Prediction of Large for Gestational Age Infants in Overweight and Obese Women at Approximately 20 Gestational Weeks

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Abstract

Large for gestational age (LGA) births are associated with many maternal and perinatal complications. As overweight and obesity are risk factors for LGA, we aimed to predict LGA in overweight and obese women at approximately 20 gestational weeks, so that we can identify women at risk of LGA early to allow for appropriate interventions. A random forest algorithm was applied to maternal characteristics and blood biomarkers at baseline and 20 gestational weeks' ultrasound scan findings to develop a prediction model. Here we present our preliminary results demonstrating potential for use in clinical decision support for identifying patients early in pregnancy at risk of an LGA birth.

Introduction

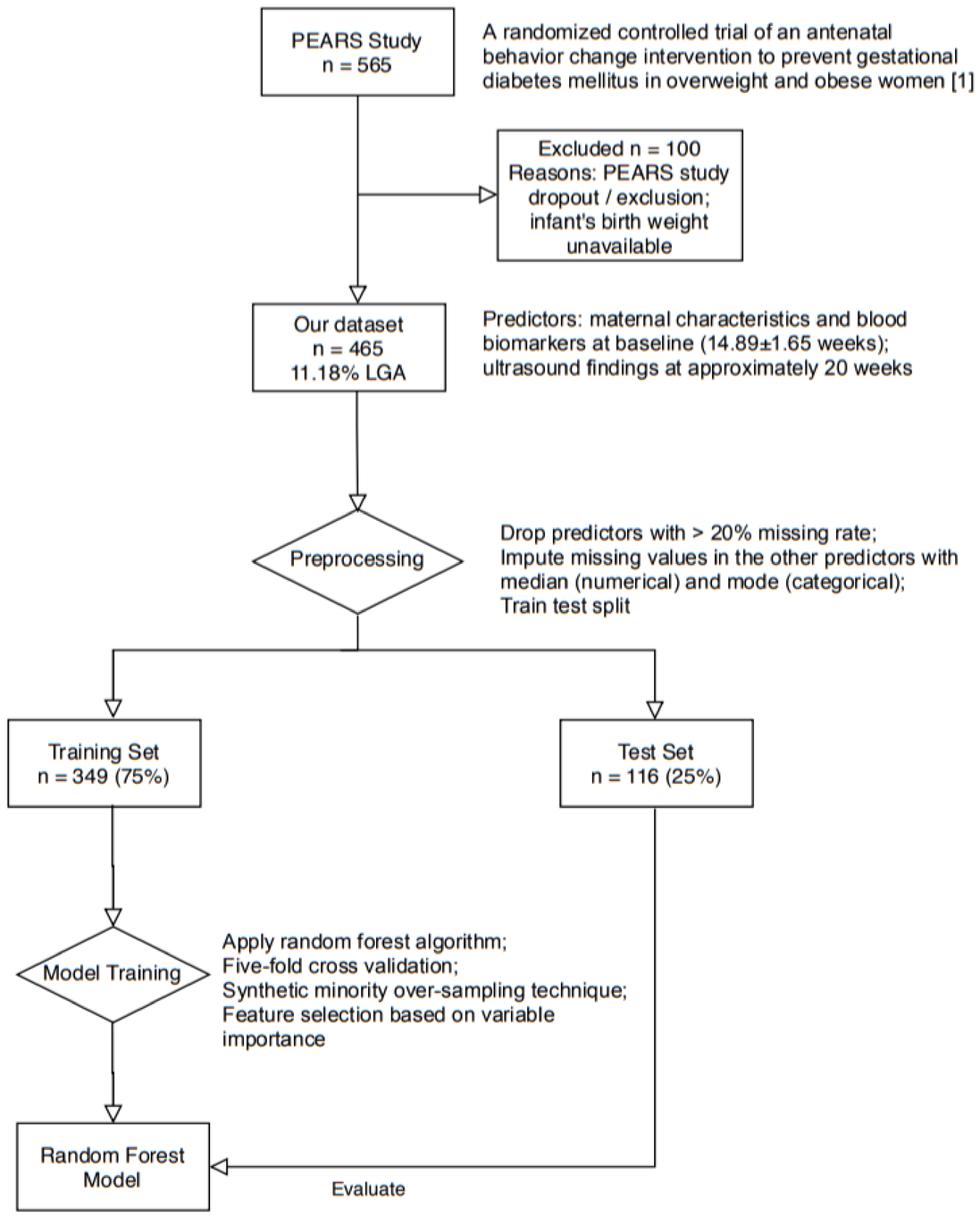
Large for gestational age (LGA):

- Infant's birth weight above 90th percentile for his/her gestational age
- Associated with many maternal and perinatal complications
- Overweight and obese women have higher risks
- Most published models focused on the late stages of pregnancy (26 – 37 weeks)

We aimed to:

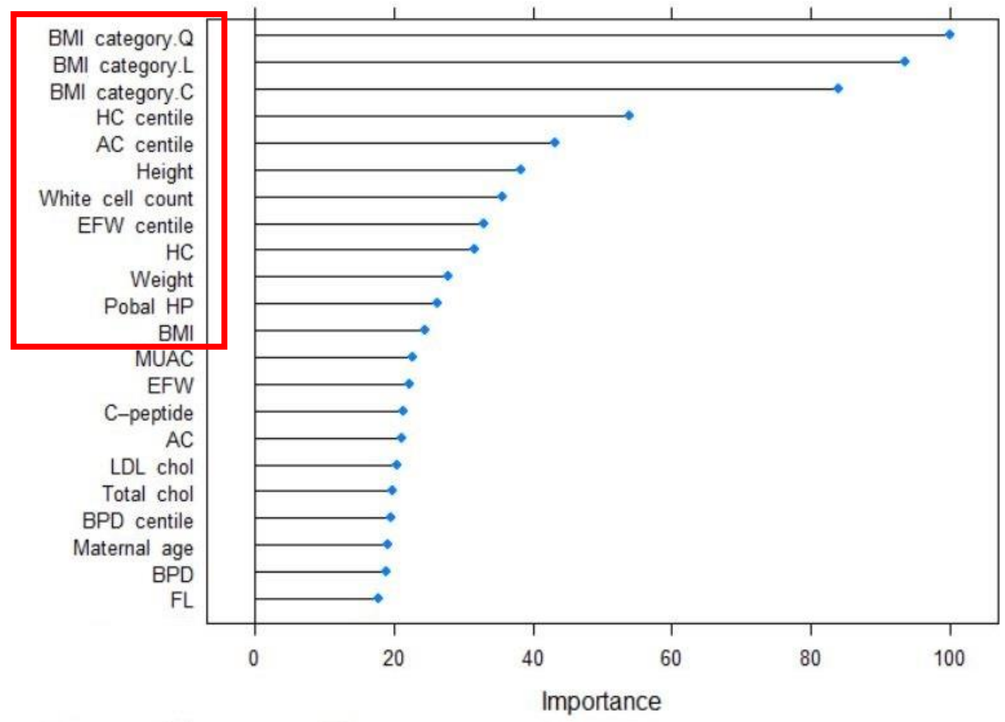
- Predict LGA at approximately 20 gestational weeks in overweight and obese women using machine learning
- Advantage: early enough to allow interventions

Method



Results

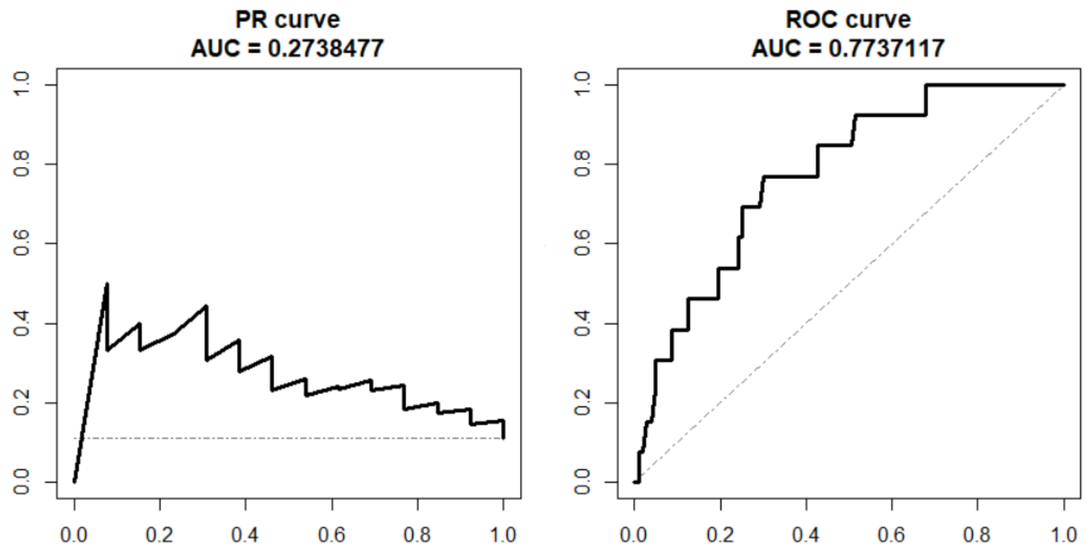
Variable importance plot showing 20 most important features only



Top 10 most important features selected

- Baseline maternal characteristics: maternal height, weight, body mass index (BMI), BMI category, Pobal HP deprivation index
- Baseline blood biomarkers: white cell count
- 20 weeks' ultrasound findings: head circumference (HC), HC percentile, abdominal circumference (AC) percentile, estimated fetal weight (EFW) percentile

PR and ROC curves of the model evaluated on the test set



Performance of the model evaluated on the test set

Evaluation Metric	Value
AUC-PR	0.27
AUC-ROC	0.77
Sensitivity at 5% FPR	0.31
Sensitivity at 10% FPR	0.38

Discussion

These preliminary results show the potential of applying machine learning in identifying women at risk of LGA in a clinical setting. Further research will be conducted on the selection of features and model validation in other populations.

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References

[1] Maria A Kennelly, Kate Ainscough, Karen L Lindsay, Elizabeth O'Sullivan, Eileen R Gibney, Mary McCarthy, Ricardo Segurado, Giuseppe DeVito, Orla Maguire, Thomas Smith, et al. 2018. Pregnancy exercise and nutrition with smartphone application support: a randomized controlled trial. *Obstetrics & Gynecology* 131, 5 (2018), 818–826.