First Trimester MMP-9 is Associated with Maternal Depression History and Treatment

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Background

- Matrix metalloproteinase (MMP-9) regulates tissue remodeling and inflammation
  - Present in circulation in normal, non-pregnant conditions
  - Expression increases during early and mid-pregnancy to facilitate placentation
- Relationship between MMP-9 and prenatal depression is largely unexplored

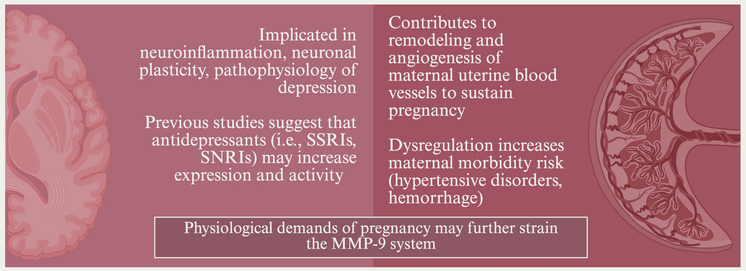
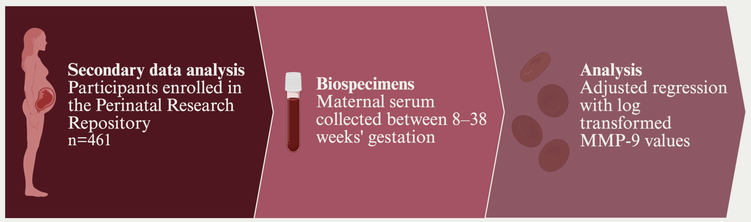


Figure 1. MMP-9 functions in maternal physiology and mental health. MMP-9 contributes to placental development and vascular remodeling while also modulating pathways relevant to mood and depression. Created in BioRender.

Methods

Figure 2. Study design and biomarker analysis. Overview of participant selection, maternal serum collection, and analysis pipeline used to examine relationships between MMP-9 and psychosocial and obstetric factors. Created in BioRender.



- MMP-9 concentrations quantified using ELISA and log-transformed
- Exclusions for analysis: multifetal gestation, IVF, fetal anomaly, placenta previa/abruption
- History of depression = documented depression, past or present, in medical record
- Treatment of depression = antidepressants prescribed as treatment for depression at any time during pregnancy
- Regression models adjusted for age; confidence intervals set at 95%

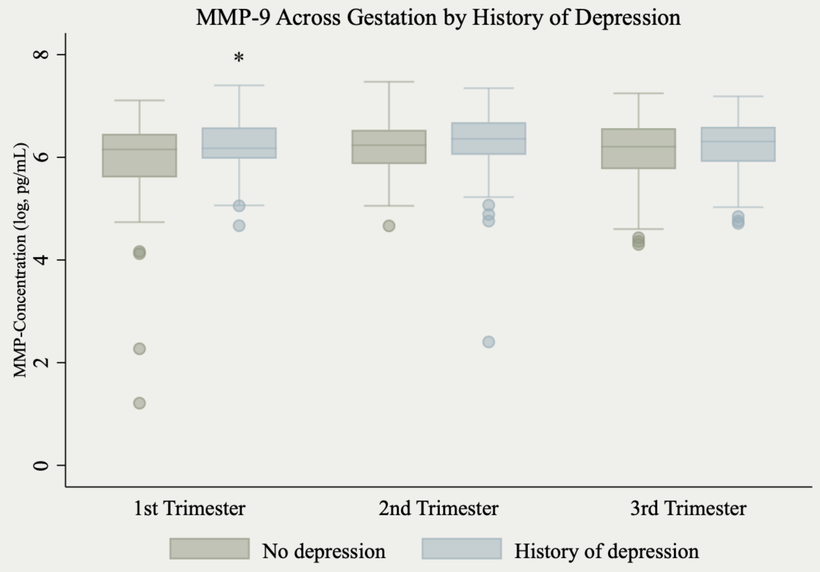


Figure 3. Boxplot of log-transformed MMP-9 concentrations (pg/mL) across pregnancy by history of depression. In the first trimester (n=66 no depression, n=45 history of depression), a history of depression was associated with a 0.32 log-unit increase in MMP-9 (p = .048). No significant differences were observed in the second or third trimesters. Box shows median and IQR.

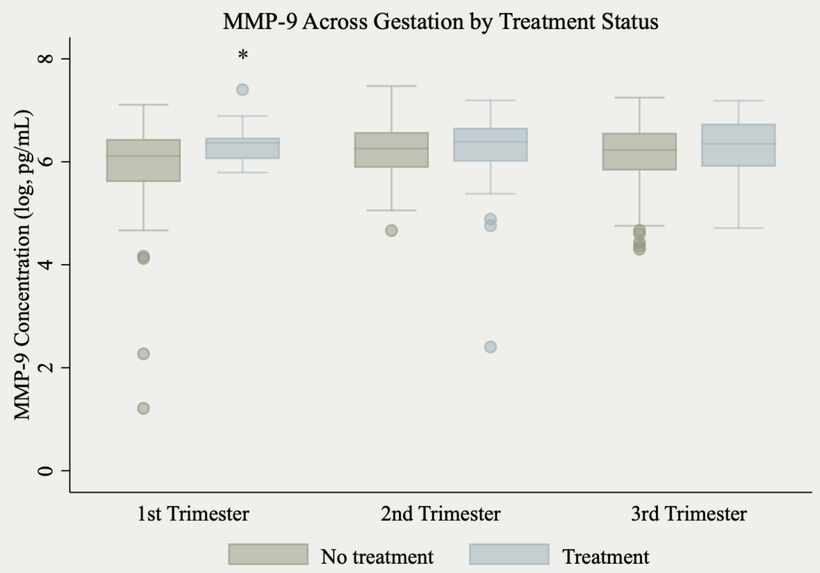


Figure 4. Boxplot of log-transformed MMP-9 concentrations (pg/mL) across pregnancy by treatment of depression during pregnancy. In the first trimester (n=89 no treatment, n=16 treated), participants receiving treatment had higher MMP-9 levels compared with untreated participants (0.46 log-unit increase, p = .043). No significant differences were observed in the second or third trimesters. Box shows median and IQR.

Results

- 111, 385, 235 samples in the 1st, 2nd, 3rd trimesters respectively
  - n=227 contributed >1 sample
- 1st trimester MMP-9 was higher among participants with depression history (β=0.32; 95% CI: 0.00–0.63; p=.048)
- Elevated 1st trimester MMP-9 concentrations in treatment group (β=0.46; 95% CI: 0.02–0.90; p=.043)
- 2nd trimester MMP-9 showed similar but weaker associations, no differences observed in 3rd trimester

Table 1: Sample Characteristics

Variable	*n*
Maternal Age, mean (SD)	26.4 (5.3)
Gravida, mean (SD)	3.4 (2.5)
Parity, mean (SD)	2.2 (1.7)
Gestational Age at Delivery, mean (SD)	36.9 (3.6)
Cesarean Birth	145 (31.7%)
History of Depression	189 (41.2%)
Depression Treatment	80 (17.9%)
Race	
Black or African American	251 (60.5%)
White	139 (33.5%)
Other	25 (5.9%)
Non-Hispanic	318 (94.6%)
Government-assisted Insurance	395 (90.0%)

Discussion

- Limitations: Retrospective design; antidepressant class not specified
- Findings suggest early pregnancy may be a sensitive window during which maternal psychological health intersects with placental remodeling biology, underscoring value of integrative prenatal care
- Future analyses will explore phenotypic differentiation within depression history, including comparisons between treated and untreated individuals, to clarify whether MMP-9 trajectories reflect medication exposure or symptom severity

References