

## Children born to obese women with diabetes at higher risk of developing autism

Children born to obese women with diabetes are more than four times as likely to be diagnosed with autism spectrum disorder than children of healthy weight mothers without diabetes, new Johns Hopkins Bloomberg School of Public Health research suggests.

The findings, to be published Jan. 29 in the journal *Pediatrics*, highlight what has become a leading theory about autism that the risk likely develops before the child is even born.

"We have long known that obesity and diabetes aren't good for mothers' own health," says study leader Xiaobin Wang, MD, ScD, MPH, the Zanvyl Krieger Professor in Child Health at the Bloomberg School and director of the Center on the Early Life Origins of Disease. "Now we have further evidence that these conditions also impact the long-term neural development of their children."

Autism spectrum disorder is a neurodevelopmental condition characterized by severe deficits in socialization, verbal and nonverbal communication and repetitive behaviors. Since the 1960s, the prevalence rates have skyrocketed, with one in 68 U.S. children now affected by it, according to the U.S. Centers for Disease Control and Prevention. Obesity and diabetes have also risen to epidemic levels in women of reproductive age over the same time period.

For the study, the researchers analyzed 2,734 mother-child pairs, a subset of the Boston Birth Cohort recruited at the Boston Medical Center at birth between 1998 and 2014. They collected data on maternal pre-pregnancy weight and whether the mothers had diabetes before getting pregnant or whether they developed gestational diabetes during pregnancy. They also followed up the children from birth through childhood via postnatal study visits and review of electronic medical records. They identified 102 children who were diagnosed with autism spectrum disorder over the course of the study. Those children with mothers who were both diabetic and obese were more than four times as likely to develop autism compared to children born to normal weight mothers without diabetes, they found.

"Our research highlights that the risk for autism begins in utero," says co-author M. Daniele Fallin, PhD, chair of the Bloomberg School's Department of Mental Health and director of the Wendy Klag Center for Autism and Developmental Disabilities. "It's important for us to now try to figure out what is it about the combination of obesity and diabetes that is potentially contributing to sub-optimal fetal health."

Previous studies had suggested a link between maternal diabetes and autism, but this is believed to be the first to look at obesity and diabetes in tandem as potential risk factors.

Along with pre-conception diabetes, children of obese mothers who developed gestational diabetes during pregnancy were also at a significantly higher risk of being diagnosed with autism.

The biology of why obesity and diabetes may contribute to autism risk isn't well understood. Obesity and diabetes in general cause stress on the human body, the researchers say. Previous research suggests maternal obesity may be associated with an inflammation in the developing fetal brain. Other studies suggest obese women have less folate, a B-vitamin vital for human development and health.

The researchers say that women of reproductive age who are thinking about having children need to not only think about their obesity and diabetes status for their own health, but because of the implications it could have on their children. Better diabetes and weight management could have lifelong impacts on mother and child, they say.

In order to prevent autism, we may need to consider not only pregnancy, but also pre-pregnancy health.

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