Artificial Intelligence Facilitated Insight in Maternity Nursing

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Introduction

In the labor and delivery setting, fetal heart rate is a critical indicator of fetal well-being and guides timely interventions to protect both mother and baby. Artificial intelligence (AI) refers to computer systems programmed and learning machines used to replicate human reasoning and decision-making. In obstetrics, AI is being introduced to assist with interpreting fetal heart rate patterns, analyzing ultrasound images, tracking labor progression, and identifying early signs of fetal distress that may be missed by traditional assessments (Medjedovic et al., 2024). These technologies improve the processing of fetal signals, making it easier to detect patterns in standard cardiotocography tracings as well as newer methods like fetal electrocardiography and phonocardiography. This leads to faster and more accurate interpretation, allowing nurses to respond with greater confidence during labor (Barnova et al., 2024). As these tools continue to evolve, their influence on clinical decision-making becomes increasingly evident. AI-powered fetal heart rate monitoring systems are transforming maternity nursing by enhancing early detection of fetal distress, reducing unnecessary maternal interventions, and supporting nurses in making faster, evidence-informed decisions during labor and delivery.

Over the past century, fetal heart rate monitoring has undergone significant changes. It began with manual assessments and gradually moved toward continuous, technology-based methods as advancements allowed. Early approaches included intermittent auscultation using fetoscopes and paper tracings, which were often difficult to manage and interpret. As clinical needs grew, cardiotocography became the standard because it allowed for live visualization of fetal heart rate and uterine contractions. This improvement helped nurses and healthcare providers monitor fetal and maternal status more accurately throughout labor. With the

advancement of technology, other methods, such as Doppler ultrasound and fetal electrocardiography, have become available, offering both invasive and noninvasive ways to assess fetal health from different angles. These developments have shaped modern maternity care, but each new advancement has come with new challenges (Ahmed et al., 2024).

Modern technologies like cardiotocography (CTG) and fetal electrocardiography (FECG) can be difficult to interpret, and mistakes may negatively affect both mothers and newborns. These errors often result from human factors such as fatigue, distraction, cognitive bias, or poor communication, especially in stressful labor situations. Artificial intelligence has advanced from simple pattern recognition to complex machine learning models that analyze fetal data in real time. Unlike human clinicians, AI systems work continuously and are not affected by stress or cognitive overload. As a recent review states, “With artificial intelligence (AI), we can now take a fresh, unbiased look at the CTG” (O’Sullivan et al., 2021). The authors also note that “better ways of using and interpreting the CTG have the potential to reduce death and disability” (O’Sullivan et al., 2021), highlighting the importance of AI in improving labor and delivery care.

AI helps spot fetal distress early by picking up small changes in fetal heart rate and labor patterns before nurses or doctors might notice them. Traditional CTG readings can be affected by bias, fatigue, or missed details. AI systems, on the other hand, can look at things like cervical dilation, fetal station, and contraction frequency in real time. By creating predictive scores as labor goes on, AI can find problems faster than a person. In the study 'Impact of Labor Characteristics on Maternal and Neonatal Outcomes of Labor: A Machine-Learning Model,' Shazly and colleagues used data from over 66,000 deliveries to build a dynamic labor risk score. The model got more accurate as labor progressed, and by 10 cm dilation, it could correctly spot adverse outcomes almost 90 percent of the time. This gives nurses a quicker and more reliable

second opinion on both fetal and maternal status (Shazly et al., 2022), supporting earlier action and closer monitoring.

In Artificial Intelligence–Augmented Clinical Decision Support Systems for Pregnancy Care, Lin and colleagues reviewed 30 studies focused on prenatal, obstetric, and postpartum care. One system was able to flag patients at risk for postpartum hemorrhage right at the time of labor admission, using data from over 228,000 deliveries. It achieved a predictive score of 0.93, indicating high accuracy in identifying individuals who required closer monitoring before complications developed. Another model utilized electronic health records to detect early warning signs of preeclampsia and achieved a score of 0.81, indicating strong reliability. These tools give nurses a clearer picture of who is at risk, enabling them to act earlier and prevent serious maternal complications (Lin et al., 2024).

This kind of predictive scoring is not limited to research models. Hospitals like Maimonides Medical Center have already implemented AI systems that actively reduce maternal complications in real time. In Innovative Use of AI in Labor & Delivery, Maimonides Medical Center reported a 91% drop in serious preventable complications after introducing an AI system called Medical Brain (2023). The tool was programmed to catch early signs of problems like untreated group B strep, unmanaged preeclampsia, and failure to stop Pitocin during non-reassuring fetal heart tones. Between 2018 and 2022, the rate of these “never events” fell from 118 per 1,000 deliveries to just 11 per 1,000. The system sends real-time alerts to nurses and providers based on patient-specific data, prompting faster action when something starts to go wrong. For nurses, this means earlier recognition of red flags, fewer missed interventions, and stronger backup when advocating for immediate care (Maimonides Health, 2023).

One of the most impactful benefits of AI in labor management is its ability to reduce unnecessary cesarean sections and operative deliveries. In the same study by Shalzy et al. (2022), 15.7 percent of deliveries resulted in intrapartum cesarean sections. Patients who experienced complications during labor had higher labor risk scores, often above 35 percent, while those who delivered without issues had scores below 25 percent. By monitoring these scores as labor progressed, nurses and providers could more confidently tell the difference between true fetal distress and normal labor variation. This helps prevent acting too early based on unclear CTG patterns or subjective judgment. The model also became more precise over time, with specificity improving from 72 percent at 4 cm dilation to 84 percent at full dilation. This means the AI system has become better at ruling out false positives, which supports the more conservative and appropriate use of cesarean delivery. For nurses, this translates to fewer premature escalations and stronger clinical support when advocating for or against intervention (Shazly et al., 2022).

In busy labor settings, nurses often have to make quick decisions based on unclear fetal heart tracings or slow cervical progress. AI tools offer a second opinion that can confirm or challenge what the nurse observes. In "Artificial Intelligence in Predicting the Mode of Delivery," Michalitsi and colleagues reviewed 18 studies from different countries, demonstrating that AI models can accurately predict outcomes such as VBAC success, failed inductions, and emergency cesarean deliveries. Many of these models were over 90 percent accurate using information such as cervical dilation, fetal weight, and labor progress. For example, one study utilized AI to determine whether a trial of labor after cesarean would likely succeed, enabling nurses to support continued monitoring rather than early surgery. This extra insight helps nurses communicate more confidently, especially for unsure staff. AI does not replace clinical judgment but supports decision-making (Michalitsi et al., 2024).

As fetal monitoring systems become more automated and supported by artificial intelligence, nurses have more time to focus on the mother than the monitor. With centralized alerts, predictive scoring, and continuous data analysis, they are no longer tied to constant manual interpretation. This shift allows nurses to prioritize patient education, emotional support, and advocacy. Nurses spend only about 21% of their time providing direct care, while the rest is taken up by documentation and administrative tasks. New AI tools can handle up to 30% of those non-clinical responsibilities (Lambrych, 2023). This means nurses can be more present at the bedside and respond quickly to maternal needs. When patients ask about AI, nurses can explain that it is a support tool, not a replacement. It strengthens clinical judgment and helps ensure safer, more responsive care throughout labor.

In 'The Role of Artificial Intelligence in Maternal and Child Health,' Victor (2025) addresses critical ethical and practical challenges encountered by nurses and healthcare providers as AI becomes more prevalent in maternal care. A primary concern is data privacy, as AI systems utilize information from electronic health records, diagnostic imaging, and provider documentation, all of which require stringent security measures to prevent misuse or unauthorized disclosure. Algorithmic bias is another significant issue; AI systems may inherit biases from non-representative training data, potentially resulting in inaccurate risk assessments. Additionally, nurses may face difficulties adapting to new technologies and obtaining adequate training, particularly in resource-limited settings where infrastructure may be insufficient for safe AI implementation. Nursing staff may experience increased stress when integrating new tools and technologies without comprehensive training. Patient autonomy and informed consent remain essential, especially when AI influences clinical decision-making. Nurses play a vital role in educating patients about these systems and ensuring they make informed choices. As AI

becomes more integrated into maternal care, continued nursing involvement is necessary to safeguard patient safety and uphold professional standards (Victor, 2025).

Artificial intelligence is transforming nursing practice in labor and delivery by facilitating early detection of fetal distress and reducing unnecessary cesarean sections, thereby enabling more timely and effective clinical decisions that benefit both mothers and infants. These technologies are intended to augment, rather than replace, clinical judgment by providing real-time analysis of complex data and offering a reliable secondary assessment, particularly in high-pressure situations. AI also automates routine administrative tasks, allowing nurses to devote more attention to direct patient care, education, and safety. Nevertheless, challenges such as data privacy, algorithmic bias, training, and patient consent require ongoing attention and consideration. As AI becomes increasingly integrated into maternity care, sustained nursing involvement in implementing and overseeing these tools is essential. Future nursing education should incorporate AI competencies, and healthcare institutions should continuously evaluate the impact of these technologies on care delivery and workflow. With appropriate support, AI can enhance the safety and responsiveness of maternal and neonatal care.

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