

THE ROLES AND RESPONSIBILITIES OF CLINICAL PHARMACISTS IN HOSPITAL SETTINGS

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FOREWORD

It is with great pleasure and anticipation that I introduce this comprehensive book on the pivotal roles and definitions of clinical pharmacists in the hospital setting. In the ever-evolving landscape of healthcare, the responsibilities of clinical pharmacists have expanded far beyond traditional roles. They are now essential members of the healthcare team, collaborating with physicians, nurses, and other professionals to optimize medication therapy, monitor patient outcomes, and ensure the highest standards of pharmaceutical care. This book takes a deep dive into these multifaceted responsibilities, shedding light on the nuanced yet pivotal contributions that clinical pharmacists make on a daily basis.

Through meticulous research, insightful analyses, and compelling patient case examples this book offers readers a comprehensive understanding of the diverse hospital services where clinical pharmacists operate. From the demanding and high-stress environment of intensive care units to the compassionate care provided in pediatric services, each chapter delves into the unique challenges and opportunities faced by clinical pharmacists in these settings. Moreover, this book underlines the human aspect of clinical pharmacy. It emphasizes the importance of patient education, medication safety, and the ethical considerations that guide every decision made by clinical pharmacists. By focusing not only on the technical aspects but also on the compassionate and empathetic dimensions of their work, this book truly captures the essence of clinical pharmacy in the hospital setting.

I commend the authors for their dedication to compiling this invaluable resource. It is my sincere hope that this book will serve as an enlightening and inspiring companion for healthcare professionals, students, and anyone interested in the intricate and profoundly meaningful world of clinical pharmacy within the hospital environment.

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PREFACE

Hospitals serve as pivotal institutions within the healthcare sector, dedicated to the treatment, healing, and compassionate care of patients. Among the multifaceted and dynamic components that constitute these healthcare establishments, clinical pharmacists stand out as indispensable healthcare professionals. This book aims to delve into the responsibilities and roles of clinical pharmacists in a hospital setting, highlighting the intricacies and significance of this vital profession.

By examining different hospital services, each with its unique requirements, this book illustrates how clinical pharmacists contribute in various areas. From intensive care units to cardiology departments and internal medicine wards to pediatric services, clinical pharmacists are dedicated to the health and well-being of patients. This book serves as a resource to help us understand the day-to-day tasks, responsibilities, and impacts of clinical pharmacists in these diverse service settings. The roles of clinical pharmacists in hospital wards extend beyond mere medication distribution. They also include medication therapy monitoring, assessment of drug interactions, addressing patients' medication-related questions, and collaboration with the healthcare team. This book provides detailed explanations of each of these responsibilities and underscores the positive influence of clinical pharmacists on patients' healthcare outcomes. Clinical pharmacists not only ensure the safe and effective use of medications in a hospital environment but also contribute to patient satisfaction. By providing education about medication therapies and assisting patients in correctly using their medications, clinical pharmacists empower patients to have a better understanding and management of their treatment processes.

This book is prepared to emphasize the critical role of clinical pharmacists in hospital services. These professionals work with dedication to preserve the health and well-being of patients, and this book aims to help us better appreciate their efforts. We hope that this book will assist in a deeper understanding of the significant contributions of clinical pharmacists in a hospital setting and inspire future practitioners of this profession.

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CHAPTER 1

Introduction to the Role of Clinical Pharmacists in Hospital Settings

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Abstract: Clinical pharmacists (CPs) play a crucial role in hospital settings by providing patient-centered care and improving medication outcomes. CPs use various tools such as medication reviews, medicine reconciliation, patient counseling, and drug monitoring to identify and resolve drug-related problems. CPs are also involved in the implementation of evidence-based guidelines and standards to improve the quality of care and patient outcomes. These competencies required by CP in hospital settings include knowledge of all pharmaceutical sciences. They must also have excellent communication skills, be able to work as part of a multidisciplinary team, and possess the ability to critically evaluate and apply research findings. CPs assess the effectiveness of interventions with quality of life, health-related quality of life, medication adherence, clinical outcome, drug utilization, readmission rate, quality-adjusted life year, cost-effectiveness, hospital length of stay, patient satisfaction, and incidence of adverse drug events. In conclusion, the role of CP in hospital settings is essential for improving patient outcomes and ensuring safe and effective medication use. They play a critical role in the healthcare team by providing pharmaceutical care, utilizing evidence-based practices, and advocating for patients. CPs are well-positioned to make a significant impact on the quality of care and patient outcomes in hospital settings.

Keywords: Adverse drug events, Adherence, Clinical pharmacy, Cognitive pharmacy services, Concordance, Compliance, Drug-related problems, Medication therapy management, Patient-oriented pharmacy practice, Pharmaceutical care, Rationale drug use.

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INTRODUCTION

Definitions and Related Concepts

Clinical pharmacy is a specialized health science that aims to optimize patient care. It is an approach to pharmacy practice that emphasizes the use of evidence-based medicine, patient-centered care and interdisciplinary collaboration. Clinical pharmacists (CPs) work closely with doctors, nurses and other healthcare providers to ensure that patients receive safe and effective drug therapy [1 - 5]. According to the European Society of Clinical Pharmacy, “*Clinical pharmacy aims to optimize the utilization of medicines through practice and research in order to achieve person-centered and public health goals*” [1, 4, 5].

Clinical pharmacy aims to improve the quality of patient care by providing rational drug use. This is achieved through various activities such as reviewing and verifying medication orders, reconciling medication regimens, providing medication education to patients and healthcare professionals, monitoring patients for potential adverse effects or drug interactions, and identifying, preventing, and managing drug-related problems. CPs also play a key role in the development and implementation of medication-related policies and procedures within healthcare organizations [1, 4, 6].

Clinical pharmacy practice can be divided into different areas of focus, such as critical care, geriatric care, oncology, pediatrics, ambulatory care, psychiatry, *etc.* CPs work in a variety of settings, including hospitals, clinics, long-term care facilities, and community pharmacies. They are an integral part of the healthcare team, and their expertise in medication therapy can lead to improved patient outcomes, reduced healthcare costs, and enhanced patient satisfaction [1, 5].

Within the healthcare system, a clinical pharmacist (CP) plays an important role. CP services may improve patient outcomes, reduce costs, and ensure the appropriate and safe use of medications. Through these services and good communication among other healthcare professionals, CPs significantly contribute to the management of diseases [7 - 10].

Pharmaceutical care (PC) is an approach to the practice of pharmacy that focuses on the patient as an individual and emphasizes the provision of personalized, patient-centered care. A holistic approach of PC aims to the use of medication that takes into account the patient's unique needs and circumstances, and it is a patient-centered approach to the use of medication [6, 10]. The main goal of PC is to improve treatment outcomes by optimizing medication use. This is achieved through the provision of personalized care that is tailored to the individual needs of the patient. PC involves the identification, prevention, and management of

drug-related problems, and the provision of medication education and counseling to patients and other healthcare providers. Pharmaceutical care can only be provided by pharmacists who have the knowledge, skills, and required competencies [10].

ROLE OF CLINICAL PHARMACISTS IN HOSPITAL SETTINGS

In a hospital setting, CPs ensure that patients receive safe and effective medication therapy by working closely with healthcare teams. The main activities of CP include reviewing patient charts and medication orders, monitoring drug therapy for potential adverse effects, and making recommendations for adjustments or changes to medication regimens. CPs also work with physicians and nurses to increase knowledge levels by educating patients about their medications. CPs may also participate in daily rounds to provide expertise on drug therapy. In addition, a CP is responsible for managing the hospital's formulary and drug inventory. Conducting scientific research to improve patient outcomes is another important role of CP [11, 12]. CPs should also conduct research to improve patient outcomes and develop new treatment protocols. They may also participate in clinical trials to evaluate the safety and effectiveness of new medications. Besides the above-mentioned roles, many different cognitive services are provided by CPs in hospital settings around the world.

Medication therapy management, or MTM, is a patient-centered service that is based on the philosophy of "Pharmaceutical Care". The MTM approach focuses on optimizing medication use and improving patient outcomes through personalized and proactive management of medication therapy. MTM is led by the idea that pharmacists should be actively involved in the care of patients and should work closely with other healthcare providers to ensure that medications are being used safely, effectively, and cost-efficiently. MTM service aims to improve the quality of care provided to patients by identifying and resolving medication-related issues, promoting better communication among healthcare teams, and providing patient education and counseling [13, 14].

Patient education and counseling are widely accepted tasks of a CP. It is a natural outcome of their responsibility to assist people who use medication by providing advice on how to use and manage those products. CPs work together with physicians and nurses to educate patients about their medications, including how to take the drugs, possible side effects, and what to do in case of an adverse event. Patient counseling is defined as an interaction between a professional and a patient, aimed at helping to inform the patient and having them make appropriate decisions. This is a proactive and individualized exchange of knowledge built on a trusting relationship between the pharmacist and the patient. To provide

Role of Clinical Pharmacists in Internal Medicine Ward

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Abstract: Internal medicine wards play a crucial role in providing healthcare services to a substantial number of patients. These wards primarily handle chronic or multiple diseases, making pharmacotherapy a fundamental approach for the majority of patients. The significance of clinical pharmacy services becomes particularly evident in these settings due to various factors, such as the coexistence of multiple diseases, advanced age, severe illnesses, or polypharmacy, all of which emphasize the importance of rational drug use. In patient populations with complex treatment regimens, especially those with specific healthcare needs, the likelihood of encountering drug-related problems increases, posing challenges to healthcare professionals in achieving desirable health outcomes. To address these challenges, clinical pharmacists (CPs) offer a range of essential services within the internal medicine ward. These services encompass pharmaceutical care, medication management, comprehensive medication review, medication reconciliation, patient education, and counseling, all aimed at improving treatment outcomes for patients admitted to the ward. The value and effectiveness of these services have been extensively discussed in the academic literature and validated through numerous clinical studies. Clinical pharmacists working in the internal medicine service are expected to demonstrate strong competence in managing various conditions, including diabetes, cardiovascular diseases, renal failure, liver failure, gastrointestinal diseases, chest diseases, and hematological diseases. In addition to their clinical expertise, CPs have a critical responsibility to ensure the rational use of medications and effectively apply their extensive knowledge of drugs in the clinical setting. By integrating these services into the daily healthcare routine and strengthening the role of the clinical pharmacist within the healthcare team, the overall effectiveness of patient treatment can be significantly enhanced.

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Keywords: Asthma, Anemia, Clinical pharmacy, COPD, Geriatric pharmacotherapy, Internal medicine, Kidney failure, Liver failure, Pharmaceutical care.

INTRODUCTION

Internal medicine is one of the main medical fields, which is applied to many patients apply and in which drug treatment is mostly used. Unlike surgical medical sciences, one of the most important weapons of internal medicine specialists is pharmacotherapeutic applications. It is important to make decision-making processes in an evidence-based manner. Patients who are admitted to internal medicine wards often require specialized care for acute hospitalizations involving undifferentiated symptoms and multiple active medical conditions. The fact that patients often have more than one disease and that multimorbidity can make the diagnosis and treatment processes quite complicated results in an increase in the number of drugs used by patients and health problems that may be caused by drugs in addition to the current disease. Internal medicine wards are responsible for managing a wide range of acute and chronic medical problems, often with the support of a multidisciplinary team, including a pharmacist [1]. With the complexity of their conditions, patients in internal medicine units frequently experience multiple comorbidities and are susceptible to drug-related problems (DRPs), which can lead to increased morbidity and mortality [2]. Medications, commonly utilized in internal medicine wards, possess the potential to pose life-threatening risks when used inappropriately, thereby impacting quality of life and elevating morbidity rates, and in severe cases, even contributing to mortality.

The involvement of clinical pharmacists in the management of hospitalized patients in internal medicine wards has progressed from a reactive service approach to a more comprehensive model that emphasizes a multidisciplinary perspective and expanded responsibilities. Existing evidence supports the effectiveness of general pharmacy services, as well as specific roles such as anticoagulation management, antibiotic stewardship, and immunization [1]. The aim of this study is to examine the effects of the services provided by the clinical pharmacist on patients hospitalized in the internal medicine service.

Many individuals may suffer from different diseases in internal medicine services. Therefore, internal medicine specialties aim to treat conditions that occur in different organ or system groups. Endocrinological diseases represent a prevalent category of conditions encountered in internal medicine services. Alongside these, clinical pharmacists working in such settings should also enhance their knowledge and competencies in the management of gastrointestinal diseases, chest diseases like asthma and chronic obstructive pulmonary disease (COPD), anemia, and

organ failure. This broad range of diseases necessitates that clinical pharmacists possess comprehensive expertise to provide optimal care to patients. In the clinical setting, numerous experts are currently engaged in the development of diagnostic and treatment guidelines based on the latest evidence-based treatment data. These guidelines serve as valuable resources for healthcare professionals in providing optimal care to patients. Table 1 provides an overview of the clinical guidelines utilized for the commonly encountered diseases in internal medicine services.

Table 1. A list of clinical practice guidelines for different medical conditions.

Condition	Related Society	Guideline
Acute Kidney Injury	o Kidney Disease Improving Global Outcomes KDIGO	o Clinical practice guidelines for acute kidney injury [7]
	o Acute Disease Quality Initiative ADQI o Perioperative Quality Initiative POQI	o Joint consensus report on postoperative acute kidney injury in adult non-cardiac surgery [8] o Recommendations on acute kidney injury biomarkers. A consensus statement [9]
	o European Society of Intensive Care Medicine ESICM	o Expert opinion on the prevention of acute kidney injury and protection of renal function in the intensive care unit, update [10]
Chronic Kidney Disease	o Kidney Disease Improving Global Outcomes KDIGO o American Diabetes Association ADA	o Consensus report for diabetes management in chronic kidney disease [11] o Clinical practice guidelines on the management of blood pressure in chronic kidney disease [12]
	o European Renal Best Practice ERBP	o Clinical practice guideline on management of older patients with chronic kidney disease stage 3b or higher (eGFR <45 mL/min/1.73 m ²) [13]
	o National Institute for Health and Care Excellence NICE	o Guideline on chronic kidney disease – Assessment and management [14]
Liver Failure	o Society of Critical Care Medicine SCCM	o Guidelines for the Management of Adult Acute and Acute-on-Chronic Liver Failure [15]
	o American College of Gastroenterology ACG	o Acute-on-Chronic Liver Failure Clinical Guidelines [16]
	o European Association for the Study of the Liver EASL	o Clinical practical guidelines on the management of acute (fulminant) liver failure [17] o Clinical practice guidelines on prevention and management of bleeding and thrombosis in patients with cirrhosis [18]
	o American Association for the Study of Liver Diseases AASLD	o Practice guidance on palliative care and symptom-based management in decompensated cirrhosis [19]

Role of Clinical Pharmacists in Infectious Disease Ward

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Abstract: Irrational use of antimicrobial agents has led to the emergence of antimicrobial resistance. The Infectious Diseases Society of America and The Centers for Disease Control and Prevention recommend that a clinical pharmacist with infectious diseases training should participate in the antimicrobial stewardship teams. Several authors stated that antimicrobial stewardship effectively reduces inappropriate antimicrobial use, cost, and hospital stays. Prospective audits and feedback can reduce the inappropriate use of antimicrobials. Clinical pharmacists may help orient the healthcare team on selecting appropriate antimicrobial agents, administration routes, dosing, treatment discontinuation, monitoring for toxicities, and therapeutic drug monitoring. Clinical pharmacists are important members of antimicrobial stewardship in the inpatient and outpatient settings. Antimicrobial stewardship pharmacists should have a role that includes designing and implementing antimicrobial stewardship interventions, measuring outcomes and relevant data, and management strategies. The participation of pharmacists in antimicrobial stewardship programs may increase compliance with guideline recommendations of antimicrobial therapies and improve adherence and response to treatment. Clinical pharmacist recommendations can also help prevent medication errors, such as missing or incorrect medications, inappropriate dosing, drug-drug interactions, or inadequate renal and hepatic function adjustment. This book chapter highlights the roles of an infectious disease-trained clinical pharmacist in the infectious diseases ward.

Keywords: Antimicrobial stewardship, Antibacterial, Antifungal, Antiviral, Audit, Clinical pharmacist, Drug-drug interactions, Drug-related problems, Education feedback, Infectious diseases, Medication review, Medication reconciliation, Patient counseling, Rational drug use, Therapeutic drug monitoring.

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INTRODUCTION

Antimicrobial agents have effectively reduced the incidence and severity of many life-threatening infections and their complications. However, the overuse and misuse of these agents in hospitals and other settings have led to the emergence of antimicrobial resistance [1]. As the discovery of new antimicrobial agents has slowed, it is important to use our limited resources wisely. The Infectious Diseases Society of America (IDSA) recommends that the core team responsible for antimicrobial management include a clinical pharmacist with infectious diseases training [2]. The Centers for Disease Control and Prevention (CDC) also recommends the appointment of a lead pharmacist to oversee antimicrobial use in hospital antibiotic management programs [3]. Several studies have demonstrated the effectiveness of antimicrobial management programs in reducing inappropriate antimicrobial use, shortening hospital stays, and reducing costs [1, 4, 5]. These studies have shown that including an infectious diseases pharmacist can decrease the consumption of antimicrobial agents and costs per 1000 patients and improve standardized hospital mortality rates for sepsis and respiratory tract infections [1, 3].

Prospective audits and feedback from clinical pharmacists (CPs) can reduce the inappropriate use of antimicrobials [2]. CPs may advise the healthcare team on selecting antimicrobial agents, administration routes, dosing, treatment discontinuation, and monitoring for toxicities. Studies have shown that prospective audits and interventions by CPs and infectious diseases (ID) physicians can significantly reduce parenteral broad-spectrum antimicrobials, which may result in cost savings per patient [6, 7].

The participation of pharmacists in antimicrobial stewardship programs has been shown to increase the rate of antimicrobial therapies that comply with guidelines and improve adherence and response to treatment [8, 9]. Clinical pharmacist recommendations and interventions can also help prevent medication errors caused by missing or incorrect medications, inappropriate dosing, or inadequate renal and hepatic function adjustment. Strategies such as consulting with a clinical pharmacist or training prescribers have also been identified as essential elements of successful antimicrobial management programs [10]. This book chapter highlights the roles and benefits of an ID-trained clinical pharmacist in the infectious diseases ward.

DRUG-RELATED ISSUES IN INFECTIOUS DISEASES

Antimicrobial agents are a common cause of drug-related problems, including therapeutic drug monitoring issues, dose errors, drug-drug interactions, inappropriate agent selection, and adverse effects [11]. These errors can have

serious consequences for patients, including suboptimal treatment and increased risk of harm. Healthcare professionals must be aware of these potential issues and take steps to prevent them. This may include careful monitoring of antimicrobial use, careful selection of agents, and close attention to dosing and potential interactions with other medications. The involvement of a clinical pharmacist with infectious diseases training in antimicrobial management programs can be particularly helpful in identifying and addressing these issues [12 - 14].

Dosing of Antimicrobials

The appropriate selection and dosing of antimicrobial agents are crucial for optimal treatment outcomes. Dose adjustment, an important role of CPs, is significant for certain patient groups, such as those with renal or hepatic failure or extremely overweight or underweight.

There have been numerous studies demonstrating the positive impact of CPs in reducing antimicrobial dosing errors in various settings [15]. For example, the integration of CPs with order entry decision support systems has been shown to help physicians provide appropriate antibiotic dosing regimens and reduce dosing errors in patients with renal dysfunction [16]. Determining the appropriate antimicrobial dosing for patients receiving continuous venovenous hemofiltration (CVVH) or other dialysis treatments can be challenging. However, the presence of a pharmacist in the intensive care unit (ICU) has been associated with cost savings, reduced adverse drug events, shorter lengths of stay in the ICU, and fewer antimicrobial dosing errors, particularly in patients receiving CVVH [17]. It has been emphasized that consulting with CPs *via* a computerized request for initial antibiotic doses of drugs with a narrow therapeutic range is an important option for drug-related clinical decision support [18].

There have been few studies examining the frequency of antimicrobial dosing errors in patients with hepatic disorders, such as liver failure. Chronic liver impairment can directly or indirectly affect the protein binding, metabolism, and renal elimination of antibiotics [19, 20]. The elimination half-lives of most antibiotics are prolonged in the presence of impaired renal function, and the volume of distribution may increase due to ascites, a common finding in severe hepatic impairment. On the other hand, drug accumulation in liver failure can lead to adverse effects. Dosage guidelines for a given antibiotic may also be limited based on reported pharmacokinetic parameters in patients with cirrhosis. Careful selection of appropriate agents and individualized dosing in these patients may reduce hepatotoxicity and improve clinical outcomes [21]. In most cases, dose reduction is made empirically, but measuring serum antibiotic concentrations directly may be a more accurate approach to administering antibiotic therapy in

CHAPTER 4

Role of Clinical Pharmacists in Intensive Care Unit**Yunus Emre Ayhan^{1,*}**¹ *Department of Clinical Pharmacy, Prof. Dr. Cemil Taşcıoğlu City Hospital, Istanbul, Türkiye*

Abstract: Intensive care units (ICUs) have a highly complex structure in terms of both diseases and medications used in treatment. Therefore, the management of ICU patients is possible with a multidisciplinary team. With their evolving skills and roles, clinical pharmacists have become indispensable parts of the ICU team. This section reviews ICU-specific issues such as the control of delirium, sedation, pain, stress ulcer prophylaxis, venous thromboembolism prophylaxis, sepsis, septic shock, prevention of drug-related problems (DRPs), healthcare-associated infections, and literature on the roles of clinical pharmacists. The studies carried out in the ICU are mainly within the scope of medication cost savings, DRPs, medication management, and compliance with the guidelines on various issues. In conclusion, it has been emphasized that including clinical pharmacists in the ICU team has improved many issues affecting DRPs, treatment costs, and patient health outcomes.

Keywords: Antimicrobial, Clinical pharmacist, Clinical pharmacy, Intensive care unit, Infection, Medication costs, Stress ulcer prophylaxis, Sepsis, Therapeutic drug monitoring, Venous thromboembolism.

INTRODUCTION

In this section, we will present the intensive care unit (ICU) and the services of clinical pharmacists in this area. As a result of many studies carried out in ICUs, the role and contribution of clinical pharmacists in this field are revealed.

CLINICAL PHARMACY AND CLINICAL PHARMACISTS

The American Association of Clinical Pharmacy (ACCP) has presented a vision for pharmacists to be healthcare providers responsible for optimal therapy. Clinical pharmacy practice encompasses a philosophy of pharmaceutical care blended with specific therapeutic ability, experience, and determination to provide optimal patient outcomes [1].

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Clinical pharmacists are in frequent and regular contact with doctors and other healthcare professionals. They follow up-to-date treatment guidelines and developments to achieve targeted patient health outcomes. They routinely provide drug therapy assessments and recommendations to patients and healthcare professionals. They also provide scientifically valid information and advice on the safe and cost-effective use of drugs [1].

THE CLINICAL PHARMACIST'S APPROACH TO DRUG-RELATED PROBLEMS

A drug-related problem (DRP) is a drug-related event or condition that interferes with or is likely to affect desired health outcomes [2]. DRPs are a common safety issue among hospitalized patients, causing harm to the patient and increasing healthcare costs. In addition, DRPs may cause increased morbidity, mortality, and healthcare costs [3]. Since many DRPs are preventable, attention should be paid to specific risk factors [2].

DRPs are primarily preventable or predictable conditions that can affect health outcomes. Clinical pharmacy activities can identify and solve these problems, potentially increasing drug therapy management, safety, and efficacy [4, 5]. Pharmacists provide a wider professional contribution to the intensive care team by preventing medication errors and optimizing medication therapy. While these activities increase quality, they reduce mortality and associated costs [6, 7].

OVERVIEW OF PHARMACISTS' CONTRIBUTIONS IN THE INTENSIVE CARE UNIT

The pharmacist's activities have evolved from the level of their traditional activities to active participation in multidisciplinary team rounds where the pharmacist and the healthcare team review the planning of patients' treatment. The clinical pharmacist's services have reached a level that is broadly grouped as a 'professional support activity' and includes guideline development, formulary practices, management and case studies, financial reporting and forecasting, teaching, auditing, and research [6].

Prospective, controlled studies have noted significant reductions in adverse drug events and hospital stays when pharmacists assume responsibility for pharmacotherapy as part of a multidisciplinary healthcare team. The ACCP states that for every \$1 spent on clinical pharmacy programs, there is a benefit of \$4.8 [8]. Pharmacists working with a multidisciplinary team in ICUs reduced prescribing errors and preventable adverse drug events by 66% ($p < 0.001$). Pharmacist recommendations were classified as an explanation of drug prescription (45%), providing drug information (25%), and alternative treatment

(12%). It has been estimated that savings of \$270,000 per unit per year are associated with preventing adverse drug events [9].

In 2000, a status report was published to present an overview of the activities conducted by intensive care pharmacists. The purpose was to provide updated recommendations and guidance for the practice of intensive care pharmacy. The 2020 update includes 82 items, consisting of 44 original recommendations and 38 newly proposed advice statements. Among these, 34 recommendations primarily focus on the responsibilities of intensive care pharmacists and their involvement in patient care within the pharmacy services domain. Additionally, 21 recommendations highlight the critical care pharmacist's role in quality improvement, encompassing patient and drug safety, clinical quality programs, and analytics. Furthermore, nine recommendations are related to research and learning, ten suggestions concerning education and training, and eight are centered around professional development [10].

COMMON COMPLICATIONS IN THE INTENSIVE CARE UNIT

Patients in the ICU suffer many complications requiring further treatment. Some complications are healthcare-associated infections (HAI). These complications include ventilator-associated pneumonia (VAP), central catheter-associated bloodstream infection (CLABSI), and catheter-associated urinary tract infection (CA-UTI). Other common complications are venous thromboembolism (VTE), including surgical site infection (SSI), deep vein thrombosis (DVT), and pulmonary embolism (PE) [11, 12].

Healthcare-associated Infections

Healthcare-associated infection (“nosocomial”) is defined as a localized or systemic condition resulting from an adverse reaction to the presence of infectious agents or their toxins [13].

Preventing mortality and health expenditures due to HAIs is a patient safety issue in the ICU. Patients in the ICU are at high risk for HAI due to the reduced host defense mechanism caused by severe disease and the high use of invasive medical devices. While developed countries reported rates of HAI in ICU patients between 5-10%, developing countries reported rates of up to 50%. Best infection prevention and control practices, guided by standards and surveillance, can reduce device-related HAI rates, associated mortality, antimicrobial overuse, and antimicrobial resistance. Turkey, a middle-income country, introduced national regulations for preventing and controlling HAI in hospitals in 1974. As a result of the measures taken in Turkey, significant reductions in all device-related HAI were achieved [14].

CHAPTER 5**Role of Clinical Pharmacists in Pediatric Disease Wards****Berre Mercumek^{1,*} and Yeliz Sahin²**¹ Department of Clinical Pharmacy, Bezmialem Vakif University, Istanbul, Türkiye² Department of Clinical Pharmacy, Ağrı İbrahim Çeçen University, Ağrı, Türkiye

Abstract: Effective medication therapy management is essential in addressing pediatric pharmacotherapy's unique challenges, as pediatric patients are distinct from adults in terms of physiological and pharmacological characteristics. This management requires a multidisciplinary team to provide optimal care, with clinical pharmacists specializing in pediatrics playing a role in ensuring safe and effective medication use in this patient population. This chapter reviews clinical pharmacists' roles and responsibilities in these settings, including participation in interdisciplinary rounds, medication reconciliation and review, and patient counseling. In addition, this chapter investigates the essential knowledge required to fulfill the roles and responsibilities of clinical pharmacists in pediatric care settings, which include a basic understanding of common pediatric diseases and medications, clinical guidelines, tools used to provide clinical pharmacy services, identification and prevention of drug-related problems, and clinical competencies. Additionally, this chapter discusses the current evidence on the impact of clinical pharmacy services on outcomes such as medication errors, adverse drug events, and treatment efficacy in pediatric disease wards and the literature on the roles of clinical pharmacists in pediatric wards. Overall, this chapter emphasizes the critical importance of integrating clinical pharmacists as essential healthcare team members in pediatric disease wards to enhance the quality of care and improve patient outcomes.

Keywords: Clinical pharmacist, Drug-related problems, Interdisciplinary rounds, Medication therapy management, Medication errors, Medication reconciliation, Pediatric diseases, Patient outcomes, Quality of care, Treatment optimization.

INTRODUCTION

Pediatric pharmacotherapy presents unique challenges that require effective medication therapy management, especially for vulnerable children. Infants and children are at an elevated risk of medication errors due to their limited buffering

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capacity. Even minor dosing errors with minimal consequences in adults could be fatal for neonates [1, 2]. Furthermore, pediatric patients' distinctive physiological and pharmacological characteristics increase the likelihood of drug-related problems (DRPs), such as adverse drug events and interactions [3].

Administering medication to children presents a challenge due to their unique dosing requirements, which must consider factors such as age, weight, and health status. Additionally, the limited availability of pediatric-specific dosage forms can lead to diluting preparations and opening capsules, increasing the risk of weight-based dosing errors [1]. Adapting practices in pediatric pharmacotherapy poses challenges due to several factors, including the vulnerability of children, off-label drug use, and the extrapolation of safety and efficacy data from adult literature [4].

Identifying DRPs is crucial to achieving optimal therapeutic outcomes, reducing morbidity, mortality, and healthcare costs in pediatric patients. Proper management is essential to ensure the safe and appropriate use of medications, as the complex and multiple medications used in this population pose a significant risk to patients [5]. In recognition of these, pharmacists are increasingly participating in clinical processes and performing tasks in patient care to prevent problems caused by drug therapy [6].

Pediatric pharmacy, a specialized area of pharmacy practice, focuses on providing safe and effective medication to children from birth to 18 years of age and plays a critical role in promoting their health and well-being [7]. To ensure the safe and effective use of medications, pharmacists specializing in pediatrics must possess the competency of a comprehensive understanding of children's unique developmental and physiological differences.

Clinical pharmacists in this field use their expertise in pharmacology, pharmacokinetics, and pharmacodynamics for medication use in children and work closely with pediatricians and other healthcare professionals to ensure the best possible care for pediatric patients. Pharmacist involvement has significantly improved medication safety and outcomes in hospitalized pediatric patients across various settings and from many perspectives. A study involving 14,713 pediatric patients found that pharmacist interventions led to a notable decrease in medication errors, with a total of 1475 interventions recorded. Dosing errors accounted for 61.3% of all prescription errors, with 2.2% of errors potentially fatal and 14.3% clinically serious [8].

In addition to improving medication safety, pharmacists can also play a crucial role in ensuring the continuity of medication management during the transition of patients between wards. A study found discrepancies in 42% of patients between

home treatment and treatment prescribed upon admission, with a 15% reconciliation error rate, 68% of which were omissions [9].

Clinical pharmacist services play a critical role not only during hospitalization but also during the discharge process. Patient counseling by pharmacists during discharge has been proven effective in preventing drug administration errors in the home environment and improving medication adherence [10 - 12]. By ensuring that patients and caregivers have the necessary knowledge and understanding to administer medications correctly and adhere to treatment plans, clinical pharmacists play an essential role in controlling disease and improving patient outcomes for pediatric patients.

Furthermore, clinical pharmacist interventions in various healthcare settings have been associated with notable reductions in drug costs. In pediatric intensive care unit (PICU), individualized doses of antibiotics saved US\$ 8,754.46/year, decentralization of pharmacy services saved US\$ 28,770.52/year, and clinical pharmacist interventions saved US\$ 633.38/year in total [13].

Incorporating pharmacists into the healthcare team for pediatric patients across various settings can yield substantial benefits in minimizing medication errors, promoting medication safety and appropriate management, enhancing patient outcomes, and reducing costs by providing expert guidance and support in medication therapy management.

This chapter will explore the role of clinical pharmacists in optimizing treatment regimens, identifying and preventing DRPs, and improving patient outcomes in pediatric disease wards. Participation in interdisciplinary rounds, medication review, medication reconciliation, education of healthcare providers, and patient-counseling clinical pharmacists can play a significant role in ensuring safe and appropriate medication use in this patient population.

PHARMACEUTICAL CARE PROCESS AND RESOURCES

In the pediatric setting, implementing pharmaceutical care is crucial to ensure that children receive safe, effective, and appropriate medication therapy. The process of pharmaceutical care involves several steps [14].

Medication Reconciliation

Medication reconciliation is when a pharmacist obtains an accurate and up-to-date list of a patient's medications to identify discrepancies and address potential DRPs, such as adverse effects, drug interactions, and medication errors (omissions, commissions, and wrong doses). Medication reconciliation is essential

CHAPTER 6

Role of Clinical Pharmacists in the Cardiology Ward

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Abstract: The provision of healthcare to cardiology patients requires a multidisciplinary team, including a clinical pharmacist as a member, to ensure optimal medication management. In this chapter, the benefits and challenges of the presence of a clinical pharmacist as a team member in cardiology care are briefly presented from a general perspective. In addition, medication management and input of clinical pharmacists in the most common cardiovascular conditions (*i.e.*, acute coronary syndrome, hypertension, pulmonary hypertension, heart failure, atrial fibrillation) are reviewed. The most prominent outcomes of the clinical pharmacists' interventions are reduced drug-related problems, increased medication adherence, improved healthcare outcomes such as reduced blood pressure levels, and prevention of hospital readmissions. Also, leading cardiology guidelines as means of evidence-based pharmaceutical care are listed. Overall, this chapter aims to emphasize the importance of incorporating clinical pharmacists in cardiology healthcare teams to provide comprehensive care for patients.

Keywords: Acute coronary syndrome, Atrial fibrillation, Clinical pharmacist, Cardiology, Cardiovascular disease, Drug-related problems, Hypertension, Heart failure, Medication adherence, Medication therapy management, Pulmonary hypertension, Pharmacotherapy.

INTRODUCTION

Cardiovascular diseases (CVDs), as the leading cause of death with a global rate of 32% and being a major contributor to reduced quality of life, have an increasing burden [1]. The increasing burden of cardiovascular diseases refers to the growing number of individuals affected by CVDs, such as acute coronary syndrome, heart failure, atrial fibrillation, hypertension, peripheral arterial disease, and several other cardiac and vascular conditions [2]. This increase is due to a combination of factors, such as the aging population, changes in lifestyle, and

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increased risk factors, such as high apolipoprotein-B-containing lipoprotein levels, adiposity, diabetes, and high blood pressure [3].

Treatment options for each patient depend on the health condition and medical history of the individual patient. Treatment plans may also be adjusted over time based on a patient's response to therapy and changes in their health status. Current treatment options for cardiovascular diseases depend on the type and severity of the disease and may include:

- Lifestyle modifications: Modifications in diet, exercise, and smoking cessation.
- Pharmacotherapy: Antiplatelet agents, anticoagulants, beta-blockers (BBs), calcium channel blockers (CCBs), diuretics, angiotensin-converting enzyme inhibitors (ACEIs), and angiotensin receptor blockers (ARBs).
- Interventional procedures: Angioplasty, stent placement, and coronary artery bypass graft (CABG) surgery.
- Implantable devices: Devices such as pacemakers, implantable cardioverter-defibrillators, and cardiac resynchronization therapy devices.
- Cardiac rehabilitation: A comprehensive program of exercise, education, and counseling for patients recovering from a heart attack, heart surgery, or other cardiovascular event.
- Heart transplantation: Especially for patients with end-stage heart failure.

Today, clinical pharmacists (CPs) are considered integral members of the healthcare team and play a critical role in optimizing pharmacotherapy in patients with cardiovascular diseases. They work closely with physicians and other healthcare providers to ensure that patients receive the most appropriate and effective medications to manage their CVDs [4]. Besides providing patient education and counseling to help patients understand their medications and improve medication adherence, clinical pharmacists play a key role in identifying and resolving drug-related problems, such as adverse drug reactions, drug interactions, and medication errors [5 - 7]. They also provide expert advice on dosing, monitoring, and drug selection, which helps to ensure the safe and effective use of medications [8]. By collaborating with physicians and other healthcare providers and using their knowledge and skills to optimize pharmacotherapy, clinical pharmacists help ensure that patients receive the most appropriate and effective medications to manage their CVD [9]. Another benefit of incorporating CPs in multidisciplinary cardiology teams is their positive impact on economic outcomes [10]. In clinical pharmacy practices, providing an evidence-based contribution is crucial. In this respect, many information sources are accessible, such as online drug information databases, clinical decision support systems, printed/electronic drug monographs, or disease-specific

guidelines. The leading guidelines supporting CPs in CVD management are listed in Table 1.

Table 1. The guidelines regarding the management of cardiovascular diseases.

<i>Condition</i>	<i>Related Society</i>	<i>Guideline</i>
<i>Cardiovascular Disease Prevention</i>	European Society of Cardiology, ESC	Guidelines on Cardiovascular Disease Prevention in Clinical Practice, 2021 [3]
-	American Heart Association, AHA American College of Cardiology, ACC	ACC/AHA Guideline on the Primary Prevention of Cardiovascular Disease, 2019 [67]
-	American Diabetes Association, ADA	Cardiovascular Disease and Risk Management: Standards of Care in Diabetes, 2023 [68]
<i>Acute Coronary Syndrome</i>	European Society of Cardiology, ESC	Acute Coronary Syndromes (ACS) in Patients Presenting without Persistent ST-Segment Elevation (Management of) Guidelines, 2020 (69) Guidelines on Management of Acute Myocardial Infarction in Patients Presenting with ST-Segment Elevation, 2017 (70) Focused Update on Dual Antiplatelet Therapy (DAPT) Guidelines, 2017 (71) Guidelines on Fourth Universal Definition of Myocardial Infarction, 2018 [72]
	American Heart Association, AHA American College of Cardiology, ACC American College of Cardiology Foundation, ACCF	AHA/ACC Guideline for the Management of Patients with Non-ST-Elevation Acute Coronary Syndromes, 2014 (14) ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction, 2013 [73]
<i>Chronic</i>	European Society of Cardiology, ESC	Guidelines on Chronic Coronary Syndromes, 2019 [74]
<i>Coronary Syndromes</i>	American Heart Association, AHA American College of Cardiology Foundation, ACCF Preventive Cardiovascular Nurses Association, PCNA	2012 ACCF/AHA/ACP/AATS/PCNA/SCAI/STS Guideline for the Diagnosis and Management of Patients with Stable Ischemic Heart Disease, 2012 [75]
	American College of Physicians, ACP American Association for Thoracic Surgery, AATS Society for Cardiovascular Angiography and Interventions, SCAI Society of Thoracic Surgeons, STS	-

Role of Clinical Pharmacists in Enteral-parenteral Preparations

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Abstract: Nutrition, as a fundamental process for sustaining health, is of paramount importance, particularly for individuals grappling with critical illnesses. The effective management of nutrition involves a collaborative effort from a diverse group of healthcare professionals, including doctors, dietitians, and clinical pharmacists, among others. Among these professionals, clinical pharmacists play a significant role in delivering nutrition and enhancing potential health outcomes within the healthcare team. In the pursuit of comprehensive patient care, clinical pharmacists are actively engaged in providing essential macro and micronutrients while diligently addressing any issues arising from nutritional products and medication usage in critically ill patients. Moreover, optimizing drug regimens for patients requiring parenteral or enteral nutrition yields substantial benefits for their overall survival. The administration of medications to individuals in need of Total Parenteral Nutrition (TPN) and Enteral Nutrition (EN) necessitates keen attention and skill. As leaders in drug administration processes for patients receiving nutritional support, clinical pharmacists assume a pivotal role, particularly in the administration of medications through enteral feeding tubes. This active involvement significantly contributes to the achievement of desired health outcomes, enhancing patient well-being and recovery. Given the indispensable contributions of clinical pharmacists, their inclusion within the multidisciplinary healthcare team is of paramount importance. By drawing upon their specialized pharmaceutical and clinical knowledge, clinical pharmacists are instrumental in the successful implementation of enteral and parenteral nutrition applications. Embracing this collaborative approach not only strengthens the efficacy of nutrition interventions but also augments the overall quality of patient care.

Keywords: Clinical pharmacist, Drug application enteral feeding tube, Enteral nutrition, Nutrition, Parenteral nutrition, Pharmaceutical care, Through feeding tube.

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INTRODUCTION TO NUTRITIONAL SUPPORT

Malnutrition Epidemiology

Malnutrition is defined as a cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions, according to World Health Organization (WHO) guidelines. The imbalance can be caused by four main factors: impaired intake, impaired digestion and absorption, over requirements, and excess nutrient loss.

Impaired intake is mainly characterized by poor quality of life and diet. Poor appetite and eating disorders may trigger impaired intake. Nausea when eating, depression and anxiety, and drug addiction can cause poor appetite and eating disorders. Hospitalization factors affecting the gastrointestinal (GI) tract functions, medical conditions, and drug therapy may lead to impaired digestion and absorption. Increased metabolic demands caused by medical history such as organ dysfunction can alter the energy requirements. The GI tract dysfunction, vomiting, and diarrhea entail excess nutrient losses in a short time.

Malnutrition negatively affects the physiological pathways and quality of life. The neuronal plasma membranes contain $\omega - 3$ and $\omega - 6$ PUFAs as essential fatty acids in their structures [1]. The amino acids are the source of nitrogen, which is crucial for neurotransmitters, hormones, and enzymes. The monosaccharides provide the primary energy sources for cellular respiration [2]. The trace elements have roles in enzyme activity as a coenzyme, hormone metabolism, and erythropoiesis as iron, zinc, selenium, copper, chromium, manganese, *etc.* [3]. The vitamins as thiamine, riboflavin, pantothenic acid, niacin, pyridoxine, folic acid, cyanocobalamin, biotin, ascorbic acid, vitamin A, vitamin D, alpha-tocopherol, and vitamin K are cofactors on metabolic pathways [4 - 6].

Macronutrients have a crucial role in neuronal activity and cognition. Depression, anxiety, and sleeping disorders are triggered by malnutrition. The smooth muscle function is weakened, and the smooth muscle cells are decayed during malnutrition maintenance [7]. Muscle atrophy is seen in cardiovascular tissue in the same way. This reduces the ejected blood volume in the atrium and ventricle, which causes dysfunction in the peripheric circulation. The renal system loses the water and ion disposition function due to malnutrition. Under this condition, low protein intake may lead to nutritional edema, which is seen on the feet and end organs. Malnutrition has an impact on immune system response. In long-term fasting, adipocyte-secreted leptin level is decreased, and it reduces the T cell number, IL-2, and memory CD8 response as a cellular immune response. Dendritic cells and B cells in the blood are decreased. The gut permeability is increased, which leads to allergen and pathogen entrance [8].

Services Applied Parenteral-enteral Nutrition

In the main approach, malnutrition is seen in patients with acute and chronic diseases, even though it mainly defines pediatric undernutrition. In hospital services during the medical administration, the patients are taken care of and under maintenance in the sense of nutrition. The hospitalization necessitates feeding and nutrition support by enteral-parenteral nutrition. The enteral-parenteral nutrition is managed based on inpatient medical status. The nutrition essentials and feeding routes are decided based on medical history. The medical history of patient-related malnutrition risks requires enteral-parenteral nutrition support. Neoplastic diseases are characterized by malnutrition due to overactive cell proliferation and loss of body fats. In addition, GI tract tumors complicate swallowing and digestion. The medication plan in neoplastic diseases, such as chemotherapy and radiation therapy, imposes a burden on patient metabolism [9]. The term hypermetabolic stress is identified as the conditions that impose a burden on normal metabolism and disturb hemodynamic stability. Situations such as burns, trauma, postoperative major surgery, and sepsis causing hypermetabolic stress may require enteral nutrition support due to overactive metabolism [10]. Organ dysfunction such as liver failure, kidney insufficiency, congenital heart disease, and organ transplantation are situations that may lead to malnutrition and require enteral nutrition support [11]. In GI tract disease, irritable bowel syndrome, short bowel syndrome, esophageal motility disorder, pancreatitis, fistulas, and gastroesophageal reflux, the patients are supported by enteral tube feeding to enhance their nutrition [12]. Acquired Immune Deficiency Syndrome, anorexia nervosa, cystic fibrosis and other special issues require monitoring of nutritional care [13]. The comorbidity in geriatric patients, extremely premature infants, and enzyme deficiencies need personal formulated nutrition and close monitoring. In hospitalized patients with inadequate oral intake as prolonged anorexia, protein-energy under nutrition can be tolerated with oral nutrition supports, but dysphagia and esophageal obstruction may require tube feeding and enteral nutrition support.

On the other hand, patients with a medical history indicating malabsorption require feeding by surpassing the GI tract. In these conditions, parenteral routes provide the nutrient supply directly to bloodstream and peripheric tissues [14]. Therefore, the main GI tract disorders at the clinical level, such as Crohn's disease, bowel obstruction, ulcerative colitis, and acute pancreatitis, can be managed by parenteral nutrition [15]. In addition, enteral feeding can cause an adverse effect on the GI tract, such as nausea, vomiting, and diarrhea. Enteral nutrition causes diarrhea rather than parenteral nutrition when the patient's energy needs are covered more than 60%. The fluid restriction-needed cases such as renal failure and renal replacement therapy can be managed with parenteral nutrition

CHAPTER 8**Role of Clinical Pharmacists in the Oncology Ward****Songul Tezcan^{1,*} and Fatima Ulya Yuruk^{2,3}**¹ *Department of Clinical Pharmacy, University of Marmara, Istanbul, Türkiye*² *Department of Clinical Pharmacy, University of Health Sciences, Istanbul, Türkiye*³ *Department of Clinical Pharmacy, Institute of Health Sciences, University of Marmara, Istanbul, Türkiye*

Abstract: Cancer treatment includes various medications and therapies, both alone or in combination, such as surgery, radiotherapy, chemotherapy, hormone therapy and immunotherapy. During chemotherapy with different cytotoxic effects, the use of supportive medications (such as antiemetic, antidiarrheal medicines, and granulocyte colony-stimulating factors) can lead to polypharmacy. For this reason, it is necessary to provide clinical pharmacy services to prevent and solve drug-related problems (DRPs). On the other hand, since most cancer drugs are in the “hazardous drug” class, pharmacists have important duties in the preparation, administration, storage and disposal of wastes. In the mid-20th century, in line with these requirements in the field of oncology, pharmacists started visiting oncology clinics, new courses were added, and oncology pharmacy specialization emerged. In this section, we will discuss the role of the clinical pharmacist in the oncology clinic, as well as examine the steps of pharmaceutical care for the cancer patient.

Keywords: Evidence base, Implementation, Oncology pharmacists, Oncology pharmacy-practice, Pharmaceutical care.

INTRODUCTION**Role of Clinical Pharmacists in Oncology Settings**

Each year, the American Cancer Society (ACS) reports the estimated number of new cancer cases and deaths in the United States (US) by collecting data from the National Centre for Health Statistics [1]. In 2023, it was estimated that over 1,900,000 new cancer cases and over 600,000 cancer deaths occurred in the United States [1]. For holistic cancer treatment, experts in the field of oncology should work together with a multidisciplinary approach. Oncology pharmacists are an integral part of the multidisciplinary team in oncology. Although the roles

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of the pharmacist are well-defined, recent studies have revealed that their responsibilities continue to expand under the topics of pharmaceutical care, patient education, chemotherapy preparation and administration, medication counseling, and pharmacoeconomics [2, 3].

Chemotherapy, radiotherapy, surgery, immunotherapy, and biological agents are the main treatment modalities for cancer [4]. Table 1 summarizes the development process, effects and side effects of cancer treatment [5 - 7].

Table 1. Summary of cancer treatments and side effects.

-	Conventional Chemotherapy (From 1940s)	Targeted Therapies (From 2000s)	Immunotherapies (From 2010)
Basic mechanisms of action	Effective against rapidly proliferating cells	Effective at a specific target in the cancer cell (HER-2, EGFR...)	It enables the immune system to fight cancer cells more effectively. (It prevents the tumor cell from inactivating the T cells)
Examples	Cisplatin Cyclophosphamide Adriamycin	Bevacizumab Trastuzumab Imatinib	Nivolumab Pembrolizumab Ipilimumab
Common side effects	Myelosuppression Alopecia Mucositis Nausea-Vomiting Neurotoxicity	Proteinuria Hypertension Skin rashes Cardiotoxicity	Fever Flu-like symptoms Loss of appetite Weakness Chills

HER-2: Human epidermal growth factor receptor 2; EGFR: Epidermal growth factor receptor.

The supportive medications used in the management of side effects (nausea-vomiting, pain, diarrhea, urticaria, *etc.*) create a state of polypharmacy in cancer treatment [8]. Possible DRPs (such as interaction, non-compliance, side effects, and dose adjustment) associated with polypharmacy may occur [9].

In order to achieve optimal treatment outcomes and reduce potential DRPs, the oncology pharmacist should be involved in the selection of anticancer therapy, including comorbidities [10, 11]. Clinical pharmacists provide a holistic approach at all points such as the most appropriate medication selection, dose calculation, preparation, and administration [10, 11]. In a recent review of 11 studies on chemotherapy medication errors, it was reported that medication errors were between 0.004% and 41.6% among various studies [12]. Chemotherapy medication errors were classified as in prescribing (0.1% to 24.6%), in preparation (0.40% to 0.50%), in dispensing (0.03%), and in administering phases (0.02% to 0.10%) [12].

In a study examining the effect of clinical pharmacists' interventions on chemotherapy preparation errors, identified problems were determined as "drug and therapy" (38%), dose, frequency and duration" (19%), and "administration and formulation" problems (10%) [13].

The treatment of other existing diseases of the cancer patient, therapeutic drug monitoring, follow-up and implementation of current treatment guidelines, providing drug information for patients and healthcare personnel, and using economic resources in the most appropriate way are some of the roles of the clinical pharmacist in the oncology clinic [11]. These main topics should be considered when creating pharmaceutical care plans for both inpatients and outpatients.

It is possible to collect clinical pharmacy services in the field of oncology under 3 main headings: Planning of cancer treatment, safe handling of chemotherapeutics, and providing supportive care. These main topics should be considered when creating pharmaceutical care plans for both inpatients and outpatients.

Planning of Cancer Treatment

The cancer treatment protocols are chosen for each patient depending on the type of cancer and patient characteristics (comorbidities, age, performance status, *etc.*) [14, 15]. At the same time, the supportive care needs of the patients are determined according to the treatment protocol.

DRPs in cancer chemotherapy can have serious consequences resulting from the high toxicity of anticancer drugs [16]. It may be due to non-compliance with protocols, chemotherapy itself, or insufficiently administered supportive medications.

The generally narrow therapeutic range of anticancer drugs means a particular risk to the patient in terms of drug safety. Therapeutic drug monitoring aims to optimize individual dosing and thus maximize efficacy and minimize toxicity [17].

Cancer treatment protocols are emerging as a result of many clinical studies. Planning of cancer treatment requires a multidisciplinary approach. The multidisciplinary team includes oncologists, radiologists, radiation oncologists, pathologists, surgeons, nurses and pharmacists. After determining the type of cancer and the appropriate treatment protocol for each patient, the pharmaceutical care process begins. This process, managed by the clinical pharmacist, includes the patient, caregiver, nurse and doctor.

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