Associations of Early Socioeconomic Hardship and Suicide Attempts in Adolescents: A Mediating Role for Reward-Related Activation in the Anterior Insular Cortex

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Over 1 million people die from suicide annually, and it is the second leading cause of death among adolescents globally. Early life socioeconomic hardship is a suicide risk factor, but few studies have investigated the mechanisms that increase the risk of suicide attempts in adolescents. Reward-related brain activation may serve as a potential biological mechanism, wherein adolescents who experience early-life socioeconomic hardship might perceive future life as less rewarding, thereby increasing their risk for suicide attempts. Here, we focused on fMRI BOLD activation in anticipation of a large reward (vs neutral; Monetary Incentive Delay [MID]) in the anterior insular cortex (AIC), a region linked to reward saliency and suicidal processing. We hypothesized that socioeconomic hardship affects suicide attempt likelihood through reduced AIC reward-related activation. Using multi-level data (survey and fMRI) from the Adolescent Brain and Cognitive Development study (N=9147), we established latent constructs of harsh socioeconomic status (HSES) at Time 1 and reward-related activation in the anterior insular cortex (AIC), which was measured at Time 1 using left and right hemisphere contrast coefficients from the MID task, comparing anticipatory large reward versus neutral conditions. Suicide attempts (SA) were assessed from Time 3 to Time 5 using K-SAD questionnaires, scored as a binary indicator. Additionally, we controlled for family membership, scanner type, age, sex, scanner motion, and ABCD propensity score. The model fit well (CFI=.97; TLI=.96), and HSES was associated with higher odds of SA (logistic regression [LR] odds ratio = 1.828; 95% CI 1.402 to 2.410; $p < 0.001$), where HSES environments confer increased risk for suicide attempts in adolescents. This link was significantly mediated via a reduction in anticipatory reward-related brain activation in the AIC. HSES was significantly associated with reduced anticipatory reward-related activation in the AIC (b = -0.047; 95% CI -0.074 to -0.021; p = 0.001), and greater anticipatory AIC reward-related activation was associated with lower odds of SA 1 to 2 years later (LR odds ratio = 0.752; 95% CI 0.582 to 0.979; p = 0.023), Thus, HSES predicts more risk for suicide attempts 1-2 years later, via reduced AIC reward-related activation. These results suggest that reduced anticipatory reward-related activation in the AIC, associated with decreased saliency for future rewards, like life, may be a mechanistic risk factor for suicide attempts in adolescents raised in socioeconomic hardship. Targeted AIC activation training with reward-related fMRI paradigms could be implemented in adolescents from harsh socioeconomic environments who are at a high risk for suicide, as a preventative measure to reduce suicidality in adolescents.