Adolescent Smoking Topography over Time

BY

GRACE GIEDGOWD
B.S., University of Pittsburgh, 2009

THESIS

Submitted as partial fulfillment of the requirements for the degree of
Master of Arts in Psychology in the Graduate College of the
University of Illinois at Chicago, 2014

Chicago, IL

Defense Committee:

Jon Kassel, Chair and Advisor
Robin Mermelstein, Psychology
Stewart Shankman, Psychology

This thesis is dedicated to my parents, Joe and Bettijean Giedgowd, my brothers, Matt and Jackson, and Marielise Fraioli, without whom it would never have been accomplished.

ACKNOWLEDGMENTS

I would like to thank my thesis committee, Jon Kassel, Robin Mermelstein, and Stewart Shankman, for their guidance, support, and contributions to this thesis. Their input undoubtedly contributed to the development and meaningful completion of this project, and for that, I am incredibly grateful. In addition, I would like to thank my fellow Substance Use Research Lab members, Ashley Braun, Megan Conrad, and Natania Crane, for their willingness to field my questions and lend an ear, especially in times of frustration.

This research is supported by the National Cancer Institute of the National Institutes of Health under award #5PO1CA098262. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
BAI	Beck Anxiety Inventory
BDI-II	Beck Depression Inventory-II
CReSS	Clinical Research Support System Micro
EFA	Exploratory Factor Analysis
mFTQ	Modified Fagerstrom Tolerance Questionnaire
NDSS	Nicotine Dependence Syndrome Scale

SUMMARY

Despite data supporting the decline in rates of cigarette smoking in middle and high school as well as the high cost of smoking in the United States, a significant portion of these adolescents categorize themselves as "current smokers." The current study evaluated changes in smoking topography over time in a sample of adolescents. Adolescent smokers (n = 45) participated in a laboratory study as a part of a Program Project ("The Social and Emotional Contexts of Adolescent Smoking Patterns"). Participants were offered to smoke a cigarette ad libitum in the laboratory and smoking topography was measured at two time points, at baseline ("Visit 1;" Mean age 15.67 years, SD = 0.65) and fifteen months later ("Visit 2"), using a CReSS micro device after a minimum of four hours of nicotine deprivation. Smoking topography variables were transformed into three summed Z scores, corresponding to a factor analysis conducted with a larger subset of the laboratory study's data (Giedgowd, Kassel, and Mermelstein, in preparation). Repeated measures ANOVA revealed that, from Visit 1 to Visit 2, adolescents manifested fewer puffs and longer interpuff intervals, as evidenced by decreasing Puff Number and Pacing scores over time. Puff Size and Length and Inhalation Speed did not significantly change over time. In addition, similar to observations found in adult smokers, sex differences in Puff Size and Length and Inhalation Speed emerged over time. Depression and Anxiety symptoms evidenced a lagged effect, such that scores at Time 1 influenced smoking topography at Visit 2. In addition, a marginal effect for number of biological parents who were "ever smokers" on Inhalation Speed was observed at Visit 2. These results are among the first to a) characterize developmental changes in smoking topography and b) use smoking topography factors in lieu of individual topography measures as outcomes, addressing issues of correlated dependent variables.

1. INTRODUCTION

Impact and Prevalence of Cigarette Smoking

Cigarette smoking is a pervasive, maladaptive health behavior that is both dangerous and costly: According to the Center for Disease Control, there are 443,000 smoking-attributed deaths annually in the United States alone (CDC, 2008). Smoking has also had the distinction of being the leading cause of preventable and pre-morbid death (CDC, 2002). Adolescence seems to be a particularly important time in the emergence of cigarette smoking: 19.5% of high school students are categorized as "current smokers," (CDC, 2009), and 90% of adults initiated smoking during adolescence (Alexander, Piazza, Mekos & Valente, 2001). Efforts to understand the processes through which smoking behavior escalates at this important developmental phase are essential for the advancement of successful smoking interventions and cessation programs. In addition, identifying specific factors of characteristics of early smokers that may contribute to vulnerability to continued use and difficulty quitting, should help guide intervention efforts aimed at this vulnerable population of smokers.

The literature is not at a loss for research following young adults and their health behaviors over time, including the measurement of rates of substance use. These studies offer important contributions to solving the puzzle of the emergence and maintenance of addiction. However, many longitudinal studies rely on self-report questionnaires for important dependent variables, such as day-to-day smoking rates and symptoms of dependence (Munafo, Hitsman, Rende, Metcalfe & Niaura, 2007; Henriksen, Schleicher, Feighery & Fortmann, 2010; Griesler, Hu, Schaffran & Kandel, 2011; Pedersen & Von Soest, 2009). Whereas such studies delve into this topic using self-reports of smoking frequency, withdrawal symptoms or dependence measure item endorsement, this type of data collection is accompanied by potential limitations of reporter

bias and inaccuracy, including poor reliability, problems with inaccurate retrospective reports, and desirability response sets (Mermelstein et al, 2002). As such, alternative measures of cigarette use that may be less susceptible to these pitfalls could prove a critical piece in advancing our knowledge of cigarette use and nicotine dependence.

Previous Work with Smoking Topography

One possibility for evaluating changing drug use over time proposed here is smoking topography, or *how* an individual smokes a cigarette. More specifically, smoking topography describes the behavior of smoking a cigarette through the extraction of numerous variables that depict the volume and time components of the smoke inhalation over the course of a single cigarette. Multiple devices have been used to measure such patterns of smoke intake, with one of the most popular being the Clinical Research Support System Micro (CReSS; Plowshare Technologies, Inc., www.plowshare.com; see Smoking Topography). The components of smoking as measured by this device include: number of puffs, total puff volume over a period of smoking (ml), duration of puff (in milliseconds), interpuff interval (i.e. the length of time in between puffs, in milliseconds), puff velocity (i.e. the speed with which each puff is inhaled), and time to peak (i.e. amount of time until the higher flow rate of a puff).

Smoking topography has been used in numerous laboratory studies, and has repeatedly demonstrated good reliability and validity (Blank, Disharoon, & Eissenberg, 2009; Lee, Malson, Water, Moolchan & Pickworth, 2003; Perkins, Karelitz, Giedgowd & Conklin, 2011). For example, one study found no differences between videotaped smoking of a cigarette (i.e. without using a smoking device) and the topography measured using a smoking device, suggesting that smoking using a measurement device may not significantly alter the way in which an individual would otherwise smoke a cigarette without said device (Blank, Disharoon, & Eissenberg, 2009).

Furthermore, topography has been related to many important indices of smoking behavior, including nicotine dependence (Zielinka-Danch, et al., 2010), craving, and nicotine metabolism (Williams, et al., 2011), as well as the amount of time adolescents spend with parents whom smoke (Collins, Lippmann, Lo & Moolchan, 2008). In a predictive capacity, topography has also been related to future smoking cessation outcomes (Franken, Pickworth, Epstein & Moolchan, 2006). Of note, the majority of these studies have treated each of the topography measures as independent constructs. As such, topography variables have typically been analyzed separately, as individual outcomes or predictors (e.g., Brauer, Hatsukami, Hanson, & Shiffman, 1996), regardless of the demonstrated correlations among them (Shahab et al., 2008). Therefore, further research regarding this important behavioral measure of smoking is needed, especially that which addresses the potentially clustered nature of topography data.

Sex Differences

One of the most productive individual differences in terms of smoking behavior is disparities by sex, which yield some important considerations. Although men and women report similar prevalence rates of cigarette use, higher rates of nicotine metabolism in males predict higher puff volume, but fewer puffs, while this pattern is absent in women (Moolchan et al., 2009). Similarly, men may take in more smoke volume per puff and in total over a single cigarette than females (Wood, Wewers, Groner, & Ahijevych, 2004; Perkins, Karelitz, Giedgowd & Conklin, 2011), despite taking fewer puffs (Hammond et al., 2005), and additionally exhibit longer puff duration compared to women (Meilikian et al., 2007). Further, smoking topography measures have been found to similarly and reliably differ between male and female adolescents, such that boys manifest longer puff duration, greater overall puff volume, and shorter amount of time between puffs compared to girls (Collins, Epstein, Parzynski,

Zimmerman, Moolchan, & Heishman, 2010). However, there is evidence that this gender effect is potentially unreliable, as topographical measures have failed to differentiate men and women in at least one other study (Kleykamp, Jennings, Sams, Weaver, & Eissenberg, 2008).

Dependence Indices

Smoking topography has been related to several indices of nicotine dependence. Specifically, higher scores of dependence have been associated with elevated total puff volume inhaled when smoking a cigarette (Perkins, Karelitz, Giedgowd & Conklin, 2011). Further, nicotine dependence has been significantly related to increases in cigarette puff volume (Zielinka-Danch, et al., 2010; Perkins et al., 2011) and an increase in number of puffs over a single cigarette in a sample of males (Burling & Burling, 2003).

Conversely, at least one study failed to find differences in smoking topography between dependent smokers and "chippers," or smokers who do not meet criteria for nicotine dependence (Brauer, Hatsukami, Hanson, & Shiffman, 1996). Further, another study failed to establish an association between nicotine dependence and smoking topography measures in a dependent adolescent sample (Collins, Epstein, Parzynski, Zimmerman, Moolchan, & Heishman, 2010). Additionally, previous work with a subset of the data to be included in the proposed study did not yield any association between nicotine dependence and puff volume and duration, inter-puff interval or puff velocity of a single cigarette (Veilleux, et al., 2011). However, changes in nicotine dependence may influence smoking patterns at different points in time, therefore meriting inclusion in the proposed study.

Smoking Quantity and Frequency

For adolescents who begin smoking cigarettes at a more regular rate, their smoking topography may exhibit accompanying changes over time. For example, one study found

support for a positive relationship between the average number of cigarettes adolescents smoke per day and the volume of smoke inhaled per cigarette (Wood, Wewers, Groner, & Ahijevych, 2004). Additionally, previous work with a subset of the data described here found support for a relationship between cigarettes smoked per week and an increase in puff volume, puff duration and puff velocity (Veilleux, et al., 2011). This finding is encouraging for the potential relationship between smoking experience and changing smoking topography as adolescents age into young adulthood.

Depression and Anxiety

Depression is often related to and highly co-morbid with smoking and drug-taking behavior: Individuals who report depression or anxiety are at elevated risk for developing nicotine dependence (McKenzie, et al, 2010), potentially accompanied by escalation of smoking topography over time. Similarly, current depression has been related to a longer puff duration during negative mood induction (Fucito & Juliano, 2009), as well as a de-escalation of puff volume over the course of a cigarette as compared to non-depressed individuals, resulting in lower nicotine intake overall (Veilleux et al., 2011). In the same study, those who endorsed current symptoms of anxiety exhibited greater puff volume and longer puff duration over the course of a single cigarette as compared to their non-anxious counterparts. Similarly, in an anxiety-inducing paradigm, anxious individuals took more puffs of a cigarette than controls (Rose, Ananda, & Jarvik, 1983). Previous research reporting associations between *past* episodes of depression and smoking topography point to a delayed effect, such that those who have previously been depressed evidence increases in puff volume inhalation (e.g. Perkins, Karelitz, Giedgowd, Conklin & Sayette, 2010).

Adding to the mixed findings and implications, depressive symptoms have been related to smoking rates in women, but not men, (Poulin, Hand, Boudreau & Santor, 2004), and in a comparison of smoking topography between depressed individuals and healthy controls, no differences in puff behaviors were found (Malpass & Higgs, 2007). As such, further investigation into the relationship between current depressive and anxious symptomatology and smoking topography is duly warranted.

Parent Smoking

Historically, the incidence of child smoking has been significantly related to the frequency with which their parents smoke cigarettes (Wohlford, 1970). More recent data have suggested that even after a parent quits smoking, the fact that the parent was ever a smoker increases the odds of his or her child at least trying smoking (Otten, Engels, van de Ven, & Bricker, 2007). Further, parent smoking status has demonstrated specific influence on smoking topography among adolescents: One study has supported the positive relationship between the amount of time an adolescent spends with a parent who is a current smoker and the adolescent's puff velocity, observing that this velocity is higher compared to adolescent smokers without current parent smokers (Collins, Lippmann, Lo, & Moolchan, 2008). It is important to note that this sample of adolescents was seeking treatment for smoking cessation. Therefore, the relationship between parent smoking and topography needs further investigation to determine if this association can be found in non-treatment-seeking young smokers.

Attempts to reliably and validly capture the development of nicotine dependence in adolescence are challenged by the limits of self-report measures. A change in smoking behavior over time in adolescence is usually dependent on these measures to describe this phenomenon. For example, frequency of smoking from day-to-day may yield inaccuracies due to the

limitations of retrospective recall, subjective decisions about what constitutes the number of cigarettes smoked, and desirability biases. Individuals may also inaccurately report feelings of withdrawal and symptoms associated with nicotine dependence. Because of these challenges, new ways to accurately capture the emergence of dependence in adolescents and the escalation of smoking behavior must be explored.

The proposed study is an attempt to fill this void: smoking topography is an objective measure of *how* an individual smokes a cigarette, and the measures yielded from this technique are less likely to be influenced by potential biases inherent in self-report. By examining smoking topography in adolescent smokers, we may gain crucial knowledge about the processes occurring from smoking experimentation to the escalation of regular smoking. To clarify, this study illuminates the topographical changes in smoking behavior during potential development of nicotine dependence. A review of the extant literature reveals a dearth of research addressing these potentially critical development processes governing smoking escalation and the emergence of nicotine dependence. Furthermore, changes in smoking topography over time have not been explored in a cohort of adolescents followed to adulthood.

Aims and Hypotheses

Change over time. The primary aim of this study is to explore potential changes in smoking topography in a group of adolescent smokers from early high school years to 15 months later. In addition, due to the acknowledged correlation among smoking topography variables, changes in this behavioral measure of smoking will be assessed, taking into account the clustered nature of the data. Whereas there are few, if any, previous findings that can be used to guide a priori hypotheses, I anticipate that over the course of time, we will observe an increase in

topographical indices, accompanied by increases in smoking quantity and frequency. Due to the unexplored nature of this particular analysis, I do not propose a priori hypotheses about changes in topography over time.

Sex differences. Based on the adolescent and adult literature presented above, I predict that, at both time points, sex differences will be observed, such that males will manifest longer puff duration, greater overall puff volume, and shorter amount of time between puffs compared to females.

Dependence and Smoking Variables. Due to the lack of correspondence between measures of dependence and smoking topography in adolescents, I hypothesize that dependence may be related to topography, but only at the second observation. I predict that, at fifteen months, smokers with higher scores on measures of nicotine dependence will evidence greater average and total puff volume. For smoking variables, I predict that experience with smoking (frequency and quantity, lifetime and recent) will be positively associated with components of smoking topography that include total puff volume, puff duration, and puff velocity.

Depression and Anxiety. Based on a review of the literature, the relationship between mood disorder symptoms and smoking topography is clearly mixed. Therefore, I make no a priori hypotheses about the relationship of depression and anxiety to smoking topography. However, it is possible that there is a delayed effect of mood symptoms on later topography. As such, not only will recent symptoms be explored with topography at a single time point, but past depression and anxiety (i.e., at baseline) will be evaluated for effects on later smoking (i.e., at fifteen months).

Parent Smoking. To our knowledge, parental smoking status' effect on topography has not been evaluated. As Collins et al. (2008) found that adolescents who spent more time with a

parent who was a “current smoker” smoked with a more rapid puff velocity, it is possible that the component of smoking topography reflecting puff velocity will be greater for those who have more parents who are currently smokers, or who were ever smokers, than those with fewer.

II. METHODS

Participants

Adolescents (N = 1263) participated in a Program Project study ("Social Emotional Contexts of Adolescent Smoking Patterns") evaluating the social and emotional contexts of cigarette use. This program project has followed Chicago area high-school students identified as high-risk for smoking and other health compromising behaviors longitudinally for five years. As a part of this larger study, all participants completed questionnaires regarding nicotine dependence and family smoking status. From this larger group, a subset of participants was invited to participate in a laboratory study measuring psychophysiological response to emotional stimuli. Participants in this laboratory study were given the opportunity to smoke a cigarette ad libitum. All procedures for this study were approved by the University of Illinois Institutional Review Board. In addition, due to the age of the participants in this study, parental consent was obtained for participation in this laboratory session, as was participant's assent.

This project was organized into three sessions. Participants were randomized to smoke during either the first session, which occurred at baseline, or during the second session six weeks later. Regardless of which of the first two sessions participants smoked, these baseline data will here be referred to as "Visit 1." Fifteen months later ("Visit 2"), participants were invited to in an identical session, wherein qualified participants were given the opportunity to smoke a cigarette in the lab. At both time points, participants were asked to abstain from smoking for at least four hours prior to the lab visit, and then were assessed for recent smoking experience, as well as recent depression and anxiety symptoms. Consequently, if they had smoked at least a puff of a cigarette in the past two weeks and did not have an intention to quit smoking, they were offered one cigarette to smoke *ad libitum* (i.e., "as much or a little as you wish") in the

laboratory. Data for this study come from two waves of data collection fifteen months apart. The final sample was comprised of those who smoked a cigarette at both sessions (n = 45), and was ethnically diverse (60.0% White, 17.8% Hispanic, 11.1% Black, and 11.1% other or unknown).

Measures

Nicotine Dependence. Two self-report measures were assessed at Visits 1 and 2 through a larger battery of self-report questionnaires mailed to all participants in the program project. The first measure, the modified Fagerstrom Tolerance Questionnaire (mFTQ; Prokhorov, Pallonen, Fava, Ding & Niaura, 1996) is a seven-item version of the longer FTQ, and is specifically adapted for assessing nicotine dependence in adolescents. Items assessed in the mFTQ are measured on a continuous scale, except for one item assessing smoking during the morning. Items measured continuously include inquiries such as "How many cigarettes a day do you smoke, on average?" and "How soon after you wake up do you smoke your first cigarette?" Total scores on the mFTQ are calculated as an average composite of all items. Reliability for the mFTQ in the current study was acceptable (α = .65).

The second measure, a modified version of the 19-item Nicotine Dependence Syndrome Scale for specificity to adolescents (NDSS; Shiffman, Waters, & Hickcox, 2004; Sterling, Mermelstein, Turner, Diviak, Flay & Shiffman, 2009) assesses dependence criteria on a scale of 1 to 4 to reflect agreement or disagreement with the items, 1 representing that the item is "not at all true" and 4 representing "very true." The NDSS includes items reflecting tolerance (e.g. "Compared to when I first started smoking, I need to smoke a lot more now in order to be satisfied"), craving (e.g. "Whenever I go without a smoke for a few hours, I experience craving"), and physical withdrawal symptomatology (e.g. "After not smoking for awhile, I need to smoke in order to keep myself from experiencing any discomfort") among other items. Like

the mFTQ, the NDSS score is the mean of all responses across the ten items. Both the mFTQ and the NDSS have demonstrated good validity and internal reliability (Prokhorov, Pallonen, Fava, Ding & Niaura, 1996; Prokhorov, Koehly, Pallonen, & Suchanek Hudmon, 1998; Shiffman & Sayette, 2005; Shiffman, Waters & Hickcox, 2004), including in the current sample (α = .93).

Current Smoking Behavior. Frequency of cigarette smoking was assessed at each visit via a pencil and paper self report as a part of a larger questionnaire inquiring into regular smoking habits. Items of interest include number of cigarettes smoked in an individual's lifetime, the number of days in the past month an individual has smoked, and the average number of cigarettes smoked during those days in the past month. These items are targeted to approximate the degree to which each participant has been exposed to and experienced cigarette smoking. These items are evaluated through multiple-choice options, which approximate a range of lifetime cigarette use, recent frequency and quantity. Of note, the number of cigarettes smoked over participants' lifetime was not normally distributed. Therefore, this variable was collapsed into two categories for both time points: either "more than 500 cigarettes" or "less than 500 cigarettes."

Depression and Anxiety. Upon arrival for each laboratory visit, each participant completed the Beck Depression Inventory II (BDI-II; Beck, Steer & Brown, 1996) and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). The BDI-II and BAI are both 21-item measures of depression and anxiety symptomatology respectively, with responses on a 0 to 3 scale, 0 reflecting experiencing the symptom in the past two weeks "not at all," and 3 reflecting "severely" experiencing the symptom. Scores are calculated as a summation of all responses. For the BDI-II, scores above 13 reflect clinically significant depression, scores in the

14 to 19 suggesting mild depression, 20 to 28 moderate depression, and 29 to 63 severe depression. Scores above 7 on the BAI suggest clinically significant anxiety, with scores of 8 to 15 reflecting mild anxiety, 16 to 25 moderate anxiety, and 26 to 63 severe anxiety. Both the BDI-II and BAI have been widely used measures to approximate depressive and anxious symptomatology, respectively, and demonstrate good validity and internal consistency (Beck, Steer & Brown, 1996; Whisman et al., 2000; Beck & Steer, 1990). Accordingly, the BDI-II (α = .89) and BAI (α = .90) demonstrated good reliability in the current study.

Parent Smoking Status. Parents' smoking status was evaluated by a single item in the larger battery of measures administered to all participants' parents in the larger program project. Measured on a categorical scale at Time 1, biological parents of the adolescents in the study reported on 16 various questions including "Have you ever tried smoking a cigarette?," "How motivated are you to quit now?," and "Do you currently smoke cigarettes on a daily basis?" The responses on each item vary from a dichotomous "yes" or "no" to a continuous response of cigarette frequency. Responses are compiled and used to categorize each parent as either a "current smoker," "ex-smoker," or has "never smoked." Therefore, each participant had two measures of parent smoking: one corresponding to the number of biological parents who were "current smokers," and another corresponding to the number of biological parents who were "ever smokers." Each variables ranged from 0 (i.e., neither biological parent) to 2 (i.e., both biological parents).

Smoking Topography. Smoking behavior was measured through the topographical device, the Clinical Research Support System Micro (CReSS; Plowshare Technologies, Inc., www.plowshare.com). The CReSS device holds the cigarette in one end of the 6.5 x 5.5 x 3 centimeter transducer, with a removable mouthpiece for puffing on the other end. The

topography measures yielded from the CReSS device include: number of puffs, total puff volume (in milliliters), duration of puff (in milliseconds), interpuff interval (i.e. the length of time in between puffs, in milliseconds), puff velocity (i.e. the speed with which each puff is inhaled), and time to peak (i.e. amount of time until the higher flow rate of a puff). Details on procedure are below.

Procedure

After completion of the BDI-II, BAI and current smoking behavior items, participants were offered to smoke as much or as little of a cigarette *ad libitum* through a CReSS micro device for measurement of topography (see Measures). Specifically, if the individual indicated they wished to smoke at the time, the participant was asked to light the cigarette, a type of their choosing from several commercially distributed brands provided to them by the lab, before inserting the cigarette into the CReSS device. Then participants were instructed as follows: "I'm now going to give you the opportunity to smoke a cigarette if you wish. Would you like to smoke? [If so:] For the experiment, I'm going to ask you to smoke through this box…Keep in mind you can smoke as much or as little of the cigarette as you wish; the important thing is that you smoke just like you normally do." Participants were permitted to smoke as much or as little of the cigarette as they chose, and the experimenter left the room until the participant removed the cigarette from the device and extinguished it in the ashtray. Sessions for both visits were identical.

Analytic Approach

Factor Structure. To assess the degree to which smoking topography variables relate to one another, an Exploratory Factor Analysis (EFA) with a larger portion of data from the laboratory study was conducted (see Giedgowd, Kassel, and Mermelstein, 2013, in preparation).

In short, the results from this EFA (n = 107) indicated that topography variables often used in the literature cluster into three variables, accounting for 86.47% of the variance. Specifically, average puff volume and duration, as well as total puff volume, and average time to peak made up a Puff Size and Length Component, average flow and average peak flow loaded onto an Inhalation Speed factor, and average interpuff interval and puff number had opposite loadings on a Puff Number and Pacing factor. Further, each topography factor demonstrated distinct convergent validity to constructs related to the individual measures of topography in the extant literature. In addition, topography factors demonstrated preliminary evidence of predictive validity for future cigarette use. The smoking topography data included in these analyses were transformed into respective summary Z scores that were summed to create factor summary scores. Due to the opposite loadings of interpuff interval and number of puffs for the Puff Number and Pacing, interpuff interval was reverse coded so that greater summed Z scores for this factor reflect more puffs and shorter interpuff interval.

Changes in Topography. To assess changes in smoking topography from Visit 1 to Visit 2, each topography component (i.e., Puff Size and Length, Inhalation Speed, and Puff Number and Pacing) was assessed separately in a repeated measures analysis of variance (ANOVA) utilizing the GLM command in SPSS version 20.0, with two levels of time as the repeated, within subjects variable.

Sex Differences and Parent Smoking. In order to evaluate the relationship of sex and topography over time, two cross-sectional ANOVAs, one for each visit, will be used with sex as a between-subjects factor into the analyses. Because parent smoking status is also measured categorically, separate analyses, with parent smoking at a between-subjects variable, will be used with topography variables as separate outcomes. To follow up on any significant effects of

parent smoking status, single degree of freedom comparisons will be made, utilizing a Bonferroni correction for multiple comparisons.

Dependence, Smoking Frequency and Quantity, and Depression and Anxiety. Similarly, the continuous self-report variables of interest (i.e., mFTQ, NDSS, BDI-II, and BAI) will be entered as covariates into separate ANOVAs with each topography factor as separate outcomes, one per visit. Further, to explore the effect of early mood symptoms on smoking in the future, additional ANOVAs will be used with depression and anxiety as covariates at Visit 1 for topography outcomes at Visit

III. RESULTS

Overall Change in Smoking Topography over Time

Adolescents evidenced change in smoking topography over fifteen months, specifically with respect to Puff Number and Pacing. Repeated Measures ANOVA indicated that there was no difference over time for the Puff Size and Length factor ($F(1,44) = 0.98$, *ns*). Similarly, the Inhalation Speed factor did not evidence any change from Visit 1 to Visit 2 ($F(1,44) = 0.31$, *ns*). However, the Puff Number and Pacing factor did evidence significant change over time ($F(1,44) = 12.00$, $p < .001$). Specifically, over time, individuals smoked fewer puffs with a longer amount of time in between puffs compared to Puff Number and Pacing measured at Visit 1, fifteen months earlier (see Table 1).

Sex Differences

Whereas differences between males and females in smoking topography were evident at both visits, these sex differences varied by topography component. In terms of Puff Size and Length, there was only a borderline effect of sex for Puff Size and Length at Visit 1 ($F(1,43) = 2.24$, $p = .14$), such that males showed greater scores for this component than females (see Table 2). At Visit 2, this trend effect became significant ($F(1,43) = 10.56$, $p < .01$), such that males evidenced greater Puff Size and Length scores than females. There was no difference between males and females for Inhalation Speed at Visit 1. While falling short of significance, there was a borderline effect of sex at Visit 2 ($F(1,43) = 2.14$, $p = .15$), such that men evidenced greater Inhalation Speed scores or slower average flow and peak flow, than women. Puff Number and Pacing evidenced a trend for sex differences at Visit 1 ($F(1,44) = 3.66$, $p = .06$), such that males smoked more puffs with less time in between compared to females. However, at Visit 2, there was not a difference for this factor ($F(1,44) = .39$, *ns*).

Dependence and Cigarette Use

Neither measure of nicotine dependence related to adolescent smoking topography at either Visit 1 or Visit 2. Specifically, Visit 1 mFTQ scores were not related to Puff Size and Length, Inhalation Speed, or Puff Number and Pacing at Visit 1 (Fs(1,44) < .28, *ns*). These findings were consistent with the lack of relationship between dependence as measured by the NDSS at Visit 1 and all topography variables at Visit 1 (Fs(1,44) < 1.55, *ns*). This relationship did not change over time, as Visit 2 topography was not related to dependence as measured by the mFTQ (Fs(1,44) < 1.53, *ns*) or NDSS (Fs(1,44) < 1.79, *ns*).

Topography standard scores at each visit as a function of lifetime cigarette use are displayed in Table 3. Smoking topography did not differ as a function of lifetime cigarettes at Visit 1 (i.e., more or less than 500). Specifically, Puff Size and Length, Inhalation Speed, and Puff Number and Pacing were not related to lifetime cigarettes (Fs(1,44) < .62, *ns*). However, this was not the case at Visit 2: for individuals with more lifetime cigarette use, Puff Size and Length was greater (F(1,44) = 11.14, p < .01). Puff Number and Pacing factor Inhalation Speed did not vary by lifetime cigarette use (Fs(1,44) < 0.86, *ns*).

Amount of regular smoking, or number of cigarettes smoked per day, was related to Puff Size and Length at Visit 1 (F(1,44) = 6.01, p < .05). By examining Puff Size and Length as a function of regular smoking via median split (see Figure 1), individuals with fewer cigarettes smoked per day at Visit 1 were more likely to have smaller puffs compared to those who smoked more cigarettes per day. However, daily smoking at Visit 1 was not related to Inhalation Speed or Puff Number and Pacing (Fs(1,44) < .91, *ns*). Daily smoking at Visit 2 was not related to any of the smoking topography variables (Fs(1,44) < 1.88, *ns*). In addition, number of days smoked

in the past thirty days at either time point was not related to topography at Visit 1 (*F*s(1,44) < 1.00, *ns*) or Visit 2 (*F*s(1,44) < 1.10, *ns*).

Depression and Anxiety

Current number and severity of depressive symptoms did not demonstrate an effect on smoking topography at Visit 1: Puff Size and Length, Inhalation Speed and Puff Number and Pacing were not related to BDI-II scores at Visit 1 (*F*s(1,43) < 1.05, *ns*). At Visit 2, however, current depressive symptoms were significantly related to Puff Size and Length ($F(1,44) = 4.37$, $p < .05$), such that, via evaluation of topography by BDI-II median split, individuals with a low score on the BDI-II at Visit 2 evidenced longer puffs than those with higher BDI-II scores (see Figure 2). Conversely, Inhalation Speed and Puff Number and Pacing were not related to current depressive symptoms at Visit 2 (*F*s(1,44) < 1.85, *ns*). Current anxiety as measured by the BAI, was unrelated to topography at both Visit 1 (*F*s(1,43) < 0.29, *ns*) and Visit 2 (*F*s(1,44) < 1.36, *ns*).

In addressing hypotheses regarding potential influence of mood symptoms at Visit 1 or topography at Visit 2, ANOVAs demonstrated modest influence of BDI-II scores at Visit 1 on measures of smoking topography at Visit 2. While the relationship between depression at Visit 1 and Inhalation Speed at Visit 2 approached significance ($F(1,43) = 3.73$, $p = .06$), neither Puff Size and Length nor Puff Number and Pacing were significantly related to past BDI-II (*F*s (1,43) < 1.92, *ns*). Examination of this trend relationship suggested that, for individuals with low depression at Visit 1, Inhalation Speed was slower than for those with higher initial depression scores (see Figure 3). For anxiety, BAI at Visit 1 evidenced a borderline relationship with later Puff Size and Length ($F(1,43) = 3.74$, $p = .06$) and with Inhalation Speed ($F(1,43) = 2.60$, $p = .11$), but not with Puff Number and Pacing ($F(1,43) = .70$, *ns*). By evaluating topography by

BAI score median split at Visit 1, individuals with low initial anxiety scores evidenced larger and longer puffs (see Figure 4) and quicker inhalation speed (see Figure 5).

Parent Smoking Status

In terms of adolescent smoking topography, the number of biological parents who were smokers at Visit 1 did not have an effect on Puff Size and Length ($F(1,44) = 1.76$, *ns*), Inhalation Speed ($F(1,44) = 1.34$, *ns*), or Puff Number and Pacing ($F(1,44) = .46$, *ns*). This was also the case for smoking topography at Visit 2 (Fs$(1,44) < 1.81$, *ns*). Topography standard scores compared by number of biological parents who were current smokers are illustrated in Table 4.

While currently smoking parents did not evidence significant influence on topography, these data suggested there may have been an influence on smoking by parents who were ever smokers. There was a borderline effect of number of parents who had ever been smokers on Inhalation Speed ($F(1,44) = 2.14$, $p = .13$; see Figure 6). Post hoc follow up comparisons using Bonferroni correction for multiple comparisons did not yield any significant differences (ps >.26). However, by examining the trend in the graph, Inhalation Speed was fastest among those with two biological parent ever smokers at Visit 2 compared to those with fewer parent ever smokers. Conversely, this effect was not evident at Visit 1 ($F(1,44) = .53$, *ns*). Further, Puff Size and Length and Puff Number and Pacing did not differ as a function of number of biological parent ever smokers at either Visit 1 or Visit 2 (Fs$(1,44) < .61$, *ns*.

IV. DISCUSSION

The current study evaluated a behavioral measure of smoking in adolescents at two points critical in the development of regular smoking behavior and nicotine dependence. Further, the analyses of topography in this study were the first to treat CReSS variables more parsimoniously, taking into account shared variance among the correlated variables. These data evidenced a significant change in smoking topography from initial assessment to fifteen months later, such that these adolescents changed from a pattern of smoking marked by more puffs with a shorter amount of time in between these puffs, to one with fewer puffs, and a longer interval between them. Conversely, these results did not support a change in either of the other topography components over time, such that adolescents failed to show change in the amount and length of smoke inhalation (Puff Size and Length) or rate of smoke inhalation (Inhalation Speed). Taken together, these data suggest that adolescents' developing smoking patterns over the course of a single cigarette changes such that they are taking fewer puffs more spread out over time as they get older, but are still taking in the same amount of smoke over the cigarette, and that the rate of inhalation during these puffs is comparable.

Overall Change

Related to these findings, previous work suggested that cigarette smoking topography for adolescents and for adults is relatively similar, such that, like adults, adolescents are able to regular their intake of smoke based on nicotine content of a cigarette (Kassel et al., 2007; Collins et al., 2011). However, this study suggests that differences in topography do exist as a function of smoking during younger years. Specifically, while this sample smoked with similar Puff Size and Length and Inhalation Speed as a whole from Visit 1 to 2, Puff Number and Pacing evidenced significant change. At Visit 1, adolescent smoking was characterized by more puffs,

with less time in between puffs, compared to their smoking fifteen months later. This illustrates a distinct behavioral change in smoking through development, and, as such, suggests that research evaluating topography over time must account for this differential pattern of smoking over time. Such considerations should also be made for sex differences in these data from Visit 1 to 2, as is discussed below.

Sex Differences

Sex differences in smoking topography emerged at both time points. Initially, males tended to smoke with greater Puff Size and Length compared to females, and this trend became statistically significant at Visit 2. Similarly, males showed slower Inhalation Speed compared to females at Visit 2. Further, at the trend level, males were taking more puffs with less time in between puffs compared to females at Visit 1, while no sex difference was observed for Puff Number and Pacing at Visit 2. The correspondence of these findings to other work is mixed. While one study found that adolescent males smoked with greater puff volume compared to females (Wood et al., 2003), other data suggests that male adolescents smoke with longer puff duration and shorter interpuff interval compared to females (Collins et al., 2011). These differences may be due differences in sample characteristics, as the current study's sample smoked fewer cigarettes per day than the Collins et al. sample. Further, considering the significant change in Puff Number and Pacing over time, it is possible that the sex differences found in the Collins et al. study may be found in this sample later in development. The sex differences observed here are consistent with adult literature outlining greater total volume inhalation in males compared to females (Wood et al., 2004; Perkins et al., 2012). Hammond et al. (2005) and Perkins et al. (2012) found that women smoked more puffs on average than men, opposite of the borderline finding in these data at Visit 1. Thus, the change in Puff Number and

Pacing over time needs to be considered, as our data may be capturing topography shortly before these sex differences emerge. To expand, the difference in males' and females' Puff Size and Length only trended at Visit 1, but reached significance at Visit 2 in the direction often observed in the adult literature.

Cigarette Use and Dependence

The role of regular and lifetime cigarette use varied by time. In terms of history of use, topography did not vary as a function of lifetime cigarette use until Visit 2. Specifically, Puff Size and Length was greater with more use. Number of cigarettes smoked per day, however, evidenced more influence at Visit 1, such that greater number of cigarettes smoked per day corresponded with greater Puff Size and Length, but this effect was no longer evident at Visit 2. These findings correspond to previous work (Wood et al., 2004), wherein the number of cigarettes that adolescents smoked per day was positively related to total puff volume. These data suggest that regular amount of smoking influences topography earlier in development.

Nicotine dependence did not relate to smoking topography at either visit. Similarly, Wood et al. (2003) found that, while the mFTQ was related to CO boost and cotinine levels, it did not relate to puff duration. In a similar vein, Corrigall et al. (2002) failed to find that topography varied by smoking frequency or dependence via the Fagerstrom Test for Nicotine Dependence. Conversely, adult studies have demonstrated a positive relationship between dependence and average puff volume, total puff volume, and puff number (Zielinka-Danch, et al., 2010; Perkins et al., 2011). In sum, the relationship between dependence with topography was not demonstrated in these data, as it has been in the adult population.

Mood Disorder Symptoms

These data suggest that depression and anxiety influence topography at this developmental stage; however, the pattern of results was unexpected. BDI-II and BAI scores were not related to topography at Visit 1. Current depression was related to topography at Visit 2, in that individuals who had greater scores on the BDI-II evidenced smaller puffs (Puff Size and Length) compared to those with lower BDI-II scores. Further, previous depression had a delayed effect, such that higher Visit 1 BDI-II scores were related to slower Inhalation Speed. This finding seemingly contrasts with work outlining comorbidity of nicotine dependence and mood disorders, which may suggest a positive relationship of depression and to Puff Size and Length. However, as discussed in another paper evaluating these topography data (Veilleux et al., 2011), these findings may reflect the low positive affect component of depression (Patterson et al., 2003): Patterson et al. found that positive affect was related to an increase in carbon monoxide as a result of smoking. Therefore, if greater BDI-II scores reflect less positive affect, these score may be accompanied by less inhalation of smoke in a single cigarette. Anxiety was not significantly related to corresponding smoking topography at either visit. However, similar to the BDI-II, BAI at Visit 1 was related to decreased Puff Size and slower Inhalation Speed at Visit 2, at the borderline level. The relationship between mood symptoms and behavioral measures of smoking merits further study, but, based on the high rate of comorbidity between anxiety and depression, it is possible that generalized psychological distress during adolescence may influence Puff Size and Length and Inhalation Speed.

Parent Smoking Status

The current smoking status of participants' biological parents did not evidence an influence on topography at either visit. However, there was a trend for an influence of biological

parent smoking history on Inhalation Speed at Visit 2: Inhalation Speed was faster for adolescents with more biological parent ever smokers than those with fewer. Previous work demonstrated an influence of parent cigarette use on at least one Inhalation Speed variable (i.e., puff velocity) although amount of time an individual spent with their parent smoker was implicated (Collins et al., 2008). Therefore, while it may not have yielded a robust influence on topography in this sample, as reflected in previous work, parent smoking may play more of a role in smoking initiation (e.g., Wohlford, 1970; Otten et al, 2007).

Limitations and Strengths

This study had several limitations that should be considered in light of both the null findings, and the interpretation of the significant results presented here. First, the sample size included in these analyses was relatively small. Findings with borderline significance may have been a product of this limitation. In addition, the length of time included in these analyses, 15 months, may not have been long enough to truly assess the changes that occur in smoking topography through the entirety of development. It is possible that, at the first observation, participants had already established a stable pattern of topography. It is also a possibility that topography may change even further into adulthood. Therefore, the primary aim of this study, to evaluate the changes in smoking topography through development, may not have been fully captured in these data, especially for Puff Size and Length and Inhalation Speed. Of note, the results presented here should be interpreted in the context of smoking after abstinence, as all participants were required to abstain from smoking for at least four hours before coming into the laboratory. Previous literature has suggested that, for adult smokers, topography can vary as a function of context (Perkins et al., 2010), such that smokers inhale more (i.e., greater total puff volume) during withdrawal and stress task compared to neutral and other negative mood

inducing settings. Therefore, it is possible that adolescents may also evidence difference topography in varying contexts.

A further limitation of the current paradigm was a potential ceiling effect for amount of ad libitum smoking. Although participants were instructed to smoke "as much or as little" as they would like, they were only provided a single cigarette. Other studies (e.g., Perkins et al., 2010; Saules, Pomerleau, Snedecor, Brouwer, & Rosenberg, 2004; Pang & Leventhal, 2013) have used methods wherein participants were offered to, and often did, smoke more than one cigarette during an ad libitum smoking session. However, it is possible that, due to the "lighter" nature of their cigarette use (i.e., mean of 5.53 cigarettes smoked per day at baseline), adolescents in this study may have only smoked one cigarette.

Despite these limitations, the current study makes several contributions to the literature on behavioral measures of cigarette use, as well as smoking during adolescence. Primarily, this study characterizes change in smoking topography over time during a critical developmental period of substance use and dependence. In addition, analyses took the correlated nature of the CReSS variables into account, and introduced a more parsimonious way to evaluate smoking topography. These data also captured the emergence of important sex differences demonstrated in the adult literature (e.g., Wood et al., 2004; Eissenberg, Adams, Riggins, & Likness, 1999; Perkins et al., 2012). In addition, this study illustrated the lagged role of anxiety and depression for this sample, such that earlier reports of symptoms had an effect on topography later in development.

Future Directions

In light of these contributions, the findings presented here may pave the way for future investigation in this area. Considering that nearly one fifth of high school students consider

themselves smokers (CDC, 2009), intervention efforts are sorely needed to hinder adolescents' development of nicotine dependence and escalated smoking into adulthood, and to reduce the harm associated with smoking. In light of the work presented here, it is clear that, even as early as fifteen years old, adolescents demonstrate smoking patterns that mimic adults (e.g., sex differences, contribution of number of cigarettes smoked per day to topography). While the current study cannot establish causality, these data do propose an effect of depression, anxiety, and biological parent smoking status on subsequent smoking. Future work with these data, including evaluating the predictive role of topography for future escalation or cessation, may serve to target those adolescents particularly in need for prevention or cessation efforts. In addition, evaluating topography for adolescents in other contexts (e.g., negative or positive mood, in the presence of alcohol) may contribute further to understanding the phenomenon of early cigarette use. More novel modes nicotine administration, such as through electronic cigarettes, merit research, especially in terms of contribution to smoking acquisition and nicotine dependence.

Related to the factor analytic work that emerged as a result of the proposal for the current project (Giedgowd, Kassel, and Mermelstein, in preparation), this factor structure should be tested in other samples, for both adolescents and adults, and in other contexts for replication. As such, evaluating the factor structure of smoking topography variables in adults would expand on these findings to the degree that a) the factors and loadings may or may not correspond to the components found with this data, and b) this approach to topography data would allow for more parsimonious evaluation of adult smoking and related constructs.

In sum, this study is the first to examine changes in smoking topography in a group of adolescent smokers. Methodologically, this study is also the first to evaluate topography using

components in lieu of individual variables, addressing issues of multicolinearity. These findings suggest that, during development, adolescents smoke cigarette with fewer puffs and longer time in between puffs. In addition, these data capture the emergence of sex differences demonstrated in the adult literature, as well as the role of mood disorder symptoms and parent smoking status. Future work should continue to assess the development of smoking from adolescence to adulthood, through both self-report and behavioral measures, especially that which focuses on prediction of increased dependence and use, and of cessation.

REFERENCES

Alexander, C., Piazza, M., Mekos, D., & Valente, T. (2001). Peers, schools, and adolescent cigarette smoking. *Journal of Adolescent Health, 29*(1), 22-30. doi:http://dx.doi.org/10.1016/S1054-139X(01)00210-5

Beck, A. T., Epstein, N., Brown, G., & Steer, R. A. (1988). An inventory for measuring clinical anxiety: Psychometric properties. *Journal of Consulting and Clinical Psychology, 56*(6), 893-897. doi:http://dx.doi.org/10.1037/0022-006X.56.6.893

Beck, A. T. & Steer, R. A. (1990). *Manual for the Beck Anxiety Inventory.* The Psychological Corporation: San Antonio, Texas.

Beck, A. T., Steer, R. A. & Brown, G. K. (1996). *Beck Depression Inventory – Second Edition manual*. San Antonio, Texas: The Psychological Corporation.

Blank, M. D., Disharoon, S., & Eissenberg, T. (2009). Comparison of methods for measurement of smoking behavior: Mouthpiece-based computerized devices versus direct observation. *Nicotine & Tobacco Research, 11*(7), 896-903. doi:http://dx.doi.org/10.1093/ntr/ntp083

Brauer, L. H., Hatsukami, D., Hanson, K., & Shiffman, S. (1996). Smoking topography in tobacco chippers and dependent smokers. *Addictive Behaviors, 21*(2), 233-238. doi:http://dx.doi.org/10.1016/0306-4603(95)00054-2

Burling, A. S., & Burling, T. A. (2003). A comparison of self-report measures of nicotine dependence among male drug/alcohol-dependent cigarette smokers. *Nicotine & Tobacco Research, 5*(5), 625-633. doi:http://dx.doi.org/10.1080/1462220031000158708

Centers for Disease Control. (2002). Annual Smoking-Attributable Mortality, Years of

Potential Life Lost, and Economic Costs. Retrieved from http://www.cdc.gov/mmwr/preview/ mmwrhtml/mm5114a2.htm

Centers for Disease Control and Prevention. (2008). Smoking-Attributable Mortality, Years of Potential Life Lost, and Productivity Losses—United States, 2000–2004. *Morbidity and Mortality Weekly Report*, 57(45),1226–8.

Centers for Disease Control and Prevention. (2009). Youth Risk Behavior Surveillance – United States, 2009. *Morbidity and Mortality Weekly Report*, 59(5).

Collins, C. C., Epstein, D. H., Parzynski, C. S., Zimmerman, D., Moolchan, E. T., & Heishman, S. J. (2010). Puffing behavior during the smoking of a single cigarette in tobacco-dependent adolescents. Nicotine & Tobacco Research, 12(2), 164-167. doi:10.1093/ntr/ntp176

Collins, C. C., Lippmann, B. M., Lo, S. J., & Moolchan, E. T. (2008). Time spent with smoking parents and smoking topography in adolescents. *Addictive Behaviors, 33*(12), 1594-1597. doi:http://dx.doi.org/10.1016/j.addbeh.2008.07.003

Eissenberg, T., Adams, C., Riggins,Earl C., I.,II, & Likness, M. (1999). Smokers' sex and the effects of tobacco cigarettes: Subject-rated and physiological measures. *Nicotine & Tobacco Research, 1*(4), 317-324. Retrieved from http://proxy.cc.uic.edu/docview/619527993?accountid=14552

Franken, F. H., Pickworth, W. B., Epstein, D. H. & Moolchan, E. T. (2006). Smoking rates and topography predict adolescent smoking cessation following treatment with nicotine replacement therapy. *Cancer Epidemiology, Biomarkers & Prevention*, 15(1), 154-157. doi: 10.1158/1055-9965.EPI-05-0167

Fucito, L. M., & Juliano, L. M. (2009). Depression moderates smoking behavior in response

to a sad mood induction. *Psychology of Addictive Behaviors, 23*(3), 546-551. doi:http://dx.doi.org/10.1037/a0016529

Griesler, P. C., Hu, M., Schaffran, C., & Kandel, D. B. (2011). Comorbid psychiatric disorders and nicotine dependence in adolescence. *Addiction, 106*(5), 1010-1020. doi:http://dx.doi.org/10.1111/j.1360-0443.2011.03403.x

Hammond, D., Fong, G. T., Cummings, K. M., et al. (2005). Smoking topography, brand switching, and nicotine delivery: Results from an *in vivo* study. *Cancer Epidemiology, Biomarkers & Prevention*, 14(6), 1370-1375. doi: 10.1158/1055-9965.EPI-04-0498

Henriksen, L., Schleicher, N. C., Feighery, E. C., & Fortmann, S. P. (2010). A longitudinal study of exposure to retail cigarette advertising and smoking initiation. *Pediatrics, 126*(2), 232-238. doi:http://dx.doi.org/10.1542/peds.2009-3021

Kassel, J. D., Evatt, D. P., Greenstein, J. E., Wardle, M. C., Yates, M. C., & Veilleux, J. C. (2007). The acute effects if nicotine on positive affect in adolescent smokers. *Journal of Abnormal Psychology*, 116(3), 543-553. doi: 10.1037/0021-843X.116.3.543

Kassel, J. D., Greenstein, J. E., Evatt, D. P., Wardle, M. C., Yates, M. C., Veilleux, J. C., & Eissenberg, T. (2007). Smoking topography in response to denicotinized and high-yield nicotine cigarettes in adolescent smokers. *Journal of Adolescent Health, 40*(1), 54-60. doi:http://dx.doi.org/10.1016/j.jadohealth.2006.08.006

Kleykamp, B. A., Jennings, J. M., Sams, C., Weaver, M. F., & Eissenberg, T. (2008). The influence of transdermal nicotine on tobacco/nicotine abstinence and the effects of a concurrently administered cigarette in women and men. *Experimental and Clinical Psychopharmacology, 16*(2), 99-112. Retrieved from

http://proxy.cc.uic.edu/docview/622247987?accountid=14552

Lee, E. M., Malson, J. L., Waters, A. J., Moolchan, E. T. & Pickworth, W. B. (2003). Smoking topography: reliability and validity in dependent smokers. *Nicotine & Tobacco Research*, 5(5), 673-679. doi: 10.1080/1462220031000158645

Malpass, D., & Higgs, S. (2007). Acute psychomotor, subjective and physiological responses to smoking in depressed outpatient smokers and matched controls. *Psychopharmacology, 190*(3), 363-372. doi:http://dx.doi.org/10.1007/s00213-006-0612-z

McKenzie, M., Olsson, C. A., Jorm, A. F., Romaniuk, H., & Patton, G. C. (2010). Association of adolescent symptoms of depression and anxiety with daily smoking and nicotine dependence in young adulthood: Findings from a 10-year longitudinal study. *Addiction, 105*(9), 1652-1659. doi:http://dx.doi.org/10.1111/j.1360-0443.2010.03002.x

Melikian, A. A., et al. (2007). Gender differences relative to smoking behavior and emissions of toxins from mainstream cigarette smoke. *Nicotine & Tobacco Research*, 9(3), 377-387. doi: 10.1080/14622200701188836

Mermelstein, R., Colby, S. M., Patten, C., Prokhorov, A., Brown, R., Myers, M., . . . McDonald, P. (2002). Methodological issues in measuring treatment outcome in adolescent smoking cessation studies. *Nicotine & Tobacco Research, 4*(4), 395-403. doi:http://dx.doi.org/10.1080/1462220021000018470

Moolchan, E. T., Parzynski, C. S., Jaszyna-Gasior, M., Collins, C. C., Leff, M. K., & Zimmerman, D. L. (2009). A link between adolescent nicotine metabolism and smoking topography. *Cancer, Epidemiology, Biomarkers & Prevention*, 18(5), 1578-

1583. doi: 10.1158/1055-9965.EPI-08-0592

Munafò, M. R, Hitsman , B., Rende, R., Metcalfe, C. & Niaura, R. (2008), Effects of progression to cigarette smoking on depressed mood in adolescents: evidence from the National Longitudinal Study of Adolescent Health. *Addiction*, 103(1), 162-171.

Otten, R., Engels, R. C. M. E., van, d. V., & Bricker, J. B. (2007). Parental smoking and adolescent smoking stages: The role of parents' current and former smoking, and family structure. *Journal of Behavioral Medicine, 30*(2), 143-154. doi:http://dx.doi.org/10.1007/s10865-006-9090-3

Pang, R. D., & Leventhal, A. M. (2013). Sex differences in negative affect and lapse behavior during acute tobacco abstinence: A laboratory study. *Experimental and Clinical Psychopharmacology, 21*(4), 269-276. doi:http://dx.doi.org/10.1037/a0033429

Pedersen, W., & von Soest, T. (2009). Smoking, nicotine dependence and mental health among young adults: A 13-year population-based longitudinal study. *Addiction, 104*(1), 129-137. doi:http://dx.doi.org/10.1111/j.1360-0443.2008.02395.x

Perkins, K. A., Karelitz, J. L., Giedgowd, G. E., & Conklin, C. A. (2012). The reliability of puff topography and subjective responses during ad lib smoking of a single cigarette. *Nicotine & Tobacco Research, 14*(4), 490-494. doi:http://dx.doi.org/10.1093/ntr/ntr150

Perkins, K. A., Karelitz, J. L., Giedgowd, G. E., Conklin, C. A., & Sayette, M. A. (2010). Differences in negative mood-induced smoking reinforcement due to distress tolerance, anxiety sensitivity, and depression history. *Psychopharmacology, 210*(1), 25-34. doi:http://dx.doi.org/10.1007/s00213-010-1811-1

Poulin, C., Hand, D., Boudreau, B., & Santor, D. (2005). Gender differences in the

association between substance use and elevated depressive symptoms in a general adolescent population. *Addiction, 100*(4), 525-535. doi:http://dx.doi.org/10.1111/j.1360-0443.2005.01033.x

Prokhorov, A. V., Koehly, L. M., Pallonen, U. E., & Hudmon, K. S. (1998). Adolescent nicotine dependence measured by the modified fagerström tolerance questionnaire at two time points. *Journal of Child & Adolescent Substance Abuse, 7*(4), 35-47. Retrieved from http://proxy.cc.uic.edu/docview/619357832?accountid=14552

Prokhorov, A. V., Pallonen, U. E., Fava, J. L., Ding, L., & Niaura, R. (1996). Measuring nicotine dependence among high-risk adolescent smokers. *Addictive Behaviors, 21*(1), 117-127. Retrieved from http://proxy.cc.uic.edu/docview/618823288?accountid=14552

Rose, J. E., Ananda, S., & Jarvik, M. E. (1983). Cigarette smoking during anxiety-provoking and monotonous tasks. *Addictive Behaviors, 8*(4), 353-359. Retrieved from http://proxy.cc.uic.edu/docview/616920820?accountid=14552

Saules, K. K., Pomerleau, C. S., Snedecor, S. M., Brouwer, R. N., & Rosenberg, E. E. M. (2004). Effects of disordered eating and obesity on weight, craving, and food intake during ad libitum smoking and abstinence. *Eating Behaviors, 5*(4), 353-363. doi:http://dx.doi.org/10.1016/j.eatbeh.2004.04.011

Shiffman, S., & Sayette, M. A. (2005). Validation of the nicotine dependence syndrome scale (NDSS): A criterion-group design contrasting chippers and regular smokers. *Drug and Alcohol Dependence, 79*(1), 45-52. doi:http://dx.doi.org/10.1016/j.drugalcdep.2004.12.009

Veilleux, J. C., Kassel, J. D., Heinz, A. J., Braun, A., Wardle, M. C., Greenstein, J., . . . Conrad, M. (2011). Predictors and sequelae of smoking topography over the course of a

single cigarette in adolescent light smokers. *Journal of Adolescent Health, 48*(2), 176-181. doi:http://dx.doi.org/10.1016/j.jadohealth.2010.06.015

Whisman, M. A., Perez, J. E., & Ramel, W. (2000). Factor structure of the beck depression Inventory—Second edition (BDI-II) in a student sample. *Journal of Clinical Psychology, 56*(4), 545-551. doi: http://dx.doi.org/10.1002/(SICI)1097-4679

Williams, J. M., Gandhi, K. K., Lu, S., Kumar, S., Steinberg, M. L., Cottler, B., & Benowitz, N. L. (2011). Shorter interpuff interval is associated with higher nicotine intake in smokers with schizophrenia. *Drug and Alcohol Dependence, 118*(2-3), 313-319. doi:http://dx.doi.org/10.1016/j.drugalcdep.2011.04.009

Wohlford, P. (1970). Initiation of cigarette smoking: Is it related to parental smoking behavior? *Journal of Consulting and Clinical Psychology, 34*(2), 148-151. doi:http://dx.doi.org/10.1037/h0029001

Wood, T., Wewers, M. E., Groner, J., & Ahijevych, K. (2004). Smoke constituent exposure and smoking topography of adolescent daily cigarette smokers. *Nicotine & Tobacco Research, 6*(5), 853-862. doi:http://dx.doi.org/10.1080/1462220042000282537

Zielińska-Danch, W., Goniewicz, M. Ł., Koszowski, B., Łabanowicz, A., Czogała, J., Szołtysek-Bołdys, I. … Sobczak, A. (2010). Relationship between nicotine dependence and smoking topography, *Przygel Lek* ("Drug Overview"), 67(10), 1033-1036.

Table 1

Smoking topography factor descriptives as standardized sum scores by time point

	Visit 1		Visit 2	
	M	SD	M	SD
Puff Volume and Length	0.27	3.58	-0.27	2.95
Inhalation Speed	-0.01	2.11	0.01	1.81
Puff Number and Pacing***	0.47	0.71	-0.47	1.54

Note: *** $p < .0$

Table 2

Topography standard score descriptives by sex and visit

		Visit 1		Visit 2	
		M	SD	M	SD
Puff Volume and Length	Males	0.98†	3.85	0.89**	3.05
	Females	-0.61†	3.09	-1.72**	2.10
Inhalation Speed	Males	-0.18	2.00	0.45†	1.93
	Females	-0.20	2.30	-0.34†	1.59
Puff Number and Pacing	Males	0.64†	0.57	-0.38	1.68
	Females	0.25†	0.81	-0.57	1.39

Notes: Significance indicates sex difference at one visit. † $p \leq .15$, ** $p < .01$.

Table 3

Topography by number of lifetime cigarettes smoked and by time point

		Visit 1		Visit 2	
		M	SD	M	SD
Puff Volume and Length	500 cigarettes or more	0.18	3.43	0.43**	2.85
	Less than 500 cigarettes	0.38	3.84	-2.75**	1.75
Inhalation Speed	500 cigarettes or more	-0.02	1.91	0.23	1.84
	Less than 500 cigarettes	-0.18	2.37	-0.37	1.71
Puff Number and Pacing	500 cigarettes or more	0.39	0.64	-0.44	1.45
	Less than 500 cigarettes	0.56	0.79	-0.57	1.92

Notes: Significance indicates differences by lifetime cigarette use at one visit. ** $p < .01$.

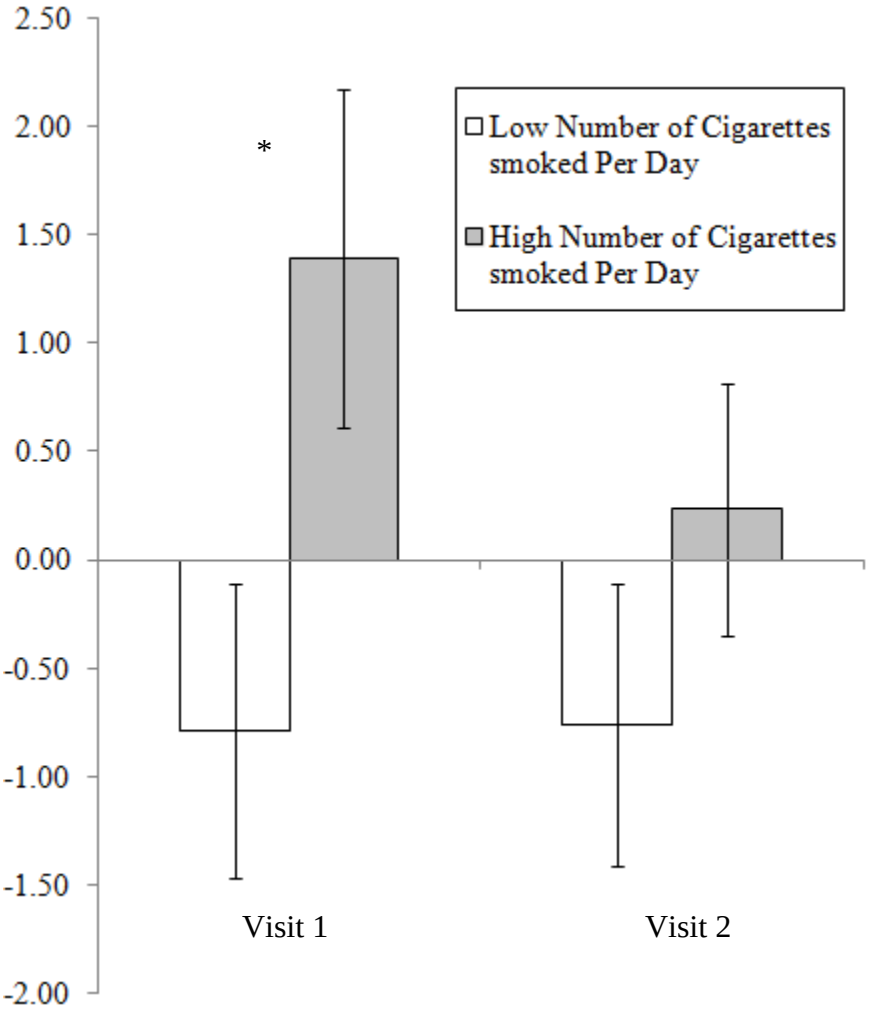

Figure 1. Puff Size and Length standard scores by number of cigarettes smoked per day median split and by visit. Significance indicates differences in topography based on number of cigarettes smoked per day, within each visit. * $p < .05$.

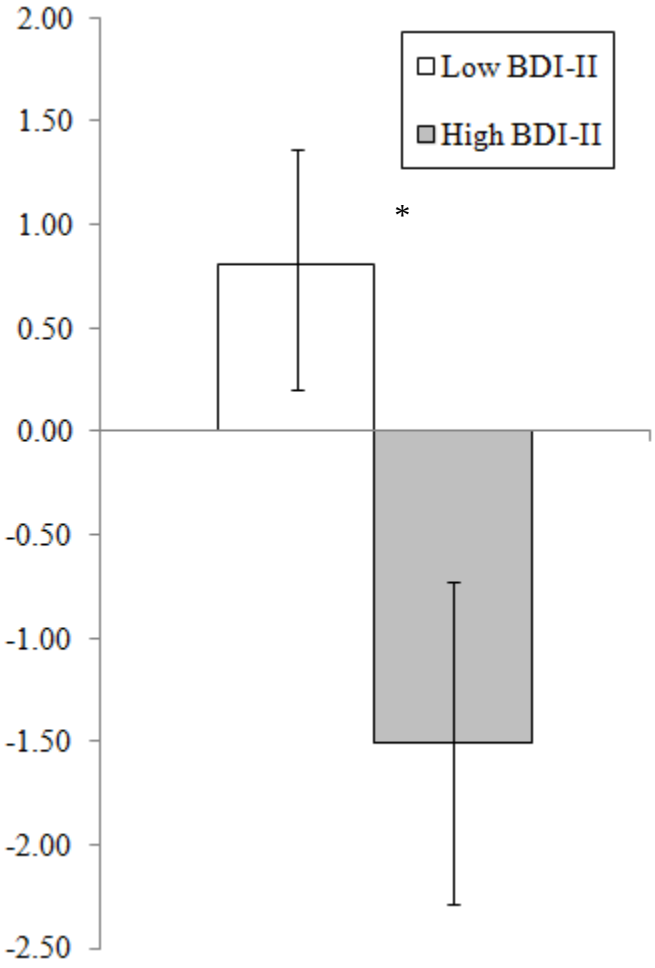

Figure 2. Puff Size and Length standard scores by BDI-II score median split at Visit 2.
* $p < .05$

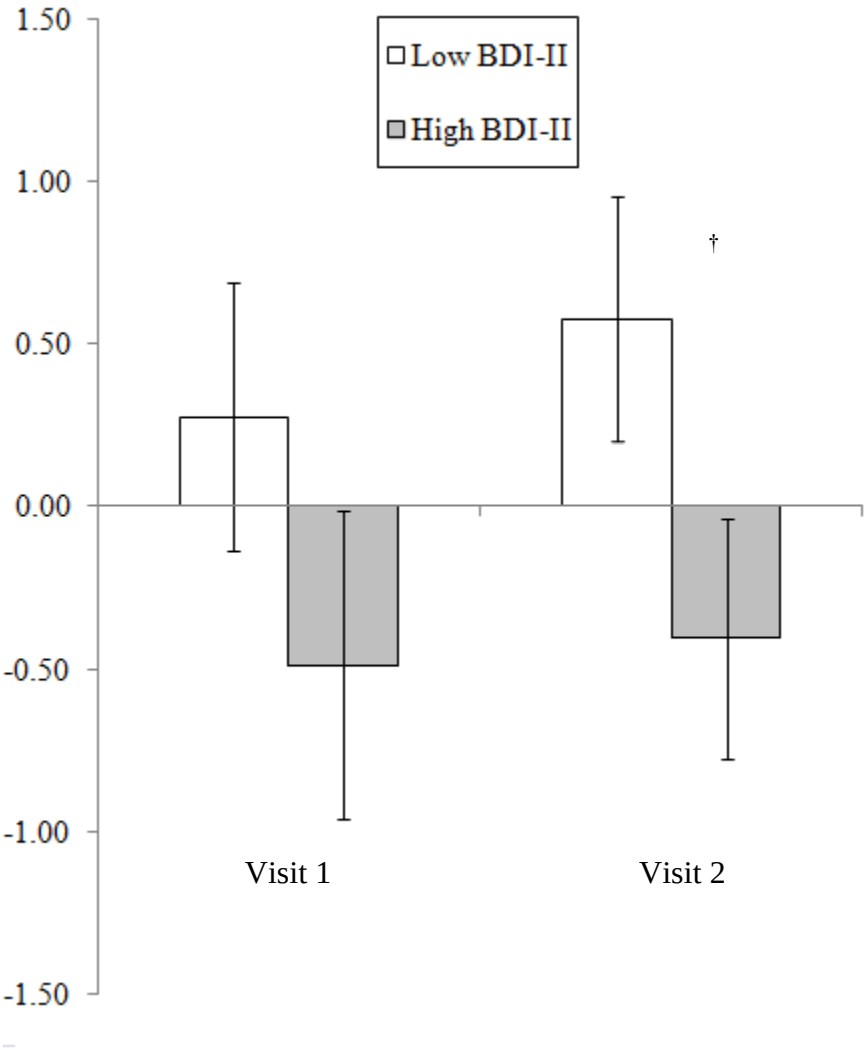

Figure 3. Inhalation Speed standard scores by BDI-II score median split at Visit 1 and by visit. Significance indicates differences in topography by BDI-II score, within each visit point. † $p \leq .15$

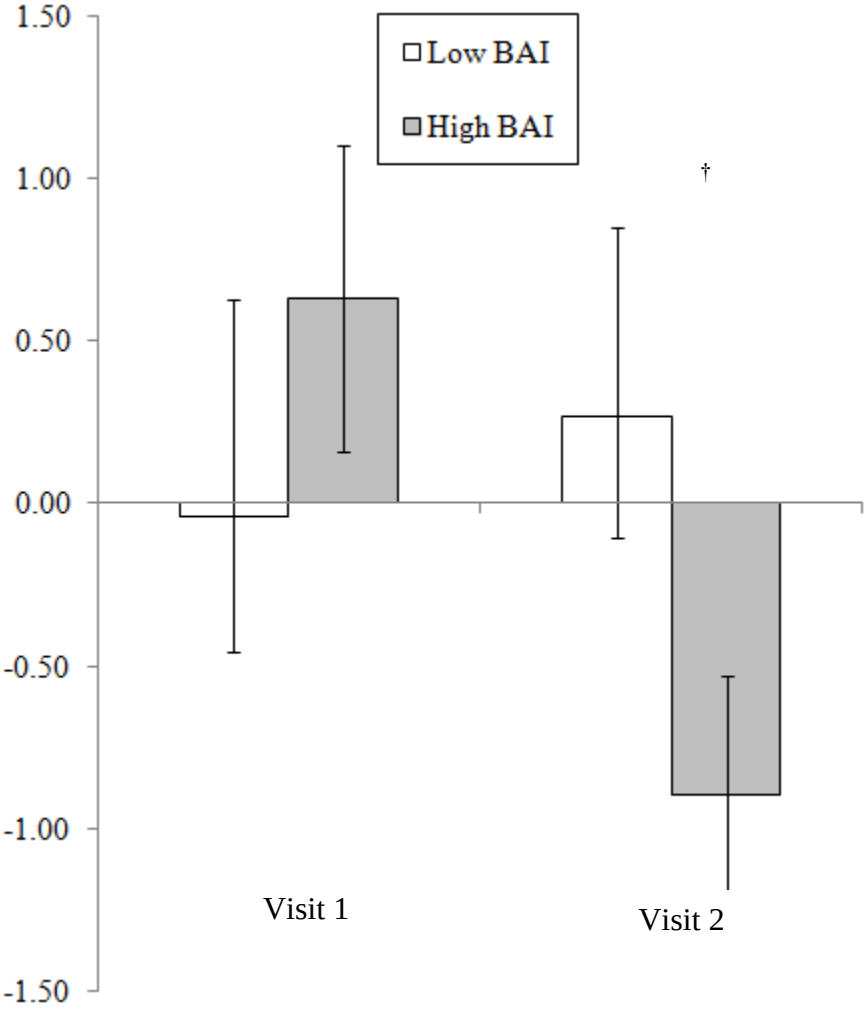

Figure 4. Puff Size and Length standard scores by BAI score median split at Visit 1 and by visit. Significance indicates differences in topography by BAI score, within each visit. † $p \leq .15$

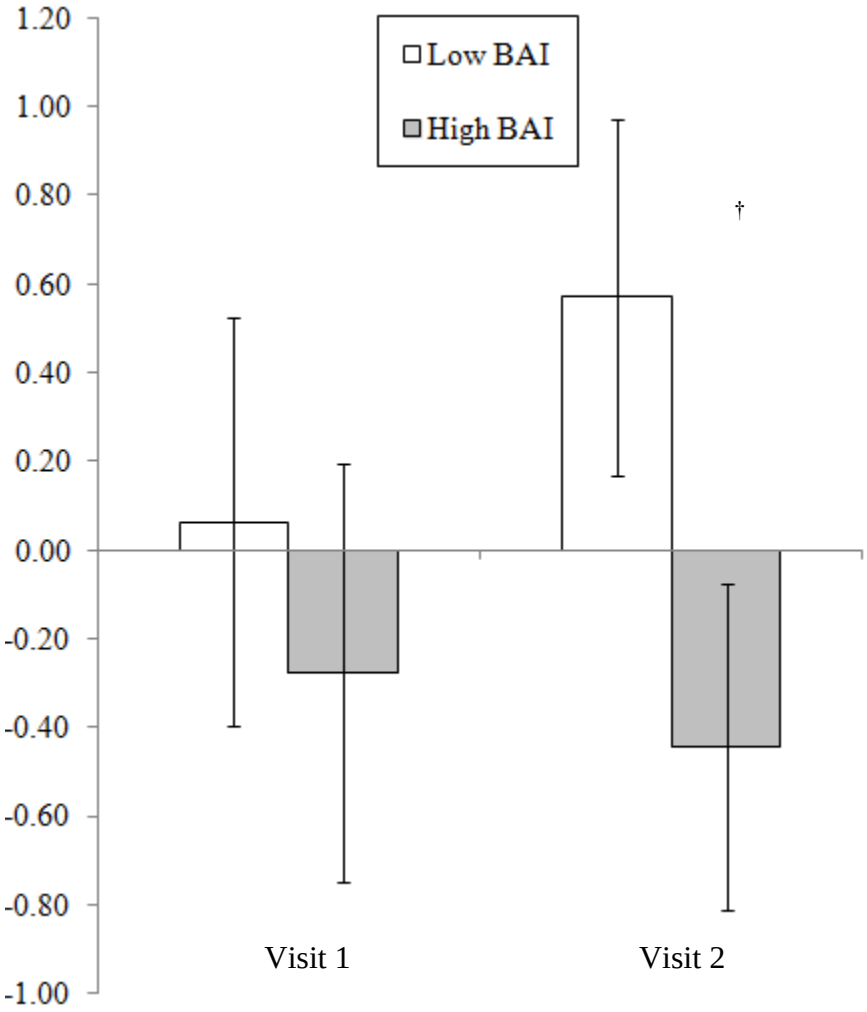

Figure 5. Inhalation Speed standard scores by BAI score median split at Visit 1 and by visit. Significance indicates differences in topography by BAI score, within each visit. † $p \leq .15$

Table 4

Topography standard scores by number of biological parents who were current smokers and by time point

		Visit 1		Visit 2	
		M	SD	M	SD
Puff Volume and Length	Neither Biological Parent	0.42	3.89	-0.29	2.55
	One Biological Parent	-1.29	2.34	-0.31	3.99
	Both Biological Parents	1.80	3.46	0.72	2.78
Inhalation Speed	Neither Biological Parent	-0.35	2.10	-0.20	1.63
	One Biological Parent	-0.54	1.75	-0.24	2.18
	Both Biological Parents	0.74	1.95	0.99	1.87
Puff Number and Pacing	Neither Biological Parent	0.50	0.71	-0.34	1.41
	One Biological Parent	0.28	0.96	-0.74	1.74
	Both Biological Parents	0.60	0.56	-0.24	1.57

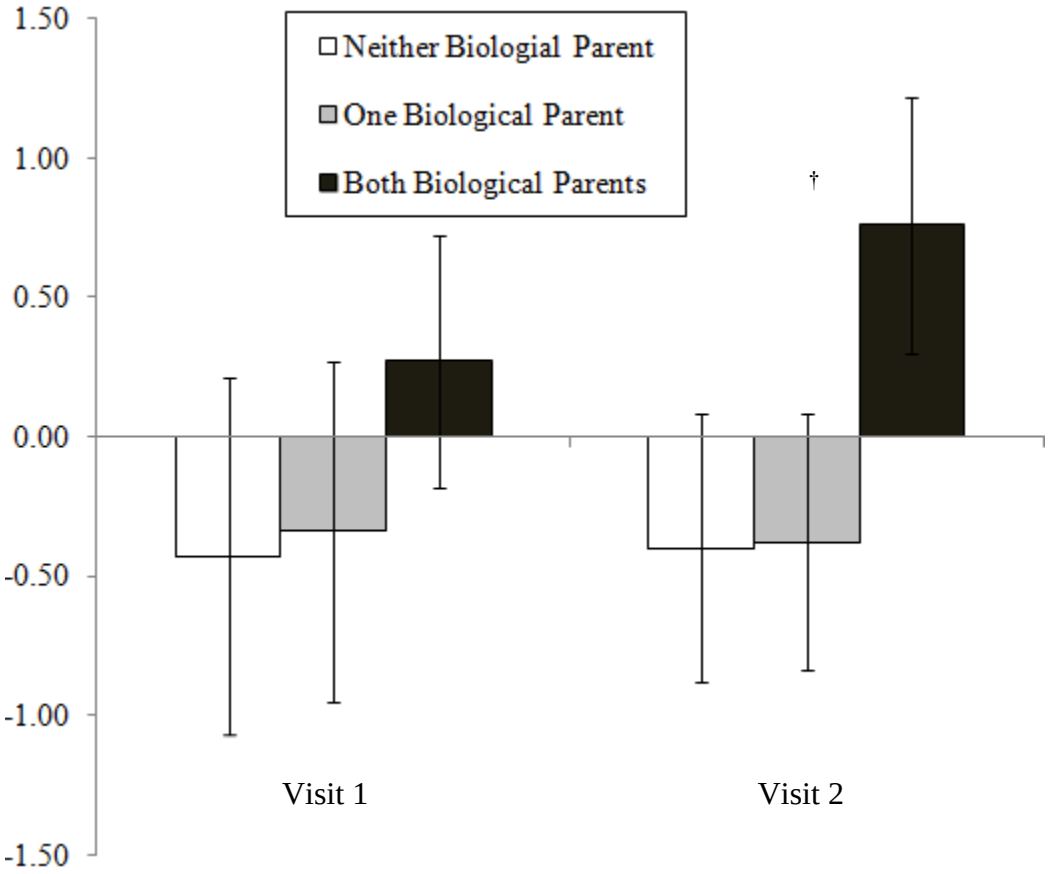

Figure 6. Inhalation Speed standard scores by number of biological parents who were ever smokers and by visit. Significance indicates effect of group based on number of biological parent ever smokers, within each visit. † $p \leq .15$

University of Illinois at Chicago
Assent to Participate in Research
"PIECE BY PIECE: MAKING HEALTH CONNECTIONS"
Project 3: Smoking & Emotions

We are asking you to take part in a research study conducted by Dr. Jon Kassel, a professor in the Department of Psychology at the University of Illinois at Chicago. You are being asked because you are involved in the "Piece by Piece: Making Health Connections" study. We ask that you read this form and ask any questions you may have before agreeing to be in the research. Because you are under 18 years of age, you will need your parents' permission in order to participate.

You decide if you want to participate in this research. If you don't want to be in this study, you don't have to be involved. Remember, being in this study is up to you and no one will be upset if you don't want to participate or even if you change your mind later and want to stop.

Why is this research being done?
We are trying to learn more about the physical and emotional effects that cigarette smoking has on adolescents, and to see if there are differences between smoking and nonsmoking adolescents. To do this, the study will include both students who have and those who have not tried smoking cigarettes. Approximately 230 teenagers (both smokers and nonsmokers) may be involved in this research.

What is are involved?
If you agree to be in this research, we will ask you to attend three separate sessions (this session now, one 6 weeks from now, and one 2 years from now). Each session will last about 1½ hours. During the session, you will be asked to fill out a short questionnaire about your experiences with cigarette smoking and your current mood. Then you will have small sensors (electrodes) placed on your arms and face in order to measure several bodily processes (for example, your heart rate) throughout the session. Placement of the sensors will take several minutes, but is not at all painful. At several points in the study, we will also ask you to blow through a tube in order to measure the level of carbon monoxide in your lungs (nonsmokers will only do this once). You will also be asked to fill out another questionnaire about how you feel right at that moment.

If you are a smoker, you will be given the opportunity to smoke one of our tobacco cigarettes; you may smoke as much or as little of the cigarette as you choose. You do not have to smoke this cigarette if you do not want to. All participants then view a series of slides, some of which are pleasant (for example, laughing babies) and others of which are unpleasant (for example, a snake). While you are viewing these slides, you will occasionally hear a loud tone presented over headphones. We ask that you simply ignore these tones and continue viewing the slides. Once you have viewed all of the slides, the study will be over and we will explain this research in more detail to you.

What are the potential risks and discomforts?
There are some potential risks from participating in this study. Some individuals may find some of the slides to be unpleasant. However, each slide is viewed for only seconds and these slides have been viewed in many studies with hundreds of participants with no reported bad effects. In addition, the loud tone presented over the headphones may be uncomfortable; however, other studies have used a similar loud tone without any reported bad effects.

Are there benefits to taking part in the research?
There are no direct benefits to you; however, the potential benefits to society are great because this study will help us better understand the effects that smoking has on adolescent smokers and create better smoking prevention and cessation programs for future high school students.

What about privacy and confidentiality?
The only people who will know that you are involved in this research are members of the "Piece by Piece: Making Health Connections" research team. No information about you, or provided by you during this research, will be shared with anyone else without your written permission, except if you are injured and need emergency care or when the UIC Institutional Review Board monitors the research or consent process.

To protect your privacy, we do not use your name on any of the information you provide to us. Your questionnaires and laboratory data will have a project ID number listed instead of your name. The only people who can match your name to your ID are members of our research team. All your information will be kept strictly confidential. This information will be kept in locked files and only authorized project staff will have access to it. The data that you provide will be kept for 10 years and then destroyed.

What are the costs for participating in this research?
There are no costs to you for participating in this research study. You will be paid for participating in the study. You will be paid $45 at the end of the first and second laboratory visit and $60 after completing the final session. Therefore, if you complete all parts of this project, you will receive a total of $150.

Can I stop participating in the study?
You can choose whether to be in this study or not. If you volunteer to be in this study and later change your mind, you can stop and no one will be upset. You may also refuse to answer any questions you don't want to answer and still remain in the study. The investigator may also end your participation in the study if there are reasons for doing so.

Who should I contact if I have questions?
The researcher conducting this study is Dr. Jon D. Kassel; you may contact him at (312) 413-9162. You can also call the toll-free Health Connections hotline with any questions at (866) 413-8824. If you have any questions about your rights as a research subject, you may call the UIC Office for Protection of Research Subjects at (312) 996-1711. You will be given a copy of this form for your records.

Signature
Signing your name on this form means that you agree to be in this study. You will also need your parents permission before you can participate.

_____ _____
Signature Date

_____
Printed Name

_____ _____
Signature of Researcher Date (must be same as subject's)

University of Illinois at Chicago
Parental Permission for Participation in Research
"PIECE BY PIECE: MAKING HEALTH CONNECTIONS"
Project 3: Smoking & Emotions

Why is your son/daughter being asked to participate?
Your son/daughter is being asked to be a subject in a research study about the effects of cigarette smoking on certain physical responses, like heart rate, that people often have when viewing different kinds of pleasant and unpleasant pictures. This study is being conducted by Dr. Jon Kassel, Department of Psychology, at the University of Illinois at Chicago. Your son/daughter has been asked to participate in the research because they are involved in the "Piece by Piece: Making Health Connections" study. We ask that you read this form and ask any questions you may have before allowing your son/daughter to be in the research.

Your child's participation in this research is voluntary. Their decision whether or not to participate will not affect their current or future relations with the University. If they decide to participate with your permission, they are free to withdraw at any time without affecting those relationships.

Why is this research being done?
Most of the previous research on cigarette smoking has used adult smokers. Far less research, however, has been done with adolescents like your son/daughter. Therefore, this study is being conducted both to better understand some of the effects that cigarette smoking has on adolescents, as well as to see if there are differences between smoking and nonsmoking adolescents. There are few, if any, risks associated with participation in this study.

Summary
The primary purpose of this study is to better understand the effects of smoking on physical and emotional responses to viewing pictures and to see if there are differences in responses between smokers and nonsmokers. Such research is important because it can help us more clearly understand some of the rewarding effects that smoking has on adolescent smokers. Approximately 230 subjects, both smokers and nonsmokers, will participate in this study.

What procedures are involved?
If your son/daughter agrees to be in this research, we would ask him/her to do the following things:

This study involves attending three separate sessions, each lasting about 1½ hours, over a 2-year period. The first two visits will occur 6-weeks apart; the final visit will be 24-months after the first visit. Upon arrival at the experimental session, your child will be asked to fill out several questionnaires asking about their experiences with cigarette smoking and their current mood. Then they will have small sensors (electrodes) placed on their arms and face in order to measure several bodily processes (for example, heart rate) throughout the session. The sensors actually measure electrical currents in the body. Placement of the sensors will take several minutes, but is not at all painful. At several points in the study, we will also ask

them to blow through a tube in order to measure carbon monoxide, which is a by-product of cigarette smoke. (Nonsmokers will only do this once). They will also be asked to fill out a questionnaire at several points in time which asks them about how they are feeling right at that moment.

If your son/daughter is a smoker, they will be given the opportunity to smoke one of our research tobacco cigarettes; they may smoke as much or as little of the cigarette as they choose. He/She does not have to smoke at all if he/she does not want to. All participants will then view a series of slides, some of which are pleasant (for example, laughing babies) and others of which are unpleasant (for example, a snake). While they are viewing these slides, they will occasionally hear a loud tone presented over headphones. We ask that they simply ignore these tones and continue viewing the slides. Once they have viewed all of the slides, the study will be over and we will explain this research in slightly more detail at that point in time.

What are the potential risks and discomforts?
Participation in this study has minimal risk. Although some of the slides are unpleasant, they are viewed for only several seconds and this procedure has been used in many studies with no reported bad effects.

Are there benefits to taking part in the research?
Although your son/daughter will not receive any direct benefits, the potential benefits to science and society are great because this study will help us better understand the effects that smoking has on adolescent smokers.

What about privacy and confidentiality?
The only people who will know that your teenager is a research subject are members of the research team. No information about your son/daughter will be disclosed to others without your written permission, except:

- if necessary to protect your child's rights or welfare (for example, if your son/daughter is injured and needs emergency care, or when the UIC Institutional Review Board monitors the research or consent process); or
- if required by law.

When the results of the research are published or discussed in conferences, no information will be included that would reveal your child's identity. Any information that is obtained in connection with this study and that can be identified with your child will remain confidential and will be disclosed only with your permission or as required by law.

Any information about your son/daughter obtained from this research, including answers to questionnaires and laboratory data, will be kept strictly confidential. Information will be kept in locked files and only the principal investigator and his research assistants will have access to it. The data provided by your child will be kept for 10 years and then destroyed.

What are the costs for participating in this research?
There are no costs to you or your child for participating in this research study.

Will your son/daughter be reimbursed for expenses or paid for participating in this research?
Your son/daughter will be paid for participating in the study. He/She will be paid $45 at the end of the first and second laboratory visit and $60 after completing the final session. Therefore, if your child completes all parts of this project, he/she will receive a total of $150.

Can your son/daughter withdraw or be removed from the study?
With your permission, your child can choose whether to be in this study or not. If your son/daughter volunteers to be in this study, he/she may withdraw at any time without consequences of any kind. Your

child may also refuse to answer any questions they don't want to answer and still remain in the study. The investigator may withdraw your son/daughter from this research if circumstances arise which warrant doing so (like belligerent behavior or noncompliance).

Who should you contact with questions?
The researcher conducting this study is Dr. Jon D. Kassel; you may contact him at (312) 413-9162. You can also call the toll-free Health Connections hotline with any questions at (866) 413-8824.

What are your son's/daughter's rights as a research subject?
If you have any questions about your child's rights as a research subject, you may call the Office for Protection of Research Subjects at (312) 996-1711. You will be given a copy of this form for your information and to keep for your records.

Signature of Parent(s)
As the legal parent of the minor, _____, I state that I am _____ years of age and permit my teenager to participate in a research study being conducted by Dr. Jon D. Kassel from the Department of Psychology. I understand that while the study will be under the supervision of this individual, other professionals who work with him may assist or act on his behalf. I have read (or someone has read to me) the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I consent for my son/daughter to participate in this research. I will be provided a copy of this form.

_____	_____
Parent/Guardian (Sign and Date)	(Print name)
_____	_____
Teenager participant (Sign and Date)	(Print name)
_____	_____
Signature of Researcher	Date (must be same as subject's)
_____	_____
Signature of Witness (if appropriate)	Date (must be same as subject's)
_____	
Printed name of Witness (if appropriate)	

CURRICULUM VITAE

Grace Elizabeth Giedgowd, M.A.
(December, 2013)

OFFICE ADDRESS
Department of Psychology
University of Illinois
1007 W. Harrison St M/C 285
Chicago, IL 60607
(973) 668-6164
ggiedg2@uic.edu

EDUCATION AND TRAINING

University of Illinois at Chicago, Clinical Psychology Doctoral Program August 2011-Current
Chicago, IL
Department of Psychology, Clinical Division
Thesis: Adolescent Smoking Topography over Time
Mentor: Jon Kassel, Ph.D.

University of Pittsburgh September 2005 – April 2009
Pittsburgh, PA
B.S. in Psychology, magna cum laude
Second Major: Anthropology
Minor: Administration of Justice

CLINICAL EXPERIENCE

Therapy Practicum January 2011- Current
University of Illinois at Chicago, Chicago, IL, Office of Applied Psychological Services (OAPS)
Supervisors: Gloria Balague, Ph.D., Nancy Dassoff, Ph.D., Amanda Lorenz, Ph.D.

- Provide individual and couples therapy in a community-based clinic, under the supervision of licensed clinical psychologists
- Interview and treat diverse clients including those with depression, anxiety, obsessive-compulsive personality disorder, attention deficit hyperactivity disorder, and post-traumatic stress disorder

Assessment Practicum Fall 2012- Current
University of Illinois at Chicago, Chicago, IL, Office of Applied Psychological Services (OAPS)
Supervisors: Amanda Lorenz, Ph.D., Ellen Herbener, Ph.D.

- Interview and conduct psychological assessment for community-based clients seeking evaluation
- Under the supervision of licensed clinical psychologists, select, administer, and interpret performance on psychological assessments
- Integrate data from assessment and interview into reports for clients, including diagnostic impressions and recommendations

- To date, have completed 6 integrated reports for diverse adolescents and adults, and have met with client and family members to provide feedback

PUBLICATIONS

Giedgowd, G. E., Kassel, J. D., & Mermelstein, R. (In preparation). Evaluation of smoking topography factor structure in young smokers.

Heinz, A. J., **Giedgowd, G. E.**, Crane, N. A., Veilleux, J. C., Conrad, M., Braun, A. R., Olejarska, N. A., & Kassel, J. D. (2013). A comprehensive examination of hookah smoking in college students: Use patterns and contexts, social norms and attitudes, harm perception, psychological correlates and co-occurring substance use. *Addictive Behaviors*, 8(11), 2751-2760. doi: 10.1016/j.addbeh.2013.07.009

Perkins, K. A., Karelitz, J. L., **Giedgowd, G. E.,** & Conklin, C. A. (2013). Negative mood effects on craving to smoke in women versus men. *Addictive Behaviors, 38*(2), 1527-1531. doi:http://dx.doi.org/10.1016/j.addbeh.2012.06.002

Kassel, J. D., Veilleux, J. C., Braun, A. R., Conrad, M., **Giedgowd, G.,** Weber, S. (In preparation, 2012). Smoking and Depression. In C. S. Richards and M. W. O'Hara (Eds.), *The Oxford Handbook of Depression and Comorbidity*. Cary, NC: Oxford University Press.

Perkins, K. A., **Giedgowd, G. E.,** Karelitz, J. L., Conklin, C. A., & Lerman, C. (2012). Smoking in response to negative mood in men versus women as a function of distress tolerance. *Nicotine & Tobacco Research, 14*(12), 1418-1425. doi:http://dx.doi.org/10.1093/ntr/nts075

Perkins, K. A., **Giedgowd, G. E.,** Karelitz, J. L., Conklin, C. A., Parzynski, C. S. (2012). Expectancy for negative affect relief due to smoking may not be predictive under acute mood situations. *Experimental Clinical Psychopharmacology*, 20(2), 161- 166. doi: 10.1037/a0026456

Perkins, K. A., Karelitz, J. L., **Giedgowd, G. E.,** Conklin, C. A. (2012). The reliability of puff topography and subjective responses during ad lib smoking of a single cigarette. *Nicotine & Tobacco Research*, 14(4), 490 - 494. doi: 10.1093/ntr/ntr150

Perkins, K. A., Karelitz, J. L., **Giedgowd, G. E.**, Conklin, C. A., & Sayette, M. A. (2010). Differences in negative mood-induced smoking reinforcement due to distress tolerance, anxiety sensitivity, and depression history. *Psychopharmacology, 210*(1), 25-34. doi:http://dx.doi.org/10.1007/s00213-010-1811-1

Perkins, K. A., Karelitz, J. L., Conklin, C. A., Sayette, M. A., **Giedgowd, G. E**. (2010). Acute negative affect relief from smoking depends on the affect situation and measure, but not on nicotine. *Biological Psychiatry*, 67 (707-714). doi: 10.1016/j.biopsych.2009.12.017

INVITED LECTURES AND PRESENTATIONS

Giedgowd, G. E. (October 29, 2013). ACT and Mindfulness. *University of Illinois at Chicago, Department of Psychology, Laboratory in Clinical Psychology (PSCH 333).*

Giedgowd, G. E. (October 23, 2013). Assessing and intervening on acute suicidality: A case study. *University of Illinois at Chicago, Department of Psychology, Interviewing (PSCH 481).*

Giedgowd, G. E. (October 15, 2013). Psychological Measurement. *University of Illinois at Chicago, Department of Psychology, Laboratory in Clinical Psychology (PSCH 333).*

Giedgowd, G. E. (September, 2012). Longitudinal Exploration of Smoking Topography in Adolescents. *Masters Proposal Presentation, University of Illinois at Chicago, Department of Psychology, Clinical Division Symposium*.

PROFESSIONAL PRESENTATIONS

Giedgowd, G. E., Conrad, M., Crane, N. A., Palmeri, M., & Kassel, J. (May, 2014). Sex differences in avoidance coping, cigarette use, and dependence. Presentation accepted for oral presentation at the 2014 annual meeting of the Midwestern Psychological Association in Chicago, IL.

Giedgowd, G. E., Conrad, M., Crane, N. A., & Kassel, J. D. (February, 2014). Sex differences in perceived and actual relief of negative affect as a result of smoking in an adolescent sample. Poster accepted for presentation at the 20th annual meeting of the Society for Research on Nicotine and Tobacco in Seattle, WA.

Crane, N. A., Conrad, M., **Giedgowd, G. E.**, Gorka, S., & Kassel, J. D. (February, 2014) Adolescents' respiratory sinus arrhythmia predicts smoking behavior five years later. Poster accepted for presentation at the 20th annual meeting of the Society for Research on Nicotine and Tobacco in Seattle, WA.

Braun, A.R., Conrad, M., **Giedgowd, G**., Crane, N., Greenstein, J., Colflesh, G. Veilleux, J., Heinz, A., & Kassel, J. (November, 2012). The effects of nicotine on selective attention. Poster presented at the 46th annual convention of the Association for Behavioral and Cognitive Therapies, National Harbor, Maryland.

Conrad, M. F., Kassel, J. D., Braun, A. R., **Giegdowd, G. E**., Weber, S., Mermelstein, R. J. (2012). Moderators and mediators of alcohol use in adolescent smokers. Poster presented at the 35th Annual Meeting of the Research Society on Alcoholism, San Francisco, CA.

Perkins, K.A., **Giedgowd, G.E.,** Karelitz, J.L., Conklin, C.A., Lerman, C. (March, 2012).

Distress tolerance and smoking reinforcement in men and women during negative mood induction. Poster presented at the annual meeting of The Society for Research on Nicotine and Tobacco Annual Conference, Houston, Texas.

Karelitz, J.L., Perkins, K.A., **Giedgowd, G.E.**, Conklin, C.A. (March, 2012). Acute mood effects on negative affect and craving to smoke. Poster presented at the annual meeting of the Eastern Psychological Association, Pittsburgh, Pennsylvania.

Weber, S. M., Conrad, M., Braun, A. R., **Giedgowd, G. E.,** Kassel, J. (2012). Effects of measured behavioral activation and inhibition on substance use in college students. Poster presented at the 24th Annual Meeting of the Association for Psychological Science, Chicago, IL.

Giedgowd, G., Perkins, K. A., Karelitz, J. L. (February 2010) Association of self-reported craving and expectancy for negative affect relief with acute smoking behavior during negative mood. Poster presented at the annual meeting of The Society for Research on Nicotine and Tobacco Annual Conference, Baltimore, Maryland.

Karelitz, J. L., Perkins, K. A., **Giedgowd, G. E.,** Conklin, C. A., Sayette, M. A. (February 2010). Differences in negative mood-induced smoking reinforcement and reward due to distress tolerance, anxiety sensitivity, and depression history. Poster presented at the annual meeting of The Society for Research on Nicotine and Tobacco Annual Conference, Baltimore, Maryland.

Perkins, K. A., Karelitz, J. L., Conklin, C. A., Sayette, M. A., **Giedgowd, G.** (February 2010). Acute negative affect relief from smoking depends on the situation and affect measure, but not on nicotine. Poster presented at the annual meeting of The Society for Research on Nicotine and Tobacco Annual Conference, Baltimore, Maryland.

RESEARCH EXPERIENCE

Graduate Research Assistant August 2011 - Current
Substance Use Research Laboratory
University of Illinois at Chicago, Department of Psychology
Supervisor: Jon. D. Kassel

- Conduct experimental sessions and assist in data management, analysis, and interpretation for two National Cancer Institute funded R01 laboratory-based projects assessing the effects of smoking on emotional and psychophysiological response in adolescents
- Supervise graduate and undergraduate students in carrying out a multi-session study evaluating negative mood regulation expectancies and substance use during the semester in the undergraduate population, including data entry and management, and analysis and interpretation of data
- Carried out experimental sessions in a laboratory study investigating the impact of binge drinking on neuropsychological outcomes in young adults

Research Specialist April 2009 – August 2011
Nicotine Research Laboratory
University of Pittsburgh Medical Center, Western Psychiatric Institute and Clinic
Supervisor: Kenneth Perkins, Ph.D.

- Oversaw execution of two laboratory-based studies, conducted experimental sessions, performed statistical analyses using SPSS, screened and recruited participants, maintained day-to-day functioning and safety of laboratory
- Assisted in developing lab procedures and protocols for new studies, performed brief cognitive-behavioral therapy sessions for individuals seeking smoking cessation
- Supervised undergraduate research assistants

Directed Research Laboratory Assistant
Alcohol and Smoking Research Laboratory
University of Pittsburgh, Department of Psychology August 2008 – April 2009
Supervisor: Michael Sayette, Ph.D.

- Investigated behavioral/physiological responses to alcohol, interviewed prospective participants using established DSM criteria for alcohol abuse/dependence
- Assisted with data collection and video recordings of live sessions, participated in data entry and FACS facial coding, scored cognitive tasks

TEACHING EXPERIENCE

Graduate Teaching Assistant
University of Illinois at Chicago, Chicago, IL Fall 2012- Current

Laboratory in Clinical Psychology Fall 2013- Current

- Helped students develop grant proposals to explore psychological research questions focused on psychopathology, and introduced them to the importance of psychometrics, including statistical techniques used in the area (Cronbach's alpha, exploratory factor analysis)
- Developed lectures addressing APA writing, how to use SPSS, and a review of how mindfulness techniques are used in the ACT framework

Introduction to Psychology Fall 2012, Spring 2013

- Oversaw graduate student teaching assistants, managed the online website for the course
- Independently conducted weekly discussion sections to review material taught during lecture, graded materials
- Assisted in the development of course material, including the development of a lesson plan to aid students in identifying and learning how to avoid plagiarism

Undergraduate Teaching Assistant
University of Pittsburgh, Pittsburgh, PA
Introduction to Psychology
Spring 2007

- Attended lectures, administered exams, graded essay questions
- Prepared and executed four review sessions before mid-terms for all sections, corresponded with students about questions on the material, individually met students upon request to review grades