Pre-pregnancy BMI associated with placental dysfunction in early but not late preterm birth

Alexander J. Layden³, Marnie Bertolet³, W. Tony Parks², James M. Roberts¹, Jennifer J. Adibi, Janet M. Catov¹,³

¹University of Pittsburgh, ²University of Toronto, ³Magee-Womens Research Institute

1. Background

Public Health Impact
- Preterm birth (<32 weeks) is the leading cause of neonatal morbidity and mortality worldwide.
- 90% of mortality is from early preterm births (<32 weeks).
- Obesity is a prevalent, modifiable risk factor of early preterm birth.
- Placental histopathology is a biologic measure to study preterm birth and its sequelae in population studies.

Overview of placental histopathology

Placenta sent to pathology

Gross and microscopic evaluation

Report >50 variables generated

Clinical Use:
1. Confirm diagnosis
2. Ignore

Caveat: Placental pathology features may co-occur, but current pathology groupings are based on expert opinion, not evidence.

2. Study Objectives

Aim 1: Establish placental pathology groups by clustering analysis of placental histopathology features.

Aim 2: Estimate associations between pre-pregnancy BMI and likelihood of placental pathology groups.

Aim 3: Compare adverse birth outcomes across placental pathology groups.

3. Methods

Study Population: 4,262 preterm deliveries at Magee-Womens Hospital (Pittsburgh) with available placental histopathology.

Primary Exposure: self-reported pre-pregnancy BMI (kg/m²)

Primary Outcome: placental histopathology features

Pathology Type | Placental Features
--- | ---
Inflammation | Chorioamnionitis, Deciduitis, Funisitis, Vasculitis, Villitis
Vascular Damage | Avascular Villi, Decidual Vasculopathy, Fetal Thrombus, Intervillous Thrombus, Fibrin Deposition, Villous infarct
Hypoxia | Chorangiosis, Chorangioma
Abnormal Growth | Advanced Villous Maturation, Delayed Villous Maturation, Placental Hypoplasia

Statistical Analysis
- Aim 1: cluster pathology features by latent class analysis separately in early and late preterm births
- Aim 2: quantify associations between BMI and likelihood of placental pathology clusters by pseudo-class regression
- Aim 3: compare birth outcomes by χ² and Kruskal-Wallis tests

4. Conclusions

- Half of late preterm births have low risk of pathology, suggesting etiology of late preterm birth may not involve the placenta.
- Placental features are subclinical.

- Increasing BMI in early preterm births is associated with greater placental malperfusion.
- Lower co-occurring malperfusion with inflammation.

5. Future Directions

- Malperfusion clusters were associated with poor birth outcomes.

This work was supported by the National Institutes of Health [T32 GM008208-28, S31T LR00388-04] and GSR funding from the Department of Epidemiology, University of Pittsburgh.

6. Acknowledgements