

Impaired executive function may exacerbate impulsiveness and risk of developing alcohol dependence

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Executive function (EF), frequently associated with the frontal lobes, guides complex behavior such as planning, decision-making, and response control. EF impairment due to alcohol dependence (AD) has been linked to alcohol's toxic effects on the frontal lobes. A study of EF in a group of adult offspring of AD individuals has found that increased impulsiveness and decreased EF may comprise an inherited trait that signifies greater risk for developing AD.

Results will be published in a special online issue of *Alcoholism: Clinical & Experimental Research* and are currently available at Early View.

"Executive functions are requested each time a subject faces a new situation or when habits are not adapted to a particular situation," explained Fabien Gierski, associate professor at the Université de Reims Champagne-Ardenne, as well as corresponding author for the study. "For example, an individual with an EF deficit will have difficulties in adapting to unexpected events in the course of the day, such as a car breakdown. This individual will also have difficulties inhibiting habitual response patterns. For example, if he has the habit of eating ice cream every evening while watching TV, but is currently on a diet, it will be difficult to inhibit this habit."

"The brain's ability to inhibit maladaptive behaviors – also known as self-control – as well as impulsivity are thought to comprise a key element in

an individual's ability to avoid engaging in excessive alcohol intake, which increases his/her vulnerability to alcohol addiction," added Mickael Naassila, a professor at the Université de Picardie Jules Verne. "In addition, poor inhibitory control and impulsivity are hallmarks of the adolescence period and may explain why adolescents are at risk for alcohol abuse."

Naassila explained that decisions around planning, initiating appropriate actions, and inhibiting inappropriate actions as well as components of impulsivity, such as acting in an unduly risky or inappropriate way in a situation, can all play key roles in alcohol abuse. "For example, seeing a beer may distract individuals, draw them to the source, induce thirst, and stimulate drinking," he said. "EF and impulse inhibition can block the movement to and drinking of beer or responding to alcohol cues. However, impairment of EF and impulsivity, through weak inhibitory control, lack of attention, or bad decisions, may lead to rapid responses without reflection. The crucial question is whether this impairment in EF and impulsivity could be a pre-existing vulnerability for AD."

Gierski and his colleagues recruited 155 participants via advertisements and flyers placed in and around the university hospitals in a region in France. Of these, 55 (41 women, 14 men) were non-alcoholic adults with (FHP) and 100 (72 women, 28 men) without (FHN) a family history of AD. All participants were screened for past and current psychiatric diagnoses, as well as alcohol, tobacco, and other substance use. Participants were also compared on self-rated impulsiveness using a 30-item self-report questionnaire called the Barratt Impulsiveness Scale (BIS-11) and EF capabilities through use of neuropsychological testing.

"Non-alcoholic adult offspring of AD individuals showed decreased EF," said Gierski. "This supports the hypothesis that EF impairment observed among AD patients may correspond partially to a vulnerability factor. "This cognitive endophenotype, associated with the well-known

P300 amplitude reduction and high levels of impulsivity, could be useful in the identification of causal factors involved in AD."

"We knew that alcohol addiction is largely subserved by brain circuits that have also been associated with executive control, specifically response inhibition, mental planning, and attentional control," said Naassila. "These neural networks are possibly dysfunctional before the alcohol abuse, rendering individuals vulnerable for alcohol addiction. In other words, while we knew that impulsivity is a vulnerability factor in alcohol addiction, this study has shown that poor EF may also be of interest and use as a vulnerability factor in [alcohol addiction](#). It was also very interesting that the number of AD family members is a good predictor of EF performance."

"We believe that EF impairment exacerbates impulsiveness," said Gierski. "Maybe impulsivity is more dependent on contexts such as emotions, whereas EF is more stable over time and contexts. The more we understand vulnerability factors to AD, and understand differences between these vulnerabilities, the more we will have tools to prevent populations from their own risk of developing AD."

"For clinicians, identifying a 'neurocognitive endophenotype' derived from brain and behavior could possibly enable early detection of a disorder before its full-blown expression," said Naasila. "Thus it could be used as a tool to identify at-risk subjects and perhaps initiate psychotherapeutic approaches ... to prevent the development of [alcohol addiction](#) or other disorders. Readers should understand that impulsiveness and poor executive functioning occur in many neuropsychiatric disorders, and may even help to define them. Furthermore, as shown by this study, impulsivity and poor executive functioning appear to have distinct, though possibly overlapping, neural and neurochemical substrates."

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