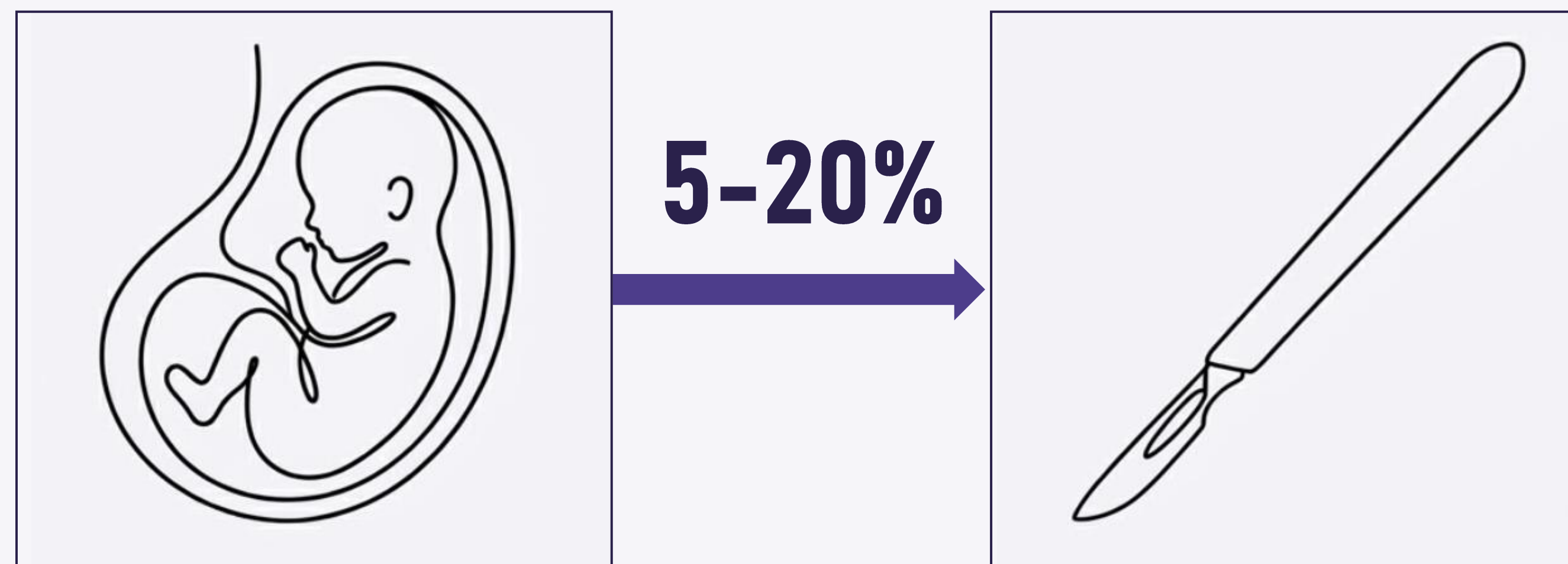


Predicting Intrapartum Cesarean Delivery in Patients with Neuraxial Labor Analgesia: A Machine Learning Approach

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The Problem



Vaginal trial
of labor

Intrapartum
cesarean

Emergent cesarean deliveries are associated with increased risks of:

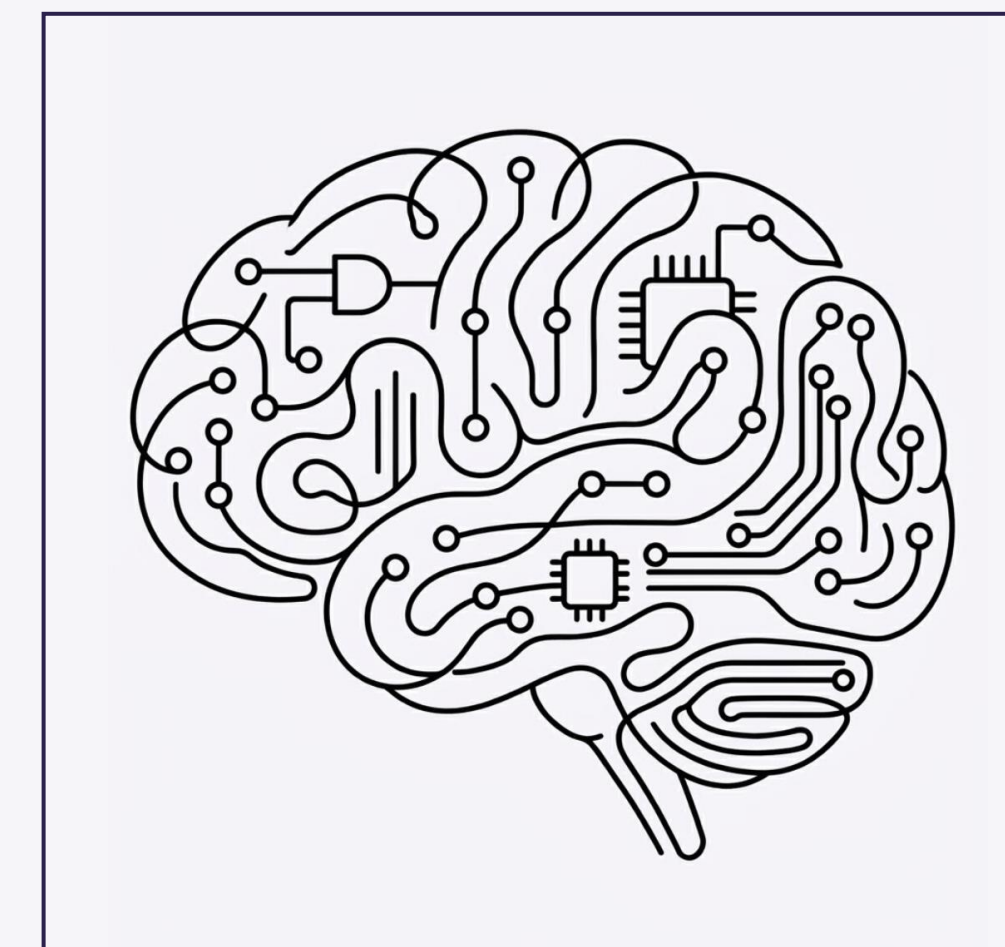
Hemorrhage

Infection

Trauma

Death

The Solution?



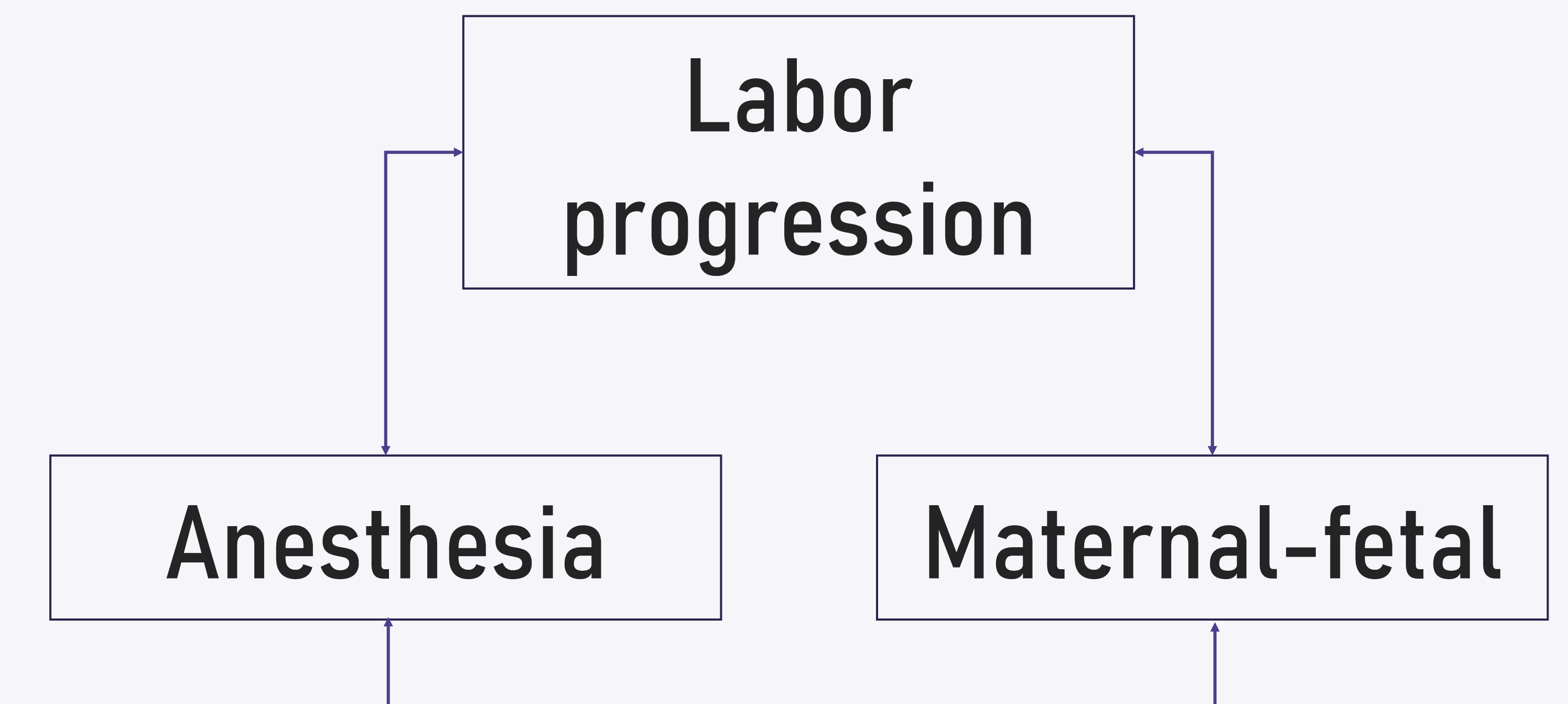
Accurate **prediction** of intrapartum cesarean delivery risk may **improve outcomes**

Proactive
optimization

Avoid
emergencies

Several machine learning (ML)
prediction models developed

The Gap



Our previous work showed an association between **NRFHTs within 60 min of neuraxial** and increased incidence of **cesarean delivery**

METHODS

Aim:

Development of a **robust ML predictive model** for **intrapartum cesarean delivery** in patients with neuraxial labor analgesia that integrates a comprehensive suite of peri-neuraxial data

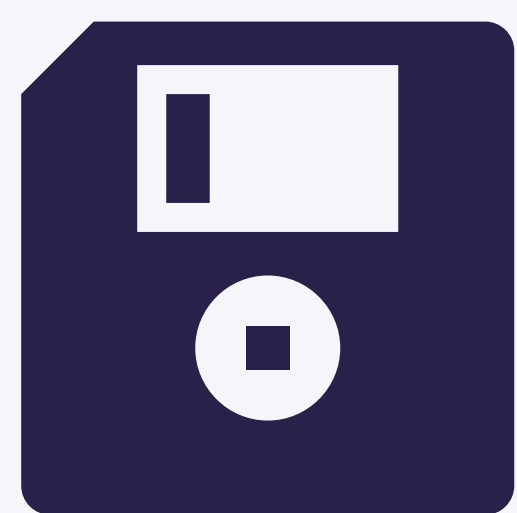
Design:

Retrospective, single-center study including patients who underwent a vaginal trial of labor with neuraxial labor analgesia from October 2018 to September 2025

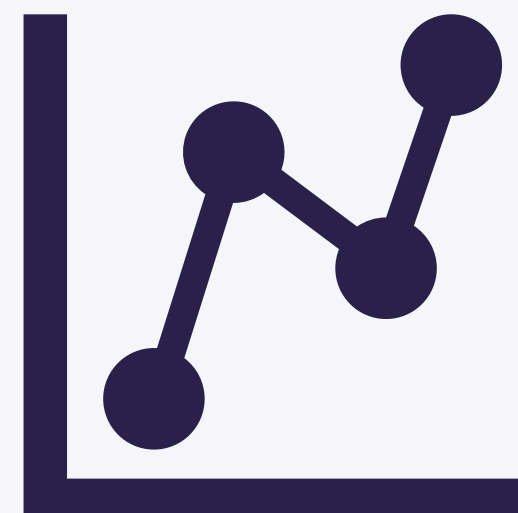
Exclusion criteria:

- Induction termination
- Intrauterine fetal demise

Model development:



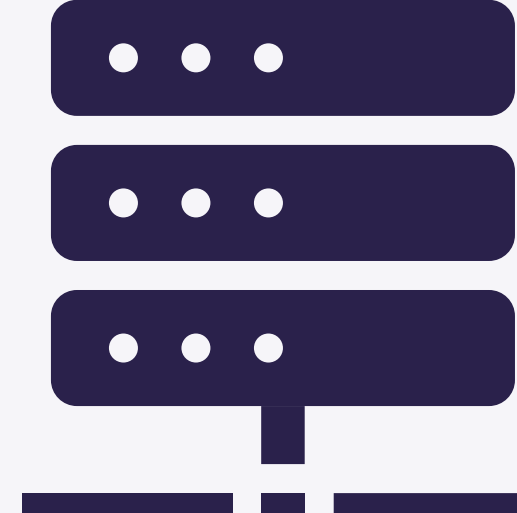
Data
preprocessing



Algorithm
selection
(XGBoost)



ML workflow
building in
Orange



Feature
selection and
model training



Model
performance
assessment

Performance metrics:

Area under the receiver operator characteristics curve (AUC-ROC), sensitivity, specificity

RESULTS

- Study population included **57,958 patients**
- Incidence of cesarean delivery was **14%** (n = 8,034)
- The final optimized model comprised **44 variables**

Performance Metric		Value
AUC-ROC		0.859
Sensitivity		0.878
Specificity		0.981

Peri-neuraxial labor analgesia variables included:



Cervical dilation

Blood pressure

Contraction frequency and duration

Pain score

Chorioamnionitis



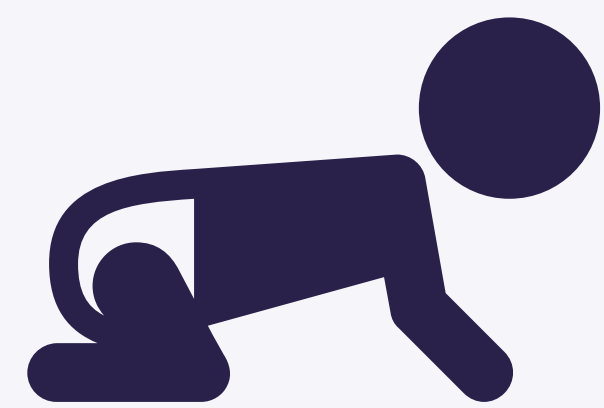
Time from admission to neuraxial placement

IT bupivacaine dose

Oxytocin dose

Vasopressor use

Tocolytic use



NRFHTs

Baseline FHT characteristics

DISCUSSION

Take-Home Points

- Current ML algorithms for prediction of delivery mode ignore the potential for neuraxial labor analgesia to alter intrapartum risk profiles
- We developed a high-performing XGBoost model that incorporates historically overlooked peri-neuraxial clinical data

Limitations

- Retrospective nature of study
- Reliance on accuracy and presence of information in the electronic health record

Future Directions

- Identification and quantification of feature importance
- Prospective study to validate ML algorithm
- Development of clinical decision support tool to reduce morbidity of unplanned intrapartum cesarean deliveries

References

1. Lancet. 2019;393(10184):1973-1982.
2. Int J Gynecol Obstet. 2025;171:775-783.
3. Am J Obstet Gynecol. 2020;233:437.e1-15.