

Blood pressure variability is an independent predictor of adverse perinatal outcomes in pregnancy.

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Objective Elevated blood pressure during pregnancy is continuously associated with adverse perinatal outcomes. Blood pressure variability (BPV), reflecting fluctuations in blood pressure over time, may provide additional prognostic information beyond absolute BP levels. This study aimed to evaluate the association between BPV and maternal and neonatal outcomes in pregnant patients undergoing home blood pressure monitoring.

Methods

This cohort study included pregnant patients managed via the Hampton App within a home blood pressure monitoring pathway. Blood pressure variability (BPV) was assessed for systolic, diastolic, and mean arterial pressure (MAP) using standard deviation (SD) and average real variability (ARV). Multivariable logistic regression was used to examine associations between BPV and preeclampsia (with and without severe features), composite adverse maternal outcomes (CAMO), birthweight <5th centile, preterm birth <37 weeks, and composite adverse neonatal outcomes (CANO). Analyses were adjusted for maternal age, parity, and mean BP. Results are presented as adjusted odds ratios (aOR) with 95% confidence intervals (CI).

Results

Higher systolic, diastolic, and mean arterial pressure variability were associated with an increased risk of preeclampsia, with the strongest associations observed for MAP variability (SD aOR 1.35, 95% CI 1.17–1.55; ARV aOR 1.28, 95% CI 1.13–1.44) (Table 1). Diastolic and MAP, but not systolic, variability were associated with increased risk of preeclampsia with severe features and adverse maternal outcomes. MAP variability (SD) was additionally associated with preterm delivery (aOR 1.22, 95% CI 1.03–1.43), whereas no consistent associations were observed between BP variability and other neonatal outcomes.

Table 1. Association Between BPV and Maternal and Neonatal Outcomes

OR (95% CI)	Systolic SD	Systolic ARV	Diastolic SD	Diastolic ARV	MAP SD	MAP ARV
Maternal outcomes						
Preeclampsia	1.15 (1.03-1.28)	1.11 (1.02-1.22)	1.25 (1.09-1.43)	1.21 (1.07-1.37)	1.35 (1.17-1.55)	1.28 (1.13-1.44)
Severe Preeclampsia	1.12 (0.95-1.32)	1.09 (0.95-1.25)	1.28 (1.04-1.59)	1.23 (1.02-1.48)	1.38 (1.11-1.71)	1.27 (1.06-1.52)
CAMO	1.08 (0.98-1.19)	1.05 (0.97-1.14)	1.18 (1.04-1.33)	1.15 (1.03-1.28)	1.24 (1.10-1.41)	1.21 (1.08-1.34)
Neonatal outcomes						
Birthweight<10 th Centile	0.94 (0.83-1.07)	0.92 (0.82-1.03)	1.12 (0.97-1.31)	1.12 (0.98-1.28)	1.10 (0.95-1.28)	1.06 (0.93-1.22)
Birthweight <5 th Centile	0.98 (0.83-1.16)	0.98 (0.85-1.13)	1.18 (0.97-1.43)	1.16 (0.97-1.37)	1.18 (0.97-1.43)	1.10 (0.92-1.31)
CANO	1.02 (0.92-1.13)	0.97 (0.89-1.06)	1.10 (0.97-1.25)	1.08 (0.96-1.21)	1.13 (0.99-1.28)	1.08 (0.96-1.09)
Preterm Delivery <37 weeks	1.10 (0.97-1.25)	1.05 (0.94-1.16)	1.12 (0.96-1.31)	1.05 (0.91-1.20)	1.22 (1.03-1.43)	1.11 (0.97-1.28)
OR- Odds Ratio, CI – Confidence Interval, BPV – Blood pressure variability (SD – Standard Deviation, Average Real Variability), MAP – Mean Arterial Pressure, CAMO – Pre-eclampsia, acute renal failure acute myocardial ischemia, hypertensive encephalopathy, cortical blindness, retinal detachment, stroke, pulmonary edema or adult respiratory distress syndrome, need for mechanical ventilatory support, disseminated intravascular coagulation, thrombotic thrombocytopenic purpura or hemolytic uremic syndrome, acute fatty liver, liver hematoma or rupture, and maternal death. CANO – Combined adverse neonatal outcomes - preterm birth, birthweight <10 th centile, intrauterine death, neonatal death.						

Conclusion: Increased blood pressure variability during pregnancy is associated with a higher risk of preeclampsia and adverse maternal outcomes, independent of mean blood pressure levels. Diastolic variability appears more strongly associated with risk than systolic variability. BPV may provide additional value for antenatal risk stratification.