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ADHD And Positive Smoking Expectancies The Role of Peer Influence as A Moderating Factor

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ADHD AND POSITIVE SMOKING EXPECTANCIES: THE ROLE OF PEER INFLUENCE AS A MODERATING FACTOR

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ABSTRACT

Research has demonstrated considerable links between symptoms of ADHD and negative outcomes such as increased risk for cigarette use, which, despite an overall decline, remains a serious public health concern. Cigarette use is often associated with positive expectancies, or ideas about the effects of smoking. While some work on ADHD symptoms has focused on alcohol expectancies, no work has investigated how they might be related to smoking expectancies Other factors, such as susceptibility to peer influence, also remain shallowly explored. The present study is the first to examine interrelations among ADHD symptoms, smoking expectancies, and susceptibility to peer influence. It was hypothesized that there would be a positive relation between symptoms of ADHD and positive smoking expectancies. Further, it was hypothesized that susceptibility to peer influence would moderate this relation such that it would be stronger for individuals who were more susceptible to the influence of their peers. Results from linear regression analyses did not support these hypotheses. However, it is unclear whether results stem from a true absence of relations among ADHD symptoms, smoking expectancies, and susceptibility to peer influence, or a lack of statistical power. Additional research with larger samples using these constructs is needed to better understand their relations and to strengthen our understanding and measurement of the construct of susceptibility to peer influence.

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CHAPTER 1

INTRODUCTION

Although overall rates have declined in recent years, cigarette smoking among adolescents and young adults remains a serious public health issue. Research indicates that 10.7% of adolescents age 12 to 17 are current (i.e., past month) cigarette smokers. This percentage more than triples for young adults ages 18 to 25, 38.1% of who are current cigarette users. Notably, 58.8% of smokers who began smoking in 2010 were under the age of 18 (SAMHSA, 2012). A number of serious health issues such as cancer and heart disease are associated with cigarette use. Therefore, it is important to identify early risk factors associated with cigarette use to facilitate the development and execution of successful prevention efforts.

While research indicates that the average age of smoking initiation is 17.3 years, even younger groups already hold smoking expectancies (i.e., beliefs about the effects of cigarette use; Brandon & Baker, 1991), which are predictive of later cigarette use (e.g., Wahl, Turner, Mermelstein, Flay, 2005; Cohen, McCarthy, Brown, & Myers, 2002). Rates of smoking among adolescents have also been shown to be higher in individuals diagnosed with ADHD than in their non-ADHD peers (e.g., Wilens et al., 2011; Molina & Pelham, 2003; Fuemmeler, Kollins, & McClernon, 2007). Studies have suggested several explanations for this increased prevalence in smoking, such as the self-medication hypothesis (i.e., the use of cigarettes to alleviate symptoms associated with ADHD; Gehricke et al., 2007) and affiliation with deviant peer groups (Marshal, Molina, &

Pelham, 2003). Although a number of factors have been examined as explaining the relation between ADHD and smoking behavior, significant gaps remain, including research on ADHD and other early risk factors for smoking, such as smoking expectancies and susceptibility to peer influence.

The present study is the first to explore susceptibility to peer influence as a factor that might affect the relation between ADHD symptoms and smoking expectancies. There are several reasons why we expect susceptibility to moderate this relation. First, traits such as impulsivity and social impairment, which are common among individuals with ADHD (American Psychiatric Association, 2000; Barkley, 1998) and may also increase their susceptibility to peer influence. Individuals with ADHD may go along with peers without fully contemplating their choices (i.e., impulsivity) or may choose to acquiesce in an attempt to increase their social status among peers. Further, research by Allen and colleagues (2006) indicates that higher levels of susceptibility to peer influence are related to a number of negative outcomes, including substance use and externalizing behaviors. Together, these findings suggest that susceptibility may represent an important moderating factor in the relation between ADHD symptoms and positive smoking expectancies.

Negative Outcomes Associated with Cigarette Use

Smoking is associated with a significant number of negative health outcomes, including increased risk for cancer, heart disease and hypertension, and pregnancy complications. For instance, smokers are 2 to 4 times more likely than non-smokers to experience coronary heart disease. Women who smoke are 13 times more likely to develop lung cancer than those who do not; this number rises to 23 for male smokers.

Finally, smoking during pregnancy increases risk for complications such as preterm delivery, stillbirth, low birth weight, and sudden infant death syndrome (SIDS). Overall, nearly half a million deaths per year in the US can be attributed to cigarette use (Centers for Disease Control and Prevention, 2012).

Smoking also poses a significant financial burden to cigarette users. According to statistics from early 2010, cigarettes cost $4.80/pack on average. Approximately 45% of smokers 12 and older report smoking 16 cigarettes or more (i.e., roughly one pack) per day (SAMHSA, 2012). These statistics suggest that smoking represents a considerable financial expense to smokers. Further, this financial burden is significantly higher when other health related costs are factored in. Cigarette use also produces significant, detrimental effects on the environment (Novotny & Zhao, 1999; Geist, 1999; Moerman & Potts, 2011; Geist, 1999). It was estimated in 1995 that worldwide cigarette production created approximately 2,262 million kilograms of manufacturing waste and 209 million kilograms of chemical waste. Manufacturing waste includes tobacco slurries, solvents, oils, greases, plastics, unusable tobacco, and packaging materials, while chemical waste includes ammonia, hydrochloric acid, hydrogen fluoride, and sulphuric acid (Novotny & Zhao, 1999). Additionally, discarded cigarettes can leach potentially harmful metals (Moerman & Potts, 2011) and production often requires significant deforestation (Geist, 1999).

Overall, research indicates that cigarette use not only impacts smokers, but also their families, and the general public. Cigarette use is linked to a large number of health issues and is expensive to maintain, representing a significant burden to smokers. Families of smokers are exposed to second hand smoke and are often involved in the

health related decisions and difficulties faced by smokers. Finally, the nonsmoking public is exposed to the detrimental environmental effects of cigarette manufacturing and use such as hazardous manufacturing wastes and resource use. These negative outcomes are a few of the reasons why it is important to assess early risk factors related to cigarette use. Smoking expectancies represent one such important early risk factor to consider.

Smoking Expectancies and Cigarette Use

Positive smoking expectancies are positive beliefs about the effects of smoking cigarettes, such as the belief that smoking will help one deal with stress (Brandon & Baker, 1991). Research has consistently demonstrated a link between positive smoking expectancies and cigarette use. This relation has been examined in both clinical (Cohen et al., 2002; Wahl et al., 2005) and community based (Chassin, Presson, Pitts, & Sherman, 2000; Heinz et al., 2010) samples of adolescents and young adults.

For example, a study by Cohen and colleagues (2002) explored the relation between negative affect, smoking expectancies, and smoking behavior. Participants were 121 adolescents and young adults ages 16 to 23 (*M* age=19.69, *sd*=1.50, Time 1) recruited from drug and alcohol treatment programs (*n*=67) and via community advertisements (*n*=54). The sample was 45% female and predominantly (85%) Caucasian. Three follow-up interviews were conducted over a period of 4 years (at 4, 6, and 8 year follow-up). Results indicated that dispositional negative affect and positive smoking expectancies were both significantly correlated with smoking behavior within and across time. Importantly, regression analyses indicated that expectancies alone were uniquely, significantly predictive of smoking behavior at and across both Time 2 and Time 3.

In another study using both clinical and community samples, Wahl and colleagues (2005) examined smoking expectancies as predictors of later smoking behavior in two groups of adolescents. The first sample consisted of 349 smokers ages 14 to 19 years (*M*=16.4, *sd*=1.1, 54% female, 75% Caucasian) who were enrolled in a cessation program. The second sample included 273 8th (43%) and 10th graders (57%) who had experimented with smoking. Seventy four percent of participants identified as Caucasian and 54% were female. Results indicated that expectancies were predictive of later smoking continuation and cessation behaviors. Specifically, smokers had higher baseline expectancies than all other groups (never triers, ever triers, current triers, escalators, rapid escalators, and quitters). Further, smokers and rapid escalators showed the largest increases in expectancies between baseline and 6-month follow up, while expectancies for the other groups remained relatively unchanged. However, it should be noted that it is unclear whether expectancies were present prior to smoking initiation.

Chassin and colleagues (2000) studied trajectories of smoking behavior in subgroups of smokers in a community sample of 6,929 individuals who were part of a larger sample of 8, 556 6th-12th graders participating in a study of the natural progression of smoking behavior. Data were available for these participants from at least two waves, and participants were, on average, 13.62 years old at the first wave and 26.60 years old at the final wave. Roughly half (51%) of participants were men and 96% were non-Hispanic Caucasian. Smoking beliefs (i.e., smoking expectancies) were most useful in distinguishing between subgroups such that groups who began smoking in adolescence held more positive beliefs about smoking than non-smokers or later initiators (f^2 = .02).

In another community-based sample, Heinz and colleagues (2010) examined the

predictive utility of affect-related smoking expectancies in relation to smoking behavior and nicotine dependence. Data were collected at baseline, 6, 15, and 24 months as part of a larger study by the National Cancer Institute. This sample included 12,970 9th and 10th graders. Participants were divided into four groups: never smokers, former experimenters, current experimenters, and current smokers. Those participants who had smoked in the last 30 days (n=568) were included in the final analyses. Of those 568, 56.7% were female and 59.5% were Caucasian, while 20.1% were Hispanic. Findings indicated that, at baseline, expectancy scores moderated the expected log odds of smoking zero cigarettes per day versus all other quantities. This finding can be interpreted such that that the likelihood of a participant of smoking zero cigarettes per day versus all other quantities of use decreased as mean levels of expectancies about negative affect relief increased. Regarding days in which cigarettes were used, (holding all other variables constant), the expected log odds of smoking zero days versus all other amounts again decreased as mean level of expectancies increased. That is, higher levels of expectancies were associated with decreased likelihood of not smoking.

Together, this research on smoking expectancies and actual smoking behavior indicates that positive expectancies are related to and predictive of cigarette use. Positive expectancies may also be associated with earlier smoking initiation (Chassin et al., 2000) and may be present well before cigarette experimentation begins. While studies of smoking expectancies have focused on children as young as 10 (Combs, Caudill, Stark, Smith, & Spillane, 2012), there is little available work in this area. However, research on alcohol expectancies has demonstrated that they may be present in even younger children (i.e., second graders; Kraus, Smith, & Ratner, 1994). By extension, young elementary

aged children may also already hold smoking expectancies, which may represent an important point of intervention aimed at preventing cigarette use. Better and earlier identification of those most at risk for smoking initiation may lead to more success in preventing these groups from becoming regular smokers and experiencing the many long term negative health consequences of smoking.

ADHD and Smoking Behavior

Although holding positive smoking expectancies may put individuals at greater risk for smoking, there are other psychosocial risk factors related to cigarette use, such as having symptoms of ADHD. Research demonstrates that individuals with ADHD are at a greater risk for cigarette use than their non-ADHD peers (e.g., Wilens et al., 2011; Molina & Pelham, 2003; Fuemmeler et al., 2007). For instance, Wilens and colleagues (2011) analyzed 10 year follow up data from 268 adolescents (*M* age=10.9, *sd*=3.2) with ADHD and 229 controls (*M* age=11.9, *sd*=3.3). Roughly half of participants were male. Findings indicated that ADHD participants were more likely to smoke cigarettes at follow-up than controls (hazard ratio (HR) = 2.38, 95% CI 1.66 –3.63, $p<.01$). Results were replicated in a subsample of participants without a history of conduct disorder (CD) at baseline, with ADHD participants again reporting more cigarette smoking than controls (HR = 2.06, 95% CI 1.36 –3.20, $p<.01$).

Molina and Pelham (2003) also investigated predictors of substance use among a sample of adolescents with and without ADHD. Participants were 242 adolescents (*M* age=15.18, *sd*=1.43), 142 of whom were ADHD probands who had previously received services from the investigators' home institution, and 100 controls recruited from the community. The proportion of females in the sample was relatively small (5% of

probands and 6.3% of controls), as was the proportion of African American participants (8% and 10.6%, respectively). Results of bivariate regression indicated that childhood inattention predicted substance use in seven of nine tests. Further, multivariate regression showed that the effects of inattention remained statistically significant even when controlling for childhood impulsivity-hyperactivity, oppositional defiant disorder (ODD) symptoms, and CD symptoms. Specifically, inattention significantly predicted quantity of cigarettes smoked (β=.20, p<.05).

Although there is abundant literature documenting the relation between ADHD and smoking behavior, the relation between ADHD and smoking expectancies is less well understood. A search of the literature found no studies specifically examining how ADHD is related to smoking expectancies. There is also a notable lack of research on factors which may influence the strength of the relation between ADHD and smoking expectancies. Thus, the present study will fill two gaps in the literature as it will be the first to examine ADHD symptoms in relation to positive smoking expectancies and the first to explore factors which may influence this relation.

Why may ADHD and Smoking Behavior/Expectancies be Related?

A number of hypotheses exist regarding the reasons for the increased risk of smoking among individuals with ADHD in comparison to their non-ADHD peers, including the self-medication hypothesis (Potter & Newhouse, 2008), the tendency of individuals with ADHD to associate with deviant peer groups (Marshal et al., 2003), and increased impulsivity and reward sensitivity among those with ADHD (Sonuga-Barke, 2005; Sonuga-Barke, Taylor, Sembi, & Smith, 1992).

The self-medication hypothesis posits that individuals with ADHD may be more

likely to use cigarettes because of the stimulating effect of nicotine on the central nervous system, which may ameliorate attentional problems (Gehricke et al., 2007). Potter and Newhouse (2008) investigated the effects of transdermal nicotine in a sample of 15 young adult non-smokers with ADHD combined type (ADHD-C). Participants were 9 males and 6 females between 18 and 24 years old (*M* age=20, *sd*=1.7) who had not used tobacco products at all in the last 6 months and had no lifetime history of regular use. Results indicated that performance on a stop signal task (as measured by reaction time, which approximates speed of inhibition) was significantly better during the nicotine condition than during the placebo condition ($t(11)=2.07$, $p<05$). Similar results were previously shown in a sample of adolescents ages 13-17 (Potter and Newhouse, 2004). However, this line of research suffers from some methodological issues, such as small sample sizes and differential conceptualizations of which symptoms are self-medicated, ranging from attention problems to sleep problems (see Glass and Flory, 2010, for a review).

Affiliation with deviant peer groups has also been investigated as a factor that may explain the link between ADHD and smoking behavior. For instance, Marshal et al. (2003) investigated deviant peer group affiliation as a mediator of the relation between ADHD and smoking behavior in a group of 142 adolescents with ADHD and 100 controls. Mean participant age was 15.2 (*sd*=1.4), 94% were male and 87% were Caucasian. Results indicated that deviant peer affiliation partially mediated the relation between ADHD and smoking. Findings also suggested that both ADHD ($B=.13$, $p<.05$) and deviant peer group affiliation ($B=.40$, $p<.001$) were significantly predictive of quantity of cigarettes smoked. As research has demonstrated that individuals with ADHD

are likely to experience social impairment (Barkley, 1998), they may be more likely to adopt the views and behaviors of their peers in order to fit in. Thus, affiliating with deviant peers may lead individuals with ADHD to take on their views (e.g., positive expectancies) and engage in similar behaviors (e.g., cigarette use).

The delay aversion model (Sonuga-Barke, 2005; Sonuga-Barke, et al., 1992), which posits that individuals with ADHD are more likely to choose immediate rewards over delayed rewards, even if the immediate rewards are smaller, may be another factor in understanding why ADHD and cigarette use are related. Cigarettes (i.e., nicotine) may represent immediate symptom alleviation in individuals with ADHD, as suggested by the self-medication hypothesis (Potter & Newhouse, 2008). Therefore, those with ADHD may be at increased risk for cigarette smoking because they are sensitive to immediate rewards, and cigarette use provides faster symptom relief than other coping mechanisms. The delay aversion model may also be related to susceptibility to peer influence such that engaging in the same behaviors as one's (deviant) peers may lead to immediate rewards via peer acceptance. These immediate rewards may be more salient and motivating than the future benefits of abstaining from tobacco use.

Although the self-medication hypothesis, affiliation with deviant peer groups, and the delay aversion model have not been examined with respect to ADHD and smoking expectancies, they may help to explain, in part, why individuals with ADHD have higher positive smoking expectancies. This group may expect more positive effects from smoking because of a belief that smoking will improve cognitive functioning, will facilitate entry into desired peer groups, or will provide other immediate reinforcing consequences. In addition (although not directly explored in the literature) certain

deficits and characteristics related to ADHD may lead individuals with ADHD to hold positive smoking expectancies. For example, certain cognitive deficits associated with ADHD may also be related to positive expectancies. One example of these deficits is impulsivity, one of the core symptoms of ADHD (American Psychiatric Association, 2000). Impulsivity may lead individuals to hastily make positive cognitive appraisals about the effects of cigarette use without giving in depth thought to the range, both positive and negative, of the potential effects. Taken together, the aforementioned theories (i.e., the self-medication hypothesis, deviant peer affiliation, the delay aversion model, and impulsivity) provide a theoretical understanding for why individuals with ADHD may hold positive smoking expectancies.

Susceptibility to Peer Influence

Another relatively unexplored area within the literature is how ADHD is related to susceptibility to peer influence. However, some research has focused on this susceptibility as it relates to factors associated with ADHD. For example, Allen and colleagues (2006) examined peer influence as a predictor of risky behavior in adolescents. Using a sample of 177 seventh and eighth graders (*M* age=13.36, *sd*=0.66, 53% female, 57% Caucasian), data were collected from participants and their parents at baseline and one year later. Results revealed that susceptibility to peer influence was predictive of higher current levels of substance use beyond race and gender (β = .24, $p \leq .01$, $\Delta R^2 = .06$, $p \leq .01$). Additional analyses revealed that results from entering externalizing behavior, drug, and alcohol use, and history of sexual activity into a hierarchical linear model predicting susceptibility (after first entering race and gender) were also significantly predictive (R^2=.11, multiple *R*=.33, *p*=.001). While these results

focus on externalizing disorders generally, it is possible that susceptibility to peer influence is also related to specific externalizing problems, such as ADHD. Similarly, results may generalize from substance use to substance use expectancies, as the two are closely related.

Research has also indicated that ADHD is related to other negative peer interactions, such as engagement in deviant behaviors (Marshal et al., 2003) and peer rejection. For example, Murray-Close et al. (2010) studied peer rejection in children with ADHD in a sample of 820 children ages 8 to 13 from The Multimodal Treatment Study of Children With ADHD (MTA). Results indicated that across four time points, children with ADHD experienced significantly more peer rejection than non-ADHD controls. Further, peer rejection was related to social skills deficits, which also predicted peer rejection at later time points. These findings may suggest that children with ADHD may be more likely to succumb to peer influence as a way to reduce peer rejection and establish better friendships. In turn, Allen and colleagues' (2006) findings that susceptibility peer influence is related to substance use suggest that this susceptibility may also be related to positive substance use expectancies, including expectancies about the effects of cigarettes. Therefore, this research addresses several unexplored areas in the literature, as the current body of work has neither investigated how susceptibility to peer influence is specifically related to ADHD nor how it is related to expectancies about the effects of cigarette use.

The Present Study

Large holes remain in the literature on smoking risk, particularly for groups most at risk, such as individuals with ADHD. Thus, the purpose of the present study was to

evaluate the relation between ADHD symptoms and positive smoking expectancies. Additionally, susceptibility to peer influence was investigated as a potential moderator of this relation. It was hypothesized that ADHD symptoms would be positively related to positive smoking expectancies. It was also hypothesized that susceptibility to peer influence would moderate this relation such that it would be stronger for individuals with higher levels of susceptibility.

ADHD symptoms were measured continuously in terms of symptom count and severity rather than categorically. Research has indicated that subthreshold ADHD can still cause significant impairment and that studying ADHD as a continuous variable can yield meaningful results (Overbey, Snell, & Callis, 2011). Findings may help to clarify the nature of the relation between ADHD and smoking expectancies and could be used to develop and refine prevention strategies primary targeting adolescents at a high risk for cigarette use.

CHAPTER 2

METHOD

Participants

Participants (i.e., "primary respondents") were 41 adolescents ages 11 to 17 (*M*=13.83, *sd*=1.72) from a previously collected dataset (see procedure). Slightly more than half of the primary respondents were female (58%) and 71% of parents identified their children as Caucasian, 27% as African American, and 2% identified them as other racial/ethnic backgrounds. Mean yearly household income range as reported by parents was $41,000-$60,000 and varied from less than $10,000 to more than $80,000. More than one third (34.1%) of parents reported completing some college or a 2-year degree, while another 31.7% had earned a 4-year degree.

Primary respondents were asked to choose a same sex friend (i.e., "friends") who was close in age to also participate in the study. Friends ranged in age from 10 to 19, (*M*=13.90, *sd*=1.90) and were very similar to primary respondents in terms of racial and ethnic background, with 75% identifying as Caucasian, 22% as African American, and 2% as other.

Procedure

All procedures were approved by the University of South Carolina's Institutional Review Board. Recruitment was carried out via advertisements on university faculty/staff listservs, at doctors' offices, and at a local school for children with ADHD and other learning disorders. Separate fliers targeted recruitment of adolescents with or without

symptoms of ADHD and advertised the study as research on friendships. Participants were also recruited from a previous study which investigated factors related to smoking in adolescents with ADHD and/or depression. Parents who contacted study coordinators were given information about the study procedures and purposes. Once parents and primary respondents agreed to participate, the children were asked to identify a close, same-sex friend to also participate. Primary respondents were asked to choose friends who were, "someone you know well, spend time with, and talk with about things that happen in your life," who were close in age, and who were not family members. The parents of the identified friend were contacted and given information about the study. Preliminary oral consent was obtained from friends' parents who agreed to participate and scheduling was coordinated. Primary respondents and friends were also screened via phone for a number of exclusion criteria, including prior diagnoses of severe learning problems (e.g., developmental disorders and mental retardation) or severe emotional or behavioral problems (e.g., psychotic disorders). All primary respondent-friend pairs were less than two years apart in age and within pairs, ages were highly correlated (r=.94, p<.001). Primary respondents reported knowing their friends for an average of 3.81 years (sd=2.72). Additionally, both primary respondents and friends were asked to rate how "good" of friends they considered each other to be using a 5-point scale, where 1 = "not at all friends" and 5 = "best friends". Primary respondent/friend ratings were strongly correlated (r=.51, p<.001), and mean ratings ($M_{primary\ respondent}$=4.52, sd=.68, M_{friend}=4.68, sd=.57) were very similar and high, indicating general agreement and high levels of closeness. Written consent was obtained from primary respondent parents upon arrival for the study and parental consent forms previously mailed to friend parents were

collected from friends. Written assent was also obtained from both adolescents. Participants were monetarily compensated for their involvement in the study; primary respondents and friends each received $20, parents received $10 and teachers received $5 for their participation.

Primary respondents, their parents, and their friends completed study measures and tasks under the supervision of trained research assistants during their visit to an on-campus research lab. Primary respondent parents completed questionnaires asking about their child's behavior and peer relationships, while primary respondents and friends filled out measures pertaining to their own behaviors and friendship with one another. Primary respondents and friends also participated together in several tasks measuring cooperation, friendship quality, and peer influence. Both adolescents were assured of the confidentiality of their data to encourage accurate responses. To further ensure accuracy, primary respondents and friends completed their measures in separate areas.

Measures

ADHD Symptoms. ADHD symptoms were collected using parent and teacher ratings on the ADHD Rating Scale (ARS-IV; DuPaul, Power, Anastopoulos, & Reid, 1998). The ARS-IV is an 18-item rating scale with half the items measuring inattention and half measuring hyperactivity/impulsivity using a 4 point scale where 0 = "not at all/rarely and 3 = "very often". Scale items were developed from the DSM-IV-TR diagnostic criteria for ADHD (American Psychiatric Association, 2000), with higher scores indicating higher symptom endorsement. Teacher ratings were only available for 59% (n=24) participants. Due to this low rate of return, correspondence was conducted with one of the measure developers to determine the best way to assess ADHD symptoms

(G. DuPaul, email correspondence, March 30, 2012). The author and chair were in agreement with the developer's suggestion to include only parent ratings. Thus, teacher measures were excluded from analyses. Scores were summed for each dimension (i.e., inattention and hyperactivity/impulsivity) as well as a total scale score. The ARS-IV exhibits adequate psychometric properties, including good internal consistency for parent ratings on both the hyperactivity/impulsivity ($\alpha_{\text{this sample}}$ =.87) and inattention ($\alpha_{\text{this sample}}$ =.94) subscales. Further, the ARS-IV demonstrates stability over a 4-week period (parent form: r_{total}= .85, $r_{inattention}$= .78, $r_{hyperactivity/impulsivity}$= .86) and has been shown to be significantly correlated with behavioral observations from parents and teachers (Power, McGoey, Ikeda, & Anastopoulos, 1998).

Susceptibility to Peer Influence. Susceptibility to peer influence was measured using a task developed by Allen and colleagues (2006), which is referred to as the 'Mars Task' in the current study. The Mars Task was designed to measure how susceptible adolescents are to being influenced by close friends on a neutral issue. Primary respondent/friend pairs were read a story about 12 fictional characters (e.g., a doctor, a baseball player) who were stranded on another planet. They were then each asked to make a written list of 7 characters chosen to make a return trip to Earth (Pfieffer & Jones, 1974). Primary respondents and friends made their choices separately and then came together to discuss differences and choose a final list of 7. They were given 8 minutes to come up with their agreed upon final list. Susceptibility to peer influence was measured as the percentage of instances where the primary respondent and friend initially disagreed about a choice and the primary respondent changed his or her stance to match that of the friend. The mean number of disagreements for pairs was 4.68 (*sd*=1.52). Across all

primary respondent/friend dyads, primary respondents changed their responses in slightly more than half (*M*=55.23%, *sd*=33.15) of disagreements.

Smoking Expectancies. Expectancies were assessed with a 12-item questionnaire measuring both positive (7 items) and negative (5 items) expectancies (Dalton, Sargent, Beach, Bernhardt, & Stevens, 1999). However, as the focus of the present study is on positive expectancies, the negative expectancy subscale was excluded from analyses. Positive expectancy items included, "I think I would enjoy smoking," "I think smoking would give me something to do when I'm bored," "I think smoking would help me to deal with problems or stress," "I think smoking would help me to stay thin," "I think smoking would help me to feel more comfortable at parties," "I think smoking would be relaxing," and "I think smoking would make me look more mature." Items were rated using a four-point Likert response scale, where 1 = "strongly disagree" and 4 = "strongly agree." Positive (α=.88, $\alpha_{\text{this sample}}$=.89) expectancy items demonstrated adequate internal consistency (Dalton et al., 1999).

CHAPTER 3

RESULTS

Preliminary Analyses

Normality and Missing data

IBM SPSS Statistics version 19.0 was used in all statistical analyses with the exception of power analyses, which were conducted using SAS version 9.0 (SAS Institute Inc., 2002-2004) and G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). Preliminary analyses were conducted and indicated that most variables demonstrated adequate normality. However, CD symptoms demonstrated significant skewness and kurtosis (1.25 and 1.73, respectively). To address this issue, a natural log transformation was applied to the variable. This reduced both skewness and kurtosis to acceptable levels (Tabachnick & Fidell, 1996; see Table 3.1 for transformed values). There were very few missing data; susceptibility to peer influence (i.e., primary respondent percent change on the Mars Task) was missing for one subject and expectancies were missing for another. As the amount of missing data was very small, the potential non-randomness of missing data was unlikely to influence findings and listwise deletion was used. All continuous predictor variables were centered to reduce nonessential multicollinearity.

While bivariate correlation analyses with continuous variables revealed a significant correlation between ADHD symptoms and CD symptoms, other correlations were not significant. Results of correlational analyses and means and standard deviations for these variables are available in Table 3.1.

Covariates

Conduct Disorder (CD) symptoms were included as a covariate in all analyses as they are strongly linked to ADHD (Barkley, 2006) and were significantly correlated with one of the predictor variables (ADHD). Although other covariates such as gender and household income were considered, they were not included due to their adverse effect on power as a result of the small sample size.

Power analyses

Power analyses were conducted to determine our ability to find effects given our sample size and number of predictors. With a model including 4 predictors (predictor, moderator, interaction, and one covariate), our power to find main effects with an R^2 of .20 was .61. Power to detect a change from .20 with the main effects of ADHD and smoking expectancies to .30 with the inclusion of the interaction was .57. These results suggest the model may have adequate power to detect moderate main effects but is underpowered to detect interaction effects. However, as even the main effects are unexplored in the current literature, our low power does not negate the potential impact of the results.

Primary Analyses

Hierarchical linear regression was used to test the hypothesis that ADHD symptoms and susceptibility to peer influence would predict positive smoking expectancies such that those with higher levels of ADHD symptoms and who were more susceptible to peer influence would have higher positive expectancy scores. Conduct disorder symptoms were included as a covariate.

ADHD symptoms, CD symptoms, and susceptibility to peer influence were entered into the model in the first step, followed by the interaction of ADHD symptoms and susceptibility to peer influence in the second step. Results of the overall model were not significant, explaining only 3.1% of the total variance in positive expectancies (R^2=.031, F(4, 38)=.325, p=.86). ADHD symptoms were not significantly predictive of positive smoking expectancies (B=-.09, SE=.110, p=.434), nor were CD symptoms (B=.617, SE=.700, p=.38), susceptibility to peer influence (B=-.010, SE=.017, p=.553), or the interaction of ADHD symptoms and susceptibility (B=.001, SE=.002, p=.642).

Table 3.1 - *Bivariate Correlations and Descriptives*

Variable	1.	2.	3.	4.
1. ADHD symptoms	---	.336*	.063	-.103
2. Conduct Disorder Symptoms		---	.123	.079
3. Susceptibility to Peer Influence			---	-.080
4. Positive Smoking Expectancies				---
Mean	11.29	1.25	55.23	8.65
Standard Deviation	10.05	0.91	33.15	3.25
Skew	.87	-.17	-.21	3.12
Kurtosis	-.13	-1.17	-.84	12.34

Note: * $p < .05$, ** $p < .01$.

CHAPTER 4

CONCLUSION

While considerable effort has been made to increase awareness of the harmful effects of cigarette smoking and to promote cessation efforts, cigarette use remains a serious public health issue. The identification of early risk factors related to cigarette use is crucial to prevention efforts aimed at reducing smoking initiation among adolescents. Positive smoking expectancies have repeatedly been shown to predict later smoking behavior (e.g., Wahl et al., 2005) and thus may represent one such factor. It follows, then, that early expectancy reduction may be a viable prevention strategy for reducing later smoking initiation and cigarette use. However, little is known about how positive expectancies are related to other risk factors for cigarette smoking, such as symptoms of ADHD and susceptibility to peer influence. Thus, the purpose of the current study was to examine susceptibility to peer influence as a moderator of the relation between ADHD symptoms and positive smoking expectancies. The hypotheses of the current study were not supported, as neither the main effect of ADHD nor a moderating effect of susceptibility to peer influence on positive smoking expectancies were found.

There are a number of probable methodological reasons for these findings, the first of which is a lack of statistical power (r=.57 for the current study). Power, the ability to detect significant effects (Keith, 2006), is influenced by a number of factors, including sample size, effect size, and alpha level (Cohen, Cohen, West, and Aiken, 2003). In all analyses, the most widely accepted alpha value (p<.05) was used to determine

significance. In power analyses, effect sizes were set to .2 for main effects and .3 for the full model (i.e., an increase of .10 with the addition of the moderator). These effect sizes represent a moderate effect (Cohen, 1988) and were chosen to maximize power given other constraints while still remaining within the range of feasibility. Given the relatively small sample size in the current study (n=41), it is likely that this factor had the most significant impact on our ability to detect effects.

At this time it is unclear whether the findings are due to a lack of statistical power to find relations among the variables or whether the null hypothesis was correctly retained. However, given the strong theoretical evidence for relations between positive expectancies and cigarette use (Cohen et al., 2002) and between ADHD and cigarette use (Wilens et al., 2011), in addition to emerging evidence for a relation between susceptibility to peer influence and engagement in risk behaviors (including substance use; Allen et a., 2006), it is likely that the lack of support for the hypothesis is due to a lack of statistical power.

A second methodological problem which may have contributed to the hypotheses of the current study not being supported is that the hypotheses assumed that, within the sample, individuals with higher levels of ADHD symptoms affiliated with peers with more positive expectancies, which they were, in turn, influenced by. As peer expectancies were not assessed, it is unclear whether this assumption is true. Although research indicates that individuals with higher levels of ADHD symptoms are more likely than their non-symptomatic peers to affiliate with deviant peer groups (Marshal et al., 2003) and that positive expectancies are also associated with deviant (i.e., smoking) behavior (Chassin et al., 2000), these data were not available for use in the present study.

A number of theoretical reasons may also help to explain the lack of significant findings if they are not the result of low statistical power. For example, the present study did not investigate differences in susceptibility to peer influence as it relates to behaviors versus views. It is possible, then, that individuals may not necessarily adopt their peers' views, even if their behavior is influenced by their peers. Little research exists on susceptibility to peer influence as it is related to ADHD, and a review of the literature revealed no studies that investigated differential effects of susceptibility of peer influence on attitudes/expectancies/beliefs versus actual behaviors. Susceptibility to peer influence was measured as the percent of time primary respondents switched their choices to that of their peer, but the extent to which they believed their peer's choice to be superior was not measured. Therefore, the type of susceptibility to peer influence measured in the present study may not represent the type of susceptibility to peer influence that would affect the outcome variable of smoking expectancies. It is possible that individuals may be susceptible to certain types of peer influence (i.e. influence over beliefs vs. behaviors), which may differentially affect attitudes such as positive smoking expectancies.

It is also possible that the tendency for individuals with higher levels of ADHD symptoms to experience social impairment may be relevant to the null findings of the current study (in the event that they are not the result of inadequate statistical power). That is, individuals with more ADHD symptoms may be less adept at reading social cues and may not necessarily be aware of their peers' views. Alternately, they may be aware of their peers' views but may not alter their own views to match their peers' as a way to improve their social status or foster close peer relationships. Again, although research has demonstrated that individuals with higher levels of ADHD symptoms tend to experience

social impairment (Barkley, 1998), specific information on how this affects their awareness or adoption of peers' views is unavailable.

Overall, the present study had several methodological flaws. As previously described, the low number of subjects resulted in inadequate statistical power. Additionally, susceptibility to peer influences was measured behaviorally and susceptibility to influence regarding changes in attitudes/beliefs was not assessed. However, it also had a number of strengths. For example, the present study sought to call attention to a number of unexplored areas of the ADHD and smoking expectancy literatures with regard to the role of susceptibility to peer influence. The present study also incorporated a measure of a unique and potentially informative construct necessary for understanding peer influence – susceptibility to peer influence. While many studies investigating the effects of peer influence use indirect measures such as peer behavior (Ali & Dwyer, 2009, Harakeh & Vollebergh, 2012, Lakon & Valente, 2012), perceptions of peer normative beliefs (Lakon & Valente, 20120), and peer pressure (Harakeh & Vollebergh, 20120), most do not include a direct measure of the degree to which participants' behaviors are actually influenced by these peer factors. The current study, in contrast, used a direct measure of influence (i.e. switches to peer's choice on the Mars Task) to measure susceptibility to peer influence. The present study also highlights a need for more work exploring differential effects of susceptibility to peer influence on attitudes/expectancies/beliefs versus behaviors. Due to the complication of low statistical power, it is unclear whether the null findings are accurate or whether they are simply the product of an inability to correctly reject the null hypothesis as a result of the small sample size. It follows, then, that significantly more work with larger samples and more

complete measures (including peer expectancies and susceptibility to peer influence on both attitudes and behaviors) is needed to accurately assess the relations among symptoms of ADHD, susceptibility to peer influence, and positive smoking expectancies.

The findings of the present study may also have some clinical implications. If the results we obtained are indeed due to low statistical power and higher levels of ADHD are, in fact, related to higher levels of positive smoking expectancies, findings can be used to better identify individuals who may be at the greatest risk for later smoking behavior (i.e., those highest in ADHD symptoms). Additionally, if susceptibility to peer influence moderates this relation, it may represent an additional point of intervention via assertiveness training (Williams &Hall, 1988) or other methods used to reduce susceptibility and foster more independent analysis and decision-making regarding smoking. If findings are in fact accurate and are not the result of low statistical power, these avenues do not represent useful ways to reduce smoking behavior or identify those most at risk. In this case, future research and practice should focus on more basic, better-established factors and methods (such as the use of warning labels; Glock, Unz, & Kovacs, 2012) to directly reduce positive expectancies and smoking behavior. Though the present study suffered from some methodological flaws, it emphasizes the need for additional research regarding risk factors for positive smoking expectancies.

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