

AI-Driven Prediction of Spontaneous Preterm Birth in Pregnancies with Short Cervix: A Machine Learning Comparison Between Singleton and Twin Gestations

Omri Dominsky, Matan Anteby, Eli Rimon, Nir Melamed, Roza Berkovits-Shperling, Neta Simon, Daniel Weiner Kalish, Noga Enoch Salton, Karina Krajden Haratz, Liran Hiersch

Lis Maternity and Women's Hospital, Tel Aviv Sourasky Medical Center, Israel | Gray Faculty of Medical & Health Sciences, Tel Aviv University

Objective

To compare predictors of spontaneous preterm birth between singleton and twin pregnancies with a newly diagnosed short cervix at 24-32 weeks, using interpretable machine learning.

Methods

- Retrospective cohort at a university-affiliated tertiary center.
- 2012-2024
- Newly diagnosed short cervix < 25 mm beyond 24 weeks
- Primary Outcome: spontaneous preterm birth < 32 weeks..

AI Model

Extreme gradient boosting (XGBoost) models were assessed by AUC, with predictor importance evaluated by SHAP. Predictors included cervical length, gestational age at diagnosis, CL/GA ratio, maternal age, BMI, parity, prior preterm birth, symptoms, cervical dilation, prior cervical procedures and IVF conception

Results

Model AUC for sPTB below 32 weeks, singletons and twins

0.84 / 0.72

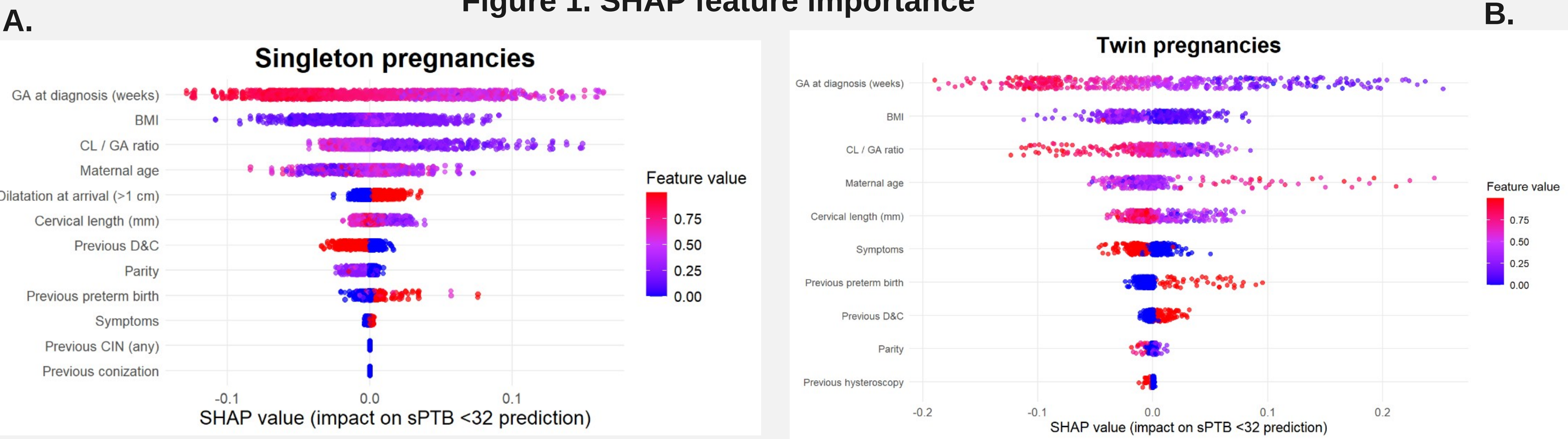
Cervical length below which predicted risk rises sharply

12 mm

Cohort and performance

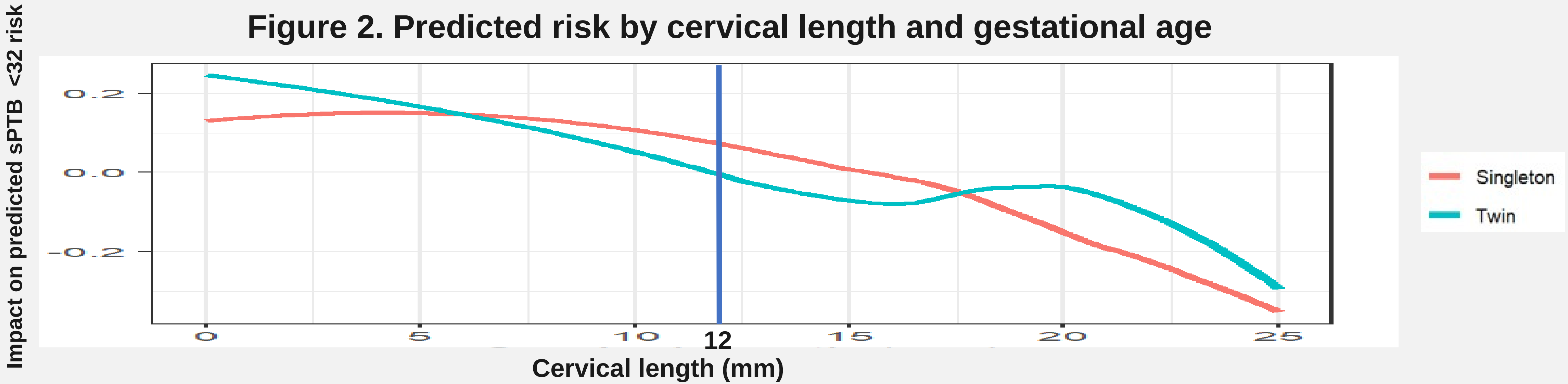
Variable	Singleton	Twins
Pregnancies	1,177	478
GA at diagnosis (wks)	30.1	29.2
sPTB below 32 wks	6.0%	10.3%
Diagnosis to delivery	6.9 wks	5.2 wks
Model AUC	0.84	0.72

Figure 1. SHAP feature importance



SHAP beeswarm plots for prediction of sPTB <32 weeks. Each point is one pregnancy; x-axis is the SHAP value, colour is the feature value. Variables ordered by overall importance. (A) Singletons, (B) Twins.

Figure 2. Predicted risk by cervical length and gestational age



Contribution of cervical length to predicted spontaneous preterm birth < 32 weeks. Values above zero indicate that a given cervical length raises predicted risk; values below zero indicate the opposite.

Conclusion Gestational age at diagnosis is the dominant predictor of spontaneous preterm birth after 24 weeks in both singleton and twin pregnancies. Importantly, cervical length measures plays a substantially greater role in twins.

These findings suggest that the predictors of spontaneous preterm birth, and their relative importance, differ between singleton and twin gestations.