World Journal of Pharmaceutical and Life Sciences

www.wjpls.org

Impact Factor: 7.409 Coden USA: WJPLA7

CLINICAL PHARMACIST CONTRIBUTION IN MANAGING PATIENTS IN INTENSIVE CARE UNIT [ICU]

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DOI: https://doi.org/10.5281/zenodo.17539788

How to cite this Article: Dr. Padige Srivarsha*, Nampelly Raaziiv Varma*, M. Kavya, Shambuni Venkatesh. (2025). Clinical Pharmacist Contribution In Managing Patients In Intensive Care Unit [ICU]. World Journal of Pharmaceutical and Life Science, 11(11), 339–344.

Article Received on 05/10/2025 **Article Revised on 25/10/2025** **Article Published on 01/11/2025**

ABSTRACT

Intensive care unit (ICU) is an advanced clinical practice setting where critically ill patients need complex and individualized medication treatment. The role of the clinical pharmacist in the ICU has changed significantly and contributed to the delivery of optimized medication therapy, the prevention of adverse drug events, and the improvement in patient care outcomes. This review will highlight some of the clinical pharmacist contributions to patient care in the ICU, including participation in both multidisciplinary rounds, as well as therapeutic drug monitoring or dosing adjustments in presence of organ dysfunction, and antimicrobial stewardship. Clinical pharmacists play an important role in reducing medication errors, documenting and managing drug interactions, promoting the need for evidence-based prescribing, and supporting the education of clinicians, patients and caregivers. Clinical pharmacists have been shown to reduce rates of morbidity and mortality, length of stay in the hospital, and costs of healthcare. In conclusion, clinical pharmacists are an important component of the ICU team, and their contributions are important to the delivery of safe, effective, patient care, and cost-effectiveness in practice in critical care.

KEYWORDS: clinical pharmacist, pharmacist, ICU, medication, drug, patient care.

INTRODUCTION

The intensive care unit (ICU) refers to a designated space for patients experiencing a high level of illness that requires advanced level monitoring and assessment, as well as life-support interventions.[1] Because of complex physiological manifestations and high-risk medication regiments, the chance of medication errors and adverse drug events (ADE) is high. Clinical pharmacist's role is integral to the patient care team in this setting, they provide important intervention in optimizing drug therapy, positively affecting outcomes in patients and ensuring medication management and safety.[2] Clinical pharmacist roles in the ICU span from engagement in multidisciplinary rounds, to dose adjustments based on "function", monitoring therapeutic ranges of drugs, and monitoring for drug interactions. It has been reported that clinical pharmacist's presence has been associated with decreased frequency of preventable ADEs, shorter length of stay and decreased costs of healthcare delivery.[3] As pharmacotherapy continues to increase in complexity in critical care, the integration of a clinical pharmacist as part of the care team in the ICU is vital to providing safe, evidence-based, and cost-effective patient care.

The clinical pharmacist oversees a variety of scenarios in the critical care unit, includes

Dose adjustment

In patients who are critically ill, clinical pharmacists are an essential part of the team because of their expertise in adjusting medication doses in response to altered pharmacokinetics and pharmacodynamics due to organ dysfunction.[4] Clinical pharmacists focus on five key areas:

1. Renal and Hepatic Dysfunction: Clinical pharmacists will calculate dose adjustments based on kidney and liver function tests to prevent toxicity and therapeutic failure.[5] For certain drugs that are eliminated by the kidneys and liver, clinical pharmacists, will monitor renal and hepatic parameters like serum creatinine and alanine aminotransferase (ALT) to facilitate dose alterations.[6]

2. Therapeutic Drug Monitoring: When prescribing drugs with particularly narrow therapeutic indices, clinical pharmacists conduct and interpret therapeutic drug monitoring (TDM) and adjust dosing in order to maintain drug concentrations.[7] TDM allows for the enhancement of drug efficacy while mitigating adverse drug events.

3. Titration of Continuous Infusions: They contribute to the development of protocols for titration of therapeutic drugs delivered via continuous infusion, such as vasopressors and sedatives, based on patient response to achieve clinical endpoints.[8]

4. Management of High-Risk Medications: They provide oversight of dosing of insulin and anticoagulants, and can adjust the dosage based on real-time monitoring and lab parameters to mitigate the risk of hyperglycaemia or bleeding.[9]

Prevention of medication errors

There are four main pillars that present opportunities and recommendations for application in the ICU setting to improve medication safety and mitigate medication errors:

Using Medical Technology: Pharmacy leaders are encouraged to make technology integration a priority, especially with regard to Computerized Prescriber Order Entry (CPOE) systems, which are often not utilized in many ICUs.[10] Development of "closed-loop" electronic medication management systems (EMMS) is also proposed to help alleviate some of the legacy issues associated with medication management, but will require focused resources to implement and operationalise a sustainable process.[11]

Consistent the Workplace and Organizational Safety Culture: At the organizational level, a culture of safety should be nurtured through providing incident reporting systems. Existing literature shows gaps in incident reporting and training that suggest there needs to be systemic support and feedback to improve safety practices.[12]

Attention to Intravenous Drugs: The increasing trend of IV medications reinforces the need for supporting protocols to decrease errors.[13] However, challenges exist and training to nursing staff on appropriate procedures is necessary.

In this environment, clinical pharmacists contribute significantly through activities such as identifying prescribing errors during ICU rounds, managing drug interactions, completing medication reconciliations, involvement in antimicrobial stewardship programs, monitoring for adverse drug events (ADEs), education of healthcare staff, and using clinical decision support systems.[14] Their involvement has been shown to decrease medication errors, adverse events, and mortality rates, with overall improvements in patient safety and decreased costs of care.

Regular monitoring of patient's vitals

The function of clinical pharmacists in the Intensive Care Unit (ICU) is extremely valuable in-patient care to evaluate and interpret changes in vital signs towards the action of drugs. Clinical pharmacists translate continuous raw data, such as heart rate, blood pressure, respiratory rate and oxygen saturation, into pharmacotherapeutic recommendations.[15] For instance, if a patient in the ICU is being treated with norepinephrine, and the clinician observes a rise in the patient's mean arterial pressure (MAP), the pharmacist can apply their knowledge of pharmacokinetics and pharmacodynamics, to recommend the appropriate dosing adjustment to prevent the adverse effect of hypertensive overshoot and ensure proper organ perfusion.[16]

Clinical pharmacists also monitor changes in respiratory assessment findings in tandem with sedative/analgesic administration to maximize patient comfort while avoiding the adverse effect of respiratory depression.[17] They holistically monitor vital signs along with urine output, serum creatinine and other metrics to inform appropriate dosing adjustments and/or monitoring for nephrotoxic agents. In general, this would support pharmacy involvement, as the clinical pharmacist combines the complete assessment of vital signs, with hemodynamic assessment to ensure clinical safety and optimize pharmacotherapeutics, in a timely fashion to address suspected adverse drug reactions.[18]

Monitoring of total parenteral nutrition time to time based on patient's condition

Total Parenteral Nutrition (TPN) is crucial to the care of ICU patients with different medical issues, tolerating oral or enteral feeding. Clinical pharmacists are key players in developing, supervising, and modifying a TPN regimen dependent on each patient.[19] Clinical pharmacists assess laboratory tests daily, focusing specifically on electrolytes, glucose, and organ function. They use this information to prevent hyperglycemia and electrolyte abnormalities.[20] They also monitor fluid balance; measure osmolarity; recommend modifications to TPN based on the clinical status of the patients; and provide oversight with other team members. The team frequently collaborates with dietitians and medical physicians to assure that patients' nutritional goals are achieved while minimizing the risk of infection and any complications.[21]

Pharmacists closely monitor if it is warranted when TPN is initiated and use evidence-based practice to recommend changes for the patients as needed. For example, patients with kidney injuries benefit from enhancing oversight of fluid volume and electrolytes[22]; patients with liver dysfunction need close monitoring of liver enzymes throughout TPN.[23] Continuous assessment and modification of TPN therapy supports optimal nutrition and is beneficial for critically ill patients.[24]

Educating ICU staff on safe drug use

A clinical pharmacist's role in the Acute Care setting, specifically in the Intensive Care Unit (ICU), is significant for patient safety and delivery of optimum care, most importantly through their involvement in education of the entire system.[25] Given the frequent dual burden of high complexity in medication therapy and patient acuity, the clinical pharmacist is actively engaged in reducing risk of adverse drug events (ADEs), drug-drug interactions, and dosing errors through continuous educational programs for physicians, nurses, and residents.[26] Clinical pharmacist education targets multiple arenas, including pharmacotherapy optimization, where clinical pharmacists engage the staff members on how to individualize drug doses based on altered organ function (e.g., kidney, bilirubin dose), and medication error review, where they act to empower the entire staff in terms of safe practices for high-risk medications including medications to be dosed based on body weight, or look-alike/sound-alike medications/infusions; and designing, implementing, and managing antimicrobial stewardship, where education is focused on appropriate selection of antibiotics, dosing, and duration.[27] In addition, pharmacists demonstrate and educate on safe administration of intravenous medications including incompatibilities, rates of infusion, and specialized Y-site compatibility charts. Lastly, the role of the clinical pharmacist includes development, implementation, and training of evidence-based orders for management of operations like pain, sedation, delirium, to standardize care but also aids in the nurse and physician to feel educated and empowered in their clinical care.[28] All in all, the clinical pharmacist role clearly enhances care and impacts direct care to improve patient outcomes within the very critical and potentially dangerous area of a care unit.[29]

Counselling patient's families about drug therapy and disease

An ICU clinical pharmacist is an essential member of the healthcare team in caring for patients and their family members in terms of educating them on drug therapy and treatment of disease.[30] In the event that patients are unable to communicate, as they have received sedation or are mechanically ventilated, pharmacists become a vital liaison between the patients and their family members.[31] Family members receive education on the patient's medication therapy (upon admissions and/or discharge), which includes reaffirming goals of therapy and possible side effects, in order to include family members in the patient care. Upon admission to the ICU, a pharmacist performs medication reconciliation to mitigate any potential medication errors that may take place due to misinformation and/or miscommunication about the patient's home medications.[32] Prior to leaving the ICU, the pharmacist also asks patients to consider the importance of deprescribing medications that were initiated during their ICU stay for safe transition back to their place of residence.[33] In addition, the pharmacist provides education on Post-Intensive Care Syndrome-Family (PICS-F) to help support family members and encourage adherence to therapy, as well as discuss drug costs and drug-drug interactions.[34]

Role of digital health and AI in ICU pharmacy

The advent of digital health technologies and artificial intelligence (AI) has dramatically changed the ways in which clinical pharmacists operate in the intensive care unit (ICU) by improving medication safety and clinical decision-making.[35] The use of AI-powered clinical decision support systems (CDSS) allows clinical pharmacists to proactively predict adverse drug events (ADEs), make the complex process of medication reconciliation more manageable, and accurately identify potential drug-drug interactions.[36] Access to real-time patient data from electronic health records (EHRs) and other digital health technology enables clinical pharmacists to perform proactive interventions for patients who are identified as being at risk, which translates to a significant reduction in medication errors.[37] The use of these digital health devices also enhances workflow efficiencies, allowing clinical pharmacists to focus on clinical aspects at work as opposed to administrative duties.[38] Moreover, the ongoing monitoring availability through digital health promotes personalized medicine and drug safety initiatives, both of which enhance patient outcomes and operational efficiencies in critical care environments.[39] Together, clinical pharmacists' knowledge and the use of AI technology facilitate a greater level of data-informed pharmaceutical care to patients with an active illness.[40]

CONCLUSION

The Intensive Care Unit (ICU) accommodates critically ill patients who require advanced monitoring and life-support due to their complex health problems and the use of high-risk medications are more often exposed to medication errors, as well as adverse drug events or ADEs. Clinical pharmacists can play an important role in optimizing drug therapy and decreasing ADEs and follow through with positive patient outcomes through participation in interprofessional rounds, dose adjustments, and monitoring of drug interactions. Clinical pharmacists specifically manage patients on high-risk medications, undertake therapeutic drug monitoring and use user-friendly technology (ie. Computerized Prescriber Order Entry, or CPOE) to promote medication safety and decrease errors. Clinical pharmacists also engage with interprofessional

coworkers in educating staff and family of the patient, continuous medication reconciliation, and promoting team safety in encouraged in the ICU. Additionally, an ever-increasing amount of advancing digital health technology and artificial intelligence can improve the role of the pharmacists, therefore guide clinical decisions while lower medication errors, and may ultimately lead to improved outcomes for patients in critical care environments.

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