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Role of Artificial Intelligence in High-Risk Obstetrics

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Abstract

High-risk obstetric care requires vigilant surveillance and timely decision-making. Artificial Intelligence (AI)-including machine learning, deep learning, and natural-language processing-offers novel capabilities for early risk prediction, continuous monitoring, and decision support. This article reviews current applications of AI in high-risk obstetrics, delineates benefits and limitations, outlines implementation and ethical considerations, and proposes a pragmatic roadmap for responsible integration into maternal–fetal medicine.

Keywords: Artificial Intelligence, Machine Learning, Obstetrics, High-Risk Pregnancy, Maternal-Fetal Medicine, Decision Support, Fetal Monitoring

Introduction

High-risk pregnancies-including those complicated by hypertensive disorders, gestational diabetes, fetal growth restriction, placenta-related dysfunction, multiple gestation, prior adverse obstetric events, or significant comorbidity-require individualized surveillance. Traditional risk tools and intermittent monitoring may miss early signals of deterioration. AI systems can learn complex, non-linear patterns from multimodal data (electronic health records, imaging, laboratory biomarkers, and physiologic streams) to provide individualized predictions and timely alerts.

Figure 1. Ai Workflow from Data to Outcomes in High-Risk Obstetrics

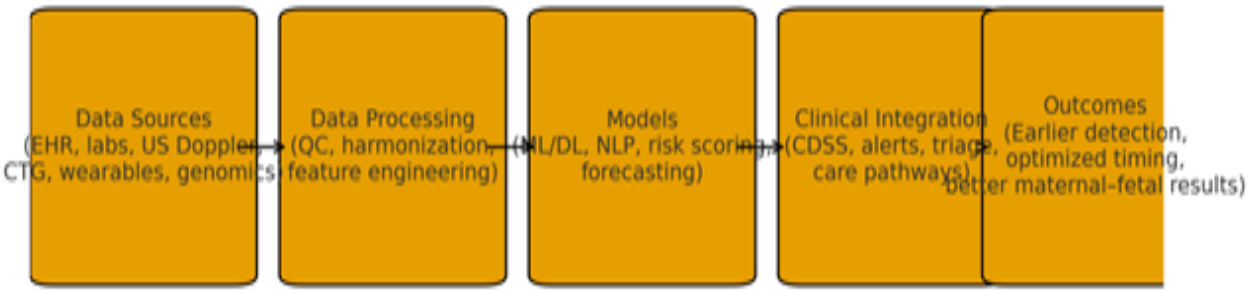

Figure 1: Schematic of an AI-enabled pipeline: data acquisition → processing → models → clinical integration → outcomes.

Applications of AI in High-Risk Obstetrics

Risk stratification and prediction

Supervised learning models predict preeclampsia, preterm birth, and postpartum hemorrhage using demographics, history, imaging, and biomarkers. Explainable approaches (e.g., SHAP) help identify key predictors for targeted care.

Real-Time Monitoring and Early Warning

Deep learning applied to cardiotocography (CTG) and multimodal maternal–fetal signals can detect evolving fetal distress or maternal decompensation and generate actionable alerts within labor and delivery or for remote monitoring.

Clinical Decision Support and Delivery Planning

AI-augmented clinical decision support systems (CDSS) can synthesize maternal and fetal status with gestational age and resource availability to assist timing of delivery, level of care, and transfer decisions.

Imaging and Biomarker Integration

Convolutional networks and radiomics have been explored for placental segmentation, prediction of placenta accreta spectrum, and early detection of placental insufficiency when combined with Doppler and serum markers.

Remote and Tele-Obstetric Management

Wearables, home BP/glucose monitoring, and smartphone-enabled inputs can feed AI services that triage alerts to clinicians, improving access for women in remote or resource-constrained settings.

Table 1. Representative Ai Applications in High-Risk Obstetrics

Clinical task	Typical data	Model approach	Clinical utility
Preeclampsia prediction	Maternal history, BP, labs, Doppler, biomarkers	Gradient boosting, DL ensembles	Early prophylaxis & surveillance
Preterm birth prediction	EHR, cervix length, infections, lifestyle, surveys	Random forests, XGBoost, SHAP	Targeted tocolysis & transfers
CTG interpretation	FHR, uterine activity time-series	CNN/RNN, transformers	Real-time alerts & delivery timing
Placenta accreta spectrum	US/MRI imaging, radiomics	CNNs, radiomics + ML	Peripartum planning & blood products
GDM screening/management	Glucose logs, diet, activity	Classification + forecasting	Personalized targets & follow-up
SMM prediction (NLP)	Admission notes, free-text	NLP (BERT), logistic heads	Triage to higher-level care

Benefits and Limitations

Potential benefits include earlier risk identification, tailored surveillance, optimized resource allocation, and decision support at critical junctures. Limitations include data bias and drift, generalizability, explainability gaps, and the need for rigorous prospective validation.

Table 2. Benefits, Limitations, and Mitigation Strategies

Benefits	Limitations/Risks	Mitigation strategies
Earlier detection; individualized risk	Data bias; poor external validity	Diverse multicenter datasets; fairness audits
Continuous monitoring & alerts	Alarm fatigue; false positives	Human-in-the-loop thresholds; calibration
Decision support for delivery planning	Opaque models; low trust	Explainable AI; transparent reporting

Resource optimization	Workflow misfit	Co-design with clinicians; EHR integration
Remote care access	Privacy/security concerns	Privacy-by-design; consent and governance

Figure 2. Multimodal data integration for obstetric AI

Figure 2: The AI engine integrates signals from maternal history, vitals/wearables, ultrasound/Doppler, CTG, biomarkers, therapies, social determinants, and omics to generate actionable risk and decision support.

Implementation Framework for Responsible Adoption

- Multidisciplinary co-design with obstetricians, MFM specialists, neonatologists, data scientists, and ethicists.
- Robust data infrastructure, interoperable standards, and privacy-preserving governance.
- Transparent model development with internal + external validation; reporting per TRIPOD-AI/CONSORT-AI.
- Clinician-centric UX integrated into EHR/CDSS; training and change-management.
- Prospective pilots with outcome endpoints (maternal/neonatal outcomes, equity metrics, cost-effectiveness).
- Post-deployment monitoring for bias, drift, and safety with feedback loops and model updates.

Ethical and Equity Considerations

AI in obstetrics must protect autonomy, privacy, and safety; minimize algorithmic bias; and ensure equitable access. Transparent consent, clear liability frameworks, and continuous auditing are essential, particularly as models begin to influence delivery timing and triage decisions.

Future Directions

Promising trajectories include multimodal foundation models tailored to perinatal care; edge AI for on-device fetal monitoring; federated learning for privacy-preserving multicenter training; and pragmatic trials establishing outcome benefits across diverse populations.

Conclusion

AI can augment high-risk obstetric care by enabling earlier detection, targeted surveillance, and informed delivery planning. With rigorous validation, ethical safeguards, and clinician-centered integration, AI systems can help improve maternal and neonatal outcomes while optimizing scarce resources.

References

1. Ranjbar A, Montazeri F, Ghamsari SR, Mehrnoush V, Roozbeh N. et al. (2024). Machine learning models for predicting preeclampsia: a systematic review. BMC Pregnancy and Childbirth 24(1), 6.
2. Lin X, Liang C, Liu J, Lyu T, Ghumman N, Campbell B (2024) Artificial intelligence–augmented clinical decision support systems for pregnancy care: systematic review. Journal of medical Internet research 26, e54737.
3. Clapp MA, Kim E, James KE, Perlis RH, Kaimal AJ. et al. (2022). Natural language processing of admission notes to predict severe maternal morbidity during the delivery encounter. American Journal of Obstetrics and Gynecology 227(3), 511-e1.
4. Park CE, Choi B, Park RW, Kwak DW, Ko HS, et al. (2025). Automated interpretation of cardiotocography using deep learning in a nationwide multicenter study. Scientific Reports 15(1), 19617.
5. Pardasani R, Vitullo R, Harris S, Yapici HO, Beard JW (2025) Development of a novel artificial intelligence algorithm for interpreting fetal heart rate and uterine activity data in cardiotocography. Frontiers in Digital Health 7, 1638424.
6. AlSaad R, Elhenidy A, Tabassum A, Odeh N, AboArqoub E. et al. (2025). Artificial Intelligence in Gestational Diabetes Care: A Systematic Review. Journal of diabetes science and technology. 19322968251355967.
7. Ahmed SAA, et al. (2025) AI for early detection of preeclampsia: toward deep phenotyping pregnancy.
8. Yeganegi M, Danaei M, Azizi S, Jayervand F, Bahrami R. et al. (2025). Research advancements in the Use of artificial intelligence for prenatal diagnosis of neural tube defects. Frontiers in Pediatrics 13: 1514447.
9. Jittou A, Fazazy KE, Riffi J (2025) Placenta segmentation redefined: review of deep learning integration of magnetic resonance imaging and ultrasound imaging. Visual Computing for Industry, Biomedicine, and Art 8(1), 17.
10. Ding L, Yin X, Wen G, Sun D, Xian D. et al. (2024). Prediction of preterm birth using machine learning: a comprehensive analysis based on large-scale preschool children survey data in Shenzhen of China. BMC Pregnancy and Childbirth 24(1), 810.
11. Kloska A, Harmoza A, Kloska SM, Marciniak T, Sadowska-Krawczenko I. (2025) Predicting preterm birth using machine learning methods. Scientific Reports 15(1), 5683.
12. Layton AT (2025) Artificial intelligence and machine learning in preeclampsia. Arteriosclerosis, Thrombosis, and Vascular Biology 45(2), 165-171.
13. WHO/UN reports on maternal mortality trends and disparities (2023–2025).
14. Ibrahim H, Liu X, Rivera SC, Moher D, Chan AW. et al. (2021). Reporting guidelines for clinical trials of artificial intelligence interventions: the SPIRIT-AI and CONSORT-AI guidelines. Trials 22(1), 11.
15. Collins GS, Dhiman P, Navarro CLA, Ma J, Hooft L. et al. (2021). Protocol for development of a reporting guideline (TRIPOD-AI) and risk of bias tool (PROBAST-AI) for diagnostic and prognostic prediction model studies based on artificial intelligence. BMJ open 11(7), e048008.