

Editorial

Maintaining a Focus on Cognitive Function in the Treatment of Substance Use Disorders

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Although effective treatments for substance use disorders do exist, there is certainly significant need for improvement, as many treatments only yield modest benefits. Substantial efforts are indeed underway to improve treatment outcomes for individuals with substance use disorders, with cognitive function receiving increased attention in this regard. Cognitive impairments are recognized as both a potential risk factor of addiction, as well as a consequence of long-term substance use, providing a variety of potential treatment targets.

Cognitive impairments have been associated with a variety of poor treatment outcomes in individuals with substance use disorders [1]. For example, both self-report and behavioral tasks measuring impulsivity have shown that individuals with substance dependence are more impulsive in comparison to healthy controls [2,3], and higher impulsivity in turn has been associated with an increased risk for relapse [4]. Substance dependent individuals also show an attentional bias for substance-related cues, which has been at least moderately associated with increased craving, quantity and frequency of use [5,6]; however, results of studies to date have been mixed, with some suggesting no association. Furthermore, activation in dorsal anterior cingulate cortex associated with attentional bias significantly predicted cocaine relapse in a recent study [7], and therefore might be considered as a biomarker of relapse vulnerability. Evidence suggests that impulsivity and attentional bias are related, and it has been hypothesized that dopaminergic alterations associated with impulsivity affect key brain regions involved in attentional biases that may result in an increased likelihood of substance-cued attentional bias and an increased association between substance cues and attention through classical conditioning processes [8]. In fact, Kosten et al. [9] observed greater activation in response to drug cues in sensory, motor and limbic cortices of depressed cocaine dependent patients with greater relapse and substance use during treatment compared to those who did not relapse and had less drug use during treatment. The authors suggest that activation, particularly in posterior cingulate, may facilitate a learned habit through initiation of motor responses. The authors also advocate the importance of examining changes in brain activation as a potential target of treatment development, particularly since brain activation better predicted relapse than did subjective reports of craving. The continual improvement and

advancements of neuroimaging techniques should allow us to better understand the neural changes associated with cognitive impairments and potential cognitive improvements that may occur following substance use treatments and abstinence.

A variety of compounds have been investigated with the hope of improving cognitive outcomes in substance users, which would in turn be expected to improve substance use outcomes (see Brady et al. [10] and Sofuoglu et al. [11] for recent reviews). Pharmacological agents targeting glutamatergic and cholinergic systems, as well as those of the biogenic amines (e.g., histamine and the catecholamines, dopamine and norepinephrine), have been associated with at least some improvements in the cognitive function of substance users [10-12]. These agents may directly reduce drug-induced cognitive deficits, as well as diminish the rewarding or reinforcing properties of addictive substances, most often by affecting neuromodulation in hippocampal and prefrontal regions. However, additional research is clearly needed in this area, as many of the studies to date have been small pilot trials that have produced equivocal results, and few studies adequately evaluate both cognitive and substance use outcomes.

Behavioral strategies such as cognitive behavioral therapy (CBT) and cognitive remediation are also being investigated [11]. Modifications to traditional CBT, including a computerized presentation, may improve the ability for substance users with cognitive impairments to better utilize such therapy and fully realize its benefits. Cognitive remediation, which involves the repetitive practice of cognitive tasks, may also directly improve cognitive function. Other behavioral interventions, such as exercise, which is associated with cognitive improvements in many other chronic diseases, is also an area that is ripe for investigation in addicted individuals. Other nontraditional therapies also warrant further consideration for use in treating cognitive impairments in substance users. For example, a pilot trial examining the nutritional supplement, citicoline, showed improvements in verbal learning and memory in cocaine dependent individuals with bipolar disorder [13]. However, another investigation of mood-disordered individuals with methamphetamine dependence did not show cognitive improvement with citicoline, suggesting that this compound may have selective effects depending on the substance abused [14].

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In addition to their potential to adversely impact substance use outcomes, cognitive impairments are increasingly becoming recognized as being associated with reduced productivity and quality of life in substance use disorders, similar to associations observed in other psychiatric disorders, such as schizophrenia and depression. This suggests a need to also evaluate the impact of cognition, and potential treatments for cognitive impairments, on measures of quality of life and functioning in addicted individuals.

The far-reaching implications of cognitive impairments associated with substance misuse indicate a need to directly treat cognitive symptoms. While the relationships between several cognitive constructs and drug use outcomes are still being fully elucidated, they hold strong potential for development of treatment modalities for substance dependent individuals to help reduce the likelihood of relapse, reduce drug use quantity and frequency, and improve quality of life. This is an exciting time in the field, as the rapid developments in neuroimaging and other technologies will be of great benefit in this area. Future research should continue to investigate this promising area by maintaining the focus on identification of both pharmacological and behavioral interventions that improve cognitive outcomes and associated substance use and functional outcomes, with the goal of ultimately improving the care and quality of life of individuals with substance use disorders.

CONFLICTS OF INTEREST

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