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The effect of maternal prenatal smoking on brain activity in childhood, adolescence and young adulthood and its association with behavioral and cognitive development using data from longitudinal cohort studies

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This dissertation investigates the effects of prenatal tobacco exposure on brain development and behavior in children and adolescents. The study aimed to examine the influence of prenatal smoking on (a) EEG brain activity, (b) ADHD-related symptoms in school-aged children, and (c) their interaction, considering the number of cigarettes smoked during pregnancy and potential confounding factors, including the child's sex, age, maternal age, maternal psychopathology, maternal smoking before pregnancy, maternal alcohol consumption, and the week of pregnancy at birth.

The research explores developmental stages from the prenatal period to adulthood, highlighting the interplay between genetic, epigenetic, and environmental factors. Based on EEG data, behavioral and clinical measures, and socio-demographic variables from a large sample of mothers and their children, significant changes in resting-state EEG were identified in response to prenatal tobacco exposure. School-aged children exposed prenatally exhibited increased delta and theta brain activity compared to non-exposed peers. These changes were significantly correlated with the number of cigarettes smoked during pregnancy.

For ADHD-related symptoms, the effects of maternal smoking during pregnancy were only significant in unadjusted models. After accounting for potential confounders, the effects were no longer significant, indicating the critical role of proximal risk factors, such as maternal psychopathology, in interpreting these findings.

A second study investigated the long-term effects of maternal smoking during pregnancy on brain activity and internalizing and externalizing behavioral symptoms in young adulthood. Building on the results from the school-aged cohort, the study found that young adults exposed prenatally to smoking also displayed altered brain activity, particularly in the delta and theta frequency bands, consistent with the findings in school-aged children. These brain activity changes were associated with higher levels of externalizing behaviors, such as aggression and impulsivity. However, these behavioral effects were significantly influenced by maternal psychopathology, the child's gender, and their own substance use, highlighting a complex, multi-layered interaction between prenatal exposures and later behavioral outcomes.

In conclusion, these studies emphasize the importance of considering prenatal exposures in the context of neurodevelopmental outcomes across the lifespan. The observed changes in brain activity in both school-aged children and young adults demonstrate how early environmental factors, such as maternal smoking, can lead to enduring changes in brain function. Moreover, the variability in behavioral outcomes—particularly regarding ADHD-related symptoms and externalizing behaviors—underscores the crucial role of socio-demographic and familial factors in mediating these effects.