

REVIEW ARTICLE

The promise and challenges of Artificial Intelligence-Large Language Models (AI-LLMs) in obstetrics and gynecology

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Article Info	ABSTRACT
<p>Received Apr 7, 2024 Revised May 21, 2024 Accepted May 31, 2024 Published Aug 1, 2024</p> <p>*Corresponding author: Khanisyah Erza Gumilar khanisyah@fk.unair.ac.id</p> <p>Keywords: Artificial Intelligence Large Language Model Obstetrics Gynecology Patient care</p>	<p>The introduction of Artificial Intelligence through Large Language Models (AI-LLM) into medicine holds great promise for improving patient care and medical education, especially in obstetrics and gynecology. AI-LLM can significantly improve diagnostic accuracy and treatment efficiency by utilizing large medical databases, which is especially useful for dealing with rare diseases that are difficult to document or understand by human practitioners alone. In addition, AI-LLM can provide informed patient care recommendations by analyzing large amounts of data and providing insights based on unique patient profiles, with the added benefit of being accessible 24/7 via the internet. This constant availability ensures that patients receive prompt information and assistance as needed.</p> <p>In the field of education, AI-LLMs enhance the learning experience by incorporating interactive simulations into the curriculum, improving medical students' and professionals' practical knowledge. They also ensure that educational materials are always up-to-date reflecting the most recent research and worldwide medical standards. This access latest information from global resources helps to bridge the educational gap, making advanced knowledge more accessible to learners regardless of their geographic location.</p> <p>However, the introduction of AI-LLMs is not without challenges. Ethical issues, such as data privacy and the risk of overreliance on technology, must be addressed. Effective management of these concerns necessitates collaboration among medical professionals, technological experts, academics, hospital committees, and representatives of patients. This multidisciplinary teamwork is vital for upholding ethical norms and preserving patient dignity and respect. AI-LLMs can considerably improve both patient care and medical education in obstetrics and gynecology provided they are appropriately balanced with innovation and ethics.</p>

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Highlights:

1. The article highlights how Artificial Intelligence with Large Language Models (AI-LLMs) greatly improves diagnosis and treatment personalization in obstetrics & gynecology, and also enhances medical education through interactive simulations and up-to-date learning materials.
2. The article also discusses the ethical issues linked to AI, emphasizing the need for cooperation among different stakeholders to use AI responsibly in medicine, focusing on protecting data privacy and minimizing reliance on technology.



INTRODUCTION

In modern medicine, the use of technology, particularly artificial intelligence (AI), has grown dramatically in recent decades. AI in the form of Large Language Models (LLMs) such as ChatGPT, Gemini, and Copilot has demonstrated significant promise in supporting the healthcare sector, including patient care and medical education.¹⁻³ The study and application of AI-LLMs in medicine provide numerous benefits while also posing problems for practitioners and educational institutions.

AI-LLM has gained popularity among the general public due to its ability to provide answers that closely resemble the expertise of a trained doctor or healthcare professional. This capability significantly improves the accessibility and reliability of medical information. One important advantage of AI-LLMs is their 24/7 internet connectivity, which allows them to meet human needs globally, regardless of time or location. Whereas the “Google doctor” phenomenon of the previous decade was considered quite limited and tended to contradict doctors' decisions, AI-LLM has gone a step further with improved quality and accuracy of the answers generated. As such, AI-LLM has the potential to play an important role in healthcare, especially two key aspects that require careful utilization and management: patient care and medical education. By effectively utilizing AI-LLM, healthcare providers can offer more accurate diagnoses and personalized treatment plans, while enhancing the educational experience for medical students and professionals, ensuring they have access to the latest knowledge and training tools.

THE ROLE OF AI IN OBSTETRICS & GYNECOLOGY PATIENT CARE

In the context of general patient care, AI-LLM can be utilized to improve the quality of diagnosis and the efficiency of the treatment.^{4,5} One of the most promising features is the use of AI-LLM to support diagnosis systems. By accessing vast medical databases and up-to-date information on diseases, AI-LLM can provide fast and accurate diagnosis recommendations to doctors. This is especially helpful in identifying rare and complex diseases that medical practitioners may not often encounter.

Meanwhile, AI-LLM can also be used for treatment personalization.⁶ By integrating individual patient data, such as medical history, genetics, and environmental

factors, AI-LLM can assist doctors in designing treatment plans that are better suited to each patient's specific needs. This technology opens up opportunities for more focused and result-oriented care, which can ultimately improve patient health outcomes.

A recent study revealed that ChatGPT is a powerful tool that has the potential to enhance obstetric patient care.^{7,8} Similar to the previous study, the same AI-LLM is able to correctly answer questions in obstetric gynecology up to 90%.⁹ Another study reports that ChatGPT has the potential to serve as a valuable aid for healthcare professionals in refining differential diagnoses,¹⁰ and advise the general public on maternity preparedness information.¹¹ Interestingly, AI-LLM also plays a role in the development of patient monitoring systems. For example, AI-based systems can provide analysis of laboratory results, and translate doctor's notes including recommending personalized health.¹² If this is applied in the scope of obstetrician-gynecology patients, it will help the doctor's task in managing patients more comprehensively and effectively. This not only improves patient adherence to treatment plans but also helps in proactive patient health management.

Our study results also show the amazing ability of ChatGPT, Gemini, and Copilot to provide adjuvant therapy recommendations for endometrial cancer.¹³ Although there are significant differences in the recommendation of therapies based on location, the expertise of each AI-LLM is convincing in addressing the complex issue of endometrial cancer. It is certainly not impossible in the future for AI to help doctors with CTG and ultrasound interpretation.

Furthermore, our search on PubMed (May 6th, 2024) also yielded 40 works of literature in 2 years (2023-2024) using the search words “ChatGPT” and “obstetric”. This phenomenon will continue to grow every day and become a hot trend. Around the same time, Google launched Med-Gemini aimed at improving the quality of healthcare through better diagnosis, more efficient research discovery, wider access to information, and overall advancements in the use of AI in the medical field.¹⁴ This shows the interest of researchers and clinicians in involving AI-LLM as a tool for diagnosis, patient management as well as evaluation in improving better patient care. As a concise and comprehensive overview, the promising opportunities of the role of AI-LLM in the field of obstetric gynecology are set out in the following illustration (Figure 1).

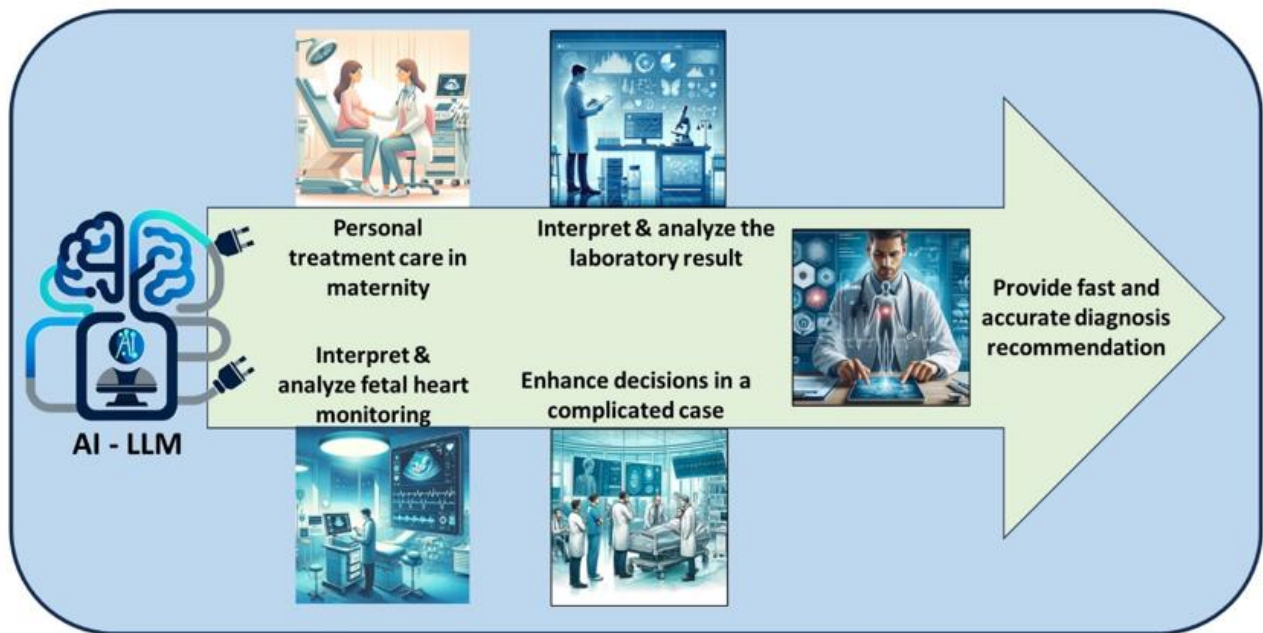


Figure 1. The role of AI-LLM in obstetric gynecology. There are at least 5 areas where performance can be improved. There is a huge opportunity for AI-LLM in its role in gynecologic obstetric services in the future.

AI ROLES IN MEDICAL EDUCATION

In terms of medical education, AI-LLM offers the potential to transform the way medical education is delivered and acquired. AI-LLM can be integrated into medical curricula to provide realistic and interactive simulations, helping medical students learn diagnosis and treatment in a risk-free environment.^{15,16} These simulators allow medical students to practice diagnosis and treatment in a safe setting, considerably increasing their practical abilities without jeopardizing actual patients. For example, AI-LLMs can provide virtual patient situations in which students can practice communication skills, medical decision-making, and clinical interactions. These scenarios can simulate a wide range of medical situations and patient responses, giving students a varied and complete teaching experience.

Furthermore, AI-LLM can also be a valuable tool in the ongoing training of doctors and healthcare workers. With the ability to update current information, AI-LLM can provide educational materials that are always up-to-date and relevant to the latest developments in medicine. In terms of enhancing practical ability, AI-LLM provides features where students can repeatedly practice clinical procedures and skills, leading to mastery in the pursuit of competencies. For example, AI-LLM can guide students through the diagnostic process, interpret test results, and suggest possible

treatment plans. This hands-on approach helps students gain confidence in their clinical abilities before they face actual patients. This is especially important in the rapidly changing medical world, where up-to-date knowledge is essential for effective medical practice.

In addition, AI-LLM is able to adjust to the pace and learning style of each learner. By providing personalized feedback and adjusting the complexity of the simulation based on the student's progress, AI-LLM ensures that every student can optimize their educational journey. This personalized approach is especially beneficial for students who may need more time to understand certain concepts or who excel in certain areas and need advanced challenges.

AI-LLM can also facilitate access to learning resources. Students and healthcare professionals from under-resourced regions can gain access to world-class educational materials that may not be available in their location. This helps reduce disparities in the quality of medical education between regions and countries, and in turn improves healthcare standards globally.

SOME OTHER POTENTIALS OF AI IN MEDICAL EDUCATION

AI-LLM is not only beneficial for medical students but also serves as a valuable resource for the continuous

education of practicing doctors and healthcare workers. The medical field is characterized by rapid advancements, and staying updated with the latest research and treatment guidelines is crucial for effective practice. It can provide up-to-date educational materials that reflect the latest developments in medicine, ensuring that healthcare professionals have access to current and relevant information.

For instance, AI-LLM can assist in continuing medical education (CME) by offering modules on new treatment protocols, emerging diseases, and advancements in medical technology. This ongoing training helps healthcare professionals maintain their competence and stay informed about innovations that can improve patient care. Additionally, AI-LLM can facilitate the completion of mandatory CME credits required for maintaining medical licensure, making the process more efficient and accessible.

In under-resourced regions, where access to advanced medical training and resources is limited, AI-LLM can provide world-class educational materials and simulations. This accessibility helps bridge the gap between different regions and ensures that medical students and professionals worldwide receive consistent and high-standard education.¹⁷ By making these resources available online, AI-LLM enables learners from remote and underprivileged areas to access the same training as those in well-equipped institutions. This not only improves the quality of medical education globally but also contributes to better healthcare standards. As a result, disparities in medical education and healthcare delivery can be reduced, leading to more equitable health outcomes.

AI-LLM's capability to offer personalized learning experiences is another transformative aspect of its integration into medical education. Each student has unique learning needs and preferences, and AI-LLM can tailor educational content to suit these individual requirements.¹⁸ By analyzing a student's performance and learning patterns, AI-LLM can recommend specific modules, adjust the difficulty level of simulations, and provide targeted feedback. This level of personalization ensures that students remain engaged and motivated throughout their educational journey. It also helps identify areas where a student may need additional support, allowing for timely intervention and remediation. Personalized learning experiences facilitated by AI-LLM lead to more effective education and better preparation for real-world clinical practice.

AI-LLM also ensures that learners as well as practitioners have real-time access to the most recent medical data. Given the quick pace of medical

breakthroughs, it is critical to stay up to date on new research findings, clinical guidelines, and therapeutic improvements. AI-LLM can give learners and practitioners quick access to up-to-date publications and evidence-based procedures, keeping them on the cutting edge of medical knowledge. This real-time access is especially useful in healthcare settings, where timely information might influence patient outcomes. For example, a doctor confronting a complex case can swiftly use AI-LLM to obtain the most recent and relevant information, allowing for more accurate and effective decision-making. This integration of AI-LLM into daily practice ensures that healthcare providers can deliver the best possible care based on the latest evidence.

CHALLENGES AND ETHICAL CONSIDERATIONS

While AI-LLM technology has many advantages, it also poses substantial problems and ethical concerns that must not be neglected. One of the most important challenges is data privacy and security.¹⁹ Health data is among the most sensitive sorts of information, and using AI to manage such data requires extraordinary vigilance to minimize breaches of patient privacy. Ensuring that patient data remains secret and secure is critical, and any breaches might have major ramifications for both patients and healthcare professionals.

Another major concern is the risk of over-reliance on technology. Clinical skills and medical decision-making necessitate substantial training, experience, and the nuanced understanding that comes with hands-on practice.²⁰ AI, while powerful, cannot completely replace the skill and judgment of educated medical practitioners. The use of technological technologies should not lessen the importance of interpersonal skills and clinical knowledge among healthcare providers. Instead, AI should be considered as a compliment to human capabilities, rather than a replacement for them.

As a result, while AI-LLM has the potential to improve healthcare, its adoption should be approached with caution. Protecting data privacy and security, as well as maintaining the primacy of human clinical expertise, is crucial to ensuring that AI benefits are realized without violating ethical standards.

Another obstacle to be aware of is AI-LLM's flaws and misinterpretations, which can manifest as hallucinations, fabrications, and even faults in supplying reference sources.^{21,22} As a result, human doctors and health specialists are required and capable of validating

AI-LLM results. Furthermore, this advanced technology must be regulated by giving suitable commands or prompts based on human needs.

Finally, AI-LLM integration in patient care and medical education offers many exciting possibilities to improve efficiency and effectiveness in both fields. However, there must be ongoing efforts to address the challenges and ensure that these technologies are used ethically and responsibly. There are at least 5 representative stakeholders who must collaborate to come up with an agreement that will be followed up by policymakers. The 5 representatives are expert doctors, AI and technology experts, academics, hospital leaders, and patient representatives.

STEPS TO PUT AI-LLM IN ITS PROPER PLACE

Here is a concept for putting the AI-LLM in the proper seat to improve patient care and medical education (Fig 2). The concept comprises of five technical moves for placing the AI-LLM in the appropriate position.

AI-LLM can serve as a clinical assistant and case manager, seamlessly linked to the clinical system. In this role, it can manage patient data, schedule appointments, and provide reminders for follow-up care. By automating administrative tasks, AI-LLM allows healthcare providers to focus more on direct patient care. Additionally, it can analyze patient records and identify trends or anomalies, facilitating early intervention and personalized care plans.²³ This proactive approach enhances patient outcomes by ensuring timely and accurate responses to evolving health conditions.

Additionally, AI-LLM can function as a diagnostic tool, improving the efficiency and accuracy of medical diagnoses. By processing vast amounts of clinical data, AI-LLM can identify patterns and correlations that might be missed by human practitioners.²⁴ For example, it can analyze medical images, lab results, and patient histories to suggest potential diagnoses and recommend further tests. This capability not only supports healthcare providers in making informed decisions but also helps in reducing diagnostic errors. The integration

of AI-LLM into diagnostic processes can lead to faster, more precise identification of medical conditions, ultimately enhancing patient care.

Moreover, chatbots can aid in developing treatment strategies based on current evidence and patient preferences. By continuously reviewing the latest medical research and clinical guidelines, AI-LLM ensures that treatment plans are up-to-date and aligned with best practices. It can also incorporate patient-specific factors, such as genetics, lifestyle, and preferences, to tailor treatment plans. This personalized approach not only improves the effectiveness of treatments but also enhances patient satisfaction by involving them in their care decisions. AI-LLM's ability to synthesize complex data into actionable insights supports clinicians in making well-informed treatment choices.

Meanwhile, incorporating AI-LLM into medical education and training programs can revolutionize how healthcare professionals are trained. AI-LLM can simulate challenging clinical scenarios in a safe and controlled environment, allowing students to practice and hone their skills. It can provide instant feedback and adapt to each student's learning pace and style, identifying areas that require additional attention. Furthermore, AI-LLM ensures that students and faculty have rapid access to the latest journals, case studies, and research findings, keeping them informed about advancements in medical science. This dynamic and interactive learning model fosters a deeper understanding of complex medical concepts and prepares students for real-world clinical challenges.

Ethical and security issues are critical considerations in the integration of AI-LLM into healthcare. Ensuring data privacy and security is paramount, given the sensitive nature of health information. A consensus among various stakeholders, including healthcare providers, policymakers, and technology experts, is necessary to establish robust guidelines and regulations. Ethics training should be incorporated into medical curricula to educate future healthcare professionals about the importance of data security and patient confidentiality. This training will equip them with the knowledge and skills to navigate ethical dilemmas and ensure compliance with data protection regulations.

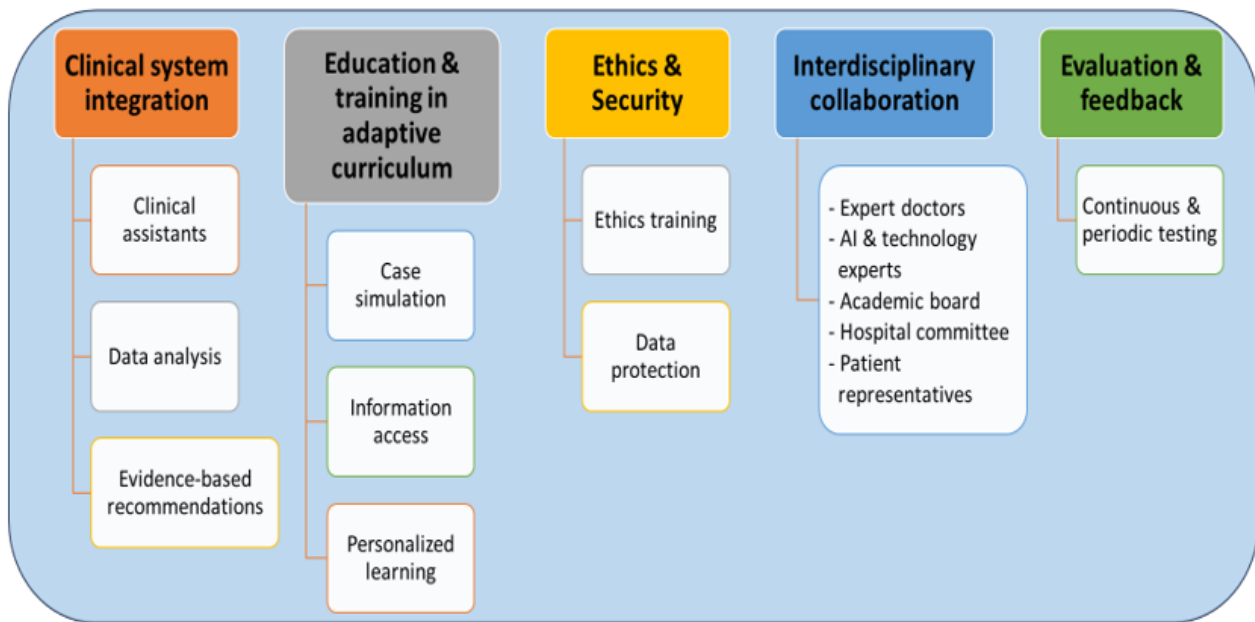


Figure 2. Strategies for utilizing AI-LLM in healthcare services and medical education

This requires interdisciplinary collaboration among several disciplines with the same vision and mission of developing AI in medicine ethically and successfully. As a last phase, evaluation and feedback should be provided through ongoing and regular examinations. This type of evaluation will ensure that the quality of service and education remains high, as well as provide an opportunity for introspection and innovation to bring about new and better things. Hopefully, by implementing these five measures, AI-LLM can considerably improve the quality of patient care and medical education.

CONCLUSION

The use of AI through Large Language Models (AI-LLMs) in healthcare and medical education is proven to be quite effective. AI-LLMs improve diagnostic accuracy and therapy customization, especially in obstetrics and gynecology, and contribute to holistic patient care. They also transform medical training by creating dynamic, simulation-based learning environments that keep instructional content up-to-date and accessible around the world. However, key concerns like as data protection, technology dependence, and the necessity for precise AI performance must be addressed by joint regulation and ongoing oversight. AI-LLMs, when properly managed, have the potential to greatly improve both patient care quality and medical education standards around the world.

DISCLOSURES

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During the preparation of this work the authors used Open AI ChatGPT-4.0 in order to improve language and readability. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

Conflict of Interest

The authors have no conflict of interest.

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Author contribution

This manuscript was conceived, written, and revised by KEG and MT. All authors have read and approved the manuscript.

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