Impact of Artificial Intelligence on Medical Education and Research: A Systematic Review

VUGUZIGA Thadee, MSc, MPH, MBA
Deputy Registrar
Rwanda Medical & Dental Council

OUTLINE

1. Background
2. Methodology
3. Finding & Discussion
4. Conclusion &Recommendations

I. BACKGROUND

Problem statement

- Despite the **potential benefits** of **AI** in enhancing medical education &research, there are **significant challenges & potential negative consequences associated** with its integration

Challenges

- **Lack of comprehensive curricula** that include **AI** training,
- **Potential dependency** on **AI** that may undermine traditional clinical skills,
- **Ethical issues** related to data privacy
- Possible **marginalization** of human judgment in clinical decision-making
- Cheating and **plagiarism**

Dwivedi et al., (2021)

I. BACKGROUND

This systematic review examines the **adverse effects** of AI in medical education & research, including issues related to ethical concerns, data quality, and dependence on technology.

II. OBJECTIVES

Identify the **challenges and negative impacts** associated with the integration of AI into medical training and research methodologies.

Propose **regulatory frameworks** or guidelines for the effective integration of AI into medical education that balance technology and traditional clinical training.

III. METHODOLOGY

The review systematically searches academic databases such as PubMed, Scopus, and Google Scholar for **peer-reviewed articles published from 2010 to 2023.**

Inclusion criteria are peer-reviewed articles that discuss the application and impact of AI in medical education and Research.

Fifteen of (15) Peer-reviewed articles discussing the application and impact of AI in medical education and Research were selected

1. Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, 8, 75264-75278.
2. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence Unleashed: An argument for AI in Education. *Pearson*.
3. Topol, E. J. (2019). High-performance medicine: the convergence of human and artificial intelligence. *Nature Medicine*, 25(1), 44-56.
4. Davenport, T. H., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. *Future Healthcare Journal*, 6(2), 94-98.
5. Mehrabi, N., Morstatter, F., Saxena, N., Lerman, K., & Galstyan, A. (2021). A Survey on Bias and Fairness in Machine Learning. *ACM Computing Surveys (CSUR)*, 54(6), 1-35.
6. Van Rijmenam, M. (2019). The Organization of Tomorrow: How AI, blockchain, and analytics turn your business into a data organization. *Routledge*.
7. Cath, C., Wachter, S., Mittelstadt, B., Taddeo, M., & Floridi, L. (2018). Artificial Intelligence and the 'Good Society': the US, EU, and UK approach. *Science and Engineering Ethics*, 24, 505-528.
8. Price, W. N., & Cohen, I. G. (2019). Privacy in the age of medical big data. *Nature Medicine*, 25(1), 37-43.
9. Dwivedi, Y. K., Hughes, D. L., Ismagilova, E., Aarts, G., Coombs, C., Crick, T., ... & Raman, R. (2021). Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy. *International Journal of Information Management*, 57, 101994.
10. Roll, I., & Wylie, R. (2016). Evolution and Revolution in Artificial Intelligence in Education. *International Journal of Artificial Intelligence in Education*, 26(2), 582-599.
11. Siemens, G., & Long, P. (2011). Penetrating the Fog: Analytics in Learning and Education. *EDUCAUSE Review*, 46(5), 30-40.
12. Topol, E. J. (2019). Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again. *Basic Books*.
13. Chen, M., Decary, M., Murray, S., & Campbell, K. (2019). Artificial intelligence in education.
14. Floridi, L. (2019). Translating principles into practices of digital ethics: Five risks of being unethical. *Philosophy & Technology*, 32(2), 185-193.
15. Mittelstadt, B. D., Allo, P., Taddeo, M., Wachter, S., & Floridi, L. (2016). The ethics of algorithms: Mapping the debate. *Big Data & Society*, 3(2), 2053951716679679.

PART ONE:
AI IN MEDICAL EDUCATION: NEGATIVE IMPACTS

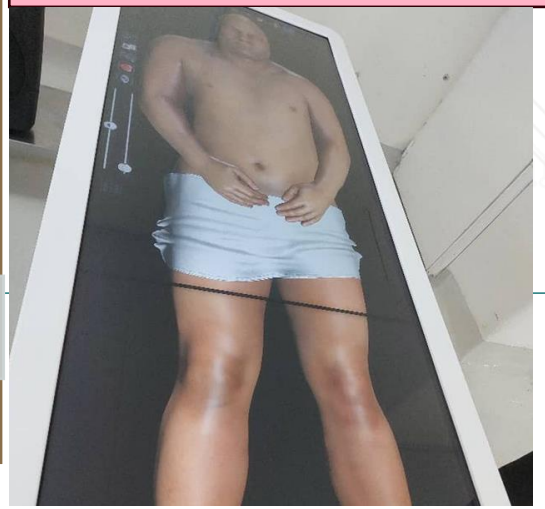
3. FINDINGS & DISCUSSIONS
AI IN MEDICAL EDUCATION: NEGATIVE IMPACTS

1. Reduced Human Interaction

AI-driven educational tools **can reduce face-to-face interactions between students and instructors**, which may impair the development of critical interpersonal skills essential for patient care.

The reliance on **virtual simulations** and automated feedback might limit opportunities for students to engage in collaborative learning and real-world problem-solving.

Anatomage table vs Dissection



Roll, I., & Wylie, R. (2016). Evolution and Revolution in Artificial Intelligence in Education. *International Journal of Artificial Intelligence in Education*, 26(2), 582-599

Example:Anatomage table to replace dissection?

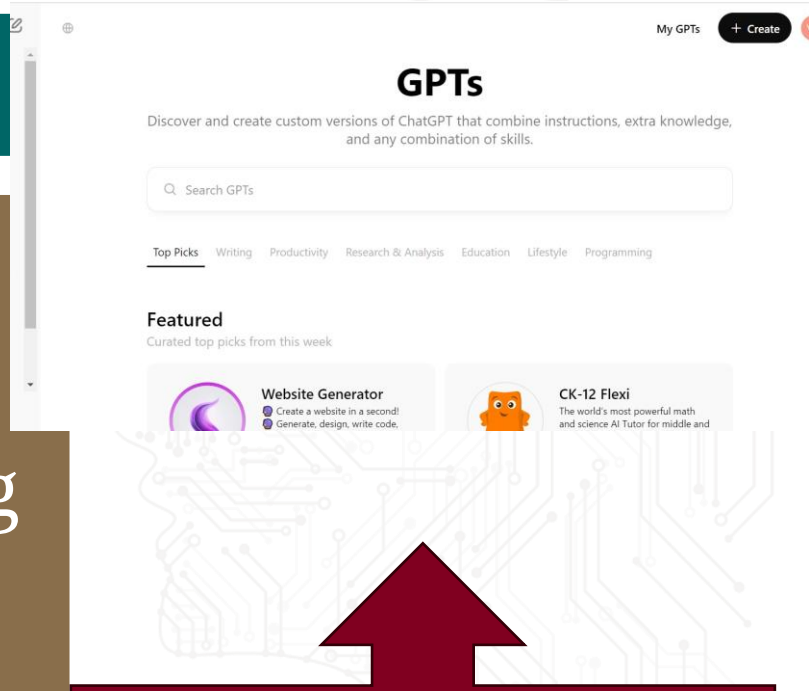
IN THE ERA
INTELLIGENCE

3. FINDINGS & DISCUSSIONS
AI IN MEDICAL EDUCATION: NEGATIVE IMPACTS

2. Overreliance on Technology

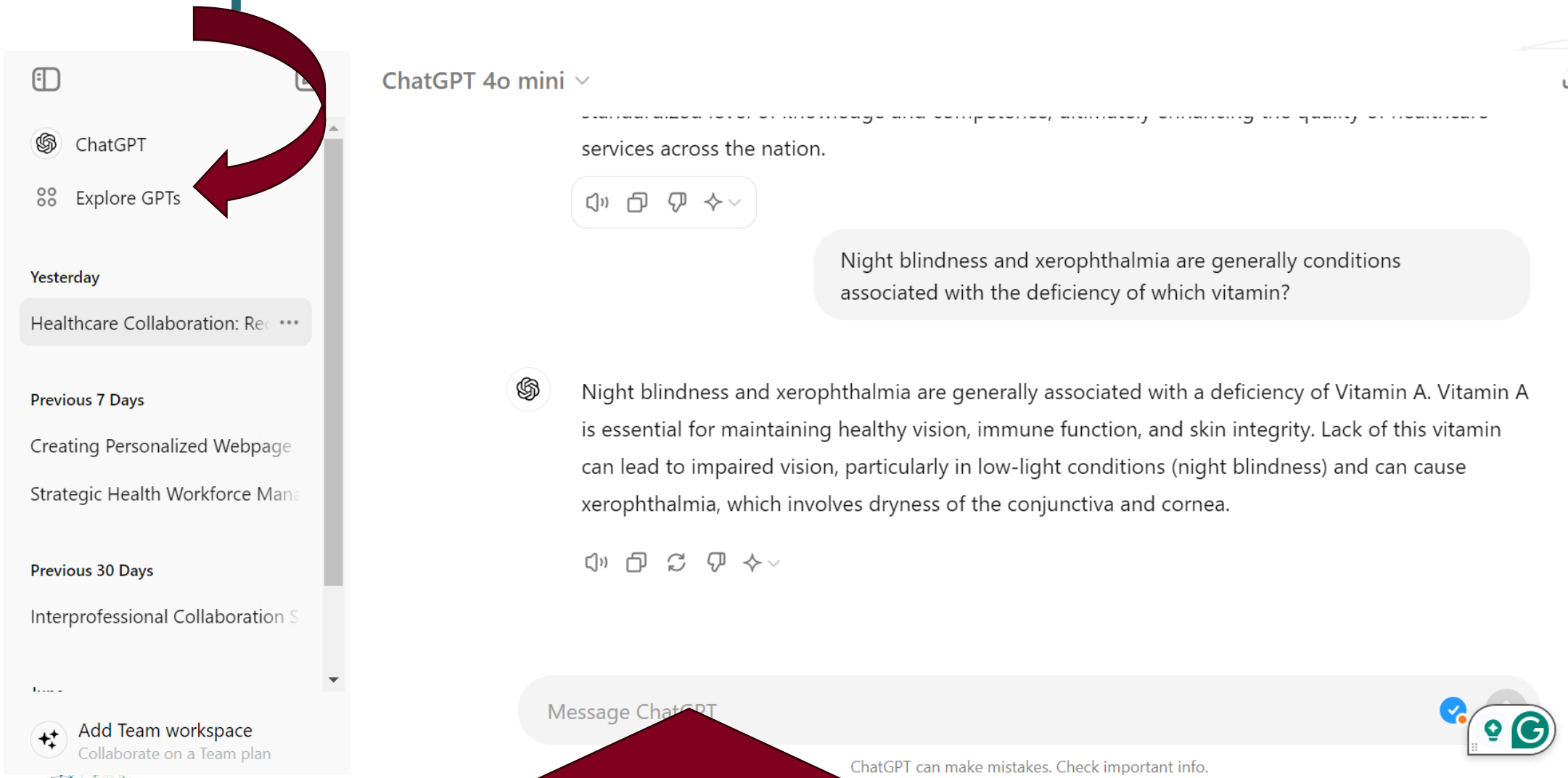
There is a risk that students might become overly **dependent on AI tools**, which could hinder the development of their critical thinking and decision-making skills.

Chen et.al. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, 8, 75264-75278



GPTs created by the ChatGPT team

Example



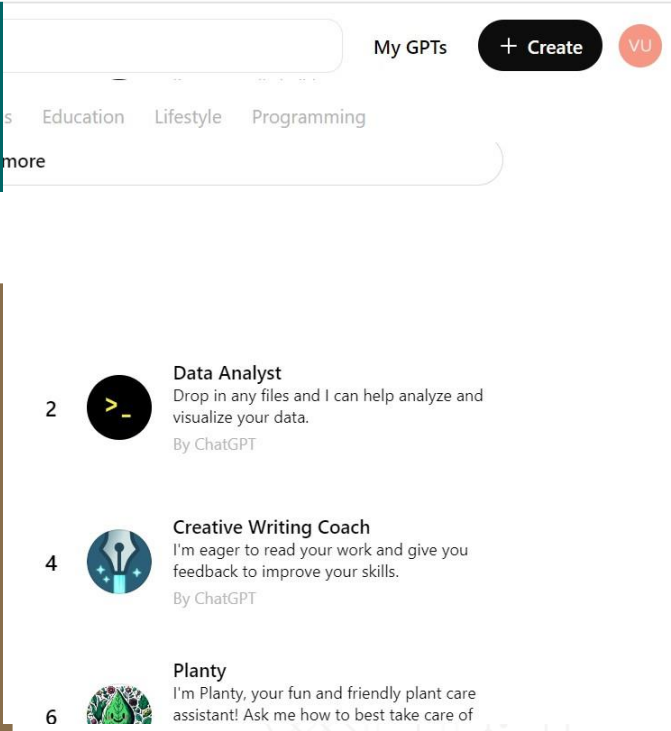
Ask AI

3. FINDINGS & DISCUSSIONS
AI IN MEDICAL EDUCATION: NEGATIVE IMPACTS

3. Data Privacy and Security Issues

The use of AI in education may involve collecting and analyzing large amounts of personal data. **Breaches** of such sensitive information could **undermine trust** in educational institutions and AI technologies

Price, W. N., & Cohen, I. G. (2019). Privacy in the age of medical big data. *Nature Medicine*, 25(1), 37-43.



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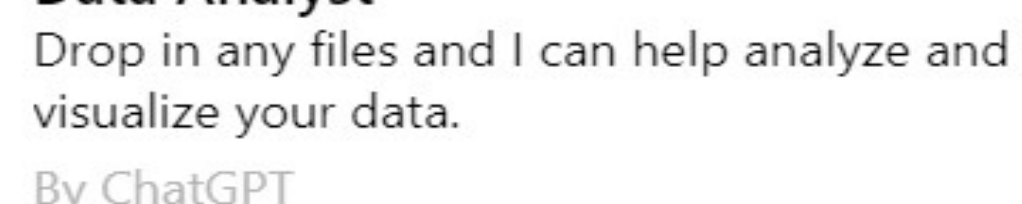


3. FINDINGS & DISCUSSIONS
AI IN MEDICAL EDUCATION: NEGATIVE IMPACTS

4. Bias and Fairness in AI Algorithms

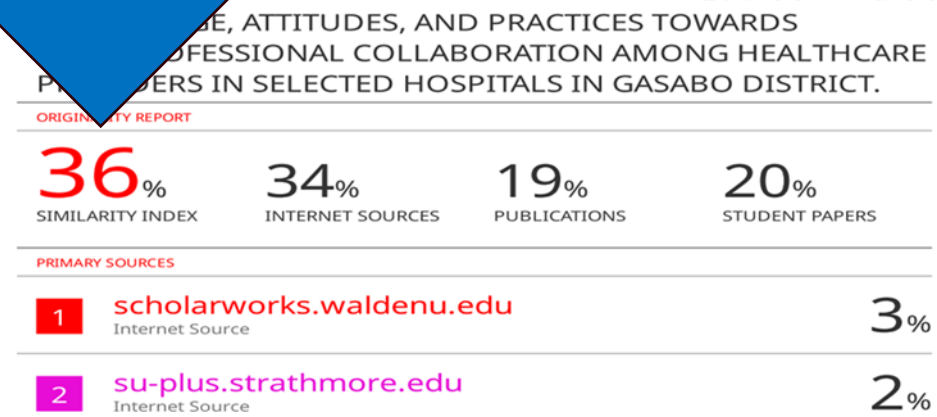
AI systems can potentially perpetuate and exacerbate **existing biases** if the underlying algorithms are not properly designed and managed

1. Algorithmic bias, which occurs when the algorithms themselves are flawed.
2. Data bias, which stems from datasets that are unrepresentative or prejudiced.
3. Interpretation bias, which arises when the outputs of AI systems are misconstrued or misapplied.

Since AI algorithms are built by humans, they can have built-in bias by those who either intentionally or inadvertently introduce them into the algorithm

Mehrabi et al., (2021). A Survey on Bias and Fairness in Machine Learning. *ACM Computing Surveys (CSUR)*, 54(6), 1-35.

PART II:
THE AI IN MEDICAL RESEARCH:
NEGATIVE IMPACTS



E, ATTITUDES, AND PRACTICES TOWARDS
OFESSIONAL COLLABORATION AMONG HEALTHCARE
ERS IN SELECTED HOSPITALS IN GASABO DISTRICT.

ORIGINALITY REPORT

36%	34%	19%	20%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	scholarworks.waldenu.edu Internet Source	3%
2	su-plus.strathmore.edu Internet Source	2%

AI I MEDICAL RESEARCH: NEGATIVE IMPACTS

1. Ethical Concerns

- AI-driven research can raise ethical issues related to the **use of patient data without proper consent**, potential biases in AI algorithms, and the moral implications of AI decision-making in clinical trials and studies
- Floridi et. Al., (2019).

2. Quality and Reliability of Data

- AI systems depend heavily on the quality of data they are trained on. **Poor data quality** can lead to inaccurate predictions and unreliable research outcomes that could lead to incorrect conclusions and potentially harmful applications in clinical practice
- Roll& Wylie (2016). Evolution and Revolution in Artificial Intelligence in Education. *International Journal of Artificial Intelligence in Education*, 26(2), 582-599.

II. AI IN MEDICAL RESEARCH-NEGATIVE IMPACTS

3. Loss of Researcher Skills

- As AI handles more data analysis tasks, researchers may **lose proficiency in traditional research skills** and statistical methods potentially reducing their ability to critically evaluate AI-generated results
- **Van Rijmenam (2024).**

4. Intellectual Property and Ownership Issues:

The use of AI in research raises questions about intellectual property and data ownership..

- Cath & Wachter, (2020).

V. REGULATORY FRAMEWORK: Future Directions

Regulatory Oversight

- Effective regulation is essential to address the negative impacts of AI in medical education and research
- Price & Cohen, (2019)

Regulatory bodies must establish guidelines to ensure data privacy, algorithmic transparency, and ethical use of AI.

Ethical Standards

- Institutions must develop and adhere to ethical standards for AI use in education and research
- Van Rijmenam, M. (2024).

Ethical AI development involves continuous monitoring and assessment to mitigate potential harms

CAN WE PROPOSE AI REGULATORY FRAMEWORKS MODEL?

Ethical standards

- respects patient autonomy, privacy, and confidentiality
- adherence to **ethical principles** such as beneficence, non-maleficence, and justice

Legal Standards

- comply with applicable laws and regulations such as; data protection, intellectual property, and **liability**
- establish policies and procedures for the development, deployment, and use of AI systems to ensure legal compliance

Technical Standards

- ensure that AI applications are safe, reliable, and effective
- standards related to data quality, interoperability, and cybersecurity
- establish processes for testing, validation, and monitoring

Regulatory bodies should establish guidelines for the licensure and credentialing of healthcare professionals who use AI technologies, ensuring that they have the necessary skills and knowledge to operate AI systems safely and effectively

CONCLUSION

- Establishing robust regulatory and ethical frameworks is essential to mitigate the identified risks and ensure the responsible use of AI.
- Medical regulatory authorities in Africa should effectively oversee the use of AI in medical education and research
- AMCOA is well-positioned to facilitate collaboration, establish standards, and ensure that AI technologies are integrated responsibly and ethically

THANK YOU

ANNUAL CONFERENCE

ASSOCIATION OF MEDICAL COUNCILS OF AFRICA

REGULATION IN THE ERA OF ARTIFICIAL INTELLIGENCE

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1. Chen, L., Chen, P., & Lin, Z. (2020). Artificial Intelligence in Education: A Review. *IEEE Access*, 8, 75264-75278.
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