High blood sugar during pregnancy ups risk of mother's type 2 diabetes, child's obesity

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A participant sits ready for body composition testing at Lurie Children's Hospital of Chicago during a visit for the international Hyperglycemia and Adverse Pregnancy Outcomes Follow-up Study, funded by the National Institutes of Health. Credit: Lurie Children's Hospital of Chicago/Northwestern University

Mothers with elevated blood glucose during pregnancy—even if not high enough to meet the traditional definition of gestational diabetes—were significantly more likely to have developed type 2 diabetes a decade after pregnancy than their counterparts without high blood glucose.

For children born to mothers with elevated or normal glucose, researchers found no statistically significant difference between the two groups of children in terms of their combined overweight and obesity, the study's primary outcome. However, when obesity was measured alone, children of mothers with elevated blood glucose were significantly more likely to be obese.

The results are part of a follow-up study published Sept. 11 in the *Journal of the American Medical Association*. Funded primarily by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), part of the National Institute of Health, the Hyperglycemia and Adverse Pregnancy Outcomes-Follow-up Study or HAPO-FUS, followed mothers and their children 10-14 years after birth.

The original HAPO study found that even modestly elevated blood glucose levels increased the risks of complications for the baby both before and shortly after birth. Based on these results many, but not all, organizations adopted a new definition of gestational diabetes, a type of diabetes that occurs during pregnancy.

HAPO-FUS compared the long-term effects of blood glucose levels in mothers who would have met the new definition of gestational diabetes with those who did not. Researchers aimed to learn if modest increases in blood glucose increased the mother's risk of developing type 2 diabetes or prediabetes and the risk of obesity in the mother's offspring at least a decade after giving birth.

The study found the harms of even modestly elevated blood glucose for

both mother and child extend more than a decade. Among women with elevated blood glucose during pregnancy, nearly 11 percent had type 2 diabetes at the follow-up study visit 10-14 years after childbirth and about 42 percent had prediabetes. Of their counterparts who did not have elevated blood glucose during pregnancy, about 2 percent had type 2 diabetes and about 18 percent had prediabetes. The study examined 4,697 mothers for type 2 diabetes, prediabetes and other disorders of glucose metabolism.

Researchers analyzed 4,832 children for overweight and obesity, collecting data using body mass index (BMI), body fat percentage, skin fold thickness and waist circumference. They found that these measures all showed that children born to mothers with elevated glucose levels were more likely to be obese. For example, using BMI, 19 percent of children born to mothers with elevated blood glucose were obese, compared with 10 percent for children of mothers with normal glucose.

Adjusting for the mother's BMI reduced—but did not eliminate—the differences between the groups.

"The differences in mothers and their children due to the mother's higher blood glucose are very concerning. Even accounting for the mother's weight, glucose had an independent effect," said Dr. Barbara Linder, a study author and senior advisor for childhood diabetes research at the NIDDK. "Our findings add to the motivation to find ways to help women at high risk for gestational diabetes who are or plan to get pregnant to take steps to reduce their risk."

The original HAPO study looked at 23,316 mother-child pairs and found that a mother's blood sugar levels, even short of diabetes, were associated with her newborn's birth weight and body fat. HAPO results led an international panel of experts to recommend new diagnostic criteria for gestational diabetes in 2010. However, not all professional

groups adopted these proposed criteria.

"HAPO helped redefine gestational diabetes, and now its follow up continues to raise important alarms about the long-term danger of high blood glucose levels during pregnancy," said study chair Dr. Boyd Metzger, emeritus Tom D. Spies Professor of Nutrition and Metabolism at the Northwestern University Feinberg School of Medicine, Chicago. "This study shows that both mothers with elevated blood glucose levels and their offspring are at higher risk for adverse health effects later in life. More research is needed to find interventions to help both these women and their children."

None of the women in HAPO-FUS were diagnosed with or treated for gestational diabetes during their pregnancy. HAPO recruited an international, racially and ethnically diverse group. Limitations of the data in HAPO include that body mass index was obtained during pregnancy, not before. As well, HAPO-FUS did not collect data on the women or children's lifestyles to evaluate other factors that could contribute to obesity or type 2 diabetes.

The results build on findings from other studies showing that type 2 diabetes in mothers during pregnancy is associated with obesity in that mother's offspring and that elevated blood glucose increases risk of type 2 diabetes in the woman after pregnancy.

"HAPO and its follow-up study have shown the detrimental long-term effects of elevated blood glucose on both mother and child and the importance of early intervention for women at risk for gestational diabetes," said NIDDK Director Dr. Griffin P. Rodgers. "We hope these results will be used to improve the health of generations to come."

More information: *Journal of the American Medical Association* (2018). jamanetwork.com/journals/jama/ … 1001/jama.2018.11628

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