Clinical Pharmacy Services Within an Interdisciplinary Model of Care in Adult Oncology

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This thesis is dedicated to all the patients and healthcare professionals who strive to improve the quality of cancer care. It is my hope that this work will contribute to better clinical practices and improved outcomes for patients in oncology.

Abstract

Identifying effective clinical pharmacist contributions within the provision of pharmaceutical services, enhances outcomes of therapy and supports interdisciplinary oncology patients' management. The aim of this project was to develop, implement and evaluate a pharmaceutical care model within oncology, reflecting the relevant contribution of pharmacists through optimisation of patient care. The objectives were to undertake a gap analysis assessing current pharmaceutical service with established practice guidelines, to develop a standard operating procedure (SOP) for the service provision, and to implement a pharmaceutical care model and consolidate it.

The research was divided into three phases. The first two phases included the evaluation of the existing policy framework, gap-finding and identification of weaknesses and opportunities. An SOP was completed and consequently, a pharmaceutical care model was constructed through adoption and adaptation of guidelines obtained from various international bodies and validated by an expert panel (n=4). Phase three of the research involved the implementation of the developed model, whereby the application of the developed SOP was undertaken across the compounding unit and oncology wards over a period of two months. This involved a thorough review of each individual patient medication record and identification of any pharmaceutical care issues. These issues were then classified using the PCNE (Pharmaceutical Care Network Europe) classification.

Findings from the gap analysis (Phase 1) were that 29 of the 75 sub-sections of the gap-finding instrument, which pertain to the duties of a clinical pharmacist working in the ward, were not carried out fully, neither in the oncology ward nor at the compounding unit by any health care professional. The developed SOP (Phase 2), which consists of three dimensions, namely patient

parameters, pharmacotherapeutic choice including dosing, and drug delivery systems, comprised three main components: the validation of the drug dosage and regimen in accordance with the indication, the validation of the prescribed drug delivery method, and the verification of the demographic information submitted by the doctor on the prescription. For each patient, in order to track cumulative doses and to note any changes from prior cycles, data from each prescription was entered into a synoptic patient medication record. For the implementation aspect (Phase 3), out of the 307 cases investigated, 72 drug related problems (DRPs) were identified. These DRPs were categorised into three sections: the occurrence of side effects (n=38, 53%), namely hypersensitivity reactions, incorrect dosage of pre-medication, and incorrect administration rate; issues with dose selection (n=28), the most common of which was the administration of a high dose; as well as issues with drug selection (n=6). These identified drug related problems were shared with the doctors, and the change or rationale for their decision was then reflected on the prescription.

Expanding the pharmacist contribution to oversee a holistic patient approach within oncology pharmacotherapy management strengthens the interprofessional care model that streamlines patient needs within a personalised patient approach. This phased study design was intended to spearhead the transformation from a product-centric to a patient-centric approach within hospital oncology service in a controlled and solid manner, respecting principles of change management dynamics.

Keywords: **pharmaceutical care model, oncology, drug related problems**

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List of abbreviations

DRP	Drug Related Problem
HCP	Health care professional
PCI	Pharmaceutical Care Issue
PCNE	Pharmaceutical Care Network Europe
SACT	Systemic anti-cancer therapy
SAMOC	Sir Anthony Mamo Oncology Centre
SOP	Standard Operating Procedure

CHAPTER 1 INTRODUCTION

1.1 Overview

The complex nature of both cancer and the treatments employed to treat it, account for the relevance of ensuring optimisation of treatment and patient support with regards to medicine use. Conventional chemotherapy has given way to targeted medicines and immunotherapies. Pharmacists have a crucial contribution in guaranteeing the safe, efficient, and customised administration of the complex oncology treatment plans. The increasing demand for specific pharmacological expertise in cancer treatment underscores the significance of clinical pharmacists as essential members of the multidisciplinary oncology healthcare team.

1.2 Complexity of Oncology

Cancer has many facets, including different forms, phases, and biological activities, all of which make oncology rather complex. Every patient's experience with cancer is different, impacted by lifestyle, environmental, and hereditary factors. Treatment plans frequently combine radiation, chemotherapy, immunotherapy, and surgery, requiring multidisciplinary teams to carefully coordinate their efforts. Complexity is further increased by occurrence of side effects, potential drug interactions, and the associated social and psychological implications. For patients crossing this difficult terrain, effective oncology care involves not only cutting-edge medical expertise but also empathetic communication and individualised care approaches.

1.2.1 Complexities of Oncology Treatment

Different cancer types exhibit unique behaviours and require specific treatments. Treatment modalities in oncology are equally diverse and complex (Schneider *et al.*, 2023). Surgery, radiation therapy, chemotherapy, targeted therapy, immunotherapy, and hormone therapy are among the primary methods. Surgery and radiation aim to remove or destroy cancer cells in a specific area. In contrast, chemotherapy uses drugs to target rapidly dividing cells, which is

a typical characteristic of cancer cells. Targeted therapies represent a significant advancement in oncology. Unlike chemotherapy, which affects all rapidly dividing cells, targeted therapies focus on specific proteins or genes involved in cancer growth and metastasis. This specificity reduces damage to healthy cells, and potentially decreasing side effects. Monoclonal antibodies and small-molecule inhibitors are examples of targeted therapies (Sharma *et al.*, 2015). Immunotherapy, which is another innovative approach, enhances the body's immune system to fight cancer. This modality includes treatments like checkpoint inhibitors, which release the 'brakes' on the immune system, allowing it to attack cancer cells more effectively (Ledford, 2011). The requirement for individualised treatment programs adds to the complexity of oncology (Collins & Varmus, 2015). A 'one-size-fits-all' approach is inappropriate because of cancer's diversity.

The use of precision medicine is growing in popularity. It customises treatment depending on the genetic composition of the tumour and the patient. In order to find appropriate targeted medicines, this method requires molecular profiling of malignancies and genetic testing. These evolving treatment modalities, combined with the diverse nature of cancer, underline the complexity of oncology. Ongoing research and clinical trials continue to expand the understanding and capabilities in treating this multifaceted disease (DeVita *et al.*, 2011).

1.2.2 Navigating Challenges in Oncology Treatment

Numerous challenges are encountered in the field of oncology treatment. These include problems such as medication interactions, adverse effects, and concerns that are specific to the patient. Each of these elements adds a level of complexity to cancer treatment, thus tailored procedures and careful monitoring are crucial. One of the challenges is handling medication interactions. A range of drugs are often prescribed to cancer patients; in addition to those that specifically target the cancer, medications to prevent adverse effects and to reduce treatment-related risks are also added (Riechelman & Del Giglio, 2009).

Interactions may decrease the efficacy of cancer treatments or exacerbate their side effects. Moreover, several drugs alter chemotherapeutic drug metabolism, affecting safety and effectiveness (Bibi *et al.*, 2009). Binotto *et al.*, 2020 assert that adverse effects of cancer can impact patients' quality of life. Targeted medicines, despite their more focused mode of action, are associated with a number of negative effects, including skin responses and liver difficulties. (Scott *et al.*, 2012). These adverse effects need to be managed to maintain the patient's quality of life and treatment compliance. Every cancer patient's experience is different, impacted by age, health, underlying medical disorders, genetics, and lifestyle (Friese *et al.*, 2017). However, given this variability, it is understood that personalised medicine, which includes adjusting treatment to each patient's unique requirements and traits, is imperative. Nevertheless, a customised strategy necessitates a deep comprehension of the patient and the particulars of their cancer type. For instance, compared to younger patients, older people have a varied tolerance to treatment, necessitating adjustments to medication dosages or available treatment options (Balducci & Extermann, 2000). In response to these problems, precision medicine focuses on using the unique genetic profile of the patient and the tumour, to better inform treatment choices. By applying this method, medications with a greater likelihood of being advantageous, and with a lower likelihood of producing negative side-effects, are identified. However, the use of precision medicine is limited since it requires access to advanced genetic testing and analysis, which are not available in all medical environments.

1.3 Precision Medicine and Targeted Therapies

This approach is crucial because the genetic characteristics of a tumour significantly determine its response to various treatments (Ashley, 2016). In contrast to standard chemotherapy, which targets any rapidly dividing cells, targeted treatments target certain genes or proteins vital in the development and survival of cancer cells (Dancey *et al.*, 2012). Most notably, this selectivity reduces adverse effects caused by conventional therapy, thus enabling a more

targeted effect on the desired cancer cells, whilst protecting healthy cells. This crucial advancement in cancer treatment employs methods like monoclonal antibodies and small molecule drugs. While small molecule medications disrupt enzymes essential for cancer cell proliferation, monoclonal antibodies are designed to attach to specific markers on cancer cells (Weiner *et al.,* 2010). In most malignancies, including leukaemia, lung cancer, and breast cancer, these treatments have significantly raised survival rates and decreased adverse effects (Shukuya, 2020). Additionally, the ability to thoroughly analyse genetic changes in cancer cells, made possible by advances in genomic technology, has fuelled the development of these tailored treatments (Mardis, 2008). Genetic insight is thus instrumental in designing therapies that precisely target the specific changes in cancer cells. The result is a more effective, personalised approach to cancer treatment, marking a significant milestone in oncology. Apart from the advantages, targeted medicines and precision medicine also have some limitations, for instance, certain individuals lack certain genetic targets, and certain malignancies have become resistant to therapies that target them (Wang *et al.,* 2017). Furthermore, access to individualised treatment choices is restricted by cost and accessibility of genetic testing.

Chemotherapy, a cornerstone of cancer treatment, was first administered with cytotoxic medicines, which attack rapidly-dividing cells without discrimination. As a result of advancements over time, more targeted chemotherapy medications have been developed, leading to better patient outcomes and fewer adverse effects (DeVita *et al.*, 2008). The invention of alkylating agents and antimetabolites, for instance, was a significant breakthrough in the 20th century (Chabner & Roberts Jr, 2005). However, even with these advancements, the broad effects of chemotherapy on rapidly growing cells have significant side effects. In recent years, tailored therapies that target cancer cells without harming healthy cells have been emphasised. Drugs that specifically target biochemical pathways involved in cancer cell growth and division have been developed using this technique (Sledge & Miller, 2003).

Additionally, unlike standard cancer treatments, which target cancer cells, immunotherapy, which is a novel cancer treatment field, boosts the body's defences. This includes treatments such as immune checkpoint inhibitors, which free up immune cells to more effectively target cancer cells (Pardoll, 2012). Numerous malignancies, including melanoma and non-small cell lung cancer, have been very successfully treated with immunotherapy. Hormonal therapy has also become a crucial component in the treatment of tumours that are susceptible to hormones, such as prostate and breast cancer. These treatments block cancer-promoting hormones. Tamoxifen, for example, has dramatically improved breast cancer survival rates by blocking oestrogen receptors. Drug combinations have also led to a more complete cancer treatment.

Combining immunotherapy, hormone treatments, and chemotherapy to build patient-specific treatment plans is becoming increasingly common. This method helps to more effectively manage adverse effects while also increasing treatment efficacy (Schilsky, 2010). Despite these advances, challenges remain. Resistance to therapies, both in chemotherapy and targeted treatments, poses a significant challenge. Ongoing research is focused on understanding and overcoming these resistance mechanisms. Moreover, the cost and accessibility of newer therapies like immunotherapy are also concerns that need addressing to ensure broader patient access (Sullivan *et al.*, 2011).

1.4 Contribution of Pharmacists in Oncology Prescribing and Patient Care

Historically, pharmacists were generally regarded as the individuals responsible for dispensing medication prescribed by physicians. Over time, pharmacists have become more involved in patient care, especially in oncology, where treatment complexity requires drug management expertise (Ferrell *et al.*, 2017). The extensive range of drugs used in cancer treatment is a major factor in this development. These treatments have different side effects and dosing requirements. As part of medication management, pharmacists now choose medications,

provide doses, monitor patients, and modify prescriptions as needed. Oncology pharmacists educate patients on pharmaceutical interactions, side effects, and treatment adherence. The importance of this educating function cannot be overstated, given the complicated nature of cancer treatments, and the possibility of experiencing unpleasant effects (Holle *et al.*, 2020). Patients are given information on how to manage side effects and ensure that they take their medications as directed, the latter being two crucial aspects of successful cancer treatment. In addition, medical specialists like nurses and oncologists are progressively coming to understand how pharmacists are critical to the interdisciplinary team. By contributing their experience and understanding of pharmacokinetics and pharmacodynamics, pharmacists are essential in improving the effectiveness of treatment and reducing the negative effects of medication (Singh *et al.*, 2022). However, there are drawbacks to the growing involvement of pharmacists in oncology. One of the most important obstacles is the need for ongoing training and education in oncology-specific medication (Isenring *et al.*, 2004). It is important for pharmacists working in the field of cancer treatment to be current with the significant breakthroughs in this sector. Additionally, consideration needs to be given to structural difficulties. The oncology care team relies heavily on pharmacists, and the healthcare system has an obligation to acknowledge and support them as such. (Herndon *et al.*, 2016).

1.4.1 Optimising Medication Therapy in Oncology: The Critical Impact of Pharmacists

Pharmacists are essential to the process of optimising pharmaceutical therapy in oncology, which is a vital aspect of patient care. The accuracy and knowledge of pharmacists are crucial in the complicated world of cancer treatment, to guarantee patients the best possible therapeutic results (Thoma *et al.*, 2016). Pharmacists play a key role in determining whether prescription drugs are suitable by considering patient history, drug interactions, and particular cancer types (Rawal *et al.*, 2023). Furthermore, as cancer treatments have advanced, so too has the intricacy

of drug schedules. Pharmacists are adept at negotiating these complications; they assist in overseeing multi-drug regimens and modifying dosages to optimise effectiveness and reduce adverse effects (Walko & McLeod, 2012). Their knowledge of pharmacotherapeutics is essential for comprehending how medications impact the body and cancer cells of patients. Pharmacists play a crucial role in creating plans to lessen the negative effects of chemotherapy and other cancer treatments, hence enhancing patients' quality of life (Hesketh, 2008). They offer helpful guidance on how to handle side effects from cancer treatments, such as nausea, discomfort, and exhaustion. Nevertheless, there are challenges to including pharmacists in oncology teams (Weingart *et al.*, 2008). Pharmacy professionals must stay informed of research and treatment guidelines to deliver the best care. Pharmacists, oncologists, and other medical professionals need to communicate well for coordinated treatment. Pharmacists need to share their expertise and suggestions with the healthcare team in ensuring that every element of a patient's treatment is considered (Hatton *et al.*, 2018).

1.5 Enhancing Oncology Care: The Role of Clinical Pharmacists in the Clinical Setting

When clinical pharmacists were added to wards medication errors decreased, and patient outcomes improved significantly (Alqurbi & Atiah, 2020). The knowledge and abilities that clinical pharmacists provide to the healthcare team are responsible for this improvement in patient care. Their responsibilities have grown to encompass active participation in patient care and drug administration in oncology wards (Gatwood *et al.*, 2017). The intricacy of cancer treatment plans, which sometimes include a wide range of medications with possible interactions and adverse effects, is what is causing this change. Clinical pharmacists make sure that every patient has an optimal pharmaceutical regimen, which improves patient outcomes. Their knowledge of pharmacokinetics and pharmacodynamics is essential for customising treatments to the requirements of each patient. They aid in maximising treatment efficacy while lowering the possibility of side effects by evaluating and modifying doses.

Additionally, clinical pharmacists are essential in lowering prescription mistakes in oncology units (Alqurbi & Atiah, 2020). Strong medications that call for exact dosage and close monitoring are frequently used in cancer treatments. In order to improve patient safety, pharmacists are trained to spot possible pharmaceutical mistakes, such as improper doses or drug interactions (Hesketh, 2008). By ensuring a second level of scrutiny for drug orders, their presence on the ward gives patients an extra layer of protection. Furthermore, through their collaboration with nurses, oncologists, and other healthcare professionals, clinical pharmacists support multidisciplinary care teams. When deciding on drug therapy, their advice is invaluable since it considers a variety of patient-specific criteria, including age, organ function, and comorbidities (Bedell, 2023). Nonetheless, there are several obstacles that need to be overcome before clinical pharmacists are successfully integrated into oncology wards. Making sure that the healthcare staff understands and applies their advice is one of the challenges. In order to achieve this, all team members need to develop open lines of communication and a shared knowledge of the pharmacist's (Shah, 2006). Their specific expertise in managing drug therapy is helpful in improving patient safety and treatment plans.

1.5.1 The Clinical Pharmacist in Patient Education, Adherence and Care

In addition to managing medications, clinical pharmacists have critical instructional and supporting roles in patient care, particularly in oncology settings. Their participation greatly improves overall care, treatment compliance, and patient understanding. Due to their special combination of abilities, clinical pharmacists are excellent candidates for positions involving patient education. They provide patients thorough instructions on how to take their drugs, as well as information on any possible adverse effects and the significance of sticking to treatment plans (Patel & Gurumurthy, 2019). This knowledge is especially important in oncology, where patients feel overwhelmed by complicated treatment plans. Additionally, the efficiency of

cancer treatments depends on drug adherence, which is something that clinical pharmacists are essential in guaranteeing. They use a variety of techniques to make sure patients realise how important it is to follow their prescription schedule. These tactics include employing adherence helps, sending reminders, and streamlining dosage regimens. Their initiatives enhance patient outcomes and lower the likelihood of treatment failures (Ferraldeschi & Newman, 2010). Nonetheless, there are difficulties in the work that pharmacists do in patient education and adherence. One difficulty is providing information according to each patient's unique demands and comprehension capacity. Pharmacists need to be skilled in explaining intricate medical concepts in a way that each patient understands and find useful. Clinical pharmacists also assist in managing the adverse effects of cancer treatment, which furthers their supportive care role. They provide guidance on managing typical problems such as pain, nausea, and exhaustion and suggest alterations to treatment plans to mitigate these symptoms.

Enhancing the quality of life of patients throughout treatment is a critical function of this supportive care (Banna *et al.*, 2010). Pharmacists also participate in coordinated care initiatives. To guarantee a comprehensive approach to patient treatment, they collaborate closely with nurses, oncologists, and other medical professionals in order to provide holistic treatment that takes into account every facet of a patient's health and wellness (Collum *et al.*, 2013). Clinical pharmacists play crucial roles in patient care in oncology through their instructional and supporting responsibilities. Treatment results and patient quality of life are improved by their engagement in patient education, medication adherence, and supportive care. As the area of oncology develops, the contributions of pharmacists to patient care and education will be crucial to the comprehensive treatment of cancer patients.

1.5.2 Collaborative Healthcare: Synergy Between Pharmacists, Oncologists, and Health Professionals in Oncology Wards

By working together, oncologists, pharmacists, and other health professionals provide patients with complete and efficient treatment in the complex world of oncology care. This synergy is essential to effectively meet the diverse requirements of cancer patients. Their pharmacological experience enhances the medical skills of nurses and oncologists, resulting in a more comprehensive approach to treatment (Choi *et al.,* 2016). Working together is crucial to creating treatment strategies that minimize side effects and maximise therapeutic outcomes (Erku *et al.,* 2017). However, it is found that when dealing with complicated situations involving many drugs, pharmacists' advice is essential in navigating potential drug interactions and contraindications.

Coordinated care also depends on the communication between all healthcare professionals. Pharmacists frequently serve as liaisons, bridging knowledge gaps and enabling the sharing of vital data pertaining to patient care (Murad *et al.*, 2014). Moreover, it is essential to comprehend that ensuring that every member of the healthcare team agrees with their approach to patient treatment and care, depends on this communication. Nevertheless, cultivating successful cooperation is not without its difficulties. These include variations in healthcare practitioners' communication methods and professional cultures. Respect for one another and an awareness of the roles and contributions made by each professional are necessary to overcome these obstacles (Hatton *et al.,* 2021). Together with nurses and oncologists, and in addition to working together on drug management, pharmacists assist with adherence assistance and patient education. They support patients in making sure they comprehend their treatment plans, the value of following instructions, and how to handle any possible adverse effects (Schnipper *et al.*, 2006). Therefore, delivering top-notch cancer treatment depends on the cooperative efforts of pharmacists, oncologists, and other medical specialists in oncology wards. These

specialists work together to improve patient outcomes and provide safe and efficient treatment. The significance of this cooperative approach in oncology wards will not diminish as cancer medicines progress.

The field of oncology, the constantly changing treatment landscape, and the crucial role played by clinical pharmacists in both ward-based care and prescription vetting are essential components of contemporary cancer care. The complex nature of oncology arises from both its complicated biology, as well as a variety of treatment approaches. It is essential for providing efficient patient care to comprehend the distinctive qualities of various cancer types and the treatments that correspond with them. Because of this intricacy, treatment need to be thorough and individualised, underscoring the need of targeted medicines and precision medicine. Cancer treatment has changed dramatically throughout the years, moving from more generalised therapies to more specialised, focused ones. It is determined that this trajectory represents notable developments in medical science and technology, leading to better patient outcomes and survival rates.

Chemotherapy, immunotherapy, and hormone treatments have transformed the treatment of cancer by providing more potent and less harmful alternatives. The complexity of cancer treatments is causing a rising requirement for pharmacists in the collaborative model of care. Pharmacists are essential in minimising drug interactions and adverse effects, improving prescribing regimens, and guaranteeing medication safety because of their specialist understanding in pharmacotherapy. Their ward participation in the process of treatment planning improves the safety and effectiveness of cancer treatments. Pharmacists in oncology wards contribute to a reduction in medication errors, enhance treatment outcomes, together with assisting patients adhere to their treatment plans, and providing patient education. They work in tandem with oncologists and other medical specialists to provide collaborative care and guaranteeing a thorough and efficient approach to cancer treatment.

1.6 Rationale of the study

Clinical pharmacists are distinguished as vital healthcare professionals to liaise straightforwardly with the patient and with different individuals from the interdisciplinary group. In this manner, the clinical pharmacist acts as a co-ordinator between every process involved. The clinical drug specialist at clinical pharmacy level can assist with improving the quality of care to oncology patients who are profoundly susceptible and vulnerable to prescription mistakes and drug related problems (DRPs).

1.7 Aims and objectives

The aim of this research was to develop, implement and evaluate a pharmaceutical care model within oncology, reflecting the relevant contribution of pharmacy through optimisation of patient care. The objectives were:

- To undertake a gap analysis assessing current pharmaceutical service compared to established practice guidelines;
- To develop and validate a standard operating procedure (SOP) for the pharmacy service provision within the oncology hospital sphere;
- To implement the developed pharmaceutical care model.

CHAPTER 2 METHODOLOGY

2.1 Setting

This research was set at the pharmacy compounding unit within Malta's main acute hospital – Mater Dei Hospital (MDH) and focused on adult patients in both oncology wards and at the Day Ward within the hospital.

Prior to the start of the study, all chemotherapy prescriptions were physically sent to the compounding unit at the pharmacy and were vetted by a pharmacist prior to reconstitution. A typical day starts with the physician at the Day Ward confirming treatment on the MOSAIQ® software. MOSAIQ® is a health information system that is specifically designed to manage the treatment of oncology patients with respect to documentation. It also allows for communication between different healthcare professionals who are providing care for these patients. The pharmacist uses the patient parameters listed on the prescription to recalculate and confirm the prescribed doses, but does not double-check parameters, demographics, and treatment plan. Information regarding other non-oncological medications or any experienced adverse reactions which in turn would warrant a longer infusion time or an alteration in the dose, are not usually documented in the prescription.

Most prescriptions are usually provided a day before the scheduled treatment day, and worksheets are subsequently prepared. Upon confirmation of treatment by the physician, the worksheet is handed to the officer in charge of assembling the trays with the starting materials for reconstitution. During ward wounds, doctors from oncology wards start confirming the patients who are fit to receive treatment, and patients whose prescription would not have been sent the day before due to foreseeable changes in dose or otherwise, would have their prescription sent on the day they are set to receive treatment. The worksheet is then prepared on the day once doses are confirmed. At the end of each reconstitution session, the pharmacists proceed to start checking, verifying and generating worksheets for the following day.

2.3 Study Design – Phased Approach

The research was divided into three phases; the first two phases can be summed up as an observation and development phase respectively, and the third phase as the implementation phase. The objectives of phases one and two were to get acquainted with the routine practices within the compounding unit and oncology wards, to develop a standardised process that aids with the implementation of a pharmaceutical care model in this clinical area. The objectives of the third phase of this research were to develop and implement a pharmaceutical care model within the adult oncology wards. The expected outcomes of the implementation phase were to identify any possible gaps in service provision and report them so that this service may ultimately be optimised and implemented as a service.

All the necessary approvals were sought, including an ethics approval from the University Research Ethics Committee – Reference No MED-2023-00313 (Appendix 1).

2.3 Phase 1 – Gap analysis of current pharmaceutical service

The first phase of the research included the evaluation of the existing policy framework and gap-finding of the system. Weaknesses and strengths of the current system adopted at both the compounding unit and oncology wards were identified in comparison with guidelines obtained from international bodies, namely the American College of Clinical Pharmacy (ACCP, 2014). The reconstitution section was visited an average of four times per week an average of 6 hours were spent there each time. During this time, the work being carried out by pharmacists and pharmacy technicians was noted to identify gaps. This phase identified:

- areas where the system needed to be strengthened, and
- goals of the new service.

During this phase, a gap-finding tool constructed by Falzon (2018) was utilised to find gaps in current system (Appendix 2); guidelines issued by the ACCP, the Society of Hospital

Pharmacists of Australia (SHPA) and European Association of Hospital Pharmacists (EAHP) were utilised to develop the chosen gap-finding tool. This tool is divided into nine sections (Table 2.1).

Table 2.1: Sections of the Gap-Finding Tool

Section	Heading
1	Accurate History
2	Current Medication Management
3	Clinical Review
4	Therapeutic Drug Monitoring
5	Providing Medicines Information
6	Adverse Drug Reaction Management
7	Participation in Interdisciplinary Care
8	Information on Ongoing Care
9	Documentation

Adopted from: Falzon S, Galea N, Calvagna V, Pham JT, Grech L, Azzopardi LM. Development and use of an innovative Gap Finding Tool to create Pharmaceutical Care Model within a paediatric oncology setting. Journal of Oncology Pharmacy Practice. 2021;11: 1-9, doi:10.1177/10781552211053249

2.4 Phase 2 – Standard operating procedure development and validation

In the nine main sections, there are a total of 75 sub-sections that highlight in greater detail the responsibilities of a clinical pharmacist. The ten-week observation phase allowed for the completion of this gap-finding tool; a week was allocated for each section. The established procedures were ticked on the gap-finding tool. Since a ward-based clinical pharmacist was not available, any further remarks required to accurately identify who was carrying out a specific task, were recorded in the comments section. The gap-finding tool was used to create the standard operating procedure in order to standardise the process that will ultimately guide anyone handling the oncology clinical pharmacy task. The procedure can also be used as a

referral when there are questions about how a task should be completed. This was done in phase 2 of the study.

This phase was used to develop a standard operating procedure (SOP) for the service provision within the pharmaceutical oncology sphere in view of any weaknesses identified during the gap analysis exercise. This document also included the scope of practice as it impacts the patient journey within the relevant oncology clinical setting.

A Mater Dei Hospital Pharmacy template was used for the SOP generation. The weaknesses outlined in phase one of this study were tackled in each step, to standardise and improve service provision. The SOP (Appendix 3) included:

- inclusion of drug history and current medication, to have a complete medical portfolio
- the verification that the treatment was prescribed according to the Systemic anti-cancer therapy (SACT) protocol,
- the method of verification of dose, dosing regimen and parameters,
- documentation and management of any adverse reactions, and
- inclusion of a synoptic medication record for each patient.

The SOP was validated by a panel of experts (n=4), which consisted of a pharmacist in the compounding section, two quality assurance pharmacists, and one clinical oncology pharmacist.

2.4 Phase 3 – Implementation phase

The implementation phase was spread over 2 months. Convenience sampling was adopted by an intermediary to select patients; extracted data was anonymised and handed over to be used in the study. The presented data was then double-checked against the set SACT protocols for prescribed indication, dose, and dosage regimen. The patient data was inputted into a synoptic medication record from which any DRP's or PCI's were identified and noted. In instances

where the indication was not in accordance with the set protocols, an off-licence form was requested to justify the use of a particular protocol. These were later discussed with prescribers to give rationale for deviation from protocol or to change the prescription.

Major domains were used to facilitate collection of results. There are numerous approved classification schemes for pharmaceutical care issues (PCIs) and DRPs in the literature. In this study, the PCNE (Pharmaceutical Care Network Europe) classification[1] was chosen.

The PCNE tool is currently available in "The PCNE Classification V9.1." This classification, in contrast to others, distinguishes between the problems and the causes of DRPs. The reason this tool was selected was because a DRP can have two possible outcomes: a cause and an issue.

The basic PCNE classification currently includes two primary domains for problems, nine primary domains for causes, five primary domains for planned interventions, three primary domains for the degree of acceptance (of interventions), and four primary domains for the problems' status. This is summarised in Appendix 4.

[1] Pharmaceutical Care Network Europe (PCNE). Classification for Drug-Related Problems V9.1. available from: https://www.pcne.org/upload/files/417_PCNE_classification_V9-1_final.pdf)

The PCNE categorisation scheme for problems, which is summarised in Tables 2.2 and 2.3, was utilised to further classify DRPs that resulted from a condition that was present and could have an impact on the patient's outcome. Table 2.2 addresses the problems domains, while Table 2.3 addresses the 9 primary Causes domains. PCNE (2020) defines a problem as "an event or circumstance involving drug therapy that actually or potentially interferes with desired health outcomes." An instance of an issue that could result in a DRP and impact the patient's course of treatment is the manifestation of a side-effect.

Table 2.2: The problem domain divided into subdomains.

Primary Domain	**Code V9.1**	**Problem**
1.Treatment effectiveness There is a (potential) problem with the (lack of) effect of the pharmacotherapy.	**P1.1** **P1.2** **P1.3**	No effect of drug treatment despite correct use Effect of drug treatment not optimal Untreated symptoms or indication
2. Treatment safety Patient suffers, or could suffer, from an adverse drug event. *N.B. If there is no specific cause, skip Causes coding.*	**P2.1**	Adverse drug event (possibly) occurring
3. Other	**P3.1**	Unnecessary drug-treatment
	P3.2	*Unclear problem/complaint. Further clarification necessary (please use as escape only)*

Adopted from: Pharmaceutical Care Network Europe (PCNE). Classification for Drug-Related Problems V9.1. available from:

https://www.pcne.org/upload/files/417_PCNE_classification_V9-1_final.pdf)

The first part of the table 2.3 deals with the prescribing part from the physician and the selection of drug followed by the dispensing part of the pharmacist.

Table 2.3: The cause domain divided into subdomains.

	Primary Domain	Code V9.1	Cause
Prescribing & drug selection	**1. Drug selection** The cause of the (potential) DRP is related to the selection of the drug (by patient or health professional)	**C1.1**	Inappropriate drug according to guidelines/formulary
		C1.2	No indication for drug
		C1.3	Inappropriate combination of drugs, or drugs and herbal medications, or drugs and dietary supplements
		C1.4	Inappropriate duplication of therapeutic group or active ingredient
		C1.5	No or incomplete drug treatment in spite of existing indication
		C1.6	Too many different drugs/active ingredients prescribed for indication
	2. Drug form The cause of the DRP is related to the selection of the drug form	**C2.1**	Inappropriate drug form/formulation (for this patient)
	3. Dose selection The cause of the DRP is related to the selection of the dose or dosage	**C3.1**	Drug dose too low
		C3.2	Drug dose of a single active ingredient too high Dosage
		C3.3	Regimen not frequent enough
		C3.4	Dosage regimen too frequent
		C3.5	Dose timing instructions wrong, unclear or missing
	4. Treatment duration The cause of the DRP is related to the duration of treatment	**C4.1**	Duration of treatment too short
		C4.2	Duration of treatment too long
Disp	**5. Dispensing** The cause of the DRP is related to the logistics of the prescribing and dispensing process	**C5.1**	Prescribed drug not available
		C5.2	Necessary information not provided or incorrect advice provided
		C5.3	Wrong drug, strength or dosage advised (OTC)
		C5.4	Wrong drug or strength dispensed

The second part of the domains concerns the correct use of medication.

Use	**6. Drug use process** The cause of the DRP is related to the way the patient gets the drug administered ***by a health professional or other carer***, despite proper dosage instructions (on label/list)	**C6.1**	Inappropriate timing of administration or dosing intervals by a health professional
		C6.2	Drug under-administered by a health professional Drug
		C6.3	Over-administered by a health professional Drug not
		C6.4	Administered at all by a health professional Wrong
		C6.5	Drug administered by a health professional Drug
		C6.6	Administered via wrong route by a health professional
	7. Patient related The cause of the DRP is related to the patient and his behaviour (intentional or non- intentional)	**C7.1**	Patient intentionally uses/takes less drug than prescribed or does not take the drug at all for whatever reason
		C7.2	Patient uses/takes more drug than prescribed Patient
		C7.3	abuses drug (unregulated overuse)
		C7.4	Patient decides to use unnecessary drug
		C7.5	Patient takes food that interacts
		C7.6	Patient stores drug inappropriately
		C7.7	Inappropriate timing or dosing intervals
		C7.8	Patient unintentionally administers/uses the drug in a wrong way
		C7.9	Patient unable to understand instructions properly
Seamless	8. **Patient transfer related** The cause of the DRP can be related to the transfer of patients between primary, secondary and tertiary care, or transfer within one care institution.	**C8.1**	**Medication reconciliation problem**
	9. Other	**C9.1**	**No or inappropriate outcome monitoring (incl. TDM)**
		C9.2	**Other cause; specify**
		C9.3	**No obvious cause**

Adopted from: Pharmaceutical Care Network Europe (PCNE). Classification for Drug-Related Problems V9.1. available from: https://www.pcne.org/upload/files/417_PCNE_classification_V9-1_final.pdf.

CHAPTER 3 RESULTS

3.1 Phase 1 – Observation Phase

This part covers the findings from the observation phase, which are the gap-finding tool results. Twenty nine of the 75 sub-sections of the gap-finding instrument (Appendix 1), which pertain to the duties of a clinical pharmacist working in the ward, were not carried out fully, neither in the oncology ward nor at the compounding unit by any HCP or pharmacist.

These 29 sub-sections were duties in areas related to all the 9 sections of the tool. Some sections were completely fulfilled, some were partially fulfilled, whereas some duties were not being done at all.

in 3 of the sections, namely:

- Participating in interdisciplinary care,
- Information for ongoing care (Promoting seamless care by contributing to transfer of information about medicines whenever patients move between and within healthcare settings), and
- Documentation

The sections that were not carried out fully are summarised in the tables below.

Table 3.1: Duties of a Ward-based Clinical Pharmacist pertaining to data collection that are Not Performed

1. Accurate History
Obtaining and documenting a complete **Drug History** including prescription and non-prescription medications, and their dose, regimens and administration routes to determine the list of current medications
Obtaining and documenting a complete **Past Medical History**
Reconciliation of medication therapy – comparing the medication history with the prescribed medications and following-up discrepancies
Asking about **storage** of current medications at home

Obtaining a complete past and present medical history is crucial for accurately documenting a patient's current medication list. It ensures potential drug interactions, allergies, and

contraindications are identified. A thorough history helps healthcare providers make informed decisions, optimise treatment plans, and improve patient safety and care outcomes.

Table 3.2: Duties of a Ward-based Clinical Pharmacist pertaining to medication management that are Not Performed

2. Current Medications
Ensuring all drugs are prescribed by their active ingredient
Tracking the cumulative doses of anti-cancer drugs
Ensuring that the date and time at which medicine administration is to commence and cease are written
Providing information on extemporaneous oral formulations

Correct prescribing and tracking of cumulative dosing are essential for patient safety and treatment efficacy. Accurate prescriptions prevent medication errors, reduce the risk of overdose, and ensure proper therapeutic outcomes. Monitoring cumulative doses helps avoid toxicities, side effects, and drug interactions, especially in long-term treatments, safeguarding patient health and promoting optimal care throughout the treatment course.

Table 3.3: Duties of a Ward-based Clinical Pharmacist pertaining to provision of medicine information and side-effect profile and management that are Not Performed

5. Providing Medicines Information
Providing medicines information to health professionals
6. Adverse Drug Reaction Management
Assessing the details of the ADR in the context of patient – specific and medication-related factors
Developing and implementing pharmacological treatment guidelines on acute and late effects of chemotherapy drugs

Providing accurate and timely medicines information to healthcare professionals is essential for ensuring safe and effective patient care. Caring physicians rely on this information to make informed treatment decisions. Effective communication channels, such as drug information services, clinical guidelines, and evidence-based resources, are therefore vital. Moreover, proper ADR documentation, patient monitoring, and timely interventions are crucial in

minimising risks and improving patient outcomes, thus ensuring that drugs' benefits outweigh potential harms.

The next three domains (Table 3.4, Table 3.5, and Table 3.6) include the involvement of interdisciplinary care, promoting a seamless service between all healthcare professionals, and also documentation of medical related issues and dosing. The gap analysis found that duties in the below three domains were not being carried out at all.

Table 3.4: Duties of the clinical pharmacist participating in interdisciplinary care that are not performed

7. Participating in Interdisciplinary Care
Being physically present to participate in ward rounds, clinics and meetings
Preparing accurate and comprehensive patient profiles for assistance when preparing for a ward round
Contributing information about the patient's medicines and medicines management
Making suggestions for selecting and monitoring medicines
Be fully informed about current patient-specific issues
Prioritising patients requiring further review or education by the pharmacist
Participating in discharge planning or planning for ongoing care
Giving advice on the administration, taking into account the availability of access lines, compatibilities and possible pharmaceutical interactions. Advise on possible alternative drugs that can be given more quickly or less frequently if appropriate

Collaboration between clinical pharmacists and oncologists fosters a holistic approach, combining the physician’s clinical knowledge with the pharmacist’s drug expertise, ultimately enhancing the efficacy, safety, and quality of cancer care for patients.

Table 3.5: Duties of a clinical pharmacist in providing seamless care that are not performed

8. Information for ongoing care (Promoting seamless care by contributing to transfer of information about medicines whenever patients move between and within healthcare settings)
Discussing the medicines that need to be supplied or sourced on discharge or transfer with the parent/legal guardian/ patient
Annotating which medicines need to be supplied on discharge on the patient profile
Removing ceased medicines for destruction with the parent's/legal guardian's/ patient's permission
Providing the parents/legal guardians/ patients with the medicines that their child/ they require/s
Providing a written list of the discharge medications as well as directions of how they should be taken, why they are used, start and stop date as well as a hospital contact name and telephone number
Providing information about adherence aids
Encouraging parents/legal guardians/ patients to contact their hospital pharmacist at any time, even after discharge as they may require further information despite comprehensive counselling
Educating parents/legal guardians/ patients on how their child/they should take any new medication prescribed, how to identify side effects and what to do if they occur after being discharged.
Obtaining consent and then communicating all medicines- related information in a timely manner to the patient's GP, community pharmacist, residential care provides or other health professional: • details of medicines prescribed on discharge or transfer, a contact name within the hospital and a telephone number • verified list of all the patient's medicines beginning at the episode of care, changes made during the episode of care and a detailed rationale of these changes • monitoring requirements for ongoing management of the patient's medicines • information regarding the patient's need for periodic medicines review and follow up including post- acute care follow-up and outpatient or non-admitted medication review • reported adverse drug events and adverse drug reactions during the episode of care

Promoting seamless care through effective transfer of medication information is vital when patients move between healthcare settings. Accurate communication of current medications reduces the risk of errors, prevents adverse drug interactions, and ensures continuity of care. This process enhances patient safety, improves treatment outcomes, and supports coordinated care, ultimately leading to better healthcare experiences for patients.

Table 3.6: Duties of a clinical pharmacist pertaining to documentation that are not performed

9. Documentation
Documenting the medication related assessment and plan of care to optimise patient outcomes directly in the patient file The following components are essential to be included in the documentation. **A. Patient medication record** Past medical history, drug history, ADRs/sensitivities, current medications noting start and stop date (if applicable) **B. Active medication problem** Date of onset, problems identified, comments, date resolved **C. PCIs** Date when PCI arose, care issue, date when action is taken, action taken, date of outcome, outcome **D. Medication Therapy Plan** Implemented collaboratively by the health care team including drug, dose, route, frequency, and relevant monitoring parameters (including therapeutic drug monitoring; medication, reference range, result, date and time of last dose administered, date and time of last sample taken, comments) and follow-up

At the compounding section, 29 of the 75 responsibilities of a clinical pharmacist, identified by the gap-finding tool, were not performed.

HCPs, primarily doctors and nurses, or pharmacists employed in other hospital pharmacy departments filled 63% (n=46) of the responsibilities of a ward-based clinical pharmacist.

The following table shows the duties in each domain of the gap-finding tool that are being performed at present.

Table 3.7: Percentage in each domain of the gap-finding tool that is being done at present (n=number of roles performed)

Domain Number	**Description of Domain**	**Number of Roles Performed (n=46)**
1	Accurate History	75% (n=9)
2	Current Medication Management	87% (n=26)
3	Clinical Review	100% (n=3)
4	Therapeutic Drug Monitoring	100% (n=2)
5	Providing Medicines Information	67% (n=2)
6	Adverse Drug Reaction Management	67% (n=4)
7	Participation in Interdisciplinary Care	0% (n=0)
8	Information on Ongoing Care	0% (n=0)
9	Documentation	0% (n=0)

3.2 Phase 2 – SOP development

In healthcare settings, clinical standard operating procedures (SOPs) offer vital advantages. By establishing SOPs for diagnosis, treatment, and safety precautions, they guarantee uniformity and high-quality patient care. SOPs improve adherence to legal and regulatory requirements while lowering the chance of mistakes and legal problems. They enable effective staff training, allowing new team members to understand clinical procedures. These documents encourage responsibility among healthcare practitioners by outlining roles and responsibilities precisely. They also facilitate the identification of excellent practices and areas in need of improvement. Clinical SOPs generally improve patient outcomes and streamline the provision of healthcare.

The general standard operating procedure approved at Mater Dei pharmacy was used as a template to create one for the provision of this pharmaceutical service. Weaknesses identified through the gap analysis, were used to construct the SOP and standardise the procedure of work. The developed SOP was validated by a panel of experts n=4. Positive feedback was received during the validation process, and no major recommendations were put forward. Any minor amendments were carried out, and the document was finalised accordingly (Appendix 3). Following the validation, the SOP consisted of six main sections: Purpose, Scope, Definitions, Responsibilities, Procedure and References. The purpose and scope described the

reason for developing the document and who it is intended for. The responsibilities section detailed who should follow the SOP. The procedure described the process of providing clinical pharmacy service in the oncology wards including patient assessment, chemotherapy order review, patient education and interdisciplinary collaboration. The final section was dedicated for references. Once validated, the SOP was approved and introduced to the practice setting.

3.2.1 Patient Medical Record

A patient medical record (Table 3.9) was created for each patient receiving chemotherapy. This document was developed to summarise all the medications both chemotherapy and any supporting medications that were being administered to the patient. It also facilitates monitoring of cumulative dose frequencies.

Table 3.8: Empty synoptic patient medication record used for oncology patients

Cycle No:			**Known Sensitivities/ADRs:**			
Chemotherapy	**Dose**	**Cycle Day/s to be taken**	**Duration of Administration**	**Route**	**Date**	**Taken**
Supporting Medications	**Form**	**Dose**	**Frequency**	**Route**	**Start Date**	**Stop Date**
Other Medications	**Form**	**Dose**	**Frequency**	**Route**	**Start Date**	**Stop Date**

3.3 Phase 3 – Implementation phase

This section connects all the sections together for the provision of service. It gives the findings of the implementation phase of the pharmaceutical care model.

3.3.1 Pharmaceutical care model

The formulated standard operating procedure serves as the foundation for this pharmaceutical care model. It guarantees consistency and reproducibility across the entire service.

The model starts with patient assessment. A thorough evaluation of the medication history must be carried out before the prescription is validated and checked. By doing this, patients will be treated at the appropriate moment. In order to get the most recent information and updates, it is also necessary to examine patient demographics and laboratory findings, particularly in cases when patients' health in previous cycles was subpar or borderline. Allergies and drug-drug interactions must be identified and reported to ensure that the same adjustment is made in subsequent cycles. When examining the laboratory findings, the clinical pharmacist needs to check how the patient responded to treatment. If not optimal, recommendations for changing or modifying the course of treatment in accordance with clinical guidelines can be put forward. Chemotherapy order validation and verification are addressed in the next step of the pharmaceutical care model. Systemic anticancer forms must be checked against established treatment protocols and recommendations, and any necessary adjustments must be made in accordance with those criteria. Verification is required for patients' demographics and laboratory results, drug selection, dosage, dosage regimen and administration methods. Any issues that may arise need to be communicated with the respective firm querying the possible reasoning. The intervention accepted or rejected, together with the outcome, must be documented in the synoptic patient medication record for future reference. The prescription must subsequently be signed and forwarded to the compounding unit at Mater Dei Hospital for

the generation of the worksheet, which will facilitate the eventual reconstitution of the patient's treatment.

Answering questions that patients may have is another responsibility of the clinical pharmacist. Patients should be advised wherever possible about supportive therapy and ways to lessen the symptoms of side effects. In clinical pharmacy services, interdisciplinary teamwork is an asset. All healthcare providers can be presented educational materials, and team meetings can be scheduled to share ideas on medication safety and management as well as to discuss novel agents with improved therapeutic outcomes.

By introducing this model in adult oncology, the patients would receive an optimised pharmaceutical service. During the implementation phase of this study PCIs were identified and investigated. They are summarised in the following section.

3.3.2 Demographic data

During the course of 2 months, 284 different patient records were seen. These were recruited by convenience sampling by the signed intermediary. Some patients were seen twice (n=23). There were 174 female patients with an average age of 54 years and 110 male patients with an average age of 62 years. The patients' demographic profile is displayed in Table 3.9.

Table 3.9: Demographic Profile of Patients (n=284)

	Male (%)	**Female (%)**	**Total (%)**
Number of patients	110 (39)	174 (61)	284 (100)
Age [years (mean)]	61.76	53.6	57.68
Range [years]	28 – 84	23 – 88	23 – 88
Median [years]	62	53	58

Compared to male patients, female patients were marginally younger. Female patients spanned a slightly wider age range than male patients, with both the youngest and oldest being female.

Following the verification and validation of the prescription, any drug related problem or pharmaceutical care issue was recorded together with the outcome. These were summarised in a table as shown below.

Table 3.10: Table created to register recorded PCI's and DRP's

Date	PCI/DRP	Proposed Action	Outcome

3.3.3 Pharmaceutical Care Issues

A total of 307 pharmaceutical care issues were identified among these patients, out of which 72 drug related problems were found. These were classified into 3 major domains, as identified by the PCNE classification, namely, Drug Selection, Dose Selection and Treatment Safety. These are summarised in Figure 1.

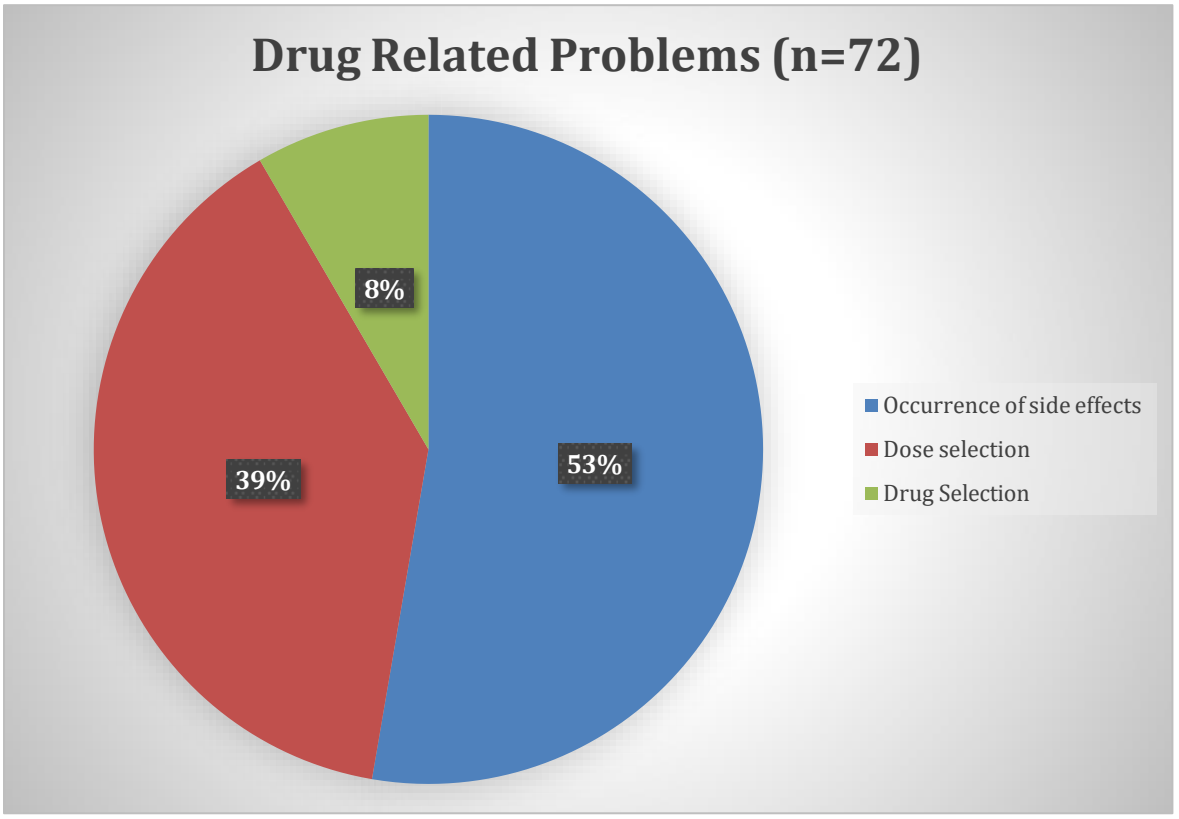

Figure 1: Drug related problems (n=72) found from the performed pharmaceutical interventions

The most common drug related problems identified were issues with adverse drug reactions, followed by issues incurred by dose selection. The least number of issues were attributed to drug selection or regimen.

Problems with adverse reactions were the most often reported DRPs (53.0%). The division of these highlighted concerns is displayed in Table 3.11 below.

Table 3.11: Classification of Side-Effects

Occurrence of side effects (n=38)	
Hypersensitivity reactions	**28**
Incorrect dosage of pre-medications.	**6**
Incorrect rate which leads to more pronounced adverse effects	**4**

Hypersensitivity reactions with agents that are viscous in nature, are the most common adverse drugs events. This is managed by either stopping the infusion and restart it at a later time after administration of steroids, or by prolonging the rate of infusion.

As part of the interdisciplinary team, the pharmacist also needs to investigate if there is a sudden increase in hypersensitivity reactions following a change in brand or even a change in batch of a particular drug.

The second most common drug related problem is dose selection, the results of which are summarised in table 3.12, below.

Table 3.12: Classification of Dose Selection

DOSE SELECTION (n=28)	
Dose too low	**7**
Dose too high	**15**
Dosage regimen not frequent enough	**1**
Dosage regimen too frequent	**1**
Dosage timing instructions wrong, unclear or missing	**4**

The most common issues within this section were prescribing errors, where the dose prescribed was higher than the recommended protocol dose.

The third category of DRP was drug selection. This category contributed to six issues during the research. The only sub-domain in this category was that the drug prescribed was not according to used guidelines and protocols. Hence an off-license form is required for each specific case since the drug would not be licensed for that specific indication. An endorsement from the clinical chair of oncology would be required together with the endorsement from the caring consultant.

Acceptance from other healthcare professionals varied. Some consultants agreed to modify accordingly (n=65) which equals to 90%, hence most of the times the pharmacist's intervention was agreed to. The remaining 10% did not agree, hence they were asked to justify the change and write on the prescription, together with any paperwork that they needed to submit in the cases of off-licence use.

CHAPTER 4 DISCUSSION

Pharmacotherapy is one of the most common interventions in healthcare. Hospitalised patients frequently have difficulties in managing even effective pharmacotherapies. In fact, a number of patients experience a drug-related adverse event while in the hospital. Medication errors are more likely to occur in hospitals because parenterally delivered drugs are often utilised in this setting. In addition, patients in hospitals are frequently unstable and require prompt clinical decision-making in addition to rigorous, ongoing monitoring. Medication mistakes are one of the most significant preventable hazards endangering patient safety in healthcare. Pharmacotherapies used in hospitals need to be well-designed for both individual patient care and organisational level procedures. Consequently, strategies and regulations aimed at enhancing safe medication practices are given priority in global patient safety programs. The establishment of preventive measures for future risk management, learning from medication errors through reporting systems, and fostering a culture of safety, have all been highlighted by these tactics.

Given the complexity and breadth of cancer treatment, the identification of drug-related problems (DRPs) in oncology has gained significance in the last ten years. In the field of cancer, DRPs can have a significant impact on clinical outcomes, healthcare expenditures, patient safety, treatment efficacy, and quality of life. Because of the significant risk of adverse drug reactions (ADRs) and the strong nature of chemotherapy drugs, patient safety is of utmost importance in oncology. Early detection of DRPs can help avoid serious adverse responses, which are common in cancer patients because of the severe effects of cancer therapy and the patients' compromised physiological state. The high frequency of ADRs in cancer patients and the requirement for proactive monitoring to improve patient safety were highlighted in a 2017 study by Poudel *et al.* To maximise the effectiveness of treatment, it is imperative to ensure that chemotherapeutic drugs are administered and dosed appropriately. While an overdose raises the possibility of toxicity, underdosing can result in less-than-ideal therapeutic outcomes.

Patel *et al.* (2019) conducted a retrospective analysis that emphasized the importance of pharmacokinetic monitoring in individualized chemotherapy dosing to enhance therapeutic efficacy and minimize toxicity. Patients will obtain the full therapeutic effect of their medications if DRPs, such as inappropriate dosages and improper administration practices, are identified and resolved.

Patients with cancer frequently experience a range of symptoms and adverse consequences from their illness as well as from therapy. Patients' quality of life can be markedly improved by effective DRP care. Debilitating symptoms, for instance, can be lessened by addressing DRPs associated with supportive care drugs, such as those for pain, nausea, and exhaustion. The beneficial effects of pharmacist-led contribution in controlling DRPs and enhancing symptom control in cancer patients were shown by a systematic study conducted by McPherson *et al.* (2014). Due to hospital readmissions, prolonged hospital stays, and the need for additional therapies to control problems, DRPs may result in higher healthcare expenses. The economic impact of DRPs in oncology was measured by Ruder *et al.* (2018), who also remarked that efficient DRP management can result in significant cost savings for healthcare systems (Ruder *et al.*, 2018), easing the financial burden on patients and healthcare providers. In cancer, personalized medicine refers to adjusting treatment regimens based on unique patient attributes, such as genetic profiles. Pharmacogenetic testing can be used to identify DRPs, which can then be used to optimise drug selection and dosage, reducing side effects and improving therapeutic efficacy. Pharmacogenetics' place in oncology was reviewed by Innocenti *et al.* (2017), who also emphasized the benefits of customized medicine in preventing DRPs and enhancing treatment results (Innocenti *et al.*, 2017). A direct correlation exists between better clinical results, such as higher survival rates, and efficient DRP management. The overall success of oncology therapies can be improved by healthcare practitioners by making sure patients receive the most suitable and effective therapy. (Van Leeuwen *et al.*, 2019).

In oncology, identifying and treating drug-related issues is essential in improving treatment outcomes, maximising patient care, and raising cancer patients' quality of life. Research conducted over the last 10 years has consistently demonstrated that proactive management of DRPs and careful monitoring, lead to improved patient outcomes, lower healthcare costs, and the development of customized medicine in oncology.

The first phase of this study has identified gaps in the system providing an overview of the extent of pharmacists involvement with other healthcare professionals focused on the provision a safe and rationale care. An important factor which was found through the gap analysis was the correct documentation of the latest information and demographics of the patient. If this information is old or incorrect, it could lead to incorrect prescribing and hence over/under dosing. Several studies show the importance of the gap analysis prior to implantation of a clinical pharmacy service such as the study by Weideman., *et al.* (2024). The study also demonstrated that when a service was put into place before its efficacy was assessed, it was frequently unsustainable and did not offer any value.

Other pharmacists who worked in different departments of the hospital pharmacy filled some of the roles of the clinical pharmacist. They were all competent in completing the task at hand, but because these pharmacists are not regularly on the ward and do not have direct patient or healthcare professional interaction, there were occasions when their scope of work was restricted. There were instances when the service was not given promptly or in accordance with the specific needs of the patient. The ward pharmacist was now responsible for verifying that medications were accessible and available; a task that had previously been performed by the dispensing pharmacists. The service designed was made in such a way that the pharmaceutical care model was based on international standards of care practice. This study was able to establish a baseline for the responsibilities of a clinical pharmacist working on a ward by using the gap-finding method. Some of the responsibilities were being omitted due to time

restrictions, the absence of a clinical pharmacist, or the inability of the other HCPs to identify a specific requirement.

A gap that was identified and fulfilled was the provision of information regarding medications. As a matter of fact, this was the ward's most sought pharmaceutical service as can be seen in a study by. Patel and Gurumurthy in 2019. Having a pharmacist on the interdisciplinary team who can provide information about medications was a more practical solution for medical staff than requiring them to contact MDH Pharmacy, since the clinical pharmacist would have more knowledge and focus on the clinical area that he is specialising in.

The second phase of the study dealt with the compilation of a standard operating procedure for the service. According to the World Health Organization (WHO), standard operating procedures direct pharmacists to participate in treatment planning and ward rounds, offering their knowledge of drug management to the interdisciplinary team. SOPs ensure quality and consistency, improve security for patients, improve productivity and flow, encourage training and education, ensure regulatory compliance, and encourage interdisciplinary collaboration.Regardless of the pharmacist on duty, SOPs standardise the processes and practices for clinical pharmacy services, guaranteeing that every patient receives the same highest standard of treatment. In oncology, where treatment plans are intricate and highly customised, this uniformity is essential. SOPs make sure that the treatment given is supported by the most recent research and best practices. This promotes better patient outcomes and sustains a high standard of care.

Patients with cancer frequently take several drugs, which can have serious interactions and side effects. SOPs help pharmacists with proper medication reconciliation, drug interaction monitoring, and adverse impact management. Moreover, SOPs help lower the risk of pharmaceutical errors by offering clear instructions and guidelines. This is important in

oncology because of the high toxicity of cancer medications and the narrow therapeutic index. Having and SOP, ensures that workflow processes are streamlined so that pharmacists can carry out their responsibilities effectively. This covers the procuring, dispensing, administering, and monitoring procedures for medications. Pharmacists can better manage their time by concentrating on clinical activities and patient consultations rather than administrative responsibilities when they implement standardized procedures.

SOPs also give new pharmacy technicians and pharmacists a clear grasp of their responsibilities and tasks in the oncology ward whilst guaranteeing that pharmacy services adhere to healthcare laws and standards, including those established by government and accrediting organizations. They offer a structure for appropriate documentation, which is necessary for inspections and audits. This paperwork aids in proving adherence to quality and safety requirements.

Pharmacists collaborate closely with nurses, oncologists, and other healthcare professionals in an oncology ward. SOPs help the team communicate and coordinate clearly, which guarantees that patient care is thorough and well-coordinated.

In this study, many of the issues put forward by pharmacists, were accepted by other healthcare professionals which further emphasizes how crucial it is to incorporate complete pharmaceutical care programs into the paradigm of oncology treatment.

The absence of a pharmacist in the oncology ward, hinders their ability to perform key duties effectively. Direct patient interaction is essential for gathering comprehensive, real-time information that supports accurate clinical decision-making. In this context, clinical

pharmacists face several limitations such as incomplete Medication Reconciliation, limited clinical assesmennts, lack of patient education and counselling, monitoring adverse reactions and outcomes and team communication.

A thorough review of a patient's medication history requires direct questioning to uncover all prescription and non-prescription medications, supplements, and adherence behaviours. Without patient interaction, important details may be overlooked or inaccurately represented in electronic health records. Clinical pharmacists rely on direct patient interaction to assess the effectiveness and potential side-effects of a medication regimen. Physical signs (e.g., skin reactions, swelling), patient- reported symptoms, and adherence challenges are more easily identified in-person. This limits the pharmacist’s ability to provide comprehensive care and promptly identify DRPs. Effective communication involves verbal and non-verbal indications to ensure that patients understand how to take their medications properly. When a pharmacist is not present to observe patients' responses, there may be misunderstandings that can affect adherence and eventual treatment success.

Direct observation helps pharmacists catch subtle signs of adverse reactions or complications that patients might not recognize as significant. Without patient interaction, pharmacists may rely solely on reported data, which can be incomplete or delayed. While virtual communication with other healthcare professionals is possible, not being present in patient care areas may limit spontaneous, real-time discussions that contribute to holistic patient care planning.

In summary, not seeing patients limits the ability of clinical pharmacists to provide personalised, comprehensive care. This affects medication safety, efficacy monitoring, patient education, and the development of trust—all critical aspects of their role.

Implementing oncology clinical pharmacy services in the long term comes with several challenges which can affect the effectiveness, sustainability, and scalability of these services. One key challenges is workforce and training Issues. Finding and retaining qualified oncology clinical pharmacists with expertise in the specific needs of cancer patients is a significant challenge. There may be a shortage of oncology pharmacy specialists in certain periods of time. Moreover, oncology is a rapidly evolving field, and clinical pharmacists must stay up to date with new drug therapies, treatment protocols, and guidelines. Ensuring that pharmacists receive ongoing education and training can be resource intensive. Another challenge is the complexity of Oncology regimens. Treatments are increasingly moving toward personalized and precision medicine, where therapies are tailored to individual patients based on genetic factors. This complexity can make it harder for pharmacists to manage drug interactions, dosing, and side effects. Consequently, oncology patients often have multiple comorbidities and may be prescribed numerous medications. Managing drug interactions, side effects, and patient adherence becomes more complex and requires specialized knowledge. The introduction of new and sometimes highly specific oncology medications requires ongoing education for the clinical pharmacy team. The rapid pace of new drug approvals and clinical trials presents challenges in keeping pharmacists informed and effective.

Considering the study's successful outcome, the oncology wards may permanently and fully adopt this pharmacological care service.

Although the study assessed the pharmacist's role in an oncology environment, other hospital departments that do not specialize in cancer may also use this standardised pharmaceutical care paradigm.

Incorporating clinical pharmacy services within the oncology care model has been shown to be cost-effective. By preventing adverse drug events, reducing hospital readmissions, and optimising medication use, clinical pharmacists contribute to significant healthcare cost savings. This economic benefit underscores the value of investing in clinical pharmacy services as part of a comprehensive oncology care strategy. Other studies can measure the economic impact of such a service.

4.1 Limitations of the study

- Time constraints; the importance and impact of the PIs were not assessed and some of the ward interventions could have been unreported..
- No cost assessments were carried out. Time constraints prevented the implementation of the cost savings resulting from the pharmacist researcher's input.
- The lack of direct patient contact limited patient-centered insights, personalized interventions, and real-world applicability, relying on indirect data. Ethical constraints and reduced engagement may impact outcomes, necessitating future research with patient involvement.

4.2 Recommendation for further studies

Further research needs to concentrate on enhancing the measurement of the influence of clinical pharmacy services on the long-term results of cancer patients. Research examining the assimilation of cutting-edge technology, such as pharmacogenomics, into clinical pharmacy practice will be beneficial as well. Additionally, gathering feedback from patients

regarding the role pharmacists play in their care can help to improve both patient satisfaction and service delivery.

4.3 Conclusion

This study aims to transform service delivery by shifting from a product-centric to a patient-centered approach. This transition enhances patient care, optimizes pharmaceutical therapy, improves overall outcomes, and promotes the cost-effective use of healthcare resources within an interdisciplinary care model.The many facets of clinical pharmacists' roles in oncology settings have been examined in this research, with particular emphasis on their contributions to interdisciplinary teamwork, drug management, and patient education.

Drug-related problems (DRPs) can be identified and resolved by pharmacists, which guarantees the safe and efficient administration of drugs used in supportive care and chemotherapy. This research presents studies that demonstrate decreased adverse medication reactions, enhanced therapy adherence, and better control of treatment-related side effects.

Clinical pharmacists perform comprehensive medication reviews, keep monitoring out for any drug interactions, and provide personalised dosage recommendations, all of which are vital to improving medication safety. By taking a proactive stance towards medication management, cancer treatment safety is improved, and medication errors are less common.

Collaboration between pharmacists, oncologists, nurses, and other healthcare workers is encouraged by the interdisciplinary model of care. Since all facets of patient care are handled holistically thanks to this cooperative approach, treatment regimens are more well-coordinated and extensive. This research provides several instances of effective interdisciplinary

approaches that have enhanced therapeutic results.

The clinical pharmacy service in this study has not been implemented yet and is still in the planning stage. Its launch will depend on approval, available resources, and integration into the healthcare system Notwithstanding its limitations, this research offers a significant addition to our knowledge of clinical pharmacy services in the context of multidisciplinary adult oncology care models. In the end, enhancing patient treatment and outcomes in oncology will come from acknowledging and addressing these limitations in future research and practice, which will also improve the findings' application and dependability.

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APPENDICES

APPENDIX 1 ETHICAL APPROVAL

L-Università ta' Malta

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26 December 2023

Mr Brandon Sultana
22, Harmony, Triq l-Arcisqof
Guzeppi Diacono
Xaghra, Gozo, Malta

With reference to your application submitted to the Faculty Research Ethics Committee in connection with your research entitled:

Clinical Pharmacy Services Within an Interdisciplinary Model of Care in Adult Oncology

The Faculty Research Ethics Committee is granting ethical approval for the above-mentioned application.

Professor Anthony Serracino Inglott
Chair
Faculty Research Ethics Committee

APPENDIX 2 GAP-FINDING TOOL

1. Accurate History	Tick	Comment
Obtaining and documenting a complete **Drug History** including prescription and non- prescription medications, and their dose, regimens and administration routes to determine the list of current medications		
Obtaining and documenting a complete **Past Medical History**		
Confirming and documenting **ADR's/sensitivities**		
Reconciliation of medication therapy – comparing the medication history with the prescribed medications and following-up discrepancies		
Asking about recently **stopped/changed medications** and the reasons for the changes		
Asking about the use of **adherence** aids		
Asking about **storage** of current medications at home		
Assessing parent's/ patient's understanding of their child's/ their illness and determining if there is need for further **education about the illness**		
Assessing parent's/ patient's understanding and attitude to their child's/ their **current drug therapy**		
Assessing parent's/ patient's ability to **use drugs as prescribed**		
Assessing the need to refer to medical staff		
2. Current medication management	**Tick**	**Comment**
A. Reviewing all prescriptions and treatment charts to ensure clarity and validity		
Ensuring prescriber's intention is clear to enable the safe supply and administration of medicines		
Ensuring that prescriptions and treatment charts are comprehensive and unambiguous		
Ensuring all drugs are prescribed by their active ingredient		
Ensuring that drug names and directions are not abbreviated		
Ensuring that the date and time at which medicine administration is to commence and cease are written		
Ensuring that the time the dose should be given is endorsed in the relevant section of the chart		

Checking that patient identifiers are documented		
Ensuring that the order is signed and the prescriber can be identified		
B. Reviewing all prescriptions and treatment charts to ensure appropriateness of all drugs		
Confirming that there is a clear **indication** for each drug		
Confirming that the medicine is prescribed for an **approved** or recognized indication. If not, ensuring that the necessary forms are filled		
Ensuring protocols and guidelines (local where appropriate) are considered during prescribing		
Considering the **latest evidence** regarding the medicine's efficacy, comparative efficacy and safety of therapeutic alternatives and likelihood of side effects compared to therapeutic alternatives		
Ensuring that the **method of administration** selected is the most appropriate: route, regimen, dosage form, administration times (e.g. with respect to food/feeds, convenience, scheduled procedures/investigations, TDM requirements) and duration of administration		
Ensuring that the infusion solution and concentration are appropriate for parenteral drugs		
Checking that **drugs and doses** are appropriate with respect to: (1) patient specific considerations e.g. disease state, age, body weight, body surface area, laboratory results e.g. renal function, liver function, patients' previous experience with drug (2) therapeutic goals of each drug and (3) licensed dose		
Checking dose conversions with changes to route or formulation		
Checking that the drug has been achieving goals of therapy		
Checking for duplications		
Checking for contraindications		
Checking for drug interactions and assessing their clinical significance. Drug interactions include: drug–drug, drug–patient, drug–disease, drug–nutrient interactions and drug- laboratory tests interactions		
Ensuring that the units of the drug prescribed are clearly indicated		
Tracking the cumulative doses of anti-cancer drugs		
Providing information on extemporaneous oral formulations		

Liaising with the cytotoxic manufacturing service to coordinate the timely supply of chemotherapeutics		
Ensuring drugs are available at the ward and where necessary are ordered, e.g. current medicine, premedication, prophylactic treatment		
Checking the medication administration record to ensure that all doses ordered have been administered		
Annotating treatment charts as necessary		
Ensuring that the order is cancelled in all sections of the medication administration record when medicine therapy is intended to cease		
Considering cost of the medicine to the patient and hospital and considering therapeutic alternatives		
Checking availability and access to medications, i.e. government restrictions, marketing approval, hospital formulary limitations, methods of obtaining further supply outside the facility		
3. Clinical Review	**Tick**	**Comment**
Reviewing and monitoring patient-specific clinical information including patient's signs and symptoms (from discussions with the patient or through review of clinical progress notes), parameters (e.g. pulse rate, temperature, blood pressure, blood glucose level and patient weight), biochemical tests (e.g. serum electrolytes, creatinine, liver function tests, haematology results and microbiology results) and other tests (e.g. radiological investigations, pain scores, bowel charts, peak flow/spirometry) to evaluate the response to the drugs and adjust therapy accordingly		
Identifying actual and potential medicines-related problems and evaluating collaboratively with other members of the health care team the need for intervention and prioritizing these per their risk and urgency		
Performing follow-up evaluations in collaboration with other members of the health care team to continually assess patient outcomes		
4. Therapeutic drug monitoring (TDM)	Tick	Comment
When necessary, the pharmacist should give exact instructions when and how TDM is to be carried out		
Informing the prescriber of the results of TDM in a timely manner, including recommended action and future monitoring requirements		
5. Providing medicines information	Tick	Comment

Providing medicines information to health professionals to provide patient-centred care and optimise quality use of medicines		
Providing medicines information to patients and their parents/legal guardians to improve their capacity for involvement, engage them in their health care and encourage the safe and appropriate use of medicines, thereby, enhancing therapeutic outcomes. This includes assuring the safe handling of hazardous drugs		
Educating the patient/caregivers (both verbally and in writing) to ensure understanding of the care plan, to optimise adherence, and to improve therapeutic outcomes		
6. Adverse drug reaction (ADR) management	Tick	Comment
A. Detection and prevention of ADRs		
Identifying and monitoring susceptible patients: patients on multiple drugs, paediatric patients, patients treated with drugs known to have a high incidence of and serious adverse effects including narrow therapeutic index drugs, previously experienced ADRs, hepatic and renal impairment, multiple disease processes		
B. Suspected ADR		
Assessing the details of the ADR in the context of patient-specific and medication-related factors		
C. Management of an ADR		
Considering the likelihood of the suspected medicine(s) having caused the reaction and the clinical significance when assessing whether to continue treatment with the suspected medicine(s).		
Recommending treatment options for the ADR and, if appropriate, recommending alternative treatments		
Involvement in the management of all cancer and drug related complications (e.g. nausea, infection, pain etc. in paediatric oncology patients)		
Developing and implementing pharmacological treatment guidelines on acute and late effects of chemotherapy drugs		
7. Participating in interdisciplinary care	Tick	Comment
Being physically present to participate in ward rounds, clinics and meetings attended by other health professionals where the overall care of the patient is discussed and planned		

Preparing accurate and comprehensive patient profiles for assistance when preparing for a ward round		
Contributing information about the patient's medicines and medicines management		
Making suggestions for selecting and monitoring medicines		
Be fully informed about current patient-specific issues		
Prioritising patients requiring further review or education by the pharmacist		
Participating in discharge planning or planning for ongoing care		
Giving advice on the administration, taking into account the availability of access lines, compatibilities and possible pharmaceutical interactions. Advise on possible alternative drugs that can be given more quickly or less frequently if appropriate		
8. Information for ongoing care (Promoting seamless care by contributing to transfer of information about medicines whenever patients move between and within healthcare settings)	Tick	Comment
A. Managing the patient's medicines and communicating with them/ their parents or legal guardians on transition		
Discussing the medicines that need to be supplied or sourced on discharge or transfer with the parent/legal guardian/ patient		
Annotating which medicines need to be supplied on discharge on the patient profile		
Removing ceased medicines for destruction with the parent's/legal guardian's/ patient's permission		
Providing the parents/legal guardians/ patients with the medicines that their child/ they require/s		
Providing a written list of the discharge medications as well as directions of how they should be taken, why they are used, start and stop date as well as a hospital contact name and telephone number		
Providing information about adherence aids		

Encouraging parents/legal guardians/ patients to contact their hospital pharmacist at any time, even after discharge as they may require further information despite comprehensive counselling		
Educating parents/legal guardians/ patients on how their child/ they should take any new medication prescribed, how to identify side effects and what to do if they occur after being discharged.		
B. Liaising with other Health Professionals on Transition		
Obtaining consent and then communicating all medicines- related information in a timely manner to the patient's GP, community pharmacist, residential care provides or other health professional: • details of medicines prescribed on discharge or transfer, a contact name within the hospital and a telephone number • verified list of all the patient's medicines beginning at the episode of care, changes made during the episode of care and a detailed rationale of these changes • monitoring requirements for ongoing management of the patient's medicines • information regarding the patient's need for periodic medicines review and follow up including post- acute care follow-up and outpatient or non-admitted medication review • reported adverse drug events and adverse drug reactions during the episode of care		
9. Documentation	Tick	Comment
Documenting the medication related assessment and plan of care to optimise patient outcomes directly in the patient file The following components are essential to be included in the documentation; **A.** Patient medication record Past medical history, drug history, ADRs/sensitivities, current medications noting start and stop date (if applicable) **B.** Active medication problem Date of onset, problems identified, comments, date resolved **C.** PCIs Date when PCI arose, care issue, date when action is taken, action taken, date of outcome, outcome **D.** Medication Therapy Plan Implemented collaboratively by the health care team including drug, dose, route, frequency, and relevant monitoring parameters (including therapeutic drug monitoring; medication, reference range, result, date and time of last dose administered, date and time of last sample taken, comments) and follow-up		

APPENDIX 3 STANDARD OPERATING PROCEDURE

Clinical Pharmacy Oncology Services		
SOP Number:	**Finalisation Month:** [Month + Year]	
Originator	*Signature*	*Stamp*
Checked By	*Signature*	*Stamp*
Approved By **Quality Assurance**	*Signature*	*Stamp*
Authorised by **Director of Pharmacy**	*Signature*	*Stamp*
Date of implementation	*Date*	
The SOP this SOP is superseding		
Change log from previous versions		
Procedure valid for three years from implementation date **This document is not valid without all the number of pages specified**		
Pharmacy section to which the SOP applies:	Clinical Oncology Pharmaceutical Services	

Purpose
To outline the responsibilities and procedures for clinical pharmacy services in the adult oncology wards. This aims to ensure the safe, effective, and appropriate use of medications for patients undergoing cancer treatment.
Scope
This SOP applies to all pharmacists, pharmacy technicians and other pharmacy professionals involved in the management of oncology patients within Mater Dei Hospital(MDH) and Sir Anthony Mamo Oncology Centre (SAMOC). It covers medication management, patient counselling, and interdisciplinary collaboration.
Definitions
Clinical Pharmacy: A branch of pharmacy that focuses on optimising medication therapy and improving patient outcomes. **Oncology:** The branch of medicine that deals with the prevention, diagnosis, and treatment of cancer. **Medication Management:** The process of overseeing and managing a patient's medication therapy.
Responsibilities
This procedure is conducted by pharmacists giving clinical pharmacy services in the adult oncology wards.
Procedure
Patient Assessment 1. During the initial consultation: - Conduct a comprehensive medication history review. - Assess patient-specific factors (namely; age, weight, renal function, liver function and complete blood count amongst others). - Identify potential drug interactions and take note of any allergies. 2. Ongoing Monitoring: - Regularly review laboratory results and patient responses to therapy.

- Adjust medication regimens as necessary based on recent clinical guidelines after discussion with consultants.

Chemotherapy Order Review

1. Verification:

- Verify the accuracy of chemotherapy orders against treatment protocols.
- Ensure correct drug selection, dosing, and administration routes.

2. Intervention:

- Consultation with prescribers regarding any discrepancies or concerns.
- Document all interventions and outcomes in the *Patient Medical Record.*

Patient Education

1. Counselling:

- Provide individualized counselling on chemotherapy agents and supportive therapies, including:
  - Mechanism of action.
  - Administration guidelines.
  - Common side effects and management strategies.

2. Resources:

- Distribute educational materials and resources to patients and caregivers.
- Address any questions or concerns raised by patients or caregivers.

Interdisciplinary Collaboration

1. Interdisciplinary Team Meetings:

- Attend interdisciplinary team meetings to discuss patient care.

- Share insights on medication management and safety.

2. Consultation:

- Provide expertise to the healthcare team regarding pharmacotherapy options and potential side effects.

References

- National Comprehensive Cancer Network (NCCN) Guidelines
- American Society of Health-System Pharmacists (ASHP) Guidelines
- Institutional Policies and Procedures
- FURTHER DEFINING THE SCOPE OF HEMATOLOGY/ONCOLOGY PHARMACY PRACTICE. Haematology/Oncology Pharmacy Association; 2019.

APPENDIX 4 – CLASSIFICATION OF DRUG-RELATED PROBLEMS

	Code V9.1	Primary domains
Problems (also potential)	**P1**	**Treatment effectiveness** There is a (potential) problem with the (lack of) effect of the pharmacotherapy
	P2	**Treatment safety** Patient suffers, or could suffer, from an adverse drug event
Causes (including possible causes for potential problems)	**C1**	**Drug selection** The cause of the DRP can be related to the selection of the drug
	C2	**Drug form** The cause of the DRP is related to the selection of the drug form
	C3	**Dose selection** The cause of the DRP can be related to the selection of the dosage schedule
	C4	**Treatment duration** The cause of the DRP is related to the duration of treatment
	C5	**Dispensing** The cause of the DRP can be related to the logistics of the prescribing and dispensing process
	C6	**Drug use process** The cause of the DRP is related to the way the patient gets the drug administered by a health professional or carer, in spite of proper instructions (on the label)
	C7	**Patient related** The cause of the DRP can be related to the patient and his behaviour (intentional or non-intentional)
	C8	**Patient transfer related** The cause of the DRP can be related to the transfer of patients between primary, secondary and tertiary care, or transfer within one care institution.
	C9	**Other**
Planned Interventions	**I0**	**No intervention**
	I1	**At prescriber level**
	I2	**At patient level**
	I3	**At drug level**
	I4	**Other**
Intervention Acceptance	**A1**	**Intervention accepted**
	A2	**Intervention not accepted**
	A3	**Other**
Status of the DRP	**O0**	**Problem status unknown**
	O1	**Problem solved**
	O2	**Problem partially solved**
	O3	**Problem not solved**

Adopted from: Pharmaceutical Care Network Europe (PCNE). Classification for Drug-Related Problems V9.1. available from: https://www.pcne.org/upload/files/417_PCNE_classification_V9-1_final.pdf)