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ADHD as risk factor for early onset and heightened adult problem severity of illicit substance use: An Accelerated Gateway Model

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Abstract

The primary aims of the present study were to assess ADHD history as a risk factor for earlier initiation and current use of licit and illicit substances among a sample of drug using adults. It was hypothesized that ADHD history would accelerate the Gateway Theory of drug use. Participants included 941 drug-using African American and Caucasian individuals in Baltimore, Maryland. The sample consisted of 124 (13.2%) participants who reported a history of ADHD and 817 (86.8%) who reported no history of ADHD. The accelerated gateway hypothesis was supported, as a history of self-reported ADHD was significantly associated with younger ages of initiation for alcohol, cigarettes, marijuana, and cocaine use. Participants with a history of ADHD were also more likely to engage in recent HIV-risk behavior, such as injection drug use and needle sharing. This study provides compelling data in support of an accelerated gateway model for substance use related to ADHD history and increased problem severity in adulthood. Targeted substance use prevention and intervention may be beneficial for those with ADHD.

Keywords

ADHD; alcohol; tobacco; illicit drugs; injection drug use

1. Introduction

According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), attention deficit hyperactivity disorder (ADHD) is a

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neurodevelopmental disorder that typically begins in childhood, may persist into adulthood, and is characterized by symptoms of inattention, hyperactivity, and/or impulsivity. Data from the 2011 National Survey of Children's Health (NSCH) estimates that 11% of children in the United States have been diagnosed ADHD, with males (13.2%) being more than twice as likely as females (5.6%) to meet diagnostic criteria (Visser et al., 2014). Among adults, emotional and behavioral dysregulation associated with ADHD may impair multiple areas of functioning. Adults with ADHD often exhibit low frustration tolerance, emotional lability, and difficulty managing strong emotions (Nigg & Casey, 2005; Reimherr et al., 2005). Attentional difficulties and deficits in the areas of working memory, inhibition and planning contribute to problems with organization, time management, and task completion (Gjervan, Torgersen, Nordahl, & Rasmussen, 2012; Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005). Accordingly, ADHD is associated with academic difficulties, lower educational attainment and reduced occupational productivity.

Research has highlighted a compelling link between the presence of ADHD and an increased risk of alcohol, tobacco, and illicit drug use (Gudjonsson, Sigurdsson, Sigdusdottir, & Young, 2012). Current literature suggests that over half of adults with ADHD will also meet criteria for a substance use disorder at some point in their lifetime (Beiderman et al., 1995) and adults with ADHD tend to abuse substances at an earlier age (Wilens et al., 1997). One explanation for the higher likelihood of substance abuse is self-medication, as ADHD is most commonly treated with stimulant medication, such as methylphenidate (U.S. Department of Health and Human Services, 2012). Research has found that nicotine, also a stimulant drug, is often used as a form of self-medication among individuals with ADHD (Gehricke et al., 2007, Khantzian, 1997). A study of adults with ADHD found that nicotine administration led to reductions in ADHD symptoms (Gehricke et al., 2006). Compared to those without ADHD, individuals with ADHD manifest an earlier onset and increased severity of nicotine dependence (Wilens et al., 2008). Research on adolescents with ADHD suggests that cigarette smoking is predictive of subsequent alcohol and drug use (Biederman et al., 2012). As such, alcohol and marijuana may also be used as a form of self-medication for symptoms of inattention and hyperactivity (Biederman et al., 1995; Upadhyaya and Carpenter, 2008). Additionally, impulsivity and oppositional behavior have been found to predict cocaine dependence among smokers with ADHD (Saules, Pomerleau, & Schubiner, 2003; Pingault et al., 2013).

1.1 Gateway Theory

First introduced by Kandel (1975), the Gateway Theory of adolescent involvement in substance use postulates a stage-wise progression from legal drugs to illicit drug use. According to the model, legal drugs, such as alcohol and cigarettes, serve as a necessary precursor to the initiation of marijuana, which in turn serves as a gateway to other "hard" drugs, such as cocaine and heroin (Kandel, 1975). Specifically in Kandel's studies, greater than one in four participants who used legal substance progressed to marijuana use, while only two percent of participants reported marijuana use without a history of alcohol or cigarette use. Similarly, one in four marijuana users progressed to "harder" drugs, compared to only one percent of non-marijuana users. The theory has been extensively researched and refined, with several authors providing support for alcohol as the key gateway drug to all

other substance use among adolescents (Welte and Barnes, 1985; Kirby & Barry, 2012). Research by Kandel, Yamaguchi, and Chen (1992) concluded that alcohol use was the key predictor of initiation to illicit drug use among males, while either cigarettes or alcohol use were sufficient gateway substances to illicit drugs among females.

1.2 Aims and Hypotheses

The primary aim of the present study was to assess ADHD history as a risk factor for earlier initiation and current use of licit and illicit substances among a sample of drug using adults. Whereas most studies in the field examining relationships between ADHD and drug use focus on ADHD populations, the present study design offers a unique approach to assessing the age of onset of substance use among a sample of adult drug users with and without a history of ADHD. It was hypothesized that individuals with a history of ADHD would have initiated alcohol use at a younger age compared to participants with no history of ADHD. In accordance with Gateway Theory, it was also hypothesized that a progression from alcohol to cigarettes, marijuana, cocaine, and heroin would also occur at younger ages for participants with ADHD history. We also hypothesized that participants with ADHD history would also have higher rates of current substance use and HIV-risk behavior, such as injection drug use and needle sharing.

2. Methods

2.1 Participants

The present study included 941 African American and Caucasian participants between the ages of 18 and 65 enrolled in the NEURO-HIV Epidemiological Study between 2002 and 2012 in Baltimore, Maryland. Inclusion criteria included non-injection or injection drug use in the past six months. Participants completed standardized face-to-face interviews, which included questionnaires regarding demographic information, substance use, and sexual risk behaviors. Participants were compensated $45 at completion of the interview. This study was approved by the University of Florida Institutional Review Board and reviewed annually.

2.2 Measures

2.2.1 HIV Risk Behavior Interview—Demographic and socioeconomic factors were assessed using a structured HIV Risk Behavior Interview that was adapted from a landmark study conducted by Vlahov and colleagues (1991). Tobacco use questions assessed average number of cigarettes smoked per day in the last 30 days. Alcohol and drug use were assessed with a series of dichotomous variables (“yes” or “no”) assessing self-reported lifetime and recent (past six months) use. Participants were also asked their age at first use for each substance.

2.2.2 Attention Deficit Hyperactivity Disorder (ADHD)—Participants provided self-reported history of ADHD diagnosis. Specifically, they were asked if they were ever diagnosed or otherwise made aware by a medical doctor, psychologist, or other professional that they met diagnostic criteria for ADHD.

2.3 Statistical analysis

Chi square analyses were conducted to assess the association between ADHD history and dichotomous outcome variables, including race, gender, and drug use. Independent samples t-test analyses were conducted to compare age differences between groups. A series of analyses of covariance (ANCOVA) were used to compare group differences in age of onset for each drug of interest, while controlling for the effects of covariates. Data analyses were conducted using IBM SPSS version 21 software (IBM, 2012).

3. Results

3.1 ADHD Group Differences

The sample consisted of 124 (13.2%) participants who reported a history of ADHD and 817 (86.8%) who reported no history of ADHD. Table 1 displays group differences for demographic and drug use variables. Those with a history of ADHD were significantly younger than those with no history of ADHD, $t(939) = 4.82$, $p < .001$. Participants with ADHD history in this sample were more likely to be Caucasian, $X^2(1, 941) = 26.47$, $p < .001$, male, $X^2(1, 941) = 8.38$, $p = .004$, report recent use of non-injection drugs, $X^2(1, 941) = 4.65$, $p = .031$, and recent use of injection drug, $X^2(1, 941) = 6.95$, $p = .008$. Furthermore, ADHD history was associated with an increased prevalence of needle sharing among injection drug users, $X^2(1, 589) = 6.23$, $p = .013$.

3.2 ADHD and Accelerated Substance Initiation

Table 2 provides lifetime prevalence and adjusted age of onset for each substance. Due to the age difference between groups, participant age was entered as a covariate in the gateway analyses. The accelerated gateway hypothesis was supported, as a history of self-reported ADHD was significantly associated with younger ages of initiation for alcohol, $F(1, 901) = 10.07$, $p = .002$; cigarettes, $F(1, 849) = 7.80$, $p = .005$; marijuana, $F(1, 866) = 10.36$, $p = .001$; nasal cocaine, $F(1, 612) = 4.12$, $p = .043$; and injection cocaine, $F(1, 405) = 5.04$, $p = .025$. Participants with a history of ADHD also reported an earlier initiation age for nasal and injection heroin, and injection speedball, though these differences were nonsignificant ($p > .05$).

4. Discussion

The present study hypothesized that adult drug users with a history of ADHD would follow the substance initiation hierarchy proposed by Kandel's seminal work on Gateway Theory (1975), while having significantly younger ages of initiation to alcohol, tobacco, marijuana, and cocaine compared to those without ADHD. This hypothesis was supported, as adult drug users with a history of ADHD reported onsets ranging from 1.2 to 2 years earlier than drug users without a history of ADHD. As suggested by prior research, nicotine and cocaine may have been used to self-medicate inattentive symptoms while alcohol and marijuana may have been used to counteract symptoms of hyperactivity and impulsivity. Furthermore, age of initiation for heroin use was not found to be associated with ADHD history after adjusting for participant age. This lack of association was anticipated, as heroin is not a stimulant drug

and thus would not serve as a mechanism for self-medicating symptoms of hyperactivity or inattention.

The most prominent finding of this study was related to injection cocaine use, as adult drug users with a history of ADHD reported an average age of onset two years earlier than those without a history of ADHD. Among participants with ADHD history, there was nearly no time lapse between the onset of nasal heroin use and the onset of injection use of cocaine or heroin – all initiated at age 22.4, on average. Conversely, participants with no history of ADHD tend to inject heroin at an earlier age than injection cocaine. On average, those without ADHD initiate non-injection heroin use at age 22.8, injection heroin use at 23.8, and injection cocaine use at 24.4 years of age. Taken together, these data may have significant public health implications related to injection drug use prevention. Drug users with ADHD may progress to injection drug use sooner than those without ADHD due impulsive characteristics and the stimulant, selfmedicating effect of cocaine. Thus, the present study findings supported what might be called an “accelerated gateway model” where ADHD history appeared to accelerate the rate at which vulnerable adolescents who ultimately became chronic drug users progressed from one drug to another as predicted by the Gateway Theory.

There are several limitations to this study that should be considered. The assessment method of ADHD was based on self-report and not diagnostic interviews. The original study design was not intended to assess diagnostic criteria for ADHD and future research would benefit from using more appropriate measures of ADHD. Additionally, this study did not assess treatment history; therefore, these findings may not generalize to all individuals with ADHD. Finally, data presented are cross-sectional, thus it is not possible to infer causality.

Despite these limitations, this study provides compelling data in support of an accelerated gateway model for substance use related to ADHD history and increased substance use severity in adulthood. It also supports the notion of self-medication via the use of stimulant drugs, such as nicotine and cocaine. Comorbidity of ADHD and substance abuse disorders have been associated with poor treatment outcomes (Wilens, 2004; Gray and Upadhyaya, 2009). This finding has potential clinical utility, such that adolescents with ADHD should be targeted for prevention efforts to counter the exceptionally high risk for substance use initiation and progression along the lines postulated by the Gateway Theory. Additionally, this research may inform substance abuse treatment facilities of the potential HIV-risk behaviors, such as injection drug use and needle sharing, among adult drug users with ADHD history.

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Highlights

- This study provides further support for the Gateway Theory of drug use
- An Accelerated Gateway Model was observed among those with a history of ADHD
- ADHD history was also associated with current drug use and HIV-risk behavior

Table 1

Demographics information.

	No History of ADHD *n*=817, 86.2%	History of ADHD *n*=124, 13.2%	t/X^2
Age: *M (SD)*	36.3 (9.2)	32.0 (9.5)	4.82***
Gender			8.38**
% Male	83.7	16.3	
% Female	90.1	9.9	
Race			26.47***
% Caucasian	79.2	20.8	
% African American	91.1	8.9	
Current Drug Risk			
% Non-injection Drugs	37.5	47.6	4.65*
% Injection Drugs	39.9	52.4	6.95**
% IDU Sharing Needles	15.4	26.1	6.23**

Note:

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 2

Effect of ADHD on lifetime drug use and adjusted[A] age of initiation.

	No History of ADHD (*n*=817)	History of ADHD (*n*=124)	*M* Difference	*t*
% Used Alcohol	96.2	96.8		
M (SE) Age Initiation	14.4 (0.16)	13.0 (0.41)	1.4	10.07**
% Used Cigarettes	89.4	94.4		
M (SE) Age Initiation	14.8 (0.19)	13.4 (0.48)	1.4	7.80**
% Used Marijuana	92.5	96.8		
M (SE) Age Initiation	15.0 (0.13)	13.8 (0.33)	1.2	10.36**
% Sniff Cocaine	66.8	63.7		
M (SE) Age Initiation	20.5 (0.24)	19.1 (0.66)	1.4	4.12*
% Sniff Heroin	77.8	72.6		
M (SE) Age Initiation	22.8 (0.41)	22.4 (1.10)	0.4	0.16*NS*
% Inject Cocaine	41.8	55.6		
M (SE) Age Initiation	24.4 (0.36)	22.4 (0.81)	2.0	5.04*
% Inject Heroin	55.4	67.7		
M (SE) Age Initiation	23.8 (0.32)	22.4 (0.76)	1.4	2.65*NS*
% Inject Speedball	42.9	58.1		
M (SE) Age Initiation	24.4 (0.32)	23.2 (0.80)	1.2	1.86*NS*

Note:

[A] adjusted for participant age

* $p < .05$;

** $p < .01$;

*** $p < .001$;

ns = nonsignificant