*SCT Proceedings in Interdisciplinary Insights and Innovations*. 2025; 3:465
doi: 10.56294/piii2025465

**Category: Applied Research in Health and Medicine**

**SHORT COMUNICATION**

# Impact of Pharmacological Competencies on the Reduction of Medication Errors in Critical Care Units

## Impacto de las Competencias Farmacológicas en la Reducción de Errores de Medicación en Unidades de Cuidados Críticos

Ayelén Estefanía Plenza [1], Sebastián Gabini [1], Liliana Ponti [1]

[1] Universidad Abierta Interamericana, Facultad de Medicina y Ciencias de la Salud - Licenciatura en Enfermería. Buenos Aires, Argentina.

**Cite as:** Plenza AE, Gabini S, Ponti L. Impact of Pharmacological Competencies on the Reduction of Medication Errors in Critical Care Units. SCT Proceedings in Interdisciplinary Insights and Innovations. 2025;3:465.https://doi.org/10.56294/piii2025465

**Submitted:** 12-09-2025 **Reviewed:** 27-11-2024 **Accepted:** 03-01-2025 **Published:** 05-01-2025

**Editor:** Emanuel Maldonado

**ABSTRACT**

The use of drugs to treat disease and relieve pain has historical roots that evolved significantly over time, especially in the 20th century, when pharmacology became a central discipline in healthcare and nursing. This practice, although essential for patient recovery, especially in high-intervention settings such as intensive care units, is prone to errors that can have serious consequences for patients. The National Coordinating Council for Medication Error Prevention (NCC MERP) has developed error classification and analysis tools, emphasizing that errors are often preventable and multifactorial, highlighting the importance of nursing staff pharmacological knowledge. Several studies have identified the causes and consequences of medication errors. In Ecuador, errors were related to high patient demand, non-compliance with schedules and poor administration technique. In Cuba, a general mastery of medications was observed, but a deficiency in the recognition of adverse reactions. In Spain, pharmacovigilance showed low rates of spontaneous reporting of adverse events, attributable to insufficient training in pharmacology. In critical care units, the most common errors included administration, dilution and dosing techniques, exacerbated by pressure of care and communication problems.In this context, nursing plays a crucial role as it is at the end of the pharmacotherapeutic process, acting as the last barrier to prevent errors from reaching the patient. This study in an Intensive Care Unit in Rosario seeks to delve into this problem, highlighting its impact on patients and on the professional development of nursing staff, with the aim of providing practical and theoretical solutions.

**Keywords:** Pharmacology; medication errors; nursing; critical care units; pharmacovigilance.

© Autor(es); 2025. Este es un artículo en acceso abierto, distribuido bajo los términos de una licencia *Creative Commons* (https://creativecommons.org/licenses/by/4.0) que permite el uso, distribución y reproducción en cualquier medio siempre que la obra original sea correctamente citada.

**RESUMEN**

El uso de medicamentos para tratar enfermedades y aliviar el dolor tiene raíces históricas que evolucionaron significativamente con el tiempo, especialmente en el siglo XX, cuando la farmacología se convirtió en una disciplina central en la salud y la enfermería. Esta práctica, aunque esencial para la recuperación de pacientes, especialmente en contextos de alta intervención como las unidades intensivas, está expuesta a errores que pueden tener consecuencias graves para los pacientes. El Consejo Nacional de Coordinación para la Prevención de Errores de Medicación (NCC MERP) ha desarrollado herramientas de clasificación y análisis de errores, subrayando que estos son a menudo prevenibles y multifactoriales, destacando la importancia del conocimiento farmacológico del personal de enfermería. Diversos estudios han identificado las causas y consecuencias de los errores de medicación. En Ecuador, se relacionaron errores con alta demanda de pacientes, incumplimientos de horarios y mala técnica de administración. En Cuba, se observó un dominio general de los medicamentos, pero una deficiencia en el reconocimiento de reacciones adversas. En España, la farmacovigilancia mostró bajas tasas de notificación espontánea de eventos adversos, atribuibles a la insuficiente formación en farmacología. En las unidades de cuidados críticos, los errores más comunes incluyeron técnicas de administración, dilución y dosificación, exacerbados por la presión asistencial y problemas de comunicación. En este contexto, la enfermería desempeña un papel crucial al encontrarse al final del proceso farmacoterapéutico, actuando como última barrera para evitar que los errores lleguen al paciente. Este estudio en una Unidad de Terapia Intensiva de Rosario busca profundizar en esta problemática, resaltando su impacto en los pacientes y en el desarrollo profesional del personal de enfermería, con el objetivo de aportar soluciones prácticas y teóricas.

**Palabras clave:** Farmacología; errores de medicación; enfermería; unidades de cuidados críticos; farmacovigilancia.

The use of medicines to cure diseases and pain relief is an ancient practice that has resorted to preparations using extracts from the plant and animal world. It was not until 1498 that the first European book legislating the preparation of drugs was published. By the 20th century, pharmacology had such a boom that it had become one of the major industries of our time. As a discipline, it studies the properties of drugs and chemical substances that act on living matter and is closely related to the professional practice of nursing (Vergel Rivera et al., 2009). Regarding the medicinal practice, Machado de Azevedo (2012) states that it is a pillar in the health recovery process, mainly in patients with high intervention in the intensive sectors and involves Nurses as a responsible protagonist of this practice susceptible to making mistakes with harmful consequences for the patient.

Then, it is not strange that the knowledge and mastery of this discipline constitutes a concern of the nursing collective in the context of the health field, where the academic concern to be oriented towards excellence is growing and where curricular adaptations and the construction of learning styles that form professionals capable of self-managing their continuing education needs throughout professional life are included (Romero Viamonte, 2018).

The National Coordinating Council for Medication Error Reporting and National Coordinating Council for Medication Error Reporting and Prevention [NCC MERP]- is an independent body composed of 27 organizations with constituent organizations such as the American Nurses Association [ANA], the American Medical Association [AMA], the United States Department of Defense [USA], the Institute for Safe Medication Practices, the Society of Hospital Medicine, and the United States Pharmacopeia (NCC MERP, 2022).

In 1998, the NCC MERP published "the first taxonomy of medication errors to provide a standardized language and structured classification of medication errors for subsequent analysis and recording." This tool, extremely useful for classifying medication errors, has proved to be important in understanding the causes of their occurrence. Although it is observed that the problem is multifactorial, the nurse has an important role in the prevention of such errors, fundamentally because of his pharmacological competencies, that is, because of the knowledge he possesses and how he applies it to solve problems in his healthcare practice (Romero Viamonte, 2018).

Páez Arellano et al. (2016) conducted descriptive research with physicians and nurses to determine the knowledge on the subject and to point out the most frequent errors in the prescription and management of medication in the Pediatrics Service of the Hospital San Vicente de Paúl Ibarra -Ecuador-. In their conceptual framework, they position themselves in events that can be prevented and are a consequence of "human failures due to lack of therapeutic knowledge, decreased attention, or system failures." They argue that most medication errors go undetected, have little clinical impact, and that some can result in significant morbidity or mortality.

A report by the U.S. Institute of Medicine states that there are 7000 deaths annually as a consequence of medical medication errors; however, little information is available on the frequency of these errors. Their study determined that high patient demand correlates with medical prescription error (45%) and the nurse's untimeliness in administering the prescription (86%). Also, in Ecuador, Vaca Aúz et al. (2016) determined that, in 30 days, 26 adverse events related to nursing care were detected. Although 50% were typified as non-injury events, 100% were classified as potentially preventable. Most occurred with poor technique at the time of medication administration, non-compliance with the schedule, and non-compliance with medical indications.

In a descriptive and retrospective study on the knowledge of the practical management of drugs in nursing at the Gynecobstetric Hospital of Guanabacoa -Cuba- a previously validated survey was applied to 24 nurses who attended births from January to December 2015. It was determined that most of them knew the drugs used in the investigated service and mastered their administration, but 62.5 % were not able to identify adverse reactions (Montero Vizcaíno et al., 2017).

In an approach to pharmacovigilance, Calderón Mediavilla (2021) describes the functioning of the Spanish System of Pharmacovigilance of Medicines for Human Use in the fulfillment of the purpose of control of drug safety and efficacy that is evaluated after marketing and use. In order to achieve this health control goal, spontaneous reporting is essential, i.e., to apply a method where professionals and patients can report suspected cases of adverse reactions. The System's notification files reveal that "reporting from the nursing community is scarce, due to multifactorial reasons, which begin to be forged in university training, being necessary interventions to reinforce the knowledge, attitudes, and behavior of professionals in pharmacovigilance." Incidentally, Calderón Mediavilla (2021) presents his translation of the article by J.Tichelaar et al. (2021), "The Potential of Training Specialist Oncology Nurses in Real-life Reporting of Adverse Drug Reactions," where a prospective study that measured the impact of pharmacovigilance training in the Netherlands in 2015 is recounted. Out of 113 oncology specialist nurses enrolled in training on prescribing the most commonly used drugs in the specialty, 88 agreed to participate so that change in spontaneous reporting behavior was determined, resulting in the total number of specialist nurses making reports up to 5 years after the training, as opposed to only 6 of those 88 having reported prior to the course.

Finally, Escrivá Gracia et al. (2017) executed a study with a mixed design in the Consorcio Hospital General Universitario de Valencia by surveying information from clinical records and interviewing professionals involved in the medication process of a UTI with three general objectives of identifying the main medication errors made during the prescription, transcription and administration of medications; to analyze the perception of expert professionals about the causes of medication errors, and to determine whether the level of knowledge of nurses about the use and administration of medications is related to

https://doi.org/10.56294/piii2025465

the most common medication errors in the use of the most commonly used drugs in critical care. They concluded that medication errors occur in critical care units and that one of the main problems is the type of administration routes used in these patients (intravenous, subcutaneous, inhalation, and nasogastric tube). The most important problems detected were -in order of frequency- the technique of administering drugs through digestive probes, non-compliance with the prescribed antibiotic dosage schedule, and dilution, concentration, and infusion rate errors with high-risk drugs. It was also found that more errors were made in prescribing than in transcribing. Concerning Nursing, specifically, the level of knowledge of the pharmacology of the nursing professional was related to the most common errors in critical care, helped by insufficient access to information, and "a context with communication problems, poor relations in the work environment, excessive care pressure, work interruptions, and an erroneous consideration of what constitutes an error, aggravated by the urgent and critical nature of professional actions in this field." A large part of the errors committed derive from failures in previous stages, "which makes this professional an important filter to prevent a considerable number of errors from reaching the patient." In the same sense, Machado et al. (2012) state that nursing is key within the pharmacotherapeutic process and point out that the fact of being at the end of the process turns the action of administering into the last opportunity to detect and interrupt the sequence of errors committed in previous phases on the one hand, and "increases their responsibility in evidencing and preventing failures." As if the above were not enough regarding the importance of the nursing role in the System, it should be added that the greater proximity to the patient's evolution enables the early detection of possible adverse events.

Therefore, the study of the assessment of the drug problem about the pharmacological competencies of nurses in an Intensive Care Unit of a public hospital in the city of Rosario in September 2021 is justified by the need to advance the knowledge of a situation that impacts both patients and the development of the professional activity of nurses. It has social relevance and constitutes a theoretical contribution to advance the solutions of the results and findings.

## REFERENCES

1. Administración Nacional de Medicamentos, Alimentos y Tecnología Médica (10 de mayo de 2022). Formulario de comunicación de eventos adversos. https://www.argentina.gob.ar/anmat
2. Aimacaña Guayta, E. (2019). Aplicación de los 10 correctos en la administración de medicación por parte del personal de enfermería en el Hospital Provincial General Docente Ambato. Universidad Técnica de Ambato, Ecuador. Facultad Ciencias de la Salud. Carrera de Enfermería. https://repositorio.uta.edu.ec/bitstream/123456789/29444/2/
3. Aldana de Becerra, G. y Ruiz, J.R. (2010). La formación por competencias y la calidad de la educación. Entrevista a Sergio Tobón Tobón. Dialnet-LaFormacionPorCompetenciasYLaCalidadDeLaEducacionR-3701429Argentina Presidencia/Boletín Oficial (8 de junio de 2022). Legislación y avisos oficiales. Resolución 2721/2015. https://www.boletinoficial.gob.ar/detalleAviso/primera/135700/20151109
4. Bunk, G. (1994). La transmisión de las competencias en la formación y perfeccionamiento profesionales de la RFA. G - Revista europea de formación profesional, 1994 - dialnet.unirioja.es https://scholar.google.com.ar/scholar?q=bunk+1994+competencias+profesionales&hl=es&as_sdt=0&as_vis=1&oi=scholart

https://doi.org/10.56294/piii2025465

5. Calderón Mediavilla, N. (2021). Farmacovigilancia: Implicación Del Profesional De Enfermería. Tesis de grado. Facultad de Enfermería, Universidad de Cantabria. https://repositorio.unican.es/xmlui/bitstream/handle/10902/22155/CALDERON%20MEDIAVILLA,%20NOELIA.pdf?sequence=1
6. Encina Contreras, P. y Rodríguez Galán, M.A. (2016). Errores de Medicación. Subdepartamento Farmacovigilancia, Instituto de Salud Pública, Ministerio de Salud, Gobierno de Chile https://www.ispch.cl/newsfarmacovigilancia/07/images/parte04.pdf
7. Escrivá Gracia, J. (2017). Riesgo de errores de medicación y conocimientos de farmacología del profesional de enfermería en una unidad de cuidados críticos. Tesis doctoral. Facultat D'infermeria I Podologia, Departament D'infermeria, Universitat de Valencia. https://core.ac.uk/download/pdf/84750116.pdf
8. Gobierno de Catalunya (2008). Boletín de Prevención de errores de medicación de Cataluña. Vol. 6, núm. 2 • mayo - septiembre 2008. Departamento de Salud. https://scientiasalut.gencat.cat/bitstream/handle/11351/2520/butll_prev_errors_ medicacio_catalunya%20_2008_06_02_cas.pdf?sequence=2&isAllowed=y
9. Honorable Congreso de la Nación (6 de junio de 2022). Normativa Ley 24004/1991. Enfermería, Ejercicio profesional. Fecha de sanción 26-09-1991, Publicada en el Boletín Nacional del 28-Oct-1991. https://www.argentina.gob.ar/normativa/nacional/ley-24004-403/texto
10. Institute for Safe Medication Practices [ISMP] (14 de junio de 2022). Inicio página institucional. https://www.ismp.org/about.
11. Instituto para el Uso Seguro de los Medicamentos (15 de junio de 2022). Inicio página institucional. https://www.ismp-espana.org/
12. Instituto para el Uso Seguro de los Medicamentos (15 de junio de 2022). Boletín nº 51. Errores de medicación de mayor riesgo para los pacientes notificados en 2021. https://www.ismp-espana.org/noticias/view/173
13. Machado de Azevedo Filho, F., Soares Martins, I.M., Rodrigues Silva Soares, C.S., Gomes Fazendeiro, P., Tanferri de Brito Paranaguá, T., y Queiroz Bezerra, A.L. (2012). Administración de medicamentos: conocimiento de los enfermeros del sector de urgencia y emergencia. Enferm. glob. vol.11 n.26 Murcia Apr. 2012.
14. Enfermería Global 11(26), 54-69 On-line version ISSN 1695-6141. https://dx.doi.org/10.4321/S1695-61412012000200005.
15. Macías Vázquez, A. (2014). Criterios que emplea el personal de Enfermería para la dilución de medicamentos intravenosos en el adulto. Tesis para obtener el postgrado de especialista. Universidad Veracruzana Campus Xalapa, Especialización de Enfermería en Cuidados Intensivos del Adulto en Estado Crítico. https://cdigital.uv.mx/bitstream/handle/123456789/46451/MaciasVazquezAngel. pdf?sequence=2&isAllowed=y
16. Molina Gómez, L., Quintero Rendón, K., Vallejo Gómez, M. y Velásquez Pérez, K. (2019). Conocimiento farmacológico en estudiantes de último año de enfermería de la Corporación Universitaria Adventista. Repositorio Institucional. Facultad de Ciencias de la Salud, Medellín, Colombia. http://repository.unac.edu.co/bitstream/handle/11254/916/Proyecto%20de%20Grado.pdf?sequence=1&isAllowed=y
17. Ministerio de Salud de Argentina (10 de mayo de 2022). ANMAT. https://www.argentina.gob.ar/anmat

18. Montero Vizcaíno, Y., Izquierdo Santa Cruz, M., Vizcaíno Alonso, M.C. y Montero Vizcaíno, Y.Y. (2017). Conocimiento del manejo práctico de fármacos en Enfermería. Servicio de reanimación neonatal. Hospital Ginecobstétrico Guanabacoa. Revista Habanera de Ciencias Médicas, vol. 16, núm. 5, pp. 822- 831. Universidad de Ciencias Médicas de La Habana. Ciudad de La Habana, Cuba versión On-line ISSN 1729-519X
19. http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1729- 519X2017000500014
20. Morón Rodríguez, F. y Levy Rodríguez, M. (2002). Farmacología General. La Habana: Editorial Ciencias Médicas; 2002. ISBN:959-212-070-6.
21. National Coordinating Council for Medication Error Reporting and Prevention [NCC MERP]- (14 de junio de 2022). Página institucional. https://www.nccmerp.org/leadership-member-organizations
22. Organización Mundial de la Salud [OMS] (2017). El tercer reto mundial por la seguridad del paciente: reducir los daños causados por los medicamentos. Boletín de la Organización Mundial de la Salud, Agosto (2017); p.95. https://argentina.campusvirtualsp.org/el-tercer-reto-mundial-por-la-seguridad- del-paciente-reducir-los-danos-causados-por-los-medicamentos
23. Organización Mundialde la Salud [OMS] (2019). Seguridad del paciente.https://www.who.int/es/news-room/fact-sheets/detail/patient-safety
24. Osinachi, Ch. (2004) Farmacología para la enfermería. Librería Arkadia. Bs. As., Argentina. Pp1 y 2. https://alumnosenfermeriauac2014.files.wordpress.com/2016/09/farmacologogia-para-la-enfermeria_-edicion-2004.pdf
25. Otero, M.J. (2003). Errores de medicación y gestión de riesgos. Revista Española de Salud Pública, 77(5),527-540. ISSN:11355727.https://www.redalyc.org/articulo.oa?id=17077503.
26. Otero, M.J., Martín, R., Robles, M. y Codina, C. (2002). Errores de Medicación. Farmacia Hospitalaria. España: Fundación Española de Farmacia Hospitalaria; 2002. p. 713-47.
27. Parra, D.I., Camargo-Figuera, F.A. y Rey Gómez, R. (2012). Eventos adversos derivados del cuidado de enfermería: flebitis, úlceras por presión y caídas. Enfermería Global versión On-line ISSN 1695-6141. Enferm. glob. vol.11 no.28 Murcia oct. 2012. cielo.isciii.es/scielo.php?script=sci_arttext&pid=S169561412012000400010#:~:text=Un%20Evento%20adverso%20(EA)%20son,dem ora%20del%20alta%2C%20a%20la
28. Páez Arellano, T.G., Meneses Dávila, M.S., Hidrobo Guzmán, J.F., Jaramillo, D. y Álvarez Moreno, M. (2016). Enfermería Investiga. Investigación, Vinculación, Docencia y Gestión-Vol. 1 No. 3 2016 (Jul-Sep). https://dialnet.unirioja.es/servlet/articulo?codigo=6194255
29. Romero Viamonte, K. (2018). El conocimiento de la Farmacología en el profesional de enfermería. Enfermería Investiga, Investigación, Vinculación, Docencia y Gestión-Vol. 3 Nº 2 p. 95-104. DOI: http://dx.doi.org/10.29033/ei.v3n2.2018.07. https://dialnet.unirioja.es/descarga/articulo/6494657.pdf.
30. Sistema Nacional de Farmacovigilancia (22 de mayo de 2022). Eventos adversos. https://www.argentina.gob.ar/anmat/farmacovigilancia/notificanos/eventosadver sos
31. Vaca Aúz, J., Muñoz Navarro, P., Flores Grijalba, M.C., Altamirano Zabala, G.N., Meneses Dávila, M.S., Barahona Cisneros, M.E. y Ortega López, C.E. (2016). Eventos adversos relacionados con los cuidados de enfermería en el Hospital de Ibarra, provincia de Imbabura. Enfermería Investiga: Investigación, Vinculación, Docencia y Gestión, ISSN 2477-9172, ISSN-e 2550-6692, Vol. 1, Nº. 3, 2016, págs. 102-106. https://dialnet.unirioja.es/servlet/articulo?codigo=6194257

32. Vera Carrasco, O. (2014). Enseñanza de la farmacología basada en competencias. Educación Medica Continua. Cuadernos Hospital de Clínicas versión impresa ISSN 1562-6776 Cuad. - Hosp. Clín. vol.55 no.4 La Paz 2014. http://www.scielo.org.bo/scielo.php?script=sci_arttext&pid=S1652- 67762014000100006
33. Vergel Rivera, G.M., Tasé Martínez, M.J. y Groning Roque, E. (2009) Farmacología. Proceso de atención en enfermería. Editorial Ciencias Médicas. La Habana, Cuba.

## FINANCING
None.

## CONFLICT OF INTEREST
None.