ese / European Science Editing

Review

Ethical concerns related to using ChatGPT in biomedical research: a scoping review

Andreea Puscasu[1,2], Octavian Andronic[1,3]✉, Stefan Sebastian Busnatu[4,5], Mihai-Alin Publik[6]

[1]Innovation and e-Health Centre, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

[2]Department of Pediatrics, Alessandrescu-Rusescu National Institute for Mother and Child Health, Bucharest, Romania
orcid.org/0009-0008-9204-3097

[3]General Surgery Department, Faculty of Medicine, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania
octavian.andronic@umfcd.ro
orcid.org/0000-0002-9053-0018

[4]Cardiology Department, Prof. Dr. Bagdasar Arseni Clinical Hospital, Bucharest, Romania

[5]Cardio-Thoracic Department, Faculty of Medicine, Carol Davila University of Medicine and Pharmacy, 020021 Bucharest, Romania
orcid.org/0000-0002-4678-9655

[6]Pathology Department, C.I. Parhon National Institute of Endocrinology, Bucharest, Romania
orcid.org/0000-0002-6943-8444

Received: 28 Jan 2026
Accepted: 2 Apr 2026
Published: 21 Sep 2026

Declaration of AI use

ChatGPT (v 4.5) was used to assist with rephrasing certain sentences into more academically appropriate and fluent English suitable for a scientific manuscript. All content was reviewed, verified, and approved by the authors, who take full responsibility for the final manuscript.

Data Availability Statement

The data that support the findings of this study are available on request from the corresponding author.

Author contributions

Conceptualization, methodology, investigation, data curation, writing – original draft: AP; Formal analysis, supervision, validation, writing – review and editing: OA; Conceptualization, project administration, supervision: SSB; Visualization, software, validation, writing – review and editing: MAP.

Declaration of Interests

The authors declare no conflicts of interest.

Funding

This study received no external funding.

This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0).

Citation

Puscasu A, Andronic O, Busnatu SS, Publik M. Ethical concerns related to using ChatGPT in biomedical research: a scoping review. *Eur Sci Ed*. 2026;52:e186819

https://doi.org/10.3897/ese.2026.e186819

ese / European Science Editing

Abstract

Background: Tools such as Chat Generative Pre-trained Transformer (ChatGPT), based on large language models (LLMs), are rapidly transforming the reporting of biomedical research.

Objectives: To examine the ethical challenges surrounding ChatGPT highlight the risk of its misuse, and recommend ways to promote its responsible and ethical use.

Methods: A scoping review was conducted using Scopus and PubMed. The inclusion criteria were open-access articles in English published between January 2023 and June 2025. Citation data were collected from the same two databases, and journal metrics were collected from Clarivate's *Journal Citation Reports*. The articles were categorized by the ethical issue(s) they focused on, namely bias, accountability, plagiarism, transparency, and confidentiality.

Results: Of the 568 screened articles, 48 met the inclusion criteria and appeared in 43 journals, mainly those published by Springer Nature and Elsevier. Half the articles were narrative reviews and seven were editorials. The leading contributing countries were the United States (nine articles) and India (eight articles). The articles earned 5707 citations, with a 20% trimmed mean of 36.13 ± 40.35 and a median of 19.5. The most cited article had been cited 2516 times. The average journal impact factor of the 43 journals was 4.08 ± 4.4. Among the ethical concerns, roughly three-quarters (38 articles) addressed bias and plagiarism (36 articles); only 10 addressed all five issues.

Conclusions: Although ChatGPT offers clear benefits, ethical risks in its use are significant, and clear guidelines are essential to ensure that the tool is used safely and responsibly.

Keywords:

Artificial Intelligence, biomedicine, ChatGPT, ethics, LLM, reporting, research, scoping review

Introduction

Over the last few years, artificial intelligence (AI) has progressed remarkably, resulting in significant changes in education and academic research.[1-4] Advanced language processing is a subtype of AI with roots in deep neural networks and deep learning techniques, with the main purpose of delivering a natural and human-like response to user demands.[5,6] The first and most popular openly available large language model (LLM) is chat generative pre-trained transformer (ChatGPT), a tool that generates multimodal and complex responses based on text, images, and audio.[7-9] Using a large corpus of online data, ChatGPT can offer nuanced, contextual, and advanced answers, closely mimicking human language.[10]

Artificial intelligence has developed rapidly in medicine as well, not only in medical practice but also in education and medical research.[11] ChatGPT stands out for providing medical information and treatment options faster than other traditional search engines,[3,12] boosting the efficiency of health care consultations[13] and facilitating access to information for medical students.[14] In research too, the impact of ChatGPT has been most significant. Alsadhan et al. identified the various applications of AI in medical research, including greater capacity to interpret and summarize data and predict outcomes in clinical studies, and other benefits such as accelerated discovery of new drugs, the capacity to offer personalized treatment to patients, and the efficiency with which abnormalities can be identified.[15] One of the most widespread applications of ChatGPT in medicine is scientific writing because the tool can generate high-quality text free of grammatical errors, adequate translations, and effective summaries.[16]

However, although promising and innovative, the use of ChatGPT in medicine is accompanied by a range of risks and limitations, which is why ethical concerns related to its increasing use should be taken into account. Among the ethical problems, we point out the risk of plagiarism, the possibility of biased data, and an insecure environment for providing confidential information.[17-19] These concerns should be cautiously addressed to preserve intellectual property rights, patients' confidentiality, and the authenticity of writing for academic studies.

Other issues related to the use of ChatGPT in medical research include inaccurate citations, fabricated references, superficial content, data manipulation, factual errors, faulty comprehension, undue specificity, and garbled information.[16,20,21] For example, Sharun et al.[22] analysed the references generated by ChatGPT in stem cell research and found 15% of them to be fabricated and 9.3% to be erroneous. Teixeira da Silva documented a verified case in which a manuscript posted on two preprint servers was retracted on both occasions because it included fabricated references generated by ChatGPT, highlighting the risks associated with unverified AI-assisted citations.[23]

The ethical dilemma surrounding the use of ChatGPT in medical research has attracted significant interest among scientists, as evident in the increasing number of publications on this topic in recent years. The present study aims to estimate the magnitude of this ethical concern through a scoping review that examines the interest and the perspectives of researchers on ethical constraints governing the use of ChatGPT for academic writing. By critically analysing the limitations and risks posed by inadequately informed use of ChatGPT, the review seeks to provide a comprehensive understanding of the impact of ChatGPT on the integrity of academic writing and the accuracy of medical research and underscores the necessity for clear

guidelines, ethical frameworks, and collaborative approaches to ensure responsible and effective use of AI in health care.

Methods

Search strategy

The scoping review used Scopus and PubMed to examine the ethical implications of ChatGPT in medical research. The search query was as follows:

(((ethic*[Title/Abstract]) AND (research[Title/Abstract])) AND (medic*[Title/Abstract])) AND (ChatGPT[Title/Abstract]).

The inclusion criteria were as follows: the articles should discuss ethical issues related to the use of ChatGPT, must be written in English, and their full text must be available online. Clinical case reports and articles on topics unrelated to biomedical sciences were excluded. Given that ChatGPT was launched on 30 November 2022,[24] we confined our search to the period from 1 January 2023 to 22 June 2025.

Study selection and screening

We used Rayyan (a tool to help researchers save the time spent on initial screening of articles to be included for systematic reviews and literature reviews) and screened the articles manually for relevance by skimming through the titles and abstracts.[25] Duplicate records were removed. Next, we removed articles that were unrelated to the theme of the present study. Finally, we reviewed the full texts of the remaining articles. The search was carried out by one of the authors (AP); both AP and MAP screened the articles independently to decide on their eligibility, with OA resolving any disagreements.

Data extraction and analysis

For each selected article, we recorded its title, authors, year of publication, study design, reported outcomes, and findings – and also citation counts (retrieved in July 2025) to assess its impact. The citation counts were normalized by the year of publication to ensure a fairer comparison. Journal metrics were pooled using Clarivate Analytics' *Journal Citation Reports*. The resulting data were analysed using Microsoft Excel (Microsoft Corporation, Redmond, Washington, USA), and graphs were generated in RStudio, Posit team (2025; Posit Software, Boston, Massachusetts, USA).

Ethical framework and categorization

To ensure a comprehensive analysis, the selected articles were categorized based on five specific ethical issues they addressed, namely biased information, lack of accountability, transparency, confidentiality, and plagiarism. These five issues were defined beforehand to construct a structured and reproducible analytical framework informed by widely recognized principles in biomedical ethics and commonly reported concerns in the literature on AI in health care. As part of the analysis, the articles were assigned to one or more of these predefined categories using directed content analysis. Articles addressing multiple ethical issues were assigned to all the relevant categories. For articles that could not be assigned clearly to any single issue, the reviewers examined them repeatedly until the most appropriate category was identified and agreed upon. No additional categories were introduced, since all the identified issues were meaningfully subsumed within the predefined framework.

The synthesis of these data provided a robust foundation for discussion on the ethical dimensions of integrating ChatGPT into medical research. Additionally, emerging trends within the literature were identified and analysed.

Ethical considerations

This research was exempt from an institutional ethics board review because no personal information was collected and the research posed no risk to participants.

Results

Search

Our initial search retrieved 568 apparently relevant articles. Of these, 164 were duplicates, leaving us with 404 articles for the next step. Of these, 248 were excluded after initial screening, and the remaining 156 were examined further; this examination, or scrutiny, left us with 48 articles that met all the criteria (Figure 1).

General characteristics of the articles

Details of the 48 articles are given in Supplementary Table 1: 43 different journals were represented, dominated by Springer Nature (nine articles) and Elsevier (seven articles). Among the types of articles, narrative reviews were the most frequent (24), followed by editorials (seven), original articles (six), scoping reviews and systematic reviews (four each), and correspondence (three). Half the articles had been published in 2023, a third in 2024, and one-sixth in 2025.

Among the 21 countries contributing to this topic, the United States was the leading contributor, with nine publications, followed by India with eight. Canada, Italy, and Saudi Arabia each contributed three publications,

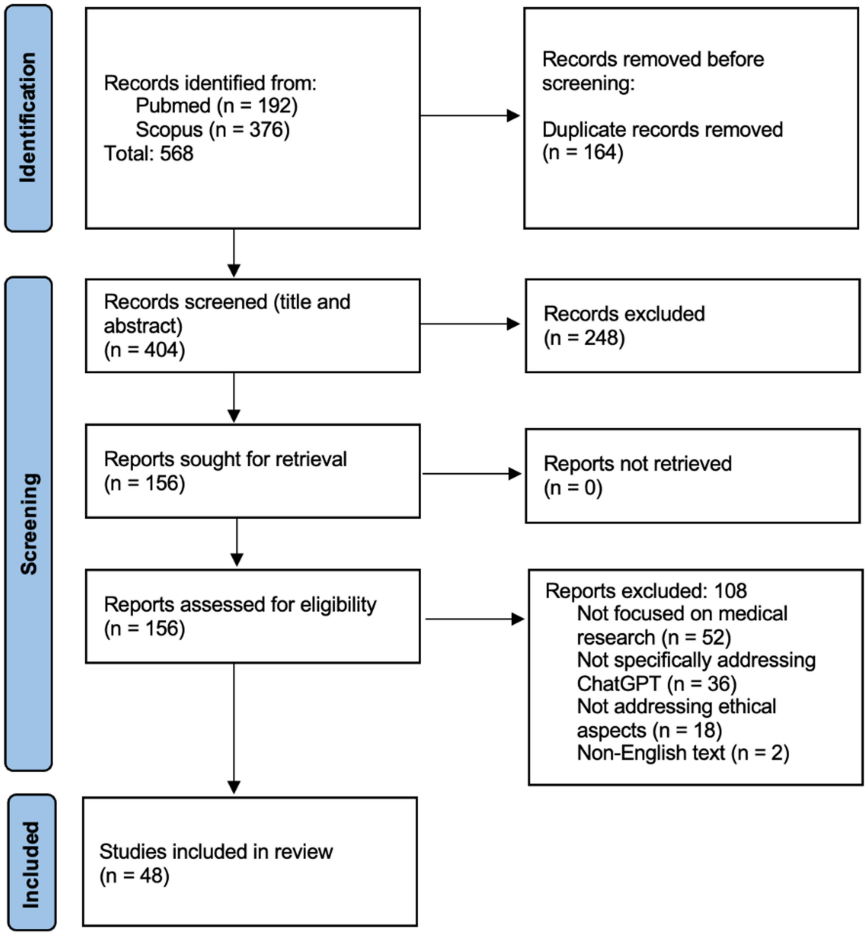

Figure 1. PRISMA flow chart of the workflow. PRISMA: preferred reporting items for systematic reviews and Meta-analyses.

while all remaining countries produced fewer than two publications each (Figure 2).

Although 36 articles addressed the topic within the context of general biomedical research, the following specialities were also represented: gynaecology, ophthalmology, pneumonology, haematology, oncology, surgery, and pharmacology.

Citations

Together, the 48 articles (Supplementary Table 1) had been cited 5707 times, although the number for each article varied widely, from 0 to 2516. Removing the outliers (10% from either end) to reduce their influence, the mean number of citations per article was 36.1 ± 40.3, with a median of 19.5. The article titled 'ChatGPT utility in healthcare education, research, and practice: systematic review on the promising perspectives and valid concerns' received the highest number of citations, followed by 'Intelligence: Is ChatGPT hype, hero, or heresy?' Figure 3 shows the 48 articles divided into five time frames, each of 6 months, and the mean citations for each time frame.

For a more reliable assessment of the impact, we performed a citation-per-year normalization, considering the number of citations recorded up to July 2025. This analysis yielded an overall mean normalized citation rate of 41.3 per year, with a median of 7.7. Across the five periods (Figure 3), the corresponding rates were as follows: January–June 2023, 147.4; July–December 2023, 19.95; January–June 2024, 17.5; July–December 2024, 10.72; and January–June 2025, 1.12.

For each of the five periods, we analysed the type of articles. Figure 4 shows how the six types – correspondence, editorials, narrative reviews, original articles, scoping reviews, and systematic reviews – were distributed across the five periods.

The mean impact factor of the journals was 4.08 ± 4.4, with a median of 2.7.

Ethical considerations

Of the five major ethical concerns chosen for the present study, the most prevalent was the risk of bias, which was mentioned

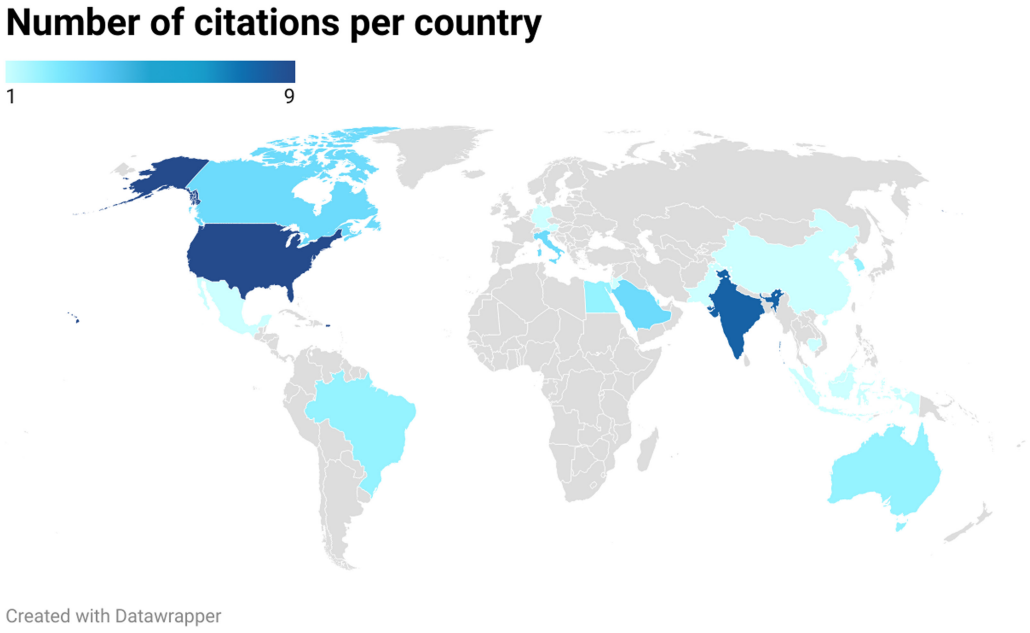

Figure 2. Geographical distribution of the publications.

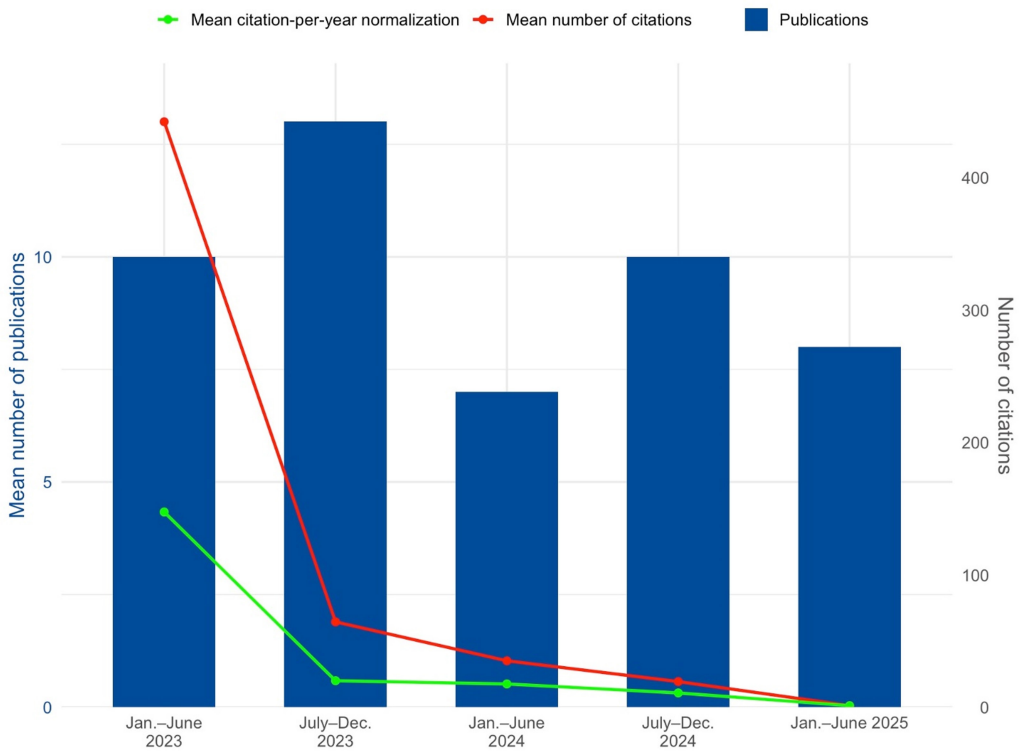

Figure 3. The number of published articles, citations, and citations normalized per year during time frames of 6 months each. Blue bars represent the number of published articles (left Y axis); red dots, mean citation counts; and green dots, mean citation-per-year normalization (right Y axis).

by nearly 80% of the articles (38 out of 48), followed by plagiarism (36 articles mentioned it) (Table 1). Only 10 articles reported all five concerns, 17 addressed four, eight addressed three, nine addressed two, and four addressed only one.

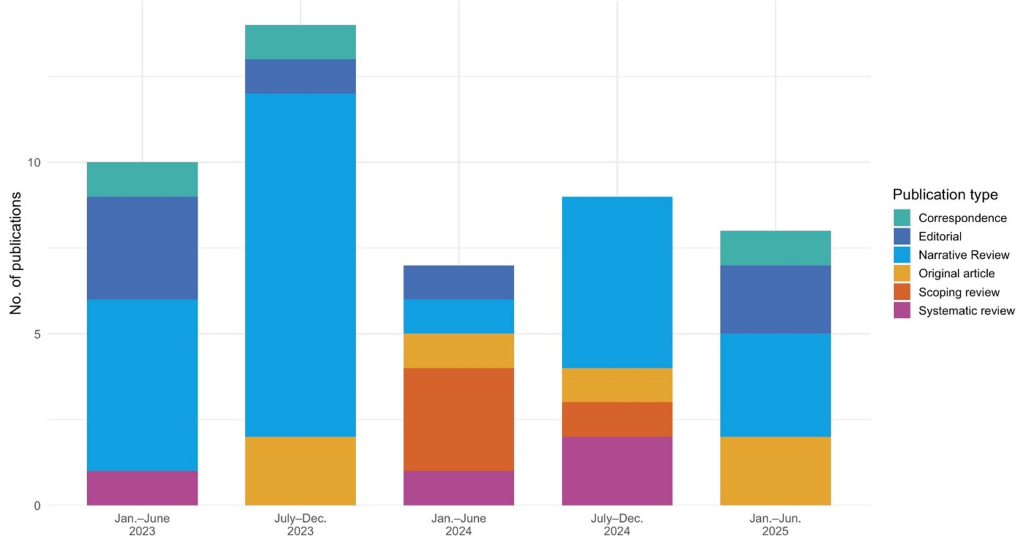

Figure 4. Distribution of articles by type within each time frame of 6 months.

Table 1. The distribution of ethical issues dealt with by the selected articles

Ethical issue	Publications related to the ethical issue	
	Number	Percentage
Bias	38	79.1
Responsibility	30	62.5
Transparency and trust	31	64.5
Confidentiality	29	60.4
Plagiarism	36	75.0

Discussion

Trends

Tools such as ChatGPT, which are based on LLMs, have become increasingly popular over the last few years. An advanced, effective, and widely available tool, ChatGPT has changed the process of writing research papers.[26] However, misuse of the tool is associated with risks and limitations, which have recently attracted the attention of the scientific community, highlighting the need to preserve the quality of medical research.[27] This scoping review aimed to examine these challenges by integrating scientists' perspectives with trends in publications dealing with the issue to provide a comprehensive overview and to identify the critical aspects associated with the use of ChatGPT in medical research.

The temporal distribution of publications shows that half of the selected articles were published in 2023, which probably reflects the growing integration of generative AI tools in health care and academia, coinciding with the widespread release and adoption of ChatGPT in medical research. Although the number of publications declined in 2024 and 2025 (Figure 3), the discourse surrounding the ethical implications of employing ChatGPT in medical research remains pertinent. The decrease may be due to the widespread integration of ChatGPT into research practices, making the topic less novel, although publication lag should also be considered in interpreting the pattern.

The larger share of narrative reviews among the chosen articles indicates that much of the current knowledge about the topic remains conceptual and exploratory rather than empirical. However, the types of articles shifted during the period chosen for the study and moved from editorials and correspondence as the predominant type to original articles as well as systematic and scoping reviews, suggesting a greater understanding of the topic, as ChatGPT increasingly became a common tool deployed in writing research papers reporting medical research.

The distribution of articles in terms of the five ethical issues shows a fragmented discourse and points to the need to develop a comprehensive ethical framework, to be consistently applied, although the frequency with which the articles were cited reflects the growing attention devoted to these challenges. To arrive at such a framework, each ethical issue must be thoroughly examined to clearly identify the underlying issues and to determine suitable practices to encourage more responsible use of the tool.

Ethical challenges and perspectives

Bias

The fact that nearly 80% of the selected articles addressing ethical issues were related to the use of ChatGPT in medical research highlighted the risk of biased content. Bias is a serious problem that can compromise the accuracy of information provided. Many types of bias are introduced when LLM-based tools such as ChatGPT are used for research and writing. Bias originating from the data is inevitable given the massive volume of online information, even if algorithms are tuned to screen and exclude low-quality information.[16, 28-31] The biases reported include generalization and propagation due to the models found in the ChatGPT algorithm and are explained by the learning pattern that

preserves stereotypes and is limited to ideas prevalent in online data.[28,32]

A particular ethical problem of bias in medical research occurs when ChatGPT propagates inaccuracies related to race, ethnicity, or gender.[33,34] Zack et al. showed that ChatGPT cannot adapt to demographic characteristics for proper medical examination of the population. For example, ChatGPT tends to (1) promote mainly the particularities of conditions related to men, (2) encourage different treatment recommendations, or (3) underestimate or overestimate the prevalence of diseases in Black, Asian, and Hispanic populations.[35] This trait of ChatGPT may be explained by the tendency of scientists to explore a certain group of patients, which biases the results towards the subjective demographic characteristics of the chosen group. This promotes inequality and discrimination in the medical approach, introducing a significant ethical issue of using AI in the academic domain. The issue can be mitigated if researchers and clinicians evaluate the outputs of ChatGPT rigorously and critically, ensuring active human supervision at all stages of information generation and interpretation.

However, it is important to consider pre-existing biases in medical literature arising from human influence. Several studies have discussed the risk of bias introduced by ChatGPT compared to that embedded in human judgement, highlighting similarities between these two. These biases in ChatGPT can emerge from the model's learning process, which reflects the traits, ideas, and perspectives it encounters in online data.[36-38]

Responsibility

Another concern is the lack of responsibility for the provided content, a concern mentioned by two-thirds of the articles we examined. Although all authors affirm the correctness and accuracy of the generated information and take responsibility for any eventual errors and misleading data, ChatGPT – lacking human awareness, deep understanding, and critical thinking – can deliver imprecise information and provide incorrect conclusions that can lead to fundamental errors in medical research.[39] In the absence of validation by authors, these aspects can be problematic because a chatbot cannot be held responsible and cannot discharge any legal, moral, or ethical obligations for future errors found in medical literature.[40,41]

The fairness or propriety of citing ChatGPT as an author is a debatable.[42-44] Based on their study, Ide et al.[45] demonstrated that it is inappropriate to consider ChatGPT as an author of medical articles because of the absence of two of the four criteria for authorship: the capacity to approve the final version of the article and to ensure its accuracy and integrity. However, another study on the ethics of using AI in research reported that before August 2023, PubMed listed more than a 1000 citations with ChatGPT as an author, a practice strongly disapproved of by many scientists despite the lack of regulation on the topic.[39,46] The International Committee of Medical Journal Editors (ICMJE) has clearly stated that ChatGPT should not be listed as an author because it does not meet the established authorship criteria. In particular, it cannot assume responsibility for the accuracy, integrity, or originality of a scientific article.[47] Furthermore, the World Association of Medical Editors (WAME) has issued a position statement on this matter, stating that chatbots cannot be recognized as authors.[48] However, this discrepancy should be handled by the Committee on Publication Ethics (COPE) by providing rigorous and precise policies governing authorship. New guidelines are necessary to clarify the issue of responsibility in future research to protect readers from potential medical misinformation.[49-52]

Plagiarism

Three-quarters of the articles mentioned plagiarism as a major problem aggravated by ChatGPT, which has significantly enhanced the risk of plagiarism by cursory rephrasing or paraphrasing, generating information in a form that closely matches one or more existing online texts, and providing content 'inspired' by different sources without naming them.[53,54] In an experiment in which ChatGPT was required to write 90 texts, Hassanipour et al.[55] demonstrated a plagiarism rate of 45%, reflecting a disturbing result that highlights the limitations of ChatGPT in providing high-quality academic texts. In the absence of detailed and clear policies from journals, unrestricted use of ChatGPT can lead to ethical problems and academic fraud.[51] Unrestricted and unguided use of ChatGPT in academic writing can promote inequalities for those who do not benefit from it and may also influence the creativity, authenticity, and writing skills of authors.[56]

In the realm of medical research, the potential for plagiarism associated with ChatGPT poses a significant risk to the integrity of information by potentially misinterpreting original sources or disseminating incomplete, unverified, or superficial data. In medicine, such problems can result in loss of credibility and, more critically, the dissemination of misinformation to patients and medical specialists.[57,58]

Transparency and trust

Nearly two-thirds of the selected articles highlighted lack of transparency as a concern in ChatGPT's learning and search algorithms. In the context of medical applications, transparency refers to providing clear explanations of how a data-processing algorithm operates, enabling users to ascertain whether the model is fairness-aware.[59] However, ChatGPT's algorithm remains opaque, lacking accountability and openness, and is often described as a 'black box' with respect to the sources of its generated content.[59,60] In a rapidly evolving field such as medicine, the lack of transparency in ChatGPT makes it difficult to verify the accuracy and timeliness of the information it provides. This can lead to the dissemination of outdated knowledge, reinforcement of stereotypes, and perpetuation of inaccurate data, all stemming from untraceable sources and the opaque nature of the model's outputs.[61]

Improving the transparency of ChatGPT has been discussed over the years as a measure to evaluate data and to comprehend data, promoting correct medical decisions. The actions include designing graphical user interfaces, developing code for user–machine interactions, and implementing transparent AI methods.[62]

Confidentiality

Confidentiality, especially regarding patients' personal data, represents the fifth and the last of the ethical concerns considered in the present review and was reported as a concern by 60% of the chosen articles. Data in the form of medical history, private information, diagnoses, and medical results can be stored by ChatGPT's algorithm, violating privacy regulations and putting users at risk in the case of data leakage or eventual hacking.[61,63] Data on patients should be entered into the ChatGPT platform only after obtaining informed consent lest it should constitute a breach of doctor–patient confidentiality. In addition, the principle of data minimization dictates that only the information essential for the task should be provided, and any identifying details such as names, ID numbers, addresses, or other personal information should be removed to reduce risks to privacy.[64] Until institutions and ethics committees implement strict and explicit regulations

for including health information in AI models such as ChatGPT, doctors should adopt all the necessary security measures to safeguard patient confidentiality.[65]

Ethical and regulatory framework for ChatGPT use in medical research

By analysing the risks associated with the use of ChatGPT in medical research, both in terms of publication trends and the specific issues discussed in the literature, the present study highlights the growing importance of addressing these concerns. Having outlined the spectrum of ethical challenges involved, the next step was to synthesize the frameworks proposed for mitigating these risks, as reflected in the recommendations provided across the analysed articles (Supplementary Table 1). The measures required to diminish these risks should be systematically structured across different stages. First, interventions at the level of AI developers are essential. These include the refinement of learning algorithms and the use of more robust, diverse, and high-quality training data sets to improve the reliability of generated outputs while ensuring greater transparency of underlying processes. Such improvements would make AI-based tools more trustworthy and consistent, thereby supporting their safer and more confident application in medical research.[66,67] Moreover, developers must ensure continued alignment with global ethical standards governing the use of LLMs and remain responsive to evolving regulatory frameworks. Ongoing monitoring and adaptation to legislative updates are essential to maintain compliance, accountability, and the responsible deployment of these systems in medical research.[68]

Secondly, maintaining the integrity and ethical use of ChatGPT in medical research requires the establishment of explicit and well-defined guideline frameworks.[69] Several committees dedicated to scientific publishing play a central role in this process. For instance, COPE is actively involved in developing clear and standardized protocols governing the use of AI tools, including recommendations on appropriate disclosure and acknowledgment of their use in scientific work.[39] These frameworks must be continually updated to reflect the rapid evolution of AI technologies and the emerging challenges they present.[70] Furthermore, the development and implementation of such guidelines should rely on multidisciplinary collaboration involving scientists, clinicians, ethicists, and philosophers to ensure a comprehensive and balanced approach.[71]

Finally, the responsibility for safeguarding patient privacy and confidentiality ultimately lies with health care professionals when integrating ChatGPT into research activities.[72] They must adhere to established ethical principles and regulatory standards governing the use of LLMs, ensuring that their application remains safe for patients and does not compromise the integrity of the health care system.[68]

Limitations

A limitation of this review is its specific focus on ChatGPT without extending the analysis to other similar LLM-based tools. By choosing ChatGPT, one of the earliest and most widely adopted such tools discussed extensively in scientific literature, we opted for using it as a relevant and well-documented model for examining the ethical implications of the use of LLMs in medical research. Moreover, many of the ethical concerns identified are not unique to ChatGPT but broadly applicable across LLM-based tools. Focusing on a single, highly influential model allowed for a more in-depth and structured analysis, avoiding an overly fragmented discussion that might have resulted from attempting to cover multiple tools within the scope of a single review. Nevertheless, we acknowledge that

extending this analysis to other tools would provide additional insights, particularly in identifying model-specific ethical challenges and comparing their relative impacts. Future research should therefore aim to conduct comparative evaluations across different tools to better distinguish between universal and system-specific ethical considerations.

Conclusion

Although ChatGPT has significantly accelerated advances in medical research, the benefits of the tool are accompanied by inherent risks and limitations. Our scoping review concentrated on the ethical concerns related to unrestricted use of ChatGPT in medical research, as highlighted in the rapidly expanding medical literature on this topic. We found that although the number of times the selected papers are cited decreased over time, the *volume* of articles remained consistently high, indicating sustained interest in the limitations of ChatGPT, particularly concerning biases, accountability, and transparency. Our findings highlight the urgent need to make users, especially publishers and the relevant associations, aware of the necessity to develop precise policies and regulations for the use of ChatGPT in medicine to mitigate its potential risks within the domain of health care.

References

1. Haleem A, Javaid M, Singh RP. An era of ChatGPT as a significant futuristic support tool: a study on features, abilities, and challenges. *Tbench*. 2022;2(4):100089. [CrossRef]

2. Roumeliotis KI, Tselikas ND. ChatGPT and open-AI models: a preliminary review. *Future Internet*. 2023;15(6):192. [CrossRef]

3. Ruksakulpiwat S, Kumar A, Ajibade A. Using ChatGPT in medical research: current status and future directions. *J Multidiscip Healthc*. 2023;16:1513-1520. [CrossRef]

4. Khan RA, Jawaid M, Khan AR, Sajjad M. ChatGPT - Reshaping medical education and clinical management. *Pak J Med Sci*. 2023;39(2):605-607. [CrossRef]

5. Lee PY, Salim H, Abdullah A, Teo CH. Use of ChatGPT in medical research and scientific writing. *Malays Fam Physician*. 2023;18:58. [CrossRef]

6. Briganti G. How ChatGPT works: a mini review. *Eur Arch Otorhinolaryngol*. 2024;281(3):1565-1569. [CrossRef]

7. Fui-Hoon Nah FH, Zheng R, Cai J, Siau K, Chen L. Generative AI and ChatGPT: applications, challenges, and AI-human collaboration. *J Inf Technol Case Appl Res*. 2023;25(3):277-304. [CrossRef]

8. Wu T, He S, Liu J, et al. A brief overview of ChatGPT: the history, status quo and potential future development. *IEEE CAA J Autom Sin*. 2023;10(5):1122-1136. [CrossRef]

9. AlZaabi A, ALamri A, Albalushi H, Aljabri R, Aal-Abdulsalam A. ChatGPT applications in academic research: a review of benefits, concerns, and recommendations. *bioRxiv*. 2023;08. [CrossRef]

10. Dave T, Athaluri SA, Singh S. ChatGPT in medicine: an overview of its applications, advantages, limitations, future prospects, and ethical considerations. *Front Artif Intell*. 2023;6:1169595. [CrossRef]

11. Arachchige ASPM. Early applications of ChatGPT in medical practice, education and research. *Clin Med (Lond)*. 2023;23(4):429-430. [CrossRef]

12. Liu HY, Alessandri Bonetti M, De Lorenzi F, Gimbel ML, Nguyen VT, Egro FM. Consulting the digital doctor: google versus ChatGPT as sources of information on breast implant-associated anaplastic large cell lymphoma and breast implant illness. *Aesthetic Plast Surg*. 2024;48(4):590-607. [CrossRef]

13. Tan S, Xin X, Wu D. ChatGPT in medicine: prospects and challenges: a review article. *Int J Surg*. 2024;110(6):3701-3706. [CrossRef]

14. Khairatun Hisan U, Miftahul Amri M. ChatGPT and medical education: a double-edged sword. *J Ped Edu Sci*. 2023;2(1):71-89. [CrossRef]

15. Alsadhan A, Al-Anezi F, Almohanna A, et al. The opportunities and challenges of adopting ChatGPT in medical research. *Front Med (Lausanne)*. 2023;10:1259640. [CrossRef]

16. Sallam M. ChatGPT utility in healthcare education, research, and practice: systematic review on the promising perspectives and valid concerns. *Healthcare (Basel)*. 2023;11(6):887. [CrossRef]
17. Peters V, Baumgartner M, Froese S, et al. Risk and potential of ChatGPT in scientific publishing. *J Inherit Metab Dis*. 2023;46(6):1005-1006. [CrossRef]
18. Bagde H, Dhopte A, Alam MK, Basri R. A systematic review and meta-analysis on ChatGPT and its utilization in medical and dental research. *Heliyon*. 2023;9(12):e23050. [CrossRef]
19. Mondal H, Mondal S. ChatGPT in academic writing: maximizing its benefits and minimizing the risks. *Indian J Ophthalmol*. 2023;71(12):3600-3606. [CrossRef]
20. Ambrosio L, Schol J, La Pietra VA, Russo F, Vadalà G, Sakai D. Threats and opportunities of using ChatGPT in scientific writing—the risk of getting spineless. *JOR Spine*. 2024;7(1):e1296. [CrossRef]
21. Komorowski M, Del Pilar Arias López M, Chang AC. How could ChatGPT impact my practice as an intensivist? An overview of potential applications, risks and limitations. *Intensive Care Med*. 2023;49(7):844-847. [CrossRef]
22. Sharun K, Banu SA, Pawde AM, et al. ChatGPT and artificial hallucinations in stem cell research: assessing the accuracy of generated references - a preliminary study. *Ann Med Surg (Lond)*. 2023;85(10):5275-5278. [CrossRef]
23. Teixeira da Silva JA. Manuscripts with fake ChatGPT-created references: a case study. *CAJMHE*. 2023;4(3):168-171. [CrossRef]
24. Rahimi F, Talebi Bezmin Abadi A. ChatGPT and publication ethics. *Arch Med Res*. 2023;54(3):272-274. [CrossRef]
25. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan-a web and mobile app for systematic reviews. *Syst Rev*. 2016;5(1):210. [CrossRef]
26. Baber H, Nair K, Gupta R, Gurjar K. The beginning of ChatGPT – a systematic and bibliometric review of the literature. *Inform Learn Sc*. 2024;125(7/8):587-614. [CrossRef]
27. Kitamura FC. ChatGPT is shaping the future of medical writing but still requires human judgment. *Radiology*. 2023;307(2):e230171. [CrossRef]
28. Ferrara E. Should ChatGPT be biased? Challenges and risks of bias in large language models. *SSRN Electron J*. Published online October 26, 2023. [CrossRef]
29. Lee SW, Choi WJ. Utilizing ChatGPT in clinical research related to anesthesiology: a comprehensive review of opportunities and limitations. *Anesth Pain Med (Seoul)*. 2023;18(3):244-251. [CrossRef]
30. Borji A, Ai Q. A categorical archive of ChatGPT failures. *arXiv*; Published online May 9, 2023. [CrossRef]
31. Sallam M, Salim NA, Barakat M, Al-Tammemi AB. ChatGPT applications in medical, dental, pharmacy, and public health education: a descriptive study highlighting the advantages and limitations. *Narra J*. 2023;3(1):e103. [CrossRef]
32. Deldjoo Y. Understanding biases in ChatGPT-based recommender systems: provider fairness, temporal stability, and recency. *arXiv*; 2024. (arXiv:2401.10545)
33. Zhang A, Yuksekgonul M, Guild J, et al. ChatGPT exhibits gender and racial biases in acute coronary syndrome management. *arXiv*; Published online November 10, 2023. https://arxiv.org/pdf/2311.14703.
34. Hanna JJ, Wakene AD, Lehmann CU, et al. Assessing racial and ethnic bias in text generation for healthcare-related tasks by ChatGPT1 [preprint]. *medRxiv*; 2023. [CrossRef]
35. Zack T, Lehman E, Suzgun M, et al. Assessing the potential of GPT-4 to perpetuate racial and gender biases in health care: a model evaluation study. *Lancet Digit Health*. 2024;6(1):e12-e22. [CrossRef]
36. Guo B, Zhang X, Wang Z, et al. How close is ChatGPT to human experts? Comparison corpus, evaluation, and detection. *arXiv*; Published online January 18, 2023. https://arxiv.org/pdf/2301.07597.
37. Motoki F, Pinho Neto V, Rodrigues V. More human than human: measuring ChatGPT political bias. *Public Choice*. 2024;198(1-2):3-23. [CrossRef]
38. Babaei G, Banks D, Bosone C, Giudici P, Shan Y. Is ChatGPT more biased than you? *Harv Data Sci Rev*. 2024;6(3). [CrossRef]
39. Guleria A, Krishan K, Sharma V, Kanchan T. ChatGPT: ethical concerns and challenges in

academics and research. J Infect Dev Ctries. 2023;17(9):1292-1299. [CrossRef]

40. Coeckelbergh M. Artificial intelligence, responsibility attribution, and a relational justification of explainability. *Sci Eng Ethics*. 2020;26(4):2051-2068. [CrossRef]

41. Jeyaraman M, Balaji S, Jeyaraman N, Yadav S. Unraveling the ethical enigma: artificial intelligence in healthcare. *Cureus*. 2023;15(8):e43262. [CrossRef]

42. Nazarovets S, Teixeira da Silva JA. ChatGPT as an "author": bibliometric analysis to assess the validity of authorship. *Account Res*. 2024;32(7):1148-1158. [CrossRef]

43. Thorp HH. ChatGPT is fun, but not an author. *Science*. 2023;379(6630):313-313. [CrossRef]

44. Goto A, Katanoda K. Should we acknowledge ChatGPT as an author? *J Epidemiol*. 2023;33(7):333-334. [CrossRef]

45. Ide K, Hawke P, Nakayama T. Can ChatGPT be considered an author of a medical article? *J Epidemiol*. 2023;33(7):381-382. [CrossRef]

46. Temsah MH, Altamimi I, Jamal A, Alhasan K, Al-Eyadhy A. ChatGPT surpasses 1000 publications on PubMed: envisioning the road ahead. *Cureus*. 2023;15(9):e44769. [CrossRef]

47. Defining the role of authors and contributors. *ICMJE*. https://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html#four.

48. Zielinski C, Winker M, Aggarwal R, et al. WAME recommendations on ChatGPT and Chatbots in relation to scholarly publications. *Vis Pan-Am*. 2023;5(1). [CrossRef]

49. Kandeel ME, Eldakak A. Legal dangers of using ChatGPT as a co-author according to academic research regulations. *J Gov Regul*. 2024;13(1)(special Issue):289. [CrossRef]

50. Wen J, Wang W. The future of ChatGPT in academic research and publishing: a commentary for clinical and translational medicine. *Clin Transl Med*. 2023;13(3):e1207. [CrossRef]

51. Dwivedi YK, Kshetri N, Hughes L, et al. Opinion Paper: "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *Int J Inf Manage*. 2023;71:2023;71:102642. [CrossRef]

52. Desaire H, Isom M, Hua D. Almost nobody is using ChatGPT to write academic science papers (yet). *Big Data Cogn Comput*. 2024;8(10):133. [CrossRef]

53. SeyedAlinaghi S, Abbaspour F, Mehraeen E. The challenges of ChatGPT in healthcare scientific writing. *Shiraz E-Med J*. 2023;25(2):e141861. [CrossRef]

54. Malik MA, Amjad AI, Aslam S, Fakhrou A. Global insights: ChatGPT's influence on academic and research writing, creativity, and plagiarism policies. *Front Res Metr Anal*. 2024;9:1486832. [CrossRef]

55. Hassanipour S, Nayak S, Bozorgi A, et al. The ability of ChatGPT in paraphrasing texts and reducing plagiarism: a descriptive analysis. *JMIR Med Educ*. 2024;10:e53308. [CrossRef]

56. Niloy AC, Akter S, Sultana N, Sultana J, Rahman SIU. Is ChatGPT a menace for creative writing ability? An experiment. *J Comput Assist Learn*. 2024;40(2):919-930. [CrossRef]

57. Sedaghat S. Plagiarism and wrong content as potential challenges of using chatbots like ChatGPT in medical research. *J Acad Ethics*. 2025;23(1):185-188. [CrossRef]

58. Patil VL, Ganganahalli P. Perception of plagiarism among medical postgraduate students: an observational study. *Cureus*. 2024;16(7):e64513. [CrossRef]

59. Ray PP. ChatGPT: a comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope. *Internet Things Cyber-Phys Syst*. 2023;3:121-154. [CrossRef]

60. Quttainah M, Mishra V, Madakam S, Lurie Y, Mark S. Cost, usability, credibility, fairness, accountability, transparency, and explainability framework for safe and effective large language models in medical education: narrative review and qualitative study. *JMIR Ai*. 2024;3(1):e51834. [CrossRef]

61. Li H, Moon JT, Purkayastha S, Celi LA, Trivedi H, Gichoya JW. Ethics of large language models in medicine and medical research. *Lancet Digit Health*. 2023;5(6):e333-e335. [CrossRef]

62. Xu T, Weng H, Liu F, et al. Current status of ChatGPT use in medical education: potentials,

challenges, and strategies. *J Med Internet Res*. 2024;26:e57896. [CrossRef]

63. Wang C, Liu S, Yang H, Guo J, Wu Y, Liu J. Ethical considerations of using ChatGPT in health care. *J Med Internet Res*. 2023;25:e48009. [CrossRef]

64. Wong RSY, Ming LC, Raja Ali RA. The intersection of ChatGPT, clinical medicine, and medical education. *JMIR Med Educ*. 2023;9(1):e47274. [CrossRef]

65. Mu Y, He D. The potential applications and challenges of ChatGPT in the medical field. *Int J Gen Med*. 2024;17:817-826. [CrossRef]

66. Puleio F, Lo Giudice G, Bellocchio AM, Boschetti CE, Lo Giudice R. Clinical, research, and educational applications of ChatGPT in dentistry: a narrative review. *Appl Sci*. 2024;14(23):10802. [CrossRef]

67. Gutiérrez-Cirlos C, Carrillo-Pérez DL, Bermúdez-González JL, Hidrogo-Montemayor I, Carrillo-Esper R, Sánchez-Mendiola M. ChatGPT: opportunities and risks in the fields of medical care, teaching, and research. *Gac Med Mex*. 2023;159(5). [CrossRef]

68. Su Z, Tang G, Huang R, Qiao Y, Zhang Z, Dai X. Based on medicine, the now and future of large language models. *Cell Mol Bioeng*. 2024;17(4):263-277. [CrossRef]

69. Costa ICP, Nascimento MC do, Treviso P, et al. Using the Chat Generative Pre-trained Transformer in academic writing in health: a scoping review. *Rev Lat Am Enfermagem*. 2024;32. [CrossRef]

70. Arshad HB, Butt SA, Khan SU, Javed Z, Nasir K. ChatGPT and artificial intelligence in hospital level research: potential, precautions, and prospects. *Methodist Debakey Cardiovasc J*. 2023;19(5):77-84. [CrossRef]

71. Scimeca M, Bonfiglio R. Dignity of science and the use of ChatGPT as a co-author. *ESMO Open*. 2023;8(5):101621. [CrossRef]

72. Dergaa I, Chamari K, Zmijewski P, Ben Saad H. From human writing to artificial intelligence generated text: examining the prospects and potential threats of ChatGPT in academic writing. *Biol Sport*. 2023;40(2):615-622. [CrossRef]

ease publications

ese European Science Editing

European Science Editing is an official publication of EASE. It is an open access peer-reviewed journal that publishes original research, review and commentary on all aspects of scientific, scholarly editing and publishing.

https://ese.arphahub.com/
https://www.ease.org.uk
https://www.linkedin.com/company/easeeditors/
https://bsky.app/profile/easeeditors.bsky.social
https://www.facebook.com/EASEeditors/
https://mstdn.science/@EASE
https://www.instagram.com/easeeditors/
https://www.youtube.com/easeeditors

© 2026 the authors. This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

ISSN 2518-3354

Caleo

arpha