The impact of AI-assisted technologies in scientific research and writing: opportunities and ethics disclosure

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Background

The origins of artificial intelligence (AI) date back to the first half of the twentieth century, thanks to the work of the British mathematician and cryptographer Alan Mathison Turing (1950), who, through the creation of a prototype of an abstract computing machine (Turing Machine), laid the foundations for the development of this research field. Few years later, John McCarthy coined the term AI as *"the science and engineering of making intelligent machines."* In 1956, during a workshop at Dartmouth, the term "Artificial Intelligence" was formally proposed and adopted. From the 1980s onward, advancements in computer processing power and the availability of large datasets gave a significant boost to the development of artificial intelligence, leading to remarkable progress in fields such as machine learning, computer vision, and natural language recognition.

A major turning point occurred in the early 2010s with the rise of deep learning, which enabled unprecedented advancements in image analysis, speech recognition, and natural language processing. The emergence of generative AI models, capable of producing human-like text, images, and code, further accelerated interest in AI applications—especially within scientific research and academic publishing.

In November 2022, OpenAI launched ChatGPT, a conversational AI tool based on its Generative Pretrained Transformer (GPT) models, followed in 2023 by Google's AI chatbot Bard(1), marking a major acceleration in the public adoption of generative AI technologies. This surge in interest has been mirrored in the scientific community, where publications on AI in medicine have grown rapidly during the last two decades: 119,325 citations are referred in PubMed, of which 93% have been published since 2000.

To address AI's rapid scientific evolution, this editorial examines the opportunities, limitations, and ethical implications of AI-assisted technologies in scientific research and writing, with a particular focus on current international guidelines and disclosure practices.

Accuracy and credibility of AI-Assisted Technologies in scientific research and writing

The term AI encompasses a wide spectrum of applications ranging from AI-assisted scientific writing to AI-generated scientific writing. The AI software programs such as Grammarly and Paperpal can correct grammatical and spelling errors, whereas Large Language Models (LLMs) like ChatGPT can produce coherent, human-like text when prompted, extending far beyond simple grammatical correction.

The potential applications of LLMs in scientific work are vast and multi-faceted, including automated abstract generation, enhancing English fluency, drafting research protocols, supporting data analysis, and assisting with exhaustive literature reviews. However, the use of AI-assisted technologies in medical scientific writing poses significant challenges, such as lack of originality, risk of inaccuracy, ethical and legal concerns bias, plagiarism, copyright issues, insufficient transparency, and faulty or fabricated citations. These issues are particularly pressing in the medical domain, where

Table 1. Recommendations of International Committee of Medical Journal Editors (ICMJE) for using AI-Assisted Technologies.

When submitting a manuscript, authors must disclose if they have utilized AI-assisted technologies. If AI was used for writing assistance, the Authors should report this in the acknowledgment section.
If AI was involved in data collection, analysis, or figure creation, the Authors should report this in the methods section.
AI tools, including chatbots like ChatGPT, should not be credited as authors, as they cannot take re-sponsibility for the work's accuracy, integrity, or originality, which are necessary for authorship.
Authors should carefully review and edit AI-generated content, as these tools may produce output that appears authoritative but can be inaccurate, incomplete, or biased.

misinformation generated by AI-assisted technologies may have severe consequences for patients' care and public health (2,3). Therefore, there is a growing movement to develop clear-cut guidance and policies regarding the use of AI-assisted technologies in medical academic writing, aiming to ensure responsible, transparent, and ethical practices. .

Prospects of International Organizations on the use of AI-Assisted Technologies

In response to challenges to produce guidance to support authors in the use of AI in scientific writing, many journals, organizations, and academic publishers have issued position statements, editorials, and are developing policy frameworks to guide authors and reviewers on the responsible use of AI in scientific writing.

The Committee on Publication Ethics (COPE), an organization comprised of editors, publishers, universities, and research institutes that helps inform publication ethics across all academic disciplines, has not yet released a comprehensive set of detailed recommendations on key aspects to guide responsible AI-assisted technologies usage in scientific writing. However, it has clearly stated that, but released a position statement on AI-assisted technologies emphasizing that "AI tools cannot meet the requirements for authorship as they cannot take responsibility for the submitted work" (1,4).

The main recommendations of the International Committee of Medical Journal Editors (ICMJE),

require authors to disclose any use of AI-assisted technologies at the time of manuscript submission,

for example in the cover letter accompanying the submission, concern the obligation for authors to declare, in the cover letter accompanying the submission of a manuscript, specifying whether AI-assisted technologies were used in the preparation of the paper, and also to explain in the methods section how AI was utilized in the conception and preparation of the manuscript (5) (Table 1). In its 2024 update, the ICMJE further clarified with examples: "If AI was used for writing assistance, describe it in the acknowledgment section. If AI was used for data collection, analysis, or figure generation, authors should describe the use in the methods" (5) (Table 1).

To underscore the importance of a clear and transparent report of research methods, the World Association of Medical Editors (WAME) advised the authors to provide a description on the use of AI-assisted technologies in "both the Abstract and the Methods section" (1).

These core principles underscore the importance of maintaining human oversight and accountability in using AI-assisted technologies in medical research and writing. Despite heterogeneity in publishers' guidance, two major issues were identified. Firstly, publishers prohibited AI to be listed as authors, and secondly most publishers encouraged the disclosure of AI use, including details such as the model's name, version, source, and the specific ways in which it contributed to the work.description, and usage. Notably, the required location for AI disclosures varies widely – some guidelines specify the Methods or Acknowledgments, while others require a separate section. There is also debate over whether the use of AI for minor tasks (e.g. spell-checking) warrants the same level of disclosure as

use for content generation. Furthermore, the scope of AI tools covered differs: some publishers' policies pertain only to 'AI-generated text', whereas others explicitly encompass AI-generated images and data analysis.

Journal Policies on the use of AI-Assisted Technologies and Ethical Concerns

In December 2022, *Nature* published the first article discussing concerns about the use of AI-assisted technologies in academic writing (6). Since then, journals and publishers have started updating their editorial policies and instructions to authors to provide guidance on how to disclose the use of AI in academic research. *Science* published an article in January 2023 stating its decision to prohibit the use of AI-assisted technologies to generate text, figures, images, or graphics in the writing process, and it views violation of the policy as constituting scientific misconduct (7).

Afterward, more and more publishers and journals introduced their own policies regarding the usage of AI-assisted technologies in the process of writing. The most detailed recommendations were provided *by JAMA, CELL*, and the *Journal of Clinical Anesthesia*. Other journals, including the *New England Journal of Medicine*, defer to ICMJE recommendations. *The Lancet* maintains a perspective that is at odds with the rapid adoption of AI-assisted technologies in research, asserting that AI may only be used to improve readability rather than essential researcher task. Finally, *Heliyon, a Cell Press journal*, states that "the use of AI and AI-assisted technologies in scientific writing must be declared by adding a statement at the end of the manuscript when the paper is first submitted. The statement will appear in the published work and should be placed in a new section before the references list". Other journals report that disclosure policies should be addressed among the references and in supplementary materials or appendices (8).

Heterogeneity in the application of AI-Assisted Technologies guidelines among publishers

In October 2023, one study surveyed the AI-assisted technologies usage guidelines for authors based on the 100 largest publishers and top 100 highly ranked journals of different disciplines; the top 100 scientific journals revealed substantial heterogeneity, with many specific guidelines not fully aligned with COPE's recommendations (9).

A similar evaluation on 100 Korean medical journals reported that only 18% of the surveyed journals had AI guidelines— a much lower rate than that of international journals.However, adoption rates increased significantly over time, reaching 57.1% in the first quarter of 2024and higher-impact journals were more likely to implement AI policies (10).

Cardiovascular medicine journals with an SCImago Journal Rank (SJR) ≥3 and h-index ≥100 were screened for an AI policy. Seventeen journals met inclusion criteria. Four of the 17 high-impact journals did not adhere to the ICMJE recommendations, either by not providing authors with an AI policy or by not requiring AI disclosure for manuscript preparation (11).

Out of 125 nursing studies journals, 37.6% required explicit statements about generative AI use in their authors' guidelines. No significant differences in impact factors or journal categories were found between journals with and without such requirement (12).

Disclosure criteria for identifying AI-Assisted Technologies in research and writing

To address the necessity of developing cohesive, cross-disciplinary guidelines on AI-assisted technologies usage, Luo et al. (13) developed a rigorous international consensus on **G**enerative **A**rtificial Intelligence tools in **ME**dical **R**esearch (**GAMER**) involving a multidisciplinary group of 51 experts from 26 countries. The expert group included professionals from various medical specialties, epidemiology, computer science, and medical ethics. Nine reporting items were included to ensure transparent disclosure of AI-assisted technologies use in medical research: general declaration, AI-assisted technologies specifications, prompting techniques, tool's role in the study, declaration of new AI-assisted technologies model(s) developed, artificial intelligence-assisted sections in

the manuscript, content verification, data privacy and impact on conclusions. The GAMER checklist is not limited to specific types of research and can be used not only to guide researchers on how to disclose and report the use of AI-assisted technologies when preparing manuscripts, but also to assist reviewers as well as journal editors, to evaluate whether the use of AI tools has been properly and transparently reported in manuscripts.

Three practical disclosure criteria for identifying AI use in research and writing have been reported by Resnik and Hosseini (8). In particular: I) mandatory disclosures include: "(a) using AI to make decisions that directly affect research results; (b) using AI to generate content, data or images; and (c) using AI to analyze content, data or images". II) Optional disclosures include: "editing of existing text for grammar, spelling or organization or to find references, to find and generate examples for existing content, to brainstorm and offer suggestions for the organization of a paper or the title of a paper/section or to validate and/or offer feedback on existing ideas, text and code" (8).

Conclusions and Future Perspectives

In conclusion, the advancement of AI-assisted technologies in medical practice offers undeniable opportunities for improvements. The use of AI in scientific publishing could be seen as an opportunity that nevertheless requires careful governance. AI can serve as a valuable tool for both researchers in preparing manuscripts and for editors in streamlining peer-review process. However, this transition must be managed with a keen awareness of AI's limitations and associated ethical responsibilities.

Using AI-assisted technologies for text generation, without proper verification of the correctness, reliability, and coherence of the information contained, exposes the author(s) to the risk of spreading false or distorted content, with evident repercussions on the reliability of the entire scientific knowledge system. Declaring AI tool usage is crucial for maintaining transparency and credibility in academic writing. The lack of standardized recommendations -combined with frequent guideline updates- suggests that immediate action is needed, particularly to ensure clarity and consistency. To promote transparency and uphold trust in science, editors and reviewers in the medical community must diligently evaluate submitted works. To date, the most effective way to verify the quality of AI-generated outputs remains human oversight.

To achieve these goals, it is essential to invest in training of new researchers and education programs tailored to empower researchers with the necessary skills for effective AI utilization, principles of transparency and best practice in scholarly publishing. This is especially important as we navigate a transformative phase of knowledge and innovation. Such training should also encompass the development of effective prompting strategies, rigorous fact-checking, and critical evaluation of AI-generated sources to safeguard scientific accuracy. At the same time, when used responsibly, these tools may stimulate new forms of methodological and conceptual innovation in medical research. Finally, it is essential to regularly review and refine the developed editorial and publication policies to adapt to the evolving landscape of AI and to ensure the maintenance of scientific integrity, transparency, human accountability, confidentiality and security concerns. As AI systems continue to advance rapidly, ongoing monitoring and reassessment of their capabilities will be crucial to anticipate emerging risks and responsibly leverage new opportunities.

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Received: 18 November 2025
Accepted: 12 December 2025
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