Department of Pharmacy

University of Malta, Msida, Malta

http://www.um.edu.mt/ms/pharmacy

Head of Department: Professor Lilian M. Azzopardi

email: lilian.m.azzopardi@um.edu.mt

tel: +356 21 344971 fax: +356 21 324835

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Compiled by
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Foreword

Passion for Pharmacy

Kazeem Olalekan, a Technology Manager for Iforg Ltd writing in the Pharmaceutical Journal last October states that passion sets the heart racing and asks the question: Can it be applied to the profession of pharmacy? This abstract booklet shows how the students in the Department of Pharmacy at the University of Malta are empowered to develop their passion to the profession through their research work towards the enhancement of knowledge and innovation in a broad spectrum of pharmaceutical processes. Students are encouraged to develop the right type of passion – a form of enthusiasm that involves professional engagement, clinical engagement, patient centred, research oriented attitude both in practice and in science whether working in clinical, laboratory or IT based projects.

The projects encompass areas that give the opportunity to each and every student to harness the passion for pharmacy, whatever the area that one is focusing on as evidenced by the width and breadth of the topics covered. These projects include point-of-care testing, pharmacotherapy, pharmacoeconomics, regulatory affairs, pharmaceutical care, pharmacy information, pharmacy administration, quality risk management, clinical management, medicinal chemistry and drug design.

Students are embedded with the concepts proposed by Vallerand that in the field of research the passion must be directed as a major motivational force that leads one to innovative and committed evolvement. Passion for the profession of pharmacy in itself is not enough. It needs to be guided to ensure that it is a harmonious passion versus an obsessive passion. It has been shown in other areas, such as in the sport scenario, that harmonious passion is conducive to high levels of performance and more importantly to ensuring a happy life.

Olalekan quotes an example from pharmacy research of how harmonious passion could make all the difference in outcomes in contrast to obsessive passion. He cites how performing a Medicines Use Review (MUR), which delivers real benefit for the patients, is considered to be harmonious but performing the same task just to make up numbers because of external pressures may be considered as obsessive.

There are certain areas in pharmacy practice, such as in certain aspects of regulatory affairs, where overregulation could lead to obsessive action which results in no ultimate patient benefit. It could be pharmacoeconomically disadvantageous to the process and is less reliably related to performance attainment. It certainly is unrelated to professional satisfaction and to happiness.

It is the evolvement of harmonious passion in our pharmacy department graduates that has made such a positive impact in the practice area whether clinical, industrial or administrative. This is perhaps the secret behind the excellence enjoyed in the international sphere by the University of Malta's Department of Pharmacy graduates – that of engaging in Harmonious Passion towards pharmacy. The research projects presented in this booklet are a significant contribution in the course plan towards achieving such academic and professional excellence. Congratulations to all students, all members of the academic, research, technical and administration staff for their hard and dedicated work and yes – for their positive harmonious passion towards Pharmacy.

Professor Anthony Serracino-Inglott

Pharmacy Practice Projects Co-ordinator

Introduction

In the 2012 Global Pharmacy Workforce Report by the International Pharmaceutical Federation (FIP), it is stated that "access to quality medicines and competent, capable health care professionals are fundamental aspects of any health care system. Pharmaceutical human resources should ensure the uninterrupted supply of quality medicines to the population, their management, and responsible use, as vital components in improving the health of nations."

Reflecting on the contribution of the Department towards preparing pharmaceutical human resources for the needs of society, it is worth noting that Malta is reported in the same report as having the highest density of pharmacists from among the 90 countries considered. What is significant, is that as opposed to other countries where currently issues with employment are being faced, despite the highest global pharmacist to population ratio in Malta, all Maltese pharmacy graduates are in employment. One reason for this is that the pharmacy programme presented by the University of Malta provides the graduate with a range of skills that allow the flexibility for the graduates to develop careers in different aspects of pharmacy.

A characteristic of the Department of Pharmacy is that it provides students with a hands-on approach to the development of research skills. This approach was reinforced with the re-structuring, last year, of the pharmacy course to a two-cycle degree process leading to a Master of Pharmacy degree. Students are encouraged and supported to disseminate results from their dissertation. It is worth mentioning that the first MPharm graduates who completed their studies last October have participated and presented their work at international conferences and published their results in peer-reviewed journals. A Maltese pharmacy graduate, Lynn Marie Mifsud, was invited to present her work from her study on the History of FIP during the FIP Centennial Congress held in The Netherlands last October.

In responding to the needs of pharmaceutical stakeholders, the Department has launched a three-year programme leading to a Bachelor of Science (Honours) degree in Pharmaceutical Technology. These new graduates in Pharmaceutical Technology will complement pharmacists in the pharmaceutical human resource required in pharmacy processes particularly related to quality systems, regulatory aspects, medicines distribution, pharmaceutical analysis and manufacturing.

Professor Lilian M. Azzopardi

Head, Department of Pharmacy

M.Pharm. Students
Dissertation Abstracts

Point-of-Care Testing and Pharmacotherapy

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Impact of Chronic Renal Failure on Bone Status
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Proposing a Framework for INR Testing and Anticoagulation Management in Community Pharmacies

Elena Marie Mifsud

Background: Point-of-care testing (POCT) devices that measure the International Normalised Ratio (INR) allow for the introduction of a community pharmacist-led anticoagulation service as an alternative to the laboratory INR testing system.

Objectives: To investigate the feasibility and acceptability of a community pharmacist-led anticoagulation service.

Design: Fifty patients taking warfarin were recruited by convenience sampling. Patients were asked to visit the pharmacy on the same day that their venous plasma INR was to be monitored at the outpatient clinic. For each patient INR monitoring was performed using the CoaguChek®XS testing device. The level of agreement between the two INR methods was analysed using Pearson correlation. Following testing, patients were asked to complete a questionnaire designed to assess their perceptions on the current and proposed INR testing system. Data collected was analysed using SPSS® version 20.

Setting: Seven community pharmacies

Main Outcome Measures: Assessment of the accuracy and clinical usefulness of CoaguChek®XS and evaluation of patients' acceptance of proposed INR testing system.

Results: Out of the 50 patients, 31 were female and 19 were male with a mean age of 73 years (range 26-89 years). Linear regression analysis demonstrated a significant positive correlation between the two INR testing methods with a Pearson correlation coefficient of 0.906 which was found to be statistically significant with a p-value of 0.000 ($p<0.05$), thus demonstrating the reliability of POCT. All patients had an overall good perception of the proposed framework with 41 patients expressing interest in using this service following implementation. Moreover, 29 patients would accept warfarin dose adjustments being undertaken by the community pharmacist.

Conclusion: The study shows that the introduction of a national community pharmacist-led anticoagulation monitoring will improve current anticoagulation management by increasing therapeutic effectiveness and patient satisfaction.

Gastric Acid Control, Amylase Activity and Proton Pump Inhibitors

Charlene Galea

Background: Proton pump inhibitors (PPIs) block the H^+/K^+-ATPase enzyme increasing gastric pH allowing amylase activity.

Objectives: To correlate any relevant patient and drug history with α-pancreatic and total amylase activity in gastric juice samples.

Design: The Reflotron® was used to analyse α-pancreatic and total amylase in gastric juice, based on a previously designed methodology.[1,2] Two types of test strips were used for analysis; pancreatic amylase and total amylase test strips. Patients targeted were those on PPI therapy (n=41) and those not on PPI therapy (control group; n=59).

Setting: Endoscopy Unit, Mater Dei Hospital; Research laboratory, Department of Pharmacy, University of Malta.

Main Outcome Measures: Determination of gastric juice pH in relation to amylase activity; possible association between types of PPIs, different omeprazole regimens, and endoscopy findings.

Results: Pearson correlation coefficient showed a positive relationship between pH and amylase activity ($p<0.05$). Two-sample t-tests assuming unequal variances indicated that control patients have a significantly lower pancreatic and total amylase activity when compared to patients on PPIs (p-value for both tests <0.05). Patients on different PPIs had different amylase activities; however this difference was not significant ($p>0.05$). A significant increased amylase activity was seen between the omeprazole 40mg bd (n=3) and the 40mg od (n=2) regimen ($p<0.05$).

Conclusion: PPIs differ in their effect on gastric amylase activity. Knowledge of the relation between gastric pH, gastric amylase activity and pathology can lead to an improved understanding of gastric function.

References:

1. Scicluna Giusti W. Investigating pancreatic α-amylase in gastric juice [dissertation]. Msida (Malta): Department of Pharmacy, University of Malta; 2008.
2. Zammit K. Determination of amylase in gastric juice [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2010.

HPLC Method Development for Analysis of Clindamycin in Peripheral Tissue

Martina Mifsud

Background: Bacterial infections in peripheral arterial disease patients take longer to heal than in a healthy individual due to compromised circulation. Such vascular damage leads to reduced levels of drugs reaching the affected site.

Objectives: To develop an innovative method using high performance liquid chromatography (HPLC) to quantify clindamycin in peripheral tissues.

Design: A method for determining the concentration of clindamycin in plasma developed by Na-Bangchang et al[1] was identified. The physicochemical properties of clindamycin namely, temperature stability, pKa and UV activity were studied to develop an efficient extraction method. Methods of extraction from plasma were developed.

Setting: Research Laboratory, Department of Pharmacy, University of Malta

Main Outcome Measures: HPLC-driven analytical method for clindamycin in tissue.

Results: Altering the mobile phase suggested by Na-Bangchang et al produced a sharper peak with a decreased retention time. Following potentiometric titrations pKa (6.27) of clindamycin was established. This was in close proximity to the pKa (6.9) found in literature.[2] pH of the mobile phase was altered to 6. Clindamycin was found to be unaffected by temperature degradation after temperature stability studies were performed. Liquid-liquid extraction of clindamycin from plasma followed by HPLC analysis was conducted.

Conclusion: Detailed physicochemical analysis and understanding of the properties of the drug being tested is fundamental for a methodical and robust analysis.

References:

1. Na-Bangchang K, Banmairuroi V, Kamanikom B, Kiod D. An alternative high-performance liquid chromatographic method for determination of clindamycin in plasma. Southeast Asian J Trop Med Public Health 2006: 37(1), 177-84.
2. Babić S, Horvat AJM, Pavlović DM, Kaštelan-Macan M. Determination of pKa values of active pharmaceutical ingredients. Trends in Analytical Chemistry 2007: 26(11), 1043-62.

Proposing a Point-Of-Care Testing Service for *Helicobacter pylori* in Community Pharmacies

Daniel Attard

Background: Point-of-care testing (POCT) delivers rapid results to healthcare professionals and patients. This approach can be used in the management of *Helicobacter pylori* (*H.pylori*).[1]

Objectives: To assess and compare two serological POC tests used in *H.pylori* detection, to evaluate practicality, feasibility and patient acceptance of implementing an *H.pylori* POCT service in the community pharmacy setting.

Design: Manufacturers and suppliers were contacted to provide information on the availability of *H.pylori* detection POC tests. Two serological tests were selected namely; GIMA and GECKO *H.pylori* Test Cassettes. Inclusion criteria were: patients suffering from dyspepsia, ≥ 18 years, without accompanying alarm signs and symptoms, no prior investigation and not on antibacterial agents. Forty patients were tested using both tests and asked to complete an interview-based questionnaire.

Setting: Ten community pharmacies.

Main Outcome Measures: Practicality, feasibility and patient acceptance of *H.pylori* detection POCT in a community pharmacy.

Results: Out of the 40 patients tested, 23 were female and 17 were male with a mean age of 36.8 years (range 18-82 years). All patients agreed that *H.pylori* POCT should be offered as a service by community pharmacists. Nine patients were positive for *H.pylori*. Two false negative and 3 false positive results were also obtained. The predominant symptom investigated was heartburn. Omeprazole was the most popular medication used (n=14) to suppress dyspeptic symptoms whilst some patients took no medication at all (n=12). The majority of patients (n=13) would be willing to pay at least €10 for the service. The tests cost €4 and €6 for GIMA and GECKO respectively.

Conclusion: Results indicate that it would be feasible to introduce *H.pylori* POCT in community pharmacies. Most patients agreed that the test should be provided by community pharmacists and are willing to pay for this service.

Reference:

1. Vella A. Point-of-care diagnostics in infections [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2010.

Adolescents' Use of Non-Prescription Analgesics

Christina Cachia

Background: The transition from childhood to independent adulthood is associated with a period when most individuals first begin to assume responsibility for self-medication of minor illnesses and become more involved in chronic disease management.[1] Several studies have indicated that adolescents gain knowledge about medicines through consumption, rather than prior to taking the medication.[2]

Objectives: To investigate non-prescription use and self-administration of over-the-counter (OTC) analgesics for ear, throat, head, muscle, joint, back, stomach and menstrual pain.

Design: A self-administered questionnaire was adapted from a previous study by Chambers et al[3] and was distributed to students aged 14 to 18 years. Statistical analysis was carried out using SPSS® version 17.0.

Setting: Four secondary schools and 2 sixth forms.

Main Outcome Measures: Adolescents' non-prescription use and self-administration practices of OTC analgesics.

Results: The final sample was 444 students (mean age = 15.4 years). Paracetamol was the most common type of medication used in all types of pain. Parents were the most popular source of medication (34-42%) and information (31-44%). Out of the 36 students who chose to take aspirin, 30 were 16 years old or younger. Of the 99 students who indicated the type of medication they took for stomach pain, only 16 chose a non-steroidal anti-inflammatory drug. The mean ages at which students reported starting self-administration ranged from 13.3 to 14.1 years.

Conclusion: Pharmacists are not the main source of information about OTC analgesics in adolescents indicating the need for pharmacist intervention in addressing misuse and misconceptions about these medications.

References:

1. Buck ML. Self-medication by adolescents. Pediatr Pharmacother 2007;13(5):1-4.
2. Stoelbhen S, Krappweis J, Rössler G, Kirch W. Adolescents' drug use and drug knowledge. Eur J Peadiatr 2000;159:608-614.
3. Chambers CT, Reid CJ, McGrath PJ, Finley GA. Self-administration of over-the-counter medication for pain among adolescents. Arch Pediatr Adolesc Med 1997;151:449-455.

Impact of Chronic Renal Failure on Bone Status

Daniela Ghio

Background: Impaired kidney function may lead to a reduction in bone mineral density predisposing patients to higher fracture risk and increased morbidity and mortality.[1]

Objectives: To estimate the prevalence of osteoporosis, evaluate bone density regression in chronic renal failure (CRF) patients and assess other risk factors.

Design: A sample of 53 postmenopausal women volunteered to participate in the study consisting of 24 CRF patients (study group) having a low estimated glomerular filtration rate (< 60ml/min/1.73m^2) who were approached during their renal care visit and were referred for a bone density test and a control group (n=29) recruited during bone density scanning. During recruitment, a semi-formal interview was undertaken to assess other risk factors in both groups. Relevant blood tests and bone density results were obtained from Mater Dei Hospital (MDH) software.

Setting: Renal and Gynaecology Units, MDH.

Main Outcome Measures: Prevalence of osteoporosis and bone density regression in CRF patients; analysis of T-score results.

Results: With increasing age, lumbar and hip T-score values for the control group were lower than those of the study group. The independent sample T-test showed that the lumbar T-scores differ significantly between the 2 groups (control=-1.31, study=-0.30; p=0.026), however hip T-scores are comparable (control=-1.46, study=-1.59; p=0.677). General risk factors were found to be higher in the control group. Two of the patients in the study group and 6 control group patients were smokers. Twenty-two control group patients and 20 study group patients lacked physical activity.

Conclusion: The mean hip T-score value of the study group is low when compared to normal values, thus CRF patients may be classified as osteopenic at the hip. Monitoring may be recommended in CRF patients to prevent excessive bone loss.

Reference:

1. Breen CS. Osteoporosis and chronic kidney disease. Seminars in Nephrology 2004; 24(1): 78-81.

Pharmaceutical Care

Pharmacist Intervention in Pain Management in Heart Surgery
Danika Agius Decelis

Lifestyle Modifications in Metabolic Syndrome
Leanne Cutajar

Pharmacist Intervention in Pain Management in Heart Surgery

Danika Agius Decelis

Background: Pain is a common complaint following cardiac surgery. Regular oral paracetamol has been shown to be an effective postoperative analgesic.[1]

Objectives: To assess pharmacist intervention in patients undergoing cardiac surgery to prevent and relieve pain.

Design: Following ethics approval, 50 post-cardiac surgery patients were recruited from the Cardiac Surgical Ward, Mater Dei Hospital (MDH). These patients were divided into 2 groups; control and intervention group. The intervention group was given a booklet including a consent form, information about pain, diagrams demonstrating ways of decreasing and avoiding pain, analgesia dosage regimen scheme and diary to annotate a detailed daily periodic medication intake with pain scoring charts. The control group was only given the consent form, diary and pain score charts. All patients were re-interviewed 6 weeks post-discharge. Their diary and pain chart data were collected and a pain assessment questionnaire was completed.

Setting: Cardiac Surgical Ward, MDH

Main Outcome Measures: Pain scores, compliance and pharmacist intervention for postoperative pain in post-cardiac surgery patients.

Results: Four patients were eliminated due to incomplete data. There were 23 patients in each group. Pain scores in both groups decreased significantly over the 6 weeks post-surgery. Decrease in pain in the intervention group was more significant (p value=0.000) than in the control group (p value=0.006). Analysis of the patients' diary showed that in the first 4 weeks, there was no statistically significant difference in analgesic consumption between the 2 groups. However, there is a statistically significant difference in the 5th and 6th week (p=0.000 for each week).

Conclusion: Preliminary results indicate that pharmacist intervention improved pain relief in post-cardiac surgery patients.

Reference:

1. Reimer-Kent J. From theory to practice: Preventing pain after cardiac surgery. Am J Crit Care 2003;12:136-143.

Lifestyle Modifications in Metabolic Syndrome

Leanne Cutajar

Background: Early identification and management of patients at risk of developing metabolic syndrome (MS) is crucial in minimising associated morbidities and mortalities.

Objectives: To assess the local prevalence of MS and evaluate the significance of a reinforced lifestyle intervention.

Design: One hundred type 2 diabetics were recruited by convenience sampling. Weight, waist circumference, blood pressure, fasting blood glucose level, high-density lipoprotein cholesterol (HDL-c) and triglycerides (TG) were recorded at baseline and repeated after 1 year. The International Diabetes Federation definition of MS was used to assess prevalence.[1] The study group was subjected to a weight management program and aerobics classes, both organised by the Health Promotion and Disease Prevention Directorate, and leaflets regarding healthy eating habits and exercise.

Setting: Diabetes and Endocrine Clinic, Mater Dei Hospital

Main Outcome Measures: Control and study group biological markers and medication changes pre- and post-intervention.

Results: Sixty-nine patients completed the study; 63 patients suffered from MS. Twenty-five of these patients comprised the study group, where 13 patients applied for the weight management programs but only 1 patient completed them successfully. The control group comprised 44 patients. The number of MS criteria satisfied by the study group post-intervention was lower. An improvement in mean HDL-c (p=0.0245) for the study group was identified after the intervention. For the control group an improvement in mean HDL-c (p=0.0005), TG (p=0.01) and weight (p=0.028) was identified.

Conclusion: Medication amendments were undertaken for 10 patients in the study group and 25 patients in the control group. A higher number of patients in the control group had their medications adjusted. This could explain, to an extent, improvement in the biological markers followed particularly for the control group.

Reference:

1. International Diabetes Federation (IDF). The IDF consensus worldwide definition of the metabolic syndrome. IDF; 2006.

Pharmacoeconomics and Regulatory Affairs

Cardiovascular Medicines: Comparative Costs and Benefits
Mark Cardona

Development and Evaluation of Pharmacovigilance Training
Elise Axiak

Cardiovascular Medicines: Comparative Costs and Benefits

Mark Cardona

Background: Cardiovascular disease (CVD) was the leading cause of death in Malta in 2011 accounting for 38% of all deaths.[1]

Objectives: To collect local comprehensive cost and formulation data regarding drugs used in the treatment of CVD.

Design: Relevant drugs were identified from the website of the Malta Medicines Authority. Prices of these drugs were compiled by surveying community pharmacies. The distinction between originator and generic products was carried out by accessing product dossiers and evaluating anecdotal evidence. The Defined Daily Dose (DDD) was selected as the comparator variable according to World Health Organization recommendations for best practice in price comparisons. The cost per DDD was calculated for each drug included in the data set.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Cost and benefit comparison of CVD drugs.

Results: Of the 162 CVD drugs included, 108 were originator and 54 were generic drugs. The average cost of originator drug is €0.7007 per DDD whereas the cost of the generic drug is €0.4342 per DDD. The 95% confidence interval stipulates that the difference in price between the generic and originator drug may vary between €0.1843 per DDD and €0.3487 per DDD in the future.

Conclusion: The proportion of generic drugs in the data set is less than half of the total and the average price difference of a generic drug is 38% that of the corresponding originator. This indicates that there is still room for improvement in the generic market for CVD drugs and the possibility of further price reductions in line with other EU countries. The study results forecast that the average price difference will vary between 26.3% and 49.8% in the future.

Reference:

1. National Statistics Office (NSO). Demographic Review 2010 [Online]. Malta: NSO; 2011 [cited 2013 Jan 18]. Available from: URL: www.nso.gov.mt/statdoc/document_file.aspx?id=3173.

Development and Evaluation of Pharmacovigilance Training

Elise Axiak

Background: Pharmacovigilance (PV) is a post-marketing surveillance strategy designed to capture any safety concerns regarding medicinal products.

Objective: To develop a training framework on pharmacovigilance at a local Marketing Authorisation Holder.

Design: The study was conducted in 5 phases. Phase 1 consisted of a literature review regarding the guidelines and legislation controlling PV and extended to the Standard Operating Procedures (SOPs). This served as the basis on which to build the training program. Discussions took place with the company's personnel to outline other key training points to be included. The training material was compiled during Phase 2 and was validated by a panel of experts in Phase 3. Any proposed changes were implemented as the final version of the training material was compiled. The training of the participants was scheduled throughout Phase 4 and the effectiveness of the training program was evaluated through an assessment of the participants in Phase 5. The assessment was divided into two sections consisting of a multiple choice question (MCQ) section and a practical simulation.

Setting: Poligas Ltd.

Main Outcome Measures: Design and implementation of a training program, assessment of the participants' understanding of the training given.

Results: The final training material consisted of 4 sections: Section 1 introduces participants to PV, section 2 deals with handling of ADR reports, section 3 outlines the procedure to be followed in case of a cylinder or batch recall and section 4 is a summary of the important points covered. All participants (N=7) completed both sections of the assessment, scoring 100% in the theoretical MCQ section and performed successfully during the practical simulation.

Conclusion: The results indicate that the training material prepared was effective in introducing personnel to PV as all the participants successfully completed the training program.

Pharmacy Information

Evaluation of a Formulary for Non-BNF Cited Items
Daniel Corso

Access to the Pharmacist through Telecommunication Services
Simon Corrieri

Pharmacist Interventions in Non-Prescription Medicine Use
Sephora Galea

Preparing Pharmacists for Prescribing
Andrew Fenech

Implementing Online Continuing Professional Development Activities for Pharmacists
Jessica Spiteri

Evaluation of a Formulary for Non-British National Formulary Cited Items

Daniel Corso

Background: The British National Formulary (BNF) is used by local healthcare professionals as a principal medicinal reference source since a Maltese national formulary does not exist. The Maltese Medicines Handbook (MMH) is an addendum to the BNF designed to include medicinal products which are available locally and not listed in the BNF.

Objectives: To update and maintain the MMH.

Design: A list of products with a Marketing Authorisation in Malta, issued by the Medicines Authority, was used to identify products not listed in the BNF. Visits to community pharmacies were conducted between September 2011 and February 2012 to identify non-BNF cited products marketed in local community pharmacies. Data concerning medicinal preparations was obtained from the Summary of Product Characteristics and the 'Martindale'.

Setting: Community pharmacies

Main Outcome Measures: Updating the second edition of the MMH; assessing its contents, use and costs.

Results: The updated version of the MMH includes 510 medicinal products and their different dosage forms. Sixty eight medicinal products have active ingredients not listed in the BNF. Details included for all medicinal products were trade name, marketing authorisation holder, prescription requirement, dosage form, active ingredient and amount, consumer price, local distributor and dose. For drugs not listed in the BNF the following information was also included: indications, cautions, contra-indications, side-effects and advice in renal and hepatic impairment, pregnancy and breast-feeding. Details for 20 medical devices were also included in the handbook.

Conclusion: As a significant number of products marketed locally are not listed in the BNF, additional formularies need to be used in conjuction to the BNF. Since the MMH was significantly updated from its previous edition regular updates are needed to sustain its utility. The publication is currently being evaluated amongst healthcare professionals.

Access to the Pharmacist through Telecommunication Services

Simon Corrieri

Background: Community pharmacy services are limited to patients visiting their local pharmacy. A pharmacy helpline was set up as a 24 hour aid to allow patients to access the services of a pharmacist when required.

Objectives: To set up a pilot pharmacy helpline and to assess the logistics required to establish this service.

Design: The methodology was adapted from Butcher.[1] Two other helplines were first contacted to verify services offered and ascertain rationale for setting up a new service. Sponsorship was sourced and a pharmacist was provided to act as the helpline operator. Five local telephony service providers were contacted and briefed on the project. An agreement to host the helpline was reached with a service provider through discussions. The Malta Communications Authority was briefed on the project and the helpline was set up in accordance with its guidelines. The helpline was transferred to a cellular device which enables it to operate 24 hours a day, 7 days a week.

Setting: Community service

Main Outcome Measures: Set up and implementation of pharmacy helpline.

Results: The helpline was activated and challenged through a single blind experiment which consisted of a random telephone call made from the Department of Pharmacy, University of Malta. The number allocated is 52302020.

Conclusion: Logistically, the pilot helpline was successful and is ready for use by the general public. Familiarisation with this new service and increased exposure are required to extend the helpline's potential to improving primary care.

Reference:

1. Butcher A. Telephone helplines association guidelines for good practice, 3rd ed. London: Telephone Helplines Association; 2003. p.24.

Pharmacist Interventions in Non-Prescription Medicines Use

Sephora Galea

Background: Pharmacists play a role in supporting patients to appropriately select and ensure safe and rational use of non-prescription medicines (NPMs).

Objectives: To investigate the factors which influence NPMs recommendation by community pharmacists.

Design: Approval from the University Research Ethics Committee was granted. A questionnaire adapted from Kotecki[1] was validated by a panel of experts. The questionnaire with a self-addressed envelope was sent by post to 217 managing community pharmacists in Malta and Gozo. Descriptive statistics were undertaken using SPSS® version 20 to obtain means (M) and frequencies (%) which were developed into cross-tabulations.

Setting: Community pharmacies

Main Outcome Measure(s): Community pharmacist intervention in NPM use.

Results: A response rate of 91% was achieved. Demographics of community pharmacists participating were: mean age=37 years (range 22-74 years), 69% female, 73% practiced in an independently-owned pharmacy, 54% practiced > 10 years. Pharmacists were most likely to make non-prescription recommendations for vitamins and nutritional supplements (99%), weight-reduction aids (96%), smoking cessation aids (91%) and home diagnostic kits (89%). Pharmacists were asked to rate importance of each factor on a 5-point Likert scale (1=strongly disagree, 2=disagree, 3=uncertain, 4=agree, 5=strongly agree). Pharmacists were influenced by 4 major factors: 'positive feedback from patients' (M=4.42), 'scientific evidence' (M=4.41), 'self-use of product' (M=4.11) and 'information from general pharmacy references' (M=4.03). Non-influential factors were 'mark up of product' (M=2.75), 'product claims' (M=2.67), 'other pharmacist's recommendations' (M=2.58), 'display materials provided' (M=2.49) and 'deals obtained from sales representatives' (M=2.46).

Conclusion: Pharmacists preferred to make non-prescription recommendations mainly for weight-reduction, vitamins, nutritional supplements and smoking cessation products.

References:

1. Kotecki JE. Factors related to pharmacists' over-the-counter recommendations. J Community Health 2002; 27(4): 291-306.

Preparing Pharmacists for Prescribing

Andrew Fenech

Background: Pharmacist prescribing is a professional service undertaken by pharmacists to contribute to timely, rational and safe patient management. Such a service may be developed in collaboration with physicians in chronic disease management and to support patients in self-medication of minor ailments.

Objectives: To develop and validate three modules to be included in a course on pharmacist prescribing.

Design: Following an intensive literature review, modules were developed using Microsoft® Office® Powerpoint 2010. The course material was validated by a panel of experts. The panel members were asked to review the modules for clarity, specificity and relevance and to note areas that required amendments.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Development and validation of modules on pharmacist prescribing.

Results: Three modules were developed and validated. 'Module 1: Practical aspects of pharmacist prescribing' discusses prescribing models, communication and consultation skills, medication errors and continuing professional development. 'Module 2: Prescribing by means of a therapeutic plan' includes patient medical records, clinical management plan skills, diagnostic testing and pharmacovigilance. 'Module 3: Electronic prescribing' incorporates electronic prescribing and computerisation of guidelines to facilitate prescribing. The modules generated a positive response from the validation panel. Suggested amendments included giving more focus on specific topics and improving module general layout.

Conclusion: The modules were well received during the validation exercise. Following the inclusion of suggested improvements, these modules can be used to provide pharmacists with a better understanding of the tasks associated with prescribing and pave the way for aspiring pharmacists to provide a safe and efficient prescribing service.

Implementing Online Continuing Professional Development Activities for Pharmacists

Jessica Spiteri

Background: Maintaining competence following graduation is essential to ensure the provision of quality in patient care. Continuing Professional Development (CPD) is an approach of lifelong learning that assists professionals in maintaining and enhancing their professional expertise.[1]

Objectives: To develop evidence-based updates on 3 chronic disease states for the purpose of implementing an online CPD programme.

Design: Venous thromboembolism (VTE), diabetes mellitus (DM) and coronary artery disease (CAD) were the 3 most frequently cited chronic disease states on the websites of the American Society of Health-System Pharmacists, American Pharmacists Association and Royal Pharmaceutical Society for which CPD resources were developed. A CPD programme consisting of 3 Microsoft® Office® PowerPoint presentations about these conditions was prepared for the local setting. Validation of these presentations was undertaken by a panel of experts consisting of a general physician, an endocrinologist, a cardiologist and 5 pharmacists.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Development of 3 CPD resources

Results: VTE (8.9%), DM (7.7%) and CAD (6.1%) were the 3 most frequently cited chronic disease states on the stated websites, followed by arrhythmias (5.26%), mood disorders (4.05%) and breast cancer (4.05%). Feedback generated from validation indicates that the prepared updates are well-researched, accurately presented and relevant to pharmacists' professional development. Recommendations put forward by the expert panel included: improvement in layout, elaboration of pictorial diagrams, clarification of language used and improvement in scientific content.

Conclusion: CPD resources have been compiled and can now be implemented in the local setting.

Reference:

1. Driesen A, Verbeke K, Simoens S, Laekeman G. International trends in lifelong learning for pharmacists. Am J Pharm Educ 2007; 71 (3): 1-10.

Pharmacy Administration

Drug Administration Systems in Geriatric Institutions
Angela Cassar

Implementation of SF36 and D39 Quality of Life Tools in English and Maltese
Caroline Maria Vella

Evaluation of the Clinical Pharmacy Services at Karin Grech Rehabilitation Hospital
Jonathan Agius

Evaluation of the Quality Management System for Non-Clinical Pharmacy Services at Karen Grech Rehabilitation Hospital
John Agius

Pharmacist Manpower: Assessment of the Directory of Pharmacists
Marcus Zarb Cousin

Drug Administration Systems in Geriatric Institutions

Angela Cassar

Background: A measure of the quality of any drug distribution system is of relevance to the incidence of medication errors. A system that limits risk of medication administration errors (MAEs) is desired.[1]

Objective: To identify and measure the incidence of MAEs in geriatric institutions.

Design: An observation sheet adopted from Meli[2] was re-validated and re-evaluated by 3 pharmacists. The direct observation method involved observing the nurses at 2 institutions, during treatment administration. Morning and evening treatment sessions were chosen with 30 observations undertaken for both institutions. Discrepancies between what was observed and what was prescribed on the treatment chart were noted as MAEs.

Setting: Rehabilitation Hospital Karin Grech (RHKG) and St. Vincent de Paul Residence (SVPR),

Main Outcome Measures: MAE rate and type of MAEs detected.

Results: At RHKG, 625 opportunities for error were encountered with a MAE rate of 56.8% (n=355). The most common error was 'drug left next to the patient' (25.4%; n=90), followed by 'oral medications not administered with recommended fluid' (23.1%; n=82) and 'wrong time ± 45mins' (21.1%; n=75). At SVPR, 829 opportunities for error were encountered with a MAE rate of 112% (n=932). The most common error was 'wrong time ± 45mins' (49.1%; n=458), followed by 'oral medications not administered with recommended fluid' (17.7%; n=165) and 'more than one medication crushed in the same container' (16.0%; n=150).

Conclusion: Findings of this study led to the identification of MAEs. Such information could lead to improvement of the medication administration system at both institutions.

References:

1. Barker KN, Flynn EA, Pepper GA, Bates DW, Mikeal RL. Comparison of methods for detecting medication errors in 36 hospitals and skilled-nursing facilities. Am J Health Syst Pharm 2002; 59(5):436–446.
2. Meli S. Medication administration system at the Rehabilitation Hospital Karin Grech [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2011.

Implementation of SF-36 and D-39 Quality of Life Tools in English and Maltese

Caroline Maria Vella

Background: A limitation of research studies involving measurement of health-related quality of life (QoL) is the unavailability of tools in both English and Maltese languages. Availabilty of tools in both languages ensures that inclusion of patients in a study is not hindered due to language barriers. Standardised translation of QoL tools is required to avoid researchers undertaking separate translation activities.

Objectives: To identify and propose a Maltese version of QoL tools that could be adopted in diabetes research.

Design: 'Short Form Health Survey (SF-36)', a disease-specific QoL tool, and Diabetes 39 (D-39), a non-disease specific QoL tool, were identified. Forward and back translations were undertaken. Re-translation was carried out to assure that translation was adequate.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Maltese version of SF-36 and D-39.

Results: The Maltese translation of SF-36 had been undertaken by 'Quality Metric Corporation'. Minor amendments were undertaken for the Maltese version of SF-36 to increase applicability in the local scenario. These revisions included changing 'round the block' to 'hundred meters' (Items 3h/3i), adding 'how much of the time' to the stem of Items 4 and 5, making minor changes to the sentence structure of Item 5c ('did work or other activities less carefully than usual') and changing 'pep' to 'life' (Item 9a) and 'feeling blue' to 'depressed' (Item 9f). D-39 consists of the following domains namely: 'anxiety and worry', 'social and peer burden', 'sexual functioning', 'energy and mobility' and 'diabetes control.' Few changes were undertaken in the Maltese version of the D-39 after the translation process changing original phrases to more easily understood phrases.

Conclusion: Following this study, the SF-36 Maltese version has been adopted and certified by the 'Quality Metric Corporation' whilst D-39 Maltese version required amendments to adapt to the local scenario.

Evaluation of the Clinical Pharmacy Services at Rehabilitation Hospital Karin Grech

Jonathan Agius

Background: Auditing of professional service provision is becoming an important requirement in the healthcare setting. Developed standards for best practice are the tool against which actual practice is measured.

Objectives: To audit standard operating procedures (SOPs) at Rehabilitation Hospital Karin Grech (RHKG), to determine whether these SOPs were being followed and to assess whether there was need for improvement.

Design: SOPs to be audited were identified namely: 'Patient Admission, 'Patient Profiling', 'Patient Discharge', 'Patient/Carer Interview' and 'Patient Medication Trolley Check'. Audit tools were created for each SOP. Audit techniques used were observation and documentation over a 6-month period. Data collected was analysed using SPSS® version 20 using the Chi-square test. Convenience sampling to observe the processes was the method of sampling applied.

Setting: Rehabilitation Hospital Karin Grech

Main Outcome Measures: Auditing of SOPs for clinical pharmacy services.

Results: Patient admissions and patient profiling activities (both n=42) were audited in the first 3 months, observing 6 pharmacists. Patient discharges and patient/carer interviews (both n=30) observing 5 pharmacists and patient medication trolley checks (n=30) observing 3 pharmacy technicians were audited in the following 3 months. The pharmacists carried out all patient admission, patient profiling and patient/carer interview activities according to the relevant SOPs. Some steps were not being followed in the SOP 'Patient 'Discharge'. Steps in the SOPs 'Patient Profiling' and 'Patient Interview' were no longer executed. Since these omissions were found to be justified, changes were recommended in the audit report.

Conclusion: Overall, the SOPs were followed correctly for each patient ensuring quality and standardisation of professional services. The auditing exercise highlighted areas for improvement in the SOPs.

Evaluation of the Quality Management System for Non-Clinical Pharmacy Services at Rehabilitation Hospital Karin Grech

John Agius

Background: Standard operating procedures (SOPs) for clinical pharmacy services at Rehabilitation Hospital Karin Grech (RHKG) were implemented by Wirth.[1] SOPs for the non-clinical pharmacy services were required to complement this developed system.

Objectives: To identify non-clinical pharmacy services undertaken by pharmacists at RHKG and to develop and implement SOPs for these services.

Design: SOPs for non-clinical pharmacy services were developed, validated twice, tested for applicability and practicality, implemented and evaluated. Descriptive statistics were undertaken using the One-way ANOVA test. Use of the SOPs was monitored through a questionnaire directed to pharmacy staff.

Setting: Rehabilitation Hospital Karin Grech

Main Outcome Measures: Implementation of SOPs for non-clinical pharmacy services at RHKG.

Results: Eleven SOPs were developed and implemented: 'Dispensing', 'Pharmacy Inventory Management', 'Ward Inventory Management', 'Repackaging', 'Quality Assurance of Oxygen Supplies', 'Cleaning of Pharmacy Premises', 'Maintenance, Control and Monitoring of Temperature', 'Pest Control', 'Management of Expired or Damaged Drugs and Medical Devices', 'Product Recall and Quality Defect Reporting' and 'Unlicensed Medicinal Products'. SOPs for 'Dispensing', 'Pharmacy Inventory Management' and 'Ward Inventory Management' showed significant improvement from validation 1 to validation 2 with p-values 0.003, 0.000 and 0.009 respectively. Results from the questionnaire indicated that the SOPs are being referred to by the staff.

Conclusion: Eleven SOPs for non-clinical pharmacy services were developed and implemented in the pharmacy. In addition to standardising practice of these processes they also serve as training and re-training tools.

Reference:

1. Wirth F. Development of a quality management system for clinical pharmacy services [MPhil dissertation]. Msida (Malta): Department of Pharmacy, University of Malta; 2011.

Pharmacist Manpower: Assessment of the Directory of Pharmacists

Marcus Zarb Cousin

Background: 'The Maltese Directory of Pharmacists' was last updated by Hili.[1] The directory is an updated compilation of contact details of locally registered pharmacists, community pharmacies, pharmaceutical agents, importers, wholesalers and companies and a list of pharmacy project and dissertation titles.

Objectives: To update and publish an updated version of 'The Maltese Directory of Pharmacists'.

Design: A questionnaire adapted from Hili was sent via postal and/or electronic mail to all pharmacists in Malta and Gozo to update their contact details. Pharmacists who did not reply were reminded via telephone.

Setting: Local pharmacist manpower

Main Outcome Measures: Compilation and publication of the 7th edition of 'The Maltese Directory of Pharmacists'.

Results: Six hundred and ten pharmacists returned the questionnaire. One hundred and four pharmacists work abroad or have retired. Thirty-three percent of the pharmacists are male. Ninety-five percent of pharmacists have worked in community pharmacy at one point in their career. Pharmacists are not satisfied with the Pharmacy Of Your Choice scheme with only 6% rating it with a score of 4 or 5 (maximum 5). The main problem with the POYC scheme is 'out of stock items' and lack of education provided to patients about the scheme.

Conclusion: Continuous updates of the directory are important since the pharmacy workforce is in constant transition and the directory could be used to support levels of communication within the profession. The study also helps to identify trends in the pharmaceutical workforce.

Reference:

1. Hili S. The Maltese Directory of Pharmacists: Present Status and Future Predictions [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2009.

Medicinal Chemistry and Drug Design

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database of Drugs Used to Target the Endocrine System
Denise Borg

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs Used in Malignant Disease and Immunosuppression
Ryan Camilleri

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs Used to Target the Respiratory System
Sara Jo Cassar

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs Used in Obstetric, Gynaecological and Urinary Tract Disorders
Mariana Ellul

Design and Optimisation of Novel 3-Hydroxy-3-Methyl-Glutaryl-CoA Reductase Inhibitors
Denise Formosa

Investigating the Anti-Oestrogenic Effects of Synephrine and *de novo* Design of Oestrogen Receptor Modulating Molecules
Christine Pace Bardon

Investigating the Anti-Oestrogenic Effects of Ephedrine and *de novo* Design of Oestrogen Receptor Modulating Molecules
Kathyrn Galea

Drug Design and Optimisation of *de novo* Designed Molecules at the Peroxisome Proliferator-Activated Receptor
Stephanie Portelli

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database of Drugs Used to Target the Endocrine System

Denise Borg

Background: The integration of molecular models within an educational scenario can encourage conceptual learning and increase student performance by improving visual and verbal skills in chemistry.[1]

Objectives: To develop a repository of drugs used to treat endocrine disorders by constructing two- and three-dimensional structures and to assess the impact of the database when used as an education tool.

Design: The 'British National Formulary No. 64' was used to generate a list of drugs used in endocrinology. The molecular modelling softwares Symyx® Draw 3.2, VMD® 1.9 and Sybyl-X®1.1 were used to generate the structures which were merged with clinical and physical parameters as a database. A pre-/post-test follow-up control group design was performed after psychometric evaluation of the research tools that consisted of a pre- and post-test questionnaire and an evaluation form. Participants were assessed at 3 intervals: At baseline, after 2 weeks from database use and 4 weeks thereafter.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Database evaluation using mean scores.

Results: A searchable repository of drugs used in endocrinology consisting of 82 drug entries was created. The paired samples t-test revealed a significant improvement in the mean scores of all the students in the experimental groups (n=49) when compared to the control groups (n=50). The experimental participants outperformed control students both at the immediate and at the delayed test (p=0.000). The groups were determined to be equivalent at baseline when the independent samples t-test was applied. The overall mean presentation score of the database was 4.54 out of a maximum of 5.

Conclusion: Use of the database improved the learning process and students had a positive perception of the database.

Reference:

1. Ealy JB. Students' understanding is enhanced through molecular modelling. J Sci Educ Tech 2004;13(4):461-471.

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs Used in Malignant Disease and Immunosuppression

Ryan Camilleri

Background: Medicinal chemistry requires development of skills in recognising characteristics in the chemical structure of drugs and understanding implications of the chemical structure in drug use.[1] Availability of computer developed two- and three-dimensional (2D/3D) molecular structures provides an excellent teaching support aid for students.[2]

Objective: To create and evaluate a 2D/3D electronic molecular database for drugs used in malignant disease and immunosuppression.

Design: Drugs were identified from the British National Formulary[3] and entered into Microsoft® Office® Excel. A 2D structure of each molecule was drawn using Symyx® Draw. PDB® entries of these drugs were identified, rendered in VMD® creating 3D images and a 3D structure of each drug was drawn using Sybyl-X®. The database was uploaded using Zoho Creator® and 3D images were uploaded using Jmol®.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Creation and evaluation of molecular database.

Results: Eighty drugs were generated of which 25 were complexed with their cognate receptor. Application of the database in a teaching environment is being evaluated and results will be correlated using the paired sample t-test and One-way ANOVA.

Conclusion: Traditional lecturing methods need to be merged with computational aids to help students improve assimilation of abstract concepts and application of their acquired knowledge into clinical practice.

References:

1. Alsharif NZ, Roche VF. Staying alive: Advancing medicinal chemistry by enhancing student responsibility for learning. Am J Pharm Educ 2002;66 (3):319-328.
2. Humphrey W, Dalke A, Schulten K. VMD: Visual Molecular Dynamics. J Mol Graph 1996:14:33-38.
3. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 64. UK (London): BMJ Publishing Group Ltd/RPS Publishing; 2012.

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs Used to Target the Respiratory System

Sara Jo Cassar

Background: Healthcare students and professionals could benefit greatly from using a holistic drug database as a reference point for clinical, physiochemical and structural information.[1]

Objectives: To compile a two-/three-dimensional (2D/3D) electronic molecular database and representations of drug protein interactions of drugs acting on the respiratory system and to assess utility of the database among pharmacy students.

Design: Chapter 3 of the British National Formulary[2] was used to identify drugs acting on the respiratory system. Structures were constructed in 2D using Symyx® Draw and in 3D using Sybyl-X®. Drug-receptor interactions were highlighted through depictive representations using VMD®. Jmol® was used to embed interactive properties to structures and entries. The database was compiled using Zoho Creator® and uploaded on the website of the Department of Pharmacy of the University of Malta. Validated pre- and post-questionnaires were disseminated to pharmacy students and statistical results were generated using SPSS® version 17.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Creation and evaluation of molecular database.

Results: A total of 46 2D structures and interactive 3D formats and 21 interactive representations of the 7 PDB entries identified were created. A positive trend in student knowledge was identified with students performing better after being exposed to the database during the intervention lecture and 86% of the students felt that the electronic database is a relevant reference point of information. A significant improvement in the final marks was attained in the experimental group with respect to the control group for the first, second and third year students.

Conclusion: Student understanding and knowledge is enhanced when teaching practices take on an innovative approach.

References:

1. McClean P, Johnson C, Rogers R, Daniels L, Reber J, Slator B et al. Molecular and cellular biological animations: Development and impact on student learning. Cell Biol Educ 2004;4(2):169-179.
2. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 62. UK (London): BMJ Publishing Group Ltd/RPS Publishing; 2011.

Creation and Evaluation of a Two-/Three-Dimensional Molecular Database for Drugs used in Obstetrics, Gynaecological and Urinary Tract Disorders

Mariana Ellul

Background: Teaching of medicinal chemistry and demonstration of its relevance to students represents an on-going challenge for educators.[1] Development of innovative teaching methods and educational media tools allows educators to embrace the challenge of teaching this subject.[2]

Objectives: To create and disseminate a user-validated two-/three-dimensional (2D/3D) molecular database that highlights the structural nuances of drugs used in obstetrics, gynaecological and urinary tract disorders.

Design: The 2D/3D depictions of drugs pertaining to chapter 7 of the British National Formulary[3] were generated using dedicated computer software. These were then compiled into a molecular database and made available online.

Setting: Department of Pharmacy, University of Malta

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

Results: Sixty-nine drugs were drawn. Symyx® Draw was used to construct images in 2D which also allowed for the generation of physicochemical characteristics. Sybyl-X® was used to construct 3D images. These files were subsequently converted into rotatable structures using Jmol®. For 10 pdb entries found, VMD® was used to demonstrate images of the apo endogenous receptor, the ligand:protein complex and the ligand:protein contacts at the active site.

Conclusion: Construction of 2D/3D databases represents a usable route through which abstract concepts such as those inherent to medicinal chemistry may be rendered more tangible. Use of this database will be evaluated through the implementation of a validation study disseminated to a representative pharmacy student cohort.

References:

1. Alsharif NZ, Galt KA, Chapman R. Instructional model to teach clinically relevant medicinal chemistry. Am J Pharm Educ 2006; 70(4): 91.
2. Kahn Farouk MO, Philip A. Medicinal chemistry and the pharmacy curriculum. Am J Pharm Educ 2011; 75(8):61.
3. British Medical Association/Royal Pharmaceutical Association of Great Britain. BNF 64. UK (London): BMJ Publishing Group Ltd/RPS Publishing; 2012.

Design and Optimisation of Novel HMG-CoA Reductase Inhibitors

Denise Formosa

Background: Hypercholesterolaemia continues to be a cause of significant morbidity and mortality, making the development of drugs with an increased efficacy and safety profile capable of lowering cholesterol levels a continued priority.[1]

Objectives: To understand the ligand bound conformation of HMG-CoA reductase (HMGR) enzyme in the context of an *in silico* drug design study and to attempt to elaborate a new analog series of molecules with the potential for development into novel hypercholesterolaemic drugs with predicted adequate *in vivo* bioavailability, synthetic feasibility and affinity for the enzyme.

Design: The preliminary phase of the study attempted to obtain a correlation between *in vitro* inhibitory rate constant data and *in silico* binding affinity of the drugs being studied. The next part of the study involved the design of novel HMG-CoA reductase inhibitor molecules. Sybyl-X®, X-Score®, Ligbuilder®, Visual Molecular Dynamics (VMD), Symyx® Draw and the Protein Data Bank were used to generate the results.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Design and optimisation of novel HMG-CoA reductase inhibitors

Results: No significant linear correlation could be established between *in vitro* and *in silico* data, making it impossible to quantify *in vitro* data based exclusively on *in silico* data. *De novo* design yielded molecules with an affinity comparable to that of statins in current clinical use.

Conclusion: *De novo* molecules designed represent viable leads for iterative optimisation procedure which could lead to the identification of novel high potency, low side-effect profile drugs. It is consequently planned to include these in a molecular library for further use.

References:

1. Carbonelli T, Freire E. Binding thermodynamics of statins to HMG-CoA reductase. Biochemistry 2005; 44:11741-8.

Investigating the Anti-Oestrogenic Effect of Synephrine and *de novo* Design of Oestrogen-Receptor Modulating Molecules

Christina Pace Bardon

Background: p-synephrine is an active component of *Citrus aurantium* which is a major component of weight loss preparations in contemporary use. Research carried out by Arbo et al[1] hypothesised that p-synephrine could have anti-oestrogenic potential.

Objectives: To study the hypothesis by Arbo et al using an *in silico* approach and to design molecules with the potential to act as antagonists at the oestrogen receptor (ER).

Design: PDB file 1ERE describing the bound coordinates of 17β-oestradiol with the ER was used. The ligand binding affinity (LBA) of oestradiol for its cognate receptor was measured. Synephrine isomers were sketched and a number of conformers (n=21) were generated for each isomer and LBA of each conformer was calculated. The best binding conformer was chosen and edited to produce seeds that would be further optimised into lead compounds. Computer programs used were Symyx® Draw, Sybyl-X®, LigBuilder®, XSCORE® and VMD®.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Drawing 2-dimensional structures, modelling, Ligand Binding Pocket elucidation and *de novo* design, LBA calculation, displaying and animating videos.

Results: The LBA of 17-β oestradiol (pKd 7.23) to the ER was used as a baseline measure against which all other successive results were compared. The LBA of the p-synephrine conformers ranged from 4.5-5. When seed molecules were guided into the oestrogen receptor, a significant increase in affinity was recorded with pKd's ranging from 6.5 to 8.45.

Conclusion: There is sufficient evidence to suggest that modification of the synephrine scaffold could yield innovative anti-oestrogenic drugs in the context of a clinical requirement for partial or total antagonism for the treatment of breast cancer and osteoporosis.

Reference:

1. Arbo M, Franco M, Larentis E, Garcia SC, Sebben VC, Leal MB et al. Screening for in vivo (anti)estrogenic activity of ephedrine and p-synephrine and their natural sources Ephedra sinica Stapf.(Ephedraceae) and Citrus aurantium L.(Rutaceae) in rats. Archives of Toxicology 2009;83(1): 95-99.

Investigating the Anti-Oestrogenic Effects of Ephedrine and *de novo* Design of Oestrogen Receptor Modulating Molecules

Kathryn Galea

Background: *In vivo* studies in immature female rats indicate that ephedrine at 0.5mg/kg/day presented a significant anti-oestrogenic effect.[1]

Objectives: To evaluate whether ephedrine acts as an anti-oestrogen *in vivo* through *in silico* studies and to identify high affinity novel ligands for the oestrogen receptor (ER) which lack the side-effects commonly associated with the steroidal scaffold.

Design: X-ray crystallographic deposition 1ERE describing the bound coordinates of 17-β-oestradiol with the ER was used. The 3D structures of the 4 ephedrine isomers, together with isomers with an added hydroxyl group at position 3 of the benzene ring as a simulation of that found on the A-ring of 17-β-oestradiol, were constructed *de novo* and conformers were generated. Conformational analysis was undertaken. Ephedrine based non-steroidal novel ER ligands were designed. Computer programs used were Symyx® Draw, VMD®, Sybyl-X®, XScore® and LigBuilder®

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: 2D structures, molecule display and animation, modelling and seed generation, Ligand Binding Affinity (LBA) calculation, Ligand Binding Pocket elucidation and *de novo* design.

Results: The average LBA of the ephedrine conformers and of the 3-hydroxyl modified isomers (pKd 5.108 and 5.23 respectively) were established.

Conclusion: The information deduced indicates a low *in silico* LBA. This is indicative of the possibility that the hypothesis by Arbo et al[1] may not be corroborated through *in silico* evaluations.

References:

1. Arbo MD, Franco MT, Larentis ER, Garcia SC, Sebben VC, Leal MB et al. Screening for in vivo (anti)estrogenic activity of ephedrine and p-synephrine and their natural sources Ephedra sinica Stapf. (Ephedraceae) and Citrus aurantium L. (Rutaceae) in rats. Archives of Toxicology 2008; 83: 95-99.

Drug Design and Optimisation of *de novo* Designed Molecules at the Peroxisome Proliferator-Activated Receptor

Stephanie Portelli

Background: Rosiglitazone withdrawal from the market[1] has led to a renewed interest in the Peroxisome Proliferator Activated Receptor γ (PPARγ) as a target for type 2 diabetes mellitus therapy, mainly via partial agonism. This may be achieved by using selective PPARγ modulators such as S-26948.[2]

Objectives: To obtain and optimise a series of molecules which have a high affinity to PPARγ and are also Lipinski Rule compliant.[3]

Design: Protein Data Bank (PDB) entries 1FM6, 1FM9 and 3FUR were identified as suitable conformations of the PPARγ Ligand Binding Pocket (LBP), and S-26948 as a suitable lead. Molecular modelling was undertaken within the apo-forms of the PDB entries, generating lead conformers. The best conformers were edited to create seeds used for *de novo* structure generation. Computer programs used were Sybyl-X® v1.1, X-SCORE® v1.3 and LigBuilder® v2.1.

Setting: Department of Pharmacy, University of Malta.

Main Outcome Measures: Calculation of ligand binding energy and ligand binding affinity, novel structure generation.

Results: Eighty-four per cent of the generated molecules obey Lipinski Rules. Ligand binding affinity ranged from 5.01 to 9.99 and molecular weight ranged from 266 to 600.

Conclusion: Notably, an alternative high affinity orientation to that occupied by the glitazones has been discovered at the PPARγ LBP warranting further investigation.

References:

1. GlaxoSmithKline (GSK). GSK regulatory update on Avandia following EMA and FDA reviews [Online]. UK: GSK; September 2010 [cited 2013 Jan 21]. Available from: URL: http://us.gsk.com/html/media-news/pressreleases/2010/2010_pressrelease_10103.htm
2. Carmona MC, Louche K, Lefebvre B, Pilon A, Hennuyer N, Audinot-Bouchez V, et al. S 26948, a new specific PPARγ modulator (SPPARM) with potent antidiabetic and antiatherogenic effects. Diabetes 2007; 56 (11): 2797-2808.
3. Lipinski CA, Lombardo F, Dominy BW, Feeney PJ. Experimental and computational approaches to estimate solubility and permeability in drug discovery and development settings. Adv Drug Delivery Rev 1997; 23, 3-25.

M.Sc. Pharmacy
Dissertation Descriptions

Pharmaceutical Care Interventions at Rehabilitation Hospital Karin Grech
Khaled Abdelmaula

Use of Quality Risk Management for Enhancing and Ensuring Good Distribution Practice
Adrian Busuttil

Management of Urinary Tract Infections in the Elderly at the Rehabilitation Hospital Karin Grech
Asma Omar Ali Omar

New Approach to Improve the Yield in the Production of Slow Release Oral Dosage Forms
Nicolette Sammut Bartolo

Pharmacists' Prescribing: Non-Steroidal Anti-inflammatory Drugs
Maria Scerri

Obtaining a Marketing Authorisation for Nitrous Oxide
Claire Anne Scicluna

Pharmaceutical Care Interventions at Rehabilitation Hospital Karin Grech

Khaled Abdelmaula

The aim of this study was to evaluate and quantify the impact of pharmaceutical care interventions made by pharmacists at a rehabilitation hospital with particular focus on the significance of these interventions. Data was collected from 500 random medical profiles. Preliminary results indicate that a pharmacist intervention was suggested in 64% (320) of patient profiles, of which 85% (272) were accepted by physicians.

Use of Quality Risk Management for Enhancing and Ensuring Good Distribution Practice

Adrian Busuttil

A set of model standard operation procedures (SOPs) used in Good Distribution Practice (GDP) in addition to a 'Risk Management' and a 'Disaster Recovery SOP' were drafted. Risks to the quality of medicinal products in distribution and current risk management practices were identified. Risks were scored as per Failure Mode Effects Analysis (FMEA) methodology for severity, probability and detectability and qualified as being acceptable or not. Further risk management and risk minimisation strategies were suggested for unacceptable risks.

Management of Urinary Tract Infections in Elderly Patients at Rehabilitation Hospital Karin Grech

Asma Omar Ali Omar

The aim of the study was to evaluate treatment choices used to manage urinary tract infections at the Rehabilitation Hospital Karin Grech. Data was collected from 165 medical profiles. Results show that 42% (69) of patients were treated with nitrofurantoin, which may have been unsuitable in 30% (21) of these patients due to pH or an impaired glomerular filtration rate. Ciprofloxacin and co-amoxiclav were used in 27% (45) and 20% (33) of patients respectively.

New Approach to Improve the Yield in the Production of Slow Release Oral Dosage Forms

Nicolette Sammut Bartolo

The new approach used in the production of slow release pellets varied from the previous method used to control the process parameters. Formerly, process parameters were varied occasionally during a batch production. In the novel method, process parameters are varied according to the requirements of the product, considering each batch as different from the others. This method leads to achievement of higher yields when compared to batches produced with the previously used method.

Pharmacists' Prescribing: Non-Steroidal Anti-inflammatory Drugs

Maria Scerri

A module and protocol intended to prepare pharmacists for prescribing of non-steroidal anti-inflammatory drugs were developed following evidence-based literature. The module and protocol were validated by a group of healthcare professionals who were asked to comment on readability, presentation, practicality, comprehensiveness and applicability. Amendments were subsequently undertaken according to suggestions given by the panel. Amendments included change of font face and inclusion of more steps in the protocol.

Obtaining a Marketing Authorisation for Nitrous Oxide

Claire Anne Scicluna

The key requirement in an application for a marketing authorisation is the submission of a dossier. Directives and guidelines issued by the European Commission were followed to compile a dossier for nitrous oxide in the Common Technical Document (CTD) format, in preparation of an abridged application. The CTD gave details on 'Module 1: Administrative Information', 'Module 2: Summaries', 'Module 3: Quality' and 'Module 4: Non-Clinical Studies' consisting of a detailed scientific bibliography. The active substance manufacturer was inspected and accepted as an approved supplier.

Fourth Year Students
Project Descriptions

Chemotherapy-Induced Blood Dyscrasias

Bernardette Blundell

Prophylactic Granulocyte-Colony Stimulating Factor (G-CSF) effectiveness in reducing neutropenia hospitalisation amongst patients who are being treated for Non-Hodgkin's and Hodgkin's Lymphoma is studied. A patients' database is being used to collect information after 4 chemotherapy cycles and an interview regarding side-effects experienced after chemotherapy is undertaken with patients to identify any difference between patients who are being treated with prophylactic G-CSF and those who are not receiving prophylactic G-CSF.

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

Sarah-Anne Briffa

This project seeks to aid the understanding of abstract concepts through the use of visualisation. Using two and three-dimensional modelling, 60 drug structures relevant to the field of ophthalmology were constructed using SYMYX® Draw 4.1 and SYBYL-X®1.2. Images of drug-receptor complexes were created for 14 of these drugs using VMD® 1.9 and using Protein Data Bank entries. These structures together with their physico-chemical properties are being compiled in a database.

Use of Liquid Capsules

Lara Brincat Ruffini

The project aims to compare liquid hard capsules with soft gel capsules and other oral solid dosage forms in terms of efficiency, speed of action, quality and innovation. The perception of patients and pharmacists on liquid hard capsules was evaluated using questionnaires which were personally distributed to patients and pharmacists. Twenty patients (out of 37) and 6 pharmacists (out of 7) stated that liquid capsules have a fast action. The main advantage chosen by patients is a tie between "fast action" and "easy to swallow".

Pharmaceutical Care in the Management of Psychiatric Conditions

Ann Bugeja

Twelve 'on-leave' patients at Mount Carmel Hospital were recruited and interviewed before and after the pharmacist intervention as part of a pilot study. The intervention included distribution and explanation of a medication chart. Patients were interviewed to assess medication adherence and patient knowledge. The interview was used as a tool to assess whether the medication chart lead to an improvement in medication adherence and patient knowledge. The results were analysed using SPSS® version 20. Pharmacist intervention proved to be of statistical significance.

Evidence-Based Pharmaceutical Care in Psychiatric Disorders

Claire Bugeja

Data regarding the current system in place at Karen Grech Rehabilitation Hospital and the ward medication order system at Mount Carmel Hospital (MCH) was undertaken. A plan is devised to introduce a ward medication top-up system within an acute and a chronic ward at MCH. Results from the pre-implementation questionnaires show that the 4 nurses in the acute ward have a different opinion on the existing system when compared to the 5 nurses in the chronic ward. Statistics show that the most common drug used in the trial wards is paracetamol, having a daily count of 20 entries.

Distribution of Ciprofloxacin to the Peripheries

Francesca Busuttil

An innovative high performance liquid chromatography method for the analysis of ciprofloxacin in biological fluids is being developed. The method being tested and validated makes use of an ACE® C18 reversed phase column with a mobile phase composed of acetonitrile and phosphate buffer (62.5:37.5, v/v) at a pH of 2.86. Detection is carried out using a UV detector adjusted at 277 nm. Well defined peaks were produced with ciprofloxacin having a retention time of 3.3 minutes when using a flow rate of 0.8ml/min.

History of Pharmacy in Malta

Angelique Camilleri

Liniments, sachets, mixtures, plasters, ointments and creams are amongst the extemporaneous preparations that have been produced in the re-enactment activities taking place at Santo Spirito Hospital. Using validated evaluation questionnaires, it was determined that 70.3% of 108 respondents, from 120 attendants, graded the activity as most satisfactory. All methods used are to be published in booklet form. The use, accuracy and types of different apparata are discussed.

An English-Maltese Dictionary for Pharmaceutical and Medical Terms

Kirsty Camilleri

Translations of terms (N=1,793) starting with letters 'T', 'U', 'V', 'W', 'X', 'Y' and 'Z' were carried out to enable the publishing of the first complete 'English-Maltese Dictionary of Medical and Pharmaceutical Terms'. Of these terms, 1,135 are newly translated. Progressive translations are amalgamated with previous works undertaken by earlier participants of the research group. All translated terms are being validated by linguists, healthcare professionals and laymen.

A Rational Drug Design Approach for the Identification of Novel Selective Cyclooxygenase-2 Inhibitors

Clarissa Caruana

Chronic inflammation is involved in the onset and development of cancer. Inhibition of cyclo-oxygenase (COX)-2 is a target in chemoprevention. Flavonoids inhibit COXs. Epidemiological studies have shown an inverse relationship between dietary flavonoid intake and incidence of different types of cancer. A drug design study is being carried out to generate anti-inflammatory agents based on the flavonoid molecule. The Ligand Binding Affinity and Ligand Binding Energy of several flavonoids which inhibit COX-2 have been calculated using X-Score® and SYBYL® respectively to initiate the molecular design.

Creation of a Two-/Three-Dimensional Molecular Database of Anaesthetic Drugs

Jonathan Cefai

Two- and three-dimensional structures of drugs used in anaesthesia were created and resulting structural and pharmacological data was incorporated into an online database to be used in validation of the database. From the initial 40 drugs, procaine was removed and 4 drugs (articaine, dexmedetomidine, mepivacaine and sugammadex) were added during the updates. Twenty-two Protein Data Bank files were obtained from online databases. Fifteen files were non-human whereas 7 were human in origin. The resulting database may shed further evidence on its usefulness as an effective teaching tool.

Simulation Study of Three High Affinity Ligands Obtained from the Common Hawthorne Plant for the Angiotensin Converting Enzyme

Justine Chetcuti

The extract of the common Hawthorne plant *Crataegus monogyna*, comprises 3 high affinity ligands for the angiotensin-converting enzyme (ACE). Manipulation of these ligands (β-amyrin, oleanolic acid and ursolic acid) was carried out using a bioisosteric approach through the software Spark®. The top 5 bioisosteres were chosen through specific criteria and scored for affinity for the ACE receptor using X-Score®. The utility of this approach was demonstrated by having all designed ligands of a similar binding affinity as the template molecules.

Point-of-Care-Testing: Hypercholesterolaemia

Rodianne Conti

The total cholesterol concentration for 21 patients at Mater Dei Hospital was analysed by 2 cholesterol point-of-care devices (Accutrend Plus® and MultiCare-In®) and results were compared with the laboratory result (Cobas 6000® Analyser Series® c501 module) using regression analysis. Accutrend Plus® and MultiCare-In® gave an r-squared value of 0.831 and 0.179 respectively indicating good correlation for Accutrend Plus®. Further analysis for the MultiCare-In® system is being undertaken.

***De novo* Drug Design at the Acetylcholinesterase Receptor**

Michelle Cutajar

Acetylcholinesterase (AChE) is an enzyme that breaks down acetylcholine by hydrolysis. AChE inhibitors increase cholinergic activity indirectly by inhibiting AChE. The X-Ray Crystallographic model of *Torpedo californica* acetylcholinesterase bound to donepezil was identified from the Protein Data Bank. *In silico* techniques are being used to design novel high affinity ligands which are sufficiently bioavailable and non-toxic to make them suitable candidates for further studies. This is being carried out using various programmes, such as SYBYL® and LigBuilder®.

Patient Access to Medication

Attilio Antonio Degiorgio

Access to medication by Maltese patients is considered together with web systems and free medication schemes. Questionnaires with a good face and content validity (average kappa reliability of 0.8) are distributed to patients and healthcare professionals. Focus groups were set up to encourage participants to share their views about patient access to medication. The insight of patients and healthcare professionals are assessed. Data regarding systems implemented internationally is compared to the local scenario, putting forward proposals for improving the local systems.

Laboratory Set Up for Bioavailability and Bioequivalence Studies

Nathaniel Farrugia

This project focuses on the set-up of a laboratory for bioequivalence testing. All Standard Operating Procedures required for running the laboratory were identified, 3 of which have been formulated to date. A liquid chromatography-mass spectrometry (LC-MS) method chosen is being validated using tolterodine and sildenafil. A calibration run with ergosterol was carried out to prepare the LC-MS.

Creation of a Two-/Three-Dimensional Molecular Database of Drugs used in the Management of Skin Conditions

Monique Fava

This project aims to design an educational tool comprising of drug molecules used in the management of dermal conditions. A list of these drugs together with their chemical features was compiled and inputted into Microsoft Excel®. The two- and three-dimensional renderings of these drug molecules were drawn using Symyx® and Sybyl® software respectively. Where possible, the binding modality of these drugs with their allied receptors was depicted using VMD®. This data is transferred into a molecular database and its utility is evaluated by a representative user cohort.

Haemoglobin Levels in Chronic Drug Use

Rebecca Joslin

The effect of drugs on haemoglobin levels in chronic drug use among the Maltese population was investigated. A total of 28 patients were recruited from a community pharmacy. A correlation between certain drug classes and blood dyscrasias were observed, particularly with the proton pump inhibitor class; 4 out of 9 patients showed abnormal haemoglobin results.

Incretin Mimetics and DPP-4 Inhibitors: An *in silico* Drug Design Study

Miguel Manara

Incretin mimetics and DPP-4 inhibitors are relatively new anti-diabetic therapies that are presently found on the global pharmaceutical market. It has been established that they regenerate pancreatic β cells and thwart their apoptosis. Incretin mimetics, however, are only available as a parenteral formulation, thereby rendering these products expensive and inconvenient to the patient. The objectives of this study are to propose novel incretin mimetic and DPP-4 inhibitor structures using *in silico* design methods.

Pharmaceutical Care in Benign Prostatic Hyperplasia

Janica Mizzi

'On-Call PSA kits' were used to carry out point-of-care testing (POCT) for Prostate Specific Antigen (PSA) levels in blood. Thirty-three participants recruited from community pharmacies and health centres underwent testing. Results from core laboratory and test kit were compared for 27 patients. POC kits did not detect 2 elevated PSA levels. 'On-Call kits' were recalled in 2008 in the United States due to inaccurate results, but not in Malta. Questionnaires measuring patient perspectives and symptom scores were distributed. Eighty-eight percent of patients acknowledge testing in a pharmacy by a pharmacist and 94% agree that such tests are advantageous.

Creation of a Two-/Three-Dimensional Molecular Databases for Drugs Acting in the Gastro-Intestinal Tract

Katya Sacco

Drugs used in the management of gastro-intestinal tract conditions listed in the section 'Gastro-intestinal System' of the BNF were used as a case study. Two- and three-dimensional molecular structures were constructed using Symyx® Draw 4.0 and SYBYL®-X 1.1 respectively. The Protein Data Bank was consulted and where applicable interactions between drug ligands and their respective endogenous receptor were illustrated using VMD® 1.9. The structures and their respective data were collated in a database. The results are currently being collated to be uploaded online as a searchable database.

Chronopharmacology in Diabetes

Francesca Sammut

Sixteen Type I diabetics were monitored by a Continuous Glucose Monitoring System (CGMS) over a 72-hour period, assessing the relationship between timed administration of insulin and glycaemic control. Using a questionnaire, a diary and CGMS analysis, recruits were divided into 2 groups according to the way they time their insulin administration. Results show that patients who timely administer their insulin have better glycaemic control. Patients who did not administer insulin in a timed manner were counselled and their glycaemic control was assessed after 3 and 6 months by HbA1c monitoring.

Newsletter for the Department of Pharmacy

Marion Sammut

The 'Pharmacy Department Review' is a bimonthly newsletter distributed to pharmacists, pharmacy students and pharmacy staff members via email and uploaded on the Pharmacy Department website. The newsletter is composed of 2 sections; a section covers events and research and the other section comprises additional information such as interviews. In the first issue of the newsletter, 2 conferences, a calendar of past events, pharmacy students' presentations and interviews to fourth year pharmacy students were included. A questionnaire was designed and distributed with the newsletter.

Drug Design of Molecules Binding to the 5-HT Receptor Using a Bioisosteric and *De Novo* Approach

Maria Schembri

Three tricyclic antidepressants and 3 selective serotonin reuptake inhibitors were selected. Molecules were manipulated using Spark®, a bioisosteric software, using a *de novo* approach. Standard Operating Procedures were written regarding the operation of Spark®. Results from the bioisosteric approach were scored for their affinity using X-Score® as a platform for comparison with the *de novo* approach. Preliminary results show that both approaches yield dissimilar results showing that it could be worthwhile to use this dual approach in a comprehensive rational drug design study.

Development of a Drug Information Bulletin

John Scicluna

A drug information bulletin providing new information on medicines available on the local market is developed. The bulletin is made available as a printed copy and on the internet. The study will evaluate the usefulness of a drug bulletin published periodically and which version of the bulletin is perceived more accessible and useful. The frequency of publishing required and financial viability of publishing the bulletin is also assessed.

Point-of-care Testing: Infectious Diseases

Laura Scicluna

Determination of the sensitivity, specificity, feasibility and patient acceptance of the 'GIMA® Streptococcus pyogenes Rapid Test Kit' was undertaken by taking 2 throat swabs from 20 patients who presented with complaints of sore throat and satisfying other inclusion criteria typical of this pathogen. One swab was tested with the 'Rapid Test Kit' whilst the other was sent to the laboratory. Out of 20 patients, 1 tested positive, 4 tested falsely negative and the rest were negative. It was found that the kit has a sensitivity of 0.2 and a specificity of 1.

Creation of a Two-/Three-Dimensional Molecular Database of Drugs Used in the Management of Conditions related to the Ears, Nose and Oropharynx

Abigail Spiteri

Graphical representation is a form of communication which allows understanding of abstract concepts. The creation of a searchable two- and three-dimensional (2D/3D) molecular database provides an aid to the understanding of molecular conformations and binding modalities. For 35 molecules, a 2D representation was constructed using Symyx®. Eight PDB entries were visualised using VMD® and binding interaction between a drug and its target was highlighted. The 3D binding modality was obtained using Sybyl-x®.

Pharmaceutical Care in Dialysis Patients

Christopher Tate

A set of protocols containing a list of medicines normally administered to patients who are on dialysis has been produced to be used by healthcare professionals. The documentation is presented according to pharmacological action and is evaluated through a focus group. The resulting document is presented in a booklet and evaluated.

Cardiac Markers in Pharmaceutical Care

Rebecca Theuma

Twenty GIMA® cardiac marker point-of-care test kits are used to test for the presence of creatine kinase-MB and troponin in post-myocardial infarction patients. The results obtained from the kits are compared to those obtained by laboratory testing. Patients are recruited from the Cardiac Care Unit at Mater Dei Hospital. University Research Ethics Committee approval was obtained.

Pharmacy Museum

Rebecca Tonna

The study entails the setting up of a pharmacy museum which describes the history of pharmacy in Malta throughout the ages. This is achieved by compiling and restoring various items and collections of pharmaceutical interest found at the Department of Pharmacy. A space at the National Archives, (formerly known as Santo Spirito Hospital), Rabat has been selected to display both medical and pharmaceutical items to continue to expand the pharmacy museum already present at the National Archives.

Point-of-Care Testing: Urine Analysis and Microalbuminuria

Shaun Ungaro

Implementation of point-of-care testing in the primary setting for urine analysis of microalbuminuria was studied. Tests were assessed in terms of accuracy, reliability and practicality in determining the presence of microalbuminuria and the clinical significance of its presence particularly related to diabetes. Out of the 9 subjects with type two diabetes tested, 2 had microalbuminuria, both having HbA1c levels of 9.5%. Five of the 9 subjects suffered from hypertension and all the subjects agreed that urine testing for microalbuminuria in community pharmacies is useful.

Perception of the Pharmacist Prescriber

Elena Maria Vella

A discussion paper 'Implementing Pharmacist Prescribing in Malta' was updated and evaluated. Two possible implementation activities for the local scenario were proposed: Supplementary prescribing in the management of minor ailments by providing protocols and guidelines and repeat prescribing in the management of chronic conditions including diabetes, hypertension and clinical conditions requiring anticoagulation treatment through the Pharmacy Of Your Choice scheme. A focus group is currently being formed to study the perceptions of general practitioners and pharmacists on prescribing authority.

Monitoring of Rheumatoid Arthritis Patients

Jessica Vella

A list of 10 disease modifying anti-rheumatic drugs which are available at Mater Dei Hospital was compiled. Algorithms describing treatment and monitoring pathways for each drug were designed. Amendments to the algorithms reflecting suggestions made by rheumatology consultants were implemented. A patient information leaflet was compiled and reviewed by an expert panel. Technical terms were adapted for improved comprehensiveness by patients. Patient questionnaires assessing patient knowledge on their condition and monitoring required were formulated. A request for ethics approval was submitted.

Evolvement of the Pharmacy Of Your Choice scheme

Marjean Xuereb

A list of pharmacies registered in the Pharmacy Of Your Choice (POYC) scheme was obtained from the Ministry of Health, the Elderly and Community Care website to investigate the problems encountered in the POYC scheme by pharmacists and patients. Twenty-five pharmacies were selected by stratified random sampling. Structured interviews are conducted with a pharmacist and 5 patients for every pharmacy in the sample. A pilot study conducted in 5 pharmacies showed that all 5 pharmacists find the POYC scheme to be inefficient and time consuming, whilst 24 patients out of 25 have encountered out of stock medication issues.

A Comparative study of Beta-Blocker and Anti-Androgen Ligands Using a Bioisosteric and a *De Novo* Approach

Ryan Zahra

Three beta-blockers and 3 anti-androgens were selected for manipulation. Comparative manipulation was undertaken using a bioisosteric approach with Spark® software and through *de novo* design. The results obtained from the bioisosteric approach were scored for affinity using X-Score® as a base line for the comparison to the *de novo* approach results. Preliminary results show that the 2 methods yield dissimilar results indicating it could be worthwhile to use both approaches in a comprehensive rational drug design study. Standard Operating Procedures describing the use of Spark® were compiled.

Third Year Students
Project Descriptions

Medicine Use in *In Vitro* Fertilisation

Christina Noella Abela

Over the past 21 years, 750 women have chosen *in vitro* fertilisation (IVF) in Malta. IVF medication is prescribed according to set protocols. A review of the medication available has been compiled and a comparative economical study of local and foreign protocols is being undertaken. These findings are used to assess the economic burden on the government upon introduction of this service.

Journal of EuroMed Pharmacy

Joseph Christian Abela

The Journal of EuroMed Pharmacy (JEMP) is published to promote the pharmacy profession. Questionnaires were developed and distributed to community pharmacists and pharmacy students to assess previous issues. Feedback from the questionnaires is used to improve future issues. Articles for a new issue were collected, edited and proofread and the new issue will be available shortly.

Veterinary Medicine

Annalise Attard

A guidebook for pharmacists and pet owners containing information about commonly encountered veterinary diseases is developed, where zoonotic diseases are highlighted. Personal interviews are held with veterinary surgeons and pharmacists to identify medications and vaccinations used in veterinary care. Knowledge and perception of pharmacists in this area is assessed.

Chronopharmacology and Pain

Christine Attard

Chronopharmacology is the predictable in-time variation of biological response to medication. Fifty patients suffering from chronic pain are recruited and asked to keep a pain diary in the form of a questionnaire as validated by the 'Oxford Pain Validity Scale'. The aim is to establish the relationship, if any, between circadian rhythm, adverse drug reactions and efficacy of drugs used in pain management.

Evidence-Base for Clinical Pharmacy

Jessica Attard

Evidence on clinical pharmacy services provided in different settings is compiled. Activities performed in settings where clinical pharmacy services are provided are identified. Following data analysis, recommendations for the local scenario are proposed. The impact of participation of pharmacists during ward rounds, pharmacist prescribing and decrease in medicines risk is examined.

Dietary Practices at Mater Dei Hospital

Francesca Attard Baldacchino

Inconsistency in nutrient intake can often be present during hospitalisation. Dietary intake of patients suffering from diabetes and cardiovascular disease is assessed to determine whether the diet is adequate for these patients. This will involve recording each patient's daily food consumption. Recommendations for healthcare professionals and patients are compiled.

Storage Temperature Control: Economical and Environmental Considerations

Kristina Baron

Costs and energy consumption to adhere to required standards of temperature control of medicines in Malta are quantified. Novel methods or adaptations of current practice are developed in an effort to reduce the carbon footprint of community pharmacies. Healthcare professionals are surveyed on their views on the importance of and adherence to good temperature control practice.

Guidelines in Product Distribution and Storage

Stephen Bartolo

Standard Operating Procedures for product storage and distribution, with emphasis on new requirements are analysed. Guidelines regarding the wholesale distribution and storage processes are reviewed and improvements recommended. The cold chain of medicinal products supply in Malta is analysed.

Diabetic Patient Risks: Outcome Indices

Leanne Bason

A questionnaire to assess current knowledge about the complications and lifestyle modifications in type 2 diabetes is compiled and distributed to 100 diabetic patients. Educational material such as leaflets, a Facebook page and YouTube videos are prepared. Use of the internet as a tool to improve knowledge and quality of life of these patients is evaluated.

Optimisation of Anti-Androgenic Molecules

Marie Claire Bonanno

Androgen receptor antagonists are used to manage prostate cancer. A series of novel non-steroidal lead antagonists are optimised from affinity and property perspectives and recommended for further evaluation in the context of iterative rounds of rational drug design.

Designing Analogues of the Naturally Occurring Alkaloid Huperzine A

Sara Bonavia

Huperzine A is a natural cholinesterase inhibitor derived from *Huperzia serrata*. Huperzine A compares favourably in symptomatic efficacy to cholinesterase inhibitors currently in use. The structure of huperzine A:acetylcholinesterase complex has been determined (PDB ID 1VOT) and is used as a template in the *de novo* design of agents with clinical potential in the management of Alzheimer's disease.

Drug Design of Pilocarpine Allotropes in the Management of Alzheimer's Disease

Neil Bugeja

Pilocarpine is a non-selective muscarinic receptor agonist used to manage conditions such as glaucoma and xerostomia. A homology model of the M_1 muscarinic receptor is created and pilocarpine is used as a lead to design M_1 muscarinic receptor subtype agonists with the potential for use in Alzheimer's disease.

Access to Oncology Medicinal Products on the Government Pharmaceutical Formulary

Alexandra Cachia

Inclusion of new medicines on the Government Formulary List (GFL) is aimed to improve the quality of life or survival rates of patients suffering from cancer. The current list is reviewed and annual drug consumption and costs are evaluated. Proposals are made on how assessments to include a new oncology medicine can be enhanced.

Pharmaceutical Care in Psychiatry

Deborah Camilleri

Pharmaceutical care in psychiatric patients is investigated. A study is undertaken through extensive analysis of current procedures, prescribing trends and major parameters surrounding drug therapy, with particular reference to Mount Carmel Hospital. The current situation is assessed and proposals for improvement through risk management and analysis are suggested.

Patient Expectations of Medicines Use Review

Matthew Camilleri

Medicines Use Reviews are conducted on patients receiving medications from the Pharmacy Of Your Choice scheme. This review will help patients gain more familiarity with their medication and any problems are identified and assessed. An individualised action plan for the patient regarding minimisation of drug related problems is devised. Follow-up is undertaken to assess the impact of this service.

Design of Novel Antihistaminic Agents Based on the Molecular Structure of Diphenhydramine

Rachel Camilleri

The X-ray crystal structure of the H_1 receptor complexed with doxepin, a first-generation H_1 receptor antagonist was identified from the protein data bank. *In silico* techniques are used for design of antagonists which are selective to the H_1 receptor with reduced lipophilicity. This will decrease penetration of the drug through the blood brain barrier consequently reducing the side effect of sedation.

Management of Side-Effects of Chemotherapy

Danika Caruana

A sample of cancer patients are recruited and interviewed to analyse the side-effects experienced after a chemotherapy cycle. Evaluation of the prescribed treatment outcomes according to established protocols for the management of these chemotherapy side-effects is undertaken. Amendments to the current protocols are suggested or new protocols are developed and implemented.

Pharmacist Prescribing and Use of Antibacterials

Gianella Casha

Previous local studies confirm that pharmacists are willing to accept supplementary pharmacist prescribing for minor infections, such as upper respiratory tract and skin infections. Guidelines for antibacterial use in different scenarios are used to propose a framework for pharmacist prescribing focusing on assessment of the condition presented and identification of antibacterials required.

Synthesis of Active Pharmaceutical Ingredients: A Case Study

Conrad Cassar

Processes to produce active pharmaceutical ingredients (APIs) are studied with special reference to steroids. Following extensive literature review, the synthetic route of the steroid molecule abiraterone is investigated. Alternative environment-friendly and safer routes of synthesis of abiraterone acetate are assessed. Chemicals and materials required for this synthesis are identified and costed.

Standard Operating Procedures in Community Pharmacy

Michelle Marie Cassar

Common processes in the community pharmacy are identified. A general standard operating procedure (SOP) for each process is developed. Twenty-five community pharmacies in Malta are chosen and the SOPs are implemented. Monitoring and a follow-up audit are undertaken to assess the effectiveness of implementation of these SOPs.

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

Ritianne Cassar

Activity of different proton pump inhibitors is evaluated by analysing salivary and pancreatic amylase in gastric juice of patients. Patients will be followed-up to evaluate impact of long-term use of these agents. Analysis of lipase content in gastric juice is undertaken.

Chronopharmacology in Hypertension

Sephorah Falzon

Effect of calcium channel blockers and angiotensin-II receptor blockers on blood pressure (BP) levels when administered in the morning or in the evening is assessed. Twenty-four hour ambulatory BP monitoring is performed on patients fitting the inclusion criteria for each drug class. Patients are recruited from the Cardiac laboratory at Mater Dei Hospital and from community pharmacies.

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 2-O-caffeoyl tartaric acid, emitine, rosmaricine and 2-O-feruloyl tartaric acid molecules are used to design novel structures capable of inhibiting the tyrosine kinase, epidermal growth factor receptor.

Pharmacoeconomics of Vaccination in Paediatrics

Maria Galea

Knowledge and perception of parents on paediatric conditions and preventable diseases, protection offered by paediatric vaccines and costs of these vaccines are assessed. Pharmacoeconomic implications of paediatric vaccinations and parents' perception of free vaccines is investigated.

Pharmaceutical Care in Venous Thromboembolism

Jeanine Grech

Prevention of venous thromboembolism (VTE) in a hospital setting is addressed. Risk assessment charts are used to identify the patients requiring prophylaxis compared to the actual prophylaxis regimes undertaken at Mater Dei Hospital. Pharmacist intervention in identification and management of prophylaxis is evaluated.

Risk Management in Pharmacy

Matthew Manfre

The science of risk management and its application to pharmacy is reviewed. Risk management protocols are applied to specific systems of pharmacy practice. The risk of these practices is calculated and ways of minimising these risks are implemented and evaluated.

Pain Management in Post Caesarean-Section

Deborah Mangion

Pain management in post-caesarean section is assessed. Analgesia used and method of administration adopted are reviewed and patient outcomes studied. A descriptive cross-sectional study regarding the use of patient controlled analgesia pumps in post-cesarean pain management is undertaken. Efficacy, safety and cost-effectiveness of this post-operative analgesia is assessed and patient satisfaction studied.

Mini-Scale Production Facility

Maria Mercieca

Further to a previous study, communication with Malta Enterprise and the Medicines Authority is undertaken to establish plans for the pharmaceutical industry in Malta. Local and foreign pharmaceutical companies are contacted to identify their interest in investing and using a mini-scale production facility based in Malta. An evaluation of the operating running costs is undertaken based on European Union Good Manufacturing Practice.

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

Benjamin Micallef

The performance of the Medicines Authority is investigated and compared to what is expected from a drug regulatory agency. Special attention is given to the dual role of legislation enforcement and protection of patients' interests. The inspectorate and post-licensing directorate of the Medicines Authority are critically appraised.

Design of Novel Carbonic Anhydrase Inhibitors

Jessica Marie Muscat

Carbonic anhydrases (CAs) are widespread enzymes which are strongly inhibited by sulfonamides. In *in vitro* and *in vivo* studies, potent CA inhibitors prevent the growth of tumour cells and are interesting leads for developing novel antitumor therapies. The aim of this project is to identify and design novel potent antagonists of CAs.

Pharmacoeconomics in the Management of Drug Abuse

Maria Pace

The costs of methadone, buprenorphine and buprenorphine/naloxone maintenance therapies are analysed using data at the 'Substance Misuse Outpatient Unit' and questionnaires are distributed to 200 opioid dependent patients. Interviews with prescribers treating opioid dependency are undertaken to identify benefits and predict results if the three treatments for treating opioid dependency are included in the national programme.

Novel Drug Design at the Dihydrofolate Reducatase Enzyme

Graziella Portelli

The aim of this project is to use the binding modality of methotrexate with the dihydrofolate reductase (DHFR) enzyme to identify novel ligands capable of inhibiting this enzyme, such that its ability to recycle the folate necessary for DNA building will be effectively curtailed. Such molecules could be potentially used in the management of neoplastic disease.

Use of Medication in Paediatric and Elderly Persons

Clarissa Rizzo

Medication use, with particular emphasis on formulations aspects in paediatrics and elderly persons is reviewed. Guidelines on the choice of formulations and extemporaneous preparations including reformulations of medicines for this intended use are proposed. Identification of the most commonly used drugs and formulations is undertaken with an evaluation of limitations related to availability in both age groups.

Impact of Technology on Shared Care

Analise Said

Shared care enables information about patients to be available to healthcare professionals who work as a team to provide improved health and quality levels. Scenario analysis for different settings namely hospital, Pharmacy Of Your Choice scheme and community practice for shared care information through computer technology is assessed. Perceptions and views of healthcare professionals on current practice and possible developments is assessed.

Centralised Preparation of Intravenous Admixtures

Diane Saliba

An overview of current procedures used for the preparation of intravenous admixtures at Mater Dei Hospital and Sir Paul Boffa Hospital is determined. Guidelines used internationally are compared to guidelines used locally. Costs of different methods of centralised intravenous admixture preparations are quantified to identify the most efficient approach, both from an economic and a clinical aspect.

Drug Design of Novel β_1-Adrenoceptor Blockers

Astrid Marie Sant

A homology model of the human β_1-adrenoceptor, which has not yet been crystallographically elucidated is being constructed. Novel structures capable of its inhibition are 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 constant emergence of resistant strains. Having high affinity and *in vitro* inhibitory activity at the CYP450 enzymes prevalent within MbT, bound conformations of azole antifungals are used as templates during the *in silico* design of novel agents capable of superior inhibitory activity at this locus.

Use of Drugs in Patients in Intensive Care Unit and Critical Care

Annalisa Thake

Scenario analysis is carried out to identify dosing regimens of gentamicin at the Intensive Care Unit at Mater Dei Hospital. Patient information records are reviewed and drug blood levels studied. Guidelines for once daily dosing of gentamicin for the local scenario are developed, implemented and assessed for impact on patient outcomes, particularly patient safety.

Evaluating Impact of Advice from Community Pharmacists

Lisa Warrington

Advice provided by community pharmacists about different diseases and medicines through frequently asked questions by patients is identified and assessed. Evaluation of such advice in the management of correct drug use and in responding to symptoms is carried out. Patients are requested to rate their level of satisfaction of this service.

Patient Education on Women's Health

Nicola Warrington

Pharmacists offer advice and education on a number of issues related to women's health. Information on pregnancy, menopause and osteoporosis is prepared, disseminated through a web portal and assessed using available questionnaires for pregnancy and menopause. A questionnaire to assess patient's knowledge on osteoporosis is developed. Perception of the website by healthcare professionals is assessed.

Second Year Students
Project Descriptions

Pharmacist Manpower
Petra Abdilla
An analysis is carried out to explore the current local pharmacy scenario. Data collected is used to identify pharmacists' job structure and mobility and gaps in the evolution of professional status. The findings are correlated with data retrieved in previous local studies.

Pharmacist Prescribing
Abigail Aquilina
Areas in which pharmacists are actively contributing to identification and management of drug therapy are identified. Proposals for structures that lead to pharmacist prescribing in these scenarios are proposed and assessed.

Drug Design at the TLR4 Receptor
Daniel Attard
Molecular bases for antagonism and agonism of the TLR4 subtype are investigated and novel structures able to modulate this protein are designed. Agonists are known in playing a role in cancer and antagonists can potentially manage autoimmune conditions.

POYC: Where are we going? Patient and Pharmacist Forum
Hannah Bonnici
Development of the Pharmacy Of Your Choice scheme and its successful implementation in pharmacies is studied. Pharmacists' perception, possible developments in the provision of the service and patient expectations are investigated.

Evidence-Based Use of Herbal Medicines
Justine Borg
An evidence-based literature search on use of herbal medicines is conducted. This literature is analysed to confirm whether herbal use is based on myths and traditions or whether it has a scientific basis for efficacy.

Design of Novel Structures with an Aminopiperazinone Scaffold capable of Inhibiting the β-Secretase Enzyme for Management of Alzheimer's Disease
Luke Borg
Current treatment for Alzheimer's disease is symptomatic. The β-secretase enzyme is a potential disease-modifying target for this condition. The aim of this project is to use the aminopiperazinone scaffold for the *in silico* design of novel structures capable of inhibiting this enzyme.

Use of Compliance Aid Devices: Psychiatry
Estelle Borg Falzon
Use of compliance aid devices by psychiatric patients, out-patients and those in domiciliary care is studied. The extent of compliance problems in psychiatric patients is assessed and impact of introduction of compliance aid devices in this patient group is tested.

Pharmacist Services in Community Pharmacies
Andrew Busuttil
A study on how community pharmacists spend their time in the provision of efficient services in a pharmacy is carried out. Proposals for systems to reduce time consumption in processes are put forward. Identification of innovative services is undertaken.

Multidisciplinary Tasking in Cancer Patient Management
Ann Camilleri
The contribution of healthcare professionals in cancer management is assessed in light of how teams collaborate to provide seamless care. Attention is given to pharmacists' contribution in the clinical setting and chemotherapy reconstitution.

Methadone Dispensing Services
Mark Caruana
Malta's national health system of drug distribution and dispensing requires improvement to meet patient's needs. A regionalised service involving community pharmacies and patient compliance is investigated. Dispensing protocols followed in other countries are reviewed.

Association of Medicinals to Sleep Apnoea
Yanica Cassar
The possible contribution of therapeutic use of medicines in the aggravation of sleep apnoea is investigated. Reduction in the use of all forms of medications through the treatment of sleep apnoea by Continuous Positive Airway Pressure therapy is recorded and analysed.

Risk Management in the Pharmaceutical Industry
Matthew Chircop
Risk of partial manufacturing within the Pharmacy Of Your Choice scheme, with special reference to stability as influenced by the containers and method of transport, is assessed. How can this risk be reduced and would it be economically feasible? What are the ethics involved in taking these risks?

Quality and Safety of Pharmaceutical Solvents used in the Pharmaceutical Industry
Darren Cioffi
Types of organic solvents used in the pharmaceutical industry and safety precautions on how to handle and store these solvents are reviewed. A comparison between solvents used is carried out to identify less hazardous alternatives.

Design of Novel Anti-Prostate Cancer Drugs which Modulate the CYP17A1 Receptor using Abiraterone as Lead Molecule
Kurt Degabriele
Abiraterone inhibits 17-alpha-hydroxylase/C-17, 20 lyase CYP17A1 enzyme, part of the steroidogenic synthesis cascade, for the formation of testosterone. Abiraterone is used as a lead for iterative design of molecular structures having similar modulation of CYP17A1 with potential in the management of prostate cancer.

Professional Development of Pharmacists
Amanda Farrugia
Updates on conditions and medications used are reviewed and prepared for the local scenario. These updates are presented to pharmacists and evaluated. Perception of the pharmacists on this process is studied.

Use of Non-Steroidal Anti-Inflammatory Drugs
Jessica Farrugia
Risks implicated in the use of non-steroidal anti-inflammatory drugs (NSAIDs) and possible interactions with concomitant use of other medications are assessed. Occurrence of side-effects with use of NSAIDs is investigated.

Drug-Induced Effects and Hospital Admissions
Nicola Farrugia
Admissions to the Emergency Department at Mater Dei Hospital are studied and drug-related hospital admissions are identified. These admissions are classified into categories and proposals to reduce risk put forward.

Medication Reconciliation during Transfer of Care
Tresha Formosa
Pharmacist intervention in ensuring seamless care is observed. The list of medications taken by patients on admission, transfer and discharge from hospital is investigated for any omissions or inconsistencies and proposals for processes to be implemented are drawn up.

Partial Manufacturing
Matthew Gatt
Partial manufacturing focuses on the repackaging and re–labelling processes of pharmaceutical products to satisfy Maltese and European directives. These processes are investigated with particular emphasis on quality, standards and selection of packaging and labelling.

Adverse Drug Reactions Database
Rachel Gauci
A database where side-effects can be attributed to specific drugs is very useful in practical clinical settings. Side-effects presenting with drugs for gastrointestinal tract, cardiovascular and respiratory systems are identified. Resources are evaluated.

New Drug Distribution Regulations
Luca Giudice
Good Distribution Practice (GDP) consists of a set of guidelines which should be followed during drug distribution to ensure quality assurance. Current procedures used by local wholesalers in GDP are analysed, evaluated and improved where feasible.

Design of Novel Anti-Prostate Cancer Drugs which Modulate the CYP17A1 Receptor using Ketoconazole as a Lead Molecule
Michael Grima
Abiraterone, the CYP17A1 enzyme inhibitor, used for the management of prostate cancer, was designed using the antifungal drug ketoconazole as a template. The ketoconazole scaffold is used as a template in the design of novel structures capable of CYP17A1 inhibition.

Drug Design at the Sphingosine-1-Phosphate (S1P) Receptor for the Management of Multiple Sclerosis
Daphne Gusman
Fingolimod is a sphingosine-1-phosphate receptor antagonist used in the management of multiple sclerosis. The aim of this project is to design novel structures based on the fingolimod scaffold with potential for clinical use in the management of this condition.

Yield in Synthesis of Active Pharmaceutical Ingredients
Christopher Davis Mallia
Improvement of synthetic processes of active pharmaceutical ingredients with respect to yield is studied. The process of synthesis is investigated and modified to identify the best practical conditions needed for optimal yield.

Use of Protocols in Community Pharmacy
Kyle Marston
Protocols are standard procedures which support the pharmacist in dispensing medicines. Local and international published protocols are critically evaluated and a comprehensive set of protocols for responding to symptoms applicable to the local scenario is proposed.

Drug Design at the Human Glucocorticoid Receptor
Sean Meachen
Endogenous glucocorticoids are involved in a range of endocrine functions. There is a need to identify agents that preserve the immune effects without side-effects. The aim of this project is to design novel structures capable of superior modulation of this protein target.

Drug Design at the HIV Reverse Transcriptase Enzyme
Marie Mifsud
Discovery of novel drugs capable of management of the HIV virus is important since acquisition of resistance by this virus to drugs in clinical use remains a consideration. The reverse transcriptase enzyme (target), for which antagonist molecules are designed, is used.

Design of Novel Non-Steroidal Structures Capable of Antagonism of the Oestrogen Related Receptor (ERR) α for Management of Breast Cancer

Keith Muscat

Breast cancer is a significant cause of death in women. This study seeks to explain the binding modality of the experimental steroidal drug SR16388 at this locus and to use its scaffold in the design of non-steroidal structures capable of successful modulation of this receptor.

Management in Chemotherapy Admixtures

Dylan Said

From procurement and preparation phases to healthcare institutes and post-clinical management, chemotherapeutic admixtures progress through a structured, coordinated process. Protocols related to this controlled system are identified and developments suggested.

Argotti Gardens and the Use of Herbal Products

Katrina Saliba

The historical background of Argotti Gardens and therapeutic uses of herbal plants found in this location are investigated. Methods of how the public could be made more aware of the benefits of herbal plants and encourage visits to the garden are suggested.

Drug Design at the Human Fatty Acid Synthase using Orlistat as Lead Molecule

Ramon Sciberras

Tetrahydropolipstatin is a drug used for treatment of obesity by inhibiting lipase. This study targets the binding site in the human fatty acid synthase enzyme for development of a novel structure with inhibitory properties using orlistat as a template molecule.

Formulary for Non-BNF Cited Items

Timothy Scicluna

The British National Formulary (BNF) does not include all medicinal products used locally. A formulary update for an addendum to the BNF is developed and evaluated. Methods for dissemination and processes required to update the formulary are proposed.

Waste Management in Pharmaceutical Processes

Shirley Tabone

Waste management from industrial and experimental chemical processes, with emphasis on solvents, is evaluated. Different ways of how to recycle waste and risk assessment on solvent recycling are discussed.

Pharmacist-Led Adherence Clinics for Chronic Conditions

Jessica Vella

Development of pharmacist-led adherence clinics for specific chronic conditions is undertaken and its impact on preventing or delaying incidence of unwanted complications is studied. A key factor to successful treatment of chronic conditions is good adherence to medication therapy.

Extraction of Drugs from Biological Fluids

Maria Vella

Drug extraction plays a very important role in toxicology as it provides quantitative and qualitative analysis of drugs in complex biological fluids. This study attempts to establish good extraction techniques of specific drugs from biological fluids.

Design of Novel A2A Adenosine Receptor Antagonists for Treatment of Parkinson's Disease

Yana Vella

Literature shows that antagonism of A2A adenosine receptor, found in brain tissue, has potential in Parkinson's Disease management by regulating dopamine and glutamate release. The aim of this project is to use this receptor for *in silico* design of novel structures to exert such antagonism.

Human Papilloma Virus Vaccination
Bettina von Brockdorff
Various factors related to the use of human papilloma virus (HPV) vaccines available and their impact on the healthcare system are identified. Perception of the HPV vaccine in different social groups and administration schemes of this vaccine are studied.

Drug Design at the Angiotensin Converting Enzyme using Rubiatriol as Lead Molecule
Althea Marie Xuereb
Rubiatriol is a triterpene occurring naturally in the dried root of Rubiacordfolia. Literature indicates that it has potential angiotensin converting enzyme-inhibitory effects. The aim of this study is to validate, by *in silico* techniques, and use rubiatriol in design of novel structures with similar activity.

Pharmacists Intervention in the Use of Diuretics
Katya Xuereb
Patients with heart failure and hypertension on diuretic treatment are investigated. The impact of a pharmacist-led intervention on pharmacotherapy of heart failure is studied.

Drug Design at the β-Secretase Enzyme for Identification of Novel Structures for Treatment of Alzheimer's Disease
Keith Xuereb
The β-secretase enzyme is a protease important for the formation of myelin sheaths in nerves. It has been implicated in the formation of the β-amyloid plaques in the brain. The aim of this project is to design novel inhibitors of this enzyme with potential for clinical use.

Medication Administration Systems at Mount Carmel Hospital
Nicola' Xuereb
The current medication administration system at Mount Carmel Hospital is observed and documented. Following observation and literature studies, improvements to strengthen and increase efficiency of the current system are proposed.

Drug Design at the Oestrogen Receptor
Sharon Zammit
A recently identified experimental drug GW5638 with potential in the management of breast cancer is known to exert its modulation of the oestrogen receptor through a novel binding modality. This project seeks to examine the novel interactions forged by this molecule.