Prenatal opioid exposure may trigger neurological, behavioral changes later in life

July 29 2022, by Brian Consiglio

Credit: Pixabay/CC0 Public Domain

While infants exposed to opioids during their mother's pregnancy have been linked to adverse health outcomes, a new study at the University of Missouri has found prenatal opioid exposure could trigger long-term

neurological or behavioral effects later in a child's life.

The key is the opioid's impact on the developing fetus' gut microbiome—a collection of bacteria and other microorganisms that naturally live inside the guts of all humans and animals and can serve as a barometer for overall health and wellness.

Cheryl Rosenfeld, a professor in the MU College of Veterinary Medicine, collaborated with Trupti Joshi, an assistant professor in the MU School of Medicine, to compare the gut microbiome of adult mice who were exposed during gestation to oxycodone, a commonly abused opioid that treats pain, in utero with the gut microbiome of mice who were not exposed to any opioids.

"Opioids are increasingly being prescribed to pregnant women to treat pain, yet when they are consumed, we are learning it is not just the mother who is being exposed, but also the fetus at a time when their organs are still developing," Rosenfeld said. "These findings highlight the potential long-term health effects for the offspring, not just when they are born, but well into adulthood as well."

After collecting fecal matter from both groups of mice at 120 days of age, the researchers identified significant changes and disruptions to the natural balance of bacteria in the guts of the mice who were exposed to oxycodone in utero. These changes were linked with alterations in metabolic pathways, which impacts metabolism and potentially both neurological and behavioral health long-term.

Rosenfeld added that the gut microbiome of humans is very similar to the gut microbiome of mice, making the animal a useful biomedical model for translational and precision medicine research.

"While this research can lead to human studies down the road, those can

take 20 to 30 years due to the much longer lifespan of humans compared to mice," Rosenfeld said. "The opioid epidemic, one of the biggest public health crises facing the United States, is causing real harm right now, so our goal is to raise immediate awareness and hopefully protect the health and well-being of women who are currently pregnant or seeking to become pregnant and their offspring from the potential negative and longstanding effects of opioids."

The research is personal for Rosenfeld, whose niece was in utero when her sister-in-law was given Quaaludes to relieve anxiety. While her niece was born healthy and seemed fine early in childhood, she later developed respiratory issues, neurological issues and behavioral abnormalities in her teenage years, and is now living in a nursing home in her 30s.

"For these children who were exposed to opioids in utero, there is also now an increased risk for them to get addicted to opioids themselves, so I do worry about them as they progress into adulthood," Rosenfeld said. "Hopefully by identifying these correlations as early as possible, potential interventions can be developed and alternative treatment options can be discussed for dealing with pain in pregnant women."

Joshi, a bioinformatics scientist in the MU School of Medicine's Department of Health Management and Informatics, was a clinical doctor who occasionally assisted with pregnancies in India before coming to the United States to study bioinformatics.

"Genomic sequencing technology, bioinformatics tools and computational techniques can all be applied together to help us as researchers start to find the links that tie together our physiology and our overall health," Joshi said. "We are starting to learn how changes in the gut microbiome can potentially impact one's mood and mental health later on in adulthood. This research helps us start to better understand the gut-brain axis, as there is a lot of communication among the brain,

central nervous system, endocrine system, immune system and gut microbiome."

"Long-term effects of developmental exposure to oxycodone on gut microbiota and relationship to adult behaviors and metabolism" was recently published in the *American Society for Microbiology*.

More information: Zhen Lyu et al, Long-Term Effects of Developmental Exposure to Oxycodone on Gut Microbiota and Relationship to Adult Behaviors and Metabolism, *mSystems* (2022). DOI: 10.1128/msystems.00336-22

Provided by University of Missouri