

Changes in Executive Function Following Short-Term Tobacco Cessation Therapy in College Students

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Received date: November 06, 2017; Accepted date: November 26, 2017; Published date: December 03, 2017

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Abstract

Objective: Evidence has been accumulating regarding the role of executive deficits in nicotine addiction; however, little is known as to whether executive abilities change as a function of treatment for nicotine dependence. The purpose of this study was to investigate whether executive function improves following short-term tobacco cessation therapy.

Methods: College students (N=17) expressing an interest in tobacco cessation therapy involving Motivational Interviewing Therapy with or without the nicotine patch were administered the self-report Frontal Systems Behavioral Scale (FrSBe), the performance-based Delis-Kaplan Executive Function System (D-KEFS) and the Fagerstrom Test of Nicotine Dependence (FTND) prior to treatment and approximately 1.5 months later. A group of non-smoking college students (N=19) was also administered the same measures of executive function across the same time period.

Results: Prior to treatment smokers had significantly higher FrSBe Apathy subscale scores compared to non-smokers. Acute tobacco cessation therapy significantly decreased nicotine dependence as measured by the FTND. After controlling for pre-treatment scores, a significant difference emerged between tobacco cessation participants and non-smoking controls on post-test FrSBe Disinhibition scores. Post hoc analyses revealed a significant improvement in FrSBe Disinhibition scores among tobacco cessation participants, but no change among non-smokers.

Conclusion: While caution is warranted due to the small sample size of this study, these results suggest self-report measures of executive function maybe more sensitive to executive deficits among smokers and change following short-term tobacco cessation therapy, particularly measures indicative of an improved ability to inhibit impulses and behavior. These results also highlight the multidimensional nature of executive function.

Keywords: Executive function; Tobacco cessation; Disinhibition; Apathy; Prefrontal cortex; Tobacco dependence

Impaired performance among drug addicted individuals has been observed on neuropsychological tests of executive function [11-13].

While the role of executive dysfunction in drug addiction has been previously examined, the extent to which executive function improves following short-term tobacco cessation therapy remains unclear.

The term executive function represents a shorthand description of a complex set of processes central for goal directed behavior and managing cognitive, emotional and behavioral activities particularly during active and novel problem solving. Multiple behaviors fall under the umbrella of executive function including planning, attention, working memory, monitoring, decision-making, inhibitory control, emotion regulation and cognitive flexibility among others [1-3]. Executive abilities are generally believed to be localized within the sub-regions of the prefrontal cortex and related circuitry [4,5]. A significant literature links deficits in executive function and drug addiction and this relationship is now viewed by many as integral to the development and maintenance of drug addiction [6,7] as deficits in executive function have been found to both predate the development of addiction [8,9] as well as worsen as a function of repeated drug exposure [10]. Moreover, structural and functional imaging studies have linked addiction with changes in the prefrontal cortex and

found to be independent of smoking recency [17]. Other research has linked impulsivity to the development of nicotine dependence among young adults [18] and related work found that scores on several domains of executive function predicted the frequency of tobacco use among college students [19]. T e

(60%) between test sessions. At the initial testing session two tobacco

smoking groups on gender, age, ethnicity, executive function scores and number of days between test sessions. Analysis of covariance (ANCOVA) was used to compare differences in executive function at the second test session between tobacco cessation participants and non-smoking participants using pretest executive function scores as a covariate. Controlling for pretest scores is particularly important given previous research has found differences in executive function between smokers and non-smokers [12,19] and this procedure may be advantageous with small samples when random assignment is not possible [44,45]. All variables were tested for normality,

changes in executive abilities were observed in this study is consistent with other research suggesting self-report measures may be more sensitive to differences in executive deficits among adolescent drug users [19] substance dependent populations [36,37] and other clinical populations [35]. Growing evidence suggests performance-based and self-report measures of executive functioning may be tapping into different constructs as the two approaches do not often yield significant correlations and those correlations are often small. Therefore, it has been hypothesized that each captures a different level of cognitive analysis with performance-based tasks assessing cognitive efficiency and self-ratings measures being indicative of successful pursuit of goals [35]. This interpretation is consistent with the general usage of performance-based measures to assess executive function

one that is vulnerable to be defined by the measures and measurement approaches used in its assessment.

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