Colombian Journal of Anesthesiology

OPEN

Received: 22 October, 2023 ▸ Accepted: 23 October, 2023 ▸Online first: 2 November, 2023

DOI: https://doi.org/10.5554/22562087.e1090



# Promises for the future: The role of artificial intelligence in education and perioperative care

## *Las promesas del futuro: El papel de la inteligencia artificial en la educación y el cuidado perioperatorio*

José A. Calvache[a-c]

[a] Editor in Chief, Colombian Journal of Anesthesiology. Bogotá, Colombia.

[b] Department of Anesthesiology, Universidad del Cauca. Popayán, Colombia.

[c] Department of Anesthesiology, Erasmus University Medical Center Rotterdam. Rotterdam, The Netherlands.

**Correspondence:** Sociedad Colombiana de Anestesiología y Reanimación (S.C.A.R.E.). Cra 15a No. 120 – 74. Bogotá, Colombia.

**E-mail:** editorinchief@scare.org.co

**How to cite this article:** Calvache JA. Promises for the future: The role of artificial intelligence in education and perioperative care. Colombian Journal of Anesthesiology. 2024;52:e1090.

Artificial intelligence (AI) refers to the development of IT systems capable of performing tasks that usually require human intelligence, such as perception, reasoning, and decision-making (1). In other words, IT systems that "mimic or try to mimic" human intelligence and reasoning (2). Usually, AI is exclusively associated with computers and robots, but it originates from various disciplines such as philosophy, psychology, linguistics, statistics and causality inference (3,4). It is important to evoke some of the visionaries in these areas, such as Charles Babbage, Alan Turing, Claude Shannon, Richard Bellman and Marvin Minsky, who contributed to lay the foundations for many of the modern essentials in AI (3). Furthermore, significant breakthroughs in IT, such as improved processing and storage hardware, have enabled the necessary fundamental technologies for the current developments.

In healthcare, AI is used to analyze large volumes of patient data such as medical records, imaging studies and laboratory test results, with a view to support clinical decision-making and hopefully, improve patient outcomes (3). However, as advocated by Judea Pearl, mathematician, computer scientist, the initial development of AI has focused on enabling machines and computer tools to reduce uncertainty and improve diagnosis or forecasting (prognosis), neglecting somewhat one of its core tasks: the cause – effect relationships, which are essential for the interpretation of how the human mind functions and rationalizes (5,6).

Medicine and other health sciences have historically been slow in adopting new technologies and the time elapsed from the development of a technology and its practical use is long. However, AI is now being used in clinical practice, particularly in areas such as radiology. Although AI has a huge potential in anesthesiology and perioperative care, there are still some challenges for its adoption into our daily clinical practice (7,8). Until now, most of the AI projects documented in the scientific literature, have focused on developing and validating models and algorithms for machine learning, with very few examples of successful integration into the clinical routine and a quantifiable impact on the results and patient outcomes (3,9). In order to delve into the concepts related to the development of AI, we have to start from a few basic definitions (Table 1).

**Table 1.** Glossary of key concepts for the approach to AI.

| |
|---|
| **Artificial intelligence [AI].** A branch of IT intended to understand and build intelligent entities, usually based on software programs. |
| **Machine learning.** A field of IT and AI that uses increasingly complex algorithms to identify existing patterns and data relationships. These machine learning methods may be supervised or non-supervised. |
| **Deep learning.** A sub-field of machine learning with increased complexity approaches using artificial neural networks with multiple layers to identify increasingly complex data patterns and relationships. |
| **Natural language processing.** This is a branch of AI that focuses on the interaction between computers and human language. Its primary goal is to allow machines to understand, interpret and generate human language in both a significant and useful way. |
| **ChatGPT.** This is the evolution of a chatbot (automatic system able to maintain a conversation) designed to simulate a human conversation in response to indications or questions (GPT stands for "Generative pre-trained transformer"). |

**Source:** Adapted from Yu K-H, et al. (10)

Lea la versión en español de este artículo en www.revcolanest.com.co

Anesthesiology and perioperative care are very well positioned to potentially benefit from the advances in AI as multiple aspects of clinical care become integrated. A recent scoping review has identified the key areas in which AI begins to gain ground in the perioperative setting and in anesthesiology (3). This review identified 173 associated articles and summarized the categories in which the current developments in AI have an impact: 1) monitoring of the depth of anesthesia; 2) controlled administration of anesthetic agents; 3) predicting the risk of developing intra – or post-operative events; 4) assisted use of ultrasound; 5) pain treatment, and 6) organizational logistics support in the operating rooms. Naturally, the authors claim that there are many other categories that may be subject to the potential influence of AI.

The current issue of the Colombian Journal of Anesthesiology includes two articles associated with the advent of AI to anesthesiology, specifically in the area of education, simulation and pedagogy. With regards to education, Díaz-Guío et al. delve on the relevant aspects of AI associated to learning and medical education in simulation; they explore the difficulties and limitations of these technologies for their appropriation, including the ethical conflicts involved (11). On the other hand, Cruz et al. assess and describe the ChatGPT capabilities to solve a standard test on the knowledge of anesthesiology and its general performance in terms of clinical reasoning and learning ability, with very interesting results (12).

The impact of AI in medical and healthcare professionals training is a constantly developing area. Banerjee et al. administered a survey among medical students of postgraduate centers of the UK National Health Service (NHS) in 2020. Most of the participants in the survey perceived a positive impact of AI in their training, particularly in terms of reducing the clinical workload and an improvement in research and audit training. However, there is still considerable skepticism in terms of its ability to improve their clinical judgement and practical skills. They felt they did not receive enough training in AI and expressed their support to the inclusion of additional formal education in AI into the curriculum, to prevent these technologies from having a negative impact on their education in clinical judgement and practical skills (13). These results are very consistent with those of the 486 students from 17 medical schools in Canada, which identified a lack of educational opportunities on AI and the absolute need to include AI in the curricula (14).

The use of AI in health sciences and perioperative care offers a huge potential, but also significant challenges. The promises for the future show benefits, but to reap those benefits, transparency and ethics in the use of AI for medical care are critical considerations that should be addressed to ensure quality, safety, and trust in both patients and practitioners. Finally, the successful adoption of AI into education processes and healthcare requires an investment in professional training, in addition to the implementation of measures to ensure its ethical and efficient use.

Finally, mention should be made of the impact of AI on education, particularly in the setting of scientific dissemination. A tremendous revolution is on the horizon here; we all look forward to significantly impacting the publishing process by offering new ways to manage and streamline peer reviews - perhaps automating some of its processes - improving the quality of peer reviews and enabling new modes of publication - including interactive and real-time or live research-. This may lead to faster publication times and increased efficiency. The AI algorithm may play a key role in supporting the reproducibility of scientific research when analyzing and validating data, which reduces the number of errors and inaccuracies and improves the credibility and reliability of scientific information (1). On the other hand, there are also potential issues to consider: there may be additional requirements to use filters in order to identify the content generated through AI (rather than by human authors), particularly for journals that have been targeted as fake-paper factories and other unethical or deceitful and predatory practices (15). In this age of generalized disinformation and lack of trust, the responsible use of the language models of AI and the transparency in how these tools are used in the development of information and its publication, are essential to promote and protect the credibility and integrity of research and trust in biomedical knowledge (16).

## Conflicts of interest

The author declares having no conflict of interest to disclose. The author is the Editor-in-Chief for the Colombian Journal of Anesthesiology.

## Funding

The authors declare not having received funding for the preparation of this article.

## REFERENCES

1. Dave M, Patel N. Artificial intelligence in healthcare and education. Br Dental J. 2023;234(10):761-4. doi: https://doi.org/10.1038/s41415-023-5845-2

2. Maheshwari K, Cywinski JB, Papay F, Khanna AK, Mathur P. Artificial intelligence for perioperative medicine: Perioperative intelligence. Anesth Analg. 20231;136(4):637-45. doi: https://doi.org/10.1213/ANE.0000000000005952

3. Hashimoto DA, Witkowski E, Gao L, Meireles O, Rosman G. Artificial intelligence in anesthesiology: Current techniques, clinical applications, and limitations. Anesthesiology. 2020;132(2):379-94. doi: https://doi.org/10.1097/ALN.0000000000002960

4. Mackenzie D PJ. The book of why: The new science of cause and effect. New York: Basic Books; 2018.

5. Hartnett K, Magazine Q. How Judea Pearl became one of ai's sharpest critics. The Atlantic; 2018.

6. Calvache JA, Higgins Tejera C. The three main tasks of modern epidemiology: description, prediction and causal inference. Colombian Journal of Anesthesiology. 2023;51(4):e1088. doi: https://doi.org/10.5554/22562087.e1088

7. Eslava-Schmalbach J. Colombian Journal of Anesthesiology, present and future challenges, in its 50th. Colombian Journal of Anesthesiology. 2022;50:e1032. https://doi.org/10.5554/22562087.e1032

8. Lonsdale H, Jalali A, Gálvez JA, Ahumada LM, Simpao AF. Artificial intelligence in anesthesiology: Hype, hope, and hurdles. Anesth Analg. 2020;130(5):1111-3. doi: https://doi.org/10.1213/ANE.0000000000004751

9. Lacassie H. Artificial inteligence for the 21 century anesthesiologist. Rev Chil Anest. 2022;51. doi: https://doi.org/10.25237/revchilanestv5111071034

10. Yu K, Beam AL, Kohane IS. Artificial intelligence in healthcare. Nat Biomed Engin. 2018;2(10):719-31. https://doi.org/10.1038/s41551-018-0305-z

11. Díaz-Guío DA, Henao J, Pantoja A, Arango MA, Díaz-Gómez AS, Camps Gómez A. Artificial intelligence, applications and challenges in simulation-based education. Colombian Journal of Anesthesiology. 2023(4):e1085. doi: https://doi.org/10.5554/22562087.e1085

12. Cruz G, Pedroza S, Ariza F. ChatGPT's learning and reasoning capacity in anesthesiology. Colombian Journal of Anesthesiology. 2024;52. [Ahead of print].

13. Banerjee M, Chiew D, Patel K, Jonns I, Chappell D, Linton N, et al. The impact of artificial intelligence on clinical education: perceptions of postgraduate trainee doctors in London (UK) and recommendations for trainers. BMC Med Educat. 2021;21(1). doi: https://doi.org/10.1186/s12909-021-02870-x

14. Pucchio A, Rathagirishnan R, Caton N, Gariscsak P, Del Papa J, Justino J, et al. Exploration of exposure to artificial intelligence in undergraduate medical education: a Canadian cross-sectional mixed-methods study. BMC Med Educat. 2022;22(1). doi: https://doi.org/10.1186/s12909-022-03896-5

15. Delgado-Noguera M, Calvache JA. Current publishing models. Revista de la Facultad de Ciencias de la Salud Universidad del Cauca. 2023:e2355. doi: https://doi.org/10.47373/rfcs.2023.v25.2355

16. Flanagin A, Bibbins-Domingo K, Berkwits M, Christiansen S. Nonhuman "authors" and implications for the integrity of scientific publication and medical knowledge. JAMA. 2023;329(8):637. doi: https://doi.org/10.1001/jama.2023.1344