

Increased brain activity predicts future onset of substance use

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Do people get caught in the cycle of overeating and drug addiction because their brain reward centers are over-active causing them to experience greater cravings for food or drugs? In a unique prospective study Oregon Research Institute (ORI) senior scientist Eric Stice, Ph.D., and colleagues tested this theory, called the reward surfeit model. The results indicated that elevated responsivity of reward regions in the brain increased the risk for future substance use, which has never been tested before prospectively with humans. Paradoxically, results also provide evidence that even a limited history of substance use was related to less responsivity in the reward circuitry, as has been suggested by experiments with animals. The research appears in the May 1, 2013 issue of *Biological Psychiatry*.

In a novel study using functional [Magnetic Resonance Imaging](#) (fMRI) Stice's team tested whether individual differences in reward region responsivity predicted overweight/obesity onset among initially healthy weight adolescents and substance use onset among initially abstinent adolescents. The [neural response](#) to food and monetary reward was measured in 162 adolescents. Body fat and substance use were assessed at the time of the fMRI and again one year later.

"The findings are important because this is the first test of whether atypical responsivity of reward circuitry increases risk for substance use," says Dr. Stice. "Although numerous researchers have suggested that reduced responsivity is a vulnerability factor for substance use, this theory was based entirely on cross-sectional studies comparing substance

abusing individuals to healthy controls; no studies have tested this thesis with prospective data."

Investigators examined the extent to which reward circuitry (e.g., the striatum) was activated in response to receipt and anticipated receipt of money. Monetary reward is a general reinforcer and has been used frequently to assess reward sensitivity. The team also used another paradigm to assess brain activation in response to the individual's consumption and anticipated consumption of chocolate milkshake. Results showed that greater activation in the [striatum](#) during monetary reward receipt at baseline predicted future substance use onset over a 1-year follow-up.

Noteworthy was that adolescents who had already begun using substances showed less striatal response to monetary reward. This finding provides the first evidence that even a relatively short period of moderate substance use might reduce reward region responsivity to a general reinforcer.

"The implications are that the more individuals use psychoactive substances, the less responsive they will be to rewarding experiences, meaning that they may derive less reinforcement from other pursuits, such as interpersonal relationships, hobbies, and school work. This may contribute to the escalating spiral of drug use that characterizes substance use disorders," commented Stice.

Although the investigators had expected parallel neural predictors of future onset of overweight during exposure to receipt and anticipated receipt of a palatable food, no significant effects emerged. It is possible that these effects are weaker and that a longer follow-up period will be necessary to better differentiate who will gain weight and who will remain at a healthy weight.

Provided by Oregon Research Institute

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