Running Title: PSYCHOPATHOLOGY, FAMILIAL FACTORS, AND SMOKING

Psychiatric Disorders, Familial Factors, and Cigarette Smoking:

III. Associations with Cessation by Young Adulthood among Daily Smokers

Paul Rohde, Ph.D.

Christopher W. Kahler, Ph.D.

Peter M. Lewinsohn, Ph.D.

Richard A. Brown, Ph.D.

Paul Rohde, and Peter M. Lewinsohn, Oregon Research Institute, 1715 Franklin Blvd., Eugene, OR, 97403-1983; Christopher W. Kahler, Center for Alcohol and Addiction Studies, Brown University, Box G-BH, Providence, RI 02912; Richard A. Brown, Butler Hospital/Brown University School of Medicine, 345 Blackstone Blvd., Providence, RI 02906.

Correspondence to: Paul Rohde, Ph.D. Oregon Research Institute, 1715 Franklin Blvd., Eugene, OR, 97403-1983. Fax: 541-484-1108; E-mail: paulr@ori.org

This research was conducted at Oregon Research Institute and was supported by DA-11299 to P.R., and MH- 40501, MH-50522, and MH-52858 to P.M.L.

Total number of pages: 47

Word Count: 11,658

Abstract

Our aim was to examine whether lifetime psychopathology, regular smoking and psychopathology in family members, and smoking characteristics were associated with successful cessation among daily smokers. A sample of 941 young adults were interviewed for lifetime psychopathology and smoking at three time points; biological parents and siblings were interviewed once for lifetime psychopathology and regular smoking. Within the subset of 242 daily smokers with complete data, most (83%) had tried to quit at least once, although only 22% met our definition of successful cessation (no smoking during the 12 months prior to turning 25). Successful cessation was positively associated with being married and higher household income in young adulthood, and negatively associated with lifetime major depressive disorder, elevated antisocial personality disorder symptoms, a family history of drug and alcohol use disorder, and nicotine dependence (for women but not men). Marital status, nicotine dependence (for women but not men), and male gender were significant in multivariate analyses; the effect for major depressive disorder approached significance (p = .052). None of the measures of familial smoking were associated with successful smoking cessation. In conclusion, whereas almost all Axis I disorders in our two previous papers had been shown to be associated with smoking initiation and progression to daily smoking, MDD and antisocial personality disorder symptoms were the only psychiatric conditions negatively associated with successful cessation. The causal nature of the significant associations and the degree to which modification of these factors increases the probability of future smoking cessation deserve further attention.

Introduction

Adolescence is a critical time to evaluate factors associated with cigarette smoking. First, almost all tobacco use begins during this time (e.g., Chassin, Presson, Rose, & Sherman, 1996), with approximately two-thirds of U.S. adolescents trying smoking by age 18 (e.g., Johnston, O'Malley, & Bachman, 2001). Second, many adolescents who are experimenting with smoking become daily smokers during this time period (e.g., Stanton, McClelland, Elwood, Ferry, & Silva, 1996). Third, approximately three-fourths of adolescent daily smokers will continue to smoke as adults (e.g., Johnston, Bachman, & O'Malley, 1992). Lastly, most smokers who try to quit are unsuccessful (e.g., Burt & Peterson, 1998; Moolchan, Ernst, & Henningfield, 2000).

The present study is the third in a series examining the associations between psychiatric disorders, familial factors, and cigarette smoking during adolescence and young adulthood. In the first study (Rohde, Lewinsohn, Brown, Gau, & Kahler, 2003), we examined the associations of these factors with smoking initiation, finding that most categories of lifetime psychopathology were associated with smoking initiation (e.g., major depressive disorder [MDD]; alcohol and drug use disorders, attention-deficit/hyperactivity disorder [ADHD]/disruptive behavior disorders [oppositional defiant and conduct disorders], and elevated levels of antisocial and borderline personality disorder symptoms). Regular smoking by one’s mother and a sibling (but not one’s father) were associated with smoking initiation, as were two of four categories of psychiatric disorders in relatives (substance use disorders and depression, but not anxiety or externalizing disorders). When all significant univariate variables were examined in a single model, drug use disorders, regular smoking by mother, and regular smoking by a sibling remained significantly associated with smoking initiation. Throughout the analyses, six interactions with gender were

found. In every instance, smoking initiation was more strongly associated with the risk factor for young women than for young men.

In the second study (Rohde, Kahler, Lewinsohn, & Brown, in press), progression from smoking initiation to daily smoking was associated with lower parental education, MDD, alcohol and drug use disorders, ADHD/disruptive behavior disorders, antisocial personality disorder symptoms, regular smoking by father (but not mother or sibling), and one measure of psychopathology in family members (externalizing disorders). Nicotine dependence was associated with drug use disorders and alcohol use disorders. When composite measures of internalizing disorders, externalizing disorders, familial smoking, and familial psychopathology were examined in a single model, only the externalizing disorders composite remained associated with both daily smoking and with nicotine dependence. Only ADHD consistently preceded the onset of daily smoking.

To our knowledge, these papers are among the most extensive examinations of associations of individual psychopathology, familial smoking, and familial psychiatric history with smoking initiation and progression to daily use to date.

The goal of the present study is to identify the variables that are associated with successful smoking cessation among daily smokers. Cigarette smoking is a complex behavior influenced by multiple factors (Derzon & Lipsey, 1999; Moolchan et al., 2000) and, as we found in our two previous studies, risk factors predicting transition to each stage of smoking may differ (e.g., Chassin, Presson, Pitts, & Sherman, 2000; Harrell, Bangdiwala, Deng, Webb, & Bradley, 1998; Rose, Chassin, Presson, & Sherman, 1996). In the present study, we do not attempt to exhaustively examine all potentially salient factors. Instead, paralleling our previous analyses, we

examine the degree to which three categories of risk factors are associated with smoking cessation: (a) lifetime psychopathology in the individual, (b) regular smoking by family members (parents and siblings), and (c) psychopathology in family members. In addition, given that analyses are restricted to daily smokers, we add a fourth category of risk factors based on smoking characteristics (age of smoking initiation, age of progression to daily smoking, presence of nicotine dependence and withdrawal).

Associations with Psychopathology

Of the various psychiatric disorders, MDD has been studied most frequently in association with smoking cessation and relapse. Adolescents and adults with MDD (Breslau, Kilbey & Andreski, 1991; Breslau & Klein, 1999; Glassman et al., 1990) or depressive symptoms (Anda et al., 1990; Colby et al., 1998; Burt & Peterson, 1998; Jorm et al., 1999) have more difficulty quitting smoking and higher rates of relapse (Covey, Glassman, & Stetner, 1990). Several mechanisms have been proposed by which MDD could negatively impact smoking cessation, including smoking as a coping mechanism in the management of negative affect (Khantzian, 1997; Kinnunen, Doherty, Militello, & Garvey, 1996), nicotine's effects on the dopaminergic reinforcement pathways (e.g., Pomerleau & Pomerleau, 1984), associations between MDD and both nicotine withdrawal and dependence (Breslau & Johnson, 2000; Niaura et al., 1999), common factors, such as neuroticism, between depression and smoking (e.g., Breslau, Kilbey, & Andreski, 1993; Breslau, Peterson, Schultz, Chilcoat, and Andreski, 1998; Kendler et al., 1993), increased dysphoria and depression following smoking cessation, especially among smokers with a history of depression (Niaura et al., 1999), and expectancy effects (i.e., the belief smokers have that smoking reduces negative mood; Brandon, Juliano, & Copeland, 1999). While depression

appears to increase a person's motivation to quit due to the health consequences of smoking (Cargill, Emmons, Kahler, & Brown, 2001), it also lowers an individual's self-efficacy to quit (e.g., Haukkala, Uutela, Vartiainen, Mcalister, & Knekt, 2000).

In contrast to the number of studies done on depression and smoking, relatively little research has focused on associations between anxiety disorders and smoking cessation. Although studies suggest that smokers with a history of anxiety disorder are especially prone to experience anxiety as a withdrawal symptom (Pomerleau, Marks, & Pomerleau, 2000), several studies have reported no significant association between smoking cessation and either current self-reported anxiety levels (Becona, Vasquez, & Miguez, 2002) or lifetime history of anxiety disorders (Keuthen et al., 2000). A recent brief report (Vessichhio, Termine, & George, 2002) described two cases in which panic attacks developed after smoking cessation.

After depression, substance use disorders, especially alcohol abuse and dependence, have received the most research attention in relation to smoking cessation. Several studies have examined the efficacy of smoking cessation with both current and former alcoholics. Heavy drinking is associated both with cigarette smoking in general and with lower likelihood of smoking cessation (Dawson, 2000). A history of alcoholism has been shown to be associated with higher rates of nicotine dependence and lower success in smoking cessation (Centers for Disease Control, 1997; Hays et al., 1999; Hurt et al., 1995). Smokers with current alcohol use disorders were less likely to quit, whereas smokers with past alcoholism had smoking quit rates comparable to non-alcoholics (Breslau, Peterson, Schultz, & Andreski, 1996). In a sample of hospitalized smokers, heavy alcohol use was associated with decreased concern regarding negative health aspects of smoking (Cargill et al., 2001).

Several studies document an association between ADHD/disruptive behavior disorders and the development of regular smoking (e.g., Upadhyaya, Deas, Brady, & Kruesi, 2001) and nicotine dependence (Lambert, 1998; Riggs, Mikulich, Whitmore, & Crowley, 1999), although little research has examined the impact of disruptive behavior disorders on smoking cessation. Adult smokers with ADHD appear to have more difficulty with cessation (Pomerleau, Downey, Stelson, & Pomerleau, 1995).

Associations with Familial Smoking

Parental smoking is associated with smoking persistence in offspring. In a cohort-sequential study of community adolescents and young adults (Chassin et al., 2000), those who showed a pattern of early stable regular smoking had a significantly higher number of parents who smoked relative to successful quitters and smoking abstainers, who did not differ. Similarly, failure to quit smoking has been associated with having parents (mothers or fathers) who were daily smokers (Farkas et al., 1999; Patton, Carlin, Coffey, Wolfe, Hibbert & Bowes, 1998; Zhu, Sun, Billings, Choi, & Malarcher, 1999).

Parent and child smoking may be related by several different processes, including genetics, modeling, parental control practices, and the parent-child bond (Brook & Whiteman, 1997; Kandel & Wu, 1995; White, Johnson, & Buyske, 2001). Madden et al. (1999) found that genetic factors accounted for approximately 40% of the variance for smoking persistence in both men and women. True and Heath (1997) estimated the genetic and shared environmental contributions to smoking in male twins. Whereas both genetic and environmental factors contributed to smoking initiation, only genetic effects loaded on the model predicting smoking persistence (accounting for 70% of the risk variance).

Associations with Familial Psychopathology

The third category of examined variables has been the least studied to date. Only a small number of previous studies have examined the role of familial psychopathology in relation to smoking. The offspring of parents treated for substance use disorders have been found to be at elevated risk for regular tobacco use and nicotine dependence, compared to offspring of either parents with anxiety disorders or parents with no mental illness (Dierker, Avenevoli, Merikangas, Flaherty, & Stolar, 2001; Merikangas, Dierker, & Szatmari, 1998). Kendler and associates (1993) reported that adult women with a family history of MDD had a greater likelihood of smoking, even after controlling for personal history of MDD. To our knowledge, no study has examined the role of familial psychopathology in relation to smoking cessation.

If psychopathology in the individual were found to be associated with smoking cessation, the hypothesis could be made that a familial predisposition to that disorder would also be associated with cessation. For example, Lyons et al. (2002) found that the frequently-reported association between smoking and schizophrenia is not completely accounted for by the disease of schizophrenia itself; rather it is related in part to a familial vulnerability to schizophrenia, in that unaffected family members of individuals with schizophrenia had elevated rates of smoking and lowered success at smoking cessation. An alternative hypothesis is that the impact of familial psychopathology is accounted for by psychopathology in the individual. A third hypothesis is that familial psychopathology plays no role in cessation. Heath and colleagues (Heath, Madden, Slutske, & Martin, 1995) suggest that the genetic effects on smoking persistence appear to be due to differences in individual responsiveness to nicotine (e.g., risk of nicotine dependence) more than differences in personality factors (including a genetic transmission of psychopathology).

That is to say, the genetic transfer of smoking is not accounted for by the genetic transfer of depression, alcoholism, or other disorders.

Smoking Characteristics

In addition to the three categories of factors examined in our previous research, we add a fourth category consisting of characteristics of the person's smoking. Specifically, four variables are examined in association with successful smoking cessation: age of smoking initiation, age of progression to daily smoking, nicotine withdrawal, and nicotine dependence. An earlier age of smoking initiation was previous shown to be associated with a lower likelihood of smoking cessation (Breslau & Peterson, 1996). The impact of age of regular smoking is less clear. Among young adults, smoking cessation rates were higher in those who started smoking later (Breslau & Peterson, 1996) or had fewer years of smoking (Matheny & Weatherman, 1998). Conversely, adolescents who became regular smokers at an earlier age were *more* likely to successfully quit as adolescents (Burt & Peterson, 1998).

Several studies report that nicotine dependence reduces the probability of successful smoking cessation, both in adolescents (e.g., McDonald, Roberts, & Descheemaeker, 2000) and adults (Breslau & Johnson, 2000; Breslau & Peterson, 1996; Killen et al., 1996; Kozlowski, Porter, Orleans, Pope, & Heatherton, 1994). Rates of nicotine withdrawal are higher in current smokers compared to recent quitters (Prokhorov et al. 2001), and Kenford et al. (2002) found that the most potent predictor of unsuccessful cessation was negative affect after quitting (a symptom of withdrawal).

The Present Study

The present study makes use of data from the Oregon Adolescent Depression Project

(OADP; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993). As part of this longitudinal study of depression and other psychopathology, extensive information regarding the smoking behavior of a large, randomly-selected representative sample of older adolescents was assessed twice in adolescence (T_1 and T_2) and at a third point (T_3) after age 24. More recently, all T_3 participants who reported any periods of daily smoking in the T_1, T_2, or T_3 interviews were invited to participate in a telephone interview which collected detailed information on lifetime smoking history. In this paper, we examine the degree to which measures of individual psychopathology, familial smoking, and familial psychopathology are associated with successful smoking cessation in young adulthood (defined as not smoking in the 12 months prior to turning 25 years of age). In addition to the two previous papers in this series, we have previously reported the cross-sectional and prospective relationships between cigarette use and psychopathology in adolescence (i.e., from T_1 to T_2; Brown, Lewinsohn, Seeley, & Wagner, 1996; Lewinsohn, Brown, Seeley, & Ramsey, 2000), and the progression from cigarette smoking in adolescence (T_1/T_2) to the development of substance use disorders by young adulthood (i.e., T_3; Lewinsohn, Rohde, & Brown, 1999). The present study extends our previous research by using the three waves of psychiatric assessments from the OADP in conjunction with data obtained from family members.

Throughout the analyses, we also consider gender differences. While current smoking prevalence rates for U.S. men and women are roughly comparable (Escobedo & Peddicord, 1997), females smokers appear to have a greater difficulty achieving successful smoking cessation (Perkins, 2001; Ward, Klesges, Zbikowski, Bliss, & Garvey, 1997; Wetter et al. 1999). The reasons for this discrepancy are unknown but could include lowered efficacy of nicotine replacement methods for women than men, differences in the mood regulation effects of nicotine,

greater concerns about cessation-related weight gains, or less support from husbands compared to the support wives give men in smoking cessation efforts (e.g., Delfino & Whalen, 2001; Perkins, 2001; Perkins, Levine, Marcus, & Shiffman, 1997). Other demographic factors assessed in adolescence (i.e., race/ethnicity, non-intact home, low parental education) and young adulthood (i.e., marital and parenting status, years of education, employment status, household income) also were examined as alternative explanatory factors.

Methods

Participants and Procedures

OADP participants. A total of 1,709 adolescents, randomly selected from nine high schools in western Oregon (mean age = 16.6, range = 14-18 years of age; 61% participation) completed the initial (T_1) assessments between 1987 and 1989 (see Lewinsohn et al., 1993) for additional details). Participants for the original T_1 sample had been recruited in three cohorts (with participation rates of 52%, 62%, and 68%). Rates of smoking initiation in the three cohorts (49%, 46%, and 51%, respectively) and rates of daily smoking (13%, 9%, and 13%, respectively) did not significantly differ, suggesting that differences in participation rates were not associated with differences in smoking behaviors.

Approximately one year later (T_2), 1,507 participants (88%) returned for a re-administration of the interview and questionnaire (mean T_1-T_2 interval = 13.8 months, *SD* = 2.3). Higher attrition from T_1 to T_2 was associated with male gender (46% of T_2 participants vs. 60% of T_2 non-non-completers), lower parental education level, a history of disruptive behaviors disorders (11% vs. 17%) and, for only young men, a history of substance abuse (14% vs. 26%). Regarding smoking, lifetime daily smoking by T_1 was associated with failure to complete T_2

(18% of T_2 participants had been daily smokers vs. 29% of non-completers); $\chi^2(1, 1709) = 11.88$, $p < .001$. Rates of T_1 lifetime psychopathology for the two groups did not significantly differ (30% of T_2 participants vs. 35% of non-completers). Perhaps more important for the present study, T_1 daily smokers who dropped out of the study were not more likely to have a lifetime psychiatric disorder than T_1 daily smokers who completed T_2 (67% vs. 72%, $p = .48$). Similarly, T_1 male smokers who dropped out did not have higher rates of psychopathology than T_1 male smokers who completed T_2 (63% vs. 64%, $p = .91$)

Additional funding was received to follow the course of psychopathology among OADP participants into young adulthood. Between 1993 and 1999, as participants reached their 24th birthday, all individuals with a history of psychopathology and a randomly selected set of participants with no history of psychiatric disorder ($N = 1,101$) were invited to the T_3 telephone interview. Sampling of the no-disorder comparison group was proportional to age and gender within age; all participants with non-White race were retained in the sample. Given our planned under-sampling of individuals with no history of psychopathology, the selected T_3 sample had a much higher proportion of individuals with lifetime psychopathology at T_2 (47% vs. 0%); $\chi^2(1, 1507) = 291.92$, $p < .001$, and a larger proportion of daily smokers (78% vs 61%); $\chi^2(1, 1507) = 11.85$, $p < .001$, compared to T_2 participants who were not invited to complete the T_3 interview.

T_3 data were obtained from 941 individuals (85% participation of selected T_2 sample; 55% of original T_1 sample), with a mean interval between T_2 and T_3 of 6.8 years ($SD = 1.4$). A total of 57% of the T_3 participants were female, 89% were White, 54% had lived with both biological parents at T_1; and 45% had one or more parents with a college education. Attrition at T_3 was associated with male gender (57% of T_3 participants were female versus 42% of T_3 non-

participants); $\chi^2(1, 1101) = 13.54$, $p < .001$, and with younger age at T_2 (T_3 participants $M = 17.8$ [$SD = 1.3$] versus T_3 non-participants $M = 17.5$ [$SD = 1.2$] years old); $t(1095) = 2.64$, $p < .01$, but was unrelated to race/ethnicity, maximum parental education, or residing with both biological parents at T_2. Of the 1,101 T_2 participants selected for T_3, completion of the T_3 was associated with neither T_2 daily smoking (24% of participants vs. 24% of non-completers) nor T_2 lifetime psychopathology (48% of participants vs. 45% of non-completers). Given the higher attrition rate for men than women, it was important to note that T_2 male daily smokers who declined to participate in T_3 did not have higher rates of lifetime psychopathology than T_2 male daily smokers who completed T_3 (91% vs. 83%, $p = .50$).

Family members. As a separate project, biological parents and full siblings of the T_3 participants were recruited and interviewed for lifetime psychopathology and smoking, with the goal of obtaining two sources of data for each family member (either direct and informant interviews or two informant interviews). Data were obtained between 1995 and 1998 on 806 families (86% of T_3 interviewed participants), which represented 2,646 individuals (803 mothers, 788 fathers, and 1,055 siblings). Approximately two-thirds of the biological fathers (68%) resided with the OADP participant at T_1, as had 89% of the biological mothers. Mean age of the siblings at the time of their assessment was 25.2 years ($SD = 5.7$).

Assessment of Psychopathology and Daily Smoking in the OADP Participant

Psychiatric disorders. Participants were interviewed at T_1 with a version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS; Orvaschel, Puig-Antich, Chambers, Tabrizi, & Johnson, 1982) designed to assess all major disorders as per DSM-III-R criteria. Participants at T_2 and T_3 were interviewed using the Longitudinal Interval Follow-

up Evaluation (LIFE; Keller et al., 1987), which provided detailed information about the onset and course of disorders since the T_1 interview.

Almost all diagnostic interviewers had advanced degrees in clinical or counseling psychology or social work and all completed a 70-hour training in diagnostic interviewing. Prior to conducting interviews, interviewers were required to demonstrate a minimum kappa (Cohen, 1960) of .80 across all symptoms for two consecutive training interviews. All interviews were recorded and a randomly-selected 12% were reviewed by a second interviewer. With few exceptions, inter-rater kappas for current and lifetime diagnoses at T_1 and T_2 exceeded .80 (Lewinsohn et al., 1993).

The T_3 interview repeated the T_2 procedures, assessing all disorders as per DSM-IV criteria. Because a significant proportion of participants no longer resided in the area, we shifted to a telephone assessment format for the T_3 diagnostic assessments. We previously showed that diagnostic agreement between the telephone and face-to-face assessment formats was very good to excellent (Rohde, Lewinsohn, & Seeley, 1997).

Antisocial and borderline personality disorders were assessed in the T_3 interview using relevant portions of the Personality Disorder Examination (PDE; Loranger, 1988). Because the rates of antisocial and borderline personality disorders were very low (1.3% each), the PDE dimensional scores were dichotomized at approximately the 90^{th} percentile (antisocial cutoff score ≥ 7; borderline cutoff score ≥ 4) and used as an indicator of Axis II psychopathology. Inter-rater reliability of the PDE dimensional scores (i.e., summation of partial and full symptom criteria) was excellent (Interclass correlations > .80).

On the basis of adequate prevalence rates (5% or greater), eight diagnostic categories of

lifetime (to T_3) psychopathology were examined (rates of disorder among the 242 daily smokers examined in the present study are included in parentheses): (1) MDD (*n* = 158, 65.3%); (2) dysthymia (*n* = 20, 8.3%); (3) alcohol use disorders (ALCOHOL; *n* = 111, 45.9%) (4) drug (other than alcohol) use disorders (DRUG; *n* = 105, 43.4%), (5) anxiety disorders (*n* = 63, 26.0%), (6) ADHD and disruptive behavior disorders (ADHD/DIS; *n* = 40, 16.5%)); (7) elevated antisocial personality disorder symptomatology (*n* = 41, 17.7%), and (8) elevated borderline personality symptomatology (*n* = 19, 8.2%).

Smoking data. As part of the T_1-T_3 interviews, information was obtained by the K-SADS regarding daily smoking (for a month or more) prior to age 24 (*N* = 381). As part of a separate project focused on the associations between cigarette smoking and psychopathology, all T_3 participants were invited to complete a mailer questionnaire assessing smoking behaviors (e.g., reactions to first cigarettes, patterns of lifetime smoking, beliefs about smoking, smoking-related physical symptoms) and related factors (e.g., smoking among peers as an adolescent, smoking in current living environment). Twenty-one individuals who had not reported daily smoking by T3 reported on the Smoking Questionnaire that they had experienced a period of daily smoking. Thus, we identified a total of 402 daily smokers from all assessment sources.

We attempted to reach all 402 daily smokers to complete a telephone-administered Smoking Interview, which gathered information on lifetime history of smoking behavior, including the timing and length of smoking quit attempts. This information allowed us to classify daily smokers based on the presence or absence of smoking in the 12 months prior to turning age 25. The interview also assessed symptoms of nicotine withdrawal and dependence, using relevant sections from the National Institute of Mental Health-Diagnostic Interview Schedule (NIMH-DIS;

Anthony et al., 1985). The audiotapes of 29 randomly-selected Smoking Interviews in the present study were reviewed and rated by a second interviewer for inter-rater agreement. Using the intra-class correlation coefficient (3,1), excellent inter-rater agreement was found for both nicotine dependence and withdrawal, *ICC* = .99 and .98, respectively.

In total, 263 of 402 potentially eligible participants (65%) completed the Smoking Interview. Participants ranged from ages 25.5 to 32.2 (mean = 28.2, *SD* = 1.4) at the time of the Smoking Interview. Completion of the Smoking Interview was associated with female gender (61% of Smoking Interview participants were female versus 40% of non-participants; $\chi^2(1, 391) = 16.7$, $p < .001$), with having an MDD history (64% of participants had a history of MDD versus 53% of non-participants; $\chi^2(1, 391) = 4.8$, $p < .05$), and with having a dysthymia history (8% of participants had a history of dysthymia versus 3% of non-participants; $\chi^2(1, 391) = 3.98$, $p < .05$), but was not significantly related to any of the other variables examined from the T_1-T_3 interviews (i.e., ethnicity, parental education, intact home at T_1, other psychiatric disorders, parental and sibling smoking, and family history of psychiatric disorders). Associations between attrition and both MDD and dysthymia were no longer significant when controlling for female gender, suggesting that gender was the primary correlate of attrition from T_3 to the Smoking Interview. Daily smokers who did not complete the Smoking Interview (n = 139) did not differ significantly from those who did complete the interview (n = 263) on age of first smoking as assessed at the T_1-T_3 interviews, $p = .64$. There also were no significant differences at the T_3 interview on lifetime maximum number of cigarettes smoked per week or having ever quit smoking prior to the interview, ps > .25. Of the 263 participants completing the Smoking Interview, 242 reported that they had begun regular daily smoking prior to the age of 25. Analyses are limited to these

individuals given our focus on quitting smoking by young adulthood.

Assessment of Psychopathology and Regular Smoking in Family Members

Parents and siblings over the age of 18 were interviewed with the Structured Clinical Interview for DSM-IV, nonpatient version (SCID-NP; Spitzer, Williams, Gibbon, & First, 1992) and the Antisocial and Borderline Personality Disorders sections of the SCID-II. Siblings between the ages of 14 and 18 received the version of the K-SADS employed in the T_1 OADP assessment, updated to assess disorders as per DSM-IV criteria.

Wherever possible, two sources of lifetime psychiatric information for each family member are obtained. OADP participants were asked to provide diagnostic information about their first degree relatives as per the Family Informant Schedule and Criteria (FISC; Mannuzza & Fyer, 1990). Other family members (most often the mother) were asked to provide additional informant data, if necessary. Interviews were conducted blind to OADP participant diagnoses and each interviewers evaluated no more than two members of any family. Inter-rater reliabilities have previously been shown to be very good to excellent (Lewinsohn, Rohde, Klein, & Seeley, 1999). Best-estimate diagnoses (Leckman, Sholomskas, Thompson, Belanger, & Weissman, 1982) were derived for all relatives using all available data by the four doctoral-level diagnosticians.

Family psychopathology, defined as having one or more family members with the disorder of interest, was examined for the following categories: (1) affective disorders (70.3% of participants who completed the Smoking Interview had one or more family members with a mood disorder), (2) drug and alcohol use disorders (80.2% of participants in Smoking Interview), (3) anxiety disorders (38.7% of participants in Smoking Interview), and (4) externalizing disorders, which included ADHD, conduct disorder, oppositional defiant disorder, and elevated antisocial

personality disorder scores (30.2% of participants in Smoking Interview).

Regular smoking among family members. Tobacco use by family members was assessed as part of the diagnostic interview. Three variables were created based on whether the mother, the father, or a sibling (one or more) had ever been a regular smoker, which was defined as smoking 10 or more cigarettes a day for at least one month. Lifetime rates of regular smoking were 50.5% for mothers, 67.0% for fathers, and 33.5% for siblings of participants completing the Smoking Interview.

Statistical Analyses

The primary outcome variable for the current paper was smoking cessation of 12 months or longer at age 25. Participants who had begun daily smoking prior to turning 25 but had not smoked at all during the 12 months prior to turning 25 (n = 53, 21.9%) were considered "quitters," although some of these individuals might have later returned to smoking. The cut-off of age 25 was used so that all participants were evaluated for smoking status at the same age, which corresponds to the period following completion of the T3 interview. Those who reported any smoking during the 12 months prior to turning 25 (n = 189, 78.1%) were considered "non-quitters." We also collected and report descriptive data on the number of quit attempts individuals had made prior to the age of 25 and the length and timing of those quit attempts.

Within the sample of 242 participants reporting daily smoking prior to the age of 25, associations between successful smoking cessation and the occurrence of psychiatric disorders, family smoking, family psychopathology, and smoking characteristics were examined using weighted logistic regression (*LR*) models. These *LR*s were conducted in SUDAAN (Shah, Barnwell, & Bieler, 1997) with sampling weights used to correct the under-representation of

White participants without mental disorders that occurred due to planned oversampling at T_3 of non-Whites and those with lifetime psychopathology. The presence or absence of family smoking and psychiatric disorder category prior to the age of 25 was calculated by combining data from the T_1, T_2, and T_3 waves of assessment. Four T_1 demographic variables were examined as alternative explanatory factors: male gender (Yes/No), white ethnicity (Yes/No), non-intact home (was the participant living with both biological parents at T1? Yes/No), and low parental education (had either parent completed college at T_1? Yes/No). In addition, five demographic variables measured at the T_3 assessment were examined for possible associations with quitting smoking: currently married (Yes/No), currently raising children (Yes/No), years of school completed, employment during the past year (dichotomized as employed for 52 weeks vs. employed for less than 52 weeks), and total household income.

The statistical significance of effects was determined by odds ratios (*OR*), with 95% confidence intervals (*CI*) provided by SUDAAN. In each set of LR analyses, the interactions between predictor variables and gender were tested to determine whether gender moderated the observed associations. Finally, to assess the effects of significant univariate predictors of quitting in a multivariate context, we entered the variables demonstrating significant effects into a weighted multiple logistic regression (*MLR*) to determine significant associations controlling for other effects.

Results

Of the 242 participants who had begun daily smoking prior to turning age 25, 53 (21.9%) reported that they had not smoked at all during the 12 months prior to turning 25. This compares to 189 participants (78.1%) who reported smoking at least some during the 12 months prior to age

25. Eighty-three percent of the daily smokers (200/242) reported having made at least one quit attempt (lasting at least 24 hours) prior to age 25, although the median and modal (n = 83, 34.4%) number of quit attempts lasting at least one day prior to age 25 was 1. The median length of longest quit attempt was 365 days, with ninety-three participants (38.5%) reporting that they had made at least one quit attempt since becoming a daily smoker and prior to the age of 25 that had lasted for at least one year. The mean age of first smoking was 13.8 years (SD = 3.5), and the mean onset age of daily smoking was 17.3 years (SD = 3.1). Of those who made a quit attempt, the median length of time from beginning daily smoking to making a quit attempt (of at least 24 hours) was 27 months. Full criteria for lifetime nicotine dependence was met by 63.9% of the sample, and 37.8% reported having had nicotine withdrawal.

Univariate Associations with Quitting Smoking

Table 1 shows the raw proportion of individuals quitting smoking based on whether specific variables were present or absent. The significance of univariate associations with quitting smoking were examined in a series of weighted *LR* analyses. In each model, the independent variable was entered, followed by gender, and the interaction with gender (unless noted, interactions with gender were nonsignificant). Odds ratios (*OR*) based on the weighted *LR* results are presented in Table 1 along with the 95% confidence intervals for significant *OR*s. Results are discussed by category.

Insert Table 1 about here

Demographics. None of the four T_1 demographic variables were associated with quitting

smoking at the $p < .05$ level. Daily smokers who were currently married, however, were approximately three times more likely to have quit smoking by age 25. Greater household income in young adulthood was also associated with a greater odds of successful smoking cessation.

Lifetime psychopathology. Two of the eight lifetime psychiatric categories were associated significantly with reduced odds of quitting by age 25: MDD and elevated antisocial personality disorder scores. Taking the inverse of the odds ratio, the odds of successful cessation were 2.5 times greater if the daily smoker did not have a history of MDD compared to daily smokers who had a history of MDD. Similarly, the odds of cessation were 3.3 times higher if the daily smoker did not have an elevated antisocial personality disorder score. None of diagnostic categories interacted significantly with gender in their association with quitting smoking.

Family member smoking. Measures of daily smoking by mothers, fathers, and siblings were not significantly associated with successful smoking cessation.

Family psychopathology. The presence of drug and alcohol use disorders among family members was associated significantly with reduced odds of quitting by age 25. Taking the inverse of the odds ratio, the odds of successful cessation were 2.3 times greater if the daily smoker did not have a family history of drug/alcohol use disorders compared to daily smokers who had this family history. The presence of other psychiatric disorders in the family and all interactions were gender were unrelated to successful smoking cessation.

Smoking-related variables. One smoking-related variable, having met lifetime criteria for nicotine dependence, was associated with lower odds of quitting smoking by age 25. The odds of successful cessation were 2.9 times greater for daily smokers who were not nicotine dependent. However, the interaction between nicotine dependence and gender was significant, $OR = 7.6$, $p =$

.012. For men, the odds of smoking cessation were not associated with nicotine dependence (20.9% of nicotine dependent men quit vs. 14.8% of non-nicotine dependent men; $p = .63$). For women, however, those who were nicotine dependent were 5.7 times less likely to quit smoking compared to those who were not (rates of quitting were 12.6% vs. 38.3%, respectively; $p < .001$). The main effect of male gender also was significant in this MLR (adjusted *OR* = 0.24, $p = .028$), indicating that among those who were not nicotine dependent, men were less likely than women to quit smoking.

Multivariate Associations with Quitting Smoking

Given that T_3 marital status, T_3 household income, MDD, elevated antisocial personality disorder scores, a family history of drug and alcohol use disorders, a history of nicotine dependence, and the gender by nicotine dependence interaction were significantly associated with the odds of smoking cessation by age 25, we ran an *MLR* to examine the effects of these variables when considered simultaneously. In this analysis, we also controlled for male gender given its inclusion in the interaction term. In this model, the effects of T_3 marital status (adjusted *OR* = 2.37), nicotine dependence (adjusted *OR* = 0.21), male gender (adjusted *OR* = 0.21), and the gender by nicotine dependence interaction (adjusted *OR* = 9.3) remained significantly associated with the odds of successful smoking cessation. The effect of MDD was just over the $p < .05$ level (adjusted *OR* = 0.4, $p = .052$). The effects of household income ($p = .18$) and antisocial personality disorder scores ($p = .22$), and a family history of substance use disorder ($p = .10$) were not significant in the *MLR*.

Discussion

The present study examined the psychiatric and familial factors associated with successful

smoking cessation. Most daily smokers in the present study (83%) had tried to quit, although only 22% met our definition of successful cessation at the age of 25. An additional 16% of daily smokers had quit for 12 months or more in the past but were smoking again by age 25. While more than three-fourths of the smokers attempted to stop smoking, the modal number of quit attempts was only one. Given that participants were examined at age 25, many are still relatively early in their smoking careers and the number of quit attempts will inevitably increase as they age. Previous research has found that the median age of smoking cessation for individuals who begin smoking as adolescents is 33 years of age for men and 37 years of age for women (Pierce & Gilpin, 1996).

Lifetime Psychopathology

MDD was the only Axis I disorder associated with successful cessation: 16% of the daily smokers with lifetime MDD had quit compared to 33% of those with no history of MDD. Several studies have previously reported that depression is associated with lower rates of successful smoking cessation (e.g., Breslau & Klein, 1999; Glassman, Helzer, Covey, Glassman, & Stetner, 1990; Colby et al., 1998; Burt & Peterson, 1998; Jorm, Rodgers, Jacomb, Christensen, Henderson, & Korten, 1999). Given that the lifetime presence of neither dysthymia nor anxiety disorders was related to smoking cessation (or initiation or progression to daily smoking in our previous studies in this series), MDD appears to be the only internalizing disorder related to or influencing smoking behavior.

Perhaps what is more surprising in the present study is that the remaining Axis I disorders were unrelated to smoking cessation, even at the univariate level. Thus, lifetime Axis I psychopathology appears to have a much more limited association with smoking cessation in

young adulthood compared to associations with either smoking initiation or progression to daily smoking. In our first study of this series (Rohde et al., 2003), smoking initiation was associated with almost all of the examined psychiatric disorders, including MDD, alcohol and drug use disorders, and ADHD/disruptive behavior disorders. The same disorders were associated with progression from initiation to daily smoking in our second study (Rohde et al., in press). Not only were more psychiatric disorders associated with the two stages of smoking that emphasize escalation, in multivariate analyses, the externalizing but not internalizing disorders remained significantly associated with both smoking initiation and progression to daily smoking. Others have reported a similar pattern in which externalizing disorders overshadow the impact of internalizing disorders in relation to smoking acquisition and escalation (e.g., Ferdinand, Blum, & Verhulst, 2001; Miller-Johnson, Lochman, Coie, Terry, & Hyman, 1998), perhaps because externalizing disorders are more strongly associated with personality traits such as disinhibition, risk taking, and behavior regulation deficits, which increase the likelihood of smoking onset (e.g., Brook, Whiteman, Czeisler, Shapiro, & Cohen, 1997; White, Pandina, & Chen, 2002).

Clearly, the etiology of smoking cessation differs from the etiology of smoking onset, with depression playing a much more prominent role in cessation. Kassel, Stroud, and Paronis (2003) recently reviewed the literature examining associations between stress, negative affect (which includes but is not limited to MDD), and various stages of smoking. Variations of thirteen models are described, which are grouped into three categories. The first category consists of models in which smoking has a direct effect on stress and negative affect through effects on opiod mechanisms, dopaminergic reinforcement pathways, or changes in the sympathetic nervous system response to stress. The second category consists of models in which mediators and

moderators influence the effect of smoking on stress and negative affect, including differences in personality traits, coping styles, or smoking's effects on attention, cognitive performance, and interpersonal functioning. The third category consists of models in which stress and negative affect influence smoking, including nicotine withdrawal escape, expectancy effects, changes in the sensitivity and availability of nicotine in the smoker's system, and cross-sensitization of the dopaminergic pathways by stress and nicotine. Varying degrees of evidence exist for several of the models, but the model which appears to most directly account for the role of depression (and nicotine dependence) is the nicotine withdrawal escape model (e.g., Parrott, 1999), in which smokers achieve a reduction in negative affect through relief of nicotine withdrawal symptoms. Pomerleau and Pomerleau (1984) in discussing this association, propose that through repeated pairings of negative affect due to nicotine withdrawal with the alleviation of that negative affect through smoking, smokers come to associate all negative affective states regardless of their cause as a stimuli to smoke. These two models are most consistent with the overall pattern of our findings, in that they apply to depression but not externalizing disorders and because they explain smoking maintenance but not smoking initiation or progression to daily smoking.

Antisocial personality disorder symptoms had a strong negative association with smoking cessation in univariate analyses, although not in multivariate analyses. Among the daily smokers who were elevated on the antisocial personality disorder dimension, only 10% were not smoking at age 25. We previously reported (Rohde et al., in press) that 94% of the participants with elevated antisocial PD scores who experimented with smoking progressed to daily smoking. Antisocial personality disorder appears to be an extremely salient factor in the acquisition of smoking and in smoking cessation. Also noteworthy is the finding that only 5% of the daily

smokers with elevated borderline personality disorder symptoms had successfully quit by age 25, compared to 23% of the daily smokers who were not elevated on this dimension. While not statistically significantly given the low number of individuals elevated on this dimension, this difference appears clinically meaningful and worthy of additional focus. To our knowledge, the role of personality disorders in smoking behavior has not received adequate clinical or research attention.

Familial Smoking

While we previously reported that regular smoking by one's mother and by a sibling was associated with smoking initiation (Rohde et al., 2003) and regular smoking by one's father was associated with progression to daily smoking (Rohde et al., in press), none of the measures of familial smoking were associated with successful smoking cessation. In retrospect, this negative finding makes intuitive sense: all of the variance associated with familial smoking was already accounted for because all of the participants were daily smokers. The effects of familial smoking as measured in the present study appear to be minimal. Our tentative conclusion is that familial smoking predicts the acquisition of smoking but not smoking cessation.

Perhaps the relevant familial factor is not parental or sibling smoking per se but whether a family member who smokes was able to successfully quit. Previous research indicates that adolescents whose parents had quit smoking were less likely to try smoking compared to adolescents whose parents were current smokers, and adolescent smokers whose parents had quit were twice as likely to quit compared to those whose parent still smoked (Farkas et al., 1999). One problem in analyzing this hypothesis is that this set of analyses would have be to restricted to participants who had a family member who smoked. Another factor in this area of research is that

parental smoking cessation appears to reduce smoking rates in offspring only if the other parent does not smoke (Chassin, Presson, Rose, Sherman, & Prost, 2002).

Familial Psychopathology

One of the four categories of familial psychopathology was associated with lower smoking cessation in the present study: 19% of participants with a family history of substance use disorders quit smoking compared to 33% of those without this family history. This association was particularly noteworthy given that alcohol and drug use disorders in the participant were not significantly related to smoking cessation. We previously found that some forms of familial psychopathology were associated with smoking behavior, although none were retained in multivariate analyses. Specifically, affective disorders and substance use disorders in the family were associated with smoking initiation, whereas externalizing disorders in family members were associated with progression to daily smoking. The pattern of findings across the three studies suggests that the presence of psychopathology, perhaps substance abuse and dependence in particular, in one's parents and siblings has a small but significant negative role in smoking among young people.

Smoking Characteristics

As expected, the presence of nicotine dependence had a robust negative association with successful cessation. Interestingly, this association was significant in the present study only for female daily smokers; rates of quitting among nicotine dependent and non-dependent men did not differ. While several studies have reported nicotine dependence as a predictor of unsuccessful smoking cessation (e.g., McDonald, Roberts, & Descheemaeker, 2000; Breslau & Johnson, 2000; Breslau & Peterson, 1996; Kozlowski, Porter, Orleans, Pope, & Heatherton, 1994), we are

unaware of any previous research suggesting this particular gender interaction. Among daily smokers who were not nicotine dependent, the converse appeared to be true: men were less likely to quit compared to women (14.8% vs. 38.3%). Rose et al. (1996) reported that female gender was associated with making a quit attempt but not with successful smoking cessation, whereas low smoking quantity (which is negatively related to nicotine dependence) was unrelated to making a quit attempt but was a strong predictor of successful smoking cessation.

Gender and Other Demographic Differences

Gender was unrelated to successful smoking cessation as a main effect but had several significant associations in moderation with nicotine dependence, as noted above. None of the four demographic measures assessed in adolescence (T_1) were associated with successful smoking cessation, although daily smokers who had successfully quit by age 25 were more likely to be married and to have higher household incomes. Being married has been previously shown to be associated with smoking cessation (e.g., Khuder, Dayal, & Mutgi, 1999; Derby, Lasater, Vass, Gonzalez et al., 1994) and lower income has been found to be associated with lower smoking quit rates (e.g., Centers for Disease Control, 2002). Both of these demographic factors of young adulthood were retained in the multiple logistic regression, indicating their unique associations with successful smoking cessation in the present study.

Limitations and Conclusions

The present study has a number of limitations which should be noted. First, attrition occurred at all of the follow-up assessments and daily smokers were more likely to drop out of the study between T_1 to T_2. In addition, participation rates in the Smoking Interview were lower than preferred, especially for male smokers. However, we found no evidence at any assessment point

that male smokers who declined further participation in the project had higher rates of psychopathology compared to male smokers who remained in the study. Nonetheless, the observed associations might be influenced by participation biases, and all findings need to be interpreted cautiously pending independent replication.

Second, the examined variables consisted of lifetime risk factors. Thus, we were not describing psychopathology prior to or during the time of smoking cessation. By collapsing current and past psychopathology, we may have missed some associations with smoking cessation. For example, Breslau and colleagues (Breslau, Peterson, Schultz, & Andreski, 1996) found that smokers with current alcohol use disorders were less likely to quit, whereas smokers with past alcoholism had smoking quit rates comparable to non-alcoholics. Keuthen et al. (2000) found that lifetime mood, anxiety, and SUD disorders were not associated with treatment outcome in a smoking cessation study, although lower depression levels (BDI scores) were associated with higher frequency of abstinence in those with no history of psychiatric disorder.

Third, several factors potentially very relevant to smoking cessation were not assessed. Rather, our focus was on a subset of potential risk factors which we attempted to assess as thoroughly and rigorously as possible. Multivariate analyses examining a broader set of variables would be informative. For example, in our previous research examining factors associated with smoking status during adolescence (Lewinsohn et al., 2000), several psychosocial factors (e.g., minor stressors, conflicts with parents, low academic aspirations and poor academic performance, peer smoking) were associated with reduced odds of successful smoking cessation in the following one year period. Factors that may be particularly associated with smoking cessation include attitudes and beliefs regarding smoking, stated intentions to quit, parent practices and

parental discussions regarding smoking, and restrictions on smoking either at home or in the workplace (e.g., Chassin, Presson, Todd, Rose, & Sherman, 1998; Gilpin, White, Farkas, & Pierce, 1999; Halpern & Warner, 1993; Hennrikus, Jeffery, & Lando, 1995; Pierce, Farkas, & Gilpin, 1998; Rose et al., 1996; West, McEwen, Bolling, & Owen, 2001).

The use of telephone assessments at T_3 and the Smoking Interview may be a potential limitation, given that telephone interviews sometimes result in a small degree of under-reporting of smoking behavior (e.g., Luepker, Pallonen, Murray, & Pirie, 1989). However, we previously reported that telephone and face-to-face interviews of psychopathology yielded basically comparable reports (Rohde et al., 1997).

Fourth, the sample was predominantly White and the pattern of associations may differ in other race/ethnicity groups. For example, parental smoking may have a stronger association with offspring smoking for White children than for African-American or Hispanic children (Griesler & Kandel, 1998).

A limitation regarding the role of nicotine dependence is that a portion of the daily smokers in our sample may not have yet developed dependence. Breslau, Johnson, Hiripi and Kessler (2001) found that almost all daily smoking had developed by age 25, whereas the onset of nicotine dependence continued until participants were in their forties. Similarly, our definition of successful smoking cessation was based solely on smoking status in the year prior to age 25. Thus, we may have incorrectly classified the nicotine dependence and smoking cessation status of some participants.

The present study also has a number of strengths. Results were based on a relatively large subset of a large community sample, and standardized procedures for assessing smoking and

lifetime psychopathology were used. Our use of reliably-assessed DSM diagnostic categories represents an important strength of the study. Most research in the area of smoking has assessed lower levels of substance use or has assessed symptoms of psychopathology by self-report questionnaire.

A unique contribution of the present study was the inclusion of familial smoking and psychopathology data, generally obtained by direct report (as opposed to the more commonly used informant report). As pointed out in our review of the literature, the impact of psychopathology (at least Axis I disorders) and smoking characteristics on smoking cessation have been previously examined. However, to our knowledge, this is the first time that psychopathology and familial factors on smoking cessation have been examined simultaneously or in this much detail. By examining this array of variables simultaneously, our findings illustrate the unique associations with smoking cessation among daily smokers. The causal nature of the significant associations and the degree to which modification of these factors increases the probability of future smoking cessation deserve further attention.

References

Anda, R. F., Williamson, D. F., Escobedo, L. G., Mast, E. E., Giovino, G. A., & Remington, P. L. (1990). Depression and the dynamics of smoking: A national perspective. *Journal of the American Medical Association, 264*, 1541-1545.

Anthony, J. C., Folstein, M., Romanoski, A. J., Von Korff, M. R., Nestadt, G. R., Chahal, R., Merchant, A., Brown, C. H., Shapiro, S., & Kramer, M. (1985). Comparison of the Lay Diagnostic Interview Schedule and a standardized psychiatric diagnosis: Experience in Eastern Baltimore. *Archives of General Psychiatry, 42*, 666-675.

Becona, E., Vasquez, F. L. & Miguez, M. (2002). Smoking cessation and anxiety in a clinical sample. *Personality and Individual Differences, 32*, 489-494.

Brandon, T. H., Juliano, L. M., & Copeland, A L. (1999). Expectancies for tobacco smoking. In I. Kirsch (Ed..), *How expectancies shape experience* (pp. 263-299). Washington, DC: American Psychological Association.

Breslau, N., & Johnson, E. O. (2000). Predicting smoking cessation and major depression in nicotine-dependent smokers. *American Journal of Public Health, 90*, 1122-27.

Breslau, N., Johnson, E. O., Hiripi, E., & Kessler, R. (2001). Nicotine dependence in the United States: Prevalence, trends, and smoking persistence. *Archives of General Psychiatry, 58*, 810-816.

Breslau, N., Kilbey, M., & Andreski, P. (1991). Nicotine dependence, major depression, and anxiety in young adults. *Archives of General Psychiatry, 48*, 1069-1074.

Breslau, N., Kilbey, M., & Andreski, P. (1993). Nicotine dependence and major depression: New evidence from a prospective investigation. *Archives of General Psychiatry, 50*, 31-35.

Breslau, N., & Klein, D. F. (1999). Smoking and panic attacks: An epidemiologic investigation. *Archives of General Psychiatry, 56*, 1141-1147.

Breslau, N., & Peterson, E. L. (1996). Smoking cessation in young adults: Age at initiation of cigarette smoking and other suspected influences. *American Journal of Public Health, 86*, 214-220.

Breslau, N., Peterson, E., Schultz, L., & Andreski, P. (1996). Are smokers with alcohol disorders less likely to quit? *American Journal of Public Health, 86*, 985-990.

Breslau, N., Peterson, E. L., Schultz, L. R., Chilcoat, H. D., & Andreski, P. (1998). Major depression and stages of smoking: A longitudinal investigation. *Archives of General Psychiatry, 55*, 161-166.

Brook, J. S., & Whiteman, M. (1997). Cigarette smoking in young adults: Childhood and adolescent personality, familial, and peer antecedents. *Journal of Genetic Psychology, 158*, 172-189.

Brook, J. S., Whiteman, M., Czeisler, L. J., Shapiro, J., & Cohen, P. (1997). Cigarette smoking in young adults: Childhood and adolescent personality, familial, and peer antecedents. *Journal of Genetic Psychology, 158*, 172-188.

Brown, R. A., Lewinsohn, P. M., Seeley, J. R., & Wagner, E. F. (1996). Cigarette smoking, major depression and other psychiatric disorders among adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 35*, 1602-1610.

Burt, R. D., & Peterson, A. V. (1998). Smoking cessation among high school seniors. *Preventive Medicine, 27*, 319-327.

Cargill, B. R., Emmons, K. M., Kahler, C. W., & Brown, R. A. (2001). The relationship among

alcohol use, depression, substance use and motivation to quit smoking with hospitalized smokers. *Psychology of Addictive Behavior, 15*, 272-275.

Centers for Disease Control and Prevention. (1997 -12/5). Efforts to quit smoking among persons with a history of alcohol problems - Iowa, Kansas, & Nebraska, 1995-1996. *Morbidity and Mortality Weekly Report, 46(48)*, 1148.

Centers for Disease Control and Prevention. (2002 -7/26). Cigarette smoking among adults – United States, 2000. *Morbidity and Mortality Weekly Report, 51 (29*), 642-645.

Chassin, L., Presson, C. C., Pitts, S. C., & Sherman, S. J. (2000). The natural history of cigarette smoking from adolescence to adulthood in a Midwestern community sample: Multiple trajectories and their psychosocial correlates. *Health Psychology, 19*, 223-231.

Chassin, L., Presson, C. C., Rose, J. S., & Sherman, S. J. (1996). The natural history of cigarette smoking from adolescence to adulthood: Demographic predictors of continuity and change. *Health Psychology, 15*, 478-484.

Chassin, L., Presson, C. C., Rose, J. S., & Sherman, S. J. (2002). Parental smoking cessation and adolescent smoking. *Journal of Pediatric Psychology, 27*, 485-96.

Chassin, L., Presson, C. C., Todd, M., Rose, J. S., & Sherman, S. J. (1998). Maternal socialization of adolescent smoking: The intergenerational transmission of parenting and smoking. *Developmental Psychology, 34*, 1189-1201.

Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement, 20*, 37-46.

Colby, S. M., Monti, P. M., Barnett, N. P., Rohsenow, D. J., Weissman, K., Spirito, A., et al. (1998). Brief motivational interviewing in a hospital setting for adolescent smoking: A

preliminary study. *Journal of Consulting and Clinical Psychology, 66*, 574-578.

Covey, L. S., Glassman, A. H., & Stetner, F. (1990). Depression and depressive symptoms in smoking cessation. *Comprehensive Psychiatry, 31*, 350-354.

Dawson, D. A. (2000). Drinking as a risk factor for sustained smoking. *Drug and Alcohol Dependence, 59*, 235-249.

Delfino, R. J. & Whalen, C. K. (2001). Temporal analysis of the relationship of smoking behavior and urges to mood states in men versus women. *Nicotine and Tobacco Research, 3*, 235-248.

Derby, C.A., Lasater, T.M., Vass, K., Gonzalez, S., & Carelton, R.A. (1994). Characteristics of smokers who attempt to quit and of those who recently succeeded. *American Journal of Preventive Medicine, 10*, 327-34.

Derzon, J. H., & Lipsey, M. W. (1999). Predicting tobacco use to age 18: A synthesis of longitudinal research. *Addiction, 94*, 995-1006.

Dierker, L. C., Avenevoli, S., Merikangas, K. R., Flaherty, B. P., & Stolar, M. (2001). Association between psychiatric disorders and the progression of tobacco use behaviors. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 1159-1167.

Escobedo, L. G., & Peddicord, J. P. (1997). Long-term trends in cigarette smoking among young U.S. adults. *Addictive Behaviors, 22*, 427-430.

Farkas, A. J., Distefan, J. M., Choi, W. S., Gilpin, E. A., & Pierce, J. P. (1999). Does parental smoking cessation discourage adolescent smoking? *Preventive Medicine, 28*, 213-218.

Ferdinand, R. F., Blum, M., & Verhulst, F. C. (2001). Psychopathology in adolescence predicts substance use in young adulthood. *Addiction, 96*, 861-870.

Gilpin, E. A., White, M. M., Farkas, A. J., & Pierce, J. P. (1999). Home smoking restrictions: Which smokers have them and how they are associated with smoking behavior. *Nicotine and Tobacco Research, 1*, 153-62 .

Glassman, A. H., Helzer, J. E., Covey, L. S., Cottler, L. B., Stetner, F., Tipp, J. E., & Johnson, J. (1990). Smoking, smoking cessation, and major depression. *Journal of the American Medical Association, 264*, 1546-1549.

Griesler, P. C., & Kandel, D. B. (1998). Ethnic differences in correlates of adolescent cigarette smoking. *Journal of Adolescent Health, 23*, 167-180.

Halpern, M., & Warner, K. (1993). Motivations for smoking cessation: A comparison of successful quitters and failures. *Journal of Substance Abuse, 5*, 237-256.

Harrell, J. S., Bangdiwala, S. I., Deng, S., Webb, J. P., & Bradley, C. (1998). Smoking initiation in youth: The roles of gender, race, socioeconomics, and developmental status. *Journal of Adolescent Health, 23*, 271-279.

Haukkala, A., Uutela, A., Vartiainen, E., Mcalister, A., & Knekt, P. (2000). Depression and smoking cessation: The role of motivation and self-efficacy. *Addictive Behaviors, 25*, 311-316.

Hays, J. T., Schroeder, D. R., Offord, K. P., Croghan, I. T., Patten, C. A., Hurt, R. D., et al. (1999). Response to nicotine dependence treatment in smokers with current and past alcohol problems. *Annals of Behavioral Medicine, 21*, 244-250.

Heath, A. C., Madden, P. A. F., Slutske, W. S., & Martin, N. G. (1995). Personality and the inheritance of smoking behavior: A genetic perspective. *Behavior Genetics, 25*, 103-117.

Hurt, R. D., Dale, L. C., Offord, K. P., Croghan, I. T., Hays, J. T., & Gomez-Dahl, L. (1995).

Nicotine patch therapy for smoking cessation in recovering alcoholics. *Addiction, 90*, 1541-1546.

Johnston, L., Bachmann, J., & O'Malley, P. (1992). *Monitoring the future: Questionnaire responses from the nation's high school seniors 1989.* Ann Arbor: University of Michigan Institute for Social Research.

Johnston, L. D., O'Malley, P. M., & Bachman, J. G. (2001). Cigarette smoking among American teens declines sharply in 2001. University of Michigan News and Information Services: Ann Arbor, MI [on-line] [On-line]. Available: www.monitoringthefuture.org.

Jorm, A. F., Rodgers, B., Jacomb, P. A., Christensen, H., Henderson, S., & Korten, A. E. (1999). Smoking and mental health: Results from a community survey. *Medical Journal of Australia, 18*, 74-77.

Kandel, D. B., & Wu, P. (1995). The contributions of mothers and fathers to the intergenerational transmission of cigarette smoking in adolescence. *Journal of Research on Adolescence, 5*, 225-252.

Kassel, J. D., Stroud, L. R., & Paronis, C. A. (2003). Smoking, stress, and negative affect: Correlation, causation, and context across stages of smoking. *Psychological Bulletin, 129*, 270-304.

Keller, M. B., Lavori, P. W., Friedman, B., Nielsen, E., Endicott, J., & McDonald-Scott, P. A. (1987). The Longitudinal Interval Follow-up Evaluation: A comprehensive method for assessing outcome in prospective longitudinal studies. *Archives of General Psychiatry, 44*, 540-548.

Kendler, K. S., Neale, M. C., MacLean, C. J., Heath, A. C., Eaves, L. J., & Kessler, R. C. (1993).

Smoking and major depression: A causal analysis. *Archives of General Psychiatry, 50*, 36-43.

Kenford, S. L., Smith, S. S., Wetter, D. W., Jorenby, D. E., Fiore, M. C., & Baker, T. B. (2002). Predicting relapse back to smoking: Contrasting affective and physical models of dependence. *Journal of Consulting and Clinical Psychology, 70*, 216-277.

Keuthen, N.J., Niaura, R.S., Borrelli, B., Goldstein, M., DePue, J., Murphy, C., et al. (2000). Comorbidity, smoking behavior and treatment outcome. *Psychotherapy and Psychosomatics, 69,* 244-250.

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4*, 231-244.

Khuder, S. A., Dayal, H. H., & Mutgi, A. B. (1999). Age at smoking onset and its effect on smoking cessation. *Addictive Behaviors, 24*, 673-677.

Killen, J. D., Fortmann, S. P., Kraemer, H. C., Varady, A. N., Davis, L., & Newman, B. (1996). Interactive effects of depression symptoms, nicotine dependence, and weight change on late smoking relapse. *Journal of Consulting and Clinical Psychology, 64*, 1060-1067.

Kinnunen, T., Doherty, K., Militello, F. S., & Garvey, A. J. (1996). Depression and smoking cessation: Characteristics of depressed smokers and effects of nicotine replacement. *Journal of Consulting and Clinical Psychology, 64*, 791-798.

Kozlowski, L. T., Porter, C. Q., Orleans, C. T., Pope, M. A., & Heatherton, T. (1994). Predicting smoking cessation with self-reported measures of nicotine dependence. *Drug and Alcohol Dependence, 34*, 211-216.

Lambert, N. (1998). *Stimulant treatment as a risk factor for nicotine use and substance abuse*.

Presentation at the NIH Consensus Development Conference in ADHD, Bethesda, MD, November.

Leckman, J. F., Sholomskas, D., Thompson, D., Belanger, A., & Weissman, M. M. (1982). Best estimate of lifetime psychiatric diagnosis: A methodological study. *Archives of General Psychiatry, 39*, 879-883.

Lewinsohn, P. M., Brown, R. A., Seeley, J. R., & Ramsey, S. E. (2000). Psychosocial correlates of cigarette smoking abstinence, experimentation, persistence, and frequency during adolescence. *Nicotine & Tobacco Research, 2*, 121-131.

Lewinsohn, P. M., Hops, H., Roberts, R. E., Seeley J. R., & Andrews, J. A. (1993). Adolescent psychopathology: I. Prevalence and incidence of depression and other DSM-III-R disorders in high school. *Journal of Abnormal Psychology, 102*, 133-144.

Lewinsohn, P. M., Rohde, P., & Brown, R. A. (1999). Level of current and past adolescent cigarette smoking as predictors of future substance use disorders in young adulthood. *Addiction, 94*, 913-921.

Lewinsohn, P. M., Rohde, P., Klein, D. N., & Seeley, J. R. (1999). Natural course of adolescent major depressive disorder: I. Continuity into young adulthood. *Journal of the American Academy of Child and Adolescent Psychiatry, 38*, 56-63.

Loranger, A. W. (1988). *Personality disorder examination (PDE) manual*. Yonkers, New York: DV Communications.

Luepker, R. V., Pallonen, U. E., Murray, D. M., & Pirie, P. L. (1989). Validity of telephone surveys in assessing cigarette smoking in young adults. *American Journal of Public Health, 79*, 202-204.

Lyons, M. J., Bar, J. L., Kremen, W. S., Toomey, R., Eisen, S. A., Goldberg, J., Faraone, S. V., & Tsuang, M. (2002). Nicotine and familial vulnerability to schizophrenia: A discordant twin study. *Journal of Abnormal Psychology, 111*, 687-693.

Madden, P. A. F., Heath, A. C., Pedersen, N. L., Kaprio, J., Koskenvuo, M. J., & Martin, N. G. (1999). The genetics of smoking persistence in men and women: A multicultural study. *Behavior Genetics, 29*, 423-431.

Mannuzza, S., & Fyer, A. J. (1990). *Family informant schedule and criteria (FISC)*, July 1990 revision. New York: Anxiety Disorders Clinic, New York State Psychiatric Institute.

Matheny, K. B. & Weatherman, K. E. (1998). Predictors of smoking cessation and maintenance. *Journal of Clinical Psychology, 54*, 223-235.

McDonald, C.A., Roberts, S., & Descheemaeker, N. (2000). Intentions to quit smoking in substance-abusing teens exposed to a tobacco program. *Journal of Substance Abuse Treatment, 18*, 291-308.

Merikangas, K. R., Dierker, L. C., & Szatmari, P. (1998). Psychopathology among offspring of parents with substance abuse and/or anxiety disorders: A high-risk study. *Journal of Child Psychology and Psychiatry, 39*, 711-720.

Miller-Johnson, S., Lochman, J. E., Coie, J. D., Terry, R., & Hyman, C. (1998). Comorbidity of conduct and depressive problems at sixth grade: Substance use outcomes across adolescence. *Journal of Abnormal Child Psychology, 26*, 221-232.

Moolchan, E. T., Ernst, M., & Henningfield, J. E. (2000). A review of tobacco smoking in adolescents: Treatment implications. *Journal of the American Academy of Child and Adolescent Psychiatry, 39*, 682-693.

Niaura, R., Britt, D. M., Borrelli, B., Shadel, W. G., Abrams, D. B., & Goldstein, M. (Ed.). (1999). History and symptoms of depression among smokers during a self-initiated quit attempt. *Nicotine and Tobacco Research, 1*, 251-257.

Orvaschel, H., Puig-Antich, J., Chambers, W. J., Tabrizi, M. A., & Johnson, R. (1982). Retrospective assessment of prepubertal major depression with the Kiddie-SADS-E. *Journal of the American Academy of Child Psychiatry, 21*, 392-397.

Parrott, A. C. (1999). Does cigarette smoking cause stress? *American Psychologist, 54*, 817-820.

Patton, G. C., Carlin, J. B., Coffey, C., Wolfe, R., Hibbert, M., & Bowes, G. (1998). The course of early smoking: A population-based cohort study over three years. *Addiction, 93*, 1251-1260.

Perkins, K. A.(2001). Smoking cessation in women: Special considerations. *CNS Drugs, 15*(5), 391-411.

Perkins, K. A., Levine, M. D., Marcus, M. D., & Shiffman, S. (1997). Addressing women's concerns about weight gain due to smoking cessation. *Journal of Substance Abuse Treatment, 14*, 173-182.

Pierce, J. P., Farkas, A. J., & Gilpin, E. A. (1998). Beyond stages of change: The quitting continuum measures progress towards successful smoking cessation. *Addiction, 93*, 277.

Pierce, J. P., & Gilpin, E. A. (1996). How long will today's new adolescent smoker be addicted to cigarettes? *American Journal of Public Health, 86*, 253-256.

Pomerleau, C. S., Marks, J. L., & Pomerleau, O. F. (2000). Who gets what symptom? Effects of psychiatric cofactors and nicotine dependence on patterns of smoking withdrawal symptomatology. *Nicotine and Tobacco Research, 2*, 275-280.

Pomerleau, O. F., Downey, K. K., Stelson, F. W., & Pomerleau, C. S. (1995). Cigarette smoking in adult patients diagnosed with attention deficit hyperactivity disorder. *Journal of Substance Abuse, 7*, 373-378.

Pomerleau, O. F., & Pomerleau, C. S. (1984). Neuroregulators and the reinforcement of smoking: Towards a biobehavioral explanation. *Neuroscience and Biobehavioral Reviews, 8*, 503-513.

Prokhorov, A. V., Hudmon, K. S., deMoor, C. A., Kelder, S. H., Conroy, J. L., & Ordway, N. (2001). Nicotine dependence, withdrawal symptoms, and adolescents' readiness to quit smoking. *Nicotine & Tobacco Research, 3*, 151-155.

Riggs, P. D., Mikulich, S. K., Whitmore, A. E., & Crowley, T. J. (1999). Relationship of ADHD, depression and non-tobacco substance use disorders to nicotine dependence in substance-dependent delinquents. *Drug and Alcohol Dependence, 54*, 195-205.

Rohde, P., Kahler, C. W., Lewinsohn, P. M. & Brown, R. A. (in press). Psychiatric disorders, familial factors, and cigarette smoking: II. Associations with progression to daily smoking. Manuscript under review. *Nicotine & Tobacco Research.*

Rohde, P., Lewinsohn, P. M., Brown, R. A., Gau, J. M., & Kahler, C. W. (2003). Psychiatric disorders, familial factors, and cigarette smoking: 1. Associations with smoking initiation. *Nicotine & Tobacco Research, 5*, 85-98.

Rohde, P., Lewinsohn, P. M., & Seeley, J. R. (1997). Comparability of telephone and face-to-face interviews in assessing Axis I and II disorders. *American Journal of Psychiatry, 154*, 1593-1598.

Rose, J. S., Chassin, L., Presson, C. C., & Sherman, S. J. (1996). Prospective predictors of quit

attempts and smoking cessation in young adults. *Health Psychology, 15*, 261-268.

Shah, B. V., Barnwell, B. G., & Bieler, G. S. (1997). *SUDAAN User's Manual, Release 7.5.* Research Triangle Park, NC: Research Triangle Institute.

Spitzer, R. L., Williams, J. B. W., Gibbon, M., & First, M. B. (1992). The Structured Clinical Interview for DSM-III-R (SCID): I. History, rationale, and description. *Archives of General Psychiatry, 49*, 624-629.

Stanton, W. R., McClelland, M., Elwood, C., Ferry, D., & Silva, P. A. (1996). Prevalence, reliability and bias of adolescents' reports of smoking and quitting. *Addiction, 91*, 1705-1714.

True, W. R., & Heath, A. C. (1997). Genetic and environmental contributions to smoking. *Addiction, 92*, 1275-85.

Upadhyaya, H. P., Deas, D., Brady, K. T., & Kruesi, M. (2001). Cigarette smoking and psychiatric comorbidity in children and adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry, 41*, 1292-1305.

Vessichhio, J. C., Termine, A., George, T. P. (2002). Smoking cessation and panic attacks: A report of 2 cases. *Journal of Clinical Psychiatry, 63*(7), 594-595.

Ward, K. D., Klesges, R. C., Zbikowski, S. M., Bliss, R. E., & Garvey, A. J. (1997). Gender differences in the outcome of an unaided smoking cessation attempt. *Addictive Behaviors, 22*, 521-533.

West, R., McEwen, A., Bolling, K., & Owen, L. (2001). Smoking cessation and smoking patterns in the general population: A 1-year follow-up. *Addiction, 96*, 891-902.

Wetter, D. W., Kenford, S. L., Smith, S. S., Fiore, M. C., Jorenby, D. E., & Baker, T. B. (1999).

Gender differences in smoking cessation. *Journal of Consulting and Clinical Psychology, 67*, 555-562.

White, H. R., Johnson, V., & Buyske, S. (2001). Parental modeling and parenting behavior effects on offspring alcohol and cigarette use: A growth curve analysis. *Journal of Substance Abuse, 12*, 287-310.

White, H. R., Pandina, R. J., & Chen, P. H. (2002). Developmental trajectories of cigarette use from early adolescence into young adulthood. *Drug and Alcohol Dependence, 65*, 167-178.

Zhu, S. H., Sun, J., Billings, S. C., Choi, W. S., & Malarcher, A. (1999). Predictors of smoking cessation in U.S. adolescents. *American Journal of Preventive Medicine, 16*(3), 202-207.

Table 1

Univariate Associations with Quitting Smoking by Age 25

	% Quitting Smoking			
Variable	Variable Present	Variable Absent	Odds Ratio[a]	95% Confidence Interval[a]
T_1 Demographics				
Male gender	19.1	23.6	0.63	NS
White race	21.1	27.6	0.70	NS
Non-intact home	19.3	24.6	0.80	NS
Low parental education	23.9	21.7	1.12	NS
T_3 Demographics				
Currently married	35.1	16.1	3.01**	1.53 - 5.92
Raising children	23.0	21.6	1.16	NS
Years of education[1]	----	---	1.11	NS
Fully employed	20.7	24.4	0.82	NS
Total household income[2]	---	---	1.25**	1.06 - 1.48
Lifetime Psychopathology				
MDD	15.8	33.3	0.40**	0.21 - 0.78
Dysthymia	25.0	21.6	1.23	NS
Anxiety disorders	19.1	22.9	0.88	NS
ADHD/DIS	30.0	20.3	1.61	NS

(table continues)

	% Quitting Smoking			
Variable	Variable Present	Variable Absent	Odds Ratio[a]	95% Confidence Interval[a]
ALCOHOL	23.4	20.6	1.15	NS
DRUG	18.1	24.8	0.62	NS
Borderline PD scores	5.3	23.0	0.16	NS
Antisocial PD scores	9.8	24.1	0.31*	0.10 - 0.93
Familial Smoking				
Maternal smoking	20.8	24.0	0.77	NS
Paternal smoking	19.9	25.4	0.80	NS
Any sibling smoking	18.3	24.1	0.79	NS
Familial Psychopathology				
Affective	22.8	20.6	1.25	NS
Anxiety	21.9	22.3	0.98	NS
Drug and alcohol use	19.4	33.3	0.43*	0.20 - 0.97
Externalizing	20.3	23.0	1.00	NS
Smoking Characteristics				
Age of initiation	---	---	1.00	NS
Age of first daily smoking	---	---	1.00	NS
Nicotine withdrawal	19.8	22.7	0.68	NS
Nicotine dependence	16.2	31.0	0.34**	.18 - .66

(table continues)

*$p < .05$; **$p < .01$.

Note. MDD = major depressive disorder; ADHD/DIS = ADHD and disruptive behavior disorders; ALCOHOL = alcohol use disorders; DRUG = drug use disorders; PD = personality disorder; NS = nonsignificant. *N* = 242 for all analyses except for family smoking and psychopathology where *N* = 212. Percent quitting is not presented for continuous variables.

[a]Odds ratios and 95% confidence intervals based on weighted logistic regression analyses that correct planned oversampling of non-Whites and individuals with a history of mental disorder.

[1] Years of education ranges from 9 to 17 years.

[2]Total household income is on a 9-point scale from no income to $50,000 or more.