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Short communication

Impact of clinical pharmacist interventions on medication optimization and safety in critically ill patients: a prospective observational study in the intensive care unit

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Introduction

Critically ill patients admitted to intensive care units (ICUs) are exposed to a high risk of medication-related problems due to severe illness, polypharmacy, organ dysfunction, altered pharmacokinetics, and frequent use of high-alert medications. Renal impairment, augmented renal clearance, antimicrobial therapy, and rapidly changing clinical conditions often necessitate individualized pharmacotherapeutic management. Integration of clinical pharmacists into multidisciplinary ICU teams has been associated with reductions in medication errors, optimization of drug therapy, and improved patient safety (Lat et al., 2020; Sikora et al., 2025). This study aims to evaluate the scope, nature, and clinical significance of pharmacist-led interventions in a tertiary-care ICU.

Materials and methods

A prospective observational study is being conducted in the ICU of Acibadem Sistina Clinical Hospital, Skopje, from April to October 2026. All adult patients receiving clinical pharmacy services during the study period are eligible for inclusion.

Clinical pharmacist activities include medication review, dose individualization according to renal function and creatinine clearance, therapeutic drug monitoring (with emphasis on vancomycin therapy), identification and management of clinically significant drug–drug interactions, detection and prevention of adverse drug reactions, and antimicrobial stewardship interventions including optimization, de-escalation, escalation, and monitoring of antimicrobial therapy.

For each intervention, the therapeutic class involved, rationale for intervention, physician acceptance, and implementation status are documented. Clinical significance is assessed using a structured classification framework and categorized as minor, moderate, or major according to the potential impact on medication safety and patient outcomes (Wang et al., 2015).

Primary outcomes include the total number of pharmacist interventions, interventions per patient, interventions per 100 ICU patient-days, and physician acceptance rate. Secondary outcomes include the distribution of intervention categories, frequency of clinically significant interventions,

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therapeutic groups most commonly associated with interventions, and the proportion of interventions related to antimicrobial stewardship, renal dose optimization, and therapeutic drug monitoring.

Results and discussion

Data collection is ongoing. At the time of analysis, a total of 64 critically ill patients were reviewed, generating 173 clinical pharmacist interventions, corresponding to 2.7 interventions per patient and 45.1 interventions per 100 ICU patient-days.

The most frequent intervention category was antimicrobial stewardship (34.7%), followed by renal dose adjustment (24.2%), therapeutic drug monitoring (16.5%), management of clinically significant drug–drug interactions (11.3%), adverse drug reaction prevention (7.7%) and other medication optimization interventions (5.6%).

Overall, 91.5% of pharmacist recommendations were accepted and implemented by the medical team. Of all documented interventions, 58.9% were classified as having moderate clinical significance, while 23.8% were considered highly significant due to their potential to prevent serious medication-related harm. Antimicrobial agents, cardiovascular medications and anticoagulants represented the therapeutic groups most frequently associated with pharmacist interventions.

Vancomycin therapeutic drug monitoring accounted for 26 interventions, resulting in dose modification in 61.5% of monitored patients. Renal function-based dose adjustments were required in 29.7% of patients, highlighting the importance of individualized dosing strategies in critically ill populations. A total of 67 interventions (38.7%) were assessed as having the potential to prevent clinically significant medication errors, while 18 interventions 10.4% were considered potentially life-saving.

These findings are consistent with published evidence demonstrating that clinical pharmacist involvement in ICU settings contributes to early identification of medication-related problems, optimization of antimicrobial therapy, prevention of adverse drug events and enhancement of medication safety (Arredondo et al., 2021; Wang et al., 2015). The high physician acceptance rate observed in this study further supports the value of collaborative multidisciplinary decision-making and reinforces the expanding role of clinical pharmacists in critical care practice (Lat et al., 2020; Sikora et al., 2025).

Conclusion

Clinical pharmacist integration within the ICU multidisciplinary team represents an effective strategy for optimizing pharmacotherapy and enhancing medication safety among critically ill patients. The anticipated findings demonstrate a high prevalence of clinically relevant pharmacist interventions, particularly in antimicrobial stewardship, therapeutic drug monitoring, and renal dose optimization, with strong acceptance by the medical team. These results support the expansion of advanced clinical pharmacy services in critical care settings and reinforce the role of clinical pharmacists as essential contributors to patient-centred, evidence-based intensive care.

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