Critical Care Pharmacists: Improving Care by Increasing Access to Medication Expertise

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Not every critically ill patient receives direct patient care from a critical care pharmacist (1).

This absence of critical care pharmacists has direct ramifications on medication safety, patient-centered outcomes, and healthcare costs.

A dedicated, pharmacotherapeutic expert is a requirement for high-quality care of critically ill patients. Their absence decreases healthcare safety and quality (2). During a typical stay in an intensive care unit (ICU), a patient is prescribed more than 20, often high-risk, medications. It has been estimated that every one of the 5 million Americans cared for in an ICU will suffer from more than one medication error per day (2). Medication errors in the form of adverse drug events can double the risk of dying in the ICU, and the annual cost of treating adverse drug events across the United States exceeds $1.5 billion (3, 4).

Improving medication safety through critical care pharmacists saves lives (5). In a recent meta-analysis, Lee and colleagues observed that pharmacists attending multiprofessional rounds in the ICU were associated with reductions in adverse drug events (by 74%), mortality (by 22%), and length of ICU stay (by 1.33 d) (5, 6). Moreover, pharmacists are a cost-effective resource with as much as a 25-to-1 return on investment. Even with this compelling evidence and endorsement by multiprofessional guidelines that pharmacists are essential members of the ICU team, a pharmacist attending rounds occurs in only 70% of ICUs (1). This is especially notable, given that higher workload of pharmacists has been associated with reduced quality of care and longer lengths of stay in the ICU (7).

Both low supply and low demand have produced this gap (1). There are only 3,600 board-certified critical care pharmacists available to provide care to the 100,000 ICU beds in the United States (for reference, there are approximately 20,000 intensivists and 512,000 critical care nurses). Every year, qualified trainees interested in critical care pharmacy residency training go unmatched, because there are only 171 accredited residency programs. Even with more programs increasing supply, the demand has remained low: Position justification has remained challenging, with most critical care pharmacist positions limited to weekday, daytime coverage (1). Pharmacists only attend multidisciplinary rounds on weekends in 15% of institutions, and $24 \times 7 \times 365$ clinical pharmacist coverage is exceedingly rare. Many critically ill patients go without a critical care pharmacist during their entire ICU stay, often because of these barriers of institutional approval of full-time positions.

Improving this gap in a complex healthcare system requires a multiprofessional approach to increase demand and supply. A first step is for hospital leadership to survey how many ICU rounding teams regularly have a pharmacist, as the most robust evidence for improvement in patient-centered outcomes supports pharmacists as core members of rounding teams (8). These effects are most pronounced on the addition of the first pharmacist to a team currently without one (8). Additionally, supporting the means to increase access to pharmacist services through institutional privileging (e.g., pharmacy-driven protocols and guidelines) may expand the reach of existing personnel resources. Pharmacists also serve as key drivers of quality improvement initiatives, and individuals involved in patient safety and healthcare quality initiatives are recommended to survey their teams for pharmacist membership (8). Staffing decisions must incorporate time for this indirect patient care role as well as provide more seamless coverage

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Table 1. Toolkit for increasing critical care pharmacy services

Actionable Steps
1. Identify multiprofessional rounding teams caring for critically ill patients that do not currently have a critical care pharmacist present on rounds.
2. Explore how institutional privileging through protocols can improve access to pharmacist services.
3. Survey existing patient safety and healthcare-quality teams to identify those that do not currently have pharmacist membership.
4. Investigate resources and potential to expand critical care pharmacy residency training programs (through Medicare Pass-Through funding, organizational grants, etc.).
5. Evaluate and document existing workload of critical care pharmacists, with a focus on number of patients care for per shift and rate of cross-coverage
Annotated Bibliography of Key References
1. Lat I, Paciullo C, Daley MJ, MacLaren R, Bolesta S, McCann J, *et al.* Position Paper on Critical Care Pharmacy Services: 2020 Update. *Crit Care Med* 2020;48(9):e813–e834 (8). • Multiprofessional position statement that summarizes the scope of pharmacy services • Impact: This provides a comprehensive resource of services that improve delivery of care.
2. Leguelinel-Blache G, Nguyen T-L, Louart B, Poujol H, Lavigne J-P, Roberts JA, *et al.* Impact of Quality Bundle Enforcement by a Critical Care Pharmacist on Patient Outcome and Costs. *Crit Care Med*. 2018;46(2):199–207. • Evaluation of the effect of pharmacist-run quality bundle, including antimicrobial agent selection, sedation management, protective mechanical ventilation targets, ventilator-associated pneumonia prevention, and removal of unnecessary central venous and urinary catheters • Impact: This program was associated with reductions in length of stay (−3.7 d), mechanical ventilation duration (−1.2 d), and cost savings of $12,000 per month.
3. Lee H, Ryu K, Sohn Y, Kim J, Suh GY, Kim E. *et al.* Impact on Patient Outcomes of Pharmacist Participation in Multidisciplinary Critical Care Teams: A Systematic Review and Meta-Analysis. *Crit Care Med* 2019;47(9):1243–1250 (5). • Meta-analysis of 14 studies evaluating patient outcomes compared with the presence or absence of a critical care pharmacist • Impact: Pharmacists on the multiprofessional ICU team were associated with lower mortality odds (OR, 0.78; 95% CI, 0.73–0.83; $P < 0.00001$) and associated with shorter ICU length of stay (−1.12 d) as well as almost 70% reduction in adverse drug events.
4. Rech MA, Gurnani PK, Peppard WJ, Smetana KS, Van Berkel MA, Hammond DA, *et al.* Pharmacist Avoidance or Reductions in Medical Costs in CRITically Ill Adults: PHARM-CRIT Study. *Crit Care Explor* 2021;3(12):e0594. • The largest economic analysis to date evaluating how optimization of medication therapy management improves costs • Impact: The mean cost avoidance was $845 per patient day, with annualized cost avoidance of $1,784,302 for a critical care pharmacist.
5. Sikora A, Ayyala D, Rech MA, Blackwell SB, Campbell J, Caylor MM, *et al.*; MRC-ICU Investigator Team. Impact of Pharmacists to Improve Patient Care in the Critically Ill: A Large Multicenter Analysis Using Meaningful Metrics with the Medication Regimen Complexity–ICU (MRC-ICU) Score. *Crit Care Med* 2022;50(9):1318–1328 (7). • Evaluation of critical care pharmacist interventions, length of stay, mortality, and a novel prediction metric observed increased pharmacist workload, which was significantly associated with reduced quantity and intensity of interventions and increased ICU length of stay. • Impact: This is the first study to demonstrate that critical care pharmacists with high workloads are unable to provide the same level of care, with significant reductions in quantity and intensity of interventions and increased ICU length of stay.
6. Newsome AS, Murray B, Smith SE, Brothers T, Al-Mamun MA, Chase AM. Optimization of Critical Care Pharmacy Clinical Services: A Gap Analysis Approach. Am J Health Syst Pharm. 2021;78(22):2077–2085 (11). • Impact: This gap analysis builds on the existing position statement and provides key areas of research and process improvement for those interested in improving ICU care by means of medication optimization through critical care pharmacist services.

Definition of abbreviations: 95% CI = 95% confidence interval; ICU = intensive care unit; OR = odds ratio.

of direct patient care (e.g., designated float pharmacist positions to cover for holiday and sick leave to minimize the workload burden of cross-coverage, additional positions so that a single pharmacist is not providing care to patients from multiple rounding teams).

This increased demand will require an increase in supply. The relative lack of training programs is a limiting factor. Multiple studies have shown economic benefit for pharmacy residency training programs, including decreases in length of hospitalization, direct cost savings, and cost avoidance (9, 10). Medicare Pass-Through funding supports these programs. These discussions with hospital administrators are immediately actionable, as robust evidence supports this quality improvement initiative. Table 1 provides a toolkit of actionable steps and key resources to support these efforts.

Identifying the optimal patient:pharmacist ratio in the ICU remains a key question. Although evidence has been established for physician and nursing workload ratios that are associated with safe and high-quality care (as well as reduced healthcare professional burnout), limited research has been conducted for pharmacists. Expert opinion has placed this ratio around 1:15, but evidence suggests that critical care pharmacists often take care of significantly more than this number (11). Evaluating the workload of existing critical care pharmacists, including the extent of cross-coverage and the presence of

evening and weekend clinical services is another actionable step for ICUs that do have daytime, weekday clinical pharmacy services. Dynamic, patient-specific, predictive models embedded within the electronic health record would inform this ratio and future position justification but remain in development.

An evidence-based, data-driven approach by a united healthcare team is required to meet ICU patient needs for critical care pharmacists. The evidence is clear that critical care pharmacists enhance both patient outcomes and the value of healthcare services. We must begin closing the gap between evidence and practice to realize the full benefits from this member of the multiprofessional team. ■

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