dosage forms.

Design: Online questionnaires, which included a photograph of different oral solid dosage forms were developed. These were filled in by 212 patients, 154 pharmacists and 33 physicians. A comparison of consumer prices of liquid capsules with other oral solid dosage forms was carried out.

Setting: Community pharmacies

Main Outcome Measures: Patients', pharmacists' and doctors' perception of liquid capsules, prices.

Results: Liquid capsules were chosen by patients as the top dosage form for: efficiency (n= 118), gentleness on the stomach (n= 98), fast action (n= 112), high quality (n= 110), easy to distinguish (n=94) and modern look (n=123). Pharmacists and physicians gave the same reasons except for distinguishability as tablets were preferred for this property. One hundred and seventy patients would be ready to pay more for liquid capsules. The price per dose for the liquid capsule containing a combination of garlic and co-enzyme Q10 is €0.32.

Conclusion: The majority of participants preferred liquid capsules for efficiency and action. Patients claimed that they would be ready to pay a higher price for this dosage form and this is probably due to the added aesthetic appeal of liquid capsules and their properties being favoured over those of other oral solid dosage forms, especially fast action.

Reference:

1. Cole ET, Cade D, Benameur H. Challenges and opportunities in the encapsulation of liquid and semi-solid formulations into capsules for oral administration. Advanced Drug Delivery Reviews 2008; 60: 747-56.

Medicinal Chemistry and Drug Design

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs Used in Opthalmology
Sarah Anne Briffa

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Anaesthetic Drugs
Jonathan Cefai

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs used in the Management of Skin Conditions
Monique Fava

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database for Drugs Acting in the Gastrointestinal Tract
Katya Sacco

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs used in the Management of Conditions Related to the Ear, Nose and Oropharynx
Abigail Spiteri

Drug Design of Molecules Binding to the 5-HT Receptor using Bioisosteric and *de novo* Techniques - A Comparison
Maria Schembri

A Comparison of the Utility of Bioisosteric vs *de novo* Techniques in Rational Drug Design using Beta-Blockers and Anti-Androgens as Case Studies
Ryan Zahra

***de novo* Design and Optimisation of Novel Leads at the Acetylcholinesterase Receptor**
Michelle Cutajar

Dipeptidylpeptidase-4 Enzyme Inhibitors: A *de novo* Design and Optimisation Study of Novel Leads containing a Deaxanthine Scaffold
Miguel Manara

Bioisosteric and *de novo* Optimisation of Three High Affinity Ligands obtained from the Common Hawthorne Plant for the Angiotensin Converting Enzyme
Justine Chetcuti

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs used in Ophthalmology

Sarah-Anne Briffa

Background: Visualisation is a way of presenting facts to aid understanding; stimulation of visual senses helps cognition and provides motivation.[1] Medicinal chemistry is significantly important for a pharmacy student, but its abstract nature challenges its learning and teaching.[2] The exposure of two and three-dimensional (2D/3D) structures of drug molecules can minimise misconceptions of chemical concepts.[1]

Objectives: To construct a 2D/3D molecular database of ophthalmic drugs and to check its validity among pharmacy students.

Design: The ophthalmic drugs were identified from the British National Formulary 64 ed.[3] The 2D structures and physicochemical properties were generated using Accelrys® Draw. The 3D structures were drawn using SYBYL-X® and the creation of drug-receptor complexes was done using VMD®. The gathered data was compiled in a database and was made available online.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Creation and dissemination of a molecular database.

Results: Seventy-four ophthalmic drugs were found in the BNF; 60 drugs were identified and generated in 2D/3D. Three dimensional representations of drug-receptor complexes were generated for 14 of these drugs. The validity of the database is being evaluated.

Conclusion: The evaluation of results is expected to show a positive measurable outcome on students' understanding and liking of medicinal chemistry. The database will be used as a student tool adjunct to medicinal chemistry lectures with the definitive aim to help students gain the required basis of chemistry needed to successfully complete the pharmacy course.

References:

1. Alake EM, Alam GM, Ayeni AE, Oloruntegbe OK, Oluwatelure AT. Is 3D just an addition of 1 to 2 or is it more enhancing than 2D visualizations? Scientific Research and Essays 2010; 5: 1536-1539.
2. Alam GM, Oke OK. Evaluation of 3d environments and virtual realitites in science teaching and learning. The need to go beyond perception referents. Scientific Research and Essays 2010; 5(9): 948-954.
3. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 64. UK (London): BMJ Publishing Group Ltd/RPB Publishing; 2012.

Creation and Dissemination of Two- and Three-Dimensional Molecular Database of Anaesthetic Drugs

Jonathan Cefai

Background: The use of visualisations and molecular modelling programmes provide a means of describing and learning chemical phenomena which are not observable without visual enhancements.[1] No conclusive evidence is available on the benefit of the use of molecular databases as a teaching tool.

Objectives: To create and evaluate a two and three-dimensional (2D/3D) electronic molecular database.

Design: 2D/3D structure visualisations of drugs in the Anaesthesia chapter of the 'British National Formulary'[2] were created. Visualisations, structural and pharmacological information were merged into an online database. A pre-/post- test case control study was performed via a questionnaire which was validated and disseminated to first, second and third year pharmacy students. The pre-test questionnaire was followed by a post-test questionnaire. Control (n=5, 5, 5) and experimental (n=9, 12, 16) groups were set-up in each course year. The difference between the two groups was that the tutorial and database were not available for the control groups.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Evaluation of molecular database in a teaching environment.

Results: A database of drugs used in anaesthesia was created containing 43 drug entries. Sixty percent of all students agreed that the ability to identify drug properties based on their structure is useful to understand pharmacology and medicinal chemistry. The paired sample t-test revealed a statistically significant increase in score obtained by the experimental groups in all the three course years between the pre and post-test (all p=0.000) compared to the control groups where the change was not significant (p=0.187, 0.128, 0.187).

Conclusion: Inferences derived from this study show significant positive perception of the database and an improvement in students' learning process.

References:

1. Jones LL, Jordan KD, Stillings NA. Molecular visualization in chemistry education: the role of multidisciplinary collaboration. Chem. Educ. Res. Pract. 2005; 6(3): 136-149.
2. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 65. UK (London): BMJ Publishing Group Ltd/RPB Publishing; 2013.

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs Used in the Management of Skin Conditions

Monique Fava

Background: Medicinal chemistry provides a branch for pharmacy students to understand a drug's mechanism of action and structure activity relationships.[1] However, it poses several educational problems related to the understanding of structures and their spatial orientation.

Objectives: To create and evaluate a two and three-dimensional (2D/3D) searchable online database for drugs used in the management of dermatological conditions.

Design: Drug molecules used in the management of dermatological conditions found in the British National Formulary[2] (64th edition) were constructed in 2D and 3D using Accelrys® Draw 4.0 and Sybyl-X®1.2 respectively. VMD®1.9 was used to view the molecules in their apo and holo form. Using Zoho® Creator, the mentioned representations were merged with clinical and physicochemical parameters to create a molecular database and uploaded on the Department of Pharmacy website. Pre- and post-test questionnaires were compiled, validated and disseminated to 82 pharmacy students. Statistical results were generated using SPSS® v. 21.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Creation and evaluation of the molecular database.

Results: Seventy-two drugs were drawn in their 2D and 3D representations. Fourteen PDB entries were identified. The questionnaires had a response rate of 85%. The One-Way ANOVA test showed that after exposure to the intervention lecture and database, students in the experimental group obtained a significantly higher mean score than the control group. All students felt that the use of the database would be relevant in other study units, not just Medicinal Chemistry.

Conclusion: Through the visualisation of molecules, this database provides a more interactive medium for students, enabling them to become more independent learners.

References:

1. Kahn Farouk MO, Philip A. Medicinal chemistry and the pharmacy curriculum. Am J Pharm Educ 2011; 75: 61
2. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 64. UK (London): BMJ Publishing Group Ltd/RPS Publishing; 2012.

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database for Drugs acting in the Gastro-Intestinal Tract

Katya Sacco

Background: Chemistry is considered to be the most visual of sciences. One of the on-going challenges in teaching chemistry is encouraging students to explore the various molecular structural features.[1]

Objectives: To design two- and three-dimensional (2D/3D) molecular structures and create a molecular database of drugs acting on the gastro-intestinal tract and to evaluate the validity of the database as an education tool.

Design: Drugs listed in the section 'Gastrointestinal System' of the British National Formulary were selected as case study. A standardised datasheet was developed using Microsoft® Excel 2010. Accelrys® Draw 4.0 and SYBYL-X 1.1 were used to generate 2D/3D molecular structures respectively. The Protein Data Bank was consulted using OCA Browser© for possible entries. Interactions between the drug ligands and their respective endogenous receptors were illustrated using Visual Molecular Dynamics (VMD)® 1.9. ZOHO® Creator was used to upload the database on the website of the Department of Pharmacy. Validated pre- and post-test questionnaires were disseminated to pharmacy students (n=80) and statistical results were generated using SPSS® version 21.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Creation and evaluation of molecular database.

Results: Fifty drugs were drawn using Accelyrs Draw® 4.0. PDB entries were found for 3 drugs and were used to generate images of the drugs in the apo, holo and receptor-ligand complex. Forty-seven drugs were generated *de novo*. Using the same evaluation questionnaire, the mean percentage score obtained by the students before using the database was 25.6%, which increased to 93.5% after using the database. This increase was statistically significant (p=0.000).

Conclusion: The students had an overall positive perception of the online database and the results show that the online database improved students' knowledge.

References:

1. Charistos ND, Teberekidis VI, Tsipis CA, Sigalas MP. Design and development of a multimedia educational tool for interactive visualisation and three-dimensional perception of vibrational spectra data and molecules. Journal of Education and Information Technologies 2003; 8(4): 369-79.
2. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 63. (UK) London: BMJ Publishing Group Ltd/RPS Publishing; 2012.

Creation and Dissemination of a Two- and Three-Dimensional Molecular Database of Drugs Targeting the Ears, Nose and Oropharynx

Abigail Spiteri

Background: The development of new technologies has enabled the extension of students' learning beyond the classroom.[1]

Objectives: Creation and evaluation, among pharmacy students, of a two- and three-dimensional (2D/3D) structural database of drugs targeting the ears, nose and oropharynx.

Design: The drugs considered were taken from Chapter 12 of the 66th edition of the British National Formulary[2] and the Malta Medicines Handbook.[3] A datasheet with information about each drug was created using Microsoft Excel® 2007. The 2D structures were assembled via Accelrys® Draw and Sybyl®X was used for the 3D construction. The OCA®Browser was used to obtain the PDB files. Jmol® was used to convert the 3D depictions into Java. The datasheet and the 2D and 3D images were embedded into Zoho®Creator. The database was uploaded onto the Department of Pharmacy of the University of Malta website. Validated questionnaires were disseminated as pre- and post-tests. Results were assessed with SPSS®version 21.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Database evaluation using mean scores.

Results: Forty-four drugs were considered and 11 PDB entries were obtained. Sixty-six students participated in the study with 30 students acting as the control group. The scores achieved by the experimental group in the post-test significantly surpassed the scores of the pre-test, with a p-value of 0.000. This trend, seen in all 3 years, indicated that the database provided essential knowledge for the students. After using the database, 92.84% of students agreed that this tool would aid them during the studies.

Conclusion: The use of information technology and merging of clinical and structural data have been shown to benefit student understanding.

References:

1. Wackerly J, Janowicz P, Ritchey J, Caruso M,Elliot E. Using the Cambridge Structural Database to Teach Molecular Geometry Concepts in Organic Chemistry. J ChemEduc 2009; 86(4):460-4
2. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 66. UK(London): BMJ Publishing Group Ltd/ RPS Publishing; 2013.
3. Corso D. Evaluation of a Formulary for Non-British National Formulary Cited Items [dissertation]. Msida (Malta): Department of Pharmacy, University of Malta; 2013.

Drug Design of Molecules Binding to the 5-HT Receptor using Bioisosteric and *de novo* Techniques - A Comparison

Maria Schembri

Background: Conversion of a lead compound into a successful drug is a challenge in drug design. One has to improve the affinity of therapeutic small molecules against their targets whilst ensuring that the molecule reaches the target safely and effectively.[1] Two approaches used are based on bioisosterism and *de novo* drug design.

Objectives: To design molecules that bind to the 5-hydroxytryptamine (5-HT) receptor by using a bioisosteric approach followed by a *de novo* approach and to compare the Ligand Binding Affinity (LBA) of the generated molecules drawn from the two methods.

Design: X-ray crystallographic depositions of 3 Selective Serotonin Reuptake Inhibitors (SSRIs) and 3 Tricyclic Antidepressants (TCAs) were used and their LBA was measured as a baseline. For each of the 6 ligands, 4 different fragments were chosen. Bioisosterism was carried out yielding novel bioisosteres of which the 5 top bioisosteres were retained and their LBA was measured. For the *de novo* design, 15 seeds were optimised into lead compounds and their LBA was measured. Computer programs used were Symyx® Draw, Sybyl-X®, sparkV10®, XSCORE® and LigBuilder®.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Molecule display, modelling, seed generation, generation of novel structures by bioisosterism and *de novo* design, LBA calculation.

Results: One hundred and twenty bioisosteres were generated with a LBA ranging from 5.51 to 7.17. Out of the 120 molecules, 59.1% (n=71) showed an improved affinity when compared to the endogenous ligand. Through the *de novo* method, 2851 molecules were designed with a LBA ranging from 5 to 9.99.

Conclusion: There is sufficient evidence to suggest that when using both bioisosterism and *de novo* design, LBA is improved. This indicates that it is worthwhile to use this dual approach in a comprehensive rational drug design study to yield the best molecules.

Reference:

1. Brown N. Bioisosteres in Medicinal Chemistry. 1st ed. Germany: Wiley-VCH Verlag& Co; 2012.

A Comparison of the Utility of Bioisosteric vs *de novo* Techniques in Rational Drug Design using Beta-Blockers and Anti-Androgens as Case Studies

Ryan Zahra

Background: Rational drug design is widely used in the identification of useful drug molecules through rational approaches.[1]

Objectives: To determine whether the bioisosteric approach is superior to the *de novo* approach and vice versa, consequently establishing whether one approach should be employed preferentially over another or both used concomitantly.

Design: Six molecules were chosen to serve as candidates from two different classes of drugs, specifically the beta-blockers (atenolol, S-propranolol and timolol) and the anti-androgens (bicalutamide, finasteride and hydroxyflutamide). Each molecule was subjected to a comprehensive research and modulation, which aimed to generate novel molecules via both approaches, for which the ligand binding affinity (LBA) was calculated. The study was carried out using computational tools including: Sybyl X1.2®, SparkV10®, X-ScoreV1.3®and LigBuilder®**.**

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Molecule display, modelling, seed generation and LBA calculation.

Results: For the bioisosteric approach, a total of 105 generated molecules were obtained. The predicted binding affinities obtained using the bioisosteric approach were compared to their respective ligands and showed similar or slightly improved affinities than the original ligands. The *de novo* approach resulted in 2133 novel molecules, which were filtered according to their drug-like properties and were subjected to Lipinski's Rules.

Conclusion: The value of using both approaches simultaneously in a drug design study or if one approach will suffice is identified.

Reference:

1. Mandal S, Moudgil M, Mandal SK. Rational Drug Design. Eur J Pharmacol 2009; 625: 90-100.

de novo Design and Optimisation of Novel Leads at the Acetylcholinesterase Receptor

Michelle Cutajar

Background: Acetylcholinesterase (AChE) is an enzyme that breaks down acetylcholine by hydrolysis into its two main components: acetic acid and choline.[1] Gradual inhibition of AChE-mediated neurotransmission is one of the proposed causes of Alzheimer's disease.

Objectives: To use *in silico* techniques, specifically receptor-based drug design, to design novel high affinity ligands for the ligand binding pocket of AChE. These ligands must be sufficiently bioavailable and non-toxic to render them suitable candidates for further iterative drug design studies.

Design: The X-ray crystallographic deposition 1EVE describing the bound coordinates of donepezil with AChE was used. Molecular modification of the receptor was carried out. The bioactive conformation of donepezil was extracted. Three seed structures were constructed and used for *de novo* structure generation. Computer programmes used were Accelrys®, Sybyl-X®, LigBuilder®, XSCORE®, Molsoft® and VMD®.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Two dimensional structures, modelling and seed generation, Ligand Binding Affinity (LBA) calculation, Ligand Binding Pocket elucidation and *de novo* design.

Results: Thirty per cent of the generated molecules obey Lipinski's rules. LBA ranged from 6.03 to 10.00 and molecular weight ranged from 353 to 555. The LBA of donepezil to AChE was used as a baseline measure against which the results were compared.

Conclusion: The *de novo* molecules that were designed represent viable leads for optimisation processes which could lead to the identification of novel AChE inhibitors with high potency and a low side-effect profile.

Reference:

1. Goodsell D. Acetylcholinesterase. Protein Data Bank. June 2004. Available at: URL: http://www.pdb.org/pdb/101/motm.do?momID=54.

Dipeptidylpeptidase-4 Enzyme Inhibitors: A *de novo* Design and Optimisation Study of Novel Leads containing a Deaxanthine Scaffold

Miguel Manara

Background: Agents with some of the advantageous properties of glucagon-like peptide 1 have the potential to address several unmet therapeutic needs of conventional type 2 diabetes mellitus treatments. Dipeptidylpeptidase-4 inhibitors (DPP4Is) promote the action of incretins and have the same clinical effects as incretin mimetics.

Objectives: To create novel incretin mimetic and DPP-4 inhibitor structures using *in silico* design methods.

Design: The study draws its null hypothesis from the papers by Sutton et al.[1] and Kim et al.[2], in which the deaxanthine scaffold, or core structure, is presented as a viable option for the creation of new chemical entities (NCEs) capable of inhibiting the DPP-4 enzyme. Two seeds were created, 'Seed A' and 'Seed B', which, after being placed into GROW algorithm software, resulted in the creation of over 11,000 NCEs for each seed. The best 200 molecules of each seed were used for this study.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Creation and optimisation of novel DPP4Is to be used for second level drug design.

Results: Of the 200 NCEs created with 'Seed A', 22 were Lipinski Rule-compliant except for the molecular weight (the top 400 NCEs were only slightly above the limit) and only one molecule passed all the Lipinski Rule of 5 criteria. Sixty-three NCEs created with 'Seed B' were Lipinski Rule-compliant except for the molecular weight.

Conclusion: All the 400 NCEs had promising physicochemical properties. A total of 22 new chemical families were identified from both seeds for the deaxanthine class of DPP4Is. These 400 NCEs could be placed in a molecular database which may be used in high throughput screening or other research methods.

References:

1.Sutton JM, Clark DE, Dunsdon SJ, Fenton G, Fillmore A, Harris NV et al. Novel heterocyclic DPP-4 inhibitors for the treatment of type 2 diabetes. Bioorg Med Chem Lett. 2012;22:1464–68.
2. Kim HJ, Kwak WY, Min JP, Sung SY, Kim HD, Kim MK et al. Dipeptidyl peptidase-4 inhibitor with β-amino amide scaffold: Synthesis, SAR and biological evaluation. BioOrgMedChemLett 2012;22:5545–49.

Bioisosteric and *de novo* Optimisation of Three High Affinity Ligands obtained from the Common Hawthorne Plant for the Angiotensin Converting Enzyme

Justine Chetcuti

Background: Literature indicates that the triterpenic extract of the Common Hawthorne plant, Crataegus Monogyna comprises three high affinity ligands for the Angiotensin Converting Enzyme (ACE). These are B-Amyrin (BA), Oleanolic acid (OA) and Ursolic acid (UA). Their structures do not conform to the generally accepted pharmacophore for the ACE.[1]

Objectives: To structurally optimise the 3 ligands using two different *in silico* methods and to obtain novel molecules with similar binding affinities as the template molecules, thereby creating a library of molecules with drug-like properties. To establish which method is the most efficient in producing the novel molecules.

Design: Structures of the best binding conformation of each ligand with the ACE as determined by studies conducted by Mifsud[2] and Farrugia[3] were obtained. Three X-ray crystallographic depositions 1UZF, 1UZE and 1O86 describing the bound co-ordinates of captopril, enalaprilat and lisinopril with ACE respectively, were used. This project was divided into 2 phases in which the ligands were first optimised using a bioisosteric approach and then modified through the *de novo* approach. The Ligand Binding Affinity (LBA) of the novel molecules created from both studies was calculated.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Drug modelling; XSCORE-LBA calculation.

Results: The *in silico* LBA of template molecules BA, OA and UA for the ACE were predicted to be 7.25, 7.46 and 7.84 respectively and were used as a baseline for comparison with the novel molecules generated. Results show that both phases produced novel molecules with LBA similar to the template molecules.

Conclusion: Lead optimisation of these ligands was possible through the use of both the bioisosteric approach and the de novo approach.

References:

1. Attard E, Attard H. The potential angiotensin-converting enzyme inhibitory activity of oleanolic acid in the hydroethanolic extract of Crataegus monogyna. Jacq Nat Prod Commun 2006; 1(5): 381-85.
2. Mifsud S. Investigating the ACE inhibiting properties of naturally occurring terpenes using in-silico model [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2011.
3. Farrugia DL. Optimisation of β-amyrin and lisinopril-based lead molecules capable of modulating the angiotensin-converting enzyme receptor [dissertation]. Msida (Malta): Department of Pharmacy, University of Malta; 2012.

M.Sc. Pharmacy
Dissertation Descriptions

Perception and Critical Analysis of the Medicines Entitlement System
Doriella Cassar

Quality Risk Management in a Partial Manufacturing Operation
Richard Despott

Cost Evaluation of Collagenase *Clostridium histolyticum* vs. Surgery for Dupuytren's Contracture in the Maltese Healthcare System
Angelique Lofaro

Pharmacoeconomics in Formulary Decision Making
Sylvana Magrin Sammut

Clozapine Treatment in Patients Living in the Community
Karl Schembri

Perception and Critical Analysis of the Medicines Entitlement System

Doriella Cassar

In Malta, medicines entitlement is based solely upon the presence of disease and is granted irrespective of means, income or age. A critical analysis was carried out through qualitative meetings to identify strengths, weaknesses, opportunities and threats within the present entitlement system. A questionnaire was distributed to determine the perceived, actual and desired knowledge regarding free medicines entitlement by healthcare professionals. A total of 207 doctors, pharmacists and pharmacy technicians answered the questionnaire. The percentage of correct answers ranged from 0 to 100% with an average of 72%.

Quality Risk Management in a Partial Manufacturing Operation

Richard Despott

The aims of the project were to evaluate the work processes of an existing Partial Manufacturing Activity functioning within a socialised National Healthcare Service and setting up of a Quality Management System to support a Licensed Partial Manufacturing Operation. This involved the design and implementation of a documented set of standard operating procedures, which ensured that all the activities are in accordance with established standards and requirements described in the EU Guidelines for Good Manufacturing Practice.

Cost Evaluation of Collagenase *Clostridium histolyticum* vs. Surgery for Dupuytren's Contracture in the Maltese Healthcare System

Angelique Lofaro

The aim of the study was to evaluate whether the introduction of Collagenase *Clostridium histolyticum* (CCH) injections in Malta would be less expensive than surgery. The costs involved in performing open fasciectomy were determined in both the government hospital and in a private hospital. Average costs of CCH injections available abroad were taken. In the government hospital setting, surgery is always less expensive than CCH injections, whereas CCH injections are less expensive in the private setting when treating one affected finger.

Pharmacoeconomics in Formulary Decision Making

Sylvana Magrin Sammut

Knowledge and extent to which pharmacoeconomic information is used locally in formulary decision making was assessed. Analysis of European pharmacoeconomic guidelines was undertaken and a survey was sent to applicable European entities to obtain information for local pharmacoeconomic concept establishment. The majority of local stakeholders strongly agree that pharmacoeconomics should be required in formulary decision making, whilst the majority of European respondents think that Malta would benefit from adopting its own system of pharmacoeconomic assessment.

Clozapine Treatment in Patients Living in the Community

Karl Schembri

An audit was performed at the Outpatients Pharmacy, Mater Dei Hospital, to evaluate patient monitoring of patients receiving clozapine (N=100). Complete blood counts were always taken, however this intervention was not documented. Patient compliance to clozapine was assessed through prescription refills where out of 90 patients, 78 patients were compliant. The medicines entitlement was used to determine co-morbidities and use of other drugs. Diabetes (n=15) was the most common co-morbidity and 76 patients receiving clozapine could be exposed to a potential drug interaction.

B.Sc.(Hons) Pharm.Tech.
Project Descriptions

Cleaning Validation
Daniel De Gaetano

Areas of Activity of the Pharmaceutical Technologist
Kurt Anthony Borg

Access to Medicines
Kirsten Mangion

Cleaning Validation

Daniel De Gaetano

The cleaning procedure applied to the tablet counting machine in use at the Pharmacy of Your Choice (POYC) scheme repackaging unit was investigated. The study includes a critical evaluation of the cleaning method employed based on published evidence. Proposals to reduce the incidence of significant cross-contamination between repackaging batch runs for the specific type of tablets and workloads encountered were put forward. Pharmacological data, together with determination of friability, were used to identify worst case scenarios that have to be tackled in prospective validation of the cleaning procedure.

Areas of Activity of the Pharmaceutical Technologist

Kurt Anthony Borg

Areas of professional activity for students graduating with a Bachelor of Science (Honours) in Pharmaceutical Technology degree and becoming pharmaceutical technologists were identified. The study units of the course were evaluated to establish the students' competencies and skills. Pharmaceutical technologists possess a varied set of skills, applicable to several employment areas within the pharmaceutical industry and other areas. Employers and stakeholders were contacted to obtain perception of the course and skills expected and to describe framework for registration of pharmaceutical technologists.

Access to Medicines

Kirsten Mangion

Medication access within the Maltese primary care system, with particular focus on the national entitlement scheme was assessed. True access is examined in terms of accessibility, availability, affordability and the underlying legislative infrastructure managing the system. Consideration is also given to developments in Malta over the years. The discussion based on pertinent data is extended by comparing Malta to other European Union countries.

Fourth Year
B.Pharm. (Hons)
Project Descriptions

Medicine Use in *in vitro* Fertilisation

Christina Noella Abela

The two main *in vitro* fertilisation (IVF) protocols, the 'long GnRH agonist protocol' and the 'GnRH antagonist protocol', were identified and compiled. A database comparing the retail prices of IVF medicines in Malta, Germany and the UK was assembled using data collected from community and hospital pharmacies. Preliminary results reveal that from 33 medicines that can be used in IVF, only an average of 6 generic medicines are available in each country, thereby contributing to highertreatment costs. This project provides concrete economic comparisons which will establish the basis of proposals for governmental implementation.

Journal of EuroMed Pharmacy

Joseph Christian Abela

The Journal of EuroMed Pharmacy (JEMP) is an annual publication by the Department of Pharmacy. A questionnaire was developed, validated and distributed to all registered pharmacists (N=916) and pharmacy students (N=154).Interviews were held with editors of healthcare scientific journals. Eighty five percent (n=137) of respondents agree the journal contributed positively to their continuous professional development or their area of study and 13% consider paying for future issues. Editors gave positive feedback and offered advice to overcome potential limitations inupcoming issues such as financing and distributing.

Veterinary Medicine

Annalise Attard

A guidebook withinformation about commonly encountered animal ailments to be used by pharmacists and pet owners is created. Interviews with veterinary pharmacists from 6 differentveterinary pharmacies in Malta,were conducted. Preliminary results show that animals mostly affected with common ailments are dogs, cats, birds and pigeons whilst rabbits, horses and farm animals are the least affected. Whilst over-the-counter medicine suffices for managing ailments in humans, presentation of symptoms in animals are referred to a veterinary surgeon.

Chronopharmacology and Pain

Christine Attard

A questionnaire to assess the diurnal variation of pain in patients has been developed and validated by a panel of 6 experts consisting of pharmacists, physicians, rheumatologists and pain specialists. The questionnaire contains 10 pain descriptors, a visual analogue scale, pain intensity scale and 12 assessors of characteristic side-effects. Results from the questionnaire will allow the evaluation of the circadian component of steroids and non-steroidal anti-inflammatory drugs used in patients suffering from rheumatoid arthritis and osteoarthritis.

Evidence-base for Clinical Pharmacy

Jessica Attard

Clinical pharmacy activities in different hospital settings were identified. An extensive literature review was conducted to analyse the interventionsof the clinical pharmacist in various medical specialisation areas. Studies performed locally and internationally were taken into account. Results show that the presence of a clinical pharmacist is beneficial both in terms of outcome of therapy, which affects the patient's medical condition and quality of life, as well as being a means of economic advantage to the healthcare system.

Dietary Practices at Mater Dei Hospital

Francesca Attard Baldacchino

The dietary habits of cardiovascular patients at Mater Dei Hospital are assessed using aFood Frequency Questionnaire (FFQ). This records the hospital food consumption patterns of in-patients. Validation and back translation of the questionnaire were carried out. Test-retest reliability proved the FFQ reliable since respondents gave reliable answers for the majority of food items, with the resulting p-value, corresponding to 78 food items, being less than 0.05, hence matching the required criterion for reliability.

Medicine Storage Temperature Control: Economical and Environmental Considerations
Kristina Baron
The annual cost of maintaining statutory temperature storage requirements was evaluated for two sample community pharmacies. This was found to amount to 70.4% of the total actual annual energy expenditure, €3811.44, as averaged between the two pharmacies. A questionnaire was disseminated to local pharmacy administrators to collect their views on, and their adherence to good temperature control practiceand their views towards adopting novel methods of energy conservation. The questionnaire aimstopromote sustainability within the context of a community pharmacy.

Guidelines in Product Distribution and Storage
Stephen C. Bartolo
The new Guidelines on the Good Distribution Practice of medicinal products have been studied. Wholesale distributors had to adapt their Standard Operating Procedures (SOPs) to adhere to these new guidelines. The new and old guidelines are compared with special attention to the transportation of medicinal products for human use. A new SOP is recommended for the transportation of products, emphasising the differences between the new and old guidelines. The recommended SOP includes the preparation, loading and delivery of medicinal products.

Diabetic Patient Risks: Outcome Indices
Leanne Bason
Determination of the motivation, drug treatment and knowledge regarding complications and lifestyle modifications in type 2 diabetic patients was undertaken by distributing a questionnaire to 50 patients who were randomly recruited from Mater Dei Hospital. The compiled questionnaire was validated by an expert panel. Results show that patients with thoroughknowledge regarding complications and lifestyle modifications lacked motivation to adhere to lifestyle changes to improve their quality of life.

Design of Novel Anti-Prostate Cancer Drugs which Modulate the CYP17A1 Receptor using Galeterone as Lead Molecule
Marie Claire Bonanno
Androgen receptor antagonists are used clinically in the management of prostatecancer and the discovery of new molecules in this area generates increasinginterest. Galeterone, or TOK-001, is an androgen receptor antagonist which iscurrently undergoing phase two studies in patients with castration-resistantprostate cancer. This study aims to use galeterone as a lead molecule for furtheriterative design of novel anti-prostate cancer drugs which modulate the CYP17A1 receptor. Optimisation and modification of this ligand could yield better CYP17A1 inhibitors with anti-prostate cancer properties.

Designing Analogues of the Naturally Occurring Alkaloid Huperzine A
Sara Bonavia
Huperzine A is a natural cholinesterase inhibitor derived from the Chinese herb *Huperziaserrata*. The X-Ray Crystallographic model of Torpedo californicaacetylcholinesterasecomplexed to the nootropic alkaloid Huperzine A (1VOT) was identified from the Protein Data Bank. Two seeds were constructed *de novo* in SYBYL® and novel structures were generated using LigBuilder®. Binding affinities of each novel structure were compared to that of Huperzine A using X-Score®.

Drug Design for the Management of Alzheimer's Disease
Neil Bugeja
Tiotropium is a long-acting anticholinergic bronchodilator used in the treatment of chronic obstructive pulmonary disease. It is a muscarinic receptor antagonist with its main action being on the M3 muscarinic receptor subtype. This project aims to create a homology model of the M1 muscarinic receptor based on the similarities shared with the M3 muscarinic receptor. A number of different tiotropium conformers have been generated *in silico*. These can now be used to design M1 receptor modulators with the potential for use in the treatment of the pathogenesis involved in Alzheimer's disease.

Access to Oncology Medicinal Products on the Government Pharmaceutical Formulary
Alexandra Cachia
The Government Formulary List (GFL) has been evaluated by analysing its contents, mapping documents and protocols regarding oncology medicines. Requests to obtain a medicine not listed on the GFL or listed for different indications through the Exceptional Medicinal Treatment Policy and Health Technology Assessments to include a product onto the GFL, have been evaluated. Reasons for approval or rejection of requests have been identified.

Pharmaceutical Care in Psychiatry
Deborah Camilleri
Current prescribing practices in antidepressant therapy are evaluated. A healthcare professional questionnaire is devised, validated and self-administered to psychiatrists and general practitioners or sent via electronic mail. Following analysis of local prescribing trends, a comparison is compiled and adherence to established guidelines is assessed. Preliminary results indicate that Selective Serotonin Reuptake Inhibitors are presently the gold standard of therapy in the treatment of major depression. Ninety percent of psychiatrists practising within a hospital setting found the introduction of a clinical pharmacist 'very useful'.

Patient Expectations of Medicines Use Review
Matthew Camilleri
Medicines Use Reviews were conducted on patients receiving medications from the Pharmacy Of Your Choice (POYC) scheme. By using five validated and reliability tested tools, this concordance and compliance review helps patients gain more familiarity with their medication and pharmacists can identify drug-related problems. A total of 120 patients were recruited from ten pharmacies selected by using stratified random sampling. Six hundred and sixty-two (N=662) interventions were made. A follow-up is done to assess impact, satisfaction and improvements to the proposed service.

Design of Novel Antihistaminic Agents based on the Molecular Structure of Doxepin
Rachel Camilleri
The histamine H1 receptor is activated by the biogenic amine histamine which is involved in the pathophysiology of allergy and inflammation. The X-ray crystal structure of the H1 receptor complexed with doxepin was identified from the Protein Data Bank. The 3D structures of desloratidine, levocetirizine and fexofenadine were constructed using Sybyl® and 20 conformers were generated for each molecule. The ligand binding energy and ligand binding affinity were calculated for each conformer using Sybyl® and X-Score® respectively. The best conformers were chosen to produce seed structures.

A Rational Drug Design Approach for the Identification of Novel Selective Cyclooxygenase-2 Inhibitors
Clarissa Caruana
This study aims to design novel ligands which selectively inhibit cyclooxygenase-2 using hydroxylated analogues of resveratrol as molecular templates. Twenty binding conformers were generated for each hydroxylated analogue. The Ligand Binding Affinity (LBA) and Ligand Binding Energy (LBE) of each binding conformer were calculated. LBA (pKd) values range from 5.36 to 6.48, compared to an LBA (pKd) of 7.39 for celecoxib. The best binding conformers, which were identified on the basis of having the highest LBA and lowest LBE values are being used as lead molecules for further modelling and design.

Pharmacist Prescribing and use of Antibacterials
Gianella Casha
Previous local studies show that pharmacists are willing to accept pharmacist prescribing mainly in the areas of minor infections and skin conditions. A set of guidelines are prepared based on common skin conditions including acne, eczema, psoriasis, insect bites and eye infections (bacterial conjunctivitis, hordeolum and chalazion). The guidelines include scenarios where pharmacists should refer, a set of protocols to help the pharmacist with the diagnoses and treatment options and a documentation system including a prescription template and a referral form.

Management of Side-Effects of Chemotherapy

Danika Caruana

Occurrence of side-effects in breast cancer patients initiating FEC or FEC-T chemotherapy regimenis assessed. A quality of life tool, theEORTC-QLQ-C30) is disseminated to patients prior to Cycle 1 and after Cycle 3, while the Morrow Assessment of Nausea and Emesis questionnaire and psychometrically evaluated assessment tools adapted for oral mucositis and diarrhoea are used after Cycle 1 and 3. Out of the 15 newly diagnosed breast cancer patients recruited, 10 reported the occurrence of nausea while 6 recounted oral mucositis manifestation following Cycle 1. No episodes of emesis and diarrhoea were described.

Synthesis of Active Pharmaceutical Ingredients: A case study

Conrad Cassar

Synthetic processes for the production of active pharmaceutical ingredients with special reference to the acylation of steroids bearing a hydroxyl (OH) group at the C21 position are studied. A review discussing the acylation of OH groups using acid or base catalysis at different reaction conditions is prepared. Special attention is given to selective and green methods. Trimethylsilyl trifluoromethanesulfonate is used to selectively acylate a OH group at the C21 position to produce a 17, 21-diester steroid molecule. Thin layer chromatography is used to monitor the reaction and assess the product.

Standard Operating Procedures In Community Pharmacy

Michelle Marie Cassar

Seven standard operating procedures (SOPs) for common processes in a community pharmacy were developed. These procedures cover dispensing, ordering and storage of medicines, non-medicinals and clinical services, documentation, waste control and staff management. Nineteen pharmacies around Malta, were identified and contacted. The SOPs were applied in 13 pharmacies and the first follow-up audits are being carried out to establish the status of implementation of these SOPs.

Further Studies on Amylase and Other Enzymes on Gastro-Intestinal Disorders

Ritianne Cassar

The activity of different proton pump inhibitors (PPIs) is evaluated using the Reflotron® device by analysing salivary and pancreatic amylase from patients' gastric juice. Two gastric juice samples were collected. One patient from whom the sample was taken was on PPI therapy and the other patient sample was used as a control. Four methods for analysis of lipase activity were found. Followingcost analysis studies, the Sigma-Aldrich® lipase activity assay kit was found to be the most cost-effective.

Chronopharmacology in Hypertension

Sephorah Falzon

Patients with primary hypertension whotake valsartan or amlodipine are monitored using a 24- hour ambulatory blood pressure (BP) monitor. Heart rate, systolic BP and diastolic BP are measured when the drugs are administered either in the morning or in the evening. A normotensive group and a control group of patients are also recruited. Results of patients on valsartan show that morning and evening dosing similarly reduce 24-hour mean systolic and diastolic BP. Morning dosing is more effective during the early morning and day-time hours, evening dosing is more effective at night.

Design of Epidermal Growth Factor Inhibitors

Marie Claire Farrugia

Disorders of intra- or intercellular communications result in a number of conditions including cancer. Naturally occurring molecules 2-o-caffeoyl tartaric acid, emetine, rosmaricineand 2-o-feruloyl tartaric acid were used in this projectto design novel structures capable of inhibiting the tyrosine kinase-epidermal growth factor receptor. The ligand binding affinity and ligand binding energy of all the possible conformations for the four naturally occurring ligands were calculated using X-Score® and SYBYL® respectively to initiate the molecular design process.

Pharmacoeconomics of Vaccination in Paediatrics

Maria Galea

To assess the knowledge, attitude and perception of parents regardingvaccines and vaccine-preventable illnesses and to evaluate the pharmacoeconomic implications of childhood vaccination. Knowledge and perception of parents on conditions, protection offered by vaccines and cost is assessed using questionnaires. An informative resource on childhood vaccination, providing adequate information for parents to make an informed decision and which addressesany misconceptions is developed.

Pharmaceutical Care in Venous Thromboembolism

Jeanine Grech

The risk ofvenous thromboembolism (VTE) in hospitalised patients and the extent of prophylaxis usedwas reviewed using the UK NICE guidelines for VTE prevention as comparison. Data from 80 patient files from the Medical and Surgical wards at Mater Dei Hospital was collected. Initial results showed that VTE prophylaxis was administered to 67% and 63% of at-risk medical and surgical patients respectively. The main prophylactic agent used was enoxaparin, a low molecular weight heparin, –(82% of the cases). In contrast, 18% of the at-risk patients received unfractionated heparin.

Risk Management in Pharmacy

Matthew Manfre

The practice of pharmacy, including risks involved, continue to evolve. It is therefore important for pharmacists to develop strategies to handle the risks they are faced with on a daily basis to safeguard themselves, their business and their patients. The aims of the project are to investigate the science of risk management and its relevance to pharmacy and to compile a glossary withthe purpose of standardisation of risk management terminology used in a pharmaceutical setting.

Pain Management in Post Caesarean-Section

Deborah Mangion

Pain management in post-caesarean section, including analgesia used and method of administration adopted is assessed. A descriptive cross-sectional study regarding the use of patient-controlled analgesia (PCA) pumps in post-caesarean pain management is carried out. Patient outcomes and satisfaction with PCA in the management of post-operative pain is evaluated. Efficacy, safety and cost-effectiveness of this post-operative analgesia are assessed.

Mini-Scale Production Facility

Maria Mercieca

The backbone of the pharmaceutical industry in Malta is innovation and sustainability, especially in start-ups. In view of this, a versatile facility for the manufacture of solid oral dosage forms is designed to satisfy “green” environmental and architectural aspects vis-à-vis European Union Good Manufacturing Practices. The proposed plan of the facility is designed on three levels; warehouse on ground floor, packaging on first floorand tableting process on the upper floor. The ancillary zones are locatedat the front of the facility.

The Medicines Authority: A Policing Authority or a Collaboration for Patient Benefit?

Benjamin Micallef

A case study qualitative method was adopted. An interview protocol was designed and validated. Seveninterviews with experts in various fieldswere carried out.Each interview had a unique set of topics and questions, based on preliminary background research and fieldwork. A total of 70 questions and probes were asked. Each interview was recorded, transcribed and analysed. Prominent themes included advocating patient benefit, future challenges, positive initiatives and prevention of abuse.

Design of Novel Carbonic Anhydrase Inhibitors

Jessica Marie Muscat

Carbonic anhydrase IX (CA IX) is a tumour- associated isoform of the carbonic anhydrase (CA) family. The aim of this project is to design *de novo,* ligands which will selectively inhibit CA IX with the objective of preventing proliferation of tumour cells with a side-effect profile that is less than that of the non-selective but potent sulfonamide CA inhibitors. The ligand binding affinity of acetazolamide for CA IX was found using X-score and will be used as a benchmark against which the affinity of the designed ligands may be compared.

Pharmacoeconomics in the Management of Drug Abuse

Maria Pace

Ninety-two questionnaires were completed to establish the cost of illness of heroin dependency and identify trends between methadone (MST) and buprenorphine (BST) substitution therapies. Ninety-two percent of patients at the Substance Misuse Outpatient Unit are on MST. Forty-three percent of patients who are on BST and 65% of patients who are on MST are unemployed. Sixty-seven percent of the unemployed patients who are on MST state that MST interferes with their work, in contrast to none of thepatients who are on BST Forty-six percent of patients who are on MST still abuse heroin regularly, while all patients who are on BST have refrained from heroin abuse.

Novel Drug Design at the Dihydrofolate Reductase Enzyme

Graziella Portelli

Dihydrofolatereducatase(DHFR), a ubiquitously expressed enzyme, is responsible for maintaining the necessary pools of folates needed by all cells for production of purine and thymidylate cellular building blocks. Inhibition of DHFR results in exhaustion of DNA building blocks hence proliferation is ceased. X-Ray Crystallographic PDB deposition 1U72, describing human DHFR bound with the antifolate inhibitor methotrexate was selected. This textual file will serve as a map for the *in-silico* design of high affinity novel molecules which inhibit hDHFR using several programmes such as LigBuilder.

Use of Medication in Paediatric and Elderly Patients

Clarissa Rizzo

The use of medication in both paediatric and geriatric patients has changed significantlythroughout the years, improving the therapeutic effect as well as compliance. This project identifies drugs which are most commonly used in both age groups and suggests how their use may be improved for betterpatient management. It provides an insight into the most common adverse drug reactions and ways in which this incidence can be decreased by enhanced patient counselling and patient communication.

Impact of Technology on Shared Care

Analise Said

Shared care promotes continuity of patient data. Through technology, quality of healthcare can be improved as information can be recorded on a single database such as an Electronic Medication Record (EMR). Technology can further promote shared care by Electronic Health Records. This record enables transfer of an EMR across different health care entities. Scenario analysis in hospital and the Pharmacy of Your Choice scheme through community pharmacies showed that some form of EMRs exist however these are not integrated and cannot be viewed by healthcare professionals in different healthcare settings.

Centralised Preparation of Intravenous Admixtures

Diane Saliba

Preparing intravenous admixtures centrally in a controlled environment is essential to ensure patient and personnel safety. A risk assessment of intravenous medications currently used at Mater Dei Hospital is being developed to determine the impact of preparing them on wards versus preparing themcentrally in a controlled environment. Risk factors evaluated include those to the present system, to healthcare workers preparing admixtures in clinical areas, as well as risks to patient safety. Out of the 20 medicines analysed to-date, 16 were found to be high-risk when prepared in clinical areas.

Drug Design of Novel β1-Adrenoceptor Blockers

Astrid Marie Sant

The structure of human β1-adrenoceptor, an important target for the management of hypertension, has not yet been crystallographically elucidated. Using its amino acid sequence and turkey β1-receptor as template, a homology model was constructed. The binding affinity of the antagonist carazolol with both receptors was found. Novel structures capable of inhibiting the β1-receptor will be designed *in silico* through an approach that takes into account the asymmetry inherent to molecules of this class and through rigidification strategies that could lock designed molecules into the required conformation.

Creation of a Tool to Predict Affinity of Drug Molecules for Cytochrome P450 Enzymes

Caroline Spiteri

Mycobacterium tuberculosis (MbT) has been difficult to eradicate due to the constantemergence of resistant strains. Azole antifungals are used as templates for this project due to their high affinity for the CYP450 enzymes prevalent within MbT (CYP51, CYP121 and CYP130) and their *in vitro* inhibitory activity. This study aims to use the Protein Data Bank deposition 2IJ7 which describes the crystal structure of *MbT* CYP121 in complex with the antifungal drugfluconazole that reveals a new azole drug-P450 binding mode.

Use of Drugs in Patients in ITU and Critical Care

Annalisa Thake

A scenario analysis was carried out to identify dosing regimens of gentamicin at the Intensive Therapy Unit, Mater Dei Hospital. Patient information records of28 adult patients receiving once daily gentamicin treatment were reviewed and drug blood levels were compiled. A data collection form was developed and validated. The treatment doses for these patients, resulted in correct dosing (61.6%), underdosing (32%) and overdosing (6.4%). One patient had a gentamicin level in the toxic range (>10mg/l) and in 5 patients treatment was stopped due to renal problemsand high gentamicin levels.

Evaluating Impact of Advice from Community Pharmacists

Lisa Warrington

Fifteen community pharmacies were selected by stratified random sampling. A pilot study is currently being conducted to evaluate requests for advice to pharmacists and patient satisfaction with the advice given. A questionnaire is distributed to eighteen patients from each of the 15 community pharmacies (N=270). From background observation studies, preliminary resultsindicate that patients ask the pharmacist advice predominantly for symptom management.

Patient Education on Women's Health

Nicola Warrington

A questionnaire forhealthcare professionals was developed to establish those areas related to women's health where patientinformation is lacking. A draft version of the questionnaire was reviewed by an expert panel to ensure face and content validity. After the necessary amendments to the questionnaire were made, test-retest reliability was undertaken. The questionnaires were distributed to 65 pharmacies across Malta. The content of the current women's health website, developed in a previous study, is being updated and a campaign to encourage patients to visit the websiteis being designed. Pharmaceutical policies in EuropeanMember States have been compared to the local scenario.

Third Year
B.Sc. (Hons) Pharm.Sci.
Project Descriptions

Pharmacist Manpower
Petra Abdilla
In the 2012 'Global Pharmacy Workforce Report' issued by the International Pharmaceutical Federation (FIP), Malta was reported to have the highest density of pharmacists amongst the 90 countries considered. An in-depth study is being undertaken to analyse the different activities covered by pharmacists within all pharmaceutical services.

Pharmacist Prescribing
Abigail Aquilina
Different hospital areas where pharmacists are contributing to drug therapy management are observed and different models of prescribing are reviewed. Protocols for pharmacist prescribing in the local hospital scenario are designed based on models currently practiced in other countries. The protocols are proposed to all health care professionals following an evaluation by a panel of experts.

Drug Design at the TLR4 Receptor
Daniel Attard
The antagonism of the TLR4 receptor is associated with the mitigation of autoimmune inflammatory responses. In this study the small molecules eritoran and TAK-242 (resatorvid) are studied as leads in the *in silico* design of novel structures with potential anti-inflammatory clinical utility.

POYC - Where Are We Going? Patient and Pharmacist Forum
Hannah Bonnici
Patients and pharmacists in community pharmacies registered under the Pharmacy of Your Choice (POYC) Scheme are interviewed to assess the current situation and identify issues within each pharmacy. Patient and pharmacist representatives are invited to put these issues forward for discussion and handling within a forum. An online forum is also set up.

Evidence Based Use of Herbal Medicines
Justine Borg
An extensive literature review is undertaken to develop an evidence-based assessment for the classification of a herbal product as a medicine or otherwise. This assessment is used to determine whether herbal product use actually has evidence-based beneficial value. Analysis of the requirements needed for a herbal preparation to obtain a marketing authorisation as a medicine is carried out.

The Design of Novel Structures with an Aminopiperazinone Scaffold Capable of Inhibiting the Beta-Secretase Enzyme for the Management of Alzheimer's Disease
Luke Borg
Current treatment for Alzheimer's disease which includes NMDA antagonists and acetylcholinesterase inhibitors is symptomatic and fails to reverse the condition. The β-secretase enzyme is cited in literature as being a potential disease-modifying target for this condition. The use of the aminopiperazinone scaffold for the *in silico* design of novel structures capable of inhibition of the secretase enzyme is studied.

Use of Compliance Aid Devices: Psychiatry
Estelle Borg Falzon
Use of compliance aid devices in psychiatric outpatients and in domiciliary care is analysed. A group of psychiatric patients chosen by convenience sampling is given different compliance aid devices to use for a specified time frame. The impact of the introduction of such devices in this patient group is evaluated with respect to practicality, cost-effectiveness and rate of compliance.

Pharmacist Services in Community Pharmacies
Andrew Busuttil
An evaluation of how time is spent on professional services by community pharmacists is undertaken. A discussion paper on the development of new professional services which could be offered locally by community pharmacists is drawn up based on an analysis of professional services offered by community pharmacies in different countries. Time and motion studies are undertaken in 22 community pharmacies.

Multidisciplinary Tasking in Cancer Patient Management
Ann Camilleri
A study is carried out to identify pharmacist intervention within a multidisciplinary team in an oncology setting. A questionnaire regarding the pharmacist's intervention is developed and distributed to other health care professionals within the team. Results obtained are used to assess the perception regarding services provided by the oncology pharmacist.

Methadone Dispensing Services
Mark Caruana
The distribution and dispensing of methadone in Malta requires improvement. The current centralised service is reviewed and the benefits of a regionalised service are investigated. The dispensing protocol implemented in other countries is evaluated to suggest improvements to the dispensing service in Malta. Community pharmacies involved and the feasibility of developing and maintaining a decentralised structure is determined.

Association of Medicinals to Sleep Apnoea
Yanica Cassar
One hundred and eighty three medical records of patients who were referred to the National Health Services Sleep Lab are reviewed taking into consideration their drug history and Epworth Sleepiness Score (ESS). According to the ESS value, patients are divided into two groups: patients diagnosed with obstructive sleep apnoea (OSA) and those not diagnosed with OSA. The aim is to determine the effect of commonly used medications and alcohol intake on OSA and its therapy.

Risk Management in the Pharmaceutical Industry
Matthew Chircop
The effect of temperature fluctuations above recommended values is evaluated in a risk study. This study incorporates drugs stored at room temperature and at colder temperatures. A risk assessment is carried out to determine drug safety following one hour exposure at one degree Celsius above the recommended temperature.

Quality and Safety of Pharmaceutical Solvents used in the Pharmaceutical Industry
Darren Cioffi
Solvents are used in the pharmaceutical industry for various purposes. The solvent selection process in the primary pharmaceutical industry concerned with synthesis of the active pharmaceutical ingredient (API) is evaluated. This process is assessed in accordance with green chemistry principles with respect to quality and safety. Alternatives to replace hazardous solvents are considered.

Design of Novel Anti-Prostate Cancer Drugs which Modulate the CYP17A1 Receptor using Abiraterone as Lead Molecule
Kurt Degabriele
Prostate cancer is one of the most common cancers in men; statistics indicate an increased incidence above the age of 70 years and possibly below 50 years. The drug abiraterone is used as a lead molecule to design novel molecules capable of inhibiting the enzyme CYP17A1. Inhibition of CYP17A1 will help in the reduction of testosterone biosynthesis decreasing the rate of prostate cancer growth.

Professional Development of Pharmacists
Amanda Farrugia
Updates on breast cancer, mood disorders, arrhythmias and medications used in these conditions are reviewed and prepared for the local scenario. Updates are developed for pharmacist Continuing Professional Development (CPD) according to an established template and are reviewed by an expert panel, presented to pharmacists and evaluated. The perception of pharmacists on these updates is studied.

Use of Non-Steroidal Anti-Inflammatory Drugs
Jessica Farrugia
A pharmacoeconomic study on the local use of non-steroidal anti-inflammatory drugs (NSAIDs), including treatment required for the occurrence of side-effects and drug interactions is undertaken. Trends in NSAID prescribing by primary care physicians are also determined. This data is collected using questionnaires distributed to different pharmacies chosen by stratified sampling.

Drug-Induced Effects and Hospital Admissions
Nicola Farrugia
The occurrence of medication errors related to hospital admissions is investigated. Admissions to the Emergency Department at Mater Dei Hospital are observed to identify drug-related hospital admissions. These admissions are classified into categories depending on the medication error that occurred. Proposals to reduce the risk of particular medication errors are put forward.

Medication Reconciliation during Transfer of Care
Tresha Formosa
Observations are undertaken to identify pharmacist intervention in patient history-taking and to assess whether the pharmacist is the most suitable healthcare professional for this task. Changes to the medication list on admission, type of changes and their potential clinical impact are investigated. Proposals for processes to be implemented are drawn up.

Partial Manufacturing
Matthew Gatt
Aspects associated with Partial Manufacturing (PM) within the Pharmacy of Your Choice (POYC) scheme are considered. The main focus is the establishment and compilation of valid standard operating procedures to be adopted in the POYC PM area. Patients' perception on the presentation of PM products is considered. An investigation of the PM process with the aim of improvement it is undertaken.

Adverse Drug Reactions Database
Rachel Gauci
A database for side-effects presenting with drugs for gastro-intestinal tract, cardiovascular and respiratory systems is developed. An evaluation is carried out to assess the usefulness of this database to health care professionals. The database is evaluated by doctors, pharmacists, pharmacy students and lay persons.

New Drug Distribution Regulations
Luca Giudice
Drugs should be distributed in accordance with Good Distribution Practice (GDP) guidelines to ensure that the patient is receiving the highest quality drug possible. An analysis of GDP in the local scenario is carried out.

Design of Novel Anti-Prostate Cancer drugs which Modulate the CYP17A1 Receptor using Ketoconazole as a Lead Molecule

Michael Grima

A well resolved X-ray crystallographic model (PDB ID: 3RUK) of CYP17A1 bound to abiraterone was identified from the Protein Data Bank. Novel abiraterone analogs were designed using the antifungal drug ketoconazole as a probe. These analogs are optimised and proposed as viable lead molecules for inclusion into databases for high throughput screening.

Drug Design at the Sphingosine-1-Phosphate Receptor for the Management of Multiple Sclerosis

Daphne Gusman

The binding modality of fingolimod for the sphinogosine-1-phosphate receptor is used to identify novel S1PR leads capable of inhibiting this enzyme. Such molecules will have the potential for further evaluation and subsequently find clinical use in the management of multiple sclerosis.

Yield in Synthesis of Active Pharmaceutical Ingredients

Christopher Davis Mallia

The improvement in the synthetic processes of active pharmaceutical ingredients with respect to product yield is studied. The synthesis of a steroidal compound is used as an example. Experimental conditions, such as temperature and pH, reagents and catalysts are varied to determine the best conditions needed for optimal yield.

Use of Protocols in Community Pharmacy

Kyle Marston

Protocols can support professional services in a community pharmacy when responding to symptoms. Protocols published locally are streamlined and compared to international versions. The developed comprehensive set of local protocols for responding to symptoms applicable to the local scenario are evaluated by an expert group.

Drug Design at the Human Glucocorticoid Receptor

Sean Meachen

Glucocorticoids are involved in a variety of endocrine functions. Their chronic use is associated with a plethora of side effects which limit their use. Novel structures capable of superior modulation of the aforementioned protein target are identified using specialised software such as VMD® and LigBuilder®.

Drug Design at the HIV Reverse Transcriptase Enzyme

Marie Mifsud

Discovery of novel drugs capable of managing the HIV virus is important since the resistance of this virus to drugs in current clinical use remains a consideration. The reverse transcriptase enzyme is used as a target for which antagonist molecules are designed. Investigational NRTI GS9148 and NNRTI GW678248 are modified to increase their potential in the modulation of the receptor.

Design of Novel Non-Steroidal Structures capable of Antagonism of the Oestrogen-Related Receptor Alpha (ERRα) for the Management of Breast Cancer

Keith Muscat

A literature review outlined the basis of breast cancer, the mechanism of action of the ERRα and the steroidal drug SR16388. This showed that the drug is promising as a lead for the development of novel structures to antagonise the ERRα. The structure activity relationships of the drug are studied to optimise its structure and create novel non-steroidal structures to antagonise the ERRα.

Management in Chemotherapy Admixtures
Dylan Said
Local management systems involving chemotherapy admixtures are reviewed with special focus on strategies that maximise the efficient preparation of cytotoxic medicines. Cost and waste minimisation of batch prepared chemotherapy doses using modern aseptic technology are computed. Validation studies and risk assessments of this proposed practice to ensure the quality of the medicinal preparations are reviewed.

Argotti Gardens and the Use of Herbal Products
Katrina Saliba
Research about the history and set up of Argotti Gardens is conducted and a booklet containing this information is prepared. Studies about herbal products undertaken by previous pharmacy students are compared to the related scientific studies undertaken by biology students at the Argotti Herbarium. The differences, similarities and consistency in the results are evaluated.

Drug Design at the Human Fatty Acid Synthase Enzyme using Orlistat as Lead Molecule
Ramon Sciberras
Obesity is increasingly becoming an alarming comorbidity, affecting the majority of organs in the body. This study targets both the pancreatic lipase which hydrolyses fat molecules for absorption, and the thioesterase domain in the human fatty acid synthase enzyme which synthesises fat molecules, using orlistat as template molecule to find a novel structure capable of inhibiting the two enzymes.

Formulary for Non-BNF Cited Items
Timothy Scicluna
The 'Maltese Medicines Handbook' serves as an addendum to the British National Formulary (BNF) as it contains medicines and medical devices found on the local market which are not found in the BNF. The latest edition of this handbook published in 2013 is evaluated and updated. The formulary is also developed online and the impact of this new dissemination platform is evaluated.

Waste Management in Pharmaceutical Processes
Shirley Tabone
The management of industrial waste with emphasis on waste disposal of solvents is evaluated. The effect of different types of waste on the environment is discussed. Methods of treatment and disposal of pharmaceuticals is assessed and the implementation of such a method in Malta is evaluated. Cost analysis of the equipment, water and electricity, labour and premises is conducted.

Pharmacist-Led Adherence Clinics for Chronic Conditions
Jessica Vella
Advice provided by community pharmacists about adherence to medications received from the Pharmacy of Your Choice scheme for chronic conditions is identified and assessed. Evaluation of interventions in pharmacist-led adherence clinics for chronic conditions in international sessions is assessed. This review puts forward the proposal for the development of local pharmacist-led adherence clinics for specific chronic conditions.

Extraction of Drugs from Biological Fluids
Maria Vella
A literature review on extraction procedures of drugs from biological fluids is undertaken. An innovative technique for the extraction of clindamycin and ciprofloxacin from human skeletal tissue is developed. The extraction method is validated and analysed using high performance liquid chromatography. The developed method is applied to a clinical setting.

Design of Novel A2A Adenosine Receptor Antagonists for Treatment of Parkinson's Disease
Yana Vella
The X-ray structure of A2A adenosine receptor complexed with ZM-241,385 (3EML) was identified from the PDB. Antagonism of the A2A adenosine receptor, abundant in basal ganglia, where it opposes the D2 receptor's actions, has potential in Parkinson's disease management. This project aims to use this receptor for the *in silico* design of novel structures capable of exerting such antagonism.

Human Papilloma Virus Vaccination
Bettina von Brockdorff
Various factors related to the use of the human papilloma virus (HPV) vaccines available and their impact on the healthcare system locally are studied. Perception of the HPV vaccine amongst Maltese pharmacists and different specified social groups is assessed. Administration schemes of this vaccine in different countries are studied and assessed.

Drug Design at the Angiotensin Converting Enzyme (ACE) using Rubiatriol as Lead Molecule
Althea Marie Xuereb
Somatic angiotensin-converting enzyme (ACE) is responsible for the regulation of blood pressure via the renin-angiotensin system. Literature indicates that rubiatriol shows ACE-inhibitory effects. The use of *in silico* techniques will validate this by challenging rubiatriol to a model of ACE obtained from the protein data bank (PDB ID 2c6n). Novel structures having similar activity are designed.

Pharmacists Intervention in the Use of Diuretics
Katya Xuereb
Patients with congestive heart failure on diuretic treatment are investigated. The impact of a pharmacist-led intervention on pharmacotherapy of heart failure is studied. Diuretic compliance and reasons for non-compliance are assessed amongst patients receiving diuretics and in hospitalised patients suffering from heart failure.

Drug Design at the β-Secretase Enzyme for the Identification of Novel Structures for the Treatment of Alzheimer's Disease
Keith Xuereb
The β-secretase enzyme is an aspartic acid protease important for the formation of myelin sheaths in peripheral nerves. It has been implicated in the formation of the amyloid β-plaques found in the brain, which characterise Alzheimer's disease. Novel inhibitors of this enzyme with potential for clinical use in the management of this condition will be designed *in silico*.

Medication Administration Systems at Mount Carmel Hospital
Nicola' Xuereb
A study of the current medication administration system at Mount Carmel Hospital (MCH) is undertaken, taking into consideration quality assurance, administration of medications to the right patient and other parameters. Current observations are documented and improvements to strengthen and increase efficiency of these systems are proposed following practical observations, ward rounds and literature studies.

Drug Design at the Oestrogen Receptor
Sharon Zammit
A recently identified experimental drug GW 5638 with potential in the management of breast cancer is known to exert its modulation of the oestrogen receptor through a novel binding modality. This molecule is being used as a template to design novel structures with potential clinical utility in the management of tamoxifen-resistant breast cancer.

Second Year
B.Sc.(Hons) Pharm.Sci.
Project Descriptions

Design of Novel Structures Capable of Inhibiting Bacterial Efflux Transporters using the Totarol Scaffold
Mark Joseph Bondin
The development of effective efflux pump inhibitors, reduces bacterial resistance by making bacteria susceptible to commonly used antibiotics. This project aims to use the *Staphylococcus aureus* efflux transporters for the *in silico* design of novel efflux pump inhibitors.

Monitoring of Patients with Heart Failure
Rebecca Bugeja
Pharmacist intervention in the monitoring and follow-up of patients with heart failure within a multidisciplinary approach is identified and described with the aim to enhance care and clinical outcomes. Follow-up of patients across different healthcare settings is considered.

Development and Evaluation of the Pharmacy Practice Resource Unit
Francesco Cassar
The Pharmacy Practice Resource Unit (PPRU) is updated to reflect contemporary pharmacotherapy and use of medical devices. The usefulness and relevance of the PPRU to pharmacy students is evaluated. Some aspects of the PPRU are presented for virtual access.

Design of RAS Inhibitors using the Polyphenolic Extracts of Green Tea as a Scaffold
Stephanie Cassar
K-RAS mutations are associated with tumorigenesis. The polyphenolic extracts of green tea inhibit the K-RAS signalling pathway and are used as leads in an *in silico* drug design study to identify novel analogues of these molecules.

Design of Novel Structures with Potential Anti-tumorigenic Activity using the Experimental Drug NPI-0052 as a Lead Molecule
Daniel Chetcuti
NPI-0052, Salinosporide A, is a novel B-lactone-y-lactam isolated from Salinisporatropica which has proteasome inhibitor properties. With the aid of *in silico* techniques, novel structures showing potential anti-tumorigenic activity are designed, using NPI-0052 as a lead.

Evaluation of the Affinity of the Small Molecule Maltanedienol for Farnesyl Pyrophosphate Synthase
Andy-Vince Falzon
Farnesyl pyrophosphate synthase when inhibited by bisphosphonates increases osteoclast turnover. Maltanedienol also increases osteoclast activity. The project analyses the affinity of maltanedienol for this enzyme and will also design novel *de novo* inhibiting molecules.

Interdisciplinary Management of Arthritis in Children
Julian Fearne
Documentation forms used at the monthly Paediatric Clinic at Mater Dei Hospital are reviewed, updated and validated. Following consultation with the rheumatology pharmacist and the interdisciplinary team, further necessary forms are identified, created and published.

Validation Instruments for Community Pharmacy: An Update
Hannah Flynn
The quality system 'Validation of Community Pharmacy' developed locally and updated in 2011 is reviewed and enforced. The elaboration of this system via an electronic platform is studied. Feasibility of this system as a self-run performance indicator for community pharmacies is evaluated.

Forensic Science
Jasmine Marie Gauci
Forensic science is a multidisciplinary subject, which incorporates a broad spectrum of sciences such as toxicology. Scientific tests, technologies and materials used to provide scientific evidence, based on collected evidence are reviewed.

Shared Care Guidelines in Rheumatology
Daniel Grixti
Shared care guidelines assist healthcare professionals and patients in clinical decision making, allowing the seamless transfer of patient treatment from secondary healthcare to general practice. Already existing guidelines are evaluated, updated and new guidelines are developed.

Drug Design at the Adenosine Receptor using Caffeine and Limonene as Lead Molecules
Danica Micallef
The adenosine receptor is recognised as a viable drug target. The antagonist caffeine and the agonist limonene are used as lead molecules in an *in silico* drug design study which aims to identify novel structures capable of modulating this receptor.

Procurement of Medicinal Products and Medical Devices
Caroline Muscat
Procurement involves efficient drug management and supply in a coordinated healthcare system. A pharmacoeconomic study of the cost-effectiveness of drugs present in the Maltese Formulary and European Union countries is undertaken. Improvements to the Maltese procurement system are suggested.

Design of Novel Antibacterial Compounds using Allicin as a Lead Molecule
Nathaniel Refalo
Literature cites the bacterial enzymes alcohol dehydrogenase, thioredoxin reductase and RNA polymerase as potential targets for allicin, a garlic compound. This study will model such enzyme interactions with allicin to design novel structures with antibacterial activity.

Compilation and Evaluation of a Two- and Three-Dimensional Molecular Database as an Adjunct to Didactic Teaching Modalities
Gabriella Sultana
The use of a two- and three-dimensional molecular database as an aid to didactic teaching modalities is evaluated. This project will collate the results of previous studies into a searchable database including drugs from the British National Formulary.

Risk in Psychiatry Drugs and QT Interval Prolongation
Natasha Torbarov
Risk of QT interval prolongation in patients receiving psychiatric drugs is identified and estimated. Methods on how to individualise a therapeutic risk-benefit approach is suggested. Possibility of multiple drug therapy and use of other drugs for co-morbidities is assessed.

Patient Monitoring of Out-Patients at the Rheumatology Clinic
Jonathan Vella
Rheumatology patients are treated with drugs which are highly immunosuppressant. Blood monitoring is important to assess disease progression and to prevent adverse reactions. It is important that the pharmacist works within the rheumatology team to further improve patient safety.

Design of K-RAS Protein Inhibitors as Anticancer Agents using Deltarasin as a Case Study
Martina Woods
The K-RAS gene is mutated in one-third of tumours. This protein only becomes fully functional once it is anchored in the cell membrane. Deltarasin will be used as aninhibitor to prevent the transport of K-RAS to the cell membrane.

Design of Histone Deacetylase Inhibitors as Anticancer Agents using Diallyl Trisulphide as a Case Study
Matthew Zarb
Diallyl disulfide is a major organosulfur constituent derived from garlic with documented ability to stop cancer cell proliferation through inhibition of histone deacetylase. A *de novo* design study to develop novel analogs of this enzyme with similar activity is undertaken.

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