BRIEF REPORT

Smoking Motivation in Adults With Attention-Deficit/Hyperactivity Disorder Using the Wisconsin Inventory of Smoking Dependence Motives

John T. Mitchell PhD, Elizabeth M. McIntyre BA, F. Joseph McClernon PhD, Scott H. Kollins PhD

Department of Psychiatry and Behavioral Sciences, Duke University Medical Center, Durham, NC

Corresponding Author: John T. Mitchell, PhD, Department of Psychiatry and Behavioral Sciences, Duke ADHD Program, Duke University Medical Center, 2608 Erwin Road, Pavilion East, Suite 300, Durham, NC 27705, USA. Telephone: 919-681-0012; Fax: 919-681-0016; E-mail: john.mitchell@duke.edu

Received June 20, 2013; accepted August 2, 2013

ABSTRACT

Introduction: Smokers with attention-deficit/hyperactivity disorder (ADHD) differ from smokers without ADHD across a range of smoking outcomes (e.g., higher prevalence rates of smoking, faster progression to regular smoking, and greater difficulty quitting). Moreover, ADHD as a disorder has been characterized by deficits in fundamental motivational processes. To date, few studies have examined how motivation for smoking might differ between nicotine-dependent individuals with and without ADHD. The goal of this study was to assess whether specific smoking motivation factors differentiate smokers with and without ADHD as measured by an empirically derived self-report measure of smoking motivations.

Methods: Smokers with ($n = 61$) and without ($n = 89$) ADHD participated in a range of laboratory and clinical studies that included the Wisconsin Inventory of Smoking Dependence Motives (WISDM).

Results: A series of one-way analysis of covariances statistically controlling for age and race indicated that smokers with ADHD scored higher on the following WISDM subscales than their non-ADHD peers: automaticity, loss of control, cognitive enhancement, cue exposure, and negative reinforcement. Smokers in the non-ADHD group yielded higher scores on the social-environmental goals WISDM subscale. No group by gender interactions emerged.

Conclusions: Cigarette smokers with ADHD report different motives for smoking than smokers without ADHD. Clarifying the role of these motivational factors has implications for smoking prevention and treatment.

INTRODUCTION

Attention-deficit/hyperactivity disorder (ADHD) is a disorder that arises in childhood and persists into adulthood in a majority of cases (Barkley, Murphy, & Fischer, 2008) and is characterized by fundamental deficits in motivational processes (Volkow et al., 2009). ADHD is also an independent risk factor for cigarette smoking (Lambert & Hartsough, 1998; Milberger, Biederman, Faraone, Chen, & Jones, 1997a, 1997b; Molina & Pelham, 2003; Pomerleau, Downey, Stelson, & Pomerleau, 1995) and is associated with earlier age of smoking onset, higher nicotine dependence, and progression to regular use (Fuemmeler, Kollins, & McClernon, 2007; Kollins, McClernon, & Fuemmeler, 2005; Milberger et al., 1997a; Rohde, Kahler, Lewinsohn, & Brown, 2004; Wilens et al., 2008). Even among non-ADHD psychiatric samples who smoke, ADHD symptoms are associated with smoking-related variables (Mitchell et al., 2012).

Given the identified deficits in motivational processes inherent in individuals with ADHD in general, specific factors

related to the motivation to smoke in those diagnosed with ADHD may further our understanding of this common comorbidity and help identify targets for treatment and prevention efforts. For example, escape and avoidance of negative affect is one proposed motive for engagement in substance use (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004), which is consistent with naturalistic studies assessing the role of negative affect in smokers with ADHD (Mitchell et al., submitted). Clinical features of ADHD itself may provide motivation to smoke (e.g., smoking to regulate inattentive ADHD symptoms; Gehricke et al., 2007; Glass & Flory, 2010). In one study among smokers with and without ADHD, in addition to perceiving smoking as more calming, lessening irritability, and providing greater positive and negative reinforcement, smokers with ADHD perceived smoking as providing greater enhancement of concentration and alertness (Van Voorhees et al., 2012).

The Wisconsin Inventory of Smoking Dependence Motives (WISDM; Piper et al., 2004) is an empirically derived self-report measure that assesses 13 different motives for smoking dependence: affiliative attachment, automaticity, behavioral

doi:10.1093/ntr/ntt144

Advance Access publication September 28, 2013

© The Author 2013. Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

choice-melioration, cognitive enhancement, craving, cue exposure/associative processes, loss of control, negative reinforcement, positive reinforcement, social–environmental goads, taste and sensory properties, tolerance, and weight control. This scale has been assessed in a variety of smoking samples with differing psychiatric comorbidities, including depression, anxiety, and schizophrenia (Galazyn, Steinberg, Gandhi, Piper, & Williams, 2010; Kahler et al., 2010; Piper, Cook, Schlam, Jorenby, & Baker, 2011; Piper et al., 2010).

Overall, there are few studies that have assessed motivational factors associated with smoking in adults diagnosed with ADHD. Given that the WISDM is a measure that assesses a variety of smoking motivations, it is an appropriate instrument to inform which motivational factors might be associated with ADHD. As the WISDM has been administered to other psychiatric samples, clarifying its association with an ADHD sample may inform future efforts to assess similarities and differences with non-ADHD psychiatric samples. Although the WISDM has been administered before in an adult ADHD sample (Van Voorhees et al., 2012), this prior study included a small sample of smokers with and without ADHD. This study proposes to assess group differences between smokers with and without ADHD on WISDM subscale scores in a larger sample. Based on previous findings reviewed in the above-mentioned studies, we hypothesized that adult smokers with ADHD would score higher than their nondiagnosed peers on the cognitive enhancement, negative reinforcement, and positive reinforcement subscales of the WISDM. Interactions with gender were also considered in an exploratory analysis given that some studies report that women with ADHD differ from men with ADHD involving different smoking outcomes (see Van Voorhees, Mitchell, McClernon, Beckham, & Kollins, 2012 for a review).

METHODS

Participants and Procedures

Participants were smokers with ($n = 61$) and without ($n = 89$) ADHD (Table 1) enrolled in a range of laboratory and clinical studies examining smoking in ADHD. Participants were recruited via clinician referrals from local outpatient clinics

and fliers, and were eligible if they were 18–65 years of age, currently smoke ≥ 10 cigarettes/day with expired-air carbon monoxide (CO) concentrations ≥ 10 ppm, yielded an intellectual functioning score ≥ 80 on the Kaufman Brief Intelligence Test, Second Edition (KBIT; Kaufman & Kaufman, 2004), and were generally healthy (i.e., no major medical problems). Exclusion criteria included: met criteria for DSM-IV Axis I disorders other than ADHD or nicotine dependence; unable to attend all required experimental sessions; were pharmacologically treated in the past month; and, if they were women, were pregnant or planned on becoming pregnant. Only baseline session data prior to any changes in smoking behavior or intervention were assessed in this report. This study was approved by the local institutional review board.

Measures

Screening Measures

Following informed consent, demographic information and medical, psychiatric, smoking, and substance use histories were collected. Baseline nicotine dependence was assessed with the Fagerström Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerström, 1991), smoking status was verified by expired CO concentrations, and intelligence quotient was assessed by the KBIT (Kaufman & Kaufman, 2004). The Conners Adult ADHD Rating Scale-Self-Report (Conners, Erhardt, & Sparrow, 1999), followed by the Conners Adult Diagnostic Interview for DSM-IV (Epstein, Johnson, & Conners, 2000) to assess full ADHD diagnostic criteria, and the computerized Structured Clinical Interview for the DSM-IV (First, Spitzer, Williams, & Gibbon, 2002), and follow-up clinical interviewing to assess Axis I disorders by a PhD-level clinical psychologist were conducted.

Outcome Measures

The WISDM (Piper et al., 2004) is a 68-item self-report measure of motivation for smoking. The 13 subscale scores are derived as differential reasons for smoking. These subscales have demonstrated adequate to very good internal consistency (Piper et al., 2004; Shenassa, Graham, Burdovic, & Buka, 2009).

Table 1. Participant Demographic Summary

	ADHD ($n = 61$)	Non-ADHD ($n = 89$)	Test statistic	p Value
Age (SD)	29.39 (8.30)	33.26 (9.04)	$t = -2.66$	.009
Gender (%)				
Men	32 (52.5%)	44 (49.4%)	$\chi^2 = 0.13$	<i>ns</i>
Women	29 (47.5%)	45 (50.6%)		
Race (%)				
White	44 (72.1%)	39 (43.8%)	$\chi^2 = 12.64$	.005
Black	16 (26.2%)	45 (50.6%)		
Asian	1 (1.6%)	2 (2.2%)		
Multiracial	0 (0%)	3 (3.4%)		
FTND (SD)	4.84 (2.02)	4.78 (1.95)	$t = 0.19$	<i>ns</i>
Number of cigarettes/day (SD)	15.95 (6.68)	16.26 (5.10)	$t = -0.32$	<i>ns</i>

Note. ADHD = attention-deficit/hyperactivity disorder; FTND = Fagerström Test of Nicotine Dependence; *ns* = nonsignificant.

Data Analysis

Analyses were conducted using SPSS version 19.0. Categorical and dimensional demographic variable differences between smokers with and without ADHD were compared using chi-square analysis and *t* tests, respectively. Both groups of smokers were compared on WISDM subscale scores in a series of one-way, between-groups analysis of covariance (ANCOVA) in which age and race were covaried (see below regarding age and race group differences; although FTND scores did not statistically differ between groups, they were covaried in a separate set of analyses in addition to sex and race as a more stringent test of our hypotheses and are available by request from the first author. Inclusion of FTND scores as a covariate did not result in any changes in statistically significant group differences on the WISDM). A modified false discovery rate method correction was used for 13 comparisons, which is less conservative than a Bonferroni correction while maintaining statistical power (Narum, 2006). Alpha was accordingly set at .01572. Cohen's *d* effect sizes (Cohen, 1988) were also computed using the following interpretive guidelines: small = .2, medium = .5, and large = .8.

Group by gender interactions were also considered in an exploratory analysis.

RESULTS

Table 1 indicates that the ADHD group was significantly younger than the non-ADHD group and differed in racial composition. No other demographic differences emerged between groups.

A series of ANCOVA's demonstrated group differences between smokers with and without ADHD on the following subscales: automaticity, loss of control, cognitive enhancement, cue exposure, negative reinforcement, and social-environmental goads (*ps* < .01572). Across these subscales, the ADHD

group consistently scored higher than the non-ADHD control group with the exception of the social-environmental goads subscale (Table 2). Effect sizes were in the medium range for loss of control (*d* = .50), cognitive enhancement (*d* = .79), cue exposure (*d* = .62), and negative reinforcement (*d* = .50), and were in the small range for group differences in automaticity (*d* = .42) and social-environmental goads (*d* = -.30).

No statistically significant group by gender interactions emerged (*F* statistics ranging from 0.003 to 1.20, nonsignificant), although there was a main effect for gender for the weight control subscale in which women (*M* = 2.96, *SD* = 1.59) scored higher than men (*M* = 2.26, *SD* = 1.30; *p* = .002, *d* = .48).

DISCUSSION

The aim of this study was to assess group differences in motivations to smoke among smokers with and without ADHD. Results indicate that individuals diagnosed with ADHD believe that they are more likely to smoke without awareness or intention (i.e., automaticity subscale), because they have lost volitional control over their smoking behavior (i.e., loss of control subscale), to improve cognitive functioning (i.e., cognitive enhancement subscale), because cues to smoke are more frequently encountered (i.e., cue exposure subscale), and to regulate negative internal states (i.e., negative reinforcement subscale). These findings are consistent with previous ADHD-smoking studies and neuropsychological theories of ADHD. For instance, regarding smoking due to poor volitional control over smoking behavior or smoking without awareness or intention, ADHD is thought to be a disorder characterized by deficits in response inhibition, which results in poorer volitional control over behavior (Barkley, 1997). Indeed, in one smoking abstinence study involving smokers with and without ADHD, those diagnosed with ADHD performed worse on a task assessing response inhibition following overnight smoking abstinence (McClernon et al., 2008).

Table 2. Differences Between Smokers With and Without ADHD on Wisconsin Inventory of Smoking Dependence Motives Subscale Scores

	ADHD	Non-ADHD	<i>F</i> Statistic	<i>p</i> Value	Cohen's <i>d</i>
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)			
Affiliative attachment	2.91 (1.58)	2.67 (1.71)	1.93	.17	.15
Automaticity	4.56 (1.51)	3.93 (1.50)	7.56	.01*	.42
Loss of control	4.22 (1.32)	3.54 (1.38)	13.30	<.001*	.50
Behavioral choice	3.59 (1.28)	3.13 (1.46)	4.75	0.03	.34
Cognitive enhancement	4.73 (1.39)	3.51 (1.69)	16.62	<.001*	.79
Craving	4.86 (1.31)	4.35 (1.46)	5.67	.02	.37
Cue exposure	5.24 (1.11)	4.52 (1.23)	11.01	.001*	.62
Negative reinforcement	4.87 (1.11)	4.23 (1.43)	7.51	.01*	.50
Positive reinforcement	4.47 (1.20)	3.86 (1.46)	5.89	.02	.46
Social-environmental goads	4.13 (2.05)	4.71 (1.80)	6.20	.01*	-.30
Taste sensory	4.46 (1.29)	4.47 (1.36)	0.001	.97	-.01
Tolerance	4.30 (1.36)	4.40 (1.46)	0.001	.98	-.07
Weight control	2.79 (1.45)	2.47 (1.51)	2.89	.09	.22

Notes. ADHD = attention-deficit/hyperactivity disorder. Scores represent average across individual items for each subscale (response options ranged from 1 to 7).

**p* value met statistical significance set at .01572.

Regarding smoking to improve cognitive functioning, such findings are consistent with laboratory-based studies (e.g., McClernon et al., 2008) and electronic diary studies of *ad libitum* smoking (Mitchell et al., submitted). In the latter study, smokers with ADHD reported that inattentive ADHD symptoms improved immediately after smoking a cigarette using ecological momentary assessment. Negative affect improved following smoking episodes in the latter study as well, which is consistent with findings from this study involving the negatively reinforcing effects of smoking on negative internal states. Such findings are also consistent with a review suggesting that nicotine has an impact on neural circuitry associated with attentional functioning and negative mood (Gehricke et al., 2007). One unexpected finding involved the social-environmental goals subscale, which indicated that smokers without ADHD were more likely to have family, friends, or acquaintances who also smoke. Given that this was an unanticipated finding and yielded a small effect size, this finding requires replication and a study design that allows for assessing social context in real-world settings.

Contrary to previous findings that women with ADHD exhibit greater effects of smoking on improving concentration and reducing irritability (Van Voorhees et al., 2012), no interactions emerged indicating that women with ADHD were more likely to smoke to regulate mood or attention. This study was similar in design to previous studies, but included a larger sample. These findings require replication, though they indicate motives to smoke are not robust for ADHD group status by gender interactions when assessed by the WISDM. However, a main effect for gender did emerge in which women reported that they were more likely to smoke to control body weight or appetite.

These findings indicate that smokers with ADHD report different reasons for smoking than their nondiagnosed peers. The WISDM is intended to reflect mechanisms underlying dependence (Piper et al., 2004), and therefore, these reported different reasons for smoking could potentially be beneficial treatment targets during smoking cessation attempts. As there is evidence suggesting that smokers with ADHD may have greater difficulty in quitting than smokers without ADHD (Pomerleau et al., 1995), understanding potential mechanisms underlying dependence to inform smoking cessation efforts are particularly relevant. For instance, group differences on the cue exposure subscale of the WISDM indicate that smokers with ADHD are characterized by more frequent encounters with smoking cues or perceive a link between cue exposure and smoking. Perhaps exposure-based therapies, which involve the controlled and repeated exposure to smoking stimuli to extinguish associated responses, may be particularly applicable for adults diagnosed with ADHD given that this study indicates that cue exposure is a reason for smoking. However, it is likely that treatments need to target multiple motivational factors. For instance, although this study indicated that smoking to enhance cognitive functioning is a motivational factor among smokers diagnosed with ADHD, stimulant pharmacotherapy treatments that improve cognitive functioning (i.e., inattentive ADHD symptoms) do not impact smoking cessation among this comorbid group (Kollins et al., in press; Winhusen et al., 2010).

These findings should be considered alongside several limitations and future considerations. First, age and racial composition group differences emerged. However, these variables were covaried in the analysis. Also, group by gender interactions were not significant. Future studies should consider additional

measures of smoking motivation and additional assessment methods (e.g., ecological momentary assessment). Future studies should also consider interactions with gender regarding other aspects of smoking. For example, smokers with ADHD who are also women have exhibited greater withdrawal severity following a 12-day quit attempt (McClernon et al., 2011). Future studies should consider non-ADHD psychiatric populations that are commonly comorbid with nicotine dependence against smokers with ADHD to assess whether the current findings are specific to ADHD or are transdiagnostic across other forms of psychopathology. In addition, it would be beneficial to link differences in motives to tobacco cessation. Finally, although the goal of this study was to assess the role of a clinically diagnosed sample of adults with ADHD, subclinical ADHD symptoms share a significant relationship with smoking (Kollins et al., 2005) and should be considered in future studies to assess generalizability.

In conclusion, this study demonstrated that smokers with ADHD report different motivations to smoke on the WISDM than smokers without ADHD, particularly smoking due to automaticity, loss of behavioral control, cognitive enhancement, cue exposure, and negative reinforcement. However, smokers without ADHD indicated they were more likely to have family, friends, or acquaintances who also smoke. This study included a sample size larger than previous studies and followed more stringent statistical significance criteria. These findings inform models assessing motives for smoking in adult smokers diagnosed with ADHD and also yield potential treatment targets for this group characterized by greater difficulty quitting.

FUNDING

This work was supported by the National Institute of Drug Abuse (K23 DA032577 to JTM and K24 DA023464 to SHK).

DECLARATION OF INTERESTS

In the last 2 years, SHK has received research support and/or consulting fees from the following: Addrenex/Shionogi, Akili Interactive, National Institutes of Health/National Institute on Drug Abuse, Otsuka, Pfizer, Purdue Canada, Rhodes, Shire, Sunovion, and Supernus.

REFERENCES

- Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review*, 111, 33–51. doi:10.1037/0033-295X.111.1.33
- Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. *Psychological Bulletin*, 121, 65–94. doi:10.1037/0033-2909.121.1.65
- Barkley, R. A., Murphy, K. R., & Fischer, M. (2008). *ADHD in adults: What the science says*. New York, NY: Guilford Press.
- Cohen, J. (1988). *Statistical power analysis for the behavioral sciences*. New York, NY: Academic Press.
- Conners, C. K., Erhardt, D., & Sparrow, E. (1999). *Conners' Adult ADHD Rating Scales (CAARS) technical manual*. North Tonawanda, NY: Multi-Health Systems, Inc.

- Epstein, J. N., Johnson, D., & Conners, C. K. (2000). *Conners' Adult ADHD Diagnostic Interview for DSM-IV*. North Tonawanda, NY: Multi-Health Systems, Inc.
- First, M. B., Spitzer, R. L., Williams, J. B. W., & Gibbon, M. (2002). *Structured Clinical Interview for DSM-IV-TR (SCID-I) - research version*. New York, NY: Biometrics Research.
- Fuemmeler, B. F., Kollins, S. H., & McClernon, F. J. (2007). Attention deficit hyperactivity disorder symptoms predict nicotine dependence and progression to regular smoking from adolescence to young adulthood. *Journal of Pediatric Psychology*, 32, 1203–1213. doi:10.1093/jpepsy/jsm051
- Galazyn, M., Steinberg, M. L., Gandhi, K. K., Piper, M., & Williams, J. M. (2010). Reasons for smoking among individuals with schizophrenia. *Schizophrenia Research*, 122, 268–269. doi:10.1016/j.schres.2009.11.014
- Gehricke, J. G., Loughlin, S. E., Whalen, C. K., Potkin, S. G., Fallon, J. H., Jamner, L. D., ... Leslie, F. M. (2007). Smoking to self-medicate attentional and emotional dysfunctions. *Nicotine and Tobacco Research*, 9, 523–536. doi:10.1080/14622200701685039
- Glass, K., & Flory, K. (2010). Why does ADHD confer risk for cigarette smoking? A review of psychosocial mechanisms. *Clinical Child and Family Psychology Review*, 13, 291–313. doi:10.1007/s10567-010-0070-3
- Heatherston, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K. O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction*, 86, 1119–1127. doi:10.1111/j.1360-0443.1991.tb01879.x
- Kahler, C. W., Leventhal, A. M., Daughters, S. B., Clark, M. A., Colby, S. M., Ramsey, S. E., ... Buka, S. L. (2010). Relationships of personality and psychiatric disorders to multiple domains of smoking motives and dependence in middle-aged adults. *Nicotine and Tobacco Research*, 12, 381–389. doi:10.1093/ntr/ntq014
- Kaufman, A., & Kaufman, N. (2004). *Kaufman Brief Intelligence Test* (2nd ed.). Circle Pines, MN: AGP Publishing.
- Kollins, S. H., English, J. S., Itchon-Ramos, N., Chrisman, A. K., Dew, R., O'Brien, B., & McClernon, F. J. (in press). A pilot study of Lis-Dexamfetamine Dimesylate (LDX/SPD489) to facilitate smoking cessation in nicotine-dependent adults with ADHD. *Journal of Attention Disorders*, doi:10.1177/1087054712440320
- Kollins, S. H., McClernon, F. J., & Fuemmeler, B. F. (2005). Association between smoking and attention-deficit/hyperactivity disorder symptoms in a population-based sample of young adults. *Archives of General Psychiatry*, 62, 1142–1147. doi:10.1001/archpsyc.62.10.1142
- Lambert, N. M., & Hartsough, C. S. (1998). Prospective study of tobacco smoking and substance dependencies among samples of ADHD and non-ADHD participants. *Journal of Learning Disabilities*, 31, 533–544. doi:10.1177/002221949803100603
- McClernon, F. J., Kollins, S. H., Lutz, A. M., Fitzgerald, D. P., Murray, D. W., Redman, C., & Rose, J. E. (2008). Effects of smoking abstinence on adult smokers with and without attention deficit hyperactivity disorder: Results of a preliminary study. *Psychopharmacology*, 197, 95–105. doi:10.1007/s00213-007-1009-3
- McClernon, F. J., Van Voorhees, E. E., English, J., Hallyburton, M., Holdaway, A., & Kollins, S. H. (2011). Smoking withdrawal symptoms are more severe among smokers with ADHD and independent of ADHD symptom change: Results from a 12-day contingency-managed abstinence trial. *Nicotine and Tobacco Research*, 13, 784–792. doi:10.1093/ntr/ntq073
- Milberger, S., Biederman, J., Faraone, S. V., Chen, L., & Jones, J. (1997a). ADHD is associated with early initiation of cigarette smoking in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 37–44. doi:10.1097/00004583-199701000-00015
- Milberger, S., Biederman, J., Faraone, S. V., Chen, L., & Jones, J. (1997b). Further evidence of an association between attention-deficit/hyperactivity disorder and cigarette smoking. Findings from a high-risk sample of siblings. *The American Journal on Addictions*, 6, 205–217. doi:10.1111/j.1521-0391.1997.tb00399.x
- Mitchell, J. T., Van Voorhees, E. E., Dennis, M. F., McClernon, F. J., Calhoun, P. S., Kollins, S. H., & Beckham, J. C. (2012). Assessing the role of attention-deficit/hyperactivity disorder symptoms in smokers with and without posttraumatic stress disorder. *Nicotine and Tobacco Research*, 14, 986–992. doi:10.1093/ntr/ntq245
- Molina, B. S., & Pelham, W. E. Jr. (2003). Childhood predictors of adolescent substance use in a longitudinal study of children with ADHD. *Journal of Abnormal Psychology*, 112, 497–507. doi:10.1037/0021-843X.112.3.497
- Narum, S. R. (2006). Beyond Bonferroni: Less conservative analyses for conservative genetics. *Conservation Genetics*, 7, 783–787. doi:10.1007/s10592-005-9056-y
- Piper, M. E., Cook, J. W., Schlam, T. R., Jorenby, D. E., & Baker, T. B. (2011). Anxiety diagnoses in smokers seeking cessation treatment: Relations with tobacco dependence, withdrawal, outcome and response to treatment. *Addiction*, 106, 418–427. doi:10.1111/j.1360-0443.2010.03173.x
- Piper, M. E., Piasecki, T. M., Federman, E. B., Bolt, D. M., Smith, S. S., Fiore, M. C., & Baker, T. B. (2004). A multiple motives approach to tobacco dependence: The Wisconsin Inventory of Smoking Dependence Motives (WISDM-68). *Journal of Consulting and Clinical Psychology*, 72, 139–154. doi:10.1037/0022-006X.72.2.139
- Piper, M. E., Smith, S. S., Schlam, T. R., Fleming, M. F., Bittrich, A. A., Brown, J. L. ... Baker, T. B. (2010). Psychiatric disorders in smokers seeking treatment for tobacco dependence: Relations with tobacco dependence and cessation. *Journal of Consulting and Clinical Psychology*, 78, 13–23. doi:10.1037/a0018065
- Pomerleau, O. F., Downey, K. K., Stelson, F. W., & Pomerleau, C. S. (1995). Cigarette smoking in adult patients diagnosed with attention deficit hyperactivity disorder. *Journal of Substance Abuse*, 7, 373–378. doi:10.1016/0899-3289(95)90030-6
- Rohde, P., Kahler, C. W., Lewinsohn, P. M., & Brown, R. A. (2004). Psychiatric disorders, familial factors, and cigarette smoking: II. Associations with progression to daily smoking. *Nicotine and Tobacco Research*, 6, 119–132. doi:10.1080/14622200310001656948
- Shenassa, E. D., Graham, A. L., Burdzovic, J. A., & Buka, S. L. (2009). Psychometric properties of the Wisconsin Inventory of Smoking Dependence Motives (WISDM-68): A replication and extension. *Nicotine and Tobacco Research*, 11, 1002–1010. doi:10.1093/ntr/ntp109
- Van Voorhees, E. E., McClernon, F. J., Fuemmeler, B. F., English, J., Holdaway, A., Hallyburton, M., ... Kollins, S. H. (2012). An examination of differences in variables maintaining smoking behavior in adult smokers with and without attention-deficit/hyperactivity disorder. *Addiction Research and Theory*, 20, 72–81. doi:10.3109/16066359.2011.564692
- Van Voorhees, E. E., Mitchell, J. T., McClernon, F. J., Beckham, J. C., & Kollins, S. H. (2012). Sex, ADHD symptoms, and smoking outcomes: An integrative model. *Medical Hypotheses*, 78, 585–593. doi:10.1016/j.mehy.2012.01.034
- Volkow, N. D., Wang, G. J., Kollins, S. H., Wigal, T. L., Newcorn, J. H., Telang, F., ... Swanson, J. M. (2009). Evaluating

- dopamine reward pathway in ADHD: Clinical implications. *JAMA*, 302, 1084–1091. doi:10.1001/jama.2009.1308
- Wilens, T. E., Vitulano, M., Upadhyaya, H., Adamson, J., Sawtelle, R., Utzinger, L., Biederman, J. (2008). Cigarette smoking associated with attention deficit hyperactivity disorder. *The Journal of Pediatrics*, 153, 414–419. doi:10.1016/j.jpeds.2008.04.030
- Winhusen, T. M., Somoza, E. C., Brigham, G. S., Liu, D. S., Green, C. A., Covey, L. S., ... Dorer, E. M. (2010). Impact of attention-deficit/hyperactivity disorder (ADHD) treatment on smoking cessation intervention in ADHD smokers: A randomized, double-blind, placebo-controlled trial. *The Journal of Clinical Psychiatry*, 71, 1680–1688. doi:10.4088/JCP.09m05089gry