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ORIGINAL

Evidence of the usefulness of clinical simulation in building the professional competencies of medical students

Evidencia de la utilidad de la simulación clínica en la construcción de las competencias profesionales de los estudiantes de medicina

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ABSTRACT

Introduction: clinical simulation is a key tool for balancing medical skills development and patient safety.
Objective: to identify possible points for improvement in the learning of medical skills in clinical simulation within the IAU as judged by students.
Methods: a cross-sectional, descriptive study was conducted. UAI students who had taken the rotating internship and received simulation sessions were selected. The study setting will be exclusively university and data will be collected by means of surveys. The surveys were elaborated according to McGaghie's 12 sections.
Results: the survey was administered to 57 students, with a gender distribution of 33 % male and 67 % female. 57 % had previous experience in a health center outside the IAU. Seventy-five percent considered the simulation to be effective in acquiring skills, and 79 % thought that the evaluations reflected their competencies. However, 63 % thought that the transfer to clinical practice could be improved, and 47 % saw teamwork as ineffective.
Conclusions: although the simulations are valued for their realism and effectiveness, areas for improvement were identified, such as curricular integration, evaluation methods, exposure time, and instructor training. It is also suggested to optimize the transfer of skills to real clinical practice and teamwork training.

Keywords: Continuing Medical Education; Undergraduate Medicine; Simulation; Translational Study; Formative Evaluation.

RESUMEN

Introducción: la simulación clínica es una herramienta clave para equilibrar el desarrollo de habilidades médicas y la seguridad del paciente
Objetivo: identificar los posibles puntos a mejorar en el aprendizaje de habilidades médicas en la simulación clínica dentro de la UAI según el criterio de los estudiantes.
Métodos: se realizó un estudio transversal, descripto. Se seleccionaron alumnos de la UAI que hubieran cursado el internado rotatorio y recibido sesiones de simulación. El entorno del estudio será exclusivamente universitario y recopilaremos los datos por medio de encuestas. Las encuestas fueron elaboradas según los 12 apartados que McGaghie.
Resultados: la encuesta fue realizada a 57 alumnos, con una distribución de género de 33 % hombres y 67 % mujeres. El 57 % tenía experiencia previa en un centro de salud fuera de la UAI. El 75 % considera efectiva la simulación para adquirir habilidades, y el 79 % opina que las evaluaciones reflejan sus competencias. Sin embargo, el 63 % piensa que la transferencia a la práctica clínica es mejorable, y el 47 % ve inefectivo el trabajo en equipo.
Conclusiones: aunque las simulaciones son valoradas por su realismo y efectividad, se identificaron áreas a mejorar, como la integración curricular, los métodos de evaluación, el tiempo de exposición, y la formación de instructores. También se sugiere optimizar la transferencia de habilidades a la práctica clínica real y el entrenamiento en trabajo en equipo.

Palabras clave: Educación Médica Continuada; Medicina de Pregrado; Simulación; Estudio Traslacional; Evaluación Formativa.

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INTRODUCTION

Background to clinical simulation

In 1999, the Institute of Medicine (IOM) published its first report entitled "To Err is Human: Building a Safer Health System," concluding that billions of Americans die each year from medical errors associated with care, hundreds of thousands suffer or barely escape with their lives from non-fatal injuries, which could be prevented in a high-quality health system.[1,2,3,4]

Since that 1999 report, which explicitly promotes the prevention of medical errors through a high-quality health system, the 2001 IOM report, "Crossing the Quality Chasm: A New Health System for the 21st Century", establishes six goals for a high-quality health system, which, to be met, should promote a change in medical education based on low-, intermediate- and high-fidelity clinical simulation to alert future physicians, at an early stage, to errors during the acquisition of skills necessary for a medical practice that meets these established goals.[1,3,5,6]

Clinical simulation, feedback, ethics, and patient-centered medical care

Medical simulation addresses the need to balance skill development with patient safety, mitigating ethical tension by promoting learning without unnecessary risk to the patient.[2,4,7] The integration of simulation into medical training has been highlighted as an effective strategy for bridging the gap between theory and clinical practice, showing improvements in students' knowledge, skills, and performance, and even a change in patients' perception.[8,9,10] Although challenges such as curricular integration and documentation of effectiveness persist, research has demonstrated the benefits of simulation in teaching key medical competencies.[7,11,12] Effective analyses reveal the importance of simulation technology and its capacity to improve the teaching and evaluation of competencies.[8,13] Furthermore, studies have demonstrated the effectiveness of simulation in teaching basic sciences, clinical knowledge, and procedural skills, as well as its usefulness in assessing learners.[14,15,16]

The formative assessment approach offers a valuable tool for promoting reflection and deep learning, both in simulation contexts and direct patient interactions.[16,17] Despite the challenges, the drive towards patient safety and the expansion of simulation in medical training reinforces the ethical commitment to prioritize patient well-being.[18,19] Evidence-based medical simulation represents a vital tool for strengthening medical training and ensuring the competence and safety of future health professionals.[12,20] The study aims to identify possible areas for improvement in learning medical skills in clinical simulation within the UAI, enhancing it through the acquisition of feedback from students trained at the institution.

METHOD

The present is a descriptive cross-sectional study. UAI students who had completed the rotating internship by March 24, 2024, were selected, and inclusion and exclusion criteria were used.

Inclusion Criteria

1. Final-year medical students at the UAI.
2. Participants have experienced at least one clinical simulation session during their training.
3. Informed consent to participate in the study.
4. Ability to complete questionnaires and participate in interviews.
5. Volunteers who have not previously been exposed to similar research on clinical simulation.

Exclusion Criteria

1. Inability to provide informed consent.
2. Participants with mental health issues that may affect their ability to participate.

The study environment will be exclusively university-based, and we will collect the data using surveys. The surveys were prepared according to the 12 sections that McGaghie.[7] The survey questions have five predetermined answers from A. These answers are evaluated depending on the question between excellent and very bad.

RESULTS

The total sample of surveys is 57 students who have participated at least once in the UAI simulators. The gender distribution is 33 % men and 67 % women, as explained in figure 1. Of the respondents, 57 % had previous experience in a health center outside the UAI, compared to 47 % who had not yet obtained any experience in a hospital or health center outside the activities of the UAI.



Figure 1. Distribution by gender

McGaghie's 12 sections

All the responses are represented in Figure 2. Question 1: 49 % of those surveyed believe the experience was positive and the helpful feedback, but it could have been more detailed. Question 2: 53 % of those surveyed think the practice was adequate. Question 3: 51 % think there is a need to improve curricular integration. Question 4: 51 % think improving how results are measured is necessary. Question 5: 54 % think the simulations are adequate and realistic. Question 6: 75 % think the simulation is effective for acquiring and maintaining skills. Question 7: 61 % think they need more time to master the skills. Question 8: 63 % think transferring their skills to clinical practice is acceptable but improvable. Question 9: 47 % think team training was ineffective and collaborative. Question 10: 79 % think that the evaluations represent their skills well. Question 11: 67 % think that the training of the instructors is acceptable but could be improved. Question 12: 60 % think the educational context is adequate but could be improved.

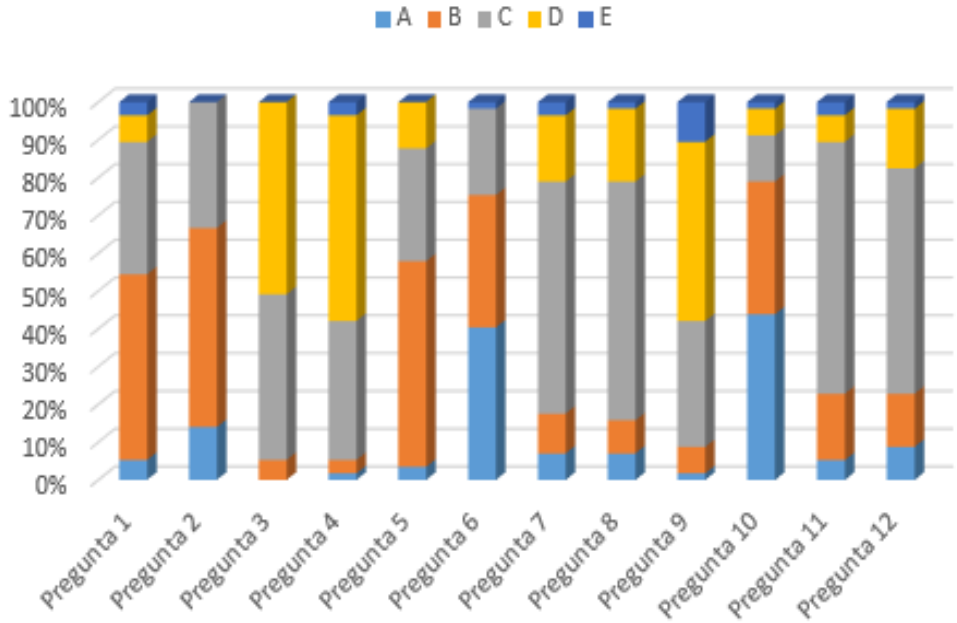


Figure 2. Survey responses

DISCUSSION

Strengths identified in the clinical simulation applied in the UAI

A large majority (75 %) of the participants perceive that the simulation is effective for acquiring and maintaining clinical skills, supporting its implementation as a pedagogical strategy.[3,21] A considerable percentage (54 %) consider the simulation scenarios adequate and realistic, which suggests a satisfactory approximation to the authentic clinical environment.[19] The evaluations accurately reflect the participants' skills, as indicated by 79 % of the results.

Areas of opportunity

A perceived need to optimize the curricular integration of simulation activities has been identified, as 51 % of the participants indicated. A significant percentage (51 %) consider that the methods of evaluation and measurement of the results obtained in the simulation should be improved. 61 % of those surveyed stated that they require more exposure time to achieve an adequate mastery of the competencies, which could imply a review of the duration or intensity of the simulation sessions. Although the transfer of skills to actual clinical practice is rated as acceptable by 63 %, there is room for improvement. Team training and collaboration during simulated scenarios were perceived as ineffective by 47 % of the participants, representing a priority area for improvement.[22,23] Instructor training and the general educational context were rated as acceptable but improvable by 67 % and 60 % of the respondents, respectively.[24,25]

In summary, the findings suggest that, although clinical simulation is valued as practical and realistic, there are opportunities for improvement in aspects such as curricular integration, evaluation methods, exposure time, transfer of skills to actual clinical practice, training in teamwork, and training of instructors. These results coincide with those reported by several studies[26,27,28] and show the international relevance of addressing these areas, which could further enhance the benefits of simulation in the training of health professionals.

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CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Darcy Walter Palacios Baldoceda, Eduardo Teragni.
Data Curation: Darcy Walter Palacios Baldoceda, Eduardo Teragni.
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Writing - Proofreading and Editing: Darcy Walter Palacios Baldoceda, Eduardo Teragni.

BIBLIOGRAPHICAL REFERENCES

1. Stefl M. To Err is Human: Building a Safer Health System in 1999. Frontiers of health services management. 1 2001;18:1-2.

2. Dávila-Cervantes A. Simulación en Educación Médica. Investigación en Educación Médica. 2014; 3(10):100-105. DOI: 10.1016/S2007-5057(14)72733-4

3. Ziv A, Ben-David S, Ziv M. Simulation based medical education: an opportunity to learn from errors. Med Teach. mayo de 2005;27(3):193-9.

4. Gutiérrez LH, Núñez AVB, Cárdenas CD, Cortés HEO, Gabriela A, Sánchez O, et al. La seguridad del paciente y la simulación clínica. Rev Fac Med UNAM 2017; 60 (S1):11-18.

5. Institute of Medicine (US) Committee on Quality of Health Care in America. Crossing the Quality Chasm: A New Health System for the 21st Century [Internet]. Washington (DC): National Academies Press (US); 2001 [citado 3 de junio de 2024]. Disponible en: http://www.ncbi.nlm.nih.gov/books/NBK222274/

6. Ziv A, Wolpe PR, Small SD, Glick S. Simulation-Based Medical Education: An Ethical Imperative. Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare. 2006;1(4):252-6.

7. McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. A critical review of simulation-based medical education research: 2003–2009: Simulation-based medical education research 2003–2009. Medical Education. enero de 2010;44(1):50-63.

8. Rudolph JW, Simon R, Raemer DB, Eppich WJ. Debriefing as Formative Assessment: Closing Performance Gaps in Medical Education. Academic Emergency Medicine. noviembre de 2008;15(11):1010-6.

9. Fitch MT. Using high-fidelity emergency simulation with large groups of preclinical medical students in a basic science course. Med Teach. marzo de 2007;29(2-3):261-3.

10. Graber MA, Wyatt C, Kasparek L, Xu Y. Does simulator training for medical students change patient opinions and attitudes toward medical student procedures in the emergency department? Acad Emerg Med. julio de 2005;12(7):635-9.

11. Waring MJ, Arrowsmith J, Leach AR, Leeson PD, Mandrell S, Owen RM, et al. An analysis of the attrition of drug candidates from four major pharmaceutical companies. Nat Rev Drug Discov. julio de 2015;14(7):475-86.

12. Cook DA, Hamstra SJ, Brydges R, Zendejas B, Szostek JH, Wang AT, et al. Comparative effectiveness of instructional design features in simulation-based education: Systematic review and meta-analysis. Medical Teacher. enero de 2013;35(1):e867-98.

13. McGaghie WC, Draycott TJ, Dunn WF, Lopez CM, Stefanidis D. Evaluating the Impact of Simulation on Translational Patient Outcomes. Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare. agosto de 2011;6(7):S42-7.

14. Barry Issenberg S, Mcgaghie WC, Petrusa ER, Lee Gordon D, Scalese RJ. Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review. Medical Teacher. enero de 2005;27(1):10-28.

15. Rosen MA, Hunt EA, Pronovost PJ, Federowicz MA, Weaver SJ. In Situ Simulation in Continuing Education for the Health Care Professions: A Systematic Review. Journal of Continuing Education in the Health Professions. 2012;32(4):243-54.

16. McGaghie WC, Issenberg SB, Petrusa ER, Scalese RJ. Revisiting 'A critical review of simulation-based medical education research: 2003-2009'. Med Educ. octubre de 2016;50(10):986-91.

17. Okuda Y, Bryson EO, DeMaria S, Jacobson L, Quinones J, Shen B, et al. The Utility of Simulation in Medical Education:

What Is the Evidence? Mount Sinai J Medicine. agosto de 2009;76(4):330-43.

18. Norman G, Dore K, Grierson L. The minimal relationship between simulation fidelity and transfer of learning. Medical Education. julio de 2012;46(7):636-47.

19. Kneebone RL, Scott W, Darzi A, Horrocks M. Simulation and clinical practice: strengthening the relationship. Med Educ. octubre de 2004;38(10):1095-102.

20. Roizen MF. Technology-enhanced simulation for health professions education: a systematic review and meta- analysis. Yearbook of Anesthesiology and Pain Management. enero de 2012;2012:414-5.

21. Riancho J, Maestre JM, Moral I del, Riancho JA. Simulación clínica de alto realismo: una experiencia en el pregrado. Educación Médica. junio de 2012;15(2):109-15.

22. Hunt EA, Shilkofski NA, Stavroudis TA, Nelson KL. Simulation: Translation to Improved Team Performance. Anesthesiology Clinics. 1 de junio de 2007;25(2):301-19.

23. Allan CK, Thiagarajan RR, Beke D, Imprescia A, Kappus LJ, Garden A, et al. Simulation-based training delivered directly to the pediatric cardiac intensive care unit engenders preparedness, comfort, and decreased anxiety among multidisciplinary resuscitation teams. J Thorac Cardiovasc Surg. septiembre de 2010;140(3):646-52.

24. Britt RC, Reed SF, Britt LD. Central Line Simulation: A New Training Algorithm. The American SurgeonTM. 1 de julio de 2007;73(7):680-2.

25. Grudziak J, Herndon B, Dancel RD, Arora H, Tignanelli CJ, Phillips MR, et al. Standardized, Interdepartmental, Simulation-Based Central Line Insertion Course Closes an Educational Gap and Improves Intern Comfort with the Procedure. Am Surg. 1 de junio de 2017;83(6):536-40.

26. Udayashankar Sulibele US, Prajapati S, Desai M. The Effects of Collaborative Simulation Education on Patient Safety in Medical Education. Salud, Ciencia y Tecnología. 2023;3:457. https://doi.org/10.56294/saludcyt2023457

27. Wang X, Yufeng W, Huang X. The effect of education with case-based scenario simulation on interns' proficiency in cardiopulmonary resuscitation. Salud, Ciencia y Tecnología - Serie de Conferencias. 2024; 3:1032. https://doi.org/10.56294/sctconf20241032

28. Pregowska A, Osial M, Gajda A. What will the education of the future look like? How have Metaverse and Extended Reality affected the higher education systems?. Metaverse Basic and Applied Research. 2023; 3:57. https://doi.org/10.56294/mr202457