L-Università ta' Malta
Faculty of
Medicine & Surgery

Department
of Pharmacy

Dissertation Abstracts and Project Descriptions

2022

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L-Università ta' Malta
Faculty of
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FOREWORD

Fundamentals and Paradigm Shifts in Pharmacy Education: Fit for the Future

Professor Anthony Serracino-Inglott
Pharmacy Practice Projects Co-ordinator

This year's Symposium is taking place in the shadows of a pandemic that posed a number of challenges and yet lessons we learnt that taught us the constant relevance of the fundamentals of the pharmaceutical sciences. We also witnessed a paradigm shift in solutions to meet people's healthcare needs. While the practical aspects of vaccine development placed Vaccinology as the focus of pharmaceutical activity making us again realise that vaccines are perhaps the greatest advancement of modern medicine, the social aspects related to anti-vaxxers, the reflections on the rights for choice, pharmacovigilance and safety all came to the fore. The basic biology of pDNA and mRNA vaccines and the latest advancements in the evolvement of the CRISPR science led us to revisit the educational curricula. Professional leadership in times of change and when the cheating of time has become a necessity presented to be real day-to-day attributes.

The biological clocks, whether related to chronopharmacology or pharmacogenetics, the fires of life or the relations between science, sex and ageing, all led to top the agenda for pharmaceutical investigations. Medical professionals and pharmaceutical scientists came together to address the conflicts and quandaries arising as inter- and intra-related between scenarios and professional competences mingled with a dose of ethics and morals. People always opposed actions that were grossly reckless, irresponsible, immoral or illegal. Yet, the flourishing ethics committees and statutory establishments point out in our research ventures the need for considering the implications of research activities very carefully before we proceed with our research, and these considerations include such delicate areas as genetics and data protection. Pharmaceutical evolvements which are being tackled by our avant-garde Department of Pharmacy are including present day considerations such as The Internet of Medical Things, including medical devices, role of big data, point-of-care services, e-healthcare applications, wearable devices, medical use of cannabis, risk management, computational pharmaceutical chemistry, prescribing skills, collaborative professional care, anticoagulation therapies and aspects that make the pharmacist and the pharmaceutical technologist fit for the future. Regulatory sciences have evolved in Malta in parallel with the pharmaceutical industry especially as related to the state-of-the-art pharmaceutical products batch release industry, keeping in mind the swift need created by the exigencies following Brexit.

The financial revolution, the mainstream drive towards creativity and innovation, the relevance of aesthetics, mastering meeting patients' modern needs and the commitment to growth, keeping the patient in the focus of our activities, placed our dynamic department as an emerging factor in what is to be the Pharmacy 5.0 in the international scenario. Graduates from our department, proudly forming part of the Faculty of Medicine and Surgery, are sound on the mission of promoting research in health care delivery and improving access to the right therapies through collaboration with other professionals.

The presentations in this Symposium serve as evidence base of our students' efforts in solving the health care puzzle, even if perhaps through radical disruptive forces, always to the benefit of our people.

PROFESSOR ANTHONY SERRACINO-INGLOTT
Pharmacy Practice Projects Co-ordinator

INTRODUCTION

Pharmaceutical Development Goals

Professor Lilian M. Azzopardi
Head, Department of Pharmacy

The 2030 Agenda for Sustainable Development adopted in 2015 by the United Nations (UN), spearheads global partnership to support peace and prosperity for society and the planet. To achieve the UN Sustainable Development Goals, actions are required to improve health and education, reduce inequality, spur economic growth and tackle climate change. Higher education institutions have a direct contribution towards the Development Goals through inclusive, equitable quality education and lifelong learning opportunities. Indirect contributions of higher education institutions arise from empowering people and people-power capital, research initiatives and by disseminating the agenda and encouraging discussion.

From a pharmacy perspective, the International Pharmaceutical Federation (FIP) launched the FIP Development Goals in 2016, to sustain the UN Sustainable Development Goals (SDGs) and ensure alignment of the pharmaceutical workforce to the wider global actions.[1] In an attempt to develop a systematic approach, three FIP Development Goals were identified as priority areas for pharmaceutical education for the European Region during an international exercise completed last December. The three priority areas identified were Policy Development, Competency Development and Digital Health.

The mission of the Department of Pharmacy at the University of Malta is to provide education and research in areas of pharmacy and pharmaceutical technology at undergraduate and post-graduate level that is relevant to support innovation and transformation of the pharmaceutical sector. At the Department of Pharmacy, a learner-centred teaching approach with student engagement is nurtured and the focus is on patient-focused pharmacy and pharmaceutical technology education.

Within the Department, all students participate in projects which contribute to policy development in pharmaceutical settings including industry, regulatory, hospital and primary care. This exposure to practice projects empowers graduates with skills necessary to recognise social, economic and environmental implications of pharmaceutical processes. Research activities undertaken within the Department research groups address understanding and optimisation of conventional processes. Through the projects which are based on an implementation science research dimension, future needs and services developments are proposed to support policy development within the pharmaceutical ecosystem. The areas addressed include patient safety, medical devices and point-of-care testing, digitalised health, accreditation and quality management, waste generation and disposal in the pharmaceutical sector.

From a curricula perspective, patient-focused competences development is a characteristic of the five programmes offered by the Department. The Department is contributing to relevant pharmaceutical workforce capacity building by empowering persons with competences that safeguard patient safety, quality of medicines and medical devices in the context of building collaborative bridges with other healthcare professionals, scientists, key players and society. As an example of competency-driven curricula, this year, the Department has elaborated and formalised a practical programme to provide certified competence of vaccine handling and administration by pharmacists.

Over the past five years, through the Doctorate in Pharmacy programme offered in collaboration with the College of Pharmacy of the University of Illinois at Chicago, USA, 65 pharmacists from 14 countries have completed their professional doctorate studies. These alumni are now contributing to the advancement and transformation of pharmacy leading policy development, academic actions and innovations and patient safety initiatives locally and in different parts of the world.

The partnerships approach embraced within the Department of Pharmacy with students, colleagues and other professionals, stakeholders and society creates a multiplier and powerful effect towards the vision to contribute to the achievement of the Pharmaceutical Development Goals on a local and international level. The Department of Pharmacy is a global player in pharmacy education and is used as an example of how education and research support improvements in health outcomes, contribute to equity and access to pharmaceutical services, and expose opportunities with technology.

PROFESSOR LILIAN M. AZZOPARDI

Head, Department of Pharmacy

Reference

1. International Pharmaceutical Federation. The FIP Development Goals: Transforming global pharmacy. 2020. The Netherlands.

Doctorate in Pharmacy

DISSERTATION ABSTRACTS

Doctorate in Pharmacy

DISSERTATION ABSTRACTS

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Patient-Centered Training for Pharmaceutical Distribution

May Florence Dela Cruz Bacayo

Background: The World Health Organization (WHO) advocates for a 'responsive' healthcare system that meets people's expectations. Patient-centeredness in healthcare delivery recognises that a patient's values and preferences must be central in the delivery of care. The Pharmacy of Your Choice (POYC) within the Ministry of Health is committed to delivering the highest quality pharmaceutical service in Malta whilst continually providing a patient-centered service.

Purposes: To address the training needs for pharmaceutical good distribution practice of Pharmacy of your Choice health workforce instilling an enhanced patient-centered approach.

Method: The methodology consists of 2 phases. Phase 1 tackles the needs assessment. A questionnaire aimed at assessing the core competencies of the services of the workforce was compiled, validated and disseminated to the POYC workforce. A focus group interview gathering feedback from stakeholders about the status of the POYC workforce services was conducted. The study findings from Phase 1 lead to Phase 2 which is the development and evaluation of a patient-centered training course on pharmaceutical good distribution practice (GDP).[1]

Results: A literature review about the research topic was carried out resulting in the development of a validated questionnaire that was disseminated to 26 POYC workforce. The literature review was also used in the interview with four POYC stakeholders to extract their views about the research topic. Study findings indicate that the highest training need focuses on Good Distribution Practices (Mean (M)=4, Std Dev=0.32). The second priority is Organization and Personnel (M=4, Std Dev=0.22) followed by Philosophy of Patient-Centered Care (M=4, Std Dev=0.16) where participants will be responsible in building more responsive patient care. Following discussions with stakeholders, it resulted that POYC integration had a good influence on the organization's ability to respond to patient requirements in a timely, effective, and efficient manner. An online self-paced course was developed for the POYC workforce.

Discussion: The appropriate training course on pharmaceutical good distribution practice was needed to meet the revised EU GDP guidelines and to ensure a patient-centered approach on the GDP process within POYC.

Reference:

1. Farrugia D, Cilia M, Serracino-Inglott A. Analysis of Good Distribution Practice Inspection Deficiency Data of Pharmaceutical Wholesalers in Malta. The Journal of Pharmaceutical and Biopharmaceutical Contract Services 2018;30-32.

Vitamin D Point-of-Care Testing

Catherine Anne Busuttil

Background: Increasing awareness of the importance of sufficient vitamin D levels has augmented the demand for vitamin D testing, unveiling a niche for development of vitamin D point-of-care testing (POCT).

Purpose: To establish a framework for pharmacist-led vitamin D POCT. The objectives were to: 1) Review available vitamin D POCT kits, 2) Develop and validate a framework for vitamin D POCT, 3) Assess the feasibility of the proposed framework.

Method: The method consists of: 1) Appraisal of vitamin D POCT methods, 2) Development and validation of a framework for pharmacist-led vitamin D POCT by a panel consisting of 7 healthcare professionals and 2 lay persons, 3) Testing the framework in a two-part study; Part A - Validation of POCT kit by comparing laboratory test results from Mater Dei Hospital with POCT results (20 patients); Part B - Assess feasibility of POCT framework (50 patients) in 5 community pharmacies.

Results: Seven vitamin D POCT kits were compared, 3 of which are available locally. The test kits use chromatographic immunoassay techniques providing quantitative (n=4) or semi-quantitative (n=3) results. All tests rely on whole blood or serum samples. Testing time ranges from 10-20 minutes and sensitivity ranges from 1.2-5ng/ml. The developed framework includes a Data Collection Sheet, Standard Operating Procedure and Action Plan. The Data Collection Sheet involves assessment of risk factors associated with development of vitamin D deficiency. The test selected for use is the semi-quantitative AcroBiotech Inc. Vitamin D Rapid Test Cassette, with a sensitivity of 4ng/ml and a cost of €6 per kit. The Action Plan provides lifestyle advice and a referral note is used to refer patients to prescribers when vitamin D deficiency is identified, for symptomatic patients or patients at high risk of developing vitamin D deficiency.

Discussion: The review identified a POCT kit that could be used within a framework for community pharmacist-led assessment of vitamin D within the context of collaborative care.

Cannabidiol: Science, Myths and Realities

Abigail Calleja

Background: The cannabis plant has more than one hundred cannabinoids. The two most researched cannabinoids are tetrahydrocannabinol (THC) and cannabidiol (CBD).[1]

Purpose: To investigate the science, myths and realities related to CBD by (i) comparing the potential therapeutic benefits of CBD (ii) assessing knowledge and perception of (a) the public and (b) healthcare professionals (HCPs) about CBD.

Method: Systematic literature review about studies demonstrating potential therapeutic benefits of CBD was carried out, followed by the development, validation and dissemination of two questionnaires targeting the knowledge and perception of the general public and HCPs about CBD. The questionnaires consisted of 4 sections; demographics, knowledge, perception and barriers related to CBD use.

Results: One hundred and twenty-six articles were identified via systematic literature search. CBD was reported to have beneficial effects on mental health disorders (33), inflammation (28), neurological disorders (22), tumours (15), cardiovascular disease (11) and neuropathic pain (5). CBD demonstrated neuroprotective effects (5) and other therapeutic effects (7). Four hundred individuals (62% female, 41% aged 26-40 years) answered the general public questionnaire and 150 individuals (58% female, 53% aged 26-40 years, 49% pharmacists) answered the questionnaire for HCPs. Seventy five percent of respondents from the general public (n=257) heard about CBD from social media/news, 76% (n=305) believe that CBD has an anxiolytic effect, 50% (n=202) think that CBD products should be prescription-only-medicine and 69% (n=277) disagree that CBD is a gateway drug. Sixty-five percent (n=262) of the general public respondents deemed social stigma as a barrier to CBD use. Seventy percent (n=97) of HCPs heard about CBD from social media/news, 67% (n=101) believe that CBD products should be prescription-only medicine, 69% (n=104) would feel comfortable in prescribing or recommending CBD for pain, 61% (n=91) of HCPs disagree that CBD is a gateway drug and 65% (n=97) of HCPs deemed their personal beliefs as a barrier to CBD use.

Discussion: Members (of the general public perceive that CBD has an anxiolytic effect while the majority (n=104) of the HCPs claim it produces an analgesic effect. Two common barriers related to CBD use are social stigma and personal beliefs of HCPs.

Reference:

1. Sharpe L, Sinclair J, Kramer A, de Manincor M, Sarris J. Cannabis, a cause for anxiety? A critical appraisal of the anxiogenic and anxiolytic properties. Journal of Translational Medicine. 2020;18(1):374.

Clinical Pharmacy Services in Primary Care

Osvaldo Cancellu

Background: The evolvement and implementation of clinical pharmacy services in primary care is a response by healthcare systems to meet healthcare needs. Comprehensive models that describe clinical pharmacy services support service development.

Purpose: To develop and evaluate a framework to support clinical pharmacy services in primary care.

Method: The study is divided into four parts. Part 1: Review and critical analysis of literature regarding clinical pharmacy services in primary care. Part 2: Development of a self-administered questionnaire to support framework elaboration. Part 3: Focus group discussion with an interprofessional panel of five members and two laypersons to generate consensus on the services covered in the framework. Part 4: Delphi validation consisting of three rounds with an expert panel of five physicians to validate the Standard Operating Procedures (SOPs) developed as part of the framework.

Results: Part 1: The community pharmacist-led services identified from the literature review comprised the management of chronic diseases, such as hypertension, dyslipidaemia, and diabetes, smoking cessation and minor ailments. Part 2: The questionnaire was disseminated to consumers (N=800) online and in community pharmacies. The pharmacist services for which the respondents showed the highest agreement were: management of infections of the throat (n=674), skin (n=642), ears and eyes (n=635), and urinary system (n=565), provision of travel health advice (n=645), recommendations on routine immunisations (n=640), Medicine Use Review (n=487) and smoking cessation (n=322). Part 3: Consensus was reached among the focus group panel for the framework to include all the services obtaining the highest agreement from the questionnaire. Part 4: 26 SOPs were developed and cover the following aspects: Core documents on conducting the clinical service (n=4), Medicine Use Review and point-of-care testing services (n=5), advice and treatment related to infections, immunisation and international travel (n=8), and supporting documents including documentation and training (n=9).

Discussion: The contribution of the study is the developed framework that can be used to support expansion and highlight clinical pharmacy service provision in primary care.

Age-Related Pharmacovigilance Perspectives

Valerie Fernandez

Background: Drug-related falls are of particular concern in older persons and lead to an increase in morbidity and mortality. Strategies to identify risk of drug related falls could contribute to optimise patient care.

Purpose: To navigate the utilisation of pharmacovigilance processes in clinical pharmacy practice within a patient-centric approach and to reduce drug-related falls for older people through medication risk assessment.

Method: A literature scoping exercise was conducted to identify a tool for the prevention of medication-related falls in clinical practice. Five multifactorial tools and three medication-based tools were identified and categorized. The tool selected for the study was the STOPPFall[1], from the medication-based category. This tool was utilised to analyse retrospectively the extent of deprescribing of Fall Risk-Increasing Drugs (FRIDs) as indicated in 55 pharmacy patient profiles of patients aged 60 years and above admitted due to a fall with or without a fracture. The selected patients were those discharged at Karin Grech Hospital during the study period of January to July 2021. The t- test for one proportion was used to assess deprescription rates.

Results: Average age of patients was 81 years (65% females). Common comorbidities were hypertension, diabetes and cardiovascular diseases. Antidepressants (n=35), diuretics (n=34), opioids (n=31) and benzodiazepines (n=23) were the most common FRIDs prescribed. Significant deprescription rates were evident for opioids (96.77%, $p<0.01$) and benzodiazepines (69.57%, $p=0.030$). Diuretics (47.06%), antipsychotics (46.15%) and antidepressants (37.14%) showed lower deprescription rates. The small sample size of other FRIDs namely sedative histamines, cardiac vasodilators, alpha-blockers and antiepileptic agents did not allow generation of reliable conclusions.

Discussion: Active pharmacovigilance by pharmacists within a patient-centric approach can reduce the use of FRIDs by older adults. Medication assessment tools enhance objectivity in clinical decision making through imparting a step-wise approach guide.

References:

1. Seppala LJ, Petrovic M, Ryg J, Bahat G, Topinkova E, Szczerbinska K, et al. STOPPFall (Screening Tool of Older Persons Prescriptions in older adults with high fall risk): A Delphi study by the EuGMS Task and Finish Group on Fall-Risk-Increasing Drugs. Age Ageing 2020;1-11.

Cannabis for Medicinal Use In Rare Diseases

Jekaterina Parovincaka

Background: Rare diseases (RDs) are severe, progressive and usually chronically debilitating. About 3.5%–5.9% of the world population is affected by a rare disease. Despite the advancements in pharmaceutical science RD patients often lack effective and accessible treatment options. Medicinal Cannabis (MC) is used for symptoms such as pain, spasticity, nausea and vomiting, seizures, and anxiety which may be experienced by RD patients.

Purpose: To identify RDs for which MC can be used and issues related to its use in patients with RDs.

Method: The methodology consisted of two parts: (1) systematic literature review using search engines: PubMed and MEDLINE. Open access peer review journal articles, published between January 2011 – September 2021 were included; (2) development, validation and dissemination of two questionnaires - for RD patients and for healthcare professionals (HCP) in Malta.

Results: There are 38 articles identified in literature which describe the use of MC as a possible therapeutic option in 23 different RDs, mainly epileptic conditions (n=7) and neurodegenerative diseases (n=6). Respondents of the questionnaire for HCP (n=20) were mostly general practice doctors (n=7) and pharmacists (n=5), with more than 15 years of practice. They reported symptoms experienced by RD patients were usually pain (n=7, mainly chronic neuropathic pain), stress and anxiety (n=6), muscle spasticity (n=6), and sleep disorder (n=5). Most often used pain medications for RD patients were paracetamol, SSRIs and anticonvulsants. Only 2 respondents used MC in their practice, but none rejected its possible use. Regarding side-effects of MC, addiction is reported to be of most concern (n=4). Patients with RDs (n=20) reported pain (n=11), muscle spasticity (n=5), stress and anxiety (n=5) as commonly presented symptoms. Most (n=11) experience symptoms irrespective of the use of medications, including pain (n=7), nausea and vomiting (n=3), muscle spasticity (n=2). Eighty-two percent of responders (n=9) would consider the use of MC with reported concerns being the cost of MC, possibly associated confusion and addiction (n=2 each).

Discussion: Literature supports the use of MC for management of RDs. In lack of efficacious treatment options for RD patients, MC can be an alternative therapy for symptom relief.

Risk Minimisation Strategies Through Drug Utilisation Review

Ana Lou Grace Manluyang

Background: The Pharmacy-Of-Your Choice (POYC) is a national pharmaceutical service provider for outpatients in Malta who benefit from medicines and medical devices supplied for free by the Government through 219 community pharmacies.[1] Approval of entitlement to medicinal products through POYC prioritises meeting pharmacy administrative processes.

Purpose: To characterise a process of pharmacists' review at the POYC entitlement unit.

Method: A focus group was established to understand the need, advantages, barriers, experiences, and prioritisation of a review process within the POYC entitlement unit. A Drug Utilisation Review (DUR) tool was developed and validated for reliability and practicality. The tool was applied retrospectively to 150 patient entitlements (60% male, 40% female) receiving at least 10 entitled medications.

Results: From the focus group discussion patients with multiple conditions and managed with multiple consultants, and with at least 10 medications were identified for prioritisation in the DUR process. From the patient DURs carried out, 84% have 10-15 entitled medications with aspirin, amlodipine, omeprazole, bumetanide, and perindopril as the most frequently prescribed medications. Hypertension (81%), diabetes mellitus type 2 (58%), and ischaemic heart disease (53%) were the top Schedule V medical conditions. Potential interaction between drugs (34%), risk for adverse drug reactions (21%), and potentially unnecessary drug therapy (20%) were the top drug-related problems requiring intervention at prescriber and patient levels that were identified by the DUR process.

Discussion: The DUR tool developed, when applied within the patient prioritisation criteria leads to a standardised clinical pharmacist intervention during the POYC entitlement appraisal procedure within POYC.

Reference:

1. Government of Malta. Pharmacy of Your Choice About Us [Internet]. Malta: Ministry of Health; 2020 [cited 2022 January 02]. Available from URL: https://deputyprimeminister.gov.mt/en/poyc/Pages/About%20Us.aspx

Addressing Long-Term Use of Benzodiazepines

Yvonne Savona Ventura

Background: Concerns regarding misuse and over-prescribing of benzodiazepines support strategies for de-prescribing and ensuring safe and rationale use.

Purpose: To collate data and obtain evidence of status of use of benzodiazepines.

Method: Data was collected through the National Health System (NHS) as well as from community pharmacies; after seeking approval through relevant institutions and ethics committee. The NHS have provided consumption trends of benzodiazepine medicines, entitlement cohort numbers, identifying the prescribed benzodiazepine, and duration of treatment. A questionnaire was designed and validated by four healthcare professionals and two laypeople. Inter-rater reliability was assessed based on interviewing five patients by multiple interviewers. Data was collected from six community pharmacies. Convenience sampling was used and the questionnaire targeted patients over 18 years of age accessing the selected community pharmacies with prescriptions for benzodiazepines, both through the 'Pharmacy of Your Choice' scheme, as well as through private prescriptions. One hundred and thirteen consenting participants were invited to answer the questionnaire which was led by trained interviewers. The information included: demographics (age and gender), benzodiazepine and prescribed dose, diagnosed condition, number of years on benzodiazepines, last visit to original prescriber, and any concurrent psychiatric medications.

Results: Within the local NHS, over 8000 patients were found to be on long-term benzodiazepines and approximately 7 000 000 benzodiazepines tablets are consumed per year through the NHS. The most commonly prescribed being lorazepam (n=2 450 000), followed by bromazepam (n=2 004 000) and diazepam (n=1 175 000). In the community, the most popular benzodiazepines reflected the same findings as the NHS, with the average number of benzodiazepine tablets per patient being three times daily. Fifty percent of the participants have been on benzodiazepines around ten years, with 95% of them having visited their prescriber within the last three years.

Discussion: The study provided a reflection on the current status and leads to the next step of developing a framework to address long-term benzodiazepine use.

A Comparative Approach of Pharmaceutical Regulation in Europe and Japan

Shunsuke Shimura

Background: Japan and EU regulatory bodies historically have in principle accepted each other's regulations and mutually agreed on the requirements and regulatory processes to provide nationals with drugs as quickly as they can while ensuring safety, quality, and efficacy.[1] Yet, there are still a large number of pharmaceutical regulations in Japan and the EU not comparable to each other.

Purpose: To identify differences/similarities and strengths/weaknesses through comparison exercises between Japanese and European pharmaceutical regulations. Perceptions of medical professionals to reflect how the regulations work in the real world are documented.

Method: Pharmaceutical regulations are obtained from regulatory bodies, official websites, laws, and related journals. Medical professionals' perceptions are evaluated through a focus group discussion. Doctors and pharmacists in Japan and Malta are recruited by convenience sampling.

Results: Two types of documents are mainly used as drug information references in Japan and the EU. Drug Information Sheet (DIS) and Patient Information Leaflet (PIL) are intended for patient use, Package Insert (PI) and Summary of Product Characteristics (SPC) are used by medical professionals. DIS and PIL provide accurate drug information for patients albeit their handling method, publisher, and contents are different between Japan and the EU. Since 2009, Japan has classified OTC drugs in risk categories: Guidance-mandatory (GM) drug, Type I, Type II, and Type III drugs (the OTC risk evaluation method). Except for GM drugs, all types are allowed to distribute through online. Type II and III can be purchased without pharmacist interventions. In Malta, there is no classification within OTC drugs, and all pharmaceutical products must be dispensed only in pharmacies. Emergency contraception (EC) is not available without prescription in Japan, but online medical consulting (OMC) is available. After OMC, patients must obtain EC from pharmacies and take it in front of pharmacists in Japan. In the EU, almost all countries allow pharmacists to provide EC without prescription.

Discussion: It is envisioned that it is possible with discussion, and allowance for some cultural differences, that harmonization is achieved between Japan and the EU regulations.

Reference:

1. Molzon JA, Giaquinto A, Lindstrom L, Tominaga T, Ward M, Doerr P, et al. The Value and Benefits of the International Conference on Harmonisation to Drug Regulatory Authorities: Advancing Harmonization for Better Public Health. Clinical Pharmacology and Therapeutics. 2011; 89(4): 503-12.

Medicine Shortages

Jessica Zarb

Background: Lack of economic market attractiveness, campaign manufacturing, policy failures, conditions for registering third-country produced products, now including post-Brexit UK registered products, are the key concepts behind shortages present in small countries like Malta. Article 20[1] exemption from registration is utilised to mitigate medicine shortages which could have a significant impact on the patient.

Purpose: To evaluate the rationale of granting an Article 20 exemption for the supply of medicines to prevent local medicine shortage.

Method: Article 20 application data is gathered retrospectively, between October 2020 and December 2021, from the Medicines Intelligence and Access Unit within the Malta Medicines Authority. The Article 20 data gathered was compiled into a database consisting of 35 sections including reason for request, conditions of exemption, considerations, errors noted in Article 20 application, source country from which stock is being obtained, reason for refusal of Article 20 application, time taken to process an Article 20 exemption application including clock stops.

Results: The number of Article 20 exemption requests that were approved totalled to 420, with 42 requests refused, 292 of which were for products sourced from third countries such as UK (N=257), Canada (N=15) and USA (N=20). Products approved by Article 20 exemption include tamoxifen 20mg tablets, hydroxyurea 500mg capsules and carboplatin 150mg solution for infusion. The three most common reasons given for an Article 20 exemption were i) interim measure as new tender is in progress(n=177) ii) product not available within the EU (N=123) and iii) increase in consumption (n=68). Prioritise sourcing and procuring of stock from within the EU was the most common condition of exemption (n=292). Considerations included registered alternative not available (n=350) and item is urgently required (n=65). Reasons for refusal of Article 20 included i) item is already registered (N=31) and ii) registered alternative available (N=3). The average time taken to process an Article 20 exemption request was 13 days.

Discussion: Article 20 exemption from registration is granted for a justified public health need for the benefit of the patient and for the humanitarian reason not to leave patients without medicines.

Reference:

1. Medicines Act of 2003, Chapter 458, [cited 2022 Jan 21]. Available from URL: https://legislation.mt/eli/cap/458/eng

M.Pharm. Students

DISSERTATION ABSTRACTS

M.Pharm. Students

DISSERTATION ABSTRACTS

Social and Administrative Pharmacy

Pharmacy Workforce Evolvements in Community Practice

Nicole Agius Markham

Background: Community pharmacy could be considered to lie within the heart of primary healthcare since pharmacists are often the first point of contact, in the management of diseases.

Objectives: To understand pharmacy workforce evolvements through consumer and community pharmacist perspective. To elaborate on suggestions for advancements in community pharmacy.

Design: Two separate self-administered questionnaires were drafted and validated; one directed to community pharmacists, and a second to the public. Both questionnaires were distributed over social media by convenience sampling. Personal distribution in community pharmacies was also performed targeting pharmacists. A thematic analysis was undertaken to extrapolate evolvement in community pharmacy practice.

Setting: Community pharmacies.

Main outcome measures: Pharmacist and consumer impression of community pharmacy.

Result: Three hundred responses from consumers were received; 43% aged between 18 to 30 and 76% were females. The majority (57%) were highly satisfied with the service provided whilst 17% of respondents felt that there is a need for improvement in the service provided by the pharmacist. For community pharmacists, 103 responses were received; 72% were females, 26% had less than 5 years of experience and 68% were locums. Pharmacists who responded to the questionnaire felt that they hold more responsibility than that perceived by the public (97%), and 59% felt that consumers' impressions of pharmacists are positive. From the thematic analysis, consumers' most common complaint was that pharmacists do not provide as much information as sometimes required with their knowledge not being used to its full potential. The most recurring theme in community pharmacists' responses was the relationship formed with patients, which instils reason into their profession.

Conclusion: The relationship formed with consumers is at the crux of community pharmacy and this is reflected upon in consumers satisfaction with services.

Defining and Evaluating Green Practices in Pharmacy: A Community Pharmacy Perspective

Michela Baldacchino

Background: The presence of active pharmaceutical ingredients within the environment poses a detrimental effect on the ecosystem. Pharmaceutical pollutants may be reduced if greener practices are adopted throughout the life-cycle of medicinal products.

Objectives: To evaluate the perception of pharmacists and pharmacy technicians working in community pharmacies towards green practices.

Design: A self-administered questionnaire, entitled "Green Practices in Community Pharmacy" was developed to evaluate the perception of community pharmacists and pharmacy technicians towards green practices.

Setting: Community pharmacies

Main outcome measures: Knowledge of pharmacists and pharmacy technicians about green practices.

Result: A total of 71 participants (56 females and 15 males) answered the questionnaire. Fifty-four participants were pharmacists, and one was a pharmacy technician. Seventy participants would like more information about green pharmacy practices mainly through social media (n=49) and webinars (n=36). Green practices such as stock rotation (n=52) and recycling (n=36) were already being implemented by participants. Thirty-three participants never (n=18) or rarely (n=15) examine the pharmacy's energy consumption. All participants have a medicinal waste bin at their pharmacy, which helps to provide a better means to dispose of expired or unwanted medication (n=64).

Conclusion: Green practices are already being implemented within community pharmacies. Educational campaigns will aid pharmacists and pharmacy technicians to improve their knowledge related to green practices and increase environmental awareness amongst patients and healthcare workers.

Strategic Planning for the POYC Scheme

Luke Cassar

Background: The study explores and analyses the local National Health System in relation to the POYC Scheme using a holistic approach.

Objectives: To analyse the current system by assessing perception and experience of community pharmacists and to explore innovative aspects of the process.

Design: Post-observing the current POYC scenario, a questionnaire for pharmacists was compiled and psychometrically evaluated. Dissemination of the questionnaire was carried out in an e-group of warranted pharmacists via Google Forms and through personal distribution in enrolled pharmacies. The collated data was used to compute frequency counts and for statistical analysis. Questions for a focus group involving experts in the field have been developed and validated. A meeting was set up to carry out the interviews.

Setting: Community Pharmacy, National Health System

Main outcome measures: Identification of shortcomings in the POYC Scheme and proposal of relevant actions.

Result: A total of 140 questionnaires were collected - 94 were females and 46 were males. From the participants, 91% perceived an excessive workload with 50% stating that they had to employ additional staff. Forty-five percent of the respondents stated that the participating pharmacy is often affected by medicine shortages. Sixty-nine percent of the participants stated that they are satisfied with the overall service provided by the POYC Unit. Sixty-five percent of the participants implied that the stock return system is inefficient. Eighty-two percent of the respondents opted for a paperless system. Post-analysing the questionnaire through statistical parameters, a maximum of 8 questions were compiled and validated for thematic analysis.

Conclusion: The POYC Scheme is dynamic and constantly changing to improve according to the experience of the operators, pharmacists, and patients. The analysis took a thorough approach involving the main stakeholders for a sustained continuous development.

Establishing an International Educational Framework for Radiopharmacy

Yasmine Fenech

Background: There is no established programme required for radiopharmacy education for pharmacists.

Objectives: To analyse the education on radiopharmaceuticals (RP) for pharmacists in Europe, USA, and Australia.

Design: A literature review was compiled describing the characteristics and education on RP in pharmacy programmes. Data was compiled by assessing curricula descriptions of schools of pharmacy accessed through the European Association of Faculties of Pharmacy (EAFP) platform, the Accreditation Council for Pharmacy Education (ACPE) in the USA and the University of Monash and the University of Sydney website. The curriculum content was analysed by checking the title and content of each study unit and if they are compulsory or optional. Post-graduate courses and Master specialisation in RP offered in a pharmacy degree were considered. An educational framework is being developed. The framework considers educational components that are relevant to an understanding of RP, quality systems and regulatory aspects, safety, and patient awareness.

Setting: Department of Pharmacy, University of Malta

Main outcome measures: Development of an educational framework for pharmacy students.

Result: All 81 universities registered with EAFP were analysed. From these, 47 offered information on RP in study units in a pharmacy degree programme. The University of Monash, University of Sydney and ACPE did not have compulsory topics on RP for pharmacy students. From the 47 European universities, 36 units are compulsory. Seven universities offer either a postgraduate course or a Master specialisation. The majority of universities gave an insight into RP covering diagnostic and therapeutic use, and production of RP. The education framework is divided into 6 categories. These are familiarization of terms, nuclear physics, diagnostic use, therapeutic use, production of RP and safety.

Conclusion: This study provides a snapshot of the RP-related topics covered in a pharmacy degree programme, particularly in Europe.

Malta Vaccine Task Force

Zina Jauda

Background: Several countries have designated a vaccination task force to contribute to the rapid increase in demand for vaccine research and development.[1] The primary objective of these task forces revolves around identifying and reviewing vaccine production bottlenecks in the European Union.

Objectives: To investigate the feasibility, including the economical, technical and legal needs to establish a vaccine task force in Malta.

Design: The study will identify the need for a vaccine task force in Malta, by looking into the functions, the composition of the task force and studying the gaps present in Europe related to the vaccines. Factors such as economics, political appetite and logistics of vaccine production are assessed. Consultations are held with stakeholders and policy makers to identify the role of public health and educational institutions, business partners and international interest in the vaccine task force.

Setting: Malta Medicines Authority - Vaccine Unit

Main outcome measures: The feasibility of setting up a vaccine task force in Malta

Result: Data from the UK and Canadian vaccination task force showed improvement in vaccine access and uptake. These vaccine task forces helped in mapping vaccine production capacity through supply chain, ensured facilitating partnership throughout the supply chain and improved sustainability manufacturing capacity in their respective regions.

Conclusion: The ability of Malta to support global vaccine access and vaccine sharing efforts because of its geographical location and size should not be underestimated.

Reference:

1. Cardenas NC. COVID-19 Emergency Vaccine Task Force: Enhancing EU and US Strategic Interconnectivity Approach on Inter-regional Blocs' Vaccination Programs. Journal of Public Health; 2021. doi.org/10.1093/pubmed/fdab293

Pharmacy Workforce: Trend Analysis

Danish Parvez

Background: It is predicted that worldwide, pharmaceutical workforce capacity is challenged to meet requirements of healthcare systems. Understanding current trends in the pharmacy workforce and implications of these trends contributes to strategic planning to support future evolvements

Objectives: To describe present pharmacist workforce and to analyse trends in pharmacist workforce.

Design: A self-administered questionnaire was developed and validated by a panel of six pharmacists from different areas of practice (community, hospital, industrial, regulatory, academia, medical representation. Following ethics approval, the questionnaire is disseminated to all registered pharmacists through the Maltese Pharmacy Council and social media. Results from the questionnaire are compared to previous studies conducted in (2003[1], 2005[2], 2009[3] and 2013[4]) to analyse trends. Descriptive statistics are undertaken using SPSS.

Setting: Department of Pharmacy, University of Malta.

Main outcome measures: Pharmacist workforce current principal areas of practice and trends analysis.

Result: The questionnaire comprises 15 questions. Topics included are: years and areas of practice, job satisfaction, continuity of practice, reasons for selecting pharmacy profession, continuing professional development, and further studies.

Conclusion: The study contributes data on the present pharmacist workforce and analysis of workforce trends over a nineteen-year period.

References:

1. Anastasi A. Pharmacist Manpower [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2003.
2. Mizzi C. A Directory of Pharmacists [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2005.
3. Hili S. The Maltese Directory of Pharmacist: Present Status and Future Predictions [project]. Msida (Malta): Department of Pharmacy, University of Malta; 2009.
4. Zarb Cousin M. Pharmacist Manpower: Assessment of the Directory of Pharmacists [dissertation]. Msida (Malta): Department of Pharmacy, University of Malta; 2013.

M.Pharm. Students

DISSERTATION ABSTRACTS

Pharmaceutical Care and Pharmacotherapy

Prescribing Practices and Patient Perception of Anticoagulant Treatment in the Older Population

Kevin Kirkop

Background: Direct acting oral anticoagulants (DOACs) are a class of oral anticoagulants used as an alternative to warfarin for long term anticoagulation in patients with cardiovascular disorders such as atrial fibrillation and venous thromboembolism.

Objectives: To review the prescribing practices of DOACs in older patients and evaluate patient experience.

Design: Phase 1 of the study involved gathering quantitative data from pharmacy patient profiles with a selection criterion of patients above 60 years on long-term oral anticoagulation. Statistical analysis was carried out using IBM SPSS. In phase 2 of the study a validated questionnaire PACT-Q2 was used to interview discharged patients on their experience with long-term oral anticoagulation.[1]

Setting: Karin Grech Hospital (KGH).

Main outcome measures: To establish trends and determine areas for improvement in the prescribing practices of DOACs in Malta.

Result: In phase 1, 499 patients were recruited over a 3-year period with an increase in DOAC use from 2019 to 2021 of 23.6% to 50.9% of the total yearly population. Appropriateness of dose at discharge from KGH improved by 19%. Fifty patients were interviewed in phase 2. Patients in the warfarin group were shown to have a lack of knowledge and awareness about their treatment when compared to those on DOACs. Patients in the DOAC group are overall satisfied except for the high price of DOACs.

Conclusion: Increase in evidence, improved health care professional knowledge, more patient awareness, and lower price have resulted in an increase in the prescription of DOACs and an improvement in prescribing practices. Patients on DOACs were shown to be more knowledgeable about their treatment compared to those on warfarin.

Reference:

1. Riva N, Xuereb CB, Makris M, Ageno W, Gatt A. Reliability and validity of the Maltese version of the Perception of Anticoagulant Treatment Questionnaire (PACT-Q) [Internet]. Patient Prefer Adherence. 2019; 13:969 [cited 2020 Jun 20]. Available from: https://www.dovepress.com/patientpreference-and-adherence-journal.

Empowering Healthcare Professionals in the Use of Biosimilars

Sephora Scicluna Bugeja

Background: Biologics are considered innovative therapies that help in various conditions including multiple cancer types, autoimmune diseases and chronic inflammatory illnesses. According to the European Medicines Authority[1], a biological medicine, commonly known as biologics or a reference medicine, is a "medicine whose active substance is made by a living organism". Biosimilars have been available on the Maltese market for 10 years.

Objectives: To assess and evaluate present perceptions and knowledge of the Maltese healthcare professionals namely, physicians and pharmacists on the concept of biosimilar and their prescribing practices.

Design: A cross-sectional study assessing and evaluating present perceptions and knowledge of the Maltese healthcare professionals on the concept of biosimilars and their prescribing or dispensing practices was conducted. Two separate questionnaires targeting physicians and pharmacists respectively, were compiled and validated for use in this study.

Setting: Maltese registered pharmacists and physicians were invited to participate in the study

Result: Participants (63%) were actively involved in the dispensing and prescribing of biosimilars. Both healthcare professionals (72%) view themselves as somewhat familiar with biosimilars. Awareness on expected interchangeability/switching outcomes, as well as knowledge on differences between a generic and biosimilar seem to be lacking. This was particularly noted among physicians. Pharmacists showed a higher acceptance for substituting/interchanging patients from a biologic to a biosimilar than physicians.

Conclusion: Current data suggests a need for further education with regards to biosimilars and more inter-professional communication between physicians and pharmacists, so as to optimise the use of biosimilars and to provide pharmacists with a more active role regarding the choice of biologic.

Reference:

1. European Medicines Agency (EMA). Biological Medicine Glossary. London: EMA; 2014.

Developing a Framework for Pharmacist Prescribing: A Risk-Based Approach

Emma Theuma

Background: Pharmacist prescribing has benefits including superior patient care and timely access to medication.

Objectives: To assess consumer perception of the risks associated with pharmacist prescribing and to develop pharmacist prescribing frameworks for selected conditions.

Design: A questionnaire using a 5-point Likert scale (1 to 5; 1 denoting the lowest score) was developed, validated and pilot tested before dissemination to the general public. Risk priority numbers (RPN) were calculated by multiplying the scores for probability of side-effects with those for severity of consequences and results categorised as low, medium or high risk with 1 denoting the lowest risk and 25 the highest. RPN results are presented to a panel of four pharmacists and four physicians to determine which conditions merit inclusion in a pharmacist prescribing framework.

Setting: Questionnaire distribution was executed via social media and in-person.

Main outcome measures: Development of pharmacist prescribing frameworks for selected conditions.

Result: Thirty-six conditions were perceived as low risk with dandruff having the lowest RPN (2.36). Twelve conditions showed medium risk with Type 2 diabetes having the highest RPN (12.34). An analysis of variances ($p<0.05$) showed that males perceived a lower probability of side-effects associated with pharmacist prescribing for acne ($p=0.018$), asthma ($p=0.047$) and type 1 diabetes ($p=0.028$) and a higher probability of side-effects associated with painful periods ($p=0.043$), urinary tract infections ($p=0.005$) and vaginal thrush ($p=0.018$) than females. Males perceived more severe consequences associated with pharmacist prescribing for dandruff ($p=0.043$), emergency contraception ($p=0.008$), insect bites ($p=0.032$), mouth ulcers ($p=0.041$), nicotine dependence ($p=0.008$) and painful periods ($p=0.001$) than females.

Conclusion: RPN results show that consumers are comfortable with pharmacist prescribing for minor ailments but are less so for chronic conditions.

Community Pharmacist Intervention in Hypertension Management

Francesca Vassallo

Background: Uncontrolled hypertension (HTN) is associated with high morbidity and mortality.

Objectives: To assess antihypertensive therapy, blood pressure (BP) control and therapy adherence

Design: Patients treated for uncomplicated HTN or with other comorbidities were recruited by convenience sampling. A data collection form, tool to compare antihypertensive therapy to guidelines[1] and BP record sheet were developed and validated. BP was measured with a validated automated device at recruitment (t1) and after 14 days (t2). BP record sheet was completed by patients who self-monitor BP and reviewed at t2. The MUAH-16 questionnaire (maximum score 112)[2] was translated to Maltese, validated, tested for reliability and used to assess therapy adherence (t1). Pharmacotherapy and BP values not according to guidelines were discussed with the general practitioner (GP).

Setting: Community pharmacies

Main outcome measures: Appropriateness of antihypertensive therapy; BP control; adherence

Result: Eighty patients (37 male, mean age 69; range 43-83 years, 23 with uncomplicated HTN, 30 who self-monitor BP) were recruited. Mean BP (t1) was 143/81 mmHg (range: systolic 106-197, diastolic 66-124 mmHg). Mean BP (t2) was 141/79 mmHg (range: systolic 104-180, diastolic 64-103 mmHg). Compliance to guidelines for both BP level control and antihypertensive therapy was observed in 63 patients. After discussion with GP, cases of non-compliance (n=17) had dose increased (n=9) or decreased (n=1), medication added (n=5) or stopped (n=2). Mean adherence score was 99 (range 67-110).

Conclusion: The study showed the contribution of community pharmacists in managing HTN through collaboration with GPs.

References:

1. Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al. 2018 ESC/ESH guidelines for management of arterial hypertension. Eur Heart J. 2018;39(33):3021-3104.
2. Cabral AC, Castel-Branco M, Caramona M, Fernandez-Llimos F, Figueiredo IV. Developing an adherence in hypertension questionnaire short version: MUAH-16. J Clin Hypertens 2018;20(1):118-24.

M.Pharm. Students

DISSERTATION ABSTRACTS

Clinical Biology

Requirements of COVID-19 Swabbing *Margaux Jeatrice Alaba*

Opportunities and Challenges of COVID-19 Self-testing *Lordwin Alexis Labuguen*

Requirements of COVID-19 Swabbing

Margaux Jeatrice Alaba

Background: In response to the outbreak of Coronavirus (COVID-19) across the globe, COVID-19 screening facilities were established to prompt early diagnosis and contribute to controlling spread of virus. Guidelines of COVID-19 screening ensure a safe and effective environment for patients and staff while maintaining quality and accurate reporting of results.

Objectives: To review and evaluate guidelines of COVID-19 screening in Malta and other countries.

Design: Systematic Literature Review on the guidelines of COVID-19 screening in Malta and in other countries is conducted. Gathered data is used for a focus group discussion composed of stakeholders within the Medical Device Unit and Scientific and Regulatory Operations Directorate to explore differences in the guidelines of COVID-19 screening in Malta compared to other countries. The benefits and risks of applying changes to the local current system are evaluated.

Setting: Malta Medicines Authority

Main outcome measures: Local and International Guidelines for COVID-19 screening.

Result: Preliminary results indicate that a total of 43 COVID-19 swab centres are registered in Malta, 39 are Rapid Antigen Test Centres and 4 are Private PCR laboratories. The results and related personal data of all tests carried out are reported to the Superintendence of Public Health via COVID Result Submission Malta web application.[1]

Conclusion: Data collected in this study assesses guidelines of COVID-19 screening in different countries and explores opportunities for improvement in the procedures.

Reference:

1. Legal Notice 357 of 2021 – Medicines Act (Cap. 458)- Testing of COVID- 19 Regulations 2021 Government Gazette Of Malta No. 20,698– 10.09.2021 [Internet]. LEĠIŻLAZZJONI MALTA. [cited 2022 Jan 30]. Available from: https://legislation.mt/eli/ln/2021/357/eng

Opportunities and Challenges of COVID-19 Self-testing

Lordwin Alexis Labuguen

Background: Use of self-testing kits for the detection of the SARS-CoV-2 varies across countries.[1] A Rapid Antigen Detection Test (RADT) can be used at home to immediately assess the presence of SARS-CoV-2, which allows rapid detection, isolation, and management of individuals infected with COVID-2019. The use of self-testing kits poses disadvantages such as underreporting of test results.

Objectives: To review implementation of self-testing and guidelines for RADT devices in different countries.

Design: A systematic literature review is conducted to extract data regarding the devices being used in self-testing and on how self-testing is implemented in European countries, the US and Asia. A Focus Group Discussion (FGD) including a panel of experts representing medical devices regulators, public health officers, and health care professionals is carried out. The FGD focuses on identifying self-testing best practice implementation and identify strategies to mitigate challenges of self-testing.

Setting: Department of Pharmacy, University of Malta

Main outcome measures: Evaluate the implementation of COVID-19 self-testing

Result: Countries including the UK, US, and Greece allow self-testing as part of their drive to hasten the screening process.[1] The self-testing kits are available in the pharmacies readily accessible to the public without the need of a prescription. Instructions on how to use the RADT device and proper reporting of results to health authorities are also included with the kits.

Conclusion: Data collected in this study assesses the implementation of self-testing in different countries and considers opportunities and challenges for the implementation of self-testing in Malta.

Reference:

1. Goggolidou P, Hodges-Mameletzis I, Purewal S, Karakoula A, Warr T. Self-Testing as an Invaluable Tool in Fighting the COVID-19 Pandemic. Journal of Primary Care & Community Health. 2021; 12: 1-8.

M.Pharm. Students

DISSERTATION ABSTRACTS

Regulatory Sciences

ISO 9001:2015 as applied to Quality Management System	*Alyana Marie Dacanay*
The Derogation for Accessibility to Medicines from the UK	*Peniel Caminna Ferolin*
An Induction Training Course on Quality Management System for Competent Medicines Authority Personnel	*Reanne Pauline Manipon*
Setting up an Official Medicines Control Laboratory	*Kairylle Joy Mina*
Challenges in Forensic Toxicology: The Importance of Training Courses for Forensic Professionals and Toxicologists	*Sarah Shanne Aro*
European Union Regulations Governing Notified Bodies for Medical Devices	*Mariah Vella*

ISO 9001:2015 as applied to Quality Management System

Alyana Marie Dacanay

Background: ISO 9001: 2015 describes a standard for the elaboration of a quality management system within any organisation with the intent of demonstrating consistency, effectiveness and supporting improvement and quality.[1] The 2025 strategy for the Malta Medicines Authority (MMA), includes the objective of enhancing the quality management system.

Objectives: To evaluate implementation of ISO 9001:2015 requirements within the quality management system using qualitative methodology.

Design: The current QMS system is evaluated and characterised for improvements to align with ISO 9001: 2015 standard. A focus group with the members of the Quality Unit is set up to discuss proposals to address weaknesses, turning them into opportunities.

Setting: MMA Quality Unit

Main outcome measures: To identify the gaps between the ISO 9001: 2015 and the current Quality Management System.

Result: The QMS of the Malta Authority involves regularly updated quality documents including policies, quality manuals, and standard operating procedures to cover the operations of the Authority.

Conclusion: The study contributes to an analysis of opportunities for improvement of the Quality Management System of the Malta Medicines Authority to align with requirements of the ISO 9001:2015 standard.

Reference:

1. Corsi CAC, Shoji M, Scarpelini KCG, Bento RL, Becari C, Assunção-Luiz AV, et al. Implementation and certification of ISO 9001:2015 seal in human tissue bank HCFMRP-USP. Cell Tissue Bank. 2020; 21 (4): 563-571.

The Derogation for Accessibility to Medicines from the UK

Peniel Caminna Ferolin

Background: Access to safe, effective, and affordable medicines is vital in reducing the cost of illness, alleviating pain, eliminating suffering and improving the populations' quality of life. Since the UK's recent separation from the European Union, importation of goods from the UK dropped from €1.36 billion in 2019 to €397 million in 2020.

Objectives: 1) Analysing the current process related to the access of medicines in Malta 2) Identifying the obstacles in the access of medicines of the different stakeholders, namely: CPSU (Central Procurement and Supplies Unit), industry and select healthcare professionals 3) Identifying the steps taken by the stakeholders to bridge the gap in medicines access

Design: A questionnaire is developed and validated by persons of authority and distributed to representatives of the CPSU, the pharmaceutical industry, and selected health care professionals, mainly physicians and pharmacists. A focus group discussion is performed with the CPSU and industry representative group as experts; and the healthcare professionals are to receive the questionnaire personally.

Setting: Central Procurement and Supplies Unit, selected pharmacies in Malta

Main outcome measures: Providing derogation for accessibility to medicines from the UK.

Result: The process of medicines access in Malta is analysed, identifying the obstacles encountered by the stakeholders. The data is gathered from the focus group discussions and questionnaires, to provide recommendations on how to bridge the current gaps in the access of medicines from the UK.

Conclusion: The results of this study contribute as a framework for developing systems that can improve the accessibility of medicines from the UK.

An Induction Training Course on Quality Management System for Competent Medicines Authority Personnel

Reanne Pauline Manipon

Background: In the EU the Benchmarking of European Medicines Agencies (BEMA) programme supports implementation of regulatory Quality Management Systems (QMS) and consistency of best practices. Optimised induction training courses on QMS employed within a competent medicines authority contribute towards best practice standards.

Objectives: i) To explore the different QMS induction training structures adopted in Pharmaceutical Inspection Co-operation Scheme (PIC/S) Competent Authorities, ii) To analyse existing QMS Training Program at Malta Medicines Authority (MMA), iii) To identify strengths, best practices, gaps, and opportunities for improvement in MMA QMS induction training program

Design: A questionnaire is developed and validated by a multidisciplinary panel and is distributed to representatives of QMS unit of the PIC/S Competent Authorities. The same questionnaire is used as a guide to examine the current QMS induction training program of the MMA. Gap analysis is performed, and the results are discussed in a focus group session with stakeholders within the MMA from which recommendations for improvement are put forward and a proposed optimized induction training course is prepared.

Setting: Malta Medicines Authority

Main outcome measures: Optimised induction training course on QMS in a competent regulatory authority

Result: An analysis report is organized to describe the current QMS induction training practices within the MMA. Responses from the competent authorities, together with the identified gaps and recommendations from the focus group discussion are used for framework development.

Conclusion: Continual improvement in induction training program supports the achievement of effective QMS implementation.

Setting up an Official Medicines Control Laboratory

Kairylle Joy Mina

Background: An Official Medicines Control Laboratory (OMCL) is an independent laboratory that analyses the quality of human and veterinary medicinal products and medical devices. The Commission of the European Union and the Council of Europe created the General European OMCL Network (GEON) in 1994 to support regulatory scientific advancements through sharing of resources and expertise in each OMCL. To ensure mutual recognition of test results from OMCLs, these must be certified according to ISO 17025.[1]

Objectives: To investigate the setting up of an OMCL with special reference to the financial resources and the personnel required to run the laboratory.

Design: The current scenario concerning the structure and composition of OMCLs in Europe is established through a validated questionnaire, disseminated to OMCLs forming part of GEON. The questionnaire targets i) the human resources including their technical capacity and skills of personnel, ii) the financial aspects such as the expenditure, and the process of generating an income required to enable the OMCL to be sustainable.

Setting: Directorate for Medical Devices, Pharmaceutical Collaboration and Entrepreneurship at the Malta Medicines Authority.

Main outcome measures: The resources of OMCLs, including equipment, technical skills and finances, that carry out activities following quality management policies that protect public health

Result: An OMCL in Malta should include not only post-marketing surveillance testing but also services to customs, food inspectors, courts, and police, including ongoing support to educational activities, European Medicines Agency (EMA) testing program, biological batch release, national standards development, evaluation of quality control part of marking, Good Manufacturing Practice (GMP) inspections, and pharmacovigilance.

Conclusion: GEON presently consists of 70 OMCLs from over 40 countries. Malta lacks a national OMCL.

Reference:

1. European Union and the Council of Europe (COE). General European OMCL Network (GEON) [Internet]. Strasbourg (France): COE; 2021 [cited 2022 Jan 12]. Available from: https://www.edqm.eu/en/general-european-omcl-network-geon

Challenges in Forensic Toxicology: The Importance of Training Courses for Forensic Professionals and Toxicologists

Sarah Shanne Aro

Background: Forensic toxicology involves the use of toxicology for the purposes of the law. Forensic professionals continue to face diverse challenges, such as the surfacing of new drugs, discrepancies in the analysis of toxicological findings, and different guidelines among laboratories.[1] The resources for sufficient staffing, technology, and training are limited. Translational techniques require a network system in which professionals work together with a common knowledge and understanding of the problems and solving them.[2]

Objectives: To highlight the importance of training courses for forensic professionals and toxicologists.

Design: The current situation concerning the various challenges of Forensic Toxicology is determined through focus group interviews with selected participants, such as Forensic Science Laboratory professionals and Toxicologists at Mater Dei Hospital. Training courses for forensics experts and toxicologists in different countries along with the laboratory standards are reviewed with a special focus on learning objectives and training content.

Setting: Malta Laboratories Network (MLN)

Main outcome measures: Identifying the challenges the forensic professionals are facing. Highlights of the significance of training courses required to overcome challenges presented.

Result: The challenges identified in forensic toxicology according to forensic professionals and toxicologists highlight the need for tailor made training courses on forensic toxicology which offer a platform of collaboration, sharing of experience and cultivation of knowledge, expertise and skills taking into consideration the use of latest technology and equipment.

Conclusion: The importance and relevance of training courses which address challenges in Forensic Toxicology help to improve the practice of forensic toxicology in Malta.

References:

1. Chung H, Choe S. Challenges in forensic toxicology. Australian Journal of Forensic Sciences [Internet] 2019; 51(6):665-673 [cited 2022 Jan 02] doi.org/10.1080/00450618.2019.1567812
2. Gundert-Remy U, Barth H, Burkle A, Degen GH, Landsiedel R. Toxicology: a discipline in need of academic anchoring—the point of view of the German Society of Toxicology. Archives of Toxicology [Internet] 2015;89: 1881-1893 [cited 2022 Jan 02] Available from: https://pubmed.ncbi.nlm.nih.gov/26314262/

European Union Regulations Governing Notified Bodies for Medical Devices

Mariah Vella

Background: The EU medical device (MD) regulatory structure is changing from Directives to Regulations to ascertain safety, quality, and efficacy of MDs in the EU market. The EU Regulations are complex and have increased security partly by adapting stringent requirements for Notified Bodies (NBs).

Objectives: 1. To analyse the main challenges presented from the transition between the Directives to Regulations governing NBs. 2. To identify the reasons and manner with which the Regulations are affecting NBs. 3. To examine the competency of Malta to become a base for NBs.

Design: Knowledge on the MD legislative system and its rigorousness towards NBs for MDs is attained through a literature review of published studies, interpretation of the Directives and Regulations, participation in conferences, interviews, and meetings.

Setting: Malta Medicines Authority (MMA)

Main outcome measures: Identification of the challenges encountered by NBs for MDs governed under the EU MD Regulations and the viability for Malta to become a base for NBs.

Result: Five challenges emerging from the EU Regulations affecting NBs include: certification of MDs; BREXIT; extension of the MD regulation derogation; delay in launch of EUDAMED; and availability of qualified personnel. Thirty-one NBs are operational under the Regulations (25 MD regulation and 6 In-vitro Diagnostic (IVD) regulation) compared to 80 NBs under the Directives (52 MD directive, 18 IVD directive and 10 Active Implantable MD directive).[1] Attractions of Malta for NBs is the timely support of the MMA and Malta Enterprise as determined through interviews with potential NBs.

Conclusion: The EU Regulations are creating challenges, which are affecting the designation of various NBs. The results show that Malta is competent to become a base for NBs.

Reference:

1. European Commission (EC). Notified Bodies Nando Legislations. EU: EC; [Internet] 2020 [cited 2021 Dec 12]. Available from: https://ec.europa.eu/growth/tools-databases/nando/index.cfm?fuseaction=directive.main

M.Pharm. Students

DISSERTATION ABSTRACTS

Medicinal Chemistry

In silico Design and Validation of Novel Cyclin Dependent Kinase (CDK) Receptor Inhibitors, using the Palbociclib Scaffold, a Molecule used for the Management of Breast Cancer as a Lead — *Andrew Felice*

Design, Identification, Optimisation and Validation of Selective Casein Kinase (CK2) Modulators — *Oksana Friggieri*

Design, Optimisation and Validation of Novel HSP-70 Modulators — *Laurent Joseph Grech*

Design and Optimisation of Novel MEK Inhibitors using the Anti-Neoplastic TAK-733 Scaffold as a Lead — *Roderick Micallef*

In silico Design and Validation of Novel Cyclin Dependent Kinase (CDK) Receptor Inhibitors, using the Palbociclib Scaffold, a Molecule used for the Management of Breast Cancer as a Lead

Andrew Felice

Background: Cyclin Dependent Kinases 4 and 6 (CDK4/6) are crucial in promoting cell growth and maturation in mitosis through interaction with Cyclin D and subsequent phosphorylation of the retinoblastoma protein. Palbociclib disrupts cancer proliferation in locally advanced or metastatic breast cancer by firmly binding to CDK4/6 and arresting the ensuing cascade.

Objectives: To probe the CDK6 ligand binding pocket (LBP) using the palbociclib scaffold for the *in silico* identification and design of lead molecules capable of high affinity modulation of the target.

Design: PDB crystallographic depositions 5L2I[1] and 5L2S[1] describing the bound coordinates of palbociclib and abemaciclib with CDK6 receptor respectively were read into LigandScout®. The generated consensus pharmacophore was used as a query in ZINCPharmer® and the Rule of 3 compliant hits were docked in a ProtoMol describing the CDK6_LBP as generated in SYBYL®-X. The Ligand Binding Affinity (LBA) (pKd) of these hits was calculated. In the *de novo* approach, 2-D topology maps describing the atomic interactions of palbociclib with the targets guided the modelling of 5 seeds in SYBYL®-X. Each seed was docked in the computed CDK6_LBP in LigBuilder® for novel molecular growth. The resultant molecular cohorts were analysed for Lipinski-rule compliance and their LBA (pKd) determined.

Setting: Department of Pharmacy, University of Malta.

Main outcome measures: Comparison of results from Virtual Screening (VS) and *de novo* of which the best candidates are to be further optimised

Result: VS yielded a total of 824 Rule of 3 compliant hits. Eight *de novo* cohorts adhere to Lipinski's Rule of 5. The molecules with the highest binding affinity will be further validated.

Conclusion: The optimal structures will be structurally compared and further optimised.

Reference:

1. Chen P, Lee NV, Hu W, Xu M, Ferre RA, Lam H, et al. Spectrum and Degree of CDK Drug Interactions Predicts Clinical Performance. Mol Cancer Ther. 2016; 15(10):2273-2281.

Design, Identification, Optimisation and Validation of Selective Casein Kinase (CK2) Modulators

Oksana Friggieri

Background: The Casein Kinase 2 (CK2) receptor is highly pleiotropic and a ubiquitously expressed protein kinase. It has been identified as a druggable target in oncology because its inhibition slows down cellular metabolism.[1]

Objectives: To use Virtual Screening (VS) and *de novo* approaches to identify novel Rule of 3 compliant CK2 receptor modulators based on the GO289 scaffold.

Design: A consensus pharmacophore incorporating the critical interactions forged between small molecules GO289 and 4-5-amino-1,3,4-thiadiazol-2-yl as described in PDB crystallographic depositions 6A1C[1] and 3AXW[2] respectively was modelled in LigandScout® and used for VS using ZINCPharmer®. Hit structures were identified, docked into a protomol describing the CK2 receptor binding pocket and ranked in order of affinity. Seeds derived from the GO289 scaffold were created and used for *de novo* growth.

Setting: Department of Pharmacy, University of Malta

Main outcome measures: Establishment of novel CK2 modulators.

Result: The binding affinity (pKd) of GO289 for the CK2 receptor was calculated as 6.19 in x-score v1.3. A total of 108 Rule of 3 compliant hits were identified through VS. The highest total scores were 4.12, 3.51 and 3.46. Twenty-two seeds were created using the *de novo* technique, from which 3 seeds sustained molecular growth.

Conclusion: The selection of the GO289 scaffold as a lead molecule was evidence-based.[1] This study established CK2 modulators to be proposed for further optimisation and validation.

References:

1. Oshima T, Niwa Y, Kuwata K, Srivastava A, Hyoda T, Tsuchiya Y, et al. Cell-based screen identifies a new potent and highly selective CK2 inhibitor for modulation of circadian rhythms and cancer cell growth. Science Advances 2019;5(1):1-15.
2. Hou Z, Nakanishi I, Kinoshita T, Takei Y, Yasue M, Misu R, et al. Structure-based design of novel potent protein kinase CK2 (CK2) inhibitors with phenyl azole scaffolds. J Med Chem. 2012;55(6):2899-2903.

Design, Optimisation and Validation of Novel HSP-70 Modulators

Laurent Joseph Grech

Background: Literature indicates that overexpression of heat shock protein-70 (HSP-70) molecules in triple negative breast cancer (TNBC) exhibit a cytoprotective role preventing apoptosis. Molecular inhibitors targeting different parts of the HSP-70 survival pathway are in clinical trial phases.[1] TNBC manifests the poorest prognosis of breast cancer subtypes due to the lack of targeted therapy.

Objectives: VER-155008, an HSP-70 molecular inhibitor, was used as a scaffold to design molecules with the potential to challenge the HSP-70's tumour protective role. Virtual screening (VS – Ligand-based) and *de novo* (structure-based) drug design tools were used to identify structures capable of similar inhibitory roles.

Design: Using LigandScout®, a consensus pharmacophore was designed superimposing the extracted VER-155008 from PDB crystallographic deposition 4IO8 and the endogenous ligand ADP-468 from PDB crystallographic deposition 3JXU. A protomol was modelled using Sybyl-X®. The ZincPharmer® online database generated 13 Rule of 3 compliant hits.

Setting: Department of Pharmacy, University of Malta

Main outcome measures: 2 novel Lipinski Rule compliant molecular cohorts deriving from VS (n = 7) and *de novo* design (n = 70)

Result: VS yielded 7 lead molecules having a high affinity for HSP-70. In the *de novo* approach, 7 VER-155008 derived seeds sustained novel growth. Topology maps of the highest affinity hits were drawn, with the highest affinity molecules being further optimised.

Conclusion: This study was valuable in the modelling of an average pharmacophoric structure that predisposed to optimal small molecule interaction with the HSP-70 ligand binding pocket. The *de novo* approach retained the critical VER-155008 moieties with novel side-chain incorporation to create novel high efficiency molecules capable of successful target modulation.

Reference:

1. Liao M, Zhang J, Wang G, Wang L, Liu J, Ouyang L et al. Small-Molecule Drug Discovery in TNBC: Current Situation and Future Directions. J Med Chem. 2021; 64(5): 2382-418.

Design and Optimisation of Novel MEK Inhibitors using the Anti-Neoplastic TAK-733 Scaffold as a Lead

Roderick Micallef

Background: The mitogen-activated protein kinase signalling pathway is dysregulated in numerous human malignancies. Mutations exert their oncogenic activity through downstream proteins such as the MEK1/2 protein kinases. TAK-733 is a selective, orally administrable, allosteric MEK1 inhibitor that has had a demonstrable antineoplastic effect.[1]

Objectives: To develop a series of novel MEK inhibitors by using the MEK1 kinase inhibitor TAK-733 scaffold as the lead molecule.

Design: PDB crystallographic deposition 3PP1, describing the bound coordinates of TAK-733 in complex with MEK1, was used in this study. For the virtual screening approach, a consensus pharmacophore was generated based on the optimal conformers of the lead molecule TAK-733 and a second MEK1 kinase inhibitor G799. A series of lead-like molecules were identified, docked into the MEK1 protomol and ranked by affinity. In the *de novo* approach, seed fragments were modelled, docked into the MEK1 bioactive site and allowed molecular growth within this space.

Setting: Department of Pharmacy, University of Malta

Main outcome measures: Molecular modelling, virtual screening and seed generation.

Result: A total of 1121 lead-like and Lipinski Rule compliant molecules were identified through virtual screening. A two-dimensional topology map describing TAK-733 in complex with MEK1 was generated and used to guide the design of seed fragments capable of sustaining molecular growth.

Conclusion: The two molecular cohorts, generated through virtual screening and *de novo* design, will be compared and the optimal structures will be promoted for validation through molecular dynamics simulation studies. The dual approach had the advantage of complementarity. Virtual screening allowed for greater structural innovation while *de novo* design had a higher propensity towards bioactivity.

Reference:

1. Dong Q, Dougan DR, Gong X, Halkowycz P, Jin B, Kanouni T, et al. Discovery of TAK-733, a potent and selective MEK allosteric site inhibitor for the treatment of cancer. Bioorg Med Chem Lett. 2011; 21(5): 1315-9.

Master of Science in Pharmaceutical and Regulatory Sciences

DISSERTATION ABSTRACTS

Accreditation of an Analytical Method for the Determination of Tetrahydrocannabinol in Oil — *Kersty Axisa*

Regulatory Frameworks Relevant to Cannabis for Medicinal Use — *Rachel Grima*

Digitalisation of Quality Management Systems — *Valentina Tabone Borg*

Accreditation of an Analytical Method for the Determination of Tetrahydrocannabinol in Oil

Kersty Axisa

Accreditation of a testing laboratory is proof that a laboratory operates competently and generates valid test results. An 'International Organisation for Standardisation (ISO) 17025 mandatory documentation checklist' was developed, containing a list of documentation required for accreditation of a testing laboratory. A Quality Management System, compliant with the ISO 17025 standard was developed for the analysis of tetrahydrocannabinol in oil. The Quality Management System is comprised of a quality manual, standard operating procedures, risk assessments and policies.

Regulatory Frameworks Relevant to Cannabis for Medicinal Use

Rachel Grima

Medicinal cannabis products without a Marketing Authorisation are nationally regulated. Local requirements and legislations are compared to Portugal, Germany and the Netherlands. A validated questionnaire for medical practitioners who prescribed at least one cannabis-based product and an interview with the highest-prescribers were carried out. The study suggests the need for a centralised laboratory for cannabis testing, a national database detailing cannabis prescribing patterns, price regulation and accredited courses for medical practitioners.

Digitalisation of Quality Management Systems

Valentina Tabone Borg

The digitalisation of quality management systems is compared within European Medicines Regulatory Authorities identifying requirements, benefits, opportunities, and challenges for the implementation of a digitalised system. The method involved a validated survey including a rating score (1-5). Improved decision-making is rated with the highest mean rating score of 4.36, featuring as the most essential opportunity of digitalisation while the characteristic of improved stakeholder-focus scored a low mean rating score of 3.57. Amongst the fundamental technologies that regulatory authorities (N = 29) are likely to adopt, data centre (n=20) and cloud computing (n=19) are preferred over the internet of things (n=6) and Hadoop (n=1).

B.Sc.(Hons) Pharm. Tech.

PROJECT DESCRIPTIONS

Patient Safety Competence Development	*Jesmond Abela*
Radiation Protection Educational and Training Needs for Pharmaceutical Workforce	*Amy Agius*
Cardiac Implantable Medical Devices	*Kimberley Bianchi*
Vaccine Production and Distribution: Feasibility of Setting Up an Industrial Process in Malta	*Paul Immanuel Buhagiar*
Chemical Considerations of Pesticides in Cannabis	*Nicholas Galea*
A Consumer's Perspective on Counterfeiting during the COVID-19 Pandemic	*Owen Sciberras*
Risk Analysis of Transdermal Drug Delivery Systems	*Isabelle Sultana*
Personal Protective Equipment: Supply Chain and Preservation Planning	*Kimberly Vassallo*

Patient Safety Competence Development

Jesmond Abela

The aim of this project is to develop a patient safety competency framework for pharmaceutical staff. The objectives are to explore attitudes and perception of patient safety practices, identify relevant knowledge and skill sets and determine training needs. A questionnaire is designed, validated and disseminated to the pharmaceutical workforce. The deliverable of the project is the proposal of a framework that is patient safety centred providing a point of reference for the training needs to support the continuous evolvement of the workforce.

Radiation Protection Educational and Training Needs for Pharmaceutical Workforce

Amy Agius

This project assesses educational requirements for the handling of radiopharmaceutical drugs. Guidelines on education and training in radiation protection and handling for medical exposures are assessed. Education requirements for working positions at various levels of radiation exposure and operation, namely pharmaceutical scientists, medical physicists, technologists, radiographers, basic scientists, chemists, handling radiopharmaceuticals are reviewed using the requirements of the International Atomic Energy Agency for baseline comparison.

Cardiac Implantable Medical Devices

Kimberley Bianchi

The aims are to identify and compare cardiac implantable electronic devices (CIEDs) available locally and review patient experiences with these devices. CIEDs used at the Cardiac Catheterisation Suite at Mater Dei Hospital are identified and characteristics including battery life, magnetic resonance imaging conditionality, remote monitoring possibility and cost are compared. A literature review on patient perception and experiences regarding CIEDs is conducted. The CIEDs identified include implantable cardioverter defibrillators (n=11), pacemakers (n=10) and implantable loop recorders (n=2).

Vaccine Production and Distribution: Feasibility of Setting Up an Industrial Process in Malta

Paul Immanuel Buhagiar

The lessons learned from the pandemic should make Malta reflect on the benefits, advantages, and challenges in setting up production and/or distribution facilities for vaccines. An evaluation and feasibility of such a process is carried out through a validated interview with stakeholders. The interview investigates economic and scientific aspects, personnel, logistics and equipment, location, country priorities, availability of EU technical and financial support and political and people's appetite.

Chemical Considerations of Pesticides in Cannabis

Nicholas Galea

Pesticide residues can be present in cannabis during growth and processing stages, and presence of these residues can put patients' health at risk. The purpose of this project is to identify the different classes of pesticides used during cultivation of the cannabis plant and compare their physical and chemical properties. Systematic literature review was conducted using the PRISMA scheme. Open access journal articles published between January 2015 and October 2020 were used for the review. Search engines used were Hydi and PubMed.

A Consumer's Perspective on Counterfeiting during the COVID-19 Pandemic

Owen Sciberras

The Covid-19 pandemic introduced a new wave of counterfeit pharmaceutical products which have entered the market. Fear of infection led to increased sales of pharmaceutical products by consumers. A qualitative literature review highlighted information about the current counterfeiting problems and anti-counterfeiting solutions. A questionnaire was disseminated amongst consumers to seek their perspective in the midst of the pandemic. Results were compared to a previous study which analysed the opinions of pharmaceutical workers on counterfeiting.

Risk Analysis of Transdermal Drug Delivery Systems

Isabelle Sultana

The aim is to apply risk analysis concepts to transdermal drug delivery systems (TDDS) and to present a framework for risk considerations in TDDS. Aspects related to 'What can go wrong?' with respect to TDDS were reviewed as part of the risk identification exercise. Keywords used included "TDDS design", "TDDS components", "TDDS risks", "TDDS drug release rate" and "drug release from patch". The literature review focused on journal articles published between 1991 and 2021, using databases such as PubMed. A risk analysis framework for TDDS, prioritising on patient's safety, is proposed.

Personal Protective Equipment: Supply Chain and Preservation Planning

Kimberly Vassallo

Personal Protective Equipment (PPEs) have been pivotal in reducing the risks of healthcare workers contracting COVID-19 and with the surge of demand for PPEs, the global supply chain has failed to keep up with the demand and supply. The aim is to analyse the situation faced during the pandemic in relation to PPE use with the objectives of assessing the risks in relation to local and international perspectives, analysing the supply chains' susceptibility to disruption, and identify long-term solutions for the effective management to reduce the imbalance between demand and supply of PPEs.

B.Sc.(Hons) Pharm. Sci Pharmacy Practice

PROJECT DESCRIPTIONS

39
Fourth Year Students

44
Third Year Students

48
Second Year Students

B.Sc.(Hons) Pharm. Sci Pharmacy Practice

PROJECT DESCRIPTIONS

Fourth Year Students

Ethical principles for a Provision of National Health Service for Medicines	*Aaron Ryan Bartolo*
Clinical Presentation and Impact of Statin Associated Muscle Symptoms	*Jean Claude Calleja*
Educating the Public on the Rational Use of Antibiotics	*Hannah Caruana*
Time and Motion Studies in Community Pharmacy	*Sophie Caruana*
Characterisation of Patients' Requests when Responding to Symptoms	*Miriana Cassar*
Pharmacogenetics and Chronopharmacology in Practice	*Kimberly Catania*
Maltese Medicines Handbook and other Drug Information Sources	*Luca Farrugia*
Identifying the Need for Education and Development of the Pharmaceutical Workforce	*Martina Fitzgerald*
Antiplatelet Therapy Prescribing in Patients with High Bleeding Risk Undergoing Coronary Stenting	*Raquel Formosa*
Deprescribing Proton Pump Inhibitors in the Older Population	*Stephanie Formosa*
Risks of Inappropriate Prescribing in a Community Pharmacy Setting	*Philippa Galea Salomone*
Monitoring Drug Levels in Biological Fluids	*Kimberly Grima*
Quality Control of Cannabis Products	*Julian Mifsud*
Relevance of ISO Standards	*Timothy Portelli*
Quality Systems in Community Pharmacy	*Alessia Stivala*
Competencies Required for a Responsible Person and a Qualified Person	*Alex Xuereb*
CE Marking of Products for Medical Use	*Nicole Xuereb*
Labelling and Language requirements for Product Information for Medicinal Products	*Tiffany Zammit*

Ethical principles for a Provision of National Health Service for Medicines

Aaron Ryan Bartolo

An analysis of the ethical principles governing the National Health System process with respect to selection, sourcing, supply, and patient access for medicines is undertaken. This systematic process will assess qualitatively, via stakeholder focus group discussions, the various scenarios involved with the final objective of identifying gaps in practical ethics.

Clinical Presentation and Impact of Statin Associated Muscle Symptoms

Jean Claude Calleja

The aim is to assess incidence and clinical presentation of statin-associated muscle symptoms (SAMS) and adherence to statin therapy. Patients undergoing coronary angiography and/or percutaneous coronary intervention and are on statin therapy are prospectively recruited by convenience sampling. A data collection form is completed using hospital records and a questionnaire assessing adherence is completed by patient interview. Of the 100 patients recruited (58 atorvastatin, 27 simvastatin, 15 rosuvastatin), 25 claimed to never miss a statin dose. Thirty-one patients self-reported experiencing SAMS.

Educating the Public on the Rational Use of Antibiotics

Hannah Caruana

This study aims to evaluate the perceptions of the general public on antibiotic use. A questionnaire was developed, validated, pilot-tested and disseminated online. A statistically significant difference was obtained when analysing level of education and public knowledge on the correct use of antibiotics ($p=0.01$), and strategies to prevent antibiotic resistance ($p=0.014$), indicating that people with higher levels of education are more knowledgeable. Results obtained are used as guidance to put forward recommendations to encourage the rational use of antibiotics among the local population.

Time and Motion Studies in Community Pharmacy

Sophie Caruana

An observational time and motion study was carried out in a community pharmacy to compile information on distribution of activities carried out by pharmacists. A time-motion framework was developed and validated by running observational studies in other community pharmacies across different districts. Forty hours of data have been collected and results indicated that pharmacists spent most of their time dispensing medication (12.4 hours). The least amount of time was spent having breaks, where this accounted for less than 1 hour (54 minutes) in total.

Characterisation of Patients' Requests when Responding to Symptoms

Miriana Cassar

Evaluation of patients presenting with symptoms or requesting a self-care product and pharmacist intervention was undertaken by carrying out non-participant observational studies in ten community pharmacies. A total of 154 requests were observed. Requests for the skin (39), respiratory (30), digestive (25) and musculoskeletal (18) systems were most frequent. Out of 107 occurrences where pharmacists gave advice, pharmacological advice (73) was the most frequent. From 117 instances where pharmacists asked questions, the most frequently asked question relates to elaboration of symptoms (75).

Pharmacogenetics and Chronopharmacology in Practice

Kimberly Catania

The knowledge and attitudes towards pharmacogenetic and chronopharmacology principles of 125 healthcare professionals (56 pharmacists (PH) and 69 medical practitioners (MP)) is obtained by means of a questionnaire. Forty-seven PH (84%) and 55 MP (80%) agreed that patient counselling on drugs with a potential for genetic and/or chronopharmacological variability are important services. Respondents express views that there are inadequate opportunities to develop professionalism in both subjects but 44 PH (79%) and 54 MP (78%) are interested in improving their knowledge, if given the opportunity.

Maltese Medicines Handbook and other Drug Information Sources

Luca Farrugia

The study analyses use of drug information (DI) sources by pharmacists in a patient care setting. A survey was disseminated to 68 pharmacies around Malta to understand pharmacists' perception of their knowledge about medicinal products and need for use of DI sources. Specific DI resources were evaluated for convenience of use and availability at the pharmacy. Method of administration and posology, indication and prices of product were the main inquiries from patients. The British National Formulary and online databases were the most used DI resources by the community pharmacists.

Identifying the Need for Education and Development of the Pharmaceutical Workforce

Martina Fitzgerald

The project aims to identify the educational and professional development needs for the pharmaceutical workforce in Malta. A literature review is conducted to identify international frameworks targeting the educational and professional aspect. Two questionnaires capturing the expectations of pharmacists and pharmacy students were compiled based on the International Federation of Pharmacy 21 workforce goals. The questionnaires were validated by an expert panel and disseminated electronically. A framework is developed based on the study findings.

Antiplatelet Therapy Prescribing in Patients with High Bleeding Risk Undergoing Coronary Stenting

Raquel Formosa

The aim is to assess bleeding risk (BR) and antiplatelet therapy in patients undergoing percutaneous coronary intervention (PCI). Patients undergoing PCI are recruited prospectively, BR is calculated with PRECISE-DAPT score, patients with moderate/high BR are discussed with cardiologist, and 12-month follow-up for ischaemic and bleeding outcomes is undertaken. Of the 136 patients recruited (111 male, mean age 66 years), BR was high (42%), moderate (26%) or low (32%). Eighty-five cases of moderate/high BR were discussed, with action taken to reduce antiplatelet therapy duration in 34 patients.

Deprescribing Proton Pump Inhibitors in the Older Population

Stephanie Formosa

This study assesses appropriateness of prescribing proton pump inhibitors (PPIs) in the older population. A retrospective review was conducted at Karin Grech Hospital (KGH) using Pharmacy Patient Profiles of patients ≥ 65 years on PPIs. Prescribing practices and pharmacist intervention data was recorded. During KGH admission, appropriateness increased from 37% to 73%. Pharmacist intervention documentation of inappropriate prescriptions was 41%. A re-audit will assess whether appropriateness of PPI prescriptions and documentation improves after promoting rational use to the Clinical Pharmacy Team.

Risks of Inappropriate Prescribing in a Community Pharmacy Setting

Philippa Galea Salomone

The aims are to assess the frequency and nature of medication errors, by retrospectively analysing medication errors through prescriptions presented at 6 community pharmacies, chosen by convenience sampling, and by interviewing 20 community pharmacists. A medication error sheet was developed and validated. Sixty-two prescriptions were analysed with the most common prescription error being "wrong quantity and frequency of medication prescribed" (n=17). Lack of communication between professionals was named by pharmacists (n=18) as one of the main reasons behind prescription errors.

Monitoring Drug Levels in Biological Fluids

Kimberly Grima

The study aims to propose a facility where analysis of drugs of abuse can be carried out for forensic purposes. Visits to a clinical toxicology laboratory were held where instrumentation, protocols and methods of analysis for determination of drugs of abuse were identified and interviews with experts working in clinical toxicology were conducted. A list of instrumentation and equipment used for analysis of drugs of abuse was drawn and focus group discussions with qualified personnel to assess the costs, needs and requirements for establishing a forensic toxicology lab are held.

Quality Control of Cannabis Products

Julian Mifsud

The study aims to compare Quality Control tests and Good Manufacturing Practices related to the production of medicinal cannabis (MC) in different countries. Regulatory frameworks set up by the 19 European Union countries where MC is legalised were identified. Focus is placed on tests required to determine active cannabinoids, terpenes, mycotoxins, pesticides and heavy metals in cannabis. The study could help in further developing the current quality control measures for MC followed by local and foreign stakeholders.

Relevance of ISO Standards

Timothy Portelli

A critical review of ISO standards relevant to the accreditation for the pharmaceutical supply chain is carried out. The methodology used includes validated questionnaires disseminated to stakeholders. The questionnaire was sent to 125 organizations, and 19 responses were received, with 17 organizations being ISO certified. The positive attribute that ISO certification promotes in certified organizations is customer satisfaction. In non-certified organizations, "customers not requiring ISO certified goods and services" was named as the limiting factor when pursuing ISO certification.

Quality Systems in Community Pharmacy

Alessia Stivala

Four quality aspects, namely care, safety, improvement, and services were identified to develop a community pharmacy quality framework (CPQF) and relevant standard operating procedures (SOP's). These were validated through a focus group. A stepwise thematic analysis was executed to code the qualitative data obtained. The general themes were then grouped into sub-themes. The dimensions identified from the focus group were the framework concept, care, safety, improvement, services and presentation and dissemination. These were used to characterise the development of the CPQF and four SOP's.

Competencies Required for a Responsible Person and a Qualified Person

Alex Xuereb

The role of a responsible person (RP) and a qualified person (QP) require defined competencies to be carried out effectively. These competencies are determined by dissemination of a validated questionnaire to working QPs and RPs, which asks respondents to perform a competency self-evaluation in areas of soft, management and scientific/quality management skills. Interviews are carried out with stakeholders at the Malta Medicines Authority in order to determine the point of view of the regulators on the competencies required for both roles. Possible frameworks for continuous professional development or tertiary education courses are discussed.

CE Marking of Products for Medical Use

Nicole Xuereb

The project focuses on defining CE marking of medical devices and the requirements to affix a CE mark. The situation of CE marking in a community pharmacy setting was evaluated by analysing all the medical devices in terms of the type of device and how the mark was obtained. The devices were classified into five tables. Opinions on CE marking were gathered via dissemination of a questionnaire to pharmacists, physicians, medical representatives and clients in the pharmacy. Research on CE marking of combination products was done and the CE marking process was compared to the FDA process.

Labelling and Language requirements for Product Information for Medicinal Products

Tiffany Zammit

A critical review of labelling and packaging guidelines is carried out. Products accessible locally are assessed for problems associated with the need for over-labelling. The advantages and limitations afforded by the system or any adjustment to the original pack are analysed by market surveillance. Two validated questionnaires, one for pharmacists and one for the public, were developed to gather their views on over-labelling. Both the general public (44.3%, n=31), and pharmacists (51.5%, n=17) stated that an over-labelled product was acceptable or somewhat acceptable.

B.Sc.(Hons) Pharm. Sci Pharmacy Practice

PROJECT DESCRIPTIONS

Third Year Students

Advances in Veterinary Medicines	*Zinah Abdaki*
Pharmacist Empowerment for a Positive Self-Care Climate	*Surma Ali*
Vaccinations in Rheumatology	*Jonathan Attard*
Action in the Evolvement of Vaccination in Pharmacy	*Tamara Attard*
Determination of Steroidal pKa	*Giulia Baluci*
Determination of CBD and THC	*Neve Borg*
Pharmacogenetic Implications of Proton Pump Inhibitors	*Leanne Borg Gauci*
Risk Aspects in Off-Label Drug Therapy	*Martina Buhagiar*
Risks in Self-Medication	*Miguel Camilleri*
Technological Aspects of Drug Delivery	*Matthew J. Cassar*
Antithrombotic Therapy After Transcatheter Aortic Valve Implantation	*Samuel Cremona*
Toxicity of Vaccines	*Kristina Filletti*
Green Pharmaceutical Practices	*Christine Gauci*
Digital Health in Cardiology	*Elena Mirone*
Pesticides in Cannabis	*Audrey Muscat*
Science, Myths and Realities surrounding COVID-19 Vaccine	*Joseph Scerri*
Pharmacist Intervention in High-Risk Medications	*Nicole Schembri*
The Cannabis Pharmaceutical Industry	*Yasmine Smaoui*
Deprescribing Benzodiazepines in Older patients	*Keith Joseph Tabone*
Market Entry and Competition: Biologicals and Biosimilars	*Sarah Xuereb*
Developing a Digitally-Enabled Pharmaceutical Workforce	*Amber Zerafa*

Advances in Veterinary Medicines

Zinah Abdaki

Veterinary medicines may lack robustness for ensuring safety and efficacy. Field research is conducted assessing the compliance of veterinary medicines available in Maltese legislations. A gap analysis of veterinary medicines legislation practice including the applications of the new EU regulations is accomplished to suggest compliance and improvements such as ways to reduce antimicrobial resistance.

Pharmacist Empowerment for a Positive Self-Care Climate

Surma Ali

Pharmacists are responsible for maintaining standards in self-care. The aim is to provide frameworks to empower pharmacists to contribute to a positive self-care climate. Evidence of pharmacists' interventions is compiled and a framework proposed. Focus groups capturing individuals representing patients are held to explore patient needs and expectations from a pharmacist self-care service.

Vaccinations in Rheumatology

Jonathan Attard

Patients suffering from autoimmune inflammatory rheumatic diseases (AIIRD) are subject to increased risk of co-morbidities with some being vaccine-preventable. These complications can compromise patients' health and also their quality of life. Health care professionals from different specialities are asked for their recommendations via questionnaires in order to provide structured information to AIIRD patients.

Action in the Evolvement of Vaccination in Pharmacy

Tamara Attard

This study aims to assess pharmacy student training in the preparation and administration of vaccines, to assess drivers for potential pharmacists-led vaccination services in Malta and to identify pharmaceutical vaccine strategies. The educational programme to achieve vaccinology competences is evaluated and pharmacists and patients' views are studied.

Determination of Steroidal pKa

Giulia Baluci

pKa impacts drug bioavailability and absorbance. The aim of this project is to develop a method for steroidal pKa determination using High Performance Liquid Chromatography with a UV-Vis detector and compared to potentiometric titration. Mobile phases with different buffers are used to mimic *in vivo* conditions. Results obtained using the two methods are compared to the theoretical pKa.

Determination of CBD and THC

Neve Borg

Analytical methods for determination of cannabinoids in biological fluids are compared through systematic literature review. Method development and validation involving sample preparation and analysis of cannabinoids in blood using High Performance Liquid Chromatography are carried out. Method is applied to determine quantity and identity of cannabinoids.

Pharmacogenetic Implications of Proton Pump Inhibitors

Leanne Borg Gauci

The aim is to investigate the pharmacogenetic implications of proton pump inhibitor (PPI) therapy. A case-control study design is adopted to compare patients demonstrating PPI therapy resistance and patients who are responsive to PPI therapy in relation to CYP2C19 genetic polymorphisms. The association between CYP2C19 genotype and side-effects of PPIs is explored.

Risk Aspects in Off-Label Drug Therapy

Martina Buhagiar

The aim is to analyse the need for off-label drug therapy and evaluate the benefits and risks from the perspective of different stakeholders, including physicians, pharmacists, regulatory authorities and patients through interviews and focus groups discussions. A documentation sheet for pharmacists, emphasising strategies for the safe dispensing of off-label drugs is developed and validated.

Risks in Self-Medication

Miguel Camilleri

The aim of this project is to determine the prevalence and factors associated with self-medication practices among the general public by disseminating a pre-validated questionnaire online. A focus group with general practitioners and pharmacists is set up to analyse results achieved and to gather further data for the compilation of an information leaflet intended for the general public.

Technological Aspects of Drug Delivery

Matthew J. Cassar

The project aims to evaluate the evolution of drug delivery technology and smart devices over the years. A systematic literature review is conducted using the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) method. Trends in drug delivery methodologies and technology in the pipeline are identified.

Antithrombotic Therapy After Transcatheter Aortic Valve Implantation

Samuel Cremona

Thromboembolic and bleeding complications negatively impact prognosis after transcatheter aortic valve implantation (TAVI). The aim is to review patients undergoing a TAVI procedure. A retrospective study design is adopted to analyse antithrombotic therapy prescribed and patient follow-up at 1, 3, 6 and 12 months post-TAVI to evaluate mortality, cardiovascular and bleeding outcomes.

Toxicity of Vaccines

Kristina Filletti

Systematic literature review is carried out to analyse toxic effects of vaccines, including Covid-19, influenza and varicella-zoster vaccines. Data is extracted from open-access peer reviewed journal articles. A tool to identify toxic effects of vaccines is developed and validated for use by healthcare professionals.

Green Pharmaceutical Practices

Christine Gauci

Application of green practices minimises the environmental impact of pharmaceutical related activities. This project aims to evaluate application of these practices in industry including waste management and solvents use. Practices implemented in the local scenario are evaluated using a questionnaire. Lacunas are identified and suggestions for improvement are put forward.

Digital Health in Cardiology

Elena Mirone

The project aims to assess the impact of remote monitoring in heart failure. Heart failure patients with a cardiac resynchronisation therapy or implantable cardioverter defibrillator device with (Cases) and without (Controls) remote monitoring of intrathoracic impedance and fluid status are compared in terms of therapy adjustments, biomarkers, overall patient status, clinical events and outcomes.

Pesticides in Cannabis

Audrey Muscat

Literature review on pesticides used in herbal medicinal products and cannabis for medicinal use specifically diazinon, carbamate and bifenthrin is conducted. Regulations and analytical methods used to determine pesticides including gas chromatography, high- and ultra-high-performance liquid chromatography are compared. Guidelines for use of pesticides in medicinal cannabis are proposed.

Science, Myths and Realities surrounding COVID-19 Vaccine

Joseph Scerri

The rapid evaluation of COVID-19 vaccines resulting in limited authorisation elucidated a discussion on the scientific aspects surrounding the safety aspects behind vaccine use with the evolvement of myths as distinct from realities. The literature and stakeholder views are critically evaluated to establish the science behind COVID-19 vaccine use and distinguish between myths and realities.

Pharmacist Intervention in High-Risk Medications

Nicole Schembri

The aims are to evaluate whether high-risk medications are treated differently to other drugs during dispensing and to assess guidelines for pharmacists dispensing high-risk medications. A documentation sheet (HiRisk) comprising of four sections to be completed by the researcher during observational studies carried out at different community pharmacies, was developed and validated.

The Cannabis Pharmaceutical Industry

Yasmine Smaoui

The pathways of medical cannabis from regulation to patient use, keeping a patient-centred focus, are followed to identify the benefits of cannabis for therapeutic use. An industry-based study is carried out to investigate the regulatory robustness required, the quality and safety aspects within the limits of production technology and sustainability. Evidence based data on the subject is evaluated.

Deprescribing Benzodiazepines in Older patients

Keith Joseph Tabone

Long term use of benzodiazepines is associated with several risks, especially in older patients. Overuse is common in the older population and deprescribing is recommended. Deprescribing tools are available and have been shown to facilitate the withdrawal process. Retrospective and prospective studies are conducted to assess the degree of deprescribing and the process adopted.

Market Entry and Competition: Biologicals and Biosimilars

Sarah Xuereb

Evaluation of the situation governing biologicals and biosimilars, using qualitative methodology to understand the concept and the challenges being faced internationally and locally with respect to policy, operational activity and affordability is undertaken. Validation of the transcribed data derived from the selected structured focus group to publish a strategy in line with the EU directives is carried out.

Developing a Digitally-Enabled Pharmaceutical Workforce

Amber Zerafa

Digitalisation in pharmaceutical services has accelerated due to the pandemic. Two surveys are carried out, one targeted for pharmacists to identify their preparedness and needs, and the other is for patients to understand their awareness with regard to digitalisation in pharmacy. An educational framework for competencies development is proposed to meet patient needs.

B.Sc.(Hons) Pharm. Sci Pharmacy Practice

PROJECT DESCRIPTIONS

Second Year Students

Crisis Management and Medicines Shortages	*Julia Agius*
Community Pharmacists Competences in Medication Risk Management	*Andrew Aquilina*
Community Pharmacists Scope of Practice	*Evan Bonello*
Concepts of Collaboration between Pharmaceutical Industry and Education	*Matthias Borg*
Pharmaceutical Services Digitalisation through myHealth	*Katarina Maria Bugeja*
Ethics Research in Pharmacy	*Gabriel Busuttil*
Harm Reduction associated with use of Cannabis	*Rachel Callus*
Clinical Trials Regulation in Europe	*Bettina Camilleri*
Patient Participation in Pharmaceutical Care Plans	*Maria Martina Cutajar*
Green Pharmaceutical Practices in Hospital	*Justine Decelis*
Pharmacist-led education in Inflammatory Bowel Disease	*Aisha Diyab*
Medical Aids: Regulations and Entitlement	*Jade Marie Falzon*
Community Pharmacy-based Point-of-care Testing	*Natalia Ferris*
Evolvements in the Management of Cardiovascular Disease	*Yosef Jarboua*
Analysis of Cannabinoids in Edibles and Cosmetics	*Michael Laferla*
Challenges related to Extraction of Cannabinoids from Different Matrices	*Michaela Mifsud*
Pharma Digitalisation: Risks and Opportunities	*Gianluca Muscat*
Green Practices in Pharmaceutical Distribution	*Maria Portelli*
Emergency Preparedness in Pharmacy: Lessons learned from the COVID-19 Pandemic	*Kathlene Saydon*
Advances in the Management of Dyslipidaemia	*Shanice Spiteri*
Medical Devices: Perception and Awareness	*Etienne Xiberras*
Anticholinergic Burden in Older Patients	*Kristy Xuereb*
Risk Management in Community Pharmacy Practice	*Paula Zammit*

Crisis Management and Medicines Shortages

Julia Agius

The pandemic and Brexit affected medicinal supply, resulting in medicine shortages. The aim is to carry out an investigation of how emergency medicinal supply was performed in Malta, considering risks involved, taking feedback from importing agents, pharmacists and stakeholders.

Community Pharmacists Competences in Medication Risk Management

Andrew Aquilina

The aim is to identify gaps in community pharmacists' current competence in medication risk management during routine dispensing, through questionnaires and focus groups. Recommendations to reduce these gaps are put forward by means of a 'competency framework' for pharmacists.

Community Pharmacists Scope of Practice

Evan Bonello

Community pharmacy practice evolved to bring to the forefront the patient focus and led to the development of clinical pharmacy practice. The objective is to develop community pharmacists scope of practice reflecting the clinical input by the pharmacist in the community setting.

Concepts of Collaboration between Pharmaceutical Industry and Education

Matthias Borg

Collaboration between the pharmaceutical industry and tertiary education addresses workforce and research needs of the industry. The aim is to identify areas of collaboration between the education sector and pharmaceutical industry to address unmet needs through interviews.

Pharmaceutical Services Digitalisation through myHealth

Katarina Maria Bugeja

The aim is to understand current extent of use of the digital portal myHealth, identify healthcare experts' views on its benefits, and evaluate its potential use to facilitate provision of pharmaceutical services. Limitations, such as inequity in patient access, are considered.

Ethics Research in Pharmacy

Gabriel Busuttil

The ethics approval for research in pharmacy is obtained after filling a form satisfying ethical and data protection requirements. Guidelines and presentations are prepared to help applicants through a smooth ethics approval protocol by means of analysing present challenges.

Harm Reduction associated with use of Cannabis

Rachel Callus

Harm reduction includes health policies and procedures intended to reduce negative social and physical impacts related to drug abuse. The study aims to assess national and international policies and procedures and present proposals related to harm reduction with the use of cannabis.

Clinical Trials Regulation in Europe

Bettina Camilleri

The challenges and opportunities presented by European directives on clinical trials are investigated. Stakeholders, such as The Malta Medicines Authority, Malta Enterprise and health professionals are identified and ways to attract the establishment of clinical trials are investigated.

Patient Participation in Pharmaceutical Care Plans

Maria Martina Cutajar

The objective is to design a pharmaceutical care plan template that could be used to incorporate patient participation in care plan development. Extent of inclusion of patients and their knowledge about care plan is studied. Feasibility of patient participation is assessed.

Green Pharmaceutical Practices in Hospital

Justine Decelis

Green practices address the impact of pharmaceutical related activities on the environment. The aim of this project is to evaluate green practices in hospital. A questionnaire is developed and distributed to pharmacists to evaluate knowledge and use of green practices.

Pharmacist-led education in Inflammatory Bowel Disease

Aisha Diyab

Pharmacists can contribute to the management of inflammatory bowel disease (IBD) as part of a multidisciplinary team, particularly in counselling on medications and adherence. The aim is to develop, implement and evaluate pharmacist-led education interventions in IBD patients.

Medical Aids: Regulations and Entitlement

Jade Marie Falzon

The National Health System procures and supplies patient treatment according to entitlement policies. Through qualitative analysis the aim is to analyse the current medical aids scenario by identifying gaps, and documenting the process for practice harmonisation.

Community Pharmacy-based Point-of-care Testing

Natalia Ferris

Extent of point-of-care (POCT) testing offered in community pharmacies is analysed. Challenges in implementing POCT are identified considering devices used, feasibility and pharmacoeconomics. Opportunities presented by POCT to support pharmacist interventions are examined.

Evolvements in the Management of Cardiovascular Disease

Yosef Jarboua

Sodium-glucose cotransporter-2 inhibitors and glucagon-like peptide-1 receptor agonists are a breakthrough in cardiovascular pharmacotherapy, providing a new therapy approach to improve outcomes. The aim is to assess clinical outcomes in cardiac patients prescribed these drugs.

Analysis of Cannabinoids in Edibles and Cosmetics

Michael Laferla

Cannabinoids are active compounds that can exert physiological effects. They can be found in drinks and food products and cosmetics like soaps and creams. This project aims to develop and validate an analytical method for the determination of cannabinoids in these products.

Challenges related to Extraction of Cannabinoids from Different Matrices

Michaela Mifsud

Cannabinoids are active components of cannabis, which may be found in different matrices such as plant material, biological fluids, oils, and fats. The project aims to identify challenges related to the extraction of cannabinoids from different matrices.

Pharma Digitalisation: Risks and Opportunities

Gianluca Muscat

Digitalisation is changing the healthcare industry, with the pharma industry being no exception. The aim is to assess the risks and opportunities of pharma digitalisation ecosystems through interviews with stakeholders, such as regulatory agencies and pharmaceutical industries.

Green Practices in Pharmaceutical Distribution

Maria Portelli

The negative impact of pharmaceutical distribution is mitigated using green practices. The aim of this project is to evaluate green practices in pharmaceutical distribution. A questionnaire is disseminated to distributers to evaluate knowledge and use of green practices.

Emergency Preparedness in Pharmacy: Lessons learned from the COVID-19 Pandemic

Kathlene Saydon

Lessons learned from the pandemic are used to elucidate preparedness for future crises, as related to pharmacy. Lessons that shed light on possible changes in pharmacy practice that benefit patients and the profession are investigated through interviews and fora with stakeholders.

Advances in the Management of Dyslipidaemia

Shanice Spiteri

Evolvements in drugs for lipid management are changing clinical practice. The study aims to review recent advances in dyslipidaemia management and compare outcomes in patients prescribed conventional statin monotherapy and novel therapies including ezetimibe and PCSK9 inhibitors.

Medical Devices: Perception and Awareness

Etienne Xiberras

The aim of this project is to determine the perception and awareness of medical devices in Malta. Questionnaires are developed, validated by experts, and disseminated to patients, healthcare professionals and medical device industry stakeholders.

Anticholinergic Burden in Older Patients

Kristy Xuereb

Anticholinergic burden is a strong predictor of cognitive and physical decline in older persons, causing an increased risk of falls, dementia, urinary retention, constipation and mortality. Reduction in anticholinergic burden prevents adverse outcomes in this patient population.

Risk Management in Community Pharmacy Practice

Paula Zammit

Pharmacy risk factors impose a major threat to healthcare outcomes. This study aims to evaluate community pharmacy risks and to investigate the risk minimisation strategies followed in such scenarios through observational studies and questionnaires for community pharmacists.

B.Sc.(Hons) Pharm. Sci Computational Chemistry

PROJECT DESCRIPTIONS

53
Fourth Year Students

57
Third Year Students

61
Second Year Students

B.Sc.(Hons) Pharm. Sci Computational Chemistry

PROJECT DESCRIPTIONS

Fourth Year Students

Drug Design at the Protein Tyrosine Phosphatase (PTP) enzyme	*Aaron Ryan Bartolo*
Drug Design at the Cardiac Myosin ATPase Receptor	*Jean Claude Calleja*
Drug Design at the Peptidylarginine Deiminase Enzyme	*Hannah Caruana*
Drug Design at DNA GYRASE B Subunit for the Potential Treatment of *Mycobacterium tuberculosis*	*Sophie Caruana*
Drug Design at M1 Muscarinic Acetylcholine Receptor using Anisodamine as a Lead	*Miriana Cassar*
Drug Design at the Calcium Adenosine Triphosphatase Isoform 2a (SERCA2a) Receptor – A Novel Drug Target for the Treatment of Heart Failure	*Kimberly Catania*
Drug design at RAS Kinase using Diazepinomicin as a lead	*Luca Farrugia*
Investigating the Maltanediol scaffold for utility at targets unrelated to bone metabolism	*Martina Fitzgerald*
Drug Design at the TGF-β Receptor using SRI 011381 as a Lead Molecule	*Raquel Formosa*
Drug Design at the Phosphoinositide 3-Kinase (PI3K) Enzyme	*Stephanie Formosa*
Drug Design at the KRAS(G12C) mutant	*Philippa Galea Salomone*
Drug design at Glycogen Synthase Kinase 3 enzyme using the Thiazolidine Tideglusib as a lead	*Kimberly Grima*
Drug Design at DNA Topoisomerase I using Salvicine as a lead	*Julian Mifsud*
Drug Design at the Glucagon-Like Peptide-1 Receptor	*Alessia Stivala*
Drug Design at the Thioredoxin Glutathione Reductase Enzyme-a Novel Target for the Management of Schistosomiasis	*Alex Xuereb*
Drug Design at the Glucagon Receptor	*Timothy Portelli*
Drug Design at the C-terminal Binding Protein (CtBP)	*Nicole Xuereb*
The Rational Design of Novel CU-CPT8M Analogs to Modulate the Toll-Like Receptor 8 (TLR8) Dimer	*Tiffany Zammit*

Drug Design at the Protein Tyrosine Phosphatase (PTP) enzyme

Aaron Ryan Bartolo

PTP-1B is an intracellular enzyme implicated in the negative regulation of insulin signalling. Experimental antagonist DPM-1001 was used to probe its ligand binding pocket and its pharmacophoric structure as modelled in LigandScout® was used to identify structurally diverse Lipinski Rule compliant hit structures from the ZincPharmer database. *de novo* design will also be carried out using DPM-1001 fragments. The highest affinity structures identified through each approach will be validated and optimised.

Drug Design at the Cardiac Myosin ATPase Receptor

Jean Claude Calleja

High-throughput screening of the cardiac myosin ATPase yielded a novel molecule- omecamtivmecarbil, that favourably alters the actin-myosin interaction configuration increasing cardiac contractility. Its scaffold was used to model its pharmacophore in LigandScout® to be used as a query in the ZincPharmer database for the identification of Lipinski Rule compliant hits. These were ranked in order of binding affinity after docking into a cardiac myosin ATPase protomol modelled in Sybyl-X®. The omecamtivmecarbil scaffold will also be used to model high efficiency fragments for *de novo* growth.

Drug Design at the Peptidylarginine Deiminase Enzyme

Hannah Caruana

Inhibition of Peptidylarginine deiminases can mitigate the effects of ischaemia in neonates. The structures of experimental 4SC SC100288 and 4SC SC97362 were used to model a consensus pharmacophore. This was read into the ZincPharmer database for hit structure identification. The Lipinski Rule compliant hits were docked into a modelled protomol for binding affinity estimation. The scaffolds of the lead molecules will also be used for fragment-based design. The highest affinity structures obtained through each approach will be further validated.

Drug Design at DNA GYRASE B Subunit for the Potential Treatment of *Mycobacterium tuberculosis*

Sophie Caruana

pdb crystallographic deposition 4DUH describing the bound coordinates of DNA gyrase subunit B bound to a benzoic acid small molecule inhibitor guided this study. A pharmacophore describing the inhibitor was modelled in LigandScout® and used for virtual screening in ZincPharmer. High affinity Lipinski Rule compliant hits were identified after docking into a modelled protomol. High efficiency molecular fragments will be modelled and used for *de novo* molecular design. The highest affinity Lipinski Rule compliant molecules will be selected for further validation and optimization.

Drug Design at M1 Muscarinic Acetylcholine Receptor using Anisodamine as a Lead

Miriana Cassar

Anti-muscarinic drugs have a number of pharmacological uses including treatment of circulatory disorders. The pharmacophoric structure of the anti-muscarinic anisodamine was modelled in LigandScout® and the read into ZincPharmer for hit identification. The Lipinski Rule compliant hits were docked into the M1 protomol and the highest affinity structures identified. Fragment based *de novo* techniques will be used in parallel and the optimal structures will be selected for further validation.

Drug Design at the Calcium Adenosine Triphosphatase Isoform 2a (SERCA2a) Receptor – A Novel Drug Target for the Treatment of Heart Failure

Kimberly Catania

Heart failure patients exhibit decreased sarcoplasmic reticulum calcium content due to decreased SERCA2a activity. Istaroxime is a novel agonist. Its critical interactions with its target were modelled and its pharmacophoric structure was elucidated in LigandScout®. On its basis virtual screening was carried out using the ZincPharmer database. The Lipinski-Rule compliant structures were docked into a modelled SERCA2a protomol and their affinity calculated. *de novo* design will be carried out using the Istaroxime scaffold. The highest affinity structures from each approach will be further validated.

Drug design at RAS Kinase using Diazepinomicin as a lead

Luca Farrugia

Diazepinomicin is a potent inhibitor of the RAS/RAF/MAPK signalling pathway with potential antineoplastic activity. Its interactions with RAS Kinase were used to model a general pharmacophore in LigandScout® for use in virtual screening at the ZincPharmer database. A RAS Kinase protomol was modelled in Sybyl-X and the Lipinski Rule compliant hits were docked and ranked in order of binding affinity. Fragments derived from the diazepinomicin scaffold will be modelled and used for *de novo* modelling. The optimal structures resulting from this dual approach will be further optimised.

Investigating the Maltanediol scaffold for utility at targets unrelated to bone metabolism

Martina Fitzgerald

The biological target for Maltanedienol, involved in endogenous calcium deposition, is unknown. A bio-informatics based approach identified potential targets for this molecule unrelated to calcium metabolism. Maltanedienol was docked into their ligand binding pockets and the highest affinity complexes identified. Novel high affinity Lipinski Rule compliant modulators were modelled using a *de novo* approach. These structures will be used as leads for their respective targets and will be validated and optimised to establish a more complete understanding of the biological role of Maltanedienol.

Drug Design at the TGF-β Receptor using SRI 011381 as a Lead Molecule

Raquel Formosa

Dementia has recently been associated with increased build-up of serum albumin to TGF-β receptors at the blood-brain barrier. This study utilised SRI-011381, a TGF-β receptor antagonist, as a lead to model a general pharmacophore in LigandScout®. This was used as a query structure in a virtual screening approach at the ZincPharmer® database. Docking into a modelled protomol identified high affinity Lipinski Rule compliant hit structures. In a *de novo* approach, SRI-011381 based fragments will be used to develop novel drug-like analogs suitable for further optimisation.

Drug Design at the Phosphoinositide 3-Kinase (PI3K) Enzyme

Stephanie Formosa

PI3K inhibitors cause apoptosis and inhibit malignant cell proliferation. The PI3K inhibitor Omipalisib was used as lead molecule in this study. Its pharmacophore was modelled and used in a Virtual Screening approach using LigandScout® to identify Lipinski Rule compliant hit structures. The highest affinity molecules as identified through docking into the PI3K protomol were selected. A fragment-based *de novo* approach based on the Omipalisib scaffold will also be adopted to model novel PI3K modulators. The results from each approach will be compared, validated and optimised.

Drug Design at the KRAS(G12C) mutant

Philippa Galea Salomone

Cancer promoting RAS proteins were considered undruggable since their smooth surfaces offer no obvious pockets to target with a drug. The G12C mutant, has recently been shown to be druggable and was probed in this study. An average or consensus pharmacophore was modelled in LigandScout® and Lipinski Rule compliant ligands of high affinity were identified from the ZincPharmer database. They were docked into a modelled protomol and their binding affinity calculated. Fragment based *de novo* design will also be attempted and the highest affinity structures obtained from each approach identified.

Drug design at Glycogen Synthase Kinase 3 enzyme using the Thiazolidine Tideglusib as a lead

Kimberly Grima

Tideglusib is a selective glycogen synthase kinase 3 inhibitor with potential in the management of Alzheimer's disease. Its interactions with its receptor were used in pharmacophore modelling in LigandScout® which was used, in turn, to identify Lipinski Rule compliant hits using ZincPharmer. The hits were docked into a protomol for binding affinity calculation. The Tideglusib scaffold was used for high efficiency fragment design and novel structures were modelled using a *de novo* approach. The resulting molecular cohorts will be used to propose structures with analogous modulatory ability.

Drug Design at DNA Topoisomerase I using Salvicine as a lead

Julian Mifsud

DNA topoisomerase I antagonism is associated with tumour proliferation inhibition. Salvicine, the active principle of Salvia prionitis has *in vivo* inhibitory effects. It was used as a lead in this study in which, through a virtual screening approach, its pharmacophore was modelled in LigandScout® and used in ZincPharmer to identify Lipinski Rule compliant hits. The highest affinity hit structures, as identified after docking with a modelled receptor protomol, will be compared with their counterparts identified through a *de novo* approach.

Drug Design at the Glucagon-Like Peptide-1 Receptor

Alessia Stivala

Glucagon-like peptide-1 (GLP-1) agonism has been shown to exert a hypoglycaemic effect. This study modelled the GLP-1 receptor agonist TT-OAD2 to identify its pharmacophoric features. A consensus pharmacophore was modelled in LigandScout® and imported into ZINCPharmer. No Lipinski rule compliant hits were obtained. Conformational analysis was used to identify the optimal conformer within the GLP-1 ligand binding pocket. 20 conformers were generated using SYBYL-X®. The optimal conformer was determined using the ligand binding energy (kcal/mol) and ligand binding affinity (pKd).

Drug Design at the Thioredoxin Glutathione Reductase Enzyme-a Novel Target for the Management of Schistosomiasis

Alex Xuereb

Thioredoxin glutathione reductase enzymes in Schistosoma mansoni are targets for human schistosomiasis treatment. PDB crystallographic depositions of 2-[4-(4-azanylbutyl)piperazin-1-yl]ethanol and 2-[4-(2-hydroxyethyl)piperazin-1-yl]ethanol in complex with the TGR inhibitor scaffold were used to model a consensus pharmacophore in LigandScout® which was used to identify high potential Lipinski Rule compliant hit molecules using ZincPharmer. Their binding affinity was calculated in Sybyl-X® after docking in a modelled protomol. A *de novo* approach will also be adopted.

Drug Design at the Glucagon Receptor

Timothy Portelli

The glucagon receptor is a hypoglycaemic target. Its inhibition lowers hepatic glucose production. The novel glucagon receptor inhibitor LGD-6972 was used to model its pharmacophore in LigandScout® on the basis of which Lipinski Rule compliant hit structures were identified in ZincPharmer. Subsequent to docking into a protomol describing the glucagon receptor ligand binding pocket, the highest affinity Lipinski Rule compliant hits were identified. High efficiency fragments based on the LGD-6972 scaffold will be modelled and used in a *de novo* approach. The resulting cohorts will be optimised.

Drug Design at the C-terminal Binding Protein (CtBP)

Nicole Xuereb

CtBPs inhibit apoptosis and promote metastasis. Inhibitors could consequently play an important role in cancer management. In this study, crystallographically resolved CtBP inhibitors were used to model a representative pharmacophore in LigandScout® on whose basis virtual screening was carried out using ZincPharmer®. Their affinity for the CtBP protomol was calculated in Sybyl-X®. Fragment based *de novo* drug design will be used to identify high affinity modulators with a propensity for *in vivo* bioavailability which will be iteratively optimised.

The Rational Design of Novel CU-CPT8M Analogs to Modulate the Toll-Like Receptor 8 (TLR8) Dimer

Tiffany Zammit

TLR8 is a mediator of inflammation. CU-CPT8M is a selective inhibitor that has utility in the management of inflammatory and autoimmune disorders. Its bioactive scaffold was used to elucidate its pharmacophoric structure in LigandScout®. This was used as a query at the ZincPharmer database where Lipinski Rule compliant hits were identified. They were docked into a TLR8 protomol modelled in Sybyl-X and ranked in order of binding affinity. The CU-CPT8M scaffold will also be used to model high efficiency fragments capable of sustaining *de novo* growth.

B.Sc.(Hons) Pharm. Sci Computational Chemistry

PROJECT DESCRIPTIONS

Third Year Students

Drug Design at the Trypanothione Reductase (TR) Enzyme using the 2-aminodiphenylsulfide Scaffold as a Lead	*Zinah Abdaki*
Drug Design at the Trypanothione Reductase Enzyme using the Mepacrine Scaffold as a Lead	*Surma Ali*
Drug Design at the Glycogen Phosphorylase Enzyme	*Jonathan Attard*
Molecular Dynamics Validation Study of the Angiotensin-Converting Enzyme (ACE) capabilities of the active principles of *Crataegus monogyna*	*Tamara Attard*
Drug Design at the Aromatase Inhibitor	*Giulia Baluci*
Drug Design at the Maltase-Glucoamylase Enzyme	*Neve Borg*
Drug Design at the PPAR Gamma Receptor using the Novel Sulfonaylhydrazone Scaffold	*Leanne Borg Gauci*
Drug Design at the Fibroblast Growth Factor Receptor 4 (FGFR4)	*Martina Buhagiar*
Drug Design at the Tyrosyl-DNA phosphodiesterase 1 (Tdp1) enzyme	*Miguel Camilleri*
Drug Design at the HIV Capsid Hexamer using the Inhibitor GS-6207 as a Lead	*Matthew Cassar*
Drug Design at the Lanosterol 14-α-Demethylase Enzyme	*Samuel Cremona*
Drug Design at the Spleen Tyrosine Kinase (Syk) Receptor	*Kristina Filletti*
Drug Design at the 5-HT3 Receptor	*Christine Gauci*
Drug Design at the Tumour Necrosis Factor Alpha Converting Enzyme	*Elena Mirone*
Drug Design at the Glucose-Regulated Protein 78 (GRP78)	*Audrey Muscat*
Drug Design at the ROCK 1 and ROCK 2 receptor	*Joseph Scerri*
Drug Design at the NPC1-like Intracellular Cholesterol Transporter 1	*Nicole Schembri*
Drug Design at the Adenosine 2a Receptor	*Yasmine Smaoui*
Drug Design at the Retinoid-X Receptor	*Keith Joseph Tabone*
Molecular Dynamics Validation Study of the Angiotensin Converting Enzyme (ACE) Capabilities of Analogs of the Active Principles of *Crataegus monogyna*	*Sarah Xuereb*
Drug Design at the Trypanothione Reductase Enzyme using Tricyclic Antidepressant and Phenothiazine Scaffolds as Leads	*Amber Zerafa*

Drug Design at the Trypanothione Reductase (TR) Enzyme using the 2-aminodiphenylsulfide Scaffold as a Lead

Zinah Abdaki

The treatment of Trypanosomiasis remains challenging. The Trypanosoma cruzi trypanothione reductase enzyme is the target in this study. The quinacrine mustard scaffold will be used as a lead and its critical interactions with the receptor will be used to identify and design analogous structures which will be further optimised in order to ensure Lipinski Rule compliance.

Drug Design at the Trypanothione Reductase Enzyme using the Mepacrine Scaffold as a Lead

Surma Ali

Trypanothione reductase, a key target due to its crucial role in the trypanothione-based redox metabolism of pathogenic trypanosomes will be studied in this project. The PDB crystallographic deposition of IGXF describing the crystal structure of the enzyme trypanothione reductase, forming a complex with the drug scaffold of Mepacrine will be used as a template for this study.

Drug Design at the Glycogen Phosphorylase Enzyme

Jonathan Attard

Maslinic Acid (MA) the lead molecule in this study, is protective against cerebral ischaemic injury and exerts a hypoglycaemic effect through its interaction with the glycogen phosphorylase enzyme. It will be used together with the spirohydantoin inhibitor co-crystallised in PDB crystallographic deposition 1A8I in Virtual Screening and *de novo* approaches to identify novel high affinity modulators.

Molecular Dynamics Validation Study of the Angiotensin-Converting Enzyme (ACE) capabilities of the active principles of *Crataegus monogyna*

Tamara Attard

It has been proposed that the triterpenoid active principles ß-amyrin, oleanolic and ursolic acid of *Crataegus monogyna* have *in vitro* ACE capabilities. In this study their optimal binding conformers will undergo molecular dynamics simulations using AMBER software. This will be done in order to validate the in vitro and preliminary in silico hypotheses of their ACE inhibitory capabilities.

Drug Design at the Aromatase Inhibitor

Giulia Baluci

Aromatase inhibitors have use in the management of breast cancer. Lead inhibitors HDDG029 and HDDG046 will be used to model a consensus pharmacophore. This will be used to identify novel aromatase modulators which incorporate its critical interactions. A *de novo* fragment-based approach will also be carried out. The resulting high affinity Lipinski Rule compliant structures will be studied further.

Drug Design at the Maltase-Glucoamylase Enzyme

Neve Borg

Maltase-Glucoamylase inhibition results in hypoglycaemic effects. Inhibitor molecules are useful in the treatment of diabetes. The Kotalanol scaffold will be used as a lead. Virtual Screening and fragment-based design will be used to identify novel molecules capable of similar high affinity interaction with the target. Emphasis will be placed on Lipinski Rule compliance and low predicted toxicity.

Drug Design at the PPAR Gamma Receptor using the Novel Sulfonaylhydrazone Scaffold

Leanne Borg Gauci

PPAR agonism is associated with hypoglycaemic effects and is of utility in diabetes. The novel sulfonylhydrazone LASSBio-331 scaffold will be modelled and used in Virtual Screening and fragment-based approaches to design and identify analogous modulators. High affinity Lipinski Rule compliant structures of low toxicity will be further studied and optimised.

Drug Design at the Fibroblast Growth Factor Receptor 4 (FGFR4)

Martina Buhagiar

Over-expression of FGFR4 is implicated in the development of hepatocellular carcinoma. This study uses the BLU9931 scaffold as a lead to probe the FGFR4 receptor in a process leading to the identification and designing of high affinity, selective modulators of the FGFR4 receptor through Virtual Screening and *de novo* design. The optimal Lipinski Rule compliant structures will be further evaluated.

Drug Design at the Tyrosyl-DNA phosphodiesterase 1 (Tdp1) enzyme

Miguel Camilleri

Usnic acid derivatives with a hydrazonothiazole scaffold were identified as Tdp1 inhibitors and will be used as leads in this study. The bioactive conformation of an experimental antagonist molecule will be used to model a consensus pharmacophore in LigandScout® and will be used in Virtual Screening and *de novo* design for the design of analogous high affinity Lipinski Rule Compliant modulators.

Drug Design at the HIV Capsid Hexamer using the Inhibitor GS-6207 as a Lead

Matthew Cassar

GS-6207 is an investigational antiretroviral HIV-1 capsid hexamer inhibitor which works by preventing capsid disassembly in infected cells. It is used as a lead for the rational development of second-generation drugs for the design of high efficiency analogs that are Lipinski-rule compliant using virtual screening and *de novo* design technique.

Drug Design at the Lanosterol 14-α-Demethylase Enzyme

Samuel Cremona

The Lanosterol 14-α-Demethylase Enzyme is a target for the management of fungal conditions. This project uses a fluconazole bound mutant as a target receptor. Virtual Screening and *de novo* techniques will be used to design structures capable of modulation of this mutant with the potential of being further developed into clinically useful agents for the management of resistant fungal species.

Drug Design at the Spleen Tyrosine Kinase (Syk) Receptor

Kristina Filletti

Syk receptors are targest for the treatment of allergic reactions mediated by immunoreceptor signalling processes. Presently, there are no drugs on the market which target this receptor. Tanshinone IA will be used as a lead, together with the co-crystallised inhibitor in PDB crystallographic deposition 4PUZ to identify novel Syk receptor modulators through Virtual Screening and '*de novo*' approaches.

Drug Design at the 5-HT3 Receptor

Christine Gauci

5-HT3 antagonists are antiemetics used in the treatment of chemotherapy induced nausea and vomiting. Palonosetron is the first second-generation antagonist with a greater affinity, efficacy and potency for serotonin receptors. It is the lead scaffold in this study which aims to model high affinity analogues based on Lipinski's rules using virtual screening and *de novo* drug design techniques.

Drug Design at the Tumour Necrosis Factor Alpha Converting Enzyme

Elena Mirone

This project aims to model high affinity TACE modulators using protein data bank crystallographic deposition 3G42 as a template. The bound bioactive Tryptophan Sulfonamide inhibitor will be used as a scaffold to model seed fragment structures which will be planted inside the TACE ligand binding pocket allowing for *de novo* growth. A Virtual Screening approach will also be taken.

Drug Design at the Glucose-Regulated Protein 78 (GRP78)

Audrey Muscat

GRP78 is highly expressed on the cell surface of a variety of cancer types and its suppression is associated with reduced tumour growth. This study will probe the GRP78 ligand binding pocket model using an inhibitory consensus pharmacophore high affinity Lipinksi Rule compliant modulators will be identified and designed using virtual screening and *de novo* approaches.

Drug Design at the ROCK 1 and ROCK 2 receptor

Joseph Scerri

Hydroxyfasudil, the active metabolite of fasudil, is the lead molecule for this study. Its scaffold will be used as a lead in Virtual Screening and *de novo* approaches for the identification of structures capable of simultaneous ROCK1 and ROCK2 modulation. The highest affinity Lipinski Rule compliant structures obtained from each approach will be further optimised.

Drug Design at the NPC1-like Intracellular Cholesterol Transporter 1

Nicole Schembri

Ezetimibe is a high affinity cholesterol absorption inhibitor at the NPC1L1. The 3D structure of ezetimibe will be modelled in LigandScout®. Its pharmacophoric structure will be elucidated for use in virtual screening using ZincPharmer®. The optimal binding pose of ezetimibe in NPC1L1 binding pocket will be identified through conformational analysis and fragmented for use in *de novo* design.

Drug Design at the Adenosine 2a Receptor

Yasmine Smaoui

A2A receptor activation results in suppression of allergic inflammation. Currently existing evidence indicates the importance of the A2A receptor as a target in management of allergic inflammation. This study uses the experimental A2A agonist CGS 21680 as a lead and aims to design and identify high affinity, low toxicity Lipinski Rule compliant analogs using Virtual Screening and *de novo* design.

Drug Design at the Retinoid-X Receptor

Keith Joseph Tabone

The retinoid X receptor (RXR) is a target for the retinoids which are effective in treating many types of cancer. Bexaroten is a novel RXR agonist whose scaffold will be used to model high affinity agonists that could emulate its *in vivo* activity. Virtual screening and *de novo* drug design platforms will be used to identify high affinity Lipinski Rule compliant structures.

Molecular Dynamics Validation Study of the Angiotensin Converting Enzyme (ACE) Capabilities of Analogs of the Active Principles of *Crataegus monogyna*

Sarah Xuereb

PDB crystallographic deposition 1O86, describing the bound co-ordinates of lisinopril with ACE, is the template for this study. Three optimal *de novo* designed molecules deriving from B-amyrin, oleanolic and ursolic acids respectively, the active principles of *Crataegus monogyna*, will undergo comparative molecular dynamics simulations to validate their hypothesized ACE inhibitory function.

Drug Design at the Trypanothione Reductase Enzyme using Tricyclic Antidepressant and Phenothiazine Scaffolds as Leads

Amber Zerafa

The tricyclic antidepressant and phenothiazine scaffolds will be used as leads for the design of trypanothione reductase modulators with potential anti-trypanosomal activity with a reduced adverse effect profile. A consensus pharmacophore will be modelled for virtual screening. A *de novo* approach will also be taken. Emphasis will be placed on Lipinski Rule compliance.

B.Sc.(Hons) Pharm. Sci Computational Chemistry

PROJECT DESCRIPTIONS

Second Year Students

Agonist Drug Design at the Farnesoid X (FXR) Receptor	*Julia Agius*
Drug Design at the Glucocorticoid Receptor (GR) α	*Andrew Aquilina*
Drug Design at the α-Glucosidase Receptor	*Evan Bonello*
Design of Novel Benzimidazole Hybrid Structures Capable of Simultaneous Peroxisome Proliferator Activated Receptorγ/Angiotensin Receptor (PPARγ/ATR) Modulation	*Matthias Borg*
Drug Design at the 8-oxoguanine DNA glycosylase (OGG1) receptor	*Katarina Maria Bugeja*
Drug Design at Cyclin-Dependent Kinase (CDK) Using the Hymenialdisine (HMD) Scaffold as a Lead	*Gabriel Busuttil*
Drug Design at the Protein tyrosine phosphatase 1B (PTP1B) Receptor	*Rachel Callus*
Agonist-Based Drug Design at the Vitamin D (VDR) Receptor	*Bettina Camilleri*
Drug Design at the Pregnane X Receptor (PXR)	*Maria Martina Cutajar*
Drug Design at the IL-1 receptor-associated kinase (IRAK) Receptor	*Justine Decelis*
Drug Design at The Trypanothione Reductase Enzyme Using the Kukoamine Scaffold as a Lead	*Aisha Diyab*
Antagonist Drug Design at the Farnesoid X (FXR) Receptor	*Jade Marie Falzon*
Drug Design at the Lactate Dehydrogenase Enzyme	*Natalia Ferris*
Drug Design at the Liver X (LXR) Receptor	*Yosef Jarboua*
Drug Design at the Cannabinoid 1 (CB1) Receptor	*Michael Laferla*
Drug Design at the Oestrogen receptor (ER) using Propyl Gallate as a Lead	*Michaela Mifsud*
Drug Design at the Constitutive Androstane (CAR)Receptor	*Gianluca Muscat*
Drug Design at the E Coli DNA Gyrase	*Maria Portelli*
Drug Design at the Dopamine D3 receptor	*Kathlene Saydon*
Drug Design at the Leucine-Rich Repeat Kinase (LRKK2) Receptor	*Shanice Marie Spiteri*
Drug Design at the Aldose Reductase (AR) Receptor	*Etienne Xiberras*
Antagonist-Based Drug Design at the Vitamin D (VDR) Receptor	*Kristy Xuereb*
Drug Design at the Dihydroorotate Dehydrogenase Receptor using the Teriflunomide Scaffold as a Lead	*Paula Zammit*

Agonist Drug Design at the Farnesoid X (FXR) Receptor

Julia Agius

Metabolic Syndrome is associated with significant morbidity and mortality. FXR agonists have been shown to decrease serum triglycerides and HDL cholesterol and to decrease hyperglycaemia in animal models. This study aims to design and identify novel FXR modulating molecules.

Drug Design at the Glucocorticoid Receptor (GR) α

Andrew Aquilina

Research into novel synthetic glucocorticoids aims to retain the immunosuppressant and anti-inflammatory effects of the traditional drugs without their metabolic adverse effects. This study uses the structures of a series of novel GRα agonists for the modelling of analogous structures.

Drug Design at the α-Glucosidase Receptor

Evan Bonello

Glucosidases catalyse hydrolysis of starch to simple sugars. Their inhibition reduces blood glucose and is of utility in Type 2 diabetes. The natural flavonoid Baohuoside 1 has α-glucosidase inhibitory activity and is used as a lead to design and identify analogous structures.

Design of Novel Benzimidazole Hybrid Structures Capable of Simultaneous Peroxisome Proliferator Activated Receptorγ/Angiotensin Receptor (PPARγ/ATR) Modulation

Matthias Borg

Dual PPARγ/ATR agonists have significant potential in the management of metabolic syndrome. This study will use the binding interactions of the benzimidazole scaffold with both receptors to model structures with simultaneous high affinity for both loci.

Drug Design at the 8-oxoguanine DNA glycosylase (OGG1) receptor

Katarina Maria Bugeja

There is evidence that the OGG1 receptor is a druggable target for the management of inflammatory conditions such as COPD and asthma. This study aims to design and identify OGG1 modulators based on molecular scaffolds with known inhibitory capability.

Drug Design at Cyclin-Dependent Kinase (CDK) Using the Hymenialdisine (HMD) Scaffold as a Lead

Gabriel Busuttil

Protein Kinase hyperactivation occurs in various diseases including cancer, neurodegenerative, and metabolic disorders. Marine product HMD has potent CDK inhibitory activity and will be used as a lead to model analogous structures.

Drug Design at the Protein tyrosine phosphatase 1B (PTP1B) Receptor

Rachel Callus

The PTP1B receptor is a validated target for Type 2 Diabetes management. The modelling of uncharged bromophenols yielded high affinity inhibitors whose scaffolds will be used in this study for the design and identification of analogous molecules.

Agonist-Based Drug Design at the Vitamin D (VDR) Receptor

Bettina Camilleri

Vitamin D and its agonist analogs are useful in the management of hyperproliferative diseases and osteoporosis. Many analogs can cause hypercalcaemia. TX522 is a VDR agonist that does not cause this adverse effect. It will be used in this study for the design of similar molecules.

Drug Design at the Pregnane X Receptor (PXR)

Maria Martina Cutajar

The PXR mediates drug-drug interactions. When multiple drugs are combined, drug-drug interactions can occur, decreasing therapeutic efficacy implying scope for the development of PXR antagonists. This study aims to probe the PXR receptor and to model small molecule modulators.

Drug Design at the IL-1 receptor-associated kinase (IRAK) Receptor

Justine Decelis

The IRAK4 receptor has been found to be over-expressed in many melanomas and is an important mediator in rheumatoid arthritis. This study uses the scaffold of the experimental CA-4948 inhibitor for the design and identification of analogous modulators.

Drug Design at The Trypanothione Reductase Enzyme Using the Kukoamine Scaffold as a Lead

Aisha Diyab

The natural antihypertensive agent, kukoamine A, a bis (trihydro-cinnamoyl) spermidine derivative, was identified as a TR inhibitor- the target for the management of trypanosimiasis. It is the lead for this study and is used for the modelling of high affinity inhibitors.

Antagonist Drug Design at the Farnesoid X (FXR) Receptor

Jade Marie Falzon

Evidence shows that FXR antagonism has a role in the management of hepatic disorders associated with bile secretion, and that suvanine, a marine sponge extract, has FXR antagonist activity. This study uses its scaffold as a lead for the design of similar FXR modulators.

Drug Design at the Lactate Dehydrogenase Enzyme

Natalia Ferris

Lactate dehydrogenase inhibition results in a hypotensive effect. The naturally occurring flavonoid myricetin is a newly identified lactate dehydrogenase inhibitor. Its scaffold will be used to probe the target, establish a pharmacophoric structure, and model analogous molecules.

Drug Design at the Liver X (LXR) Receptor

Yosef Jarboua

Non-alcoholic fatty disease is a consequence of obesity and metabolic syndrome. It is a public health issue worldwide. Studies show that LXR agonism decreases liver fat levels. This study uses the scaffold of experimental agonist SR9238 for the design of novel LXR modulators.

Drug Design at the Cannabinoid 1 (CB1) Receptor

Michael Laferla

Rimonabant, a CB1 antagonist is useful in reducing tobacco and narcotic dependence. Its scaffold is used as a lead in this study for the development of analogs devoid of the nausea and central adverse effects associated with rimonabant.

Drug Design at the Oestrogen receptor (ER) using Propyl Gallate as a Lead

Michaela Mifsud

The ER, a breast cancer mediator, also binds to antagonist xeno-oestrogens known as endocrine disruptors. Propyl gallate, is a recently identified example. Its scaffold will be used as a lead in this study to design and identify novel structures with potential for ER antagonism.

Drug Design at the Constitutive Androstane (CAR)Receptor

Gianluca Muscat

The CAR is a nuclear receptor that has gained importance as a druggable target. Its agonism has been associated with the treatment of cholestasis while its antagonism has potential in hepatocellular carcinoma. This study aims to identify and design novel CAR modulators.

Drug Design at the E Coli DNA Gyrase

Maria Portelli

DNA gyrase is vital in bacterial DNA compaction. It is a prime target for inhibitors including the quinolones. Myricetin, a naturally occurring flavonoid, has been shown to be a DNA gyrase inhibitor. It is the lead scaffold in this study that aims to model analogous structures.

Drug Design at the Dopamine D3 receptor

Kathlene Saydon

D3 receptors are elevated in the mesolimbic system of schizophrenic patients. D3 antagonists are also useful in cocaine addiction. The scaffolds of experimental D3 selective antagonists GSK598809 and GSK618334 are leads in this study for the design of analogous structures.

Drug Design at the Leucine-Rich Repeat Kinase (LRKK2) Receptor

Shanice Marie Spiteri

LRRK2 activation is associated with Parkinson's disease. It is a target for novel drug design in this field. Some LRRK2 inhibitors are in Phase 1 trials. Their scaffolds will be used in this study to design and identify analogous structures.

Drug Design at the Aldose Reductase (AR) Receptor

Etienne Xiberras

AR, through its conversion to sorbitol, drives the peripheral complications of diabetes. The natural products quercitin and quercitirin have AR antagonist properties. Their pharmacophoric structures will be modelled in this study and used to identify analogous molecules.

Antagonist-Based Drug Design at the Vitamin D (VDR) Receptor

Kristy Xuereb

VDR hyperactivity is associated with cholestasis, depression and cardiac dysfunction. Evidence shows that angiotensin receptor blockers, specifically Telmisartan, are potent VDR antagonists. This scaffold will be used as a lead for the design of analogous structures.

Drug Design at the Dihydroorotate Dehydrogenase Receptor using the Teriflunomide Scaffold as a Lead

Paula Zammit

Mouse studies show that DHODH inhibition is a novel route for the treatment of epilepsy and that Teriflunomide, used in Multiple Sclerosis is a potent inhibitor. Teriflunomide has poor intra-cerebral penetration. Its scaffold will be used in the design of more non-polar analogs.

Doctorate in Pharmacy

DISSERTATION TITLE INDEX

M.Pharm.

DISSERTATION TITLE INDEX

Master of Science in Pharmaceutical and Regulatory Sciences

DISSERTATION TITLE INDEX

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