

## Medical process simulation: a documentary analysis of its impact on health professional training

### Simulación de procesos médicos: análisis documental de su impacto en la formación de profesionales de la salud

Carla Valeria Vizcarra Bautista, Cinthia Rubí Hernández Rocha, Jair Alejandro Hernández Raga, Jesús Alberto Mata Javier, MTI. Daniel Arturo Maupomé Rosales\*

#### Abstract

Highly competent in increasingly complex clinical scenarios, medical simulation has emerged as a key tool in this context. By utilizing computational models, artificial intelligence (AI), virtual reality (VR), and interactive three-dimensional environments, it allows for the recreation of clinical procedures in controlled settings, transforming errors into learning opportunities without risk to the patient. This methodology addresses the ethical and logistical limitations of practicing with real patients. The objective of this documentary research is to analyze the impact of medical simulation on the training of health science students, highlighting its pedagogical benefits, technological advancements, and challenges in its implementation. The research is descriptive and non-experimental, based on the review of academic sources published between 2005 and 2025. The results show that simulation significantly improves students' clinical competencies, such as technical skills, communication, decision-making, and teamwork. Furthermore, it accelerates skill acquisition, facilitates immediate feedback, error identification, and reduces stress. Despite technological advancements, challenges remain related to costs and integration with real healthcare systems. Future research should evaluate the impacts on patient care and the efficiency of the healthcare system.

**Keywords:** medical simulation; medical education; artificial intelligence; virtual reality; clinical competencies

**Correspondencia:** daniel.maupome@itspanuco.edu.mx

**Fecha de recepción:** 08/julio/2025 | **Fecha de aceptación:** 02/octubre/2025 | **Fecha de publicación:** 26/marzo/2026

\*Instituto Tecnológico Superior de Pánuco, Extensión Pueblo Viejo, México

#### Resumen

La educación médica enfrenta el desafío de formar profesionales altamente competentes ante escenarios clínicos cada vez más complejos. En este contexto, la simulación de procesos médicos ha emergido como una herramienta clave. Utilizando modelos computacionales, inteligencia artificial (IA), realidad virtual (VR) y entornos tridimensionales interactivos, permite recrear procedimientos clínicos en entornos controlados, transformando el error en una oportunidad de aprendizaje sin riesgos para el paciente. Esta metodología responde a las limitaciones éticas y logísticas de la práctica con pacientes reales. El objetivo de esta investigación documental es analizar el impacto de la simulación médica en la formación de los estudiantes de ciencias de la salud, destacando sus beneficios pedagógicos, avances tecnológicos y desafíos en su implementación. La investigación es descriptiva y no experimental, basada en la revisión de fuentes académicas publicadas entre 2005 y 2025. Los resultados muestran que la simulación mejora significativamente las competencias clínicas de los estudiantes, como habilidades técnicas, comunicación, toma de decisiones y trabajo en equipo. Además, acelera la adquisición de habilidades, facilita la retroalimentación inmediata, la identificación de errores y reduce el estrés. A pesar de los avances tecnológicos, persisten desafíos relacionados con los costos y la integración con sistemas de salud reales. Las futuras investigaciones deben evaluar los impactos en la atención al paciente y la eficiencia del sistema de salud.

**Palabras clave:** simulación médica; educación médica; inteligencia artificial; realidad virtual; competencias clínicas





## Medical process simulation: a documentary analysis of its impact on health professional training

Maupomé Rosales Daniel, Vizcarra Bautista Carla Valeria, Hernández Rocha Cinthia Rubí, Hernández Raga Jair Alejandro, Mata Javier Jesús Alberto  
**Instituto Tecnológico Superior De Pánuco, Ext. Pueblo Viejo**

### INTRODUCTION

Contemporary medical education faces the challenge of training highly competent professionals capable of effectively responding to increasingly complex clinical scenarios. In this context, medical process simulation has emerged as one of the most innovative and effective pedagogical strategies in health sciences education. Through computational models, artificial intelligence (AI), virtual reality (VR), and interactive three-dimensional environments, simulation allows the recreation of clinical procedures in controlled and safe settings, where errors become learning opportunities rather than risks to the patient (Muñoz Gualán & Sierra, 2024).

The integration of simulation into medical education addresses the need to effectively combine theory and practice, overcoming the ethical and logistical limitations associated with practicing on real patients (Vera-Carrasco, 2024).

### METHODOLOGY

This work is a descriptive documentary research, as it is based on the collection, review, analysis, and interpretation of information from various academic sources related to medical simulation in the training of health professionals. The design is non-experimental and cross-sectional, as no variables are manipulated, and the analysis focuses on documents published within a specific period.

The population consists of the scientific production related to computational medical simulation and its application in health sciences education. The sample includes 30 documents selected from scientific articles, theses, books, and institutional reports published between 2005 and 2025, in both Spanish and English, that address theoretical, methodological, and applied aspects of medical simulation.

### OBJETIVE

Analyze, through documentary research, the impact of medical simulation based on computational models on the academic and professional training of health science students, identifying its pedagogical benefits, technological advancements, and main implementation challenges.

### RESULTS

The results of medical process simulation include a significant improvement in students' clinical competencies, encompassing the development of technical skills, communication, decision-making, and teamwork. Additionally, simulation accelerates skill acquisition, provides immediate feedback, facilitates error identification, reduces stress in high-pressure situations, and enhances customer care.

### CONCLUSIONS

In conclusion, the results of this documentary research confirm that medical simulation, by integrating advanced technological resources and active pedagogical strategies, enhances clinical learning, strengthens professional competencies, and promotes safer and more efficient medical practice. The analyzed studies agree that clinical simulation not only optimizes the individual training of students but also transforms the institutional environments where it is applied by fostering a culture of patient safety and standardizing procedures (Issenberg et al., 2005; Gaba, 2004).

The documentary analysis reveals a growing trend towards the use of simulators with artificial intelligence, virtual reality, and machine learning, which allow for the adaptation of difficulty and feedback levels based on the user's progress (Sanchez et al., 2022; López & Rodríguez, 2023).

Montiel et al. (2024) propose that future research lines focus on evaluating translational outcomes, meaning how simulation directly impacts the improvement of real patient care and the efficiency of healthcare systems.

### REFERENCES

- Durante Montiel, I., Barona Núñez, A. V., & Hernández Gutiérrez, L. S. (2024). La simulación y su contribución al sistema de salud. *Revista de Simulación en Ciencias de la Salud*, 2, 25-33.
- Gaba, D. M. (2004). The future vision of simulation in health care. *Quality and Safety in Health Care*, 13(Suppl 1), i2-i10.
- Issenberg, S. B., McGaghie, W. C., Petrusa, E. R., Gordon, D. L., & Scalese, R. J. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. *Medical Teacher*, 27(1), 10-26.
- López, M. A., & Rodríguez, J. (2023). Aplicación de realidad virtual en simulación médica. *Revista de Tecnología y Salud*, 11(2), 45-56.
- Muñoz Gualán, G. G., & Sierra, R. E. (2024). La simulación clínica en la educación médica moderna: revisión de revisiones. *Revista Eugenio Espejo*, 19(1), 102-116.
- Sánchez, L., Méndez, C., & Rojas, F. (2022). Inteligencia artificial en simuladores clínicos: una revisión sistemática. *Revista Mexicana de Educación Médica*, 8(1), 15-29.