The Potential Impact of Open Access Artificial Intelligence Technologies on Improving Maternal Health Outcomes in Obstetrics and Gynecology

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Abstract

Open access artificial intelligence technologies offer significant opportunities for early risk detection, complication prediction, and personalized care in maternal health. In the literature, algorithms such as random forest, XGBoost, and deep learning have been shown to provide

higher accuracy and sensitivity compared to classical methods in complications such as preeclampsia, preterm birth, and gestational diabetes. Open-source and low-cost solutions have the potential to increase access to healthcare and reduce inequalities, particularly in low- and middle-income countries.

Mobile applications and clinical decision support systems reduce the workload of healthcare professionals, enhance standardization of care, and strengthen patient safety. However, challenges such as data security, algorithmic bias, data quality, clinical integration, and ethical-legal regulations persist. The transparency and community-based development of open access systems may provide advantages in overcoming these challenges.

In conclusion, open access artificial intelligence technologies have the potential to contribute to maternal health in obstetrics and gynecology. The development of explainable, human-centered, and locally adapted artificial intelligence models and compliance with ethical standards are necessary for sustainable and effective implementation.

Keywords: Artificial intelligence, maternal health, obstetrics, open access, machine learning, clinical decision support, equity in health care.

Introduction

Maternal health is one of the fundamental indicators of sustainable development and the effectiveness of health systems in societies. According to the World Health Organization, approximately 260,000 women die each year due to complications related to pregnancy and childbirth (1). Maternal mortality and morbidity rates remain high, particularly in low- and middle-income countries, exacerbated by inequalities in access to healthcare, inadequate infrastructure, lack of education, and socioeconomic factors (1,2). Improving maternal health outcomes is a priority under the United Nations Sustainable Development Goals and highlights the need for innovative solutions (1).

Artificial intelligence (AI) technologies are emerging in the healthcare field through applications such as data analytics, disease prediction, clinical decision support, and automation (2,3). By processing large and complex datasets, it has become possible to identify risks during pregnancy early on, predict complications, and create personalized care plans (2,4). Algorithms developed in subfields such as machine learning and deep learning can make predictions and classifications with high accuracy in maternal health (4-6). These technologies contribute not only to diagnosis and treatment but also to patient monitoring, education, and administrative processes (2,7).

Open-access AI technologies are democratizing digital transformation in healthcare and making it accessible to a wider audience. Open-source software and publicly available algorithms,

especially by offering low-cost and scalable solutions, enable the implementation of innovative healthcare services even in resource-constrained regions (8,9). This facilitates access to information for healthcare professionals and patients, improving service quality and accessibility (9,10). The transparency and community-based development of open access systems also offer advantages in terms of reducing algorithmic bias and ensuring compliance with ethical standards (3,11).

However, the widespread adoption of AI-based applications also brings challenges such as data privacy and security, algorithmic bias, integration into clinical workflows, and training of healthcare professionals (3,12,13). Additionally, algorithms must be adapted to local data and needs, and explainability and ethical responsibilities must be ensured (3,11).

This article comprehensively evaluates the effects of open access AI technologies on maternal health in obstetrics and gynecology, their application areas, success factors, and encountered obstacles in light of the current literature. The aim is to summarize the current situation and provide guiding recommendations for future research and applications.

Method

This article reviewed original research, systematic articles, meta-analyses, observational studies, clinical practice reports, and modeling studies published between 2020 and 2025 that examined the impact of open access AI technologies on maternal health outcomes in obstetrics and gynecology. Literature searches were conducted in the Semantic Scholar, PubMed, Scopus, and Web of Science databases using the keywords “open access artificial intelligence,” “AI in maternal health,” “obstetrics and gynecology,” “maternal outcome,” “machine learning,” “deep learning,” “risk prediction,” and “clinical decision support.” Reference lists and journal archives were also reviewed manually.

Inclusion Criteria:

- Studies evaluating the impact of artificial intelligence or machine learning applications on maternal health outcomes
- Populations including pregnant or reproductive-age women
- Reporting of maternal health outcomes (mortality, morbidity, complications, psychosocial conditions, perinatal outcomes, etc.)
- Use of open-access or publicly available AI algorithms
- Presentation of clinical application and/or outcome data

Exclusion Criteria:

- Studies focusing solely on fetal or neonatal outcomes

- Technical algorithm descriptions without clinical application or outcome reporting
- Editorial articles, conference abstracts, and letters

From the eligible studies, the study design, sample size, population characteristics, AI technology and algorithm type used, data sources, primary/secondary outcomes, performance measures, and ethical/implementation dimensions were systematically extracted.

Statistical analyses used accuracy, sensitivity, specificity, AUC, F1 score, and appropriate tests. Since this article uses only previously published data obtained from publicly available sources, no new data was collected from human participants and no direct intervention was made. Therefore, ethical committee approval is not required for this study according to national and international ethical standards.

Findings

Application Areas of Open Access AI Technologies

Open access AI algorithms are widely used for the early detection and risk prediction of maternal complications (preeclampsia, preterm birth, gestational diabetes, postpartum hemorrhage, etc.) (4,9,14).

Neural networks, random forests, XGBoost, and deep learning algorithms have been successfully applied to structured and unstructured data using electronic health records and natural language processing techniques (4,5). Mobile applications are particularly effective in expanding healthcare services in rural and low-income areas (9,10,15). AI-based systems are also used in the prediction and management of psychosocial risks such as perinatal depression and anxiety (12,16). Clinical decision support systems reduce the workload of healthcare professionals and ensure standardization of care through diagnosis, risk classification, and treatment recommendations (2).

Clinical Outcomes and Impact

The clinical outcomes of AI-based open-access applications in the early detection and risk prediction of maternal complications offer significant gains for maternal and infant health. These technologies stand out for their high accuracy rates in predicting common and high-risk complications during pregnancy, such as preeclampsia, preterm birth, and gestational diabetes (4,5,9,14).

Various studies have reported that models using algorithms such as random forest, XGBoost, artificial neural networks, and deep learning achieve higher sensitivity, specificity, and overall accuracy rates compared to classical statistical methods. For example, random forest and deep learning-based models have been shown to provide over 90% accuracy and high AUC (Area Under the Curve) values in predicting preeclampsia risk (9).

Artificial intelligence models developed for gestational diabetes and preterm birth are also able to provide earlier and more effective warnings than traditional risk scoring, thereby saving time for healthcare professionals in preventing or effectively managing complications (5,14). This high performance offers significant advantages, particularly in low- and middle-income countries where access to healthcare is limited.

Open-access and low-cost artificial intelligence applications enable early detection of complications and contribute to the prevention of maternal and infant mortality in settings where basic healthcare services are unavailable or there is a shortage of specialist physicians (9,10). These systems, integrated with mobile applications and portable devices, support the decision-making processes of field workers and midwives, thereby improving the quality of care.

The use of clinical decision support systems reduces the workload of healthcare workers, increases standardization in care, and improves patient safety. These systems reduce unnecessary tests and interventions by providing patient-specific risk scores and recommendations, ensuring the effective use of resources. Especially in environments where inexperienced healthcare personnel work, AI-supported systems facilitate the adoption of guideline-based clinical decisions and ensure equity in care (2).

Furthermore, analyses using natural language processing techniques have enabled the identification of racial and socioeconomic biases in health records and improved data quality (13). AI-based automation speeds up administrative processes and supports healthcare professionals in patient education and follow-up (9,15).

All these findings demonstrate that AI-based open access technologies offer clinically meaningful and practical benefits in the early detection of maternal complications and risk prediction, and play an important role in personalizing care processes and strengthening health systems. However, the success of these technologies varies depending on factors such as the quality of the data used, the suitability of the algorithms for local populations, and the training of healthcare professionals. Therefore, a multidimensional approach is required for the widespread adoption and sustainability of these systems.

Success Factors and Barriers

High-quality and accessible data, explainable and transparent algorithms, user-friendly design, community participation, and interdisciplinary collaboration are crucial for the successful implementation of open access AI technologies in maternal health. The widespread adoption of electronic health records, the cost reduction of open-source software, and seamless integration into clinical workflows facilitate the adoption of these technologies. Additionally, transparent

and explainable models enhance the trust of healthcare professionals and patients, while community-based development processes ensure that systems are continuously updated and adapted to local needs (4,9,11).

However, challenges such as inadequate data security and privacy, algorithmic bias and generalizability issues, technical infrastructure deficiencies, clinical integration difficulties, and ethical and legal uncertainties remain significant barriers. In particular, the lack of digital infrastructure and financial resources in low- and middle-income countries can limit the widespread adoption of AI applications. Furthermore, the absence of clear ethical and legal regulations creates uncertainty regarding responsibility and accountability, making the sustainable integration of technology into healthcare services challenging (3,9,12,13).

Discussion

Open-access AI technologies have the potential to reshape not only technical innovation but also the functioning of healthcare systems, the roles of healthcare workers, and social equity.

Findings indicate that these technologies achieve high accuracy rates in the early detection of maternal complications and risk prediction, playing a critical role in preventing complications such as preeclampsia, preterm birth, and gestational diabetes (4,5,14).

The high accuracy rates of AI-based applications in the early detection of maternal complications are of great importance for maternal and infant health. Complications such as preeclampsia, preterm birth, and gestational diabetes carry serious morbidity and mortality risks for both the mother and the fetus. To prevent or effectively manage these complications, risks must be identified as early as possible and in a reliable manner (9). Traditional risk assessment methods primarily rely on clinical observation, history, and standard laboratory tests. However, these methods may not adequately account for individual variations and multiple risk factors and may be susceptible to subjective evaluations in some cases. Artificial intelligence, on the other hand, can analyze multidimensional and large datasets (e.g., demographic data, laboratory results, vital signs, medical history, genetic information) simultaneously, uncover complex relationships, and provide more accurate risk predictions (4,5).

For example, in the case of preeclampsia, a difficult-to-predict complication, random forest and deep learning algorithms have been shown to achieve over 90% accuracy and high AUC values (9). Similarly, models developed for preterm birth and gestational diabetes offer higher sensitivity and specificity compared to classical statistical methods (5,14). This high performance provides significant advantages in preventing complications or enabling early intervention, particularly in low-resource settings or regions with limited access to healthcare services.

Another advantage offered by artificial intelligence is the ability to dynamically update and personalize risk predictions over time. As the patient's clinical condition, lifestyle changes, or new laboratory results are entered into the system, algorithms can automatically recalculate risk scores. This enables continuous monitoring and proactive intervention (2).

The impact of clinical decision support systems on standardization and patient safety in care is also noteworthy. Clinical decision support systems reduce human error and forgetfulness by providing healthcare professionals with patient-specific recommendations and alerts, thereby increasing adherence to treatment guidelines. Additionally, they strengthen clinical decision-making processes and promote equity in care, particularly in settings where less experienced healthcare personnel are present (2).

Thanks to the integration of these systems, unnecessary tests and interventions can be reduced, while more efficient use of resources and increased patient satisfaction can be achieved. However, the success of clinical decision support systems depends on being fed with accurate and up-to-date data, the explainability of algorithms, and the trust of healthcare professionals in these systems.

Factors such as algorithmic bias, data gaps, or the system's incompatibility with clinical workflows can limit potential benefits. Therefore, the development and implementation of AI-based systems require validation across multiple centers and diverse populations, the creation of user-friendly interfaces, and the establishment of ongoing education programs (3,11).

Open-access AI systems promote health equity and narrow the technological divide in low-resource settings (8,9). However, algorithmic bias and inadequate data representation carry the risk of exacerbating health inequalities (13). Data quality, the lack of electronic health records, and the adaptation of models to local populations are important limitations (3). Integration into clinical workflows and training of healthcare professionals are other important factors determining the effectiveness of applications (4). The development of explainable AI approaches and the improvement of user experience are necessary (11).

From an ethical and legal perspective, data privacy, transparency, and accountability for algorithmic decisions are important areas of discussion (3,12). Models must be continuously monitored, updated, and made sensitive to societal variables (11,13). In health policies, public-private sector collaboration should be encouraged for sustainability through data sharing, standard setting, and the establishment of legal frameworks (8,9,12).

In the future, research should focus on real-world application and impact analyses, explainability, data ecosystems, ethics/public participation, and policy/standards. This article is

limited to the published literature, and the performance of algorithms and application results may vary from study to study. More field research and long-term impact analyses are needed.

In conclusion, AI-supported risk prediction models and clinical decision support systems offer revolutionary opportunities for preventing maternal complications and improving patient safety. However, a holistic approach at the ethical, technical, and operational levels is necessary for the sustainable and effective integration of these technologies into healthcare systems.

Conclusion

Open-access AI technologies offer significant opportunities for improving maternal health outcomes in obstetrics and gynecology. AI-based systems enable highly accurate risk prediction during pregnancy and childbirth, early detection of complications, and individualized care processes. In addition, advantages such as reduced administrative workload and more efficient use of resources increase the overall efficiency of healthcare services. These technologies have the potential to increase access to and quality of healthcare, especially in low- and middle-income countries. However, the widespread use of artificial intelligence applications brings with it some ethical, legal, and practical challenges.

Issues such as data privacy and security, prevention of algorithmic bias, model explainability, and integration into clinical workflows must be addressed with great care. Furthermore, factors such as infrastructure, financing, and user training should be considered in the integration of these technologies into existing healthcare systems. In the long term, an ethical, transparent, and human-centered approach should be adopted to ensure that the opportunities offered by artificial intelligence are made available to all segments of society in a fair and sustainable manner. In this context, collaboration between policymakers, healthcare professionals, and technology developers will pave the way for lasting and meaningful improvements in maternal health.

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