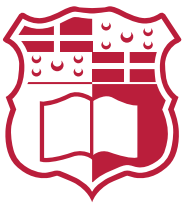

L-Università ta' Malta

DEPARTMENT OF PHARMACY

FACULTY OF MEDICINE AND SURGERY

DISSERTATION ABSTRACTS AND PROJECT DESCRIPTIONS 2018

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Foreword: Heroes of Pharmacy

Who are your Heroes in Pharmacy? Heroes in pharmacy are those who leave a mark in our pharmaceutical life. Leadership is key in the impact on the pharmaceutical profession. Professors and teaching academics are the first that come to mind as being heroes in their role models. Students are definitely heroes of pharmacy, certainly heroes of our Department because it is always important to keep in mind that a University Department is relevant if it gives the greatest importance to its students. All students. The Department of Pharmacy is blessed with all possibilities of pharmaceutical sciences students starting from the Bachelor in Pharmaceutical Technology going on to the professional Bachelors in Pharmaceutical Sciences and the Master in Pharmacy onto the Masters in Pharmaceutical Sciences encompassing areas of specialisation in Hospital Pharmacy, Industrial Pharmacy, Pharmacoeconomics and Regulatory Sciences. One cannot but not mention the highly successful international degree of the Doctorate in Pharmacy, a highly challenging degree carried out in collaboration with the College of Pharmacy of the University of Illinois in Chicago. Heroes in pharmacy are definitely our Ph.D. graduates and candidates because it is they who move the areas of excellence encompassed by the Department forward, whether ranging from studies in pharmaceutical chemistry such as the determination of drugs in biological fluids to pharmacogenetics, big data, green chemistry in pharmaceutical synthesis, aspects of risk and regulatory sciences as well as clinical planning and pharmaceutical care aspects in areas of specialisation such as cardiovascular disease and rheumatoid arthritis. The Department has witnessed seven such heroes graduating in recent years.

The Department, each year, acknowledges a number of persons who contributed to the Department's mission, representing the large number of persons without whom the Department could not have achieved such a success in its endeavours. The first person to be recognised in one of the first symposia organised by the Department is Anthony Darmenia, who as the first chief pharmacist worked tirelessly not only towards the establishment of Hospital Pharmacy, but was instrumental to see to the development of the Department as an entity on its own merit raising its status to that of Medicine, Surgery and Obstetrics and Gynaecology which were the only three other Departments in the Faculty of Medicine and Surgery. Certainly Anthony Darmenia is a hero par excellence for pharmacy.

The professionals to be recognised this year for their contribution to pharmacy are Christopher Barbara, Head of Pathology at Mater Dei Hospital whose knowledge, intellect and laboratory know-how are always available for pharmacists and pharmacy students, Marisa Cassar, a pharmacist who has established the DNA and new toxicology laboratory and where members of our Department carry out parts of their work or studies, Michael Farrugia whose interest and contribution to the management of the Government Pharmaceutical Services with special attention to education needs and continuous support to students undergoing placements in these areas are unprecedented, Charmaine Gauci, Superintendent of Public Health, a faculty member whose contribution to Regulatory Sciences in her public health quest in addition to her educational skills are exemplary and an excellent role model to follow and Anthony Sant Portanier, a community pharmacist of the old school but with tomorrow's vision in practice with a significant contribution to the Koperattiva Servizzi Farmaċewtiċi which gives a significant impetus to independent community pharmacists owners. These all fit the definition of true heroes of pharmacy.

And how about our research, administrative and technical staff? These are definitely heroes – as can be witnessed by all students and academic staff. The staff are perhaps, at first glance, looked at as ordinary people but they all have made big differences in the way we perform and in the achievements we make, fitting very well in the description of 'heroes' given by Dennis B. Worthen in the second edition of the book 'Heroes of Pharmacy'. Being a "hero" is not only an appellation but it brings with it a level of accountability and responsibility. Heroes mean that one is compelled to move beyond one's personal goals, while servicing the needs of the Department, of the University, of the professors and of the community at large. Heroes in pharmacy are those who work towards equal accessibility to drugs of certified quality, safety and efficacy – people who have responded to the needs of patients through quality standards.

Heroes are those who dreamt innovations in science, practice and management and who were able to answer to the evolvement of pharmacy such as clinical pharmacy and pharmaceutical care by saying "yes we can" at the proposals and not "impossible" but saying "why not?" instead of asking "why should I change?" Heroes are those who could adapt and participate in creativity. Heroes are those whose desire to ensure society access to quality health and hence quality and timely medicines, and who changed the way we use medicines. Those who contribute to the education of pharmaceutical professionals are the most important heroes of pharmacy. The evolution of the profession requires heroes who do not accept the status quo given but assume the responsibility of developing leadership skills to lead the student as well as the pharmaceutical graduate into accepting the challenges to respond to the needs of the industry, the patients and the community.

Professor Anthony Serracino-Inglott
Pharmacy Practice Projects Co-ordinator

Introduction

The Annual Pharmacy Symposium is dedicated to the development of research skills for students following undergraduate and post-graduate courses at the Department of Pharmacy. The inclusion of a pharmacy practice project for the pharmacy course at the Department has its origins to the 1980's. The Pharmacy Practice project today evolved into a structured learning experience for students following the two-cycle programme leading to a degree in pharmacy, the MPharm. An applied research project also features in the course that is focused to preparing graduates who are specialists in pharmaceutical technology, the Bachelor of Science (Hons) in Pharmaceutical Technology.

The practice project is designed so as to provide students with a knowledge and understanding through application, of experimental design, qualitative and quantitative research and statistical analysis. Pharmacy and Pharmaceutical technology students develop intellectual skills in performing gap analysis, elucidating a research question and preparing a strategy to address a hypothesis, and critically analyse literature. They develop practical skills in designing and carrying out questionnaires, interviews, focus groups as well as managing a project from a timeline and economic perspective. Students acquire the transferable skills of handling data protection and ethics approvals, data handling, problem solving and troubleshooting, and dissemination of research results. Students reading for the Master of Pharmacy degree and the Master of Science in Pharmacy degree present their dissertations. Master students are developing skills in dissemination of research in different fora including international platforms.

During an Education and Business Encounter session focusing on pharmaceutical aspects organised by the Ministry for Education and Employment last January, intended to bring together education specialists, industry and policy makers, the practice at the Department of pharmacy and pharmaceutical technology students working on applied research projects in collaboration with stakeholders including pharmaceutical industry, pharmaceutical regulatory science services and patient-service providers was showcased. The stakeholders highlighted the value of the development of practical and transferable skills that will enable graduates to think logically, approach processes and service developments analytically, and assess innovations critically.

A significant contribution to innovation is presented through the dissertations undertaken by the Doctorate in Pharmacy students. The post-graduate course leading to the Level 8 degree of Doctorate in Pharmacy, is offered in collaboration with the College of Pharmacy of the University of Illinois at Chicago. The course is an international programme and currently pharmacists from fourteen countries are enrolled. Two characteristics of this programme are 1) the merging of the European and US perspectives for pharmaceutical health systems and 2) the dimension of applied practice research which is included. The research outcomes from this Doctorate in Pharmacy are serving to spearhead innovative processes in ensuring patient safety related to evaluation of new technologies such as biosimilars and new medications, and in the development of novel pharmaceutical services at primary, secondary and tertiary care settings.

The goal of the Annual Pharmacy Symposium is to bring together undergraduate and postgraduate students and academic staff at the Department and collaborators to discuss outcomes of the projects and dissertations presented particularly from a perspective of how these findings can be applied to contribute to pharmaceutical developments.

The Department of Pharmacy is a leader in innovations in pharmacy education. In September 2017, the Department collaborated with the European Association of Faculties of Pharmacy, the Accreditation Council for Pharmacy Education and the American Association of Colleges of Pharmacy and hosted an international workshop on *Curriculum Design and Updating for Clinical Pharmacy Teaching*. The experiences from the curriculum development and the post-graduate Doctorate in Pharmacy course at the Department were presented as models that can be adapted in other European schools of pharmacy which are now embarking on changing curricula towards patient-centred pharmacy education. During the 2018 Annual Pharmacy Symposium, Buzz sessions were introduced as a new feature. These Buzz sessions are facilitated learning sessions where students have an interactive opportunity to reflect on experimental design, research methodologies adopted and the impact of outcomes of the research studies presented. This exercise helps to introduce pharmacy and pharmaceutical technology students in their first years of study, who have not yet embarked on the research project or dissertation study unit, to fundamental concepts in research methodology.

Professor Lilian M. Azzopardi
Head, Department of Pharmacy

Doctorate in Pharmacy
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Access to Orphan Drugs and Quality of Life in Rare Diseases

Amar Ibraheem Abbas

Background: Over 7000 rare diseases (RDs) affect around 300 million patients worldwide. The majority of RDs are genetic and appear early in life, resulting in a 30% mortality in children diagnosed before their fifth birthday. To date, there has been no locally conducted study about the healthcare needs of people living with RDs.

Purpose: (1) To retrospectively analyse existing regulations and policies related to Orphan Drugs (OD) locally and internationally, (2) To create a Quality of Life assessment tool specific to RD patients and explore issues of diagnosis, information provision at the time of diagnosis, use of health and support services and general quality of life.

Methodology: A retrospective analysis was carried out to extract features of various OD policies to help identify areas that can improve accessibility. A self-administered Health Related Quality of Life (HRQOL) Assessment tool was developed, validated by seven experts and published online. Different patient groups in Asia, Europe, Africa and America were contacted to invite their members to participate.

Results: There were OD specific legislations in 29 countries included in this study. Accessibility of OD depended on pricing, re-imbursement policies and product availability. One hundred and thirty responses given by RD patients were analysed. Sixty percent (n=78) of responses gathered were from Malta, 20% (n=26) from Ireland and 10% (n=13) from the USA. Accessibility issues were a hurdle for RD patients as 50% (n=65) reported that medication is available in other countries but not in their country. Forty percent (n=52) received a misdiagnosis and 30% (n=39) were waiting over 1 year to receive a diagnosis. In terms of mental health, 70% (n=91) complained of stress and anxiety problems.

Discussion: Although all the countries examined in this study had an OD regulation in place, there were differences between countries in pricing, licensing and reimbursement of ODs which have an impact on accessibility. There is a need for improvement in the quality of life of RD patients given the high cost of illness, mental health problems and poor accessibility to medications.

Development of a Paediatric Intravenous Formulations Manual

Dania Al-Haddad

Background: A Parenteral Drug Therapy Manual (PDTM) is a document or database that includes information related to administration, reconstitution of medicinal products, compatibility with other medicines and adverse reactions, and is used as guidance for the preparation and administration of medications via parenteral routes. The use of manuals for drug therapies is adopted in various settings abroad, including the Ottawa Hospital and Alberta Health Services in Canada. In the local setting, there is currently no PDTM for paediatrics.
Purpose: To develop a manual for intravenous medication commonly administered in the paediatric wards at Mater Dei Hospital (MDH) to be used as a quick reference by healthcare professionals.

Method: The commonly used intravenous (IV) medications for paediatrics were identified by interviewing nurses in charge of paediatric wards, reviewing consumption medication reports and using a questionnaire. The information included in the monographs was collected from literature, the latest version of the Summary of Product Characteristics (SmPC) and evidence-based practice at MDH. Each monograph contains the drug indication, reconstitution, preparation and administration method and any monitoring required during and after administering the therapy. The developed monographs were reviewed and validated by 3 pharmacists working at MDH. Pre- and post-testing questionnaires were developed and validated by 11 panellists, to evaluate the impact of the monographs on the administration practice of IV medications by nurses.

Results: Monographs were developed for 30 IV medications. Fifty six paediatric nurses out of 62 participated in the study; reconstitution and dilution practice and choice of compatible fluids when preparing an IV medication were identified as main difficulties encountered in administration practice by 40 nurses. Lack of standardised guidelines for medication administration and inconsistency between different resources and references were considered by 49 nurses as the main factors that contribute to medication errors. Feedback collected has shown that 49 nurses prefer to consult monographs as a source of information when they administer medications.

Discussion: Availability of a standardised reference at ward level contributes to safer medication administration by providing concise updated information required for administration practice.

Patient-Centred Regulatory Audits in Community Pharmacy

Annalise Attard

Background: The pharmacy profession is moving towards patient-centred practice and this should be reflected in its regulation.

Purpose: (1) To retrospectively analyse community pharmacy regulatory audit (CPRA) reports, (2) To develop, validate and implement a tool for CPRAs, (3) To identify case studies from CPRAs to recommend improvements to patient safety.

Method: Reports from CPRAs were retrospectively analysed to extract features that could lead to identification of patient-related deficiencies in community pharmacy practice. The audit tool was developed by conducting interviews with community pharmacists and by analysing the retrospective CPRA data. The tool was validated by eight inspectors from the Malta Medicines Authority and two community pharmacists. The tool was implemented in routine CPRAs and desirable patient-related improvements were identified through informal educational discussions with the practicing pharmacists during the CPRA. Case studies on the identified deficiencies related to patient safety were evaluated through the review of dossiers, European Public Assessment Reports and consultation with the Marketing Authorisation Holders.

Results: An audit tool for CPRAs was developed using the analysis of 512 audit reports for a 57-month period (January 2012-September 2016), and interviews with 12 community pharmacists extracting views on how CPRAs could be patient-focused. The audit tool was implemented in 85 pharmacies from January to November 2017. Storage of insulins, vaccines and epoetins below 2°C presented an example of a case study which could threaten intended therapeutic outcomes. Dispensing of government-paid prescriptions being given secondary importance versus private prescriptions formed the basis of another case study. The need to implement corrective actions to ensure that equal attention is given to all patients was acknowledged following discussion between the community pharmacist and the auditor. Another example which highlights how CPRAs relate to patient safety is a reported complaint of an error of dispensing methotrexate 2.5mg instead of methyldopa 250mg, which was followed up by an audit to find a possible cause for dispensing errors. The CPRA led to an agreement to store cytotoxics in a separate cabinet as a way to avoid future unfortunate, harmful events.

Discussion: An educational approach by auditors in CPRAs, reaching concordance to regulation as distinct to forceful compliance, may improve pharmacist motivation and patient care outcomes.

Aspirin and Novel Oral Anticoagulants: Reporting of Adverse Drug Reactions

Jessica Attard

Background: The efficacy of aspirin as antithrombotic therapy in peripheral artery disease (PAD) patients remains uncertain. Novel oral anticoagulants (NOACs) have the potential to be used in PAD.

Purpose: To observe adverse drug reactions (ADRs) following the use of aspirin and NOACs in the Maltese population and compare them to ADRs documented in pharmacovigilance reports, to observe the use of NOACs in PAD as demonstrated in clinical studies, and to analyse patient accessibility to NOACs.

Method: Eudravigilance and Vigibase were used to identify and analyse ADRs of aspirin and the NOACs apixaban, dabigatran and rivaroxaban. A questionnaire was used to gather information from patients about ADRs encountered while on aspirin or NOACs. Documented ADRs from pharmacovigilance reports were compared to reported ADRs from patients. A literature search was carried out to identify clinical studies involving PAD patients who were prescribed NOACs. The local hospital formulary was used to identify which NOACs are procured through the National Health Service.

Results: A total of 5083 ADRs were reported for aspirin in pharmacovigilance reports. For apixaban, dabigatran and rivaroxaban, 529, 712 and 721 ADRs were reported respectively. Fifty patients were recruited for the questionnaire, 36 of whom reported at least one ADR following administration of aspirin or NOACs. No statistical significant difference between reported ADRs in patients on aspirin or rivaroxaban was observed. Clinical trials on the use of NOACs in PAD are limited. Positive results from these studies support the potential use of NOACs in PAD. Rivaroxaban is the only NOAC which is available through the hospital government in-patients formulary for restricted use- for the prevention of venous thromboembolism in patients undergoing elective hip or knee replacement surgery for a maximum of 14 days.

Discussion: The adverse reaction profile and effectiveness of the agent should be considered when choosing medication to prevent thrombotic complications. Pharmacovigilance assures that the risk-benefit profiles of medicinal products are under ongoing review. The potential use of NOACs for secondary prevention in PAD is seen to have a promising future. Further studies are necessary to establish new indications for NOACs in PAD.

Interdisciplinary Impact of a Pharmacy-Led Medication Safety Service

Dustin Balzan

Background: Medication safety is an intrinsic function of hospital quality systems.

Purpose: To establish a pharmacy-led medication safety service and study changes within the staff's patient safety attitude at Mater Dei Hospital.

Methods: A pre-validated Agency for Healthcare Research and Quality (AHRQ) questionnaire[1] on patient safety attitudes of staff was distributed amongst a pre-selected cohort of 235 participants, from areas including anaesthesia, pharmacy and hospital administration. An internal hospital audit focusing on nine classes of high alert medications was carried out using an international safety tool designed by the Institute for Safe Medication Practices[2] together with a gap analysis exercise on international accreditation requirements. A pharmacy-led medication safety service was developed in line with findings.

Results: Response rate for AHRQ questionnaire was 51%. Results indicated that attitudes on twelve patient safety domains were ≤ 3 from a five-point scale (1 lowest and 5 highest), with the attributes 'Staffing', 'Handoffs/ Transitions', 'Non-punitive approach to errors' and 'Teamwork across units' scoring lowest (≤ 2). Participation in event reporting was low, with over 65% of respondents stating that they do not report, 20% stating that they reported from 1-2 events and the remaining 15% reporting between 3-10 events per year. Technical interventions were focused on three main domains, each impacting on systematic parts of the medication use process; drug distribution re-engineering, improvement of safety alert flagging system and work towards achieving centralised aseptic dispensing.

Discussion: Low trends in safety attitude scores demonstrate room for growth. The impact of re-instating the role of pharmacy in strategic aspects such as quality improvement of aseptic preparation of medicines, safety alert flagging and drug distribution re-engineering remains an important mechanism for pharmacy's dual role (co-ordinator and participant) within the hospital's medication use process.

1. Agency for Healthcare Research and Quality (AHRQ).Hospital Survey on Patient Safety Culture [Internet]. Rockville, MD:AHRQ; 2007[cited 2018Feb 6. Available from: http://www.ahrq.gov/sops/quality-patient-safety/patientsafetyculture/hospital/index.html

2. Institute for Safe Medication Practices (ISMP). ISMP Medication Safety Self Assessment® for High-Alert Medications [Internet]. 2017 [cited2018 Feb 6]. Available from: http://www.ismp.org/selfassessments/SAHAM/

Pharmacist-Led Discharge Service at Mater Dei Hospital

Denise Borg

Background: The provision of a discharge pharmacist service enhances the safe transition of patients across various healthcare settings. A medication review service at discharge consisting of a series of pharmaceutical care interventions offers the opportunity to facilitate seamless patient management and encourages transitional care.

Purpose: To develop a patient-centred pharmacist-led discharge service within the Hospitality Lounge at Mater Dei Hospital (MDH).

Method: A novel clinical pharmacy service was implemented within the Hospitality Lounge at MDH, whereby patients flagged by healthcare professionals were reviewed by a pharmacist prior to hospital discharge. Holistic and tailored pharmacist interventions were delivered as part of the devised pharmacist-led discharge service. A dedicated pager service was established for healthcare professionals to contact a designated pharmacist for assistance on any medication-related issues and patient counselling prior to discharge. Pharmacist activities included validation of discharge information prior to patient discharge by providing a clinical check, supply of medication at discharge to ensure continuation of care, and customised patient counselling.

Results: The service was launched on December 20, 2016 and up to December 30, 2017, there were 3161 discharged patients through the Hospitality Lounge during the working hours of the dispensary. The pharmacist was contacted 247 times and 679 patients (21.5%) were flagged for further pharmacist intervention. Activities performed by the pharmacist consisted of arrangements to ensure ongoing medication supply at discharge (n=642), direct patient counselling on the medication treatment at discharge (n=525), and validation of discharge information by providing a clinical check (n=672).

Discussion: An on-demand clinical pharmacy paging system service enables multidisciplinary medication reviews of flagged patients during transition of care. The developed service represents an innovative model of pharmacist intervention in transitional patient care highlighting a ground-breaking service focusing on patient safety.

Assessment of Medicinal Products: A Comparative Study between Europe and United States of America

Matthew Camilleri

Background: Medicinal products are allowed on the market following the approval by autonomous regulatory agencies that are responsible for the evaluation of these products. Regulatory systems were developed independently in different areas. Differences in requirements for registration of medicinal products are found in Europe and the United States of America and such differences pose a barrier to the introduction of new products. Regulatory standardisation through the identification of differences between agencies is necessary to reduce redundancy and accelerate the review process workload for the benefit of all.

Purpose: To identify novel cardiology-related medicinal products which have been evaluated by the European Medicines Agency (EMA) and the US Food & Drug Administration (FDA), to compare the evaluations conducted by the EMA and the FDA from an efficacy and safety perspective and to highlight and analyse differences in information and the decision-making process between the two regulatory agencies.

Method: A list of all cardiovascular-related medicinal products assessed by the EMA was extracted from the EMA website through the Anatomical Therapeutic Chemical (ATC) code. Cross-matching with the FDA approved counterparts was performed through the FDA website using active ingredients, branded names and authorisation holder details. Assessment reports from the EMA and reviews from the FDA for each identified drug were obtained. A tool was developed and validated to compare data.

Results: A total of 87 products were identified. Twenty-seven products met the established inclusion criteria (new molecular entity products, products evaluated by both agencies and products with an outcome prior to 1 January 2017). The validated tool consists of six sections: 'administrative information', 'non-clinical information', 'clinical aspects', 'benefit-risk balance', 'risk minimisation plans' and 'risk evaluation and mitigation strategies and product information'. One case was identified where the EMA refused a product while the FDA approved its counterpart. The decision to refuse was related to safety issues. An orphan designation was given to the product by the FDA but not by the EMA.

Discussion: Differences in legislation between countries can shift the benefit-risk balance of a product and can impact the decision between approving and refusing a product.

Development of a Pharmaceutical Care Model within Paediatric Oncology

Sephorah Falzon

Background: Pharmacists can help to improve health outcomes and quality of care of paediatric oncology patients by contributing to safe and optimum use of the complex pharmacotherapy involved.

Purpose: To develop and implement a pharmaceutical care model in the Paediatric Adolescent Ward at Sir Anthony Mamo Oncology Centre.

Method: Following ethics approval, the pharmacist attended ward rounds where patient files, treatment charts and prescriptions were reviewed to identify pharmaceutical care issues (PCIs). PCIs identified were discussed with the clinicians and the outcomes were recorded. Other pharmaceutical services found to be lacking were developed.

Results: A total of 527 PCIs were identified during 315 pharmaceutical care sessions provided over 7 months. The most common PCIs identified were classified as counselling need to parents/legal guardians about medications (n=147); incorrect dose (n=91); monitoring need (n=80); no indication for drug (n=61); no drug treatment despite existing indication (n=34); missing, wrong or unclear instructions on treatment chart or prescription (n=28); adverse drug reaction (n=24); drug interaction (n=9); inappropriate route of administration (n=8); non-adherence to protocol (n=8) and inappropriate dosage form (n=7). Other pharmaceutical services provided to support the ward service included dosage calculations (n=906); drug information to healthcare professionals (n=355); liaison with staff at the dispensary and compounding sections of Mater Dei Hospital (n=45); guiding clinicians and nurses in filling the appropriate pharmacy related forms (n=45); checking availability and accessibility of drugs (n=31); attending interdisciplinary meetings (n=25); liaison with the Directorate of Pharmaceutical Affairs regarding patient access to treatment (n=6); preparing chemotherapy flow sheets (n=6) and participation in research studies (n=1).

Discussion: This study reflects the relevant contribution of the pharmacist at ward level within the interdisciplinary healthcare team through the implementation of a novel pharmaceutical care model which focuses on PCIs and patient specific needs.

Risk Assessment of Dispensing Errors Arising from Prescriptions in Malta and Germany

Jeffrey I. Kupka

Background: Errors on a physician's prescription may lead to errors in dispensing medications by the pharmacist. A risk assessment of errors arising from prescriptions in Malta and Germany was undertaken.

Purpose: To assess physicians' prescribing practices in Malta and Germany, and to assess risk of prescribing errors by physicians from a physician and pharmacist perspective.

Method: Interviews with physicians were conducted to describe the medical use process in both countries. Two questionnaires, Prescribing Error Questionnaire 'PEQ_{med}' for physicians and 'PEQ_{pharm}' for pharmacists were developed and validated by 16 experts using a two-round Delphi technique. Both professions were asked to assess root causes for errors that were discussed in the physician interviews and to rank potential prescribing errors on a scale from 1 (high score) to 4 (low score) by their probability and severity to obtain an overall 'Risk Priority Number' (RPN) (1 - 4 low risk) (6 medium risk) (8 - 16 high risk).

Results: Eleven physicians (5 Malta, 6 Germany) were interviewed to describe their prescribing practice. Four physicians in Malta mentioned that the working atmosphere and disturbances while treating patients may influence the prescribing error rate, whilst in Germany only 1 physician identified this issue as problematic. One hundred and twenty one physicians (59 Malta, 62 Germany) and 103 pharmacists (47 Malta, 56 Germany) answered the PEQ_{med} and PEQ_{pharm} respectively. Prescribing errors due to illegible handwriting (RPN of 6.71 for physicians, 8.42 for pharmacists) and continuing the prescription for a longer duration than necessary (RPN of 5.69 for physicians, 7.82 for pharmacists) were rated as the two highest risks leading to potential dispensing errors in Malta. Physicians in Germany rated the continuing prescriptions as the highest risk with a score of 5.3.

Discussion: In both countries an uncontrolled duration of a medication is seen as one of the highest risks for patients. Physician's handwriting in Malta is seen as the main source of prescribing errors. In Germany illegible handwritten prescriptions are not an issue as prescriptions are issued electronically. Risk minimisation strategies to address these risks include the use of electronic software.

Emerging Patterns in the Development of Medicines in Paediatric Oncology

Benjamin Micallef

Background: Understanding the patterns in clinical development of paediatric oncology medicinal products may facilitate the approval of safer and more effective medicines to treat children with cancer.

Purpose: To review clinical development programs (CDPs) of centrally authorised medicines used in paediatric acute lymphoblastic leukaemia (ALL) to identify emerging patterns.

Method: CDPs for centrally authorised products to treat ALL in children were retrieved from European public assessment reports accessed from the European Medicines Agency (EMA) website. CDPs for drugs in the development phase were retrieved from the EMA database for opinions and decisions on Paediatric Investigation Plans and from clinical trials listed in the EU Clinical Trials Register. The drug class and line of therapy was described for each authorised and prospective product. CDPs were analysed and compared on the basis of the number, type and design of studies, the number of participants in each study and the endpoints used.

Results: Nine centrally authorised products (7 small molecules and 2 biologicals) were indicated to treat paediatric ALL. Forty-four investigational medicinal products are in various stages of clinical development in Europe: 12 products were in phase I, 19 in phase II, 12 in phase III and 1 trial was a long-term follow up study. The number of patients recruited varied from 8 in a phase I pharmacokinetic dose finding study to 4895 in a phase III randomised controlled safety study. Out of 44 products, 24 were small molecules, 13 were advanced therapies with 38% being chimeric antigen receptor-modified T cells, 5 were biological and 2 products were antibody-drug conjugates. Liposomal delivery, pegylation and the development of paediatric-friendly dosage forms was observed in authorised products and investigational medicinal products. Overall survival, disease-free survival and objective response rate are endpoints used by industry to prove efficacy and safety in phase III trials.

Discussion: Reformulation of the old armamentarium is being used as strategy to overcome acute toxicity and improve treatment compliance. Immunotherapy with chimeric antigen receptor-modified T cells shows potential to improve cure rates in relapsed or refractory ALL, especially in patients not suitable to undergo bone marrow transplantation.

Availability of Antiretroviral Drugs and Associated Factors: A Comparison between Malta and Norway

Catherine Namulindwa

Background: Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS) is a public health concern in Europe. The EU/EEA reported 29,444 new HIV cases in 2016. Malta was one of 3 countries with the highest rates of new HIV cases (14.5 per 100000 population) and the rate has more than doubled since 2006.[1] In 2015, Norway reported the greatest decline in HIV in 10 years.[2] The rate per 100000 population fell from 6.3 in 2008 to 4.2 in 2016.[1] Effective antiretroviral treatment (ART) is valuable for HIV prevention. With more people on ART, the need to scale up treatment rises. The challenge then becomes the cost of availing ART to an increasing population of individuals living with HIV.

Purpose: To compare availability of antiretroviral drugs (ARVs) between Malta and Norway and determine associated factors.

Method: This is a mixed-methods, comparative cross-sectional study. Data was obtained from the dispensing database at Mater Dei Hospital in Malta and the Norwegian Prescription Database to determine the ARVs provided, number of patients receiving each ARV regimen and adherence to ARVs. Face-to-face interviews were conducted using an interviewer-administered questionnaire to collect data on factors associated with ARV availability.

Results: In Malta and Norway, ART is free-of-charge for diagnosed patients covered by the national insurance scheme. An outdated formulary, challenges in drug forecasting, absence of HIV-allocated funding and the small market size are some of the factors constraining availability of newer ARVs in Malta. These challenges, however, did not result in treatment interruption. Norway does not experience challenges in availing newer ARVs; willingness-to-pay is high, but Norway's small market size raises the cost of ARVs. Pre-exposure prophylaxis (PrEP) is free-of-charge in Norway, unlike in Malta.

Discussion: Favourable procurement practices can improve availability of ARVs. Norway's greatest decline in HIV cases was in men-who-have-sex-with-men (MSM). This is likely due to free PrEP. Similar practices in Malta could lower HIV rates, as Malta's greatest increase in HIV cases is in MSM. Improved availability to medicines can lower new HIV cases by maximising the effect of treatment as a prevention tool.

1. European Centre for Disease Prevention and Control/WHO Regional Office for Europe. HIV/AIDS surveillance in Europe 2017 – 2016 data. Stockholm: ECDC; 2017

2. Norwegian Institute of Public Health. Decline in HIV cases in Norway in 2015. Oslo; 2016 [Cited 2017 Jun 12]. Available from https://www.fhi.no/en/news/2016/HIV-2015/

Establishment of Pharmaceutical Services within the Emergency Department

Graziella Portelli

Background: The pharmacist within the Emergency Department (ED) has an essential role to assure safe, efficient and effective medication use to critically-ill patients presenting with an acute, life-threatening condition or trauma at the ED, which is typically chaotic, with limited resources and burnt-out staff.

Purpose: To establish a pharmaceutical service tailored to the needs of the Adult Emergency Department (ED) at Mater Dei Hospital.

Method: ED dynamics were observed for 3 weeks and gap analysis exercises performed. Areas of weaknesses in the medication use process and the needs of the local situation were identified through discussions held with a focus group consisting of lead ED clinicians, nursing management within the ED, senior pharmacy management and quality assurance staff at the pharmacy. A questionnaire to assess the expected role of the ED pharmacist was compiled, validated and distributed to the physicians and nurses within the ED. Operational changes were implemented, followed by establishment of clinical services.

Results: Gap analysis and questionnaires (60 collected from 87 ED nurses and 29 from 55 ED physicians) highlighted that medication stock management, including antidotes and pre-hospital medications, reorganisation of treatment room and resuscitation rooms according to international standards and hospital policies had to be carried out. A new stock maintenance procedure was implemented with the addition of 5 new drugs on the shop-floor. A total of 150 clinical pharmacy interventions were documented to-date and a total of 4 departmental policies and guidelines were written. Continuing education lectures targeting nursing staff in relation to pharmacology of drugs used within the ED department was established.

Discussion: In the ED, the pharmacist fosters collaboration as part of the multidisciplinary team to improve overall performance and care. This provides a safe and effective medication use process, which is necessary within the ED dynamics.

Accessibility and Safety of Antipsychotics in the Treatment of Autism Spectrum Disorder in Children and Adolescents

Shaista Sadaf

Background: The approach towards the treatment of autism spectrum disorder (ASD) may be economically and culturally influenced.

Purpose: To develop a questionnaire intended for psychiatrists in India and Malta to study the influence of the ASD screening tools 'Indian Scale of Assessment of Autism' (ISAA) and 'Childhood Autism Rating Scale' (CARS) on the prescription of risperidone and aripiprazole, to study the accessibility of risperidone and aripiprazole, and to study the safety of risperidone and aripiprazole using European Pharmacovigilance systems (EudraVigilance).

Method: The ASD comparative questionnaire (India-Malta) (ASD-Q_{IND-MT}) was developed and validated by 10 experts through a content validity index tool and disseminated to 47 psychiatrists in India (31) and Malta (16). Regulatory authorisation, availability and price of risperidone and aripiprazole were compared for accessibility in both countries. The EudraVigilance data analysis system (EVDAS) was accessed to detect safety signals to identify potential adverse drug reactions. An age filter range of 6-17 years (risperidone) and 5-16 years (aripiprazole) was applied as per FDA recommendations. Valid signals from 2001 until 25 September 2017 were extracted.

Results: Feedback from the ASD-Q_{IND-MT} (140 close-ended questions) indicated that 21 psychiatrists (14 India, 7 Malta) agreed that screening tools influence the prescription of medication, seventeen (12 India, 5 Malta) agreed that pictorial assessment tools may be more accurate, thirty-one (22 India, 9 Malta) agreed that accessibility could significantly be improved by including risperidone and aripiprazole on the government drug policy list. Risperidone and aripiprazole are authorised by Central Drug Standard Control Organisation in India and by European Medicines Agency (EMA) for Malta. Price for a single risperidone and aripiprazole tablet are €0.04, €0.08 (India) and €0.89, €0.96 (Malta) respectively. Policies influencing accessibility are National List of Essential Medicines (NLEM) and Jan Aushadhi in India and Schedule V scheme in Malta. Signals of disproportionate reporting (141 aripiprazole and 177 risperidone) were extracted from EudraVigilance to conduct the causality assessment

Discussion: Pictorial signs can be included in ISAA and CARS to make it more user-friendly. Updating the NLEM and Schedule V with risperidone and aripiprazole indicated for ASD may significantly increase their accessibility. Suggestive ADRs extracted from EudraVigilance can be included in the Summary of Product Characteristics.

Implementation of a Pharmaceutical Care Model within Haematology

Diane Saliba

Background: The complexity of haematological diseases together with complications that may arise during treatment warrant the need of having a complete interdisciplinary team, including the presence of a ward-based clinical pharmacist.

Purpose: To develop a standardised pharmaceutical care model within the haematology ward at Sir Anthony Mamo Oncology Centre.

Method: Current practices within the ward were observed to develop a baseline against international standards of pharmacy practice care. The standards were used to devise an evidence-based clinical pharmacy service at the ward. During ward rounds and whilst reviewing treatment charts and patient files, the pharmacist identified pharmaceutical care issues (PCIs). These were recorded in the pharmacist patient profile developed. Discussions to resolve these PCIs were held with the other healthcare professionals (HCPs).

Results: A total of 357 pharmaceutical care sessions were held in 6 months of ward attendance during which 451 PCIs were identified. The PCIs were monitoring needs (n=136), need for treatment discontinuation (n=64), need for additional drug (n=60), patient education (n=51), drug dosing adjustments (n=39), incorrect dosage regimen frequency (n=23), more appropriate drug (n=23), more appropriate route of administration (n=15), drug interactions (n=15), change in dosing schedule (n=10), side-effect occurrence (n=12) and medicines reconciliation (n=3). Eight-seven percent of the interventions proposed for these PCIs were accepted by the other HCPs. The pharmacist provided other pharmaceutical services (n=347), with the most common services being medicines information (n=167), administration advice (n=40), modifications on treatment charts (n=35), dosage calculations (n=34), liaison with other pharmacy entities (n=19) and provision of medication tables on discharge (n=7).

Discussion: This study demonstrates the benefits of an integrated role for clinical pharmacists at the haematology ward. The role responds to the new challenges and pressures that accompany the ever growing demand for cancer care services and the expanding complexity of cancer drug regimens. The development of a standardised clinical pharmacist service within a collaborative management model contributes to rational and safe patient management.

Chronic Obstructive Pulmonary Disease Exacerbations: Cost, Risk Factors and Impact of Long-Acting Muscarinic Antagonists

Jessica Spiteri

Background: Long-acting muscarinic antagonists (LAMAs) are the gold-standard of care in chronic obstructive pulmonary disease (COPD) management. In spite of this, LAMA use locally is not widespread due to formulary restrictions. Hospital admissions are good indicators of the severity of COPD exacerbations.

Purpose: To estimate the incidence and cost of COPD exacerbations leading to hospitalisation and to put forward recommendations for LAMA use in Malta.

Method: The medical admissions booklet at the Accident and Emergency department at Mater Dei Hospital was screened for COPD-related admissions from February to April 2017. Excluded patients included those given an alternative diagnosis by the caring medical firm and newly diagnosed cases. The number of COPD hospitalisations, duration of the patients' hospital stay, use of non-invasive ventilation (NIV) and Intensive Therapy Unit (ITU) admissions were recorded. Cost estimates using an activity-based costings approach was computed. A case-control study was performed to identify the risk factors leading to COPD hospitalisation. Cases were recruited from the COPD admissions, using the cluster sampling technique. Control patients were recruited from respiratory outpatients and the inclusion criteria were clinically stable patients without a COPD hospitalisation one-year previously. A data collection proforma was completed for recruited cases and control patients.

Results: A total of 148 COPD admissions were recorded. Out of these, 81 patients were interviewed and recruited as cases. Out of a total of 148 admissions, 9 patients required NIV and 3 patients required ITU admission. The length of hospital stay for the COPD admissions ranged from 1 to 44 days (median 4 days). Pearson's correlation showed a positive correlation between the length of hospital stay and the patients' BAP-65 score ($p=0.015$), implying that this score can be used as a predictor for hospital resource utilisation.

Discussion: Estimating the cost of exacerbation-related hospitalisations may assist in the prioritisation of healthcare policies. Introducing LAMAs on the national formulary may prove to be cost-effective through reduction of hospitalisations.

Developing Safe and Effective Medicinal Products to Treat Leber Hereditary Optic Neuropathy: Clinical and Regulatory Challenges

Marta Zuccarelli

Background: Leber Hereditary Optic Neuropathy (LHON) is a rare type of maternally-inherited mitochondrial optic neuropathy, with prevalence reported to be between 1/15,000 and 1/50,000. LHON may lead to blindness. LHON is caused by three mitochondrial DNA (mtDNA) point mutations, m.11778G>A, m.14484T>C and m.3460G>A, which respectively encode for the subunits ND4, ND6 and ND1 of complex I of the electron transport chain. To-date, an unmet medical need to treat LHON exists.
Purpose: To suggest treatment protocols in LHON and to understand emerging patterns in clinical development programs (CDPs) being pursued by pharmaceutical companies when developing safe and effective innovative medicines to treat LHON.

Methodology: Medicinal products (MPs) to treat LHON were identified from the online databases clinicaltrials.com (https://clinicaltrials.gov/) and clinicaltrialsregister.eu (https://www.clinicaltrialsregister.eu/). Descriptive statistics was calculated and CDPs were identified. A prospective treatment protocol for LHON was developed and emerging patterns in primary endpoints over time to prove efficacy were identified and compared.

Results: Eleven MPs suitable to treat LHON are in development: 7 products are small molecules, 3 products consist of advanced therapies and 1 product consists of phototherapy. Out of the 11 MPs, 5 are modulating agents, 3 are inhibitors of apoptosis, 2 consist of gene therapy products and 1 consists of reverse-disease therapy. Ten of the 11 MPs act at mitochondrial level and 1 product acts on retinal ganglion cells. Out of the 11 MPs, 1 product (Raxone®) has a marketing authorisation in the EU under exceptional circumstances and 1 product ($rAAV_2$) obtained orphan designation. Comparison among CDPs shows that different primary endpoints are being studied in phase III trials.

Discussion: To-date only one product is licensed in LHON. The analysis of CDPs and regulatory pathways allows the understanding of the requirements needed to develop safe and efficacious products. This may help in increasing the number of innovative drugs reaching the market in a timely fashion, increasing the treatment armamentarium for LHON.

M.Pharm. Students
Dissertation Abstracts

Pharmaceutical Care

Medication Use Management in a Long-term Elderly Care Setting
Tiziana Fenech Caruana

Patient Monitoring with Use of Lithium
Julia Pirotta

Documentation of Prescribing Processes in a Long-Term Psychiatric Setting
Roberto Briffa

Community Pharmacist Intervention in the Management of Older Persons
Rebecca Zammit

Medication Use Management in a Long-term Elderly Care Setting

Tiziana Fenech Caruana

Background: Literature shows that the incidence of preventable adverse drug events is higher in long-term care facilities for the elderly than in ambulatory care.[1] Pharmacist interventions in these facilities were successful in improving patient outcomes.

Objectives: To identify weaknesses in the drug distribution system and to highlight any inappropriate medication given to the elderly.

Design: Questionnaires were developed and disseminated to pharmacists, nurses, pharmacy technicians and physicians working at St. Vincent de Paule (SVP) residence to learn about their perception on the drug distribution system. The STOPP[2] tool was applied to a random sample of 25 patients to identify whether any of the medications administered could be discontinued. Statistical analysis of the data generated with the STOPP tool and questionnaires was carried out using the one-sample proportion test and SPSS respectively.

Setting: SVP long-term care facility

Main Outcome Measures: Application of STOPP tool; healthcare professionals' perception of the drug distribution system

Results: Significant results obtained indicate that 9 STOPP criteria were practised. These affected 20 out of the 25 patients under review. On average there were 2 STOPP criteria that were significantly practised on a single patient. Qualitative data from the questionnaires underlined the urge to extend the current pharmacy opening hours.

Conclusion: SVP pharmacists need a stronger role in decision-making on selection of pharmacotherapy. The current drug distribution system can be improved in aspects such as unit-dosing dispensing, individual patient medication and differentiation of similar medicines.

References:

1. Gurwitz JH, Field TS, Harrold LR, Cadoret C, Auger J, Judge J, *et al*. The incidence of adverse drug events in two large academic long- term care facilities. Am J Med. 2005;118(3):251-8.
2. O'Mahony D, O'Sullivan D, Byrne S, O'Connor MN, Ryan C, Gallagher P. STOPP/START criteria for potentially inappropriate prescribing in older people: Version 2. Age Ageing. 2015;44(2):213-8.

Patient Monitoring with Use of Lithium

Julia Pirotta

Background: Lithium yields successful pharmacotherapeutic outcomes but has a narrow therapeutic index[1] requiring vigilant patient monitoring. There is presently a lack of registries and fixed guidelines implemented for patients receiving lithium from local psychiatric institutions.

Objectives: To identify strengths and weaknesses of monitoring practices at Mount Carmel Hospital (MCH) and the Psychiatric Out-Patients Department at Mater Dei Hospital (MDH).

Design: Quantitative data from files of 44 patients on lithium therapy was collected using a data collection tool which was tested for inter-rater reliability and content validity. Patient files were selected from MCH and MDH via convenience sampling, based on inpatient wards and outpatient clinics with known statistics of lithium consumers. Data was analysed using IBM SPSS Statistics 23 to generate descriptive statistics. The chi-square test was used to assess the influence of patient and management factors on lithium monitoring.

Setting: MCH and Psychiatric Out-Patients Department at MDH

Main Outcome Measures: To reflect trends in patient demographics, medical background and monitoring frequency of crucial clinical parameters

Results: Data from 20 inpatients and 24 outpatients was obtained (N=44). Of these 44 patients, 15 patients were found to have serum lithium levels monitored every 3 months. Side-effects were self-reported by 7 patients between 2015 and 2017, 2 of which were associated with lithium toxicity. A significant correlation was found between non-compliance and monitoring of serum lithium levels ($p<0.001$) and between occurrence of side-effects and co-existing comorbidities ($p=0.05$).

Conclusion: Monitoring strategies for lithium therapy currently lack standard uniformity and quality of pharmaceutical care provided could be improved.

Reference:

1. Keck PE, McElroy SL. Clinical pharmacodynamics and pharmacokinetics of antimanic and mood-stabilizing medications. J Clin Psychiatry. 2002; 63(4): 3-11.

Documentation of Prescribing Processes in a Long-Term Psychiatric Setting

Roberto Briffa

Background: A study by Nirodi and Mitchell showed that prescribing for inpatients in psychiatric institutions is very poor, with only 18% of the prescriptions under study being fully legible, signed by a physician and error free.[1]

Objective: To identify risks that may possibly arise due to drug prescribing errors.

Design: The study was conducted with a questionnaire disseminated to healthcare professionals, namely, physicians, pharmacists and nurses, working at Mount Carmel Hospital. The questionnaire evaluated the perception of healthcare professionals with respect to the three major factors contributing to prescribing errors during ward rounds and optimal ways to avoid these factors.

Setting: Mount Carmel Hospital Pharmacy

Main Outcome Measures: Evaluation of the perception of physicians, nurses and pharmacists regarding drug prescribing errors during ward rounds.

Results: Seven of the 12 healthcare professionals who completed the questionnaire identified illegible prescriptions and miscommunication between team members as the two main factors contributing to prescribing errors during ward rounds, while lack of staff leading to large volume ward rounds was another factor noted by 6 healthcare professionals. Chart review at the end of a patient's visit and reducing disturbances during ward rounds were perceived to be two possible ways to avoid prescribing errors by 8 healthcare professionals.

Conclusion: Guidelines on prescription writing should be implemented in a psychiatric setting over a period of time to increase acceptability by both healthcare staff and inpatients.

Reference:

1. Nirodi P, Mitchell AJ. The quality of psychotropic drug prescribing in patients in psychiatric units for the elderly. Aging and Mental Health 2002; 6(2):191-6.

Community Pharmacist Intervention in the Management of Older Persons

Rebecca Zammit

Background: The pharmacist plays a vital role in safeguarding the community with extensive knowledge on pharmacotherapy. The pharmacist aims at providing services on safe medication use and lifestyle promotion which will provide better care for the growing elderly population.

Objectives: To evaluate and understand pharmacist intervention in the management of older persons.

Design: A questionnaire in the form of an interview for elderly patients was developed. This questionnaire addresses the needs of the elderly from community pharmacies. The Maltese districts were analysed for statistical purposes and five localities were identified by convenience sampling. Twenty patients per pharmacy were interviewed (N=100). Data was inputted into Microsoft Excel and analysed with IBM SPSS statistics 24.

Setting: Community pharmacies

Main Outcome Measure: Pharmaceutical care needs for elderly patients within a community pharmacy setting

Results: From 100 patients, 52% were female and 48% were male. All patients have been visiting the pharmacy on a regular basis for the past 5 years with 15% visiting more than once a week, 22% visiting weekly, 27% visiting monthly, 35% visiting more than once a month but not on a weekly basis and 1% did not know. Thirty-two percent of patients take between 2 to 3 different types of medications daily with a mean of 3.07 medications (range of 5), and 94% take their medicines alone. Forty-nine percent of patients find it hard to follow or remember what the pharmacist has said and only 6% have had a medication review performed. Sixty-four percent feel that they are taking their medication correctly and 89% are aware of the indications for which they take their medications. Thirty-eight percent find the packaging of the medication most challenging and 19% of the patients feel that they need more attention from the pharmacist.

Conclusion: Patients are overall satisfied with the service a community pharmacist offers but certain areas may be improved. From the data obtained models are proposed for improved pharmaceutical care.

Pharmacy Administration and Regulatory Affairs

Public Perception and Expectations of Pharmacy Services
Yasmine Hefny Mohamed

Clinical Practice and Pricing Insights into Medicine Access Intelligence
Stefan Cassar

Improvements in the Registration of Medicines Process
Francesca Cilia

Public Perception and Expectations of Pharmacy Services

Yasmine Hefny Mohamed

Background: Evaluating public perception and expectations of services provided by pharmacists is important in the advancement of pharmacy services.

Objective: To assess public perception of the pharmacist

Design: A self-administered questionnaire consisting of 8 statements to rate public perception of the pharmacist on a Likert-scale from 1 (strongly disagree) to 5 (strongly agree), was developed, validated and disseminated to participants recruited by convenience sampling from the main reception of Mater Dei Hospital (MDH) and from a community pharmacy. Participants were at the hospital for an outpatient visit or to visit an inpatient, and at the community pharmacy to visit the physician, to collect their chronic medications or to purchase a non-prescription product. Descriptive statistics were undertaken using IBM SPSS statistics 24.

Setting: Mater Dei Hospital; community pharmacy

Main Outcome Measure: Public perception of the pharmacist

Results: Of the 244 participants who completed the questionnaire (165 from MDH, 79 from the community pharmacy), 56% (n=137) were ≥ 60 years, 62% (n=152) were female, 46% (n=112) were educated to secondary level and 44% (n=108) live in the Northern Harbour district. Participants agreed or strongly agreed that pharmacists are accessible healthcare professionals (90.2%, n=220), ensure patient safety in the medicine use process (90.2%, n=220), help patients to achieve the best outcomes from their medicines (89.8%, n=219), collaborate with the healthcare team (84.4%, n=206), are medicine specialists on the healthcare team (83.2%, n=203), are involved in scientific research and innovation (68.0%, n=166), contribute to improving cost-effectiveness of therapy (63.1%, n=154) and perform regular health monitoring (56.1%, n=137).

Conclusion: Participants had a very good overall perception of the pharmacist, particularly pharmacist accessibility, ensuring patient safety in the medicine use process and helping patients to achieve optimal outcomes from medicine use.

Clinical Practice and Pricing Insights into Medicine Access Intelligence

Stefan Cassar

Background: Access to medicines depends on five factors: 'Availability', 'accessibility', 'affordability', 'quality' and 'acceptability'.

Objectives: To devise and propose answers to research questions arising from case studies regarding access to medicine problems, such as identification of factors which could improve the situation.

Design: A literature review on medicine access was compiled, including the different barriers that exist, the economics and the healthcare system in Malta. The project involved the analyses of case studies investigated by the Medicines Intelligence and Access Unit (MIAU) of the Malta Medicines Authority (MMA). Cases regarding access to medicine problems were followed.

Setting: MIAU at the MMA

Main Outcome Measures: Types of barriers that cause lack of access, duration of the progression of the investigation, members of the healthcare system who intervened in the process and medicine access.

Results: Twenty cases were investigated. Access barriers were identified due to: Product not being available in Malta (7), price (5), side-effects (3), out of stock situations (3), and product not being available on the Government Formulary List (2). Fourteen out of the 20 cases were resolved positively and the patient could access the required medicine resulting in an increase to medicines access. Two cases were not resolved while 4 cases are still ongoing. The cases resolved positively include: A price of a medicinal product was reduced by more than half the price from €548 to €222, a medicinal product being made available to a patient although the product is not licensed in Malta and a patient being granted access to a branded medicine on a named patient basis after the occurrence of a side-effect owing to generic medicine.

Conclusion: Intervention by pharmacists at the MIAU positively resolved problems of access to medicines in a significant number of cases.

Improvements in the Registration of Medicines Process

Francesca Cilia

Background: All medicinal products require a Marketing Authorisation to enter the European market. The registration procedure ensures the safety, quality and efficacy of a medicinal product. The requirements to obtain a Marketing Authorisation are complex and may adversely influence the accessibility to medicines particularly in small countries such as Malta.

Objectives: To analyse the registration processes in Malta and to identify problems that could be improved for better efficiency.

Design: The registration procedure, which was investigated through a literature review of published studies and an examination of the functions of the legal and administrative framework on which it is based, was compiled in a booklet. A structured interview was designed, developed and conducted with 10 local pharmaceutical companies having the most products licensed on the Maltese market. Companies were identified using the Malta Medicines Database obtained from the Malta Medicines Authority (MMA).

Setting: MMA and Regulatory Departments of pharmaceutical companies.

Main Outcome Measures: Compilation of a booklet on the registration of medicines and recording views expressed by Responsible Persons of local pharmaceutical companies.

Results: The booklet was divided into two sections: (1) the registration process and (2) the Marketing Authorisation application. The first section outlines information on the general concept of each registration process, the application and evaluation procedure, the requirements of a Marketing Authorisation and the renewal process. The second section provides information on the application dossier in the Common Technical Document format and the various types of applications.

Conclusion: Harmonisation, increasing financing and resources, and consultations between companies and the regulatory authorities during drug development are three factors that may improve efficiency. The system should be intelligently structured in a way that while it retains its robustness it does not impact accessibility and affordability.

Medicinal Chemistry

Identification and Optimisation of Leishmania Kinase Inhibitors
Yasmin Caruana

***in silico* Design and Optimisation of Polyphenolic Flavonoid Quercetin Analogs for Histone Deacetylase and Histone Acetyltransferase Inhibition**
Durston Delia

***in silico* Design and Optimisation of Oleuropein and Lisinopril Analogs for MMP-9 Receptor Modulation**
Matthias Karl Farrugia

***in silico* Design and Optimisation of Phytoalexin Resveratrol Polyphenolic Analogs for Histone Acetyltransferase Inhibition**
Rebecca Hammett

***in silico* Design and Optimisation of Novel Human Glucocorticoid Receptor Modulators**
Sean Meachen

***in silico* Design and Optimisation of Poly (ADP-ribose) Polymerase Inhibitors using Olaparib as a Lead Molecule**
Christopher Muscat

Design and Optimisation of Epigallocatechin-3- gallate and Genistein Analogs for Histone Deacetylase Inhibition
Luke Xuereb

Identification and Optimisation of Leishmania Kinase Inhibitors

Yasmin Caruana

Background: Leishmaniasis is a disease transmitted by the protozoan Leishmania which depends highly on glycolysis for production of energy essential to its survival. Inhibition of pyruvate kinase, the enzyme which mediates protozoal glycolysis, is one route to terminate the protozoal lifecycle.

Objectives: To use the PYK inhibitor suramin as a query molecule to identify novel antagonists through virtual screening (VS) and *de novo* design.

Design: Protein Data Bank deposition 3PP7 describing suramin bound to *Leishmania mexicana* PYK (LmPYK) was selected as a template for the design of higher affinity antagonists.[1] Databases were screened in VS to identify morphologically and electronically similar molecules to suramin. In the *de novo* approach, structure activity data and modelled two-dimensional topology maps were used to identify the critical interaction between LmPYK and suramin. Five seed structures were modelled and were assigned growing sites at non-functionally critical areas. The optimal Lipinski Rule-compliant molecules identified through each approach were identified for molecule dynamics studies.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Virtual Screening, Seed Generation, Ligand Binding Affinity (LBA) Calculation

Results: The 3 highest scoring ligands of 171 identified molecules through VS were selected to visualise and compare intermolecular interactions. The *de novo* generated molecules were grouped into families based on pharmacophoric similarity and ranked according to LBA (pKd).

Conclusion: Lipinski Rule-compliant molecules with an affinity for PYK exceeding that of suramin were identified. The optimal structures were selected for molecular dynamics evaluation.

Reference:

1. Morgan H, McNae I, Nowicki M, Zhong W, Michels P, Auld D, *et al*. The trypanocidal drug suramin and other trypan blue mimetics are inhibitors of pyruvate kinases and bind to the adenosine site. J Biol Chem. 2011;286(36):31232-40.

in silico Design and Optimisation of Polyphenolic Flavonoid Quercetin Analogs for Histone Deacetylase and Histone Acetyltransferase Inhibition

Durston Delia

Background: Histone deacetylases (HDACs) and histone acetyltransferases (HATs) are two enzymes involved in tumour initiation and progression. Literature indicates that quercetin has a potent inhibitory effect on these enzymes and consequently its scaffold is a suitable lead for the design of other inhibitory analogs.[1]

Objectives: To use the quercetin scaffold as a basis for novel HDAC and HAT modulator identification using the twofold approaches of virtual screening (VS) and *de novo* design.

Design: Protein Data Bank depositions describing HDAC and HAT were chosen as templates. Quercetin was docked into the apo-form of the receptors and conformational analysis was carried out to obtain the best conformers. Using the latter, VS was performed and the resultant molecules were filtered according to Lipinski's rules criteria. The filtered molecules were docked into the receptors' protomols and their affinity calculated. *De novo* design approach relied on the molecular modification of the non-critical interactions between the optimal quercetin conformer and the respective receptors. Novel Lipinski Rule-compliant molecules were designed and ranked according to affinity.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: *de novo* design, VS, structure/receptor-based drug design

Results: Two Lipinski rule-compliant molecular cohorts with affinity for both HDAC and HAT were obtained through *de novo* design and VS. The optimal molecules from each cohort were identified for molecular dynamics.

Conclusion: Quercetin was confirmed as an adequate lead molecule in the design of novel HDAC and HAT inhibitors with potential *in vivo* tumour mitigation.

Reference:

1. Adawiyah R. Histone acetyltransferase P300/CBP-associated factor inhibition by quercetin as anticancer drug candidate with *in silico* and *in vitro* approach. International Journal of Pharmacy and Pharmaceutical Issues. 2016;8(5):211-5.

in silico Design and Optimisation of Oleuropein and Lisinopril Analogs for MMP-9 Receptor Modulation

Matthias Karl Farrugia

Background: Matrix metalloprotease-9 (MMP-9) mediates breast cancer and Alzheimer's disease (AD). MMP-9 is linked with proliferation of malignant cells in breast cancer and drives the formation of tau oligomers in AD.

Objectives: To use oleuropein and lisinopril as leads to probe the MMP-9 ligand binding pocket (LBP) and identify their optimal bound conformations, and to use these molecules to identify analogs through virtual screening (VS) and design structures *de novo* capable of MMP-9 inhibition.[1]

Design: Protein Data Bank crystallographic deposition 2OVZ describing MMP-9 bound to a phosphinate inhibitor was used as template. Apo MMP-9 was modelled, lisinopril and oleuropein docked, conformational analysis performed and optimal bound conformers of each found. Each selected conformer was submitted to ViCi® database for analog identification. A consensus pharmacophore was generated using the phosphinate inhibitor from 2OVZ and the best conformers of lisinopril and oleuropein. This was submitted to the ZINCPharmer® database for analog identification. A protomol (idealised LBP) was modelled and the Lipinski Rule-compliant hits identified were docked into the protomol and ranked by affinity. LBP maps of MMP-9 circumscribed by the optimal conformers of lisinopril and oleuropein were generated. Seed structures were modelled, planted into each LBP map and allowed *de novo* growth.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: *de novo* design, Virtual Screening

Results: 1144 and 610 Lipinski Rule-compliant molecules were identified through VS and *de novo* approaches respectively.

Conclusion: The hypothesis that both ligands are suitable leads for the design of MMP-9 ligands is justified. The best molecules are commended for further validation.

Reference:

1. Tochowicz A, Maskos K, Huber R, Oltenfreiter R, Dive V, Yiotakis A *et al*. Crystal structures of MMP-9 complexes with five inhibitors: Contribution of the flexible Arg424 side chain to selectivity. J Mol Biol 2007; 371(4): 989-1006.

in silico Design and Optimisation of Phytoalexin Resveratrol Polyphenolic Analogs for Histone Acetyltransferase Inhibition

Rebecca Hammett

Background: The mutation and amplification of Histone Acetyl Transferase (HAT) enzymes occurs in multiple cancers, especially those of haematological or epithelial origin. Consequently, inhibitors of such enzymes have the potential to be promising chemotherapeutic agents due to their ability to restrict DNA double strand repair in neoplastic cells.[1]

Objectives: To use trans-resveratrol as a scaffold for the *in silico* identification and design of high efficiency binding molecules that are capable of modulating the p300-HAT enzyme.

Design: The X-ray crystallographic deposition 4PZT describing the holo-p300-HAT_LBP bound to Acetonyl-CoA was selected, and the small molecules' bound co-ordinates were used as a template for the conformational analysis of trans-resveratrol, extracted from PDB ID: 4DPN. The optimal conformer was identified and used for the design of novel analogs via the *de novo* and virtual screening drug design approaches. This was followed by the analysis of the molecular oral toxicities, a critical step which prevented the disposal of toxic molecules at a later stage.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Dissemination of the molecular database, Ligand Binding Affinity (pKd) and Ligand Binding Energy (kcal mol-1) calculations, seed generation, *de novo* design, virtual screening, oral toxicities

Results: The molecules Chembridge_5190757 (pKd: 6.31) and IBS-STOCK1N-57915 (pKd:6.42) were chosen for further studies in molecular dynamics as a result of their predicted *in vivo* bioavailability and non-toxic properties (LD50>5000mg/kg).

Conclusion: This dual approach led to the generation of molecular cohorts whose structures and affinities may be compared and are possible suitable candidates for inclusion into molecular libraries that contain p300-HAT modulating properties.

Reference:

1. Wapenaar H, Dekker FJ. Histone acetyltransferases: challenges in targeting bi-substrate enzymes. Clin Epigenetics. 2016;8:59.

in silico Design and Optimisation of Novel Human Glucocorticoid Receptor Modulators

Sean Meachen

Background: The Glucocorticoid Receptor (GR) mediates effects in response to the secretion of corticosteroids. Steroidal pharmacotherapy is associated with adverse effects.

Objectives: The aim was to create and identify novel non-steroidal GR modulators via a non-steroidal ligand using *de novo* drug design and Virtual Screening (VS) to eliminate steroid-related adverse events.

Design: Protein Data Bank crystallographic deposition 4MDD[1] describing the bound coordinates of the GR and bound non-steroidal ligand 29M was modelled such that bioactive coordinates of the bound molecule and receptor could be analysed. This allowed creation of 7 seeds incorporating critical interactions capable of sustaining molecular, user-driven growth. A map of the GR Ligand Binding Pocket was modelled and seed fragments were planted in this pharmacophoric space. In a VS approach, the co-crystallised bound small molecule queried the Vici database for analog identification.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: *de novo* design, VS and structure/receptor based design

Results: The *de novo* approach yielded 200 Lipinski rule-compliant molecules from each seed fragment via *de novo* drug design. One hundred and thirty-four Lipinski compliant molecules were obtained, through VS and were individually docked into the protomol and ranked in terms of affinity.

Conclusion: This study supports the hypothesis that it is possible to design efficient non-steroidal GR modulators. Optimisation of selected structures will provide further validation.

Reference:

1. Carson M, Luz J, Suen C, Montrose C, Zink R, Ruan X. *et al*. . Glucocorticoid Receptor Modulators Informed by Crystallography Lead to a New Rationale for Receptor Selectivity, Function, and Implications for Structure-Based Design. Journal of Medicinal Chemistry. 2014;57(3): 849-60.

in silico Design and Optimisation of Poly (ADP-ribose) Polymerase Inhibitors using Olaparib as a Lead Molecule

Christopher Muscat

Background: Poly-ADP Ribose Polymerase (PARP) inhibition is associated with mitigation of neoplastic disease. A very important breakthrough has been made through the development of such inhibitors specifically through the design of the third generation inhibitor olaparib. Inhibition of these enzymes further drives the DNA damage process from single to double strand breaks which will cause death of cancer cells in which PARPs are over expressed.[1]

Objectives: To use the olaparib scaffold to identify and design novel PARP inhibitors through virtual screening (VS) and *de novo* techniques respectively.

Design: Protein Data Bank crystallographic deposition 3U9Y describing olaparib bound to the human tankyrase 2 catalytic domain was selected to be used as a template for this study. In VS the bioactive conformation of olaparib was screened against various databases and molecules having morphological and electronic similarity were obtained. In a *de novo* approach, novel seed structures were constructed with the aid of structure activity analysis and a two dimensional topology map outlining critical interactions between olaparib and the receptor. Seed structures were planted into the receptor and molecular growth was allowed within its confines. The optimal structures identified through a VS and a *de novo* approach were identified for further molecular studies.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: Molecular display, seed generation, *de novo* design of novel structures

Results: From a database of 1000 molecules, 780 molecules were found to be Lipinski rule-compliant having a high affinity for the receptor. The best conformers were promoted for further study.

Conclusion: Novel molecules which exhibited a ligand binding affinity value greater than that of olaparib were chosen for further *in silico* drug design.

Reference:

1. Farmer H, McCabe N, Lord C, Tutt A, Johnson D, Richardson T *et al.* Targeting the DNA repair defect in BRCA mutant cells as a therapeutic strategy. Nature. 2005;434 (7035):917-21.

Design and Optimisation of Epigallocatechin-3- gallate and Genistein Analogs for Histone Deacetylase Inhibition

Luke Xuereb

Background: Histone Deacetylases (HDACs) play an important role in cancer development and their inhibition mitigates carcinogenesis. Particular importance is given to breast and prostate cancer as both epigallocatechin-3-gallate (EGCG) and genistein were found to be efficacious in their mitigation by acting as inhibitors of HDACs.

Objectives: To use the crystallographic co-ordinates of known histone deacetylase inhibitors as a template and use ligand and receptor based drug design to enable molecular growth leading to the creation of novel structures that antagonise the HDAC receptor.

Design: The Protein Data Bank deposition 4QA[1] describing M344 bound to HDAC8 was chosen as a template for this study. Both genistein and EGCG were docked into the apo form of HDAC8. Conformational analysis was performed and the best conformer of each was selected. Critical interactions of conformers with HDAC8 were noted and the unsatisfied moieties were modified. Seed structures were generated, docked into the ligand binding pocket and novel structures were created through a *de novo* drug design approach. Virtual screening was used to obtain molecules with similar shape and electrostatic compositions to both EGCG and genistein. A protomol was generated and these molecules were docked and ranked on the basis of their affinity.

Setting: Department of Pharmacy, University of Malta

Main Outcome Measures: *de novo* drug design and virtual screening.

Results: A cohort of molecules were obtained from genistein and EGCG via the *de novo* design approach and the virtual screening approach. These were compared and ranked according to their affinity to the target.

Conclusion: EGCG and genistein were confirmed to be suitable leads in developing novel molecules able to antagonise HDAC8. Optimal molecules will be studied further.

Reference:

1. Decroos C, Bowman CM, Moser JA, Christianson KE, Deardorff MA, Christianson DW. Compromised Structure and Function of HDAC8 Mutants Identified in Cornelia de Lange Syndrome Spectrum Disorders. ACS Chemical Biology 2014; 9:2157-64.

M.Sc. Pharmacy
Dissertation Descriptions

Accurate and Efficient Pharmaceutical Service Delivery through the Pharmacy of Your Choice Scheme

Steven James Schiavone

Analytical Considerations in Testing Genetic Polymorphisms of Clinical Relevance

Celine Psaila

Determination of Amitriptyline and its Metabolites from Blood

Noeleene Mangion

Regulatory Science and Medicinal Cannabis

Lara Sciberras

Comparing EMA and FDA GMP Requirements for the Production of Pharmaceuticals

Mandy Muscat

Impact of Medicinal Products Identifier on the Wholesale Distribution of Medicines

Cristina Miceli

Aseptic Preparation of Medicines in the Hospital Pharmacy

Stephanie Wonnacott

Accurate and Efficient Pharmaceutical Service Delivery through the Pharmacy of Your Choice Scheme
Steven James Schiavone

The aim of the study is to compare variances between blood glucose readings from equipment available on the private market and within the public health service in order to establish whether patients understand such variances. Results from three blood glucose machines available on the market are compared with the hospital's laboratory results. Awareness of the use of such equipment and related variances is assessed by recruiting 30 patients from across Malta.

Analytical Considerations in Testing Genetic Polymorphisms of Clinical Relevance
Celine Psaila

Genetic polymorphisms influence the function of cytochrome P450 2D6 and 2C19 drug metabolism enzyme genes. CYP2D6 and CYP2C19 are involved in the metabolism of approximately 25% of prescription drugs. Variations in patient genotypes result in four potential phenotypes - poor, intermediate, extensive and ultra-rapid metabolisers - with consequent implications on clinical outcomes, particularly response and adverse events. The study aims to perform laboratory genetic testing for both genes in a cohort of recruited individuals.

Determination of Amitriptyline and its Metabolites from Blood
Noeleene Mangion

The main metabolites of amitriptyline are nortriptyline and the hydroxy-metabolites. In therapeutic drug monitoring studies, the hydroxy-metabolites are often overlooked, despite the possibility of possessing adverse effects. The optimal conditions for the extraction of the parent drug and relevant metabolites from blood samples of individuals taking amitriptyline are selected. An HPLC method of analysis for determination of amitriptyline and its metabolites in blood is developed and validated.

Regulatory Science and Medicinal Cannabis
Lara Sciberras

The regulatory science governing the production of cannabis products, their prescribing and dispensing are compared in different countries, including aspects in the cultivation of the cannabis plant. A number of cannabis products meant for medicinal use do not satisfy the requirements for obtaining a marketing authorisation. Other regulations to safeguard aspects of quality and safety such as requirements for GMP are evaluated.

Comparing EMA and FDA GMP Requirements for the Production of Pharmaceuticals
Mandy Muscat

Harmonisation between pharmaceutical regulators is important to ensure the provision of high quality medicinal products. The European Medicines Agency and the US Food and Drug Administration are two of the main regulatory bodies in the pharmaceutical industry. GMP guidelines provided by both agencies are compared to identify differences in requirements and to highlight any areas which may require harmonisation.

Impact of Medicinal Products Identifier on the Wholesale Distribution of Medicines
Cristina Miceli

The Falsified Medicines Directive (FMD) is an EU-wide legislative tool which is used to safeguard public health and involves the placing of safety features, for example, a unique identifier, supported by a 2-D barcode, and an anti-tampering device on the packaging of prescription medicines. This study will identify scenarios in the wholesale of medicinal products related to the FMD using an internationally-based pharmaceutical company as an example. An impact assessment of the FMD on wholesale medicine distribution and accessibility is carried out.

Aseptic Preparation of Medicines in the Hospital Pharmacy
Stephanie Wonnacott

Current aseptic preparation of medicines at Mater Dei Hospital (MDH) pharmacy is limited to hazardous medicines. Parenteral drugs reconstituted at the patient's bedside pose a number of risks to patient safety. This study will investigate the possibility of implementing a centralised aseptic service at MDH pharmacy.

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

Falsified Medicines through Online Purchase
Luca Arrigo

Risks of Using Returned Medicines
Jonathan Joseph Attard

Structure Activity Relationships of Drugs of Abuse
Kersty Axisa

Use of Pesticides
Pauline Falzon

Ethics for Pharmaceutical Technologists
Christian Francalanza

Qualitative and Quantitative Analytical Methods for Drugs of Abuse
Julia Mifsud

The Pharmaceutical Technologist in the Government Pharmaceutical Services
Mark Spiteri

Drug Stability
Shanice Marie Spiteri

Pharmaceutical Technology and Regulatory Affairs
Melanie Xerri

Falsified Medicines through Online Purchase
Luca Arrigo

Falsified medicines emerge on the market despite having a secure, legal supply chain. The project aims are to evaluate ways how internet technology protects against purchases of falsified medicines identifies breaches in supply chains and aids recall processes. The methodology consists of examining existing legislation, contacting stakeholders and is supported by case studies and real life implementations.

Risks of Using Returned Medicines
Jonathan Joseph Attard

In Europe, including Malta, medicines returned to a pharmacy are disposed of. Health authorities cannot re-dispense returned medicines as their storage conditions are not known. The aim of this project is to assess the risks, in terms of quality and safety, of using returned medicines. The risk assessment exercise is undertaken by identification, analysis and evaluation of risks through structured interviews and a brainstorming session with various healthcare professionals.

Structure Activity Relationships of Drugs of Abuse
Kersty Axisa

The introduction of novel psychoactive substances (NPS) increased the strain on public health due to the unpredictable toxicity associated with synthetic drugs. This project focuses on Structure Activity Relationships (SAR) of traditional drugs of abuse and compares them to the SAR of synthetic variants. Analyses of the structural modifications in the analogues are conducted to understand and account for changes in the physiological effects and toxicity of NPS.

Use of Pesticides
Pauline Falzon

The validation of a multi-residue method is carried out in an ISO 17025 accredited laboratory which is intended for the routine analysis of pesticide residues in local agricultural crops to check for compliance with EU legislation on maximum residue levels, and to evaluate food safety and potential risks. The procedure employs the QuEChERS method for sample preparation, combined with triple-stage quadrupole GC-MS for the analyses and detection of pesticides.

Ethics for Pharmaceutical Technologists
Christian Francalanza

Since pharmaceutical technology is a relatively new profession in Malta, a Code of Ethics is still absent in the Maltese legislation. The project aims to create a framework for a Code of Ethics specifically intended for pharmaceutical technologists. The primary sources of information used to achieve this goal included Codes of Ethics for pharmacists and medical doctors in the Maltese legislation.

Qualitative and Quantitative Analytical Methods for Drugs of Abuse
Julia Mifsud

Synthetic drugs are man-made substances that mimic the effect of legally controlled drugs, such as amphetamines and cannabis. Following the proliferation in abuse, several qualitative and quantitative analytical methods have been developed to identify and quantify synthetic cannabinoids and cathinones. The project reviews the various assays currently available to detect, identify and quantify these chemical classes even at low concentrations. A critical assessment of published methods is disseminated to assist local authorities in the selection of methods appropriate for the local scenario.

The Pharmaceutical Technologist in the Government Pharmaceutical Services
Mark Spiteri

An exploratory study was conducted to define the role of pharmaceutical technologists within a general acute hospital setting. The perceptions and attitudes of pharmacists and pharmacy technology graduates towards the role of pharmaceutical technologists in various areas within the Department of Pharmacy at Mater Dei Hospital (MDH) are investigated. The project will investigate whether the skills and knowledge of pharmaceutical technologists acquired from the pharmaceutical technology course fits the needs of MDH Pharmacy.

Drug Stability
Shanice Marie Spiteri

Conditions in which medicinal products are stored have an effect on the stability of the active pharmaceutical ingredient (API) and as a result, its shelf life. A questionnaire intended for the general public is developed which aims to evaluate the conditions under which medications are stored when they leave the controlled environment of the pharmacy. An analytical method using high performance liquid chromatography is developed to compare expired to non-expired samples of glibenclamide tablets to determine whether the amount of the API is within the acceptable limits.

Pharmaceutical Technology and Regulatory Affairs
Melanie Xerri

The aim of the project is to explore and analyse the role of the pharmaceutical technologist within the local context of regulatory affairs. Various techniques are used to gather information pertinent to the research, including semi-structured interviews and questionnaires to various individuals that work within relevant entities. Recommendations are analysed in the light of new job creation within the pharmaceutical technology sector.

B.Sc.(Hons) Pharm. Sci. Fourth Year Students

Project Descriptions

Pharmacist Services in Community Pharmacies
Rand Abdulrahman

The perceptions of pharmacists and the public on extended pharmacy services were evaluated by self-administered questionnaires. A time and motion study was carried out in five community pharmacies each in a different district. Results show that 10 out of 25 pharmacists do not work after-hours. Out of these 10 pharmacists, 8 are willing to work extended hours. Results from the time-motion study show that the highest average time spent after-hours in all districts was dispensing of prescription medicines (mean value = 22.99 minutes) followed by dispensing of non-prescription medicines (mean value = 12.41 minutes).

Economic Impact of POYC Out-of-Stock Medication
Charlene Bartolo

A questionnaire to investigate the out-of-stock (OOS) situation in the POYC scheme was developed and disseminated to 200 patients. In a span of 6 months (January to June 2017), 13% (n=26) of patients encountered an OOS medication. Patients reported 26 medications to be OOS. These were: aspirin (2), atorvastatin (2), blood glucose strips (1), budesonide inhaler (4), emollient cream (2), enalapril (3), simvastatin (4) and warfarin (2). The other 6 medications were unspecified. The retail cost of the specified medications is €250. Patients admitted of hoarding their medication with the main reason (46%, n=92) being to have a supply in case of an OOS.

Dosage Forms and Medicine Acceptability
Maria Bartolo

The aim of this study was to assess preferences of dosage forms in the general population by adapting the Medication Delivery Route Preferences questionnaire being developed by UCL, London. Two hundred and seventy-six questionnaires were collected and analysed to compare mean rating scores provided for 'discomfort', 'efficacy', 'speed of action' and 'acceptability' for a dosage form between independent groups. Mean rating scores provided for acceptability when medicine is swallowed are significantly higher for females (8.76) when compared to males (8.38). For discomfort, efficacy and speed of action there is no gender bias.

Rational Design of Structures Capable of Modulating Liver X Receptors for the Management of Pancreatic Cancer using the Agonist GW3965 Scaffold as a Lead Molecule
Nicole Bonello

Liver X receptors (LXRs) are expressed in many cancer types and their agonism has been associated with decreased tumour cell proliferation. Two lead agonist molecules, GW 3965 and 4-(3- Aryloxyaryl)quinoline sulfone were selected. Their bound co-ordinates were identified on the Protein Data Bank (pdb) and used to generate Ligand Binding Pocket (LBP) maps. This space was used to dock fragments deriving from the two lead molecules and molecular growth allowed. The optimal Lipinski Rule compliant novel structures were identified for further validation.

Professional Development Programmes for Pharmacists
Catherine Anne Busuttil

Frameworks for Continuing Professional Development (CPD) for pharmacists in various countries were analysed and compared, alongside the current local scenario. A questionnaire was developed for students who have completed a handbook directed towards their preparation in embracing CPD alongside the working experience carried out within a chosen pharmaceutical sector, during their fourth year of studies. The questionnaire dealt with students' understanding of CPD and what importance they give to this learning experience with respect to their validation as pharmaceutical professionals.

Formulary for Non-BNF Cited Products
Renita Busuttil

The Maltese Medicines Handbook (MMH) is a compilation containing medicinal products available on the local market but not listed in the BNF (British National Formulary). Although the MMH has reached its 5th revision, its use is not very popular among healthcare practitioners as its validity goes out of date easily. The project has been directed to stir away from the traditional updating procedure and to search for ways and means on how the MMH can be kept alive and up-to-date.

Forensic Pharmacy: Drugs and Driving
Abigail Calleja

There is lack of awareness among the general public about the potential impairing effects on driving caused by certain legal drugs. Regulations implemented in other countries were examined and compared with Malta's legislation. Questionnaires were developed, validated by a panel, which consisted of five people, and disseminated to the public. Two hundred and forty-seven participants answered the questionnaire and 70% (n=172) strongly agreed that healthcare professionals should inform them about important side effects. A number of participants (19.1%, n=47) were unaware that some medicines may cause dizziness, drowsiness and sedation.

Health Economic Study on the Use of Warfarin
Grazielle Camilleri

The perceptions of doctors, patients and pharmacists on the treatment of Novel Oral Anticoagulants (NOACs) are evaluated. Fifty patients who are on warfarin, indicated for non-valvular atrial fibrillation for at least six months, were recruited from five community pharmacies. The availability, advantages and disadvantages of NOACs were discussed. Validated questionnaires were developed to assess willingness of doctors to prescribe NOACs, willingness of patients to pay for the products and how much, and whether pharmacists recommend use of NOACs.

Design of Novel Protein Kinase Inhibitors Using the Naturally Occurring Isojacareubin Scaffold as a Lead
Jeanelle Caruana

Protein Kinase C (PKc) is a target for the design of anti-cancer agents because its over-expression drives tumour growth. This study used isojacareubin (ISJ), a naturally occurring PKc inhibitor, as a lead scaffold for the *de novo* design of high efficiency PKc modulators. Specifically, conformational analysis determined the optimal bound ISJ scaffold and its critical interactions within the PKc Ligand Binding Pocket (LBP). This data was used for seed fragment modelling. Seed growth within the PKc_LBP yielded novel high affinity Lipinski Rule compliant structures which require further validation.

Chronopharmacology in Disease Management
Onyinyechi Chesa

The study aims to understand patient and healthcare professionals' knowledge of chronopharmacology in disease management. Time to Take Medicine Questionnaire for patients and Chronopharmacology Questionnaire for doctors and pharmacists were designed and validated, and a pilot study undertaken. All 20 patients interviewed thought medicines should be taken at the time they work best. All 10 doctors and pharmacists thought simvastatin taken in the evening is most effective. No healthcare professional or patient on statin knew when endogenous cholesterol synthesis is highest.

Forensic Pharmacy: Drug Testing
Michaela Cini

Methods for the identification and quantification of drugs using Gas Chromatography-Mass Spectrometry were developed. These were validated for Heroin, Cocaine and 3,4-Methylenedioxymetamphetamine (3,4-MDMA) and gave the following results respectively: linearity (0.996, 0.998, 0.998), stability (6, 36, 36 hours at room temperature), precision (14.488, 9.257, 13.550), accuracy (2.445, -5.361, 1.346), carry-over (none), limit of quantification (12.5%, 1%, 1%) and limit of detection (all 1%).

Design of Novel Structures Capable of Modulating the Steroid Receptor Co-activator for the Management of Neoplastic Disease
Ruth Fiorentino

This project derives from data that indicates that paradoxical agonism of the Steroid Receptor Co-activator (SRC) normally associated with cancer progression actually has a mitigating effect on tumour growth. The implicated small agonist molecule MCB-613 was used as a lead, docked into the SRC ligand binding pocket and conformational analysis performed. The optimal conformer was identified, and its critical interactions with the SRC used in seed fragment modelling and *de novo* ligand growth. The optimal structures will be further validated through molecular dynamic studies and *in vitro* assays.

Seamless Pharmaceutical Care in Rheumatoid Disease Management
Francesca Galea

The 'Rheumatology Transitional Care Letter' was developed and validated through a focus group. The letter highlights changes in medications of the patient and contains basic patient details, current medications and changes in the medications, co-morbidities and additional notes by healthcare professionals aimed at achieving seamless care between the hospital and the community setting. Patients and pharmacists will have a better understanding of the patient's current medication. Feedback from the community pharmacists is sought.

3D Printing and Pharmaceutical Dosage Forms
Christopher Johnson

A tablet containing 10 mg of amitriptyline for individual dosing is designed using a printing filament. The 3D modelling software Autodesk Fusion 360® is used to design the tablet. The 3D model is imported into a slicing software to select printing parameters namely scale, infill and printing temperature. Passive diffusion is used to load the drug onto the printing filament. An Ultimaker 2+ 3D printer is used to produce the tablets.

Design of Novel Protein Kinase Inhibitors Using the Naturally Occurring Staurosporine Scaffold as a Lead
Elena Maria Mallia

Protein Kinase C (PKc) inhibitors have anti-cancer activity. Staurosporine, a PKc inhibitor, was used as a lead for the design of novel PKc modulators. The holo staurosporine:PKc complex was modelled in Sybyl® and baseline affinity determined. Two-dimensional topology maps highlighting the critical intra-complex interactions were generated in PoseView® and used to model seed fragments which were planted into a Ligand Binding Pocket map generated in LigBuilder®, and allowed growth within this pharmacophoric space. The optimal generated Lipinski Rule complaint molecules were identified for further optimisation.

Targeting the Kappa Opioid Receptor in the Treatment of Addiction
Maria Mangion

The Kappa Opioid Receptor (KOR) is associated with endogenous addiction control. KOR agonists increase receptor activity and consequently have therapeutic potential in its management. Conformational analysis identified the best pose of Salvinorin A, a non-alkaloid hallucinogen found in *Salvia divinorum* within the KOR ligand-binding pocket. The ligand JDTic, co-crystallised with KOR in pdb ID 4DJH and the optimal Salvinorin A conformer were used to generate an average pharmacophore, which was used as a query for virtual screening. The resultant hits will be used for optimisation in *de novo* design.

Pharmacist Prescribing and Point-of-Care Testing
Tricia Micallef

Pharmacist prescribing (PP) has been successfully implemented in various countries. A questionnaire, focused on the opinion of the local introduction of PP, reliability and availability of point-of- care testing in pharmacies and validation of the frameworks developed regarding antidiabetic and antihypertensive treatment selection, was disseminated in all community pharmacies and to 250 physicians in the six regions of Malta. Following statistical analysis of the data collected, suggested changes are to be made to the frameworks and a focus group set up in order to discuss the updates.

Rational Design of Novel Androgen Receptor Inhibitors Using the Experimental Small Androgen Receptor Modulators (S)-11 and (R)-9, and R-bicalutamide Scaffolds as Lead Molecules
Simona Svetlozarova Neykova

Prostate cancer chemotherapy is of limited utility due to resistance. Experimental molecules (R)-9 and (S)-11 were used as leads to identify high affinity Androgen Receptor (AR) modulators. A consensus pharmacophore was modelled in LigandScout® using R-bicalutamide, (ref. pdb ID 1Z95), and (R)-9 and (S)-11. This was used to virtually screen the molecular database ZINCPharmer®. A protomol, or idealised ligand binding pocket was modelled, and the resulting Lipinski Rule compliant hits were docked into the protomol for affinity calculation. The optimal structures will be investigated further.

Targeting the BCL-2 Receptor in the Management of Leukaemia and Other Solid Tumours
Yvonne Savona Ventura

Evidence from literature is indicative of the pro-apoptotic activity of navitoclax and venetoclax through cell lymphoma 2 (BCL-2) receptor inhibition. These molecules were recruited as lead molecules for this study. Navitoclax was co-crystallised with BCL-2, and the optimal venetoclax scaffold was modelled and identified through conformational analysis. These small molecules were submitted as queries to the ZINCPharmer database for analog identification based on 3D and electronic similarity. They were docked into a modelled protomol, and the optimal molecules proposed for futher optimisation.

Point-of-Care Haemoglobin Measurement
Martina Scicluna

Sensitivity, specificity and reliability testing of two test kits (DiaSpect Tm and Stat-Site M Hgb) was undertaken and compared to standard lab testing. Testing was implemented in two Health Centres on 20 diabetes patients, 20 chronic kidney disease patients and 20 adults with no co-morbidities who acted as the control group. DiaSpect Tm gave accurate results in 40 out of 60 patients tested. Stat-Site M gave accurate results in 10 out of 60 patients tested. Fifty-eight out of 60 patients think that this test should be offered within a community pharmacy. Feasibility of providing this service within a community pharmacy is studied.

Rational Design of Partial Peroxisome Proliferator Activated Receptor-γ Agonists Using the Synthetic Analog of Tetrahydrocannabinol Ajulemic Acid Scaffold as Lead Molecule
Kirby Zammit

The peroxisome proliferator activated receptor-γ (PPAR) is a target for the management of diabetes and inflammatory disease. PPAR agonism is associated with unacceptable adverse events. This study utilised AJA to identify novel PPAR modulators with potential partial agonist activity. A virtual screening (VS) approach was adopted. The bioactive AJA conformer was designated as query molecule at the ZincPharmer® database. A protomol was modeled and the Lipinski rule complaint hits were docked into it and ranked in order of affinity. The optimal structures consequently identified will be further validated through molecular dynamics.

Medicine Reconciliation at Discharge
Thomas Zammit

The project investigated discharge processes at local hospitals. Observational visits to Mater Dei Hospital and Karin Grech Rehabilitation Hospital (KGRH) were carried out. Patient discharge forms and procedures were compared for the two settings and recommendations proposed. After taking note of 60 patients' drug histories and current medications, patients underwent medicine reconciliation by medical staff and were then interviewed. Twenty-nine out of thirty KGRH patients stated that they were aware of alterations in medication between admission and discharge from hospital.

Pharmacist-Led Management of Insulin Therapy
Jessica Zarb

Diabetes is a chronic illness associated with long term dysfunction and deterioration of different organs. The feasibility of a framework for the implementation of pharmacist-led management of insulin therapy is studied by identifying patient care issues and tackling them together with the prescriber to establish better diabetes management. Impact of pharmacist intervention is studied by monitoring management of blood glucose and HbA1c.

B.Sc.(Hons) Pharm. Sci. Third Year Students

Project Descriptions

Rational Design of Novel Acid Ceramidase Inhibitors
Gabriel Abela

Carmofur was used as a lead molecule in this study. It was docked into the acid ceramidase ligand binding pocket. Conformational analysis was performed and the optimal conformer was identified. The critical interactions will be used to guide *de novo* analog design and virtual library screening will facilitate identification of novel antagonists with potential for development in melanoma treatment.

Rational Design of Novel μ-opioid Antagonists based on the PZM21 Scaffold
Stephanie Attard

The novel PZM21 scaffold was modelled and docked into the μ-opioid receptor (MOR). After conformational analysis, its critical interactions with the ligand binding pocket were identified and will be used in the *de novo* design and identification, through virtual screening, of novel MOR modulators of acceptable bioavailability with the potential of providing opioid level analgesia without the typical concomitant side-effects.

Pharmacist-recommended Medicines for Paediatric Patients
Chiara Baldacchino

Scenario analysis of pharmacist-recommended medications available on the market for paediatric patients was undertaken. A statistical model to capture safety and efficacy of these products is developed. Safety is based on the side-effect profile, contra-indications and cautions. The pharmacokinetic and pharmacodynamic profiles are used to assess efficacy.

Rational Design of Glutathione-S-Transferase Pi1 (GSTP1) Antagonists based on the Novel LAS17 Scaffold
Gabriel Borg

The LAS17 molecule was docked into the GSTP1 receptor and conformational analysis was performed. Critical interactions driving antagonism were highlighted and used to identify, through virtual screening and *de novo* design, molecules with acceptable bioavailability and low toxicity, suitable for development into clinically useful molecules for the potential treatment of triple negative breast cancer.

Rational Design of Proto-Oncogene Tyrosine-Protein Kinase SRC Antagonists based on the Novel ECF506 Scaffold
Lara Marie Busuttil

The ECF506 molecule was modeled, docked into the tyrosine kinase SRC receptor and conformational analysis was performed. The optimal conformer was selected and its interactions with the target identified. This conformer will be used in virtual screening and its interactions used in a *de novo* approach to create an analog series of molecules, with the potential to treat triple negative breast cancer.

Rational Design of Dual PPARγ/α Agonists based on the Novel SR10171 Scaffold
Justin Cassar

The PPARγ/α agonist SR10171 was modelled and its interactions with both receptor subtypes were identified. The interactions common to both receptor subtypes were used to create a consensus pharmacophore, on the basis of which novel dual agonists will be designed *de novo* and identified through virtual screening. These molecules have potential use in the simultaneous management of type 2 diabetes and osteoporosis.

Use of Antibacterial Drugs in the Intensive Care Unit
Julia Catania

Use of antibacterial drugs in the local intensive care unit is being reviewed. A retrospective study for the past 10 years is conducted and compared to presently compiled data. The ATC/DDD methodology as designated by the World Health Organisation is applied in this study. Data is analysed to observe trends in resistance and costings.

Rational Design of Novel Structures based on the Leiodermatolide Scaffold capable of Tubulin Inhibition
Graziella Chetcuti

The leiodermatolide molecule was modelled. Three binding sites on tubulin were identified and probed. The best conformer of leiodermatolide at the optimal binding site was selected. This conformer and its critical interactions will be used in virtual screening and *de novo* design respectively, for the identification of potentially useful tubulin antagonists suitable for the management of pancreatic cancer.

Rational Design of Novel Histone Deacetylase inhibitors based on the AR-42 Scaffold
David Gatt

Experimental molecule AR-42 was modelled and docked into the histone deacetylase (HDAC) receptor. Conformational analysis was performed and the optimal AR-42 conformation was used as a lead in the *de novo* design of novel molecules and in the virtual identification of analogs with predicted useful bioavailability and low toxicity. These molecules may be candidates to treat cachexia in cancer patients.

Use of the UM-164 Scaffold to Design Tyrosine-Protein Kinase SRC Inhibitors
Thomas Sammut

The experimental molecule UM-164 was modeled and docked into the SRC receptor, a driver of triple negative breast cancer. Conformational analysis was performed and critical interactions made by the optimal UM-164 conformer and the SRC receptor will be used in the *de novo* design and identification, through virtual screening, of SRC antagonists with potential clinical utility in the management of this condition.

Repurposing Fluphenamic Acid and Glibenclamide for the Design of AKR1C1 Receptor Inhibitors
Matthew Scicluna

In this repurposing study, fluphenamic acid and glibenclamide were successively docked into the AKR1C1 receptor. Conformational analysis was performed, the optimal conformations were selected and will be submitted as queries to virtual libraries, and to design *de novo* molecules, with the potential to be further developed to treat bladder cancer.

Rare Diseases and Orphan Medicines
Sharon Vassallo

The definition of rare diseases is revised, validated by a focus group and disseminated internationally. Early Access Programmes for orphan drugs are evaluated. The existing register for rare diseases and the established treatment protocol for Malta are updated and validated. An information booklet is developed, validated and disseminated to increase public awareness and to promote the use of the register.

Determination of Orthoesterification Mechanisms in Drug Synthesis
Maria Xiberras

Steroid orthoesterification is carried out under controlled conditions using dehydrated and non-dehydrated tetrahydrofuran (THF) as the solvent. The isolated products are analysed using high-performance liquid chromatography with a UV detector and compared. The effect of using dehydrated THF on the reaction products is investigated. A reaction mechanism as influenced by using a dehydrated solvent is proposed.

Use of Newer Generation Statins in Cardiovascular Disease
Maia Zarb

This study questions risks and benefits of therapy with older generation statins and evaluates treatment with newer generation statins. Patients diagnosed with ischaemic heart disease are recruited from the Cardiology Department at Mater Dei Hospital (MDH) and advantageous outcomes with the use of newer generation statins are assessed. This prospective approach challenges current statin protocols at MDH.

B.Sc.(Hons) Pharm. Sci. Second Year Students

Project Descriptions

Repurposing the Methotrexate Scaffold to Design novel Janus Kinase Inhibitors
Francesca Borg

Human studies show methotrexate to be a Janus Kinase (JAK) suppressor and that it could be repurposed for the treatment of myeloproliferative neoplasms. This study will use its scaffold in the design of high efficiency analogues with potential clinical utility.

Design of Novel CU-CPT8M Analogs to Modulate the Toll-Like Receptor 8 Dimer
Claire Bugeja

Toll-like receptors (TLRs) are targets for autoimmune disease. CU-CPT8M, the first selective inhibitor for TLR8, reported in 2017, binds to the receptor in an unexpected way. This study uses CU-CPT8M to design analogs capable of superior TLR8 modulation.

Repurposing the Anthelmintic Drug Niclosamide for the Rational Design of pten-induced Putative Kinase 1 Agonists
Abigail Buttigieg

PTEN-induced putative kinase 1 (PINK1) mutations trigger Parkinson's disease. The anthelmintic niclosamide, a PINK1 agonist, reverses parkinsonian symptoms in animal models. This study uses repurposed niclosamide to design high efficiency PINK1 modulators.

Cultivation of Cannabis
Miriana Cachia

Medical cannabis (MC) is researched through processes of good manufacturing practice and quality control in relation to conditions of cultivation as it relates to different MC species. Regulations and laws related to the cultivation of MC in different countries are compared.

Outcomes of Pharmacist-Led Medication Use Review for Patients with Respiratory Disease
Christy Caruana

Co-ordination of care for respiratory disease is evaluated by analysing the impact of pharmacist-led medication review in patients diagnosed with respiratory disease. A review of medication for respiratory disease and other medications is undertaken.

Risk with Use of Medical Cannabis
Michael Cini

A risk assessment and a questionnaire on cannabis for medicinal use is carried out through two focus groups (health professionals and cannabis users) ranking views, experience, occurrence and severity. A Consensus National Conference is planned and the proceedings disseminated.

Identification of Potential Endogenous Targets for Maltanedienol
Ella Coppini

Maltanedienol mediates *in vivo* calcium deposition through a hitherto unidentified target. This study will adopt a bioinformatics approach to identify this target and to subsequently utilise this in the design of analogs with similar biological activity.

Rational Design of Phosphoinositide 3-Kinase Modulators
Hannah Coppini

Chordoma is a spinal tumour classified as a rare disease. Phosphoinositide 3-kinase (PI3K) inhibition has been shown to mitigate its proliferation. This study uses the quinazoline scaffold to design P13K modulators which can be optimised for clinical use.

Pharmaceutical Care for Stem Cell Transplant Patients
Krysta Cutajar

A stem cell pharmaceutical care service is implemented at Sir Anthony Mamo Oncology Centre. Pharmaceutical care issues within a multidisciplinary team are identified to optimise safe and effective care. The service considers medicine access and patient concordance.

The Unique Identifier on Drug Products
Mireille Debono

The impact of the unique identifier on accessibility, distribution and dispensing of medicines in Malta is analysed. Focus groups, interviews and a strengths, weaknesses, opportunities and threats analysis with stakeholders are used to predict problems that may be associated with the directive on the unique identifier.

Pharmaceutical Interventions During Labour
Rebecca Marie Falzon

Pharmaceutical interventions during labour are investigated. Medications currently used during labour such as oxytocin are analysed. An action plan to identify any weaknesses with the use of such medications and their processes is put forward and evaluated.

Pharmaceutical Care in Paediatric Oncology
Sarah Marie Falzon

The use of drugs used in combination with cytotoxic chemotherapy in paediatric oncology is evaluated. Gap analysis of the local practice against national and international clinical guidelines and protocols is undertaken.

Pharmaceutical Care Interventions in Obstetrics and Gynaecology
Naomi Fiteni

The aims are to identify medications used in obstetrics and gynaecology, to perform an audit for medication use and verify whether there is adherence to protocols, and to assess the impact of a pharmacist-led action plan on education, recommendations and updating of guidelines.

Design of BRD9 receptor antagonists based on the BI-7273 scaffold
Paula Gambin

BRD9 is a new target for drug design to treat acute myeloid leukaemia. A lead molecule BI-7273, has been identified by Boehringer Ingelheim and is used as a scaffold in this study to design novel structures capable of superior modulation of this target.

Design of Androgen Receptor Inhibitors using the naturally occurring Capsaicin Scaffold as a Lead Molecule
Johan Grech

Capsaicin has an apoptotic effect on prostate cancer cell lines. This study aims to design and identify novel structures based on the capsaicin scaffold, capable of androgen receptor modulation with potential for use in prostate cancer management strategies.

Design of BU10119 Analogs for the Management of SSRI Refractory Depression
Matthew Grech

K opioid (k) receptor blockade is associated with anti-depressant effects. This study uses BU10119, a dual k/μ (mu) antagonist as a lead for the design of analogs with potential refractory depression treatment.

Risk-based Processes in Pharmacy Practice
Emily Magro

Risks in pharmaceutical processes related to community pharmacy practice leading to accessibility problems and medication errors are evaluated through interviews, focus groups, questionnaires and observation. Brainstorming sessions for pharmacists and patients are organised.

Evaluation of Anaesthetic drugs in the Intensive Therapy Unit
Julia Micallef

Current drugs used in the Intensive Therapy Unit in terms of drug safety, adherence to protocols and delivery of the drug are established. A status review of these drugs followed by recommendations for possible introduction of new drugs or technologies in protocols is undertaken.

Outcomes of Pharmacist-Led Medication Use Review for Diabetics
Mathea Montebello

The impact of pharmacists in medication use review for diabetic patients is assessed. This study is undertaken by monitoring blood glucose levels and collecting data using a holistic approach towards medication use in Type 1 and Type 2 diabetics.

Smoking Cessation in Post Hospitalisation Rehabilitation
Gabrielle Scicluna

Nicotine, a psychoactive parasympathomimetic drug in tobacco, causes addiction and physical dependence. The aim is to assess the impact of pharmacists in smoking cessation interventions for hospitalised patients to prevent relapse post-discharge.

Design of 6-Phosphogluconate Dehydrogenase Inhibitors Using Parietin, and its Semi-Synthetic Derivative S3 Scaffolds as Lead Molecules
Daniel Sinagra

Parietin, expressed in a pigment present in rhubarb, selectively suppresses 6-phospogluconate dehydrogenase (6PGD), an important metabolic mediator of cancer cell proliferation. This study aims to design novel 6PGD modulators with potential for clinical use.

Simplification of the Experimental Molecule FR900359
Brandon Sultana

The extract of the plant *Ardisia crenata*, compound FR900359, through G-protein inhibition, has potent airway constriction inhibitory capability. It will be used in the drug design of analogs with potential for optimisation into a new class of bronchodilators.

Patient Education and Medication Compliance in Osteoporosis
Michaela Vella

Patient awareness and medication compliance regarding osteoporosis management and monitoring in post-menopausal women are reviewed. Questionnaires are distributed to evaluate patients' perception about the condition, medications and compliance.

Rational Design of Glutaminase c Modulators
Lara Zammit

Experimental drug CB-839 mitigates lung tumours by truncating essential glutamate through Glutaminase C (Gc) inhibition. Its scaffold is used as a template for the design of Gc modulators which could be further optimised into clinically useful agents.

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