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Predicting smoking in young adulthood: Comparisons of adolescent smokers and nonsmokers

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Master of Public Health

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Abstract

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By Jennifer R. Mendel

Background: Alcohol use and mental health disorders have been associated with smoking. Little is known about predictors of smoking initiation vs. maintenance from adolescence to young adulthood.

Objective: This study aims to examine predictors of smoking in young adulthood among (1) adolescent nonsmokers and (2) adolescent smokers.

Methods: Data were analyzed from the first 5 waves of a 7-wave longitudinal study of adolescents and their parents entitled Lives Across Time: A Prospective Study of Adolescent and Adult Development (LAT). The initial 4 waves of assessment occurred during adolescence at 6-month intervals from 1988-1992. The fifth wave occurred in young adulthood from 1993-1998.

Results: Of the 776 participants included in this analysis, 29.1% smoked at both time points, 47.7% were nonsmokers at both, 13.7% smoked in adolescence but not as an adult, and 9.5% did not smoke in adolescence but smoked as an adult. Average age of participants in adolescence and adulthood was 15.79 (SD=.70) and 23.8 (SD=1.35) years, respectively, 50.8% were female, and 98.3% were white. Binary logistic regression indicated that predictors of smoking in young adulthood among adolescent nonsmokers included less education (OR=0.77, CI 0.60, 0.99, p=.04), being unmarried in adulthood (OR=0.11, CI 0.20, 0.62, p=.01), lower family social support (OR=0.97, CI 0.94, 1.00, p=.03), nonsmoking parents (OR=0.42, CI 0.17, 1.03, p=.06), and increased alcohol use from adolescence to adulthood (OR=1.06, CI 1.03, 1.08, p<.001). Predictors of smoking in young adulthood among adolescent smokers included lower family social support (OR=0.97, CI 0.95, 1.00, p=.05), slower decreases in CESD scores from adolescence to adulthood (OR=1.05, CI 1.00, 1.10, p=.04), and greater proportion of adolescent friends who used drugs (OR=1.02, CI 1.00, 1.04, p=.05).

Conclusions: These results indicate that distinct factors predict smoking initiation vs. maintenance among young adults. Thus, interventions targeting specific factors (e.g., depressive symptoms vs. alcohol use) might address smoking differently among these groups.

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I. Introduction

Cigarette smoking represents a major public health problem that continues to be the leading preventable cause of death, disease, and disability in the United States (Centers for Disease Control and Prevention CDC, 2002). It is responsible for about one in five deaths per year and results in approximately 5.1 million years of potential life lost annually (CDC, 2008). Smoking harms nearly every organ of the body and increases an individual's risk for cardiovascular disease, respiratory disease, stroke, and cancer (U. S. Department of Health and Human Services, 2004; CDC 2008). Smokers may die 13 to 14 years earlier than nonsmokers (CDC, 2002). Beyond the negative health impact, tobacco use creates an enormous economic burden. From 2000-2004, cigarette smoking health-related economic losses in the United States attributed $96 billion in direct medical costs and $97 billion in lost productivity to total approximately $193 billion (CDC, 2008).

Historically, the prevalence of current cigarette use increased to 27.5% in 1991 and peaked at 36.4% in 1997. By 2003, rates decreased sharply to 21.9%, however the rates have remained stable and still at a high rate from 2003-2007 (Morbidity and Mortality Weekly Report, 2008). Currently it is estimated that 21% of U.S. adults continue to smoke and about 24% of U.S. teens continue to smoke (MMWR, 2010). In addition, each day, about 1,000 people under 18 years of age (Substance Abuse and Mental Health Services Administration, 2008) and 1,800 people above 18 years of age (SAMHA, 2006) begin smoking on a daily basis. Thus, it is important to continue to research smoking among adolescents and young adults and determine factors that predict smoking onset so as to continue to inform prevention and cessation efforts.

Cigarette smoking prevalence among adolescents increased across all racial and ethnic groups during the 1990s. Adolescents also reported an increase in their friends' smoking prevalence. This may signify a new trend for tobacco use to become 'normal' again among adolescents (CDC, 2000). Adolescent and young adult stages of life are critical points in an individual's development and the desire for experimentation is pivotal in the initiation rates of cigarette smoking. Many adolescents who experiment with cigarettes become addicted to tobacco and continue to smoke in adulthood (CDC, 1994). Further, the smoking rates for most individuals who continue to smoke often escalates into regular cigarette use (Orlando, Tucker, Ellickson, & Klein, 2004). Findings from Everett et al. (1999) show a relationship between students' ages and smoking rates. Results indicated that adolescent smokers who start at a younger age, 8 years or younger, are more likely to progress to becoming regular smokers and may smoke more often and more cigarettes than those who reported starting to smoke at a later age, 13 or older (Everett et al., 1999). Additionally, Chassin, Presson, Sherman, & Edwards (1990) indicated that adolescent smoking significantly raised the risk for continued adult smoking, with higher levels of adolescent exposure contributing to increased risk of becoming a regular adult smoker.

Approximately 80% of adult smokers begin smoking before the age of 18 (USDHHS, 1994). Those who smoke daily, even only for 1 to 2 years, are likely to become dependent on nicotine (USDHHS, 1994). Smoking prevention, as well as delaying age of smoking initiation among adolescents, may help reduce smoking rates in young adulthood, ultimately minimizing the negative consequences and impacts of tobacco use. Smoking behavior is commonly viewed as a developmental process and it is

proposed that adolescents who start smoking are likely to follow smoking patterns leading to nicotine dependence (Flay, 1993). These findings support the importance of continued research exploring smoking behaviors among adolescents and into young adulthood since these are pivotal times in development of the behavior and once the progression advances, it is more difficult for smokers to stop smoking (Kaplan, Nápoles-Springer, Steward, & Pérez-Stable, 2001).

In addition to the risk for adolescent smoking behaviors, research is now turning its attention to smoking in young adulthood, especially since little is known about the onset of smoking after age 20 (Kendler, Schmitt, Aggen, & Prescott, 2008). The factors related to the transition from smoking in adolescence to young adulthood may not be the same as those factors associated with smoking initiation in young adulthood. Additionally, behavioral characteristics typical of adolescent smokers may differ from those of young adults who initiate smoking. Ajdacic-Gross et al. (2009) examined the association of depression and other mood disorders while differentiating between adolescent and adult onset of smoking. The study analyzed data from the Zurich Study looking at psychiatric epidemiology (Angst et al., 2005; Angst, Dobler-Mikola, & Binder, 1984) and found that only major depression and dysthymia were associated with adult onset smoking. Factors associated with adolescent smoking onset included bipolar disorders, parental smoking, extroverted personality, discipline problems, and rebelliousness. The results confirm the need for more specific study designs with larger samples to address smoking onset in adulthood and the role of smoking in mental disorders.

Despite the decrease in current rates, tobacco use continues to be a long-term health threat as many adults continue to smoke cigarettes and adolescents continue to begin smoking thereby perpetuating the trend for future generations to confront the negative health and economic consequences associated with smoking. For smoking prevalence to continue to decline with trends similar to the 1997-2003 period, tobacco control efforts need to continue to prevent the onset or continuation of tobacco use from adolescence to young adulthood to ameliorate the adverse health effects from tobacco use.

II. Literature Review

With the critical periods for successful smoking prevention and intervention surrounding the adolescent years, studies have examined smoking behavior from adolescence to young adulthood. A number of theories have been utilized in researching factors related to adolescent and young adulthood smoking. The dominate theoretical approaches utilized have been social learning theory (Bandura, 1977), theory of planned behavior (Ajzen, 1991), and problem behavior theory (Jessor & Jessor, 1977; Orlando et al., 2004). This study will integrate key constructs guided by the social learning theory and problem behavior theory as well as integrating major aspects of the ecological model (Bronfenbrenner, 1979) to include the potential range of factors contributing to adolescent and young adulthood smoking. The three theories have been commonly used in addressing adolescent health issues and understanding substance use, and their utility in this research can help examine and explain factors predicting smoking from adolescence to young adulthood.

Social learning theory (Bandura, 1977) is useful in providing insight into individuals' interpersonal environments. The tendency to model or imitate behavior has been useful in identifying determinants of smoking (Avenevoli & Merikangas, 2003; Kobus, 2003; Bandura, 1977). Social learning theory suggests that adolescent smoking behavior may be influenced by exposure to cigarette use and smoking-related attitudes among family members and peers. Exposure to parental, sibling, and friends' smoking may influence adolescent smoking behaviors and may increase the intensity of smoking (Lessov-Schlaggar et al., 2008; O'Loughlin et al., 2003). Adolescent development is marked by behavioral patterns which are influenced greatly by parents and peers and serve as important core factors impacting adolescent behaviors.

Problem behavior theory proposes that substance use tends to co-occur with other types of problem behaviors during adolescence (Jessor & Jessor, 1977). Jessor, Donovan, & Costa (1991) define a behavior as problematic when it causes concern, is undesirable in society, and is negatively related to conventional behavior such as marijuana usage and alcohol abuse. This theory has been widely applied to understand adolescent risk behaviors (Galaif et al., 2007; Jessor et al., 2006; Jessor & Jessor, 1977; Jessor et al., 1991). The theory has been revised to include smoking as a problem behavior since it is a form of drug use with traits of addiction, society is in favor of smoking reduction, and smoking is related to other problem behaviors (Jessor et al., 1991). Smoking behavior has been strongly associated with heavy drinking and illicit drug use (Breslau, Kilbey, & Andreski, 1991; Flay et al., 1998; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000; Patton et al., 1996; Sher, Wood, Wood, & Raskin, 1996; Shiffman and Balabanis, 1996) as well as delinquency (Breslau, Kilbey, & Andreski, 1993; Chassin, Presson, Sherman,

Montello, & McGrew, 1986; Diem, McKary, & Jamieson, 1994). In addition, smoking has been negatively related to academic attitude and behaviors (Chassin & Stager, 1984; Chassin, Curran, Husson, & Colder, 1996, Diem et al., 1994; Mayhew, Flay, & Mott, 2000; Newcomb, McCarthy, & Bentler, 1989; Rose, Chassin, Presson, & Sherman, 1996). Overall, smoking has been associated with behavioral and psychosocial problems ranging from depression to anxiety and various behavioral problems (Crone & Reijneveld, 2007; Laukkanen, Shemeikka, Notkola, Koivumaa-Honkanen, & Nissinen, 2001; Liu, 2003; Patton et al., 1998). Accordingly, problem behavior theory offers important insight in assessing the emotional and behavioral state of adolescents.

Brofenbrenner's (1979) ecological systems theory brings attention to the interrelationships of multiple factors that are active and impact an individual's development. According to this theory, individuals are significantly affected by interactions among overlapping ecosystems such as family, peers, classroom, community, society and culture. All domains are important for development from adolescence to young adulthood and may impact smoking behaviors.

The theories mentioned above incorporate a broad model of relevant factors to examine predictors of smoking in a multidimensional context. To explore the individual and social interacting contexts of smoking behaviors, this study will emphasize a range of important constructs. Risk factors and their associations with smoking in adolescence have been a topic for many studies. For an extensive review of the risk factor literature focusing on cross-sectional comparisons of smokers and nonsmokers see Evans, Henderson, & Raines (1979). Cross-sectional and longitudinal studies have shown that adolescent tobacco use is associated with a variety of sociodemographic and psychosocial

factors. Factors such as low socioeconomic status, smoking by parents or guardians, low levels of academic achievement, aggressive behaviors, delinquency, and impaired psychosocial functioning are associated with youth tobacco use (CDC, 2010a; CDC, 2010b; Escobedo, Reddy, & DuRant, 1997; Stein, Newcomb, & Bentler, 1996). Further, smoking during adolescence is associated with alcohol use and other substance use (CDC, 2010a; CDC, 2010b). Measures of sociodemographic status, including age, gender, parental education and income, have been commonly investigated as predictors of smoking onset (Conrad, Flay, & Hill, 1992). However, often times the same variable may be predictive in one analysis but in another study is not found to be significant. Therefore it is important to include sociodemographic factors as determinants of tobacco use to expand on the current debated literature.

Research highlights the role of mental health disorders, especially depressive symptoms and disorders, in smoking behaviors among adolescents and adults. Yet the direction and magnitude of effects are debated (Windle & Windle, 2001). Substantial research has investigated depressive symptoms as a risk factor for initiation and/or maintenance of smoking among adolescents and adults (Anda et al., 1990; Breslau et al., 1998; Brown, Lewinsohn, Seeley, & Wagner, 1996; Fergusson, Goodwin, & Horwood, 2003; Kandel & Davies, 1986; Killen et al., 1997; Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008; Patton, Coffey, Carlin, Sawyer, & Wakefield, 2006; Repetto, Caldwell, & Zimmerman, 2005; Windle & Windle, 2001). These findings suggest that adolescent depressive symptoms precede and predict later smoking in adolescence. McCaffery, Papandonatos, Stanton, Lloyd-Richardson, & Niaura (2008) examined depressive symptoms and cigarette smoking in twins and found depressive symptoms and smoking

to be significantly correlated in both males and females. Brook, Shuster, & Zhang (2004) suggest that a history of earlier cigarette use in adolescence may predict depressive symptoms in young adults. Adding to this, Prinstein and La Greca's (2009) findings indicated that adolescent cigarette use was foreshadowed by childhood depressive symptoms, thus suggesting the predictive nature of depression and adolescent cigarette use. Further, research shows cigarette smoking predicting development of depression symptoms among adolescents, with a significant dose-response effect of higher smoking levels associated with greater depressive symptoms (Choi, Patten, Gillin, Kaplan, & Pierce, 1997; Kandel & Davies, 1986). Additionally, adolescent depressive symptoms are known to be correlated with adolescent cigarette use and predict greater maladjustment in adulthood.

Research supports the relation between depression and smoking, but less is known about its role in adolescent versus young adult smoking initiation. Ajdacic-Gross et al. (2009) examined smoking correlations in adolescence and young adulthood and found that adult onset smoking was associated with depression; however, significant correlations were also indicated for other mood disorders (bipolar disorders, dysthymia). In their study, risk factors typically associated with adolescence smoking had weak or no correlation with smoking in young adulthood. Ajdacic-Gross et al. (2009) compared adult versus adolescent onset of smoking and specifically addressed mood disorders as risk factors. Findings indicated that the significant factors correlated with smoking initiation in adolescence included parental smoking, extroverted personality, and discipline problems in youth. However, these factors were not applicable in describing risk factors associated with smoking initiation in young adulthood. Only depression was found to be

a common factor between the two different onsets of smoking (Ajdacic-Gross et al., 2009). These studies began to address young adulthood factors, but did not find many statistically significant results and only focused on psychosocial predictors. More research is needed to further assess the role of mental health disorders in transitions in smoking, as well as additional associations between adolescent and young adulthood smoking.

There is increasing support in the literature that smoking is associated with other high-risk behaviors including marijuana use, other drug use, school drop-out, low academic achievement, behavioral problems in school, and other delinquent behaviors. Ellickson, Tucker, & Klein (2001) indicated that early smokers versus nonsmokers were more likely to demonstrate problem behaviors including poor grades, experimenting with alcohol, and being inclined to engage in delinquent behavior. Alcohol and other substance use have consistently predicted smoking onset in multiple studies (de Vries, Dijkstra, Grol, Seelen, & Gerjo, 1990; McNeill et al., 1989; Ary, Biglan, Nautel, Weissman, & Severson, 1983; Ary & Biglan, 1988). Also, increased tobacco cigarette smoking has been associated with alcohol use (Griffiths, Bigelow, & Liebson, 1976; Mello, Mendelson, Sellars, & Kuehnle 1980; Mello, Mendelson, & Pahnieri, 1987). Epidemiologic studies have consistently shown positive associations between smoking and alcohol use (Anthony and Echeagaray-Wagner, 2000; Chiolero, Wietlisbach, Ruffieux, Paccaus, & Cornuz, 2006; Dawson, 2000; Falk, Yi, & Hiller-Sturmhofel, 2006; Friedman, Tekawa, Klatsky, Sidney, & Armstrong, 1991; Grant, 1998; Kahler 2008). However, the effects of marijuana use on tobacco cigarette smoking behavior have been shown to have no relationship or small effects with little reductions in cigarette smoking

(Mello and Mendelson, 1985; Nemeth-Coslett, Henningfield, O'Keefe, & Griffiths 1986; Simons and Tashkin, 1995; Kelly, Foltin, Rose, Fischman, & Brady, 1990; Mello et al.,1980).

Mello and Mendelson (1985) and Nemeth-Coslett et al. (1986) found that marijuana smoking did not produce significant changes in tobacco smoking. Simons and Tashkin (1995) compared tobacco and marijuana smoking and found an individual's smoking habit did not affect marijuana smoking. Marijuana smoking was determined to be independent of tobacco absence or concomitant tobacco use. However, tobacco smoking decreased when marijuana was also smoked. Kelly et al. (1990) also found short-term decreases in the quantity of tobacco smoked following marijuana smoking. Mello (1980) concluded that tobacco smoking was not systematically related to marijuana smoking but was with alcohol consumption patterns. Additionally, marijuana smoking was also not related to alcohol consumption. More research is needed to explore these effects addressing all three factors: tobacco smoking, marijuana smoking, and alcohol usage.

Conrad et al. (1992) discussed a variety of factors predicting smoking initiation; these included social, family, and peer bonding. The social environment has been identified as an important domain affecting adolescent smoking. Wen, Van Duker, & Olson (2009) showed that environmental multilevel factors (peer, family, and school) influenced smoking behavior among adolescents. The family environment, including parents' and/or siblings' smoking have been key factors for smoking involvement (Mayhew et al., 2000; Avenevoli et al., 2003; Conrad et al., 1992; Hu, Davies, & Kandel, 2006; Kardia, Pomerleau, Rozek, & Marks, 2003; Lieb, Schreier, Pfister, & Wittchen,

2003; Kandel, Hu, Griesler, & Schaffran, 2007). Additionally, smoking among significant others and marriage partners has been supported as important predictors of onset and continuation of smoking, but less is known about this role (de Leeuw, Scholte, Vermulst, & Engels, 2009). Friend groups also play an important role in the prediction of adolescent smoking (Mayhew et al., 2000; Conrad et al., 1992; Kobus, 2003; Urberg, Değirmencioğlu, & Pilgrim, 1997; Hu et al., 2006; Kandel et al., 2007; Audrain-McGovern et al., 2007). Friends become increasingly important during adolescent development, which suggests peers' strong influence on smoking behaviors (Larson, Richards, Moneta, Holmbeck, & Duckett, 1996). Moreover, a variety of studies identify that children are more likely to become smokers if they have parents who smoke and have attitudes supportive of the habit (U.S. Department of Health, Education and Welfare, 1979; Murray, Swan, & Johnson, 1983; Doherty & Allen, 1994). Chassin, Presson, Sherman, & Pitts (2000) found patterns of early regular smoking among children of parents who were daily smokers. de Leeuw et al. (2009) examined predictors of smoking onset and continuation in adolescents focusing on the interpersonal environment. The findings highlighted the role smoking friends play in the development of nicotine dependence. These studies exhibit the multidimensional factors that impact smoking behaviors.

There is extensive research devoted to understanding the factors that are associated with adolescent smoking. Considerable progress has been made, including results from longitudinal studies, in identification of psychosocial characteristics and behaviors that are associated with youth smoking (Derzon & Lipsey, 1999). However, less is known about the interaction of multiple variables in longitudinal data from adolescence to young

adulthood, especially looking into the factors functioning in later smoking onset in young adulthood. The explanatory factors of smoking in adolescence are multideminsional (Bronfenbrenner, 1979; Kawachi & Berkman, 2003; Susser, 1994a,1994b; Wilcox, 2003) and individuals cannot be effectively studied without examining the effects of multiple ecological factors (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993). Therefore to consider the multiple interactions and contributors in exploring smoking behaviors, this study will support and extend current research by utilizing the following theories: social learning theory, problem behavior theory, and the ecological systems theory (Bandura, 1977; Jessor and Jessor, 1977; Bronfenbrenner, 1979). Applying these theoretical models will address the multiple domains encompassing the individual from adolescence to young adulthood including parents, friends, spouses, and children. All domains are potentially important for development from adolescence to young adulthood and may impact smoking behaviors.

This study aims to increase the availability of smoking specific research using longitudinal data from adolescence into young adulthood, a developmental phase significantly associated with smoking initiation and dependence. There needs to be additional research expanding upon the association between late-onset smoking in young adulthood. With this study, we wish to examine predictors of smoking in young adulthood among (1) adolescents who did not smoke and (2) adolescents who smoked. This study will extend upon previous research findings regarding the transitions in cigarette use in three ways. First, prospective data were collected longitudinally from a cohort of participants from early adolescence into young adulthood, encompassing a multitude of various measures and assessing tobacco use. Studies of adolescent smoking

behaviors indicate multiple risk factors for smoking in adolescence. Less is known about maintenance versus initiation of smoking from adolescence to young adulthood. This study will look at a range of demographic, psychosocial and behavioral characteristics guided by the background literature and utilizing multiple theories to support the analyses. The variables associated with smoking explored in this study are age, gender, ethnicity, parental marital status, family income, years of education, marital status, children, GPA, depression, delinquency, stressful live events, quality of friendships, parental smoking status, adolescent alcohol use, adolescent marijuana use, extent of alcohol problems, percent of friends who drink, and percent of friends who use drugs.

Second, respondents will be categorized into four smoking groups for unique comparisons to better assess predictions of risk and magnitude of smoking development (see Figure 1). We will classify participants into the following four groups: 'stable non-smokers' (those who never smoked), 'quitters' (those who smoked in adolescence but not in young adulthood), 'continued smokers' (those who smoked in adolescence and continued smoking in young adulthood), and 'late-onset smokers' (those who initiated first smoking in young adulthood). These categories reflect smoking behaviors from abstaining, initiation, continuation, and cessation of cigarette smoking. These classifications were created to explore the predictors of smoking in young adulthood by assessing initiation, continuation, or cessation from the adolescent years into the young adult years. The groups were defined based on how many cigarettes participants smoked per day in the past 6 months at each wave of the research in adolescence (4 times) and young adulthood (1 time). Although smokers by our definition are not necessarily all regular smokers, many adolescents who report smoking become addicted (CDC, 1994)

and thus reporting of smoking at least ‘1 per day in the past 6 months’ is a sufficient level to potentially develop nicotine dependence and transition into regular smoking by young adulthood. Additionally, we assessed smoking behaviors in the past 6 months under the assumption that this smoking time frame offers a better representation of regular smoking behaviors in contrast to just experimenting.

Third, this research focuses on smoking in young adulthood, which has not been extensively studied. By looking into smoking continuation versus initiation in young adulthood, this study aims to extend the literature on the predictors of smoking in young adulthood.

Specifically the research will address the following areas and questions:

(1) What are the sociodemographic, psychosocial, behavioral, and environmental predictors of continued smoking in young adulthood among adolescent smokers?

(2) What are the sociodemographic, psychosocial, behavioral, and environmental predictors of smoking initiation in young adulthood among adolescent nonsmokers?

Based on Jessor and Jessor’s problem behavior theory (1977), social learning theory (Bandura, 1977), and the ecological model (Bronfenbrenner, 1979), we hypothesize that adolescents who engaged in other problem behaviors (drinking, marijuana use, delinquency), have less of an academic orientation, have lower family support, experience poorer mental health, and have a higher percent of friends who drink and use drugs will be more likely to smoke in adolescence and potentially transition to smoking in young adulthood. Further, important developmental changes (e.g., greater autonomy from family relationships, school and work transitions, new romantic relationships) occurring during the transition from adolescence to young adulthood may

result in differences in the predictors of smoking behavior in young adulthood (Ary et al., 1988; Chassin, Presson, Rose, & Sherman, 2001; Schulenberg & Maggs, 2002).

III. Method

We examined predictors of smoking in young adulthood among adolescent nonsmokers and smokers. The current study uses data from the first five waves of a 7-wave longitudinal study of adolescents and their parents entitled Lives Across Time (LAT). The initial four waves of assessment occurred during adolescence at 6-month intervals from 1988-1992. The fifth wave occurred in young adulthood from 1993-1998. A description of the participants and data collection methodology for each of these phases is provided in more detail below.

Participants

The sample consisted of approximately 1,200 teens from 3 suburban high schools in Western New York. At the time of the initial assessment, the average age of the participants was 15.79 (SD=0.70) years and the participants were in the 10^{th} or 11^{th} grades of high school. During the fifth wave, participants were approximately 24.22 (SD=1.34) years of age. Fifty-one percent of the sample were girls. Ninety-eight percent were Non Hispanic White with 67 percent of the sample identifying as Catholic. The mean family income was approximately $40,000. Eighty-eight percent of the adolescents' parents were currently married (twelve percent divorced, one percent widowed). Of students eligible, approximately 76 percent of the high school students participated.

Procedure

The Adolescent Phase (1988-1992)

The LAT study began by collecting paper-and-pencil survey data from sophomores and juniors in their high school classrooms. Schools provided a mailing list of the addresses of 10th- and 11th-graders. A packet of materials, including a letter of introduction by the principal, a description of the study, and informed-consent forms, was mailed to adolescents and their parents. Those individuals willing to participate in the study were requested to sign the informed statement of consent form (both the adolescent and one parent) and to return it to the investigator in a self-addressed, stamped envelope. Participation in the study required written informed consent by both one primary caregiver and the target adolescent. Confidentiality was also assured with a Department of Health and Human Services Certificate of Confidentiality. (This Certificate was renewed throughout the study.) Teachers made announcements about the study in homeroom classrooms. Adolescents completed the self-report paper-and-pencil surveys in large groups (e.g., 40-50 students) in their high school setting. A trained survey research team administered the survey to adolescents, and neither teachers nor school administrators were in the room during the time the students completed the surveys. The survey took about 45-50 minutes to complete, and participants received $10.00 for their participation. A make-up date for testing was arranged for participants who were absent or unable to participate on the regularly scheduled day of testing. A similar procedure was used at each wave of measurement for Waves 1 through 4.

The collection times during the adolescent phase were spaced 6 months apart occurring in October and April of successive years. That is, Wave 1 data were collected

in the fall semester, Wave 2 data were collected in the spring semester, Wave 3 data were collected in the following fall semester, and Wave 4 data were collected in the following spring semester. Sample retention across Waves 1-4 was high; exceeding 90%, and 83% of students who participated at Wave 1 participated at all four measurement occasions.

The Time 5 Young Adult Phase (1993-1998)

Data collection at Wave 5 occurred on average 6.87 years (SD=1.10) after the Wave 4 data collection. For the Wave 5 data collection, the scope of the study was expanded in several ways. First, both parents were invited to participate in the study, along with the target young adult (formerly the target adolescent). Second, face-to-face or telephone interviews were implemented with participants, while self-report paper-and-pencil surveys were continued. Third, using the interviewer-administered Composite International Diagnostic Interview (CIDI), data were collected that allowed for the DSM-IV psychiatric diagnoses scoring. Fourth, data collection was expanded to include in-depth information on work experiences, interpersonal and romantic relationships, and family history of psychopathology and alcohol and substance disorders. At Wave 5, participants' written informed consent was required. Participants were reimbursed $20 for their completion of the interview-administered portion of the study and $20 for their completion of the paper-and-pencil portion of the study. At Wave 5, data were collected from one or more family members totaling 941 participants.

From the total of 941 participant responses from Wave 1 to Wave 5 data collection, 776 participants had data, including specific smoking behavior data, at some point in the adolescent phase and also during the young adult phase. Therefore, for the purposes of this research, 776 participants were included in the analyses.

Measures

Candidate predictor variables included *baseline sociodemographic variables* (age, gender, ethnicity, parental marital status, parental income); *factors assessed in adolescence* included GPA, depressive symptoms, stressful life events, family social support, adolescent alcohol and marijuana use, friends use of substances, and parental smoking; and *factors assessed in young adulthood* including years of education obtained, marital status, having children, substance use, and depressive symptoms. For data analyses, we calculated an aggregate score for most measures by averaging two waves of measurement to get a representative measure of variables across the older years of adolescence. If a variable was assessed at Waves 3 and 4, these two measurements were used; otherwise, Wave 2 and 4 data were used. If the measure was reported from only one of the given times, that score was used to maximize sample size.

Smoking Status: We asked: "How many cigarettes or packs of cigarettes did you usually smoke per day in the last 6 months?" with response categories of (1) none, (2) less than 1, (3) 1-5 cigarettes per day, (4) about ½ pack per day, (5) about 1 pack per day, (6) about 1 and ½ packs per day, and (7) about 2 packs or more per day. Reporting 'no smoking' or 'less than 1 cigarette' (response options 1 or 2) was categorized as the non-smoking group. Screening positive for recent smoking was defined by reporting ≥ 1 cigarette per day (cpd) in the past 6 months. In adolescence (Waves 3 and 4), 444 (57.2%) were nonsmokers, 227 (29.3%) smoked less than 10 cigarettes per day, 47 (6.1%) smoked 10-19 cigarettes, and 58 (7.5%) smoked at least 20 cigarettes per day. In young adulthood (Wave 5), 485 (63.7%) were nonsmokers, 125 (15.7%) smoked less

than 10 cigarettes per day, 62 (5.1%) smoked 10-19 cigarettes per day, and 124 (15.5%) smoked at least 20 cigarettes per day.

For the scope of this analysis we divided our sample into four groups: 'stable non-smokers', 'quitters', 'continued smokers', and 'late-onset smokers' (see Literature Review, pg. 13 and Figure 1). Our aim is to identify predictors of smoking change or stability from adolescence into young adulthood.

Baseline Sociodemographic Variables: At Wave 1, we assessed age (operationalized as a continuous variable), gender, ethnicity (White, Black, Hispanic, Asian, Native American Indian, and Other), parental marital status, and parental income (operationalized as a continuous variable). Ethnicity was categorized as Non-Hispanic White vs. Other, as the over-whelming majority (98.3%) of participants described themselves as White. Parental marital status at study entry was collapsed to married vs. other for ease of interpretation, as 86.3% reported being married.

Young Adulthood (Wave 5) Sociodemographic Variables: Years of education (operationalized as a continuous variable), marital status, and having children were assessed at Wave 5. Marital status of the participant was categorized as unmarried vs. other, as 80.8% reported being unmarried. The children variable was categorized as having children versus not.

Adolescent Psychosocial Predictor Variables:

-*Grade Point Average (GPA):* Respondents were requested to report their cumulative GPA with the following item: "What grades do you usually get in school?" This item had a 7-point response format ranging from (1) Mostly A's, (2) Mostly A's and B's, (3) Mostly B's, (4) Mostly B's and C's, (5) Mostly C's, (6) Mostly C's and D's, to

(7) Mostly D's and F's. The Pearson product–moment correlation between adolescents' reports of their GPA and official high school records (which used a somewhat different measurement scale) was .78. Therefore, this self-report item was judged to be valid for assessing GPA. To calculate an average GPA out of the 4.0 scale, (1) was given the value of 4.0, (2) calculated as 3.5, (3) calculated as a 3, (4) calculated as a 2.5, (5) calculated as a 2, (6) calculated as a 1.5, and (7) calculated as a 0. Data from Wave 3 and Wave 4 were averaged and used as a continuous variable.

-*The Center for Epidemiologic Studies Depression Scale (CES-D):* The Center for Epidemiologic Studies Depression Scale (Radloff, 1977) was used to assess depressive symptoms at all five waves of data collection. The CES-D consists of 20 self-report items asking participants to indicate how many days during the past week they experienced the indicated emotions or behaviors. The scale provides a unitary measure of current depressive symptomatology, with an emphasis on the affective component of depressed mood. The CES-D has been used frequently in studies of middle adolescents (Lewinsohn et al., 1994). The internal consistency estimate for the CES-D with this sample was .90. Data from Wave 3 and Wave 4 were averaged for the *Adolescent CES-D score*. To calculate the *CES-D change variable*, the Adolescent CES-D score (average of Wave 3 and Wave 4) was subtracted from the Young Adulthood CES-D score from Wave 5.

-*Delinquency:* Delinquent activity was measured with 16 items used in prior delinquency research (Elliott, Huizinga, & Menard, 1989). A 6-point Likert scale (1 = never, 2 = once, 3 = 2-3 times, 4 = 4-5 times, 5 = 6-9 times, 6 = 10 or more times) was used for each item in reference to the past 6 months. Items varied in terms of severity of offense and included skipped school, hit teacher or parent, stole something that was

valued at more than $20, beat up someone, destroyed school or public property, and was suspended from school. The number of times the adolescent reported engaging in the various activities was summed to obtain a composite delinquency score. The alpha level for the 16 items at Time 1 was .75, and test-retest reliability was .70. The internal consistency estimate for the measure was .84. Wave 2 and Wave 4 data were averaged.

-*Stressful Life Events:* A list of 31 undesirable life events was constructed by adapting the Adolescent Life Change Event Scale (ALCES) of Yeaworth, York, Hussey, Ingle, and Goodwin (1980). Events were sampled from multiple social stress domains: family (e.g., “hassling with parents”), school (e.g., “failing one or more subjects”), interpersonal (e.g., “breaking up with a close personal friend”), and intrapersonal (e.g., “getting badly hurt or sick”). Adolescents evaluated the events and were asked to report whether each event occurred within the past 6 months, with higher scores indicating a greater number of stressful events and greater intensity of stress. The internal consistency estimate for the composite score, formed by summing all affirmative responses, was .65. Wave 3 and Wave 4 data were averaged.

-*Family Social Support:* The Perceived Social Support—Family measure was administered to assess the amount of perceived emotional support provided by family (Procidano & Heller, 1983). The measure consists of 20 items with four response options ranging from *generally false*, *more false than true*, *more true than false*, and *generally true*. Examples of survey items include "My family gives me the moral support I need," "Members of my family are good at helping me solve problems," and "My family is sensitive to my personal needs." The response format of this perceived social support measure was modified to include a “don’t know” response option with the four-response

option format as proposed by Procidano and Heller (1983) in order to increase the utility of the measure (Windle & Miller-Tutzauer, 1992). The internal consistency estimate for this measure at Wave 1 with this sample was .94.

-*Quality of Friendships*: This was measured by a Close Friend 15-item scale of interactive friendship events assessing characteristics of adolescent friendships such as reciprocity, conflict, and self-disclosure (Windle, 1994). Windle based this measure of friendship characteristics on the research of Youniss and Smollar (1985). The events measured the frequency of occurrence and relative seriousness of problematic events in relationships with a close friend. Events represented behaviors that included both actions and inactions by the respondent toward his or her friend, as well as actions and inactions by the friend toward the respondent. Respondents were requested to answer the occurrence of each event with reference to their closest same-sex (adolescent) friend and to indicate how often each event had occurred. The four response alternatives provided were (1) never happened, (2) happened once, (3) happened twice, (4) and happened more than twice. Sample items included: my close friend told me a secret, my close friend criticized me, and I talked to my close friend about a personal problem in my life. The score was an average of Wave 2 and Wave 3 data.

-*Parental Smoking Status:* Maternal and paternal smoking, included as part of a measure of family history of alcoholism and other mental health problems (Andreasen, Endicott, Spitzer, & Winokur, 1977), was assessed by asking the parent if they personally ever smoked regularly. This lifetime index of ever smoking regularly correlated .60 with measures of current self-reported smoking by the primary caregiver. The smoking status of the parent(s) was assessed at wave 1 of data collection.

- *Alcohol Use:* Alcohol use was measured with a standard quantity frequency index (QFI) that assessed beer, wine, and hard liquor consumption in the past 6 months (Armor & Polich, 1982). Respondents were asked how often they usually had each beverage in the last 6 months (responses ranged on a 7-point scale from 1 = *never* to 7 = *every day)* and, when they had the beverage, on average how much they usually drank (10-point scale from 1 = *none* to 10 = *more than 8* cans, bottles, or glasses, depending on the beverage). A QFI of 0.5 is equal to 1 drink. The QFI measures from Wave 3 and Wave 4 were averaged to provide a measure of the average number of ounces of ethanol consumed in the past 6 months. *Change in alcohol use* was calculated by assessing self-reported young adult alcohol use in Wave 5 and subtracting the adolescent alcohol use (average of Wave 3 and Wave 4) QFI value.

-*Adolescent Marijuana Use:* Marijuana use was measured with the participant self-reporting the frequency of marijuana use during the past 6 months by using a 7-point scale that ranged from 1 (never used) to 7 (used every day). The validity of self-reports of substance use has been supported in numerous research studies (Getting & Beauvais, 1990; Winters, Stinchfield, Henly, & Schwartz, 1991). Data were averaged from Wave 3 and Wave 4 to determine adolescent usage.

-*Extent of Alcohol Problems:* To assess alcohol-related problems that occurred during the past 6 months, participants responded to 13 items to determine individual effects of drinking. The scale used a 5-point response option to quantify the number of times a problem occurred as a result of alcohol (0, 1-2, 3-5, 6-10, and 10 + times). Items included problems with friends, family, teachers, or legal authorities caused by drinking behavior, in addition to missing school, “passing out,” and having regrets the day after

drinking. These items were selected on the basis of their representation in previous adolescent alcohol studies (Barnes, 1990) and their consistency with diagnostic criteria from the revised third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R; American Psychiatric Association, 1987). Cronbach's alpha for this measure with this sample was .84. Averages of Wave 3 and Wave 4 were used.

-*Percent of Friends who Drink:* To calculate the percentage of friends who use alcohol, adolescents were requested to indicate the number of adolescents whom they considered friends. Over 99% of adolescents reported at least one friend, with most reporting five or more. Adolescents were then requested to indicate how many of these friends consumed alcohol. Percentage scores were calculated by dividing the number of alcohol-using friends by the total number of friends and multiplying the dividend by 100, with a possible range of 0-100%. Percentage scores were calculated as averages of Wave 3 and Wave 4.

-*Percent of Friends who Use Drugs:* A similar procedure as *percent of friends who drink* was used to calculate the number of illicit (e.g., marijuana or cocaine) drug-using friends. Adolescents were requested to indicate how many of their friends used drugs. Again, percentage scores were calculated based on the previous indicated number of adolescents they considered friends. The value was calculated as averages of Wave 3 and Wave 4.

Analysis

Initially, sociodemographic, smoking-related, and psychosocial variables were summarized using descriptive statistics. Results were expressed as means (standard deviation) for continuous variables and frequencies (percentages) for categorical variables. We then conducted two sets of bivariate analyses: (1) comparing quitters to continued smokers and; (2) comparing stable non-smokers to late-onset smokers. We used t-tests for continuous variables and Chi-Squared tests for categorical variables.

We then conducted multivariate binary logistic regression analysis with 3 sequential block forced entries predicting smoking status in young adulthood. Logistic regression is a useful and robust statistical model to determine predictor variables for binomially distributed dependent variables (McCullagh & Nelder, 1989; Hosmer & Lemeshow, 1989; Hocking, 1976). We used logistic regression to determine the binary outcome of smoking (yes or no) in young adulthood. Sequential logistic regression was utilized to complete the analysis in 3 forced block entries. The key rationale of this ordering of adding variables was to test the contribution to predicting the outcome of smoking sequentially, first examining the predictive value of sociodemographic variables, then adding in the predictive value of psychosocial factors, and then finally including changes in critical variables (i.e., change in alcohol consumption and depressive symptoms) to determine the cumulative predictive value in predicting smoking.

More specifically, we used this approach to develop two models predicting (1) late-onset smoking vs. continued abstinence among adolescent nonsmokers and (2) continued smoking vs. cessation among adolescent smokers. All data were analyzed

using PASW statistical software version 17.0. Significance levels were set at $\alpha \leq .05$. In Model A, we entered the sociodemographic variables of gender, parental marital status, family income, years of education, marital status, and children. In Model B, we entered the variables from Model A and the adolescent psychosocial variables of GPA, CESD, delinquency, stressful life events, family social support, quality of friendships, parental smoking, alcohol use, marijuana use, extent of alcohol problems, percent of friends who drink, and percent of friends using drugs. In Model C, we entered the variables from Model B and change in CESD and change in alcohol use from adolescence to young adulthood.

IV. Results

Descriptive Statistics:

Table 1 contains participant descriptive statistics. Of the 776 participants included in these analyses, 29.1% (N=226) were continued smokers- smoked in adolescence and in young adulthood, 47.7% (N=370) were stable non-smokers- did not smoke as an adolescent or as an adult, 13.7% (N=106) were quitters-smoked as an adolescent but not as an adult, and 9.5% (N=74) were late-onset smokers- did not smoke in adolescence but did smoke in young adulthood. Eighty-six percent of participants' parents were married and average family income was $39,019.08 (SD=12,804.18). The average GPA was 2.97 (SD=0.67), the average Adolescent CESD score was 15.13 (SD=9.40), the average delinquency score was 5.85 (SD=4.26), the average Stressful Life Events score was 12.61 (SD=7.56), the average Family Social Support score was 56.70 (SD=13.58), and the average Quality of Friendships score was 48.05 (SD=6.56). Approximately 32% of

adolescents' parents were smokers. Adolescent alcohol use average was 12.34 (SD=25.24) in the past 6 months. Approximately 28% of adolescents reported marijuana use. The average score for alcohol problems was 2.29 (SD=2.54) problems in the past 6 months. The average percent of friends who drink was 67.93% and of friends who use drugs was 15.72%. At Wave 5, young adult participants had an average of 15.27 years of education (SD=1.91), 80.8% were unmarried, and 14.3% had children. The average change in CESD was -3.92 (SD=9.67), and change in alcohol use was a 3.63 increase (SD=31.09).

Bivariate Analyses:

Table 2 shows the results of the bivariate analyses for sociodemographic and psychosocial variables as predictors of change in smoking status among adolescents who smoked. Among adolescents who smoked, significant correlates of smoking in young adulthood included obtaining fewer years of education by young adulthood ($p<.001$), being unmarried in young adulthood ($p=.04$), lower GPA in adolescence ($p=.02$), having used marijuana in adolescence ($p<.001$), having a greater proportion of adolescent friends who used drugs ($p<.001$), slower decreases in depression from adolescence to young adulthood ($p=.02$), and increases in alcohol use from adolescence to young adulthood ($p=.04$).

Table 3 shows the results of the bivariate analyses for sociodemographic and psychosocial variables as predictors of change in smoking status among adolescents who did not smoke. Among adolescents who did not smoke, significant correlates of smoking in adulthood included obtaining fewer years of education by young adulthood ($p=.004$),

being unmarried in young adulthood (p=.03), and increases in alcohol use from adolescence to young adulthood (p<.001).

Regression Analyses:

Table 4 shows the results of the multivariate models predicting continued smokers. Predictors of continued smoking included lower family social support during adolescence (OR=0.97, CI 0.95, 1.00, p=.05), slower decreases in depression among those who smoked in adolescence and in young adulthood (OR=1.05, CI 1.00, 1.10, p=.04), and having a greater proportion of adolescent friends who used drugs (OR=1.02, CI 1.00, 1.04, p=.05).

Table 5 shows the results of the multivariate models predicting late-onset smokers. Predictors of smoking initiation in young adulthood included fewer years of education (OR=0.77, CI 0.60, 0.99, p=.04), being unmarried in young adulthood (OR=0.11, CI 0.20, 0.62, p=.01), lower family social support during adolescence (OR=0.97, CI 0.94, 1.00, p=.03), parents being nonsmokers (OR=0.42, CI 0.17, 1.03, p=.06), and increases in alcohol use from adolescence to young adulthood (OR=1.06, CI 1.03, 1.08, p<.001).

V. Discussion

This research employed longitudinal data from a larger sample of adolescents through young adulthood to investigate predictors of smoking in young adulthood. Analyses examined distinct predictors of (1) continued smoking from adolescence to young adulthood and (2) late-onset smoking in young adulthood.

(1) What are the sociodemographic, psychosocial, behavioral, and environmental predictors of continued smoking in young adulthood among adolescent smokers?

Results from bivariate analyses revealed that the correlates of continued smoking from adolescence into young adulthood were obtaining fewer years of education, being unmarried in young adulthood, having increases in alcohol use by young adulthood, having a lower GPA in adolescence, using marijuana in adolescence, having a greater proportion of adolescent friends who used drugs, and having slower decreases in depression (relative to Quitters) from adolescence to young adulthood.

In multivariate regression analyses, when looking at the predictors of continued smoking and accounting for covariates, slower decreases in depression, lower family social support during adolescence, and having a greater proportion of adolescent friends who used drugs significantly predicted smoking continuation. Substantial research has discussed the association among depressive symptoms as a risk factor for initiation and or maintenance of smoking among adolescents and adults (Anda et al., 1990; Breslau et al., 1998; Kandel & Davies, 1986; Leventhal et al., 2008; Fergusson et al., 2003; Killen et al., 1997; Patton et al., 2006; Repetto et al., 2005). The present study shows that the change in depression did decrease among continued smokers, but at a rate that was slower than that of the non-smokers implying that the higher levels are still problematic. This shows support for depression as a significant risk factor for continuation of smoking from adolescence into young adulthood.

Another factor that emerged as a significant finding in the multivariate analyses was lower family social support. Procidano and Heller (1983) suggest that high perceived family social support is an important dimension that is inversely related to psychosocial

disorders and distress which, in turn, can be indicative of increased risk to smoking. Our findings are consistent with this research by showing that lower perceived family social support predicted smoking during adolescence and continuing into young adulthood.

Having a greater proportion of adolescent friends who use drugs, which research documents as having an important role on influencing smoking behaviors (Mayhew et al., 2000; Conrad et al., 1992; Kobus, 2003; Urberg et al., 1997; Hu et al., 2006; Kandel et al., 2007; Audrain-McGovern et al., 2007; Larson et al., 1996) was also predictive of continued smoking. Our findings support the impact of the relationship between drug-using friends in adolescence and cigarette smoking in adolescence and continued into young adulthood (de Leeuw et al., 2009). This shows the significant influence peers behaviors exert on adolescents' involvements with substances.

In our bivariate analyses, marijuana use during adolescence was correlated with continued smoking during young adulthood. Some research suggests that marijuana use has little or no effect on tobacco cigarette smoking (Mello et al., 1980; Mello and Mendelson, 1985; Nemeth-Coslett et al.,1986; Kelly et al., 1990). Adolescent marijuana use did not remain significant in the multivariate regression; however, the correlational relationship between marijuana use and smoking behaviors in adolescence may reflect the risk for and experimentation with drugs often characteristic of adolescence (Hechinger, 1992; Gans & Blyth, 1990). It would be interesting to explore what causes individuals who experiment with both substances to continue or choose one substance over the other.

(2) What are the sociodemographic, psychosocial, behavioral, and environmental predictors of smoking initiation in young adulthood among adolescent nonsmokers?

Among the late-onset smokers, correlates of being a smoker in young adulthood were obtaining fewer years of education, being unmarried in young adulthood, and having increases in alcohol use by young adulthood. The predictive factors from the multivariate analyses for late-onset smoking initiation in young adulthood, a main interest of the current study, were family social support, change in alcohol use, marital status, parent smoking status, and years of education.

We found lower family social support to be a critical factor in predicting smoking among both late-onset smokers and continued smokers. This supports previous research indicating the importance of perceived family social support in a child's development and healthy adjustment through adolescence (Reuger, Malecki, & Demaray, 2010). Determining how family social support plays a role specifically in late-onset smoking versus continued smoking was beyond the scope of the present study. It warrants further exploration since it is ultimately a significant factor in the adoption of smoking behaviors. Perhaps the measure of family social support used in this research also reflects the parenting styles to which the adolescents were exposed. Three commonly studied parenting style dimensions in relation to problem behaviors among adolescents are monitoring, nurturance, and normative expectations (Windle et al., 2010). Higher parental monitoring (Petit, Laird, Dodge, Bates, & Criss, 2001), higher parental nurturance (Loeber & Dishion, 1983), and more conventional parental norms (Jaccard & Dittus, 2000; Wood, Read, Mitchell, & Brand, 2004) are all associated with lower problem behaviors among children. Based on this previous research, perhaps in the present study, the continued smokers who reported lower family social support also were exposed to parenting styles reflective of lower monitoring and nurturance and less

conventional behaviors within the family, such as the acceptance of alcohol, drug, and cigarette use (Cooper, Grotevant, & Condon, 1983; Douvan & Adelson, 1966; Kandel & Lesser, 1972). Those adolescents who reported lower family social support during this transition may also have been more influenced by peer groups. Therefore those involved with delinquent peers throughout adolescence and into young adulthood may have been more at risk for problem behaviors, like continued smoking and late-onset smoking.

Our findings support prior research indicating a positive association between smoking and alcohol use (Bachman, Wadsworth, O'Malley, Johnston, Schulenberg, 1997; Ellickson et al., 2001; de Vries et al., 1990; McNeill et al., 1989; Ary & Biglan, 1988; Anthony and Echeagaray-Wagner, 2000; Chiolero et al., 2006; Dawson, 2000; Falk et al., 2006; Friedman et al., 1991; Grant, 1998; Kahler 2008). Increases in alcohol use were predictive of late-onset smoking. Increases also were associated with continued smoking among adolescent smokers (although this effect was not significant in the multivariate models). These findings are consistent with prior research documenting increased tobacco cigarette smoking being associated with alcohol use. (Griffiths et al., 1976; Mello et al., 1980; Mello et al., 1987). A possible reason explaining why change in alcohol use was not predictive among continued smokers is that alcohol use behaviors were persistently high from adolescence to young adulthood and there was thus no or little change in the levels of alcohol use during that time period. Being unmarried in young adulthood was a correlate of smoking among both late-onset smokers and continued smokers. However, in the multivariate analyses, it was a significant predictor for the late onset group only. Higher rates of cigarette smoking among unmarried young adults, relative to married young adults, is supported in the literature (van Loon, Tijhuis,

Surtees, & Ormel, 2005). Perhaps this difference could be related to the influence from the smoking status of the marital partner (e.g. marrying a nonsmoker may influence cessation or marrying a smoker may influence initiation). This could possibly explain why being unmarried in young adulthood predicted late-onset smoking since there was not the extra influence of a marital partner's behavior impacting the individual. A further explanation may be that some of those unmarried may not yet be ready for commitment and thus involved in a lifestyle characterized by higher levels of alcohol, drug, and cigarette usage. In support of this notion, the present study showed that an increase in alcohol consumption from adolescence to young adulthood was a concomitant occurrence with the initiation of cigarette use among young adult late onset smokers. Future research should look at the factors related to marriage that contribute to changes in smoking (e.g. what makes some individuals who marry smokers adopt smoking, while in others the partner quits smoking) as well as the related effects of concurrent alcohol usage.

Also consistent with expectations, the present study revealed that predictors of late-onset smoking included fewer years of education. It has repeatedly been shown that a lower level of educational attainment is associated with greater risk and higher rates of smoking throughout the life course (SAMHSA, 2010; Barbeau, Krieger, Soobader, 2004; Helmert, Borgers, & Bammann, 2001; Jefferis, Graham, Manor, & Power, 2003; Jefferis et al., 2004; Solberg, Asche, Boyle, McCarty, & Thoele, 2007). Therefore, it is not surprising that the late-onset smokers in our study attained fewer years of education. Whether a cause-and-effect relationship exists is unclear. However, it is possible that late-onset smoking occurs more frequently among individuals with lower levels of education, and therefore possibly lower socioeconomic status, who are at greater risk for

higher levels of stress (Kassel, Stroud, Paronis, 2003; Wills, 1986; Wills, Sandy, & Yaeger, 2002), depression (Covey & Tam, 1990; Jarvelaid, 2004; Tekbas, Ceylan, Hamzaoglu, & Hasde, 2003; Breslaw et al., 1991; Glassman et al. 1990; Glied & Pine, 2002), and anxiety (McCabe et al., 2004; Patton et al., 1996) and who have fewer resources to cope with life stressors (Siqueira, Diab, Bodian, & Rolnitzky, 2000; Vickers et al., 2003). In the present study, it may be that those young adults with lower levels of education were transitioning from a greater dependence on parents to greater independence and more responsibility. As a result, they may have been starting to face higher levels of stress related to, for example, economic difficulties and lower familial support. In turn, such stressors may have contributed to the development of mental health disorders, which consequently may have lead to late-onset smoking. While this scenario is speculative, it warrants continued investigations into causative factors that explain the late onset smoking/lower academic achievement association.

One of the distinct differences we found when comparing the continued smokers and late-onset smokers was that the continued smokers were characterized as having slower decreases in depression relative to late-onset smokers. Research has highlighted how psychiatric disorders are associated with adolescent smoking versus smoking initiation in young adults (Ajdacic-Gross et al, 2009). The current results support this notion as depression was predictive of continued smoking, but was not a significant predictor of later smoking initiation in young adulthood. However, a history of cigarette use may predict depressive symptoms in young adults (Brook et al., 2004) and in past research depression has been found to be a common psychiatric associated with later smoking onset (Ajdacic-Gross et al, 2009). Thus research needs to continue to emphasize

the relationship of smoking and mental health disorders in relation to smoking during all life stages

It is well documented that adolescent smoking behavior may be influenced and increased in intensity by exposure to parental, sibling, and friends' smoking (Lessov-Schlaggar et al., 2008; O'Loughlin et al., 2003). If an individual is raised in an environment with smokers, that individual is more likely to become involved in smoking. (Mayhew et al., 2000; Avenevoli et al., 2003; Conrad et al., 1992; Hu et al., 2006; Kardia et al., 2003; Lieb et al., 2003; Kandel et al., 2007). Moreover, children are more likely to become smokers if they have parents who smoke and have attitudes supportive of the habit (U.S. Department of Health, Education and Welfare, 1979; Murray et al., 1983; Doherty, 1994). Our findings did not indicate parent smoking as a significant factor. However, having a parent nonsmoker did predict late-onset smoking. Perhaps this suggests that parent smoking status may be protective during adolescence, but in young adulthood the influence of parents no longer holds as strong of an impact. This idea expands on the notion that social relations with parents change during development (Cooper et al., 1983; Douvan & Adelson, 1966; Kandel & Lesser, 1972). More research needs to address how the family and peer environment impacts individuals as they develop in young adulthood.

Measures of sociodemographic status, including age, gender, parental education and income, have been commonly investigated as predictors of smoking onset (Conrad et al., 1992); however, these factors were not found to be significant predictors in the present study. Additionally, we found no associations with delinquency behaviors and smoking. This was surprising since many findings reveal problem behaviors such as

delinquency to be related with smoking in adolescence (Ellickson et al., 2001; Breslau et al., 1993; Chassin et al., 1986; Diem et al., 1994). A possible explanation for the lack of association between delinquency and smoking may be that other significant predictors of smoking (e.g., low levels of family social support, depression, alcohol use) had a greater influence on smoking and thus diminished the effects of delinquent behavior.

Conclusions

This study is unique in that it specifically examines predictors of smoking initiation in young adulthood and predictors of smoking continuation from adolescence to young adulthood. Few longitudinal studies have followed adolescents into young adulthood assessing tobacco use during the transition. Low levels of family social support emerged as a critical factor relevant in smoking among both continued smokers and late-onset smokers. The results also indicate that distinct factors predict smoking continuation versus later initiation among young adults. The most notable differences in predictors of late-onset smokers and continued smokers are that increased alcohol use predicts late-onset smoking whereas continued smoking was significantly predicted by depression levels. Given the results of this present study, interventions targeting specific factors (e.g., depressive symptoms vs. alcohol use) might address smoking differently among these groups.

Strengths and Limitations

Like all research, this study does have limitations that should be acknowledged. Results were based on a predominantly middle-class, Caucasian sample and therefore this

limits the generalizability of findings to other populations of adolescents and young adults. Also it is important to note that the measures used in this study were based on self-reported items which may introduce bias. In addition, in our definition of the four smoking status groups, we did not take into account variation in level or intensity of smoking (e.g., light versus heavy smoking). Furthermore, at this stage of the research, we were not able to investigate smoking initiation in young adulthood as merely experimentation or if the late-onset smokers would develop regular use as they age. Despite these limitations, this study offered a unique opportunity to compare predictors of smoking from adolescence to young adulthood by investigating smoking behaviors during the peak risk periods for smoking onset. Additionally, the longitudinal design of the research advances our knowledge about transitions from adolescence into young adulthood and smoking behavior outcomes and raises several issues to be addressed in interventions and future research. In regard to all findings, it is important to note that the final wave of assessment for this study was at age 23. It will be interesting to see what predictors remain or become significant as the participants continue to develop in young adulthood and beyond.

Implications and Recommendations

Given the continued high smoking prevalence rates (CDC, 2002; MMWR, 2010; Orlando et al., 2004) and the findings of this present study, smoking behaviors among adolescents and young adults warrant continued attention. The results of this study suggest directions for future research and practice. Research should further examine distinct factors predicting these different trajectories of smoking and the interplay among

these factors and other potential underlying mechanisms. Also future research should apply this approach to more recent longitudinal data sets and to data sets including greater ethnic and socioeconomic diversity. In practice, our results suggest the importance for future public health campaigns and smoking cessation interventions to understand those at risk for continued smoking or late-onset smoking. Smoking reduction strategies need to address the multidimensional context of smoking behaviors. Alcohol, depression, and family social support were strong predictors of smoking in this study and support the usefulness of a multilevel approach in prevention and cessation strategies. Also it is important to recognize and emphasize the protective nature of education in reducing health risk behaviors. Understanding those at risk for continued smoking or late-onset smoking will be useful in reducing smoking initiation and escalation among adolescents and young adults.

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Appendix

Table 1. Participant characteristics

Variable	N (%) or M (SD)
Sociodemographic variables	
Adolescent variables	
Age	15.79 (0.70)
Gender	
Male	598 (49.2%)
Female	617 (50.8%)
Ethnicity	
Non-Hispanic White	1141 (98.3%)
Other	20 (1.7%)
Parental marital status	
Married	717 (86.3%)
Family Income	39019.08 (12804.18)
Adulthood variables	
Years of Education	15.27 (1.91)
Marital Status	
Unmarried	654 (80.8%)
Children	
No	693 (89.7%)
Adolescent psychosocial variables	
GPA	2.97 (0.67)
CESD	15.13 (9.40)
Delinquency	5.85 (4.26)
Stressful Life Events	12.61 (7.56)
Family social support	56.70 (13.58)
Quality of friendships	48.05 (6.56)
Adolescent alcohol/drug use	
Parental smoking status	
Non-smoker	571 (67.9%)
Smoker	270 (32.1%)
Adolescent alcohol use	12.34 (25.24)
Adolescent marijuana use	
Yes	319 (27.6%)
Extent of alcohol problems	2.29 (2.54)
% friends who drink	67.93 (33.03)
% friends who use drugs	15.72 (26.09)
Change, adolescence to adulthood	
Change in CESD	*-3.92 (9.67)*
Change in alcohol use	3.63 (31.09)
Smoking Status Change	
Continued smokers	226 (29.1%)
Stable non-smokers	370 (47.7%)
Quitters	106 (13.7%)
Late-onset smokers	74 (9.5%)

Table 2. Bivariate analysis of sociodemographic variables and psychosocial variables as predictors of change in smoking status among adolescents who smoked

Variable	Quitters N (%) or M (SD) N = 106	Continued Smokers N (%) or M (SD) N = 226	p
Sociodemographic variables			
Adolescent variables			
Age	15.71 (0.63)	15.83 (0.70)	0.116
Gender			0.138
Male	30 (28.3%)	83 (36.7%)	
Female	76 (71.7%)	143 (63.3%)	
Ethnicity			0.631
Non-Hispanic White	101 (95.3%)	219 (96.9%)	
Other	5 (4.7%)	7 (3.1%)	
Parental marital status			0.657
Unmarried	9 (12.5%)	17 (10.5%)	
Married	63 (87.5%)	145 (89.5%)	
Family Income	39635.31 (12418.06)	39080.59 (13416.26)	0.730
Adulthood variables			
Years of Education	15.42 (1.78)	14.59 (1.97)	**<0.001**
Marital Status			**0.036**
Unmarried	74 (72.5%)	183 (83.2%)	
Married	28 (27.5%)	37 (16.8%)	
Children			0.534
No	82 (80.4%)	183 (83.2%)	
Yes	20 (19.6%)	37 (16.8%)	
Adolescent psychosocial variables			
GPA	2.96 (0.60)	2.78 (0.66)	**0.018**
CESD	16.69 (8.67)	16.69 (10.29)	0.995
Delinquency	6.58 (4.41)	7.25 (4.34)	0.193
Stressful Life Events	15.38 (7.25)	14.77 (8.29)	0.519
Family social support	57.03 (14.90)	54.37 (13.25)	0.103
Quality of friendships	47.54 (6.70)	47.66 (6.27)	0.877
Adolescent alcohol/drug use			
Parental smoking status			0.099
Non-smoker	54 (75.0%)	104 (63.8%)	
Smoker	18 (25.0%)	59 (36.2%)	
Adolescent alcohol use	17.75 (34.08)	21.00 (32.37)	0.404
Adolescent marijuana use			**<0.001**
No	73 (68.9%)	107 (47.3%)	
Yes	33 (31.1%)	119 (52.7%)	
Extent of alcohol problems	3.23 (2.57)	3.42 (2.58)	0.524
% friends who drink	79.45 (23.49)	82.78 (24.97)	0.256
% friends who use drugs	15.39 (22.62)	29.62 (32.13)	**<0.001**
Change, adolescence to adulthood			
Change in CESD	-6.70 (9.16)	-3.87 (10.73)	**0.020**
Change in alcohol use	-8.25 (35.36)	1.44 (41.07)	**0.038**

Table 3. Bivariate analysis of sociodemographic variables and psychosocial variables as predictors of change in smoking status among adolescents who did not smoke

Variable	Stable non-smokers N (%) or M (SD) N = 370	Late-onset smokers N (%) or M (SD) N = 74	p
Sociodemographic variables			
Adolescent variables			
Age	15.78 (0.70)	15.73 (0.69)	0.631
Gender			1.000
Male	184 (49.7%)	37 (50%)	
Female	186 (50.3%)	37 (50%)	
Ethnicity			0.201
Non-Hispanic White	360 (97.3%)	69 (93.2%)	
Other	10 (2.7%)	5 (6.8%)	
Parental marital status			0.684
Unmarried	43 (15.2%)	7 (12.1%)	
Married	240 (84.8%)	51 (87.9%)	
Family Income	39540.23 (12197.38)	39090.85 (14199.07)	0.782
Adulthood variables			
Years of Education	15.76 (1.73)	15.10 (1.95)	**0.004**
Marital Status			**0.027**
Unmarried	293 (80.9%)	67 (91.8%)	
Married	69 (19.1%)	6 (8.2%)	
Children			0.398
No	324 (89.5%)	68 (93.2%)	
Yes	38 (10.5%)	5 (6.8%)	
Adolescent psychosocial variables			
GPA	3.18 (0.64)	3.08 (0.60)	0.248
CESD	13.75 (8.88)	12.70 (7.41)	0.340
Delinquency	4.52 (3.70)	4.62 (3.26)	0.830
Stressful Life Events	10.91 (6.42)	10.78 (6.40)	0.871
Family social support	59.48 (13.05)	57.02 (12.86)	0.140
Quality of friendships	48.37 (6.49)	47.78 (6.52)	0.488
Adolescent alcohol/drug use			
Parental smoking status			0.347
Non-smoker	198 (68.5%)	44 (75.9%)	
Smoker	91 (31.5%)	14 (24.1%)	
Adolescent alcohol use	4.62 (11.42)	5.20 (8.76)	0.681
Adolescent marijuana use			0.691
No	327 (88.4%)	67 (90.5%)	
Yes	43 (11.6%)	7 (9.5%)	
Extent of alcohol problems	1.32 (1.92)	1.41 (1.85)	0.711
% friends who drink	55.39 (34.70)	55.68 (3.82)	0.946
% friends who use drugs	7.04 (17.74)	5.10 (11.55)	0.370
Change, adolescence to adulthood			
Change in CESD	-3.51 (9.06)	-2.05 (9.29)	0.209
Change in alcohol use	4.81 (15.99)	21.47 (38.43)	**<0.001**

Table 4. Predictors of continued smokers

Variable	Model A			Model B			Model C		
	OR	CI	P	OR	CI	P	OR	CI	P
Sociodemographic variables									
Adolescent variables									
Gender									
Male		Ref			Ref			Ref	
Female	0.73	0.38, 1.41	0.35	0.71	0.29, 1.71	0.44	0.89	0.35, 2.24	0.80
Parental marital status									
Married		Ref			Ref			Ref	
Unmarried	0.73	0.27, 2.02	0.55	0.78	0.26, 2.31	0.65	0.77	0.25, 2.43	0.66
Family Income	1.00	1.00, 1.00	0.56	1.00	1.00, 1.00	0.55	1.00	1.00, 1.00	0.67
Adulthood variables									
Years of Education	0.79	0.66, 0.94	0.01	0.81	0.66, 1.01	0.06	0.85	0.69, 1.06	0.16
Marital Status									
Unmarried		Ref			Ref			Ref	
Married	0.49	0.24, 1.02	0.06	0.49	0.21, 1.12	0.09	0.68	0.28, 1.65	0.40
Children									
No		Ref			Ref			Ref	
Yes	1.08	0.45, 2.59	0.87	0.89	0.33, 2.38	0.82	0.87	0.33, 2.34	0.80
Psychosocial variables									
GPA				1.15	0.60, 2.20	0.68	1.00	0.51, 1.96	1.00
CESD				1.01	0.96, 1.05	0.81	1.04	0.99, 1.10	0.16
Delinquency				0.97	0.86, 1.09	0.61	0.97	0.86, 1.09	0.59
Stressful Life Events				1.00	0.94, 1.05	0.85	0.99	0.93, 1.04	0.58
Family social support				0.98	0.95, 1.00	0.04	0.97	0.95, 1.00	**0.05**
Quality of friendships				1.02	0.97, 1.07	0.52	1.02	0.97, 1.07	0.50
Alcohol/drug use									
Parental smoking									
Non-smoker					Ref			Ref	
Smoker				1.69	0.81, 3.53	0.17	1.73	0.81, 3.68	0.16
Adol. alcohol use				1.00	0.99, 1.02	0.89	1.02	0.99, 1.05	0.27
Adol. marijuana use									
No					Ref			Ref	
Yes				1.55	0.68, 3.51	0.29	1.54	0.68, 3.52	0.30
Extent of alcohol problems				0.98	0.82, 1.19	0.87	0.99	0.82, 1.20	0.90
% friends who drink				1.00	0.99, 1.02	0.97	1.00	0.98, 1.01	0.87
% friends using drugs				1.02	1.00, 1.04	0.04	1.02	1.00, 1.04	**0.05**
Change variables									
Change in CESD							1.05	1.00, 1.10	**0.04**
Change in alcohol use							1.01	0.99, 1.04	0.29

Nagel Kerke R^2= .308 p<.001

Table 5. Predictors of late-onset smokers

Variable	Model A			Model B			Model C		
	OR	CI	P	OR	CI	P	OR	CI	P
Sociodemographic variables									
Adolescent variables									
Gender									
Male		Ref			Ref			Ref	
Female	1.20	0.64, 2.24	0.58	1.16	0.56, 2.38	0.69	1.95	0.84, 4.52	0.12
Parental marital status									
Married		Ref			Ref			Ref	
Unmarried	0.77	0.24, 2.44	0.66	0.81	0.24, 2.73	0.73	0.94	0.26, 3.43	0.93
Family Income	1.00	1.00, 1.00	0.45	1.00	1.00, 1.00	0.35	1.00	1.00, 1.00	0.23
Adulthood variables									
Years of Education	0.79	0.65, 0.96	0.02	0.83	0.66, 1.04	0.11	0.77	0.60, 0.99	**0.04**
Marital Status									
Unmarried		Ref			Ref			Ref	
Married	0.17	0.04, 0.68	0.02	0.11	0.02, 0.51	.01	0.11	0.20, 0.62	**0.01**
Children									
No		Ref			Ref			Ref	
Yes	1.63	0.48, 5.57	0.44	3.18	0.77, 13.13	0.11	3.18	0.71, 14.28	0.13
Psychosocial variables									
GPA				0.69	0.36, 1.33	0.27	0.85	0.41, 1.75	0.66
CESD				0.98	0.93, 1.03	0.35	0.97	0.92, 1.03	0.37
Delinquency				1.00	0.87, 1.14	0.98	0.98	0.84, 1.15	.84
Stressful Life Events				1.01	0.94, 1.08	0.75	1.00	0.92, 1.10	.92
Family social support				0.98	0.95, 1.01	0.11	0.97	0.94, 1.00	**.03**
Quality of friendships				1.02	0.97, 1.08	0.48	1.01	0.96, 1.10	.64
Alcohol/drug use									
Parental smoking									
Non-smoker					Ref			Ref	
Smoker				0.54	0.25, 1.20	0.13	0.42	0.17, 1.03	**0.06**
Adol. alcohol use				0.99	0.94, 1.05	0.74	1.03	0.90, 1.07	0.47
Adol. marijuana use									
No					Ref			Ref	
Yes				1.02	0.24, 4.33	0.98	1.13	0.20, 6.33	0.89
Extent of alcohol problems				1.05	0.78, 1.41	0.74	0.83	0.57, 1.21	0.34
% friends who drink				1.00	0.99, 1.01	0.77	1.01	0.99, 1.02	0.36
% friends using drugs				0.97	0.94, 1.01	0.12	0.98	0.94, 1.02	0.32
Change variables									
Change in CESD							1.00	0.96, 1.05	0.99
Change in alcohol use							1.06	1.03, 1.08	**<0.001**

Nagel Kerke R^2= .299 p<.001

Figure 1. Smoking Groups