Do Depression and Antisocial Behavior Moderate

the Relationship Between ADHD and Smoking Progression?

BY

MARIE CHESANIUK
B.A., Adelphi University, 2006
M.A., University of Chicago, 2007

THESIS

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Defense Committee:

Robin Mermelstein, Chair and Advisor, Psychology & Institute for Health
Research and Policy
Jon Kassel, Psychology
Kristine Molina, Psychology
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ABSTRACT

Introduction This study examines whether depression, antisocial behavior, and gender moderate the relationship between ADHD symptoms and smoking among a sample of young adults (N=939). ADHD symptoms, depression symptoms, antisocial behavior, and gender have been consistently related to smoking, but rarely are their combined effects examined longitudinally. We hypothesized that depressive symptoms would exacerbate the ADHD-smoking association, particularly for females. We also hypothesized that antisocial behavior would exacerbate the ADHD-smoking association, particularly for males.

Methods Participants for this study were recruited in either 9th or 10th grade, and followed for 7 years. Data for this study come from the baseline, 2, and 6-year data collection waves.

Results ADHD symptoms were associated with both any smoking and higher rates of past month smoking. Depressive symptoms moderated the relationship between ADHD symptoms and any prior month smoking, such that ADHD symptoms were more strongly associated with smoking among adolescents with higher levels of depression. Among smokers, male gender and higher levels of depression and ADHD symptoms were each associated with more smoking days. Additionally, an interaction was observed showing that while ADHD symptoms were positively associated with smoking for males, this association was not significant for females. Furthermore, a significant interaction between ADHD symptoms and depression symptoms showed that ADHD symptoms were positively associated with past month smoking days at low and mean, but not high, levels of depression. Antisocial behavior did not moderate the link between ADHD symptoms and any smoking. Among smokers, however, gender interacted with antisocial behavior revealing a significant positive effect of antisocial behavior on past-month smoking.
days specific to female smokers. Antisocial behavior was also found to moderate the link between ADHD symptoms and past-month smoking days. While ADHD symptoms were significantly positively associated with past-month smoking among those reporting mean and high levels of antisocial behavior, there was no significant association for those with low antisocial behavior. An interaction between ADHD symptoms and gender showed that while ADHD symptoms were positively associated with smoking for females, this association was not significant for males.

**Conclusions** In sum, this study suggests that the relationship between ADHD and smoking is not straightforward and can vary significantly in response to depression and antisocial behavior. Additionally, treating these variables dimensionally may help discriminate between profiles of adolescent smoking and identify those who may be at risk for smoking progression earlier in their smoking careers.
1. INTRODUCTION

1.1 **Background**

Smoking is still a public health problem. Despite a noticeable drop in the prevalence of smoking over the past several decades, that decline has recently plateaued. Smoking prevalence among adults in the U.S. dropped from 20.9% in 2005 to 18.1% in 2012 (CDC, 2014). This leaves 42.1 million adults who still smoke (CDC, 2014). Prevalence of smoking among teenagers has also declined, but more substantially. The Monitoring the Future study (Johnston, 2014) reports that from 2005 to 2013, the rates of smoking among tenth grade students in the past 30 days dropped from 14.9% to 9.1%.

As the prevalence of smoking decreases, current adolescents and adults who smoke may have greater prevalence of other comorbidities and psychological symptoms that place them at increased risk for both initiating and maintaining smoking (Brown, Lewinsohn, Seeley, & Wagner, 1996; Upadhyaya, Deas, Brady, & Kruesi, 2002). One in five adults in the general population smoke. Among the mentally ill, that number rises to one in three (CDC, 2013). A number of psychological and psychiatric disorders have been associated with a higher prevalence of smoking, including schizophrenia, depressive disorders, and anxiety disorders (Hughes et al., 1986; Mihailescu and Drucker-Colin, 2000; Thorsteinsson et al., 2001; Sacco et al., 2004; Singh et al., 2004; Newhouse et al., 2004a,b).

Smoking is also more common among individuals with attention deficit hyperactivity disorder (ADHD) than those without. ADHD has a childhood onset and often lasts into adulthood. It is characterized by developmentally inappropriate levels of inattentiveness, hyperactivity, and impulsive behavior across multiple settings commonly coincident with impairment in daily life activities. The combined subtype is the most common ADHD diagnosis.
(Pelham, Fabiano, & Massetti, 2005). Using the National Longitudinal Study of Adolescent Health, Kollins, McClernon, and Fuemmeler (2005) found a mainly linear relationship between retrospectively reported ADHD symptoms and lifetime smoking such that each additional symptom of ADHD confers greater risk of smoking. One study found that 27% of their sample with ADHD were smoking dependent versus 11% of non-ADHD case controls (Biederman et al., 2012) at the 16 year follow up of a cohort of Caucasian boys ranging in age from 6-18 years at baseline. Another prospective study of tobacco smoking and dependence found that by age 17, 46% of adolescents with ADHD were smoking cigarettes daily versus 24% of age-matched controls (Lambert & Hartsough, 1998). Previous research demonstrates that this elevated use of cigarettes cuts across gender: both men and women with ADHD tend to smoke more than the general population (Pomerleau, Downey, Stelson, & Pomerleau, 1995). Smoking has been found to run in families of ADHD probands (Milberger, Biederman, Faraone, Chen, & Jones, 1997a), and adolescents with higher levels of ADHD symptoms tended to smoke more than those with lower levels of ADHD symptoms (Whalen, Jamner, Henker, Delfino, & Lozano, 2002). This situation continues into adulthood. Most individuals maintain ADHD symptoms into adulthood (Biederman, Mick, & Faraone, 2000; Hervey, Epstein, & Curry, 2004; Wender, 1995), and adults with ADHD in a prospective study had a greater likelihood of becoming habitual smokers (Lambert & Hartsough, 1998) and remaining smokers (Pomerleau et al., 1995).

But ADHD does not occur in isolation. Many of the associated correlates of ADHD are also linked to smoking (polysubstance use: (Gudjonsson, Sigurdsson, Sigfusdottir, & Young, 2012); conduct disorder (Molina, Marshal, Pelham, & Wirth, 2005); social impairment (Greene et al., 1999); lower levels of cognitive coping skills (Molina et al., 2005); novelty seeking (Tercyak & Audrain-McGovern, 2003); antisocial personality disorder (Rasmussen & Gillberg,
2000); depression and anxiety (Barkley, 2006)). Thus teasing apart the unique contribution of ADHD symptoms to smoking outcomes can be challenging.

The goal of this study was to examine the combination and potential synergistic role of symptoms from different disorders along with ADHD symptoms in examining smoking uptake and progression. This project addresses the relationship between ADHD and two frequently comorbid conditions, depression and antisocial behavior, among a sample of adolescents transitioning into young adulthood to test the hypothesis that depressive symptoms and antisocial behavior moderate the relationship between ADHD symptoms and smoking progression in young adults.

This study may provide a more comprehensive understanding of how ADHD relates to smoking among youth and young adults. It considers smoking progression from adolescence to young adulthood, which is relatively understudied in the literature compared to smoking initiation/onset, and puts ADHD in context of two common comorbidities: depression and antisocial behavior. By including these often co-occurring conditions, we can begin to understand ADHD symptoms in the larger context in which it frequently appears.
1.2 ADHD Symptoms and Smoking

A link between nicotine dependence and childhood ADHD has been shown consistently across multiple studies. Forty to fifty percent of children with ADHD may become daily smokers by adulthood (Molina, 2011). The self-medication conceptualization of ADHD symptoms and smoking posits that smokers with ADHD symptoms use nicotine as a stimulant drug to reduce cognitive deficits. Specifically, nicotine is an indirect dopamine agonist that improves attention and arousal not unlike common ADHD medications methylphenidate and dextroamphetamine. Nicotine-induced cognitive improvements have been observed across the lifespan in children (Shytle, Silver, Wilkinson, & Sanberg, 2002), adolescents (Potter & Newhouse, 2004), and adults (Levin, Conners, Silva, Canu, & March, 2001; Potter & Newhouse, 2008) across all ADHD and smoking statuses. Nicotine has even been proposed as a formal treatment for ADHD (Levin et al., 1996; Levin & Rezvani, 2000).

Nicotine improves performance on cognitive-attentional tasks, which is especially relevant for individuals with ADHD-related cognitive impairments. For example, reducing ADHD symptoms also reduced later smoking in youth (Huizink, van Lier, & Crijnen, 2009). Nicotine has also eased difficulty concentrating in daily life (Gehricke, Whalen, Jamner, Wigal, & Steinhoff, 2006). Furthermore, increases in cognitive performance due to nicotine exposure are also found in smokers (Wesnes & Warburton, 1983) and nonsmokers with and without ADHD (Levin et al., 1998; Provost & Woodward, 1991). For smokers and nonsmokers with ADHD, Levin et al. (1996) found that both groups reported improvements in concentration and reaction time, which was maintained over a four-week course of transdermal nicotine administration for smokers with ADHD (Levin et al., 2001).
Some have suggested that, despite the strength of research findings regarding sustained attention impairment as a key cognitive deficit in ADHD (Willcutt, Doyle, Nigg, Faraone, & Pennington, 2005), this deficit may be secondary to deficits in behavioral inhibition (Nigg, 2001; Potter & Newhouse, 2008). Impairments in a number of measures of inhibitory control associated with ADHD have been shown to improve with nicotine. Nicotine reduced the Stroop effect (a measure of cognitive inhibition) in normal smokers (Wesnes & Warburton, 1983), non-smokers (Provost & Woodward, 1991), and adolescents with ADHD (Potter & Newhouse, 2004); it reduced stop signal reaction time in the Stop Signal Task for those with ADHD (Potter & Newhouse, 2004, 2008), and improved behavioral inhibition in adolescents with ADHD (Potter & Newhouse, 2004). Nicotine (Parrott & Winder, 1989; Wesnes & Warburton, 1983) and cigarette smoking (Revell, 1988; Warburton & Arnall, 1994; Wesnes & Warburton, 1983) have also improved inhibitory control for information processing, or parsing relevant from irrelevant information, and the ability to suppress interference (Nigg, 2000). Administration of nicotine has even been found to reduce eye movements to task irrelevant stimuli (Rycroft, Rusted, & Hutton, 2005).

Although ADHD contributes independently to smoking initiation, controlling for conduct problems and other forms of psychiatric comorbidity (Milberger et al., 1997a; Milberger, Biederman, Faraone, Chen, & Jones, 1997b), this is not to say these factors are unimportant. On the contrary, the contributions of comorbid conditions must be considered in order to better understand how the larger ADHD picture relates to smoking outcomes.
1.3 **Comorbidity with ADHD and Smoking**

There are high comorbidity rates between internalizing (Lawrence, Mitrou, Sawyer, & Zubrick, 2010) and externalizing disorders, substance use disorders (SUD), and smoking (Cornelius, Lynch, Martin, Cornelius, & Clark, 2001). Brown et al. (1996) found that adolescent smokers in a community sample were five times more likely than nonsmokers to meet criteria for an externalizing disorder, even after controlling for the effects of other disorders including SUDs. Smoking rates are higher for youth with two or more psychiatric diagnoses: 58% versus 38% among youth with one psychological disorder (Lawrence et al., 2010). Elevated smoking rates are found across youth with comorbid externalizing and internalizing problems, although externalizing problems tend to somewhat outpace the rate of smoking between the two. For example, among youth scoring in the clinical range on the CBCL externalizing problems scale, 50% had smoked cigarettes in the last 30 days, and 51% among youth on the YSR externalizing problems scale. Whereas with internalizing problems, 41% had smoked in the last 30 days among clinical-range youth on the CBCL internalizing problems scale, and 42% among young people on the YSR internalizing problems scale (Lawrence et al., 2010).
1.4 **Antisocial Behavior and Smoking**

Of the externalizing disorders, ADHD and conduct disorder (CD) have had the strongest relationships to both SUDs and smoking. Both ADHD and CD have each individually been associated with increased risk for developing SUDs (Fagan, Weis, & Cheng, 1990; Riggs, Mikulich, Whitmore, & Crowley, 1999; Thompson, Riggs, Mikulich, & Crowley, 1996). However, almost half of all ADHD children also meet criteria for conduct disorder (Biederman, Newcorn, & Sprich, 1991). Several studies have found that when conduct disorder is taken into account, ADHD no longer has a unique association with SUDs, thus suggesting that the relationship with SUDs is largely mediated by CD (Biederman et al. 1997 (Barkley, Fischer, Edelbrock, & Smallish, 1990; Biederman et al., 1997; Crowley & Riggs, 1995; Wilens, Biederman, & Spencer, 1996). The relative contributions of ADHD and CD to smoking outcomes in particular, however, are not as well researched as more general substance use. One such study by Abrantes, Strong, Ramsey, Lewinsohn, and Brown (2005) paints a more nuanced picture: ADHD and CD symptoms may be related to different aspects of substance use. Specifically, Abrantes et al. (2005) found that CD symptoms were associated with early onset of substance involvement. On the other hand, ADHD inattention symptoms were associated with marijuana and nicotine dependence.

Although ADHD and CD relate broadly to SUDs, there are mixed findings when studying ADHD with CD to predict later smoking outcomes. There is some support for adolescent CD as a mediator of the association between adolescent ADHD and adult SUD (Brook, Brook, Zhang, & Koppel, 2010). But Sibley et al. (2014) found that when modeling behavior from early childhood, ADHD and not CD symptoms predicted adolescent substance use. Molina and Pelham (2014) explain these inconsistent findings by suggesting that childhood
ADHD may set the stage for later onset and escalation of conduct problems, including delinquency, which creates an SUD risk.

It is often difficult to identify ADHD symptoms versus disruptive behavior as a unique contributor to smoking outcomes. Children with early behavior problems are about twice as likely to engage in daily cigarette smoking as those without these problems (Lynskey & Fergusson, 1995). Behavior and attention problems are also associated with early cigarette use: 19% of affected mid-adolescent boys smoke vs. 10% of controls (Milberger et al., 1997b). Young people with mental disorders started smoking at an earlier age on average, particularly so for conduct disorder (Lawrence et al., 2010).
1.5 **Depression and Smoking**

Lerman et al. (2001) suggest that the association of ADHD and smoking may be partially attributable to symptoms common to both depression and ADHD. Chronis-Tuscano et al. (2010) found an increased rate of recurrent depressive episodes by age 18 among young children with ADHD followed longitudinally, compared to those without ADHD (18.4% versus 1.6%), even after controlling for possible confounders, like maternal depression. In adulthood, rates of depression have been higher, especially for those with persisting ADHD symptoms and in treatment-seeking populations (Barkley, Murphy, & Fischer, 2010). Previous studies have generally found that nicotine relieves self-reported depression and fatigue (Bekker, Böcker, Van Hunsel, van den Berg, & Kenemans, 2005) and enhances vigor (Levin et al., 1996) and feelings of happiness (Levin et al., 2001; Warburton & Mancuso, 1998), contributing to higher rates of smoking among people with symptoms of both ADHD and depression.

However, certain aspects of internalizing symptoms manifest in ways that promote nonsmoking. Social neglect, passivity, shyness, and withdrawal that are experienced by some children with ADHD, or variants including social phobia or anxiety, have been shown in some studies to predict decreased risk of adolescent substance use (Fröjd, Ranta, Kaltiala-Heino, & Marttunen, 2011; Kaplow, Curran, Angold, & Costello, 2001), presumably due to decreased social opportunities related to substance use. In a longitudinal study of childhood ADHD and adolescent alcohol use (Molina et al., 2012), two different pathways resulting in increased versus decreased alcohol use were found: one social impairment pathway resulted in increased delinquency and drinking and another pathway from childhood ADHD to increased social impairment predicted lower drinking frequency via fewer social opportunities. Wilens et al. (2011) report mixed results: mood disorders predicted drug use disorders, but not overall SUD,
alcohol use disorders, or cigarette smoking among young adults. The variable effects of internalizing symptoms on adolescent substance use may explain the often weak or inconsistent findings in cigarette use. A more nuanced examination of these factors may clarify how they usher youth toward – or away from – certain smoking outcomes.
1.6 **Gender Differences**

Lerman et al. (2001) There are male-biased gender discrepancies in ADHD, smoking, and conduct disorder. At the same time, there is a female-biased gender discrepancy in depression and other internalizing disorders. In a systematic evaluation of the impact of gender on the clinical features of ADHD, Biederman et al. (2002) reported that girls with ADHD were at less risk for comorbid disruptive behavior disorder than boys with ADHD. These authors suggest that because disruptive behavior provokes referrals, this finding might explain the substantial discrepancy in the male/female ratio between clinic-referred (10:1) and community (3:1) samples of children with ADHD. Biederman et al. (2005) further reason that this gender discrepancy may cause girls with ADHD to be under-identified and under-treated. These authors also report similar phenotypes of ADHD across genders (Biederman, Faraone, Monuteaux, Bober, & Cadogen, 2004), as well as high rates of mood and anxiety disorders in adults with ADHD, with a bias toward females (Biederman, 2005). However, there were inconsistent findings with regard to ratios of males to females with ADHD (Biederman et al., 2004; Biederman et al., 1994), suggesting that further research is needed to clarify this otherwise relatively consistent phenomenon.
1.7 **ADHD, Depression, Anti-Social Behavior, Gender, and Smoking**

Tobacco use is predicted by an array of overlapping contributing factors. The associations between these contributing factors and cigarette smoking are rarely straightforward, and it is necessary to consider their relative contributions to smoking progression. Thirty-day smoking rates were higher for youth with specific mental disorders: 72% for young people with conduct disorder, 46% for depressive disorder, and 38% for ADHD (Lawrence et al., 2010). Milberger et al. (1997a) found a positive association between cigarette smoking, conduct disorder, and major depression, even after adjusting for confounding variables in adolescent ADHD probands and their families. Among adolescents, the severity of CD, ADHD, and major depressive disorders is associated with level of nicotine dependence (Riggs et al., 1999). In these same adolescent males, ADHD and CD were also associated with earlier onset of regular smoking (Riggs et al., 1999).

Taken together, these interrelated symptoms may work synergistically with ADHD symptoms to increase frequency and amount of cigarette use as well as progression toward dependency. Symptoms of depression present a need for a mood elevation separate from ADHD symptoms. However, when smoking for mood-related needs occurs in the presence of ADHD symptoms, the risks for increased cigarette use and progression associated with ADHD symptoms may interact with the risks for smoking linked to depression symptoms to create an increased probability of use and progression beyond an additive effect. Depression symptoms, particularly inattention and social withdrawal, may also present a social context that may or may not support this type of progression as described in the social impairment literature. Given the gender differences in both ADHD and depression, the combined effects of the two may also vary by gender.
In a similar fashion, antisocial behavior may present a need for novelty seeking and deviant behavior separate from ADHD symptoms. But, when smoking for antisocial reasons occurs in the presence of ADHD symptoms, the risks for increased cigarette use and progression associated with ADHD symptoms may interact with the risks for smoking linked to antisocial behavior to create an increased probability of use and progression beyond an additive effect. Antisocial behavior may also present a social context that may support this type of progression via association with deviant peers and increased opportunities to use. In light of gender discrepancies commonly present in ADHD, antisocial behavior, and smoking (all of which are male-biased), gender effects may also emerge.
1.8 **Hypotheses**

1. In line with previous research on ADHD and smoking outcomes, I hypothesize an association between ADHD symptoms and smoking progression such that more ADHD symptoms will be associated with more progression beyond initial trials of cigarette smoking.

2. It is hypothesized that depression and antisocial behavior (ASB) will independently moderate the relationship between ADHD symptoms and smoking progression outcomes for youths. Specifically, I hypothesize that depression moderates the relationship between ADHD symptoms and smoking progression such that this relationship is stronger for those high in depression than those low in depression. Similarly, I hypothesize that antisocial behavior moderates the relationship between ADHD symptoms and smoking progression such that this relationship is stronger for those high in ASB than those low in ASB.

3. I also hypothesize a gender interaction for each of depression and ASB. I expect a depression by gender interaction such that this relationship will be stronger for girls than for boys. I also expect an ASB by gender interaction such that this relationship will be stronger for boys than for girls. Thus, ADHD symptoms, depression, ASB, and gender are all independent variables whereas smoking progression is the dependent variable.
2. METHODS

2.1 Participants

Data for this study come from the baseline, 2, 5, and 6-year assessment waves of the Social and Emotional Contexts of Adolescent Smoking Patterns (SECASP) study. The cornerstone of the longitudinal study was the establishment of a cohort of adolescents oversampled for ever smoking.

Participants were recruited from 16 Chicago-area high schools. The sample was derived in a multi-stage process. All 9\textsuperscript{th} and 10\textsuperscript{th} graders at the schools (N = 12,970) completed a brief screening survey of smoking behavior. Invitations were mailed to eligible students and their parents. Students were eligible to participate in the longitudinal study if they fell into one of four levels of smoking experience: 1) never smokers; 2) former experimenters (smoked at least one cigarette in the past, have not smoked in the last 90 days, and have smoked fewer than 100 cigarettes in their lifetime); 3) current experimenters (smoked in the past 90 days, but smoked less than 100 cigarettes in lifetime); and 4) regular smokers (smoked in the past 30 days and have smoked more than 100 cigarettes in their lifetime).

Recruitment packets were mailed to 3,654 eligible students and their parents. Recruitment targets included all youth in the “current experimenter” and “regular smoker” categories plus random samples from the “never smoker” and “former experimenter” categories. Youth were enrolled into the longitudinal study after written parental consent and student assent was obtained. It is important to note that all youth and parents had to agree to potentially participate in all components of the main larger, program project study including multiple, longitudinal questionnaire assessments, an ecological momentary assessment study, a family observation study, and a psychophysiological laboratory assessment study. Of the 3,654 students
invited, 1,344 agreed to participate (36.8%) with 1,263 (94.0%) completing the baseline assessment wave. Their racial/ethnic distribution was 56.5% white, 17.2% Hispanic, 16.9% black, 4.0% Asian, and 5.5% “other”.

Participants for the current study are those who completed measures of Year 5 ADHD symptoms, Year 5 depression symptoms, Year 2 antisocial behavior, and Year 6 smoking days (N = 939) of the previously described longitudinal study. Table 1 presents the sociodemographic characteristics of this sample.
2.2 Measures

ADHD symptoms. The ADHD Adult Attention Deficit Hyperactivity Disorder Self-Report Scale (ASRS) (Kessler et al., 2005) was administered in the 5-year follow up survey. The ASRS is a 15-item measure that assesses individuals’ frequency of ADHD symptoms. Sum scores were calculated for all 15 items (coefficient alpha = .65 at the 5 year wave.)

Depression. The Center for Epidemiological Studies-Depression (CES-D) scale is a 20-item self-report measure of depression in the general population across four subscales: depressed affect, happy, somatic and retardation, and interpersonal (Radloff, 1977). All items were summed if at least 16 items were completed (coefficient alpha = .90 at the 5-year wave).

Antisocial behavior. The Antisocial Behavior Checklist (Zucker, 1999; Zucker & Fitzgerald, 1992) was administered in the 2-year follow up survey. The ABC is a 28-item measure that assesses individuals’ problem behavior across six domains: aggression, deceit, police contact, rule violation, theft, and vandalism. Sum scores were calculated for all 22 items (coefficient alpha = .88 at baseline), as well as for each domain to reflect the frequency of antisocial behaviors committed by the adolescent during his/her lifetime. In addition, six age of onset questions (i.e. “How old were you the first time you did any of the above?”) were inserted after each of the domains, with response choices as follows: “I have never done any of these things”, “10 years old or younger”, “11-13 years old”, “14 years old or older.”

Smoking Days. Participants self-reported the number of days smoked in the prior 30 days. In this study, measures of smoking days were used from the baseline and Year 6 data collection waves.
30-Day Smoking Rate. 30-day smoking rate is a computed measure of participant’s daily smoking rates at baseline and Year 6 by multiplying their smoking days by the average number of cigarettes smoked on these days and dividing by 30.
2.3 **Analytic Approach**

Moderated linear regression analyses were used to predict 30-day number of smoking days and smoking rate at Year 6. ADHD symptoms, depression symptoms, and antisocial behavior were centered such that zero represents an absence of symptomatology. Analyses using depression and antisocial behavior to predict outcomes were conducted separately. Each analysis examined the three-way interaction between ADHD symptoms, gender, and either depression or antisocial behavior. Analyses controlled for baseline smoking. A two-step piecewise analytic process was used to examine smoking outcomes: first a binary logistic regression was conducted examining no smoking vs. any smoking; and then a second Poisson regression analysis was conducted to examine level of smoking among those who smoked at all in the past 30 days.
3. Results

3.1 Hypothesis 1

In line with Hypothesis 1, more ADHD symptoms were associated with more progression beyond initial trials of cigarette smoking. Specifically, among the whole sample (including smokers and nonsmokers), logistic regression analysis revealed that higher ADHD symptoms were associated with higher likelihood of any smoking in the past 30 days while controlling for gender and any baseline smoking, \( OR \, (95\% \, CI) = 1.15 \, (1.06-1.25), \, Wald = 0.14, \, p < .05 \) (see Table 2). And within smokers, Poisson regression revealed that higher ADHD symptoms were associated with higher rates of smoking while controlling for gender and baseline smoking days, \( \beta = 0.07, \, z = 5.44, \, p < .05 \) (see Table 3). More specifically, a one-unit increase of ADHD symptoms resulted in a 6.7% increase in smoking rate (95% CI: 1.04-1.09).
3.2 **Hypotheses 2 & 3**

3.2.1 **Depression**

The three-way interaction between ADHD symptoms, depression symptoms, and gender in predicting any smoking in the past 30 days was not significant, and therefore was removed; all two-way interactions were entered into the final model, controlling for any baseline smoking (see Table 4). There was evidence to support the hypothesis that depression moderates the relationship between ADHD symptoms and any smoking in the past 30 days for the sample of smokers and nonsmokers, \( OR \ (95\% \ CI) = 1.01 \ (1.001-1.02) \), \( Wald = 0.01 \), \( p < .05 \). The relationship between ADHD symptoms and any smoking was not significant among those reporting low (i.e., 1 standard deviation below the mean; \( OR \ (95\% \ CI) = 1.02 \ (0.87-1.20) \), \( Wald = 0.02 \), n.s.) and mean (\( OR \ (95\% \ CI) = 1.13 \ (0.98-1.29) \), \( Wald = 0.12 \), n.s.) depression symptoms. However, among those reporting high (i.e., 1 standard deviation above the mean) levels of depression symptoms, there was a significant positive relationship between ADHD symptoms and any smoking, \( OR \ (95\% \ CI) = 1.24 \ (1.06-1.47) \), \( Wald = 0.22 \), \( p < .05 \), such that a unit increase in depression is associated with a 24% increase in odds of any smoking. A main effect of gender was also revealed such that females were 44% less likely to report any past-month smoking relative to males, \( OR \ (95\% \ CI) = 0.56 \ (0.33-0.94) \), \( Wald = -0.59 \), \( p < .05 \).

The three-way interaction between ADHD symptoms, depression symptoms, and gender in predicting smoking days was not significant. This interaction was removed and all two-way interactions were entered into the final model, controlling for baseline smoking days (see Table 5). Among smokers, Poisson regression analysis revealed a main effect of depression symptoms on number of smoking days. Higher levels of depression symptoms were associated with more smoking days, \( \beta = 0.01 \), \( z = 3.30 \), \( p < .05 \). Male gender (\( \beta = -0.104 \), \( z = 2.68 \), \( p < .05 \)) and higher
levels of ADHD symptoms ($\beta = 0.041, z = 2.30, p < .05$) were associated with more smoking days. However, this effect was qualified by an interaction between gender and ADHD symptoms, $\beta = -0.044, z = -3.16, p < .05$. For males, there was a significant positive relationship between ADHD symptoms and more smoking days. However, for females, there was no significant effect of ADHD symptoms on smoking days, $\beta = 0.00, z = -0.22, n.s$. A significant interaction was also revealed between ADHD symptoms and depression, $\beta = -0.001, z = -2.25, p < .05$. Among those reporting low (i.e., 1 standard deviation below the mean; $\beta = 0.036, z = 3.31, p < .05$) and mean ($\beta = 0.024, z = 2.58, p < .05$) levels of depression symptoms, there was a significant positive relationship between ADHD symptoms and smoking days. However, the relationship between ADHD symptoms and smoking days was not significant among those reporting high (i.e., 1 standard deviation above the mean) depression symptoms, $\beta = 0.01, z = 1.11, n.s$. No significant interaction was observed between depression symptoms and gender, $\beta = 0.00, z = 1.71, p = .09$, providing no evidence to support the hypothesis that gender moderates the link between smoking and depression symptoms.
3.2.2 **Antisocial Behavior**

Controlling for any baseline smoking, the interaction among ADHD symptoms, antisocial behavior, and gender to predict any smoking in the past 30 days was not significant and therefore was removed. All two-way interactions were entered into the model. There were also no significant two-way interactions between these three variables and the two-way interactions were removed from the model. Thus, the final model included only the main effects of antisocial behavior, ADHD symptoms, and gender on any smoking in the past 30 days (see Table 6). Main effects were observed such that greater antisocial behavior (OR [95% CI] = 1.04 [1.02-1.07], Wald = 0.04, p<0.001), ADHD symptoms (OR [95% CI] = 1.13 [1.03-1.23], Wald = 0.12, p<.05), and male gender (OR [95% CI] = 0.61 [0.46-0.81], Wald = -0.49, p<.05) were associated with increased odds of any smoking.

Controlling for baseline smoking days, there was no significant three-way interaction between ADHD symptoms, antisocial behavior, and gender in predicting past-month smoking days. This interaction was removed and all two-way interactions were entered into the final model (see Table 7). Among smokers, Poisson regression analysis revealed no main effect of antisocial behavior on number of past-month smoking days for males, $\beta = -0.001$, $z = -0.44$, $p = .66$. However, this effect was qualified by an interaction between gender and antisocial behavior, $\beta = 0.011$, $z = 3.88$, $p < .05$. We followed up this model to investigate this relationship among females and observed a significant positive effect of antisocial behavior on smoking days, $\beta = 0.01$, $z = 3.62$, $p < .05$.

ADHD symptoms were not significantly associated with past-month smoking days among male smokers, $\beta = -0.006$, $z = -0.45$, n.s. However, this effect was qualified by two interactions. First, an interaction was observed between ADHD symptoms and gender, $\beta = -0.03$,
In following up this model we found that ADHD symptoms were significantly negatively associated with smoking days among females, $\beta = -0.09, z = -3.16, p < .05$. Second, an interaction was observed between ADHD symptoms and antisocial behavior, $\beta = 0.003, z = 3.02, p < .05$. In following up this second interaction we found that among those reporting low (i.e., 1 standard deviation below the mean) levels of antisocial behavior, ADHD symptoms were not significantly related to smoking days. However, among those reporting mean ($\beta = 0.021, z = 2.41, p < .05$) and high (i.e., 1 standard deviation above the mean; $\beta = 0.041, z = 4.27, p < .05$) levels of antisocial behavior, ADHD symptoms were significantly positively related to smoking days, consistent with the hypothesis that antisocial behavior moderates the relationship between ADHD symptoms and smoking. A third interaction was observed between antisocial behavior and gender ($\beta = 0.011, z = 3.88, p < .05$). Antisocial behavior was not significantly associated with smoking days among male smokers, $\beta = -0.001, z = -0.44, n.s.$ However, among females, antisocial behavior was significantly positively related to smoking days, $\beta = 0.010, z = 3.62, p < .05$. 

4. DISCUSSION

4.1 Overview

Replicating previous research findings and as predicted, more ADHD symptoms were associated with more progression beyond initial trials of cigarette smoking for both males and females. Accordingly, among past month smokers, higher ADHD symptoms were also associated with higher rates of smoking in the past 30 days. The present study assessed symptoms of ADHD, not a categorical diagnosis, and as such, suggests that risk for future and continued smoking is associated with severity of symptoms along a continuum. It suggests that this risk differentially reflects the symptom severity of each individual, which may explain the mixed findings of studies (Fröjd et al., 2011; Kaplow et al., 2001) using a dichotomous diagnosis that does not capture differences in symptom levels within ADHD and control groups.

Beyond the influence of ADHD symptoms on smoking, this study identified several moderators of the link between ADHD symptoms and smoking progression at the levels of any smoking and last-month smoking days among adolescents. Depression moderated the relationship between ADHD symptoms and any smoking in the past 30 days. The association between ADHD and smoking was stronger for those reporting higher levels of depression symptoms. Considering these findings, the association between ADHD symptoms and smoking may be better considered in the context of mood symptoms. Historically, depression has not been as strong of a moderator of ADHD and smoking as other variables, like antisocial behavior. However, this study suggests that dimensional measures of depression symptoms may better differentiate patterns of adolescent smoking. Adding mood to the model suggests that mood, in addition to ADHD symptoms, has a differential effect depending on level of severity of mood symptoms. Specifically, as youth experience higher levels of depression, the relationship
between ADHD symptoms and smoking weakens. The interaction between depression symptoms and ADHD observed in this sample may help explain some of the inconsistent findings on the association between mood disorders and cigarette smoking (Wilens et al., 2011).

Among smokers, main effects for depression and ADHD symptoms demonstrated that higher levels of each were associated with more past-month smoking days. However, this was qualified by a gender interaction. For males, ADHD symptoms had a positive relationship with smoking, but for females, this relationship was not significant. Contrary to predictions, no significant interaction was observed between depression symptoms and gender, providing no evidence to support the hypothesis that gender moderates the link between smoking and depression symptoms. These results suggest that the positive relationship between ADHD and smoking may be driven by males and may not characterize this link for females. The higher base rate of externalizing among boys relative to girls may reflect the finding that, for girls, there is no or a negative relationship between ADHD symptoms and smoking and not just an attenuated but still positive relationship.

Antisocial behavior did not moderate the link between ADHD symptoms and any smoking. Instead, main effects were observed such that greater antisocial behavior and male gender were associated with increased odds of any smoking, replicating prior findings. Among smokers, gender interacted with antisocial behavior revealing a significant positive effect of antisocial behavior on past-month smoking days specific to female smokers. That is, for females, higher levels of antisocial behavior were associated with more smoking among those who smoked during the past month, but this association was not found for males.
Among past month smokers, the association between ADHD symptoms and smoking rate was dependent on gender and on antisocial behavior. The significant interaction between ADHD symptoms and gender indicated that ADHD symptoms were significantly negatively associated with past-month smoking days among female smokers, but there was no significant effect among male smokers. A second interaction indicated that antisocial behavior moderated the link between ADHD symptoms and smoking days. As predicted, ADHD symptoms were positively associated with more smoking days, but only among those reporting mean and high levels of antisocial behavior. This finding may help clarify the inconsistent findings (Brook et al., 2010; Sibley et al. (2014) regarding how adolescent behavior problems influence smoking.

In sum, this study suggests that the relationship between ADHD and smoking is not onedimensional. Instead, it varies dimensionally for both depression and antisocial behavior and according to gender. Treating these variables dimensionally may help to better discriminate between profiles of adolescent smoking and help to identify those who may be at risk for progression in smoking both earlier in their smoking careers and with more sensitivity to their potential pathways. It may be the case that measuring the effect of ADHD on smoking during adolescence is already too late in development to intervene.

This stage of development presents an intersection of ADHD symptoms and smoking habits. While not true of every adolescent with ADHD symptoms, ADHD symptoms typically develop earlier in childhood and decrease with age (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Faraone, Biederman, & Mick, 2006). Thus, the symptoms participants self-reported were likely present and possibly more severe prior to the assessment of smoking, and temporal linkages may be difficult to disentangle with the current study.
4.2 **Limitations**

This study represents a longitudinal look at several comorbid symptomatologies at this point in development. While the ADHD symptoms self-reported by participants in this study were likely present from a younger age, the one-time measure of ADHD presents a limitation. This could be mitigated by repeated prospective measurement of ADHD symptoms in youth from a younger age into and through adolescence. This would better capture the development of ADHD symptoms that precede smoking initiation and progression. Another potential limitation is the fact that this cohort oversampled youth smokers who might have a greater proclivity for externalizing behavior overall than a normative sample.
4.3 **Conclusion**

Depression, antisocial behavior, and gender moderate the link between ADHD and smoking. Dimensional measurement of these factors suggests differences in moderation according to level of symptom severity. Further research may consider investigating the relationships between these factors prospectively and earlier in adolescents’ developmental trajectories.
**TABLE I**

SAMPLE CHARACTERISTICS AT YEAR 5 (N = 939)

<table>
<thead>
<tr>
<th>Characteristics (Y5)</th>
<th>M(SD) or N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21.4 (0.81)</td>
</tr>
<tr>
<td>Female</td>
<td>566(60.3%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>546(58.2%)</td>
</tr>
<tr>
<td>Black</td>
<td>160(17.0%)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>142(15.1%)</td>
</tr>
<tr>
<td>Other</td>
<td>91(9.7%)</td>
</tr>
<tr>
<td>Education</td>
<td></td>
</tr>
<tr>
<td>&lt;HS Diploma</td>
<td>29(3.1%)</td>
</tr>
<tr>
<td>HS Diploma or GED</td>
<td>161(17.2%)</td>
</tr>
<tr>
<td>Vocational/Technical School</td>
<td>20(2.1%)</td>
</tr>
<tr>
<td>Some College</td>
<td>550(58.6%)</td>
</tr>
<tr>
<td>2-Year Degree</td>
<td>100(10.7%)</td>
</tr>
<tr>
<td>4-Year Degree</td>
<td>75(8.0%)</td>
</tr>
<tr>
<td>Graduate Degree</td>
<td>3(0.3%)</td>
</tr>
<tr>
<td>Employment</td>
<td></td>
</tr>
<tr>
<td>Work Full-Time (35hrs+)</td>
<td>232(24.7%)</td>
</tr>
<tr>
<td>Work Part-Time</td>
<td>443(47.2%)</td>
</tr>
<tr>
<td>Don’t Work at All</td>
<td>263(28.0%)</td>
</tr>
</tbody>
</table>
Living Situation

- Living at Home with Parents: 549 (58.7%)
- Campus-Affiliated Housing: 66 (7.1%)
- Apart from Family: 321 (34.3%)

*Note.* Y5 = 5-year data collection wave; HS = High School; GED = High School Equivalency; ‘Other’ race includes ‘American Indian/Alaskan Native,’ ‘Asian,’ ‘Pacific Islander,’ and ‘More Than One Race.’
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI Low</th>
<th>95% CI High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.29</td>
<td>0.15</td>
<td>-1.98</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ADHD Symptoms</td>
<td>0.14</td>
<td>0.04</td>
<td>3.29</td>
<td>&lt;0.001*</td>
<td>1.15</td>
<td>1.06</td>
<td>1.25</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.59</td>
<td>0.14</td>
<td>-4.15</td>
<td>&lt;0.001*</td>
<td>0.55</td>
<td>0.42</td>
<td>0.73</td>
</tr>
<tr>
<td>Any Baseline Smoking</td>
<td>1.19</td>
<td>0.14</td>
<td>8.39</td>
<td>&lt;0.001*</td>
<td>3.28</td>
<td>2.49</td>
<td>4.34</td>
</tr>
</tbody>
</table>

Note. *p <.05. All predictor and covariate variables were entered simultaneously into a logistic regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
TABLE III
POISSON REGRESSION PREDICTING PAST MONTH SMOKING RATES AMONG SMOKERS AT YEAR 6 WITH ADHD SYMPTOMS AT YEAR 5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI Low</th>
<th>95% CI High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.44</td>
<td>0.04</td>
<td>34.96</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ADHD Symptoms</td>
<td>0.07</td>
<td>0.01</td>
<td>5.44</td>
<td>&lt;0.001*</td>
<td>1.07</td>
<td>1.04</td>
<td>1.09</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.24</td>
<td>0.04</td>
<td>-5.76</td>
<td>&lt;0.001*</td>
<td>0.78</td>
<td>0.72</td>
<td>0.85</td>
</tr>
<tr>
<td>Baseline Smoking Days</td>
<td>0.09</td>
<td>0.01</td>
<td>16.57</td>
<td>&lt;.001*</td>
<td>1.10</td>
<td>1.08</td>
<td>1.11</td>
</tr>
</tbody>
</table>

Note. *p < .05. All predictor and covariate variables were entered simultaneously into a Poisson regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
### TABLE IV
LOGISTIC REGRESSION PREDICTING ANY PAST MONTH SMOKING WITH ADHD, DEPRESSION, AND GENDER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-0.24</td>
<td>0.24</td>
<td>-0.99</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Depression</td>
<td>-0.003</td>
<td>0.02</td>
<td>-0.18</td>
<td>0.86</td>
<td>1.00</td>
<td>0.96</td>
<td>1.03</td>
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<tr>
<td>ADHD Symptoms</td>
<td>-0.02</td>
<td>0.09</td>
<td>-0.19</td>
<td>0.85</td>
<td>0.98</td>
<td>0.82</td>
<td>1.18</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>-0.59</td>
<td>0.27</td>
<td>-2.19</td>
<td>0.03*</td>
<td>0.56</td>
<td>0.33</td>
<td>0.94</td>
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</tr>
<tr>
<td>Any Baseline Smoking</td>
<td>1.19</td>
<td>0.14</td>
<td>8.36</td>
<td>&lt;0.001*</td>
<td>3.29</td>
<td>2.50</td>
<td>4.37</td>
<td></td>
</tr>
<tr>
<td>Depression X ADHD Symptoms</td>
<td>0.01</td>
<td>0.005</td>
<td>2.16</td>
<td>0.03*</td>
<td>1.01</td>
<td>1.00</td>
<td>1.02</td>
<td></td>
</tr>
<tr>
<td>Depression X Gender</td>
<td>-0.003</td>
<td>0.02</td>
<td>0.19</td>
<td>0.85</td>
<td>1.00</td>
<td>0.97</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>ADHD Symptoms X Gender</td>
<td>-0.04</td>
<td>0.09</td>
<td>-0.39</td>
<td>0.70</td>
<td>0.96</td>
<td>0.80</td>
<td>1.16</td>
<td></td>
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</table>

*Note. *p < .05. All predictor and covariate variables were entered simultaneously into a logistic regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI Low</th>
<th>95% CI High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>2.72</td>
<td>0.03</td>
<td>77.76</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Depression</td>
<td>0.007</td>
<td>0.002</td>
<td>3.30</td>
<td>&lt;0.001*</td>
<td>1.01</td>
<td>1.00</td>
<td>1.01</td>
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<tr>
<td>ADHD Symptoms</td>
<td>0.041</td>
<td>0.012</td>
<td>3.36</td>
<td>&lt;0.001*</td>
<td>1.04</td>
<td>1.02</td>
<td>1.07</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.104</td>
<td>0.039</td>
<td>-2.68</td>
<td>&lt;0.01*</td>
<td>0.90</td>
<td>0.84</td>
<td>0.97</td>
</tr>
<tr>
<td>Baseline Smoking Days</td>
<td>0.018</td>
<td>0.001</td>
<td>17.37</td>
<td>&lt;0.001*</td>
<td>1.02</td>
<td>1.02</td>
<td>1.02</td>
</tr>
<tr>
<td>Depression X ADHD Symptoms</td>
<td>-0.001</td>
<td>0.0005</td>
<td>-2.25</td>
<td>0.02*</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Depression X Gender</td>
<td>0.004</td>
<td>0.002</td>
<td>1.71</td>
<td>0.09</td>
<td>1.00</td>
<td>1.00</td>
<td>1.01</td>
</tr>
<tr>
<td>ADHD Symptoms X Gender</td>
<td>-0.044</td>
<td>0.014</td>
<td>-3.16</td>
<td>&lt;0.01*</td>
<td>0.96</td>
<td>0.93</td>
<td>0.98</td>
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</tbody>
</table>

Note. *p < 0.05. All predictor and covariate variables were entered simultaneously into a Poisson regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
### TABLE VI
LOGISTIC REGRESSION PREDICTING ANY PAST MONTH SMOKING WITH ADHD, DEPRESSION, AND GENDER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI Low</th>
<th>95% CI High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-.63</td>
<td>0.17</td>
<td>-3.60</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ASB</td>
<td>0.04</td>
<td>0.01</td>
<td>3.59</td>
<td>&lt;.001*</td>
<td>1.04</td>
<td>1.02</td>
<td>1.07</td>
</tr>
<tr>
<td>ADHD Symptoms</td>
<td>0.12</td>
<td>0.04</td>
<td>2.71</td>
<td>&lt;.01</td>
<td>1.13</td>
<td>1.03</td>
<td>1.23</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.49</td>
<td>0.15</td>
<td>-3.40</td>
<td>&lt;.001*</td>
<td>0.61</td>
<td>0.46</td>
<td>0.81</td>
</tr>
<tr>
<td>Any Baseline Smoking</td>
<td>1.08</td>
<td>0.15</td>
<td>7.42</td>
<td>&lt;.001*</td>
<td>2.93</td>
<td>2.21</td>
<td>3.91</td>
</tr>
</tbody>
</table>

*Note.* p < .05. All predictor and covariate variables were entered simultaneously into a logistic regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
TABLE VII
POISSON REGRESSION PREDICTING PAST MONTH SMOKING RATES AMONG
SMOKERS AT YEAR 6 WITH ADHD SYMPTOMS AT YEAR 5, ANTISOCIAL
BEHAVIOR (ASB), AND GENDER

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Estimate</th>
<th>SE</th>
<th>z value</th>
<th>p</th>
<th>OR</th>
<th>95% CI</th>
</tr>
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<tr>
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<td>Low</td>
</tr>
<tr>
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<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Intercept</td>
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<td>0.04</td>
<td>74.43</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>ASB</td>
<td>-0.001</td>
<td>0.003</td>
<td>-0.44</td>
<td>0.66</td>
<td>1.00</td>
<td>0.99 1.00</td>
</tr>
<tr>
<td>ADHD Symptoms</td>
<td>-0.006</td>
<td>0.01</td>
<td>-0.45</td>
<td>0.65</td>
<td>0.99</td>
<td>0.97 1.02</td>
</tr>
<tr>
<td>Gender</td>
<td>-0.15</td>
<td>0.04</td>
<td>-3.58</td>
<td>&lt;0.001*</td>
<td>0.86</td>
<td>0.79 0.93</td>
</tr>
<tr>
<td>Baseline</td>
<td>0.02</td>
<td>0.001</td>
<td>16.04</td>
<td>&lt;0.001*</td>
<td>1.02</td>
<td>1.01 1.02</td>
</tr>
<tr>
<td>Smoking Days</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASB X ADHD</td>
<td>0.003</td>
<td>0.001</td>
<td>3.02</td>
<td>&lt;0.01*</td>
<td>1.00</td>
<td>1.00 1.00</td>
</tr>
<tr>
<td>ADHD Symptoms X Gender</td>
<td>0.01</td>
<td>0.003</td>
<td>3.88</td>
<td>&lt;0.001*</td>
<td>1.01</td>
<td>1.01 1.02</td>
</tr>
<tr>
<td>X Gender</td>
<td>-0.03</td>
<td>0.01</td>
<td>-2.30</td>
<td>0.02*</td>
<td>0.97</td>
<td>0.95 1.00</td>
</tr>
</tbody>
</table>

Note. *p <.05. All predictor and covariate variables were entered simultaneously into a Poisson regression model. Parameter estimates and confidence intervals were exponentiated to obtain odds ratios. Reference group for gender is males.
REFERENCES


patterns among participants in a smoking-cessation program. *Nicotine & Tobacco Research*, 3(4), 353-359. doi: 10.1080/14622200110072156


Rasmussen, P., & Gillberg, C. (2000). Natural Outcome of ADHD With Developmental Coordination Disorder at Age 22 Years: A Controlled, Longitudinal, Community-Based


VITA
Marie Chesaniuk
4343 N. Clarendon Ave, #2411 – Chicago, IL 60613 – (516) 650-6638 – mariechesaniuk@gmail.com

EDUCATION

*University of Illinois at Chicago*

Doctoral Program in Clinical Psychology
Chicago, IL
M.A. in Clinical Psychology expected May 2015
Sept 2013-present
Advisor: Robin J. Mermelstein, Ph.D.

*Columbia University*

Post-Baccalaureate Program in Psychology
New York, NY
Sept 2009- Dec 2010

*Epidemiology and Population Health Summer Institute (EPIC)*

June 2011

*Hunter College, City University of New York*

Undergraduate (Non-Degree)
New York, NY
Jan 2011- Dec 2011

*University of Chicago*

M.A. in the Humanities, Concentration in Writing
Chicago, IL
Sept 2006-June 2007

*Honors College, Adelphi University*

B.A. in English, *summa cum laude*
Garden City, NY

FELLOWSHIPS

UIC University Fellowship, UIC
August 2013-May 2014

Behavioral Science Student Fellowship, Epilepsy Foundation of America
June 2011-April 2012

RESEARCH EXPERIENCE

*Institute for Health Research & Policy*

Chicago, IL
Supervisor: Robin J. Mermelstein, Ph.D. (Director)
August 2013-present
Graduate Student Researcher, Social-Emotional Contexts of Adolescent Smoking Patterns

- Working on a research program aimed at exploring the biological, social, and emotional contexts of smoking among a cohort of adolescents followed through young adulthood (National Cancer Institute Grant# P01 CA098262)
- Support participant retention and tracking, code data, and run participants in the field as needed

**UIC Department of Neurology**

Supervisor: Dilip Pandey, M.D., Ph.D., FAHA (Director of Clinical Research)

January 2015-present

Volunteer Research Assistant, **PAUSE to Learn your Epilepsy**

- Provide research and administrative support designing a longitudinal educational intervention to improve self-management for patients with epilepsy to be developed first in the UIC Epilepsy Specialty Clinic and then disseminated in the community at local Chicago health clinics in collaboration with the Epilepsy Foundation of America and local chapters thereof
- Support study by conducting literature searches, developing survey measures, preparing IRB documents, and piloting web-based educational modules and providing feedback for improvements

**Columbia Couples Laboratory**

Columbia University, Psychology Department

Oct 2009 – August 2013

Supervisors:

Niall Bolger, Ph.D.

Gertraud Stadler, Ph.D.

Study Coordinator, **Transplant Study**

- Coordinated administration of the study across 2 institutions (Columbia U & Mount Sinai Medical Center), supervised a team of 10 research assistants, responsible for recruiting, interviewing, and running training sessions for lab members
- Met daily with Dr. Gertraud Stadler to plan and implement our program of research
- Worked on the design of surveys and adherence studies and helped script survey administration for patients and caregivers
- Participated in lab meetings and directed study team meetings for research assistants
- Coordinate and contribute to preparation of consent forms and eight questionnaires pertaining to patient and caregiver adherence predictors and covariates and health outcomes in English and put together and supervise two teams to translate all study materials into Spanish and Mandarin
- Research, write, and contribute materials for presentation to Mount Sinai School of Medicine Department of Behavioral Oncology

Study Coordinator, **Epilepsy Study**

- Led writing of fellowship proposal and design of internet questionnaire regarding psycho-social contributors to self-management and medication adherence among adults with epilepsy
- Create presentation of on-going research for Columbia University Medical Center (CUMC) Epilepsy Center’s seminar series
- Recruited participants nationally via word of mouth, Epilepsy Foundation (EF) newsletters, EF and epilepsy-related web forums, doctors’ offices, medical centers, and epilepsy support groups
- Created and maintained ongoing national database of participants and health professionals
- Developed and implemented comprehensive screening protocol for internet recruitment
• Liaised with participants, health providers and health and patient advocates
• Networked and formed partnerships and collaborations with CUMC’s Epilepsy Center, PatientsLikeMe.com, MedHelp.org, regional chapters of the Epilepsy Foundation, and the NYC Epilepsy Meet-Up Group
• Trained and supervised four research assistants in all areas of running the study and performing analyses for research presentations

**Research Assistant, Attenuation Effect Study, Diabetes Study, Genetics Study**

• Assisted with writing and editing of IRB proposals and correspondence as well as a NIH grant proposal
• Recruited and corresponded with 700+ study participants via email, phone, and text message
• Assisted in developing and writing questionnaires (paper and internet formats) for daily diary intensive longitudinal study
• Analyzed and presented individual data at 2011 SPSP Conference on undergraduate rejection sensitivity and alcohol use
• Coded participant interviews for support and planning language in study of diabetes and social support among lower-income minority patients in the Washington Heights area
• Prepared, collected, and provided training sessions for research assistants and participants in biological sampling of saliva for cortisol and genetic analysis
• Prepared raw data for data analysis
• Created a manual for how to run a past study of stress and social support in dyads
• Created and enhanced graphs, figures, and training materials using Adobe Creative Suite graphic design software
• Paid participants for their contribution to studies
• Presented training demonstrations in Research Assistant Meetings

**Columbia University-NYS Psychiatric Institute**

**Child Psychiatric Epidemiology Group, Intern**

New York, NY

Jan 2011 – Jan 2012

Supervisor: Christina Hoven, Dr.PH, MPH

• Interview first-responder and control parent and child participants in a study of familial transmission of PTSD stress symptoms related to the 9/11 WTC attack
• Trained to perform structured diagnostic interviews including *Composite International Diagnostic Interview* and *National Institute of Mental Health’s Diagnostic Interview Schedule for Children, Version IV (DISC-IV)*
• Trained to administer the *KBIT* intelligence test as well as questions developed specifically for this study
• Edit, format, and contribute to writing and developing manuscripts for publication on topics related to child mental health interventions in developing countries, interpersonal violence, and effects of parental job loss on children
• Conduct quality assurance reviews of recorded interviews
• Administer, explain, and collect consent/assent, contact, and payment documents for participants

**Center for Decision Sciences, Research Assistant**

New York, NY

Columbia Business School, Columbia University

Mar 2010 – Feb 2011

Supervisors: Jonathan Westfall, Ph.D. (Assoc. Director)

• Wrote and coded responses to survey pertaining to computer and internet-based social science research security practices
• Arranged IRB Renewal Submission and Protocol updates for *Neuropsychology of Judgment and Decision Making* and *Decision Making Under Uncertainty* studies
• Proofread and copy-edited manuscripts and working papers
• Wrote web copy related to principle investigators and their research
• Assisted in development and creation of internet-based surveys on adult intelligence and physical activity
• Performed data collection and entry for global warming perception study
• Wrote R code for data analysis
• Provided administrative support and events coordination for center talks and functions

**TEACHING EXPERIENCE**

**Department of Psychology, University of Illinois at Chicago**

**Teaching Assistant, Psychological Testing; Theories of Personality**

August 2014-May 2015

Supervisor: Steve DuBois, Ph.D. (Assistant Professor); Julie Chen, Ph.D. (Assistant Professor)

• Give semi-annual guest lecture to undergraduates on the topic of Psychiatric Epidemiology
• Write exam questions based on Psychiatric Epidemiology lecture
• Develop course assignments with instructor
• Meet with students to provide additional academic support and guidance

**PROFESSIONAL & CLINICAL EXPERIENCE**

**UIC Office of Applied Psychological Services**

**Clinician**

August 2013 – present

• Provide intake, therapy, and psychological assessment services
• Provide therapy and intervention primarily using cognitive behavioral therapy and motivational interviewing
• Administer psychological evaluations to adults and children to assess for psychological disorders and disability
• Write psychodiagnostic testing reports with recommendations for clients

**Council on Accreditation for Children and Family Services**

**Data Management Analyst, Quality Management**

July 2010 – March 2012

• Scripted and streamlined comprehensive correlation, univariate and multivariate regression analyses of overall customer satisfaction year-end report
• Compiled, coded, analyzed, and formally reported on qualitative and quantitative data from internal processes efficiency tracking and internet-based surveys of participating accredited health and human services providers nationwide and in Canada regarding best practices and customer service satisfaction
• Provided analysis and reported on outcome measures and bench-marks used by community mental health providers and make recommendations regarding which measures to integrate into accreditation requirements
• Participated in development and revision of foster care standards of practice, cross-referencing with state and federal guidelines
• Attended and reported on industry webinars to Directors
• Set up and edited internet-based surveys of participating organizations and their clients
• Created and enhanced graphs using Adobe Creative Suite graphic design software
• Wrote and edited copy for website, conference brochures, departmental reports

FEGS Health and Human Services
New York, NY

PROS (Personalized Recovery Oriented Services) Intern
May 2010 – Aug 2010

• Interviewed incoming clients to make assessments and service recommendations
• Led group out-patient day services and group therapy sessions pertaining to methods of compensating for cognitive deficits, crisis and rehabilitation planning, use of community resources, and stress management
• Provided supervision and conducted interviews for PROS Pioneers program in which clients propose, interview for, and run their own group activities
• Taught small group and individual tutoring sessions on language, literacy, writing, and ESL

PUBLICATIONS


Marie Chesaniuk & Robin Mermelstein. (2015). Do depression and antisocial behavior moderate the relationship between ADHD and smoking progression? (In preparation.)


David Heilman, Marie Chesaniuk, & Gertraud Stadler. Depressed Affect as a Risk Factor for Medication Adherence in Persons Living with Epilepsy. (Paper submitted to Neurology.)

Gertraud Stadler, Marie Chesaniuk, Ashley Okamoto, & Niall Bolger. Perceived Behavioral Control and Mood in Daily Life. (In preparation.)

Ping Woo, Megan Ryan, Francesca del Gaudio, Cristiane Duarte, Marie Chesaniuk, & Christina Hoven. Parental 9/11 Related Job Loss and Child Mental Health. (Submitted to The Journal of Child Psychology and Psychiatry.)

PRESENTATIONS

Marie Chesaniuk, “Sleep & Insomnia.” (Summer 2015.) Guest lecture for undergraduate Abnormal Psychology course.


Marie Chesaniuk & Robin Mermelstein. “Effects of Antisocial Behavior on the Relationship between ADHD and Smoking Progression.” (April 2015.) Poster session to be presented at the annual meeting of the Society for Behavioral Medicine in San Antonio, TX.

Marie Chesaniuk & Robin Mermelstein. “Depression Moderates the Link between ADHD and Smoking Progression.” (February 2015.) Poster session to be presented at the annual meeting of the Society for Research on Nicotine & Tobacco in Philadelphia, PA.

Marie Chesaniuk & Gertraud Stadler. “Stigma is Associated With Less Health-Promoting Behavior and its Social-Cognitive Predictors.” (May 2012.) Poster session presented at the annual meeting of the Association for Psychological Science in Chicago, IL.

David Heilman, Marie Chesaniuk, & Gertraud Stadler. "Depressed Affect Predicts Less Action Implementation and its Social-Cognitive Predictors." (May 2012.) Poster session presented at the annual meeting of the Association for Psychological Science in Chicago, IL.


HONORS & AWARDS

- UIC Student Travel Presenter's Award June 2015
- Performed Hindemith Trumpet Sonata with Grammy Nominee Christopher Lyndon-Gee May 2006
- Best Critical Essay, Adelphi U. English Department Awards May 2006
- Best Paper Presentation, Adelphi U. Undergraduate Research Conference May 2005
- NABET-CWA Local 11 Undergraduate Scholarship Aug 2004
- Sigma Tau Delta, International English Honor Society May 2004

AFFILIATIONS & MEMBERSHIPS

- Society for Research on Nicotine & Tobacco
- Society of Behavioral Medicine
- Association for Psychological Science
- American Psychological Association
- Society for Personality and Social Psychology
- Sigma Tau Delta (International English Honor Society)