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Special article

[Translated article] Activities of clinical pharmacists in intensive care units

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ABSTRACT

The main objective of the activity carried out in an intensive care unit (ICU) and in general, in all hospitalization units, is to provide all the human and material resources to offer the best therapeutic care to admitted patients. Work in multidisciplinary teams, made up of specialists in intensive care medicine as those responsible for the patients, doctors from other specialties, specialized nursing, physiotherapists, nutritionists, and clinical pharmacists is an optimal approach to achieve the proposed objective. The activities of the clinical pharmacist can be developed at different levels (basic, intermediate, and excellent) depending on the degree of involvement, the time dedicated, the training, and the available resources. This article aims to establish an initial work guide, through recommendations aimed at the activity to be developed by the clinical pharmacist in the ICU in relation to critical patient care and quality improvement, which serves as a reference for those pharmacists who go to develop pharmaceutical care activities in critical patients.

Actividades del farmacéutico clínico en las Unidades de Cuidados Intensivos

Palabras clave:
Farmacia clínica
Farmacia hospitalaria
Atención farmacéutica
Farmacéutico clínico
Paciente crítico
Recomendaciones
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RESUMEN

El objetivo principal de la actividad llevada a cabo en una unidad de cuidados intensivos y en general en todas las unidades de hospitalización, es facilitar todos los medios humanos y materiales para ofrecer la mejor atención terapéutica a los pacientes ingresados. El trabajo en equipos multidisciplinarios, compuestos por especialistas en Medicina Intensiva como responsables de los enfermos, médicos de otras especialidades, enfermería especializada, fisioterapeutas, nutricionistas y farmacéuticos clínicos es un enfoque óptimo para alcanzar el objetivo propuesto. Las actividades del farmacéutico clínico pueden desarrollarse a diferentes niveles (básico, intermedio y excelente) dependiendo del grado de implicación, el tiempo de dedicación, la capacitación y los recursos disponibles. El presente artículo pretende establecer una guía de trabajo inicial, mediante recomendaciones dirigidas a la actividad a desarrollar por el farmacéutico clínico en UCI en relación con el cuidado del paciente crítico y la mejora de la calidad, que sirva de referencia para aquellos farmacéuticos que vayan a desarrollar actividades de atención farmacéutica en unidades de cuidados intensivos.

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Introduction

Intensive care units (ICUs) manage critically ill patients with varying degrees of severity, complexity, and a wide range of conditions, often involving complex treatments, depending on the centre or specific sub-units within the same hospital. The main objective of ICUs, and of all hospitalization units in general, is to provide all the human and material means to offer the best therapeutic care to patients. To meet this objective, multidisciplinary teams are the optimal choice, consisting of intensive care specialists responsible for patient management, doctors from other specialties, specialized nurses, physiotherapists, nutritionists, and clinical pharmacists. The multidisciplinary approach is justified by the expanding knowledge base specific to critically ill patients, advances in therapeutic strategies, and the increasing complexity of their care[1].

One of the objectives of pharmacists in daily clinical practice is to contribute to improving the effectiveness, safety, and appropriate use of medicines to enhance the patients' quality of life and achieve the best health outcomes[2]. The American College of Clinical Pharmacy (ACCP) defines clinical pharmacy practice as "health science discipline in which pharmacists provide patient care that optimizes medication therapy and promotes health, and disease prevention.[3]. This definition covers a wide range of pharmacy activities and can be applied to all types of patients, including those in ICUs.

In 1999, the Society of Critical Care Medicine (SCCM) formally recognized the role of pharmacists in providing high-quality care to critically ill patients[4]. In 2000, the paradigm for clinical pharmaceutical services in ICUs was established by the SCCM/ACCP Position Paper, which outlines fundamental, desirable, and optimal activities to be conducted in both clinical and non-clinical settings to enhance patient safety and optimize the pharmacotherapeutic process[5]. This document was updated in 2020, and the activities were reorganized into 2 categories: fundamental and desirable. It also introduced a new framework for defining the levels of critical care services across 3 categories[6], which forms the basis for the discussion in the rest of the article.

Objective

This article aims to provide an initial working guide for pharmacists in intensive care units, offering recommendations focused on the clinical pharmacist's activities in critical patient care and quality improvement.

Methodology

We reviewed the most relevant scientific literature on the role of clinical pharmacists within multidisciplinary ICU teams to optimize the comprehensive treatment of critically ill patients. In 2020, a working group was established to review the literature (PubMed search) and official documents from various international scientific societies addressing the activities of pharmacists in ICUs. The updated SCCM/ACCP Position Paper[6] was selected as the basis for developing recommendations on the activities of clinical pharmacists in ICUs, with the aim of adapting it into Spanish.

The working group included members of the Intensive Care and Critical Patients Pharmacists (FarMIC) working group of the Spanish Society of Hospital Pharmacy (SEFH), as well as members of the FarmUCI group of the Catalan Society of Clinical Pharmacy.

The FarMIC group was proposed by a group of pharmacists specializing in hospital pharmacy with close professional ties to ICUs, and was approved by the SEFH Governing Board on 15 February 2018. FarMIC consists of a coordinating group of 10 members and their associates, who provide support for the group. Membership is open to all SEFH members[7].

In the first phase, a peer review was conducted by 2 members of the FarMIC working group, Sara Cobo-Sacristán and Fernando Becerril-Moreno, who independently translated and adapted all the activities related to patient care and quality improvement. The inclusion of each item was assessed based on its applicability to local healthcare settings and practices, and those considered inappropriate were discarded. Each recommendation was categorized as either fundamental or desirable, based on the clinical judgment, experience, and opinion of each evaluator. Following individual analysis, a discussion was held to establish a common ground for implementing these recommendations within the national context. The agreements and disagreements regarding the inclusion or categorization of certain items from the first phase were presented for review and consensus by the other members of the FarMIC group. A second phase was agreed upon, during which a form was created using Microsoft Forms (Microsoft Corporation, Redmond, WA). This form included activities that were subject to initial disagreements regarding their inclusion or categorization, allowing all members to give their opinions based on their clinical experience in ICUs. Finally, 2 rounds of voting were required to reach a consensus on each item. Table 1 shows the result of the adaptation process of the original recommendations, which finally included 25 related to "patient care" and 20 for "quality improvement".

Table 1
Results of the adaptation process of activities under review.

Areas	No. of initial activities	Type of adaptation	*n*
Patient care	34	Merging several activities into one	5
		Redefine category (fundamental or desirable)	9
		Eliminate item as not applicable or change the focus of the text	4
Quality improvement	21	Merging several activities into one	1
		Redefine category (fundamental or desirable)	7

Levels of pharmaceutical care

Pharmacists should be an integral part of the multidisciplinary team caring for critically ill patients, collaborating in a coordinated and standardized manner with other healthcare professionals, including medical specialists, nurses, nutritionists, and physiotherapists. This multidisciplinary approach allows all members of the ICU care team to collaborate and contribute their expertise and knowledge patient care. To date, the activities of clinical pharmacists in our field have generally been limited, although variations exist between centres. However, in recent years, there has been growing interest and gradual integration of pharmacists into teams responsible for the care of critically ill patients[8]. It is therefore important to agree upon and define certain aspects of pharmacists' activities.

Table 2
Pharmaceutical care activities conducted in ICUs in Spain out of a total of 58 respondents.

Pharmaceutical care of the critically ill patient		
	n	%
Pharmacotherapy (validation and follow-up)	49	84.5
Clinical pharmacokinetics	39	67.2
Participation in the development of therapeutic protocols	39	67.2
ASP	38	65.5
Artificial nutrition	38	65.5
Reconciliation	34	58.6
Safety - ISO - Pharmacovigilance	27	46.6
Teaching ICU staff	27	46.6
Narcotics control	25	43.1
Research studies on critically ill patients	22	37.9
Participation in innovation activities	19	32.8

ISO, International Standards Organization; ASP, Antimicrobial Stewardship Program; ICU, intensive care unit. Source: adapted from the original article[10].

Table 3
Clinical activities performed.

Distribution of the percentage of time dedicated to clinical activities during the working week	
	%
Medication reconciliation	28.5
Identification of adverse events	27.6
Evaluation of pharmacotherapy	26.1
Monitoring pharmacological treatments	23.8
Management of pharmacotherapy	21.4

Source: adapted from the original article[12].

Specialized healthcare training in hospital pharmacy should equip professionals with the knowledge, skills, and attitudes required to fulfill the responsibilities of clinical pharmacists in ICUs. Ideally, the training of pharmacists caring for critically ill patients should be enhanced by developing competencies specific to this patient population through continuing education activities and/or advanced specialization, such as certification by the Board of Pharmaceutical Specialties[9].

To address the varying levels of clinical practice and understand the logistical and financial resources required, it is essential to define roles and responsibilities of pharmacists within the teams. This approach provides opportunities to share experience and knowledge with all team members.

The current situation of clinical pharmacists in ICUs

Several guidelines and experiences have been published on the development of clinical pharmacy activity in ICUs nationally and internationally, 3 of which are discussed below[10–12]. In 2019, the FarMIC working group published the results of a survey involving 58 pharmacy services across Spain. The survey aimed to describe the role of hospital pharmacists in ICUs, focusing on their care, teaching, and research activities. The results showed that only a single pharmacist attended the ICUs in 77.6% of the centres, covering an average of 30.8 beds (interquartile range [IQR]: 5–70). Daily attendance at rounds or on-call handovers was reported in 22.4% of cases, while 36.2% reported indicated no attendance at rounds. Part-time attendance in ICUs was reported in 93.1% of services[10]. Table 2 shows the activities conducted by pharmacists in this study. A nationwide study was published by the Spanish Society of Intensive Care, Critical Care, and Coronary Units (SEMICYUC), the SEFH, and the Spanish delegation for the Institute for Safe Medication Practices to determine the level of implementation of safe medication practices in intensive care services (ICS), thus identifying opportunities for improvement. In total, 40 ICSs voluntarily completed a "Medication Safety Self-Assessment Questionnaire", which contained 147 items grouped into 10 key elements. The incorporation of a pharmacist into the ICS was the key element with the lowest score. Specifically, the item addressing the availability of a pharmacist assigned to the ICS—

Table 4
Recommendations for ICU pharmacists regarding patient care activities.

	Patient care	Level I	Level II
1	ICU pharmacists actively engage in multidisciplinary team activities (e.g., ward rounds, on-call handovers, and sessions), ensuring comprehensive medication management for all patients. They also participate in discussions with patients and/or their families, aiding in informed decision-making regarding pharmacotherapy options.	Fundamental	Fundamental
2	ICU pharmacists deliver relevant and comprehensive drug information, address clinical queries, and conduct educational activities in any setting where issues related to the pharmacotherapy of critically ill patients are discussed.	Fundamental	Fundamental
3	ICU pharmacists collaborate with the healthcare team to prevent potentially inappropriate pharmacotherapy.	Fundamental	Fundamental
4	Medication-related consultations (pharmacotherapeutic and pharmacokinetic) are available 24 h a day, 7 days a week for all critically ill patients.	Fundamental	Desirable
5	ICU pharmacists provide pharmacokinetic recommendations and follow-up for prescriptions of drugs that are amenable to pharmacokinetic monitoring.	Fundamental	Desirable
6	ICU pharmacists perform medication reconciliation at all possible transitions of care for the critically ill patient.	Fundamental	Fundamental
7	When validating medical prescriptions, ICU pharmacists prospectively evaluate all drug therapies for indication, dosage, and potential interactions or allergies, and monitor the patients' drug regimens for effectiveness and adverse events, intervening as necessary.	Fundamental	Fundamental
8	ICU pharmacists educate patients and/or their caregivers about drugs used to treat the patients during and after acute illness, as appropriate.	Fundamental	Fundamental
9	ICU pharmacists perform independent patient assessments of pain, agitation, delirium, nutrition, and other relevant factors.	Fundamental	Desirable
10	ICU pharmacists contribute to the development of treatment protocols and ensure their availability at the point of care for resuscitative and time-sensitive emergencies, such as cardiac arrest, polytrauma, haemorrhagic shock, sepsis, or acute neurological life-support.	Fundamental	Fundamental
11	ICU pharmacists optimize the use of anti-infectives and other medications, particularly those classified as high risk, high cost, or prone to misuse, such as anticoagulants, sedatives, and gastric secretion inhibitors.	Fundamental	Fundamental
12	ICU pharmacists collaborate with pharmacists from other specialties, such as emergency medicine, infectious diseases, transplantation, and oncology, as needed to address patient- and disease-specific therapeutic challenges.	Fundamental	Fundamental
13	ICU pharmacists in nutritional support teams review nutrition therapy plans and recommend changes to optimize nutritional regimens.	Desirable	Desirable
14	ICU pharmacists use medical records to communicate with other healthcare professionals and/or to document specific pharmacotherapeutic recommendations or activities.	Fundamental	Fundamental
15	ICU pharmacists use appropriate tools to document the outcome and economic impact of their patient care activities, such as disease status, pharmacotherapeutic follow-up, pharmacokinetic monitoring, adverse drug events, education, and other patient care activities.	Fundamental	Fundamental
16	ICU pharmacists have a separate section in the medical record dedicated to the pharmacotherapeutic follow-up of the patient during ICU admission.	Desirable	Desirable
17	ICU pharmacists serve as liaisons between pharmacy services and the multidisciplinary ICU teams, ensuring that healthcare professionals are informed of decisions made by the Pharmacy and Therapeutics Committee.	Fundamental	Fundamental
18	ICU pharmacists conduct pharmacoeconomic analyses in collaboration with multidisciplinary teams to assess the pharmacy service portfolio and determine the role of new drugs in critical care pharmacotherapy.	Fundamental	Fundamental
19	ICU pharmacists are proactive in the design, prioritization, and promotion of new clinical pharmacy programmes and services.	Fundamental	Fundamental
20	Heads of pharmacy services evaluate the clinical programmes or services provided to determine stakeholder satisfaction, relevance, and economic impact.	Fundamental	Fundamental
21	ICU pharmacists participate in the Pharmacy and Therapeutics Committee by evaluating drugs used in the care of critically ill patients for potential inclusion in guidelines and protocols.	Desirable	Desirable
22	ICU pharmacists participate in the planning and implementation of emergency protocols in scenarios applicable to critically ill patients.	Fundamental	Fundamental
23	ICU pharmacists focus most of their activity on critical patient care.	Fundamental	Fundamental
24	If no ICU pharmacist is present, comprehensive medication management can be supplemented by telemedicine.	Desirable	Desirable
25	The pharmacist-patient ratio in each ICU is determined by the severity and complexity of the patient, as well as the scope of available clinical and operational services.	Fundamental	Desirable

ICU, intensive care unit. Source: adapted from the original article[6].

integrated into the care team with sufficient time to perform the clinical activities required by the ICS—had a mean score of 5.80 ± 5.27 out of a maximum possible score of 16[11].

A recent study by McLaren *et al.*[12] evaluated the services and activities performed by ICU pharmacists across the United States based on the new recommendations published in 2020[6]. The study presented the results of surveys from 493 ICUs, showing that clinical pharmacy services were available in 70.8% of them. Pharmacists attended clinical rounds 5 days per week (IQR: 4–5 days), with a median patient-pharmacist ratio of 17 (IQR: 12–26).

Table 3 shows the percentage of time pharmacists spent on each clinical activity[12].

Activities of clinical pharmacists in ICUs

The role of clinical pharmacists in multidisciplinary ICU teams is to ensure that patients receive the best pharmacological treatment in terms of effectiveness, safety, and cost-effectiveness. Therefore, the work of clinical pharmacists in ICUs should involve developing the following competencies:

- Participation in care, teaching, and research activities should vary at different levels, depending on the available human and material resources, as well as the pharmacists' training.
- Incorporate new information and communication technologies into daily practice to facilitate treatment optimization.
- Facilitate and streamline the transfer of patients between different care settings (e.g., transfers between different hospitalization units).

It is important to note that the updated SCCM/ACCP Position Paper defines 2 categories[6]: fundamental and desirable, the latter being considered an added value. Furthermore, they can be applied in 3 different environments depending on the type of ICU:

Level I ICU: Covers a wide range of patients requiring intensive care, providing comprehensive support services and, usually, teaching activities.

Level II ICU: May lack resources to manage specific patients and does not provide teaching activities.

Level III ICU: Can perform initial stabilization, but does not offer critical patient care as such.

This paper groups the activities analyzed into 5 areas:

- Patient care
- Quality improvement
- Research and scholarship
- Training and education
- Professional development.

Tables 4 and 5 show the results of the adaptation of activities, along with their degree of recommendation, as applicable to Level I and Level II ICUs. Level III ICUs were excluded because the authors considered that they were incompatible with the Spanish healthcare environment and

Table 5
Recommendations for ICU pharmacists regarding quality improvement.

	Quality improvement	Level I	Level II
1	ICU pharmacists take a leadership role in medication safety for critically ill patients by identifying potential adverse events, managing existing ones, and enhancing medication use practices.	Fundamental	Fundamental
2	ICU pharmacists assist in managing adverse drug events and implement process improvements to reduce or prevent medication errors.	Fundamental	Fundamental
3	ICU pharmacists participate in the reporting of adverse events.	Fundamental	Fundamental
4	ICU pharmacists are involved in the continuous evaluation of critical drug availability to ensure the optimization of automated dispensing systems.	Fundamental	Fundamental
5	ICU pharmacists should actively participate as team members in the design and development of new or remodelled critical care areas.	Desirable	Desirable
6	ICU pharmacists implement and maintain departmental policies and procedures related to the safe and efficient use of medications in ICUs.	Fundamental	Fundamental
7	ICU pharmacists coordinate the development and implementation of patient-centered pharmacotherapeutic protocols for critically ill patients to maximize the effectiveness of pharmacotherapy.	Fundamental	Fundamental
8	ICU pharmacists independently investigate or collaborate with other ICU team members to assess the impact of pharmacotherapeutic protocols implemented in ICUs.	Fundamental	Desirable
9	ICU pharmacists participate in hospital committees that address pharmacotherapy issues for critically ill patients, and provide expertise to support consultations and decision-making processes.	Fundamental	Fundamental
10	ICU pharmacists contribute to issues related to medication use in ICUs, such as preparing drug monographs and participating in safety bulletins.	Fundamental	Fundamental
11	ICU pharmacists identify and assess opportunities to reduce drug-related costs and implement cost-containment measures.	Fundamental	Fundamental
12	ICU pharmacists participate in identifying local quality measures for continuous improvement, such as medication errors involving prescribed or dispensed medications, duration of mechanical ventilation, incidence of delirium, or patient mobilization.	Fundamental	Desirable
13	ICU pharmacists participate in quality assurance programmes to improve medication management, reduce costs, continually evaluate current processes, and identify the need for new programmes or processes.	Fundamental	Fundamental
14	ICU pharmacists serve on hospital committees or commissions focused on compliance with quality indicators related to critically ill patients, such as *Clostridioides difficile* infection rates, vaccine administration, and patient satisfaction surveys.	Fundamental	Desirable
15	ICU pharmacists collaborate with teams and management to achieve unit accreditation by quality bodies and to address identified challenges.	Fundamental	Desirable
16	The ICU pharmacy space and facilities are regularly reviewed to identify opportunities for efficiency improvements, where appropriate.	Fundamental	Desirable
17	Pharmacists can access quality and medication usage indicators for real-time analysis.	Desirable	Desirable
18	Safety technologies are being implemented for critically ill patients, including bedside barcode scanning, clinical decision-support systems, and smart intravenous drug delivery devices.	Desirable	Desirable
19	Prescribing software should be able to do the following: (a) create and maintain patient medication profiles; (b) interface with patient laboratory data and other relevant test results; (c) interface with patient records (medication profiles) from other health systems and outpatient clinics; (d) alert users to medication allergies; (e) alert users to maximum medication dosage limits; (f) alert users to medications prior to admission; (g) alert users to diagnoses; (h) alert users to drug–drug and drug–food/nutrient interactions; (i) alert users to medications included and excluded from the Pharmacotherapeutic Guide, as well as their therapeutic equivalents; (j) alert users to medication supply problems; and (k) provide real-time data that can be incorporated into pharmacotherapy decision-making.	Fundamental	Fundamental
20	The hospital's electronic information management system should support medication use processes and have the following capabilities: (a) enable direct order entry from suppliers; (b) interface with bedside clinical information systems in real time; (c) alert users to drug–drug and drug–disease interactions; (d) provide information on intravenous mixtures, such as compatibility, stability, and preparation; (e) deliver drug information via internal protocols; (f) record pharmaceutical patient care interventions; (g) provide quality data for benchmarking purposes; (h) offer access to drug-related policies and procedures; (i) interface with mobile devices; and (j) deliver patient-specific treatment algorithms.	Fundamental	Fundamental

ICU, intensive care unit. Source: adapted from the original article[6].

clinical practice. These tables show items from the patient care and quality improvement groups, respectively.

Final considerations

Clinical pharmacy activities in ICUs improve patient care and health outcomes when integrated into multidisciplinary teams. This collaborative approach also fosters greater respect for the profession from other healthcare professionals and society at large. Such recognition can act as a catalyst for the continuous improvement of pharmacotherapy in this patient population[8].

The impact of pharmacists' activities on clinical safety is one of the most extensively studied and documented areas[13–16]. Pharmacists' contributions to pharmacotherapy—such as recommendations on indication, dosage, interactions, duration, and monitoring of efficacy and safety—could be significantly enhanced by their in situ involvement during the prescribing process. This would be achieved by integrating pharmacists into the healthcare team and ensuring their presence when decisions are made about the patients' pharmacological treatment[17–19]. In this way, such teamwork could lead to significant improvements in overall healthcare practice, particularly in the optimization of pharmacotherapy. It is expected that this collaborative approach will result in improved health outcomes in the medium and long term, in line with safety and efficiency standards.

Excellence in clinical pharmacy activities in ICUs requires us to develop robust training that encompasses knowledge, attitudes, and skills across various areas. From a pharmacotherapy perspective, the main areas to be considered are as follows:

- Supportive treatments and monitoring of critically ill patients (e.g., monitoring scales, mechanical ventilation techniques, drug administration techniques, renal replacement techniques, and therapeutic hypothermia).
- Pathophysiological changes in organ function and structure resulting from the patient's severe condition and their impact on drug pharmacokinetics and pharmacodynamics.
- Nutritional management of the critically ill patient (including acid–base balance and blood volume replacement).
- Anti-infective therapy.
- Analgesia and management of delirium.
- Central nervous system pharmacotherapy.
- Respiratory support and ventilatory management.
- Haemodynamic management and hemostasis control.
- Preventive therapies (e.g., stress ulcer prophylaxis, deep vein thrombosis prophylaxis).

Limitations and strengths

The recommendations come mainly from North American publications, where the healthcare system and the structure of under- and postgraduate pharmaceutical education differ from those in Spain. Although publications from other countries have also outlined the activities of pharmacists in ICUs[20,21], the working group selected the SCCM/ACCP Position Paper[6] for its relevance, given its detailed review of pharmaceutical activities and its recent update at the time of writing. The lack of external linguistic validation for the translated text may have hindered the understanding of some of the activities included. Moreover, the implementation of these recommendations may have been affected by the resources available or the lack of a safety culture. This article is aimed at clinical pharmacy activities in adult ICUs. The implementation of activities in specialized ICUs (e.g., neonatal, paediatric, burn, neurocritical) should be supplemented with specific information tailored to the specific patient population. The areas of research, training, and professional development have not been included in detail in this first version. However, the authors consider their development to be essential and intend to address them in future revisions and recommendations.

This consensus is intended to serve as a reference document for improving pharmaceutical care for critically ill patients. The activities outlined are intended as recommendations for the standardized and cross-disciplinary implementation of pharmaceutical services, with the aim of improving the effectiveness, safety, and efficiency of pharmacological treatments in this patient population.

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Declaration of competing interest

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References

1. Unidad de Cuidados intensivos. Estándares y recomendaciones. [Monografía en Internet]. Madrid: Ministerio de Sanidad y Política Social; 2010 [citado 18/05/2022]. Disponible en: http://www.msc.es/organizacion/sns/planCalidadSNS/docs/UCI.pdf.
2. Calvo MV, Alós M, Giráldez J, Inaraja MT, Navarro A, Nicolas J. en representación del Grupo de Trabajo Atención Farmacéutica de la SEFH; Bases de la atención farmacéutica en Farmacia Hospitalaria. Farm Hosp. 2006;30 (2):120–3.
3. American College of Clinical Pharmacy. The definition of clini.cal pharmacy. Pharmacotherapy. 2008 (6):816–7. doi: 10.1592/phco.28.6.816 PMID: 18503408.
4. American College of Critical Care Medicine and the Society of Critical Care Medicine. Critical care services and personnel: recommendations based on a system of categorization into two levels of care. Crit Care Med. 1999;27 (2):422–6.
5. Society of Critical Care Medicine (SCCM), Rudis MI, Brandl KM. Position paper on critical care pharmacy services. Society of Critical Care Medicine and American College of Clinical Pharmacy Task Force on critical care pharmacy services. Crit Care Med. 2000;28(11):3746–50. doi: 10.1097/00003246-200,011,000-00037.
6. 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;Sep;48(9):e813–34. doi: 10.1097/CCM.0000000000004437.
7. Web oficial del grupo de trabajo farmacéuticos de medicina intensiva y pacientes crítico. [página Web]. Sociedad Española de Farmacia Hospitalaria; 2024 [citado 23/06/2024]. Disponible en: https://gruposdetrabajo.sefh.es/farmic/index.php.
8. Pharmacist in the ICU. [Monografía en Internet]. ICU Manage Pract. 2024;24(1) [citado 23/06/2024]. Disponible en: https://healthmanagement.org/c/icu/issue/volume-24-issue-1-2024-1.
9. Lawson B.E. and Guiu Segura J.M., Análisis de la certificación en el marco de especialización farmacéutica a nivel internacional, *Farm Hosp.*, **46** (3), 2022, 191–198. doi: http://dx.doi.org/10.7399/fh.13185
10. Valera Rubio M, Domingo Chiva E, Aquerreta González I, Periáñez Párraga L, Ruiz Ramos J, Soy Muner D. Nationwide current situation of hospital pharmacists in intensive care units. Farm Hosp. 2019;43(6):18.2–6. English: https://doi.org/10.7399/fh.11215.
11. Otero MJ, Merino de Cos P, Aquerreta González I, Bodí M, Domingo Chiva E, Marrero Penichet M, et al. Evaluación de la implantación de prácticas seguras con los

medicamentos en los Servicios de Medicina Intensiva. Med Intens (Engl Ed). 2022;46 (12):680–9. doi: 10.1016/j.medine.2022.05.009.
12. MacLaren R, Roberts RJ, Dzierba AL, Buckley M, Lat I, Lam SW. Characterizing critical care pharmacy services across the United States. Crit Care Explor. 2021;3(1), e0323. doi: 10.1097/CCE.0000000000000323.
13. Knibbe CA, Tjoeng MM. Clinical pharmacist on intensive care unit saves lives and reduces costs. Crit Care Med. 2008;36(12):3269–70. doi: 10.1097/CCM.0b013e31818bd9c0.
14. Bond CA, Raehl CL. Clinical pharmacy services, pharmacy staffing, and hospital mortality rates. Pharmacotherapy. 2007;27(4):481–93. doi: 10.1592/phco.27.4.481.
15. MacLaren R, Brett McQueen R, Campbell J. Clinical and financial impact of pharmacy services in the intensive care unit: pharmacist and prescriber perceptions. Pharmacotherapy. 2013;33(4):401–10. doi: 10.1002/phar.1226.
16. Heeyoung L, Kyungwoo R, Youmin S, Jungmi K, Gee Young S, EunYoung K. Impact on patient outcomes of pharmacist participation in multidisciplinary critical care teams: a systematic review and meta analysis. Crit Care Med. 2019;47(9):1243–50. doi: 10.1097/CCM.0000000000003830.
17. Leape LL, Cullen DJ, Dempsey Clapp M, Burdick E, Demonaco HJ, Erickson JI, et al. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. JAMA. 1999;282 (3):267–70. doi: 10.1001/jama.282.3.267.
18. Papadopoulos J, Rebuck JA, Lober C, Pass SE, Seidl EC, Shah RA, et al. The critical care pharmacist: an essential intensive care practitioner. Pharmacotherapy. 2002;22(11): 1484–8. doi: 10.1592/phco.22.16.1484.33694.
19. Shulman R, McKenzie CA, Landa J, Bourne RS, Jones A, Borthwick M, et al. Pharmacist's review and outcomes: treatment enhancing contributions tallied, evaluated, and documented (PROTECTED UK). J Crit Care. 2015;30(4):808–13. doi: 10.1016/j.jcrc.2015.04.008.
20. Escobar L, González C, Amador R, Amador J, Cariqueo M, representación del grupo Crisol. Consenso de farmacia clínica inten.siva a nivel nacional [Consensus about the duties of pharmacists in intensive care units in Chile]. Rev Med Chil. 2018;146 (12):1452–8. Spanish: https://doi.org/10.4067/s0034-98,872,018,001,201,452 PMID: 30848749.
21. Bunte M, The Society of Hospital Pharmacists of Australia. Standards of practice for clinical pharmacy services. J Pharm Pract Res. 2021;51 (6):536–51. doi: 10.1002/jppr.1774.