

Stress during pregnancy increases risk of mood disorders for female offspring

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High maternal levels of the stress hormone cortisol during pregnancy increase anxious and depressive-like behaviors in female offspring at the age of 2, reports a new study in *Biological Psychiatry*. The effect of elevated maternal cortisol on the negative offspring behavior appeared to result from patterns of stronger communication between brain regions

important for sensory and emotion processing. The findings emphasize the importance of prenatal conditions for susceptibility of later mental health problems in offspring.

Interestingly, male offspring of mothers with [high cortisol](#) during pregnancy did not demonstrate the stronger [brain connectivity](#), or an association between maternal cortisol and mood symptoms.

"Many mood and anxiety disorders are approximately twice as common in females as in males. This paper highlights one unexpected sex-specific risk factor for mood and anxiety disorders in females," said John Krystal, MD, Editor of *Biological Psychiatry*. "High maternal levels of cortisol during pregnancy appear to contribute to risk in females, but not males."

"This study measured maternal cortisol during pregnancy in a more comprehensive manner than prior research," said first author Alice Graham, Ph.D., of Oregon Health & Science University. To estimate the overall cortisol level during pregnancy, senior author Claudia Buss, Ph.D., of Charité University Medicine Berlin and University of California, Irvine and colleagues measured cortisol levels over multiple days in early-, mid-, and late-pregnancy. Measurements taken from the 70 mothers included in the study reflected typical variation in maternal cortisol levels. The researchers then used brain imaging to examine connectivity in the newborns soon after birth, before the external environment had begun shaping brain development, and measured infant anxious and depressive-like behaviors at 2 years of age.

"Higher maternal [cortisol](#) during pregnancy was linked to alterations in the newborns' [functional brain connectivity](#), affecting how different brain regions can communicate with each other," said Dr. Buss. The altered connectivity involved a brain region important for emotion processing, the amygdala. This pattern of brain connectivity predicted

anxious and depressive-like symptoms two years later.

The findings reveal a potential pathway through which the prenatal environment may predispose females to developing mood disorders. The study supports the idea that maternal stress may alter brain connectivity in the developing fetus, which would mean that vulnerability for developing a mood disorder is programmed from birth. This could be an early point at which the risk for common psychiatric disorders begins to differ in males and females.

More information: Alice M. Graham et al. Maternal Cortisol Concentrations During Pregnancy and Sex Specific Associations with Neonatal Amygdala Connectivity and Emerging Internalizing Behaviors, *Biological Psychiatry* (2018). [DOI: 10.1016/j.biopsych.2018.06.023](https://doi.org/10.1016/j.biopsych.2018.06.023)

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