

Promoting Natural Birth Amid the Rising Trend of Cesarean Deliveries with the Aid of Artificial Intelligence

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World Journal of Biology Pharmacy and Health Sciences, 2026, 25(02), 222-228

Publication history: Received on 18 December 2025; revised on 01 February 2026; accepted on 03 February 2026

Article DOI: <https://doi.org/10.30574/wjbphs.2026.25.2.0084>

Abstract

The global rise in cesarean deliveries has become a major public health concern, with many procedures performed without clear medical necessity. While cesarean section (CS) remains a life-saving intervention for high-risk pregnancies, its overuse is linked to increased maternal and neonatal complications. Consequently, promoting safe natural birth has gained renewed emphasis, supported by advancements in medical technologies—particularly artificial intelligence (AI).

This paper explores the role of AI in promoting natural childbirth through predictive, personalized, and real-time approaches. AI algorithms can analyse vast clinical datasets to predict labor risks, personalize care plans, and support real-time decision-making during delivery. Furthermore, AI-driven monitoring systems and educational tools empower both clinicians and expectant mothers, reducing elective and repeat cesarean procedures. Emerging evidence indicates that AI applications in obstetrics, such as predictive models for vaginal birth after cesarean (VBAC) and continuous fetal monitoring, enhance maternal and neonatal outcomes while improving clinical confidence in natural birth management. Despite its potential, AI implementation faces challenges related to data quality, system integration, bias, ethical concerns, and cost. Ensuring transparency, equity, and rigorous clinical validation remains essential to maintain trust and safety.

In conclusion, AI represents a transformative opportunity to complement obstetric expertise, reduce unnecessary surgical interventions, and promote safer, more natural childbirth experiences. The future of obstetric care depends on harmonizing technological innovation with human compassion, ensuring that AI enhances—not replaces—the vital role of clinicians in supporting women through childbirth.

Keywords: Artificial Intelligence; Cesarean; Obstetrics; Vaginal Birth After Cesarean; Natural Birth

1. Introduction

Global healthcare has witnessed a remarkable rise in caesarean deliveries over recent decades. While caesarean section (CS) has historically played a crucial role in reducing maternal and neonatal mortality in high-risk childbirth(1), its overuse has emerged as a significant public health concern(2). Performing CS in low-risk pregnancies is associated with increased short- and long-term health risks for both mothers and newborns(3). In response, there has been renewed emphasis on promoting safe natural birth, supported by advancements in medical technologies. Among these, artificial intelligence (AI) is emerging as a pivotal tool in shaping future obstetric care(4).

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1.1. History of AI

The origins of modern artificial intelligence can be traced back to 1956, when John McCarthy introduced the term “*artificial intelligence*” during a landmark conference at Dartmouth College, marking the formal birth of the field. After initial progress, AI research experienced fluctuations until 2006, when Geoffrey Hinton and colleagues revolutionized the discipline by introducing deep neural networks and solutions to the problem of vanishing gradients(4). Their work sparked the modern wave of AI development.

Artificial intelligence can be described as a computer system designed to simulate human cognitive functions, particularly information processing(5). Its structure is inspired by the organization of the human brain, where interconnected neural nodes form networks capable of recognizing complex patterns. These artificial neural networks (ANNs) provide a mathematical framework for analysing and interpreting multifactorial data(6).

With continuous advancements, AI has become increasingly integrated into everyday life and diverse professional fields, including healthcare. Modern hospitals are evolving rapidly — from basic digital information systems, to interconnected “Internet hospitals,” and ultimately towards the concept of the Smart Hospital, where AI plays a central role in optimizing patient care, clinical decision-making, and operational efficiency(6,7).

1.2. The Rise of Cesarean Deliveries

Cesarean section (CS) is a life-saving surgical procedure that has significantly reduced maternal and neonatal mortality in high-risk pregnancies. However, the continued global rise in CS rates is not fully understood and is increasingly viewed as a challenge for public health(7,8). One major contributor is the decline in vaginal birth after cesarean (VBAC). Obstetricians’ uncertainty about the safety of VBAC, coupled with many women’s reluctance to attempt it, has contributed to higher repeat CS rates(8,9).

In addition, several other factors have been linked to the growing prevalence of CS deliveries:

- **Maternal request:** Increasing numbers of women are opting for elective cesarean delivery, often due to fear of labor pain, perceived safety, or convenience (10).
- **Foetal monitoring technologies:** Advances in monitoring have led to heightened detection of suspected fetal distress, which can prompt early surgical intervention(11).
- **Medical-legal considerations:** Concerns about litigation have encouraged defensive medical practices, with physicians more likely to recommend CS to mitigate perceived risks(12).

In many countries, cesarean rates have exceeded the World Health Organization’s recommended threshold of 10–15%(18), highlighting an over-reliance on surgical intervention. While CS is vital in certain scenarios, unnecessary procedures carry significant risks. For mothers, these include infections, haemorrhage, thromboembolic events, surgical complications, and adverse outcomes in future pregnancies (e.g., placenta previa, placenta accreta, or uterine rupture)(2,10). For infants, risks include transient tachypnoea, altered gut microbiome, and potential long-term impacts on immunity and metabolism(19).

These challenges underscore the importance of promoting safe vaginal births whenever medically feasible, while still ensuring timely access to cesarean procedures when clinically indicated(10).

2. The Role of Artificial Intelligence in Promoting Natural Birth

Artificial intelligence is transforming modern healthcare, and obstetrics is one of the fields with the greatest potential to benefit(6,20). AI applications can support the promotion of natural birth through predictive, personalized, and real-time approaches:

- Predictive Analytics

AI algorithms can process large-scale clinical and demographic data from electronic health records to predict risks during pregnancy and labor. By identifying complications such as obstructed labor(20), foetal distress, or maternal comorbidities early, clinicians can make more precise decisions about when cesarean delivery is essential and when a natural birth can safely be pursued. This reduces unnecessary surgical interventions(6).

- Personalized Care Plans

Machine learning models can integrate individual patient data—such as maternal age, obstetric history, comorbidities, and lifestyle factors—to generate tailored birth plans (20,22). Personalized recommendations can optimize maternal and neonatal outcomes while aligning with mothers' preferences, thereby enhancing the likelihood of successful vaginal delivery(6).

- Real-time Monitoring and Decision Support

AI-driven monitoring systems are being developed to analyse maternal and foetal parameters during labor, including cardiotocography (CTG), maternal vital signs, and labor progression (13). These systems can generate real-time alerts when early signs of complications appear, allowing timely interventions while minimizing unnecessary surgical escalation. By supporting clinical judgment, AI enhances safety and confidence in natural labor management(20).

- Education and Support Tools

AI-powered applications, virtual assistants, and mobile platforms can provide evidence-based education and psychological support to expectant mothers (22). These tools empower women by answering questions, alleviating anxieties, and offering guidance on coping strategies for labor. Informed and reassured mothers may be more willing to attempt natural birth, reducing elective cesarean requests.

2.1. Challenges in Implementing AI in Obstetrics

While the potential of artificial intelligence (AI) in obstetrics is considerable, its widespread adoption faces several challenges that must be addressed to ensure safe, equitable, and effective implementation(6,20).

- Data Quality and Availability

AI systems require access to large volumes of high-quality, structured data(20). However, inconsistencies in medical records, incomplete documentation, and variability in data collection methods across institutions can reduce the accuracy and reliability of AI models. Standardizing data input and improving interoperability are essential steps to overcome these limitations(6).

- Integration with Existing Systems

Seamlessly incorporating AI tools into existing hospital infrastructures, particularly electronic health records (EHRs), poses technical and financial challenges (20,21). Ensuring interoperability between AI systems and clinical workflows is crucial to prevent disruptions and to maximize their utility in real-world settings.

- Ethical and Legal Concern

The deployment of AI in healthcare raises important ethical considerations. Protecting patient privacy, safeguarding data security, and ensuring informed consent for data use are critical to maintaining trust(20). Additionally, regulatory and legal frameworks must evolve to govern the responsible application of AI in obstetrics(20,20).

- Bias and Fairness

AI models are only as unbiased as the data on which they are trained. If datasets underrepresent certain demographic or clinical groups, predictions may reinforce existing healthcare disparities(20). Ensuring fairness, equity, and representativeness in training datasets is therefore essential to avoid unintended consequences.

- Clinical Validation

Before clinical adoption, AI tools must undergo rigorous testing and validation to confirm their safety, accuracy, and clinical relevance (13,20). This process requires extensive collaboration between AI developers, healthcare providers, and regulatory bodies, and can be time-consuming.

- **Training and Adoption**

Successful implementation depends on healthcare professionals being adequately trained to use AI-based tools(20). Resistance to new technologies, combined with limited digital literacy among some practitioners, may slow adoption. Ongoing education and change management strategies are vital to encourage acceptance.

- **Cost and Resource Allocation**

Developing and maintaining AI infrastructure involves significant financial investment. Institutions must carefully weigh the costs against potential benefits such as improved efficiency, reduced complications, and long-term cost savings. Equitable access to AI technologies also remains a concern, particularly in low-resource settings(14).

2.2. Electronic Surveillance Systems in Clinical Practice

Electronic surveillance systems represent one of the most practical applications of AI and automated decision-support in modern healthcare. Widely implemented in emergency departments and critical care units, these systems enhance patient safety by continuously monitoring clinical data streams and alerting healthcare providers to potential risks(11,15,19).

An automated health surveillance framework typically involves three key components:

- **Data collection** from wearable devices, sensors, and electronic medical records.
- **Rapid analysis** of real-time patient data using advanced algorithms(15).
- **Timely alerts** to warn clinicians about emerging health risks(21).

Several studies have reported successful deployment of such systems. For instance, AI-enabled surveillance tools have been used to predict severe sepsis in emergency and intensive care settings, enabling earlier intervention and reducing mortality(15,16). Similarly, in perioperative environments, automated monitoring has improved glucose management, demonstrating the potential of AI to enhance decision-making and optimize patient outcomes.

The lessons learned from electronic surveillance systems in critical care can inform the development of similar tools in obstetrics, such as continuous labor monitoring and early-warning systems for maternal or foetal distress(11,21). By adapting these proven frameworks, AI could play a transformative role in improving maternal and neonatal care.

2.3. Innovative Applications of AI in Promoting Natural Birth

Several innovative projects and studies have demonstrated the potential of artificial intelligence (AI) to reduce unnecessary cesarean deliveries and promote safe natural birth(22). These applications span predictive analytics, personalized care, monitoring, decision support, and maternal education.

2.4. Predictive Analytics and Machine Learning Models

Machine learning has been applied to predict the likelihood of a successful vaginal birth after cesarean (VBAC). By analysing electronic health record data—including maternal age, body mass index (BMI), gestational age, and previous obstetric history(7,8)—AI models have demonstrated high accuracy in predicting VBAC outcomes. These tools provide healthcare providers and mothers with crucial insights, supporting evidence-based decision-making and reducing reliance on repeat cesarean deliveries(8,9).

2.5. AI-Powered Foetal Monitoring Systems

AI-driven monitoring technologies have been integrated into hospital settings to continuously analyse foetal heart rate patterns and other maternal-foetal parameters in real time(13). These systems can accurately detect early signs of distress and prompt timely clinical interventions, thereby improving labor outcomes. Studies have shown that such systems reduce non-medically necessary cesarean sections while maintaining high standards of maternal and neonatal safety(13).

2.6. Personalized Care Plans Using AI

AI has been used to generate individualized pregnancy care plans tailored to maternal health status, medical history, and personal preferences. Personalized recommendations improve the likelihood of natural births by optimizing

prenatal care and labor management. Evidence suggests that AI-guided care pathways are associated with higher rates of vaginal delivery and fewer unnecessary interventions(22,25).

2.7. Real-Time Decision Support Systems

AI-based decision-support systems assist clinicians during labor by analysing continuous maternal and foetal data. These systems offer real-time guidance on appropriate interventions, enabling proactive responses to complications(13,25). By enhancing the precision of labor management, AI decision support has been linked to reductions in cesarean delivery rates and improvements in maternal-foetal outcomes.

2.8. AI-Driven Educational Tools and Support Platforms

AI-powered chatbots, mobile applications, and virtual assistants provide expectant mothers with evidence-based education, emotional support, and practical guidance(22). These tools empower women by increasing knowledge, alleviating anxieties, and encouraging informed choices. Studies have found that AI-driven education and support platforms increase maternal confidence in attempting natural birth and reduce elective cesarean requests.

Collectively, these studies highlight the diverse applications of AI in promoting natural birth and minimizing unnecessary surgical interventions.

2.9. Challenges and Ethical Considerations

Despite promising results, the integration of AI in obstetrics raises several challenges and ethical concerns. Accuracy and reliability of algorithms are critical, as incorrect predictions may endanger maternal and neonatal health. Data privacy, informed consent, and algorithmic transparency must be safeguarded to maintain trust(20). Furthermore, ensuring fairness in AI predictions is essential to avoid reinforcing existing healthcare disparities.

AI should complement rather than replace the expertise of obstetricians, midwives, and nurses. Human judgment, empathy, and individualized care remain irreplaceable elements of the childbirth experience.

Ethical frameworks guiding AI implementation must uphold principles such as autonomy, justice, fairness, equality, self-determination, and privacy. Addressing these considerations will ensure equitable access to AI-based solutions while protecting patient rights.

3. Conclusion

Promoting natural birth amid the rising rates of cesarean deliveries is a critical priority for improving maternal and neonatal outcomes. AI offers a powerful set of tools—including predictive analytics, personalized care, real-time monitoring, and educational platforms—that can support clinicians and empower expectant mothers.

If implemented responsibly, AI has the potential to ease the workload of healthcare providers, generate reliable population-level data, and extend high-quality obstetric care to underserved regions, including low-resource settings(22). Developing explainable AI models will further increase clinician confidence and accelerate adoption.

Ultimately, the future of obstetric care lies in the collaboration between advanced technologies and human expertise. By leveraging AI while preserving the irreplaceable human touch in maternity care, healthcare systems can reduce unnecessary cesarean deliveries and promote safer, more natural birth experiences worldwide.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

“Informed consent was obtained from all individual participants included in the study.

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