

Initial Steps Towards a Personalized Model of Glucose and Insulin Dynamics during Pregnancy

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ABSTRACT

Maternal metabolism has important short- and long-term implications for mothers and their infants. Elevated levels of circulating maternal glucose and insulin are associated with large for gestational age infants and increased fetal adiposity, both of which can have negative health effects. Assessing maternal glucose and insulin dynamics during pregnancy is important for identifying women in need of intervention. We developed a novel system dynamics simulation model that estimates plasma insulin and glucose levels in early (12-16 weeks) and late (34-36 weeks) pregnancy. Model output closely resembled research data collected from 28 racially and ethnically diverse participants at both time points. We tested four known metabolic adaptations known to occur as gestation progresses and found that a combination of all four adaptations best fit research participant data. Together, the adaptations create maternal insulin resistance that facilitates maternal energy storage and fetal growth. This study is an initial step toward developing a personalized tool for monitoring maternal glucose dynamics to improve prenatal care, especially for pregnancies complicated by obesity.