Critical care multidisciplinary team - The role of the pharmacist

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"Conflict of interest: nothing to disclose"

ICU patients characteristics

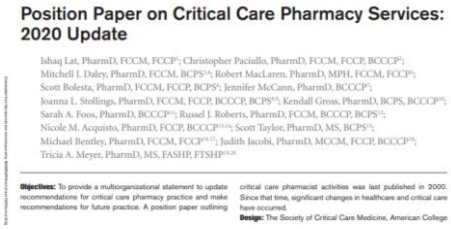
- Complex drug treatments
- High-alert medications
- Multi organ failure, severe illness
- IV administration
- High work load
- Altered PK: ↑Vd, ↓Cl, ↓ Albumin
- Stressful and changing enviroment

Higher incidence of preventable adverse events

Impact of ICU pharmacist

Critical care pharmacists are recognized in the guidelines from the Society of Critical Care Medicine (SCCM) as essential team members for the delivery of care for critically ill patients

Society of Critical Care Medicine and the American College of Clinical Pharmacy Pharmacotherapy 2000;20(11):1400–1406



Position Paper on Critical Care Pharmacy Services: 2020 Update

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Objectives: To provide a multiorganizational statement to update recommendations for critical care pharmacy practice and make recommendations for future practice. A position paper outlining critical care pharmacist activities was last published in 2000. Since that time, significant changes in healthcare and critical care have occurred.
Design: The Society of Critical Care Medicine, American College

- Fundational pharmacist activities: core
- Desirable activities: value added

Critical Care Medicine 2020:48(9):e813-e834.

ICU pharmacist activity

Objetives:

- Optimize pharmacotherapy: patients receive the most effective and safest treatment according to their *individual characteristics*
- Maximize efficiency

ICU pharmacist activity

Objetives:

- Improve patient results working integrated in multidisciplinar ICU health-care team
- The interaction with other team members ADDS UP
- Higher impact if the pharmacist participates in rounds

Impact on Patient Outcomes of Pharmacist Participation in Multidisciplinary Critical Care Teams: A Systematic Review and Meta-Analysis

4,275 studies

Heeyoung Lee, PharmD, PhD[1]; Kyungwoo Ryu, RPharm[1]; Youmin Sohn, MS, BCPS, BCCCP[2]; Jungmi Kim, PhD[3]; Gee Young Suh, MD, PhD, FCCM[4]; EunYoung Kim, PharmD, PhD, BCPS[5,6,7]

	OR	95% CI	p
↓ Mortality	0.78	0.73-0.83	p < 0.00001
↓ ICU stay	-1.3 days	-1.75-0.90	p < .00001
↓ Preventable adverse events	0.26	0.15-0.44	p < 0.00001
↓ Non-preventable adverse events	0.47	0.28-0.77	p < 0.005

Economic impact: The return of investment of an ICU pharmacist was at least multiplied by 4 not considering educational interventions and prevented ADEs.

Crit Care Med. 2019 Sep;47(9):1243-1250

University hospital of Navarra

- Medical-Surgical ICU
  - 12 beds ICU
  - 12 beds intermediate care unit
- Open ICU
- 70% surgical patients

Our experience in the ICU

- Since 2002
- Pharmacist participates in ICU meetings and rounds
- Available for drug consultations at least 6 hours/day
- Physically in the ICU close to drug prescription-preparation-administration
- Pharmacist interventions documented daily

ICU pharmacist daily activity

- 8-9 h Check medication of early discharge
- 9-10 h ICU meeting with anesthesiologists and nurses
- 10-12 h Check labs, cultures, clinical chart, medications, patient or family interview. Communication of urgent interventions
- 12-13 h ICU rounds with anesthesiologists and nurses
- 13-16 h Antimicrobial stewardship, pharmacist interventions documentation

- Available for consultation in the unit
- Drug preparation
- Stocks review
- ICU drug distribution
- Opioids management in the ICU

Pharmacist interventions

- Indication
- Safety
- Effectiveness
- Efficiency
- Adherence

Pharmacist interventions

- Dosage optimization:
  - Dose adjustment to renal/hepatic failure, renal replacement therapies, hypoalbuminemia
  - Therapeutic drug monitoring, PK parameters estimation
  - Weight adjustment (total, actual o adjusted body weight)
  - Drug interactions: Dose adjustment, alternative drug
- Antimicrobial therapy optimization
  - Adequate empiric and directed therapy
  - Antibiotic de-escalation to isolated microorganisms
  - Duration of the therapy
  - IV to PO conversion

Pharmacist interventions

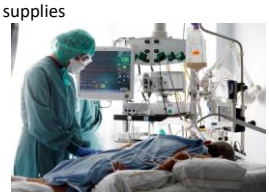
- Additional treatment needed
  - Chronic medication reconciliation
  - Additional preventive therapy needed
  - Synergistic treatment
- Stop unnecessary medication:
  - Treatment duration
  - Duplicated medications
- IV to PO or nasogastric tube conversion
  - Oral bioavailability of the drug
  - Patient oral tolerance

Pharmacist interventions

- Effectiveness and safety monitoring
  - Adverse drug events: dose adjustment, alternative drug recommendation, PK
  - Therapeutic failure: dose adjustment, alternative drug recommendation, PK
- Drug interaction management
  - Alternative drug recommendation , dose adjustment, PK
- Nutritional support
  - Oral supplements, oral or parenteral nutrition

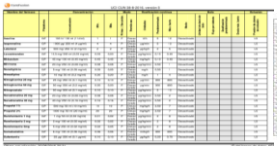
Pharmacist interventions

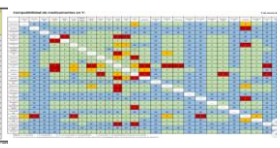
- COVID-19
  - Treatment protocols with available evidence
  - Drug interactions
  - Drug induced QTc prolongation
  - Drug shortages: alternatives
  - Special medications supplies



Pharmacist interventions

- Optimizing fluid therapy: type of fluid, electrolytes, amount of fluid
- IV administration
  - Optimal fluid: NS, G5%
  - Minimum volume if fluid restriction necessary
  - Y-site injection drug compatibility
  - Smart pumps, drug library. Soft and hard limits





Pharmacist interventions (Jan 2020-Jan 2021*)

- 2,069 interventions in 530 patients
- 185 medication errors
- Acceptance: 97%
- Considered important for patient care: 98%
- Improves patient care: 99%
- Avoidance cost: 87,308 €

24% Effectiveness
76% Safety
25% Efficiency

*Except March-April 2020

DRPs (n=2,069)

DRPs detected	N (%)
Overdosing	897 (42)
Unnecessary medication	554 (28)
Additional treatment needed	375 (19)
Underdosing	119 (6)
Inadequate medication	30 (3)
Other DRPs	26 (2)

Pharmacist interventions (n=2,069)

Actuación AF	N	%
Stop a medication	839	41
Modify dose or dosing interval	569	28
Start a medication	354	18
Change to a more cost-effective administration route or method	175	9
Change to a more cost-effective drug	45	2
Change to a more effective drug	36	2
Modify dosage form	25	1
Change to a more effective administration route or method	19	1
Others	7	0.3

Teaching

- ICU physicians and nurses
- Hospital pharmacy residents
- Pharmacy students
- Available for consultation

Research

Contents lists available at ScienceDirect

Research in Social and Administrative Pharmacy

journal homepage: www.elsevier.com/locate/rsap

Clinical and economic impact of clinical pharmacist interventions regarding antimicrobials on critically ill patients

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ARTICLE INFO

Keywords:
Antimicrobial agent
Anti-infective agent
Clinical pharmacist
Cost analysis
Critical care
Critically ill

ABSTRACT

Background: Incorporating in the Intensive Care Unit (ICU) a clinical pharmacist who performs interventions on antimicrobials may be cost-effective.
Objectives: To evaluate the clinical and economic impact of clinical pharmacist interventions on antimicrobials in an ICU. To identify drug related problems and medication errors detected by the pharmacist.
Methods: A retrospective observational study was performed to analyze drug related problems, medication errors and clinical pharmacist interventions related to antimicrobials in adults admitted to an ICU in a 5-month period. The economic impact of pharmacist interventions was estimated considering difference in cost derived from antimicrobial treatment, adverse drug events and clinical pharmacist time.
Results: A total of 212 drug related problems were detected in 114 patients, 18 being medication errors. Clinical pharmacist developed one intervention for each problem identified. 204 interventions (96.2%) were considered important with improved patient care and 7 (3.3%) very important. No negative impact of any intervention was identified. Physicians accepted 97.6% of the interventions. A potential saving of 10,905 € was estimated as a result of pharmacist interventions and 4.8 € were avoided per euro invested in a clinical pharmacist.
Conclusions: A clinical pharmacist performing interventions on antimicrobials in the ICU has a positive impact on patient care and decreases costs.

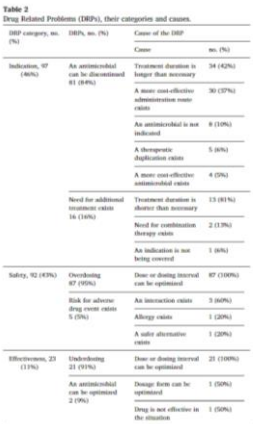
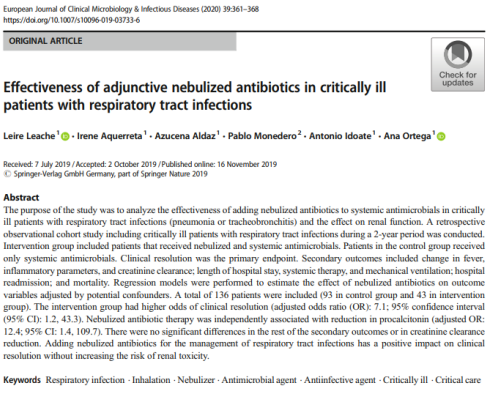


Table 2
Drug Related Problems (DRPs), their categories and causes.

DRP category, no. (%)	DRPs, no. (%)	Cause of the DRP	
		Cause	no. (%)
Indication, 97 (46%)	An antimicrobial can be discontinued 81 (84%)	Treatment duration is longer than necessary	34 (42%)
		A more cost-effective administration route exists	30 (37%)
		An antimicrobial is not indicated	8 (10%)
		A therapeutic duplication exists	5 (6%)
		A more cost-effective antimicrobial exists	4 (5%)
	Need for additional treatment exists 16 (16%)	Treatment duration is shorter than necessary	13 (81%)
		Need for combination therapy exists	2 (13%)
		An indication is not being covered	1 (6%)
Safety, 92 (43%)	Overdosing 87 (95%)	Dose or dosing interval can be optimized	87 (100%)
	Risk for adverse drug event exists 5 (5%)	An interaction exists	3 (60%)
		Allergy exists	1 (20%)
		A safer alternative exists	1 (20%)
Effectiveness, 23 (11%)	Underdosing 21 (91%)	Dose or dosing interval can be optimized	21 (100%)
	An antimicrobial can be optimized 2 (9%)	Dosage form can be optimized	1 (50%)
		Drug is not effective in the situation	1 (50%)

- 5 months
- Antimicrobials
- 202 DRPs in 114 patients
- Acceptation 97.6%
- Potential saving of 10.900€ (4.8 € avoided per € invested in a clinical pharmacist)



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ORIGINAL ARTICLE

Check for updates

Effectiveness of adjunctive nebulized antibiotics in critically ill patients with respiratory tract infections

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Abstract

The purpose of the study was to analyze the effectiveness of adding nebulized antibiotics to systemic antimicrobials in critically ill patients with respiratory tract infections (pneumonia or tracheobronchitis) and the effect on renal function. A retrospective observational cohort study including critically ill patients with respiratory tract infections during a 2-year period was conducted. Intervention group included patients that received nebulized and systemic antimicrobials. Patients in the control group received only systemic antimicrobials. Clinical resolution was the primary endpoint. Secondary outcomes included change in fever, inflammatory parameters, and creatinine clearance; length of hospital stay, systemic therapy, and mechanical ventilation; hospital readmission; and mortality. Regression models were performed to estimate the effect of nebulized antibiotics on outcome variables adjusted by potential confounders. A total of 136 patients were included (93 in control group and 43 in intervention group). The intervention group had higher odds of clinical resolution (adjusted odds ratio (OR): 7.1; 95% confidence interval (95% CI): 1.2, 43.3). Nebulized antibiotic therapy was independently associated with reduction in procalcitonin (adjusted OR: 12.4; 95% CI: 1.4, 109.7). There were no significant differences in the rest of the secondary outcomes or in creatinine clearance reduction. Adding nebulized antibiotics for the management of respiratory tract infections has a positive impact on clinical resolution without increasing the risk of renal toxicity.

Keywords Respiratory infection · Inhalation · Nebulizer · Antimicrobial agent · Antiinfective agent · Critically ill · Critical care

Key points

- Pharmacist integration in the ICU participating in medical rounds allows optimize patient pharmacotherapy increasing effectiveness, safety and cost-effectiveness.

- The ICU pharmacist can teach health care team members about the use of drugs

- *Key to success:* add something different to the team providing pharmaceutical knowledge such as antimicrobials, PK/PD, drug interactions, adverse drug reactions, compatibilities. Be in charge of medication reconciliation, dosage adjustments, IV to PO conversion.