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Signature: Erika Ashley Pinsker Date: 4/5/2012

Intentions to quit smoking among daily smokers and consistent and converted nondaily college student smokers

By

Erika Ashley Pinsker
MPH

Behavioral Sciences and Health Education

Dr. Carla J. Berg
Committee Chair

Dr. Eric J. Nehl
Committee Member

Dr. Michael Windle
Department Chair

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By

Erika Ashley Pinsker

BA
University of Michigan
2009

Thesis Committee Chair: Carla J. Berg, PhD

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Abstract

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By Erika Ashley Pinsker

Given the high prevalence of smoking, particularly nondaily smoking, among young adults, research is needed to understand the different trajectories of smoking among this group. We examined factors related to smoking initiation, progression, and cessation and differing smoking trajectories in relation to readiness to quit smoking in the next month. The current study is a secondary data analysis of an online survey that was administered to six Southeast colleges in Fall 2010. A total of 24,055 students were recruited, yielding 4,849 responses (20.1% response rate), with complete data from 4,438 students. Overall, 63.8% (n = 3,094) were nonsmokers, 6.0% (n = 293) were quitters, 6.5% (n = 317) were consistent nondaily (i.e., never daily) smokers, 5.8% (n = 283) were converted nondaily (i.e., historically daily) smokers, and 9.3% (n = 451) were daily smokers. There were significant differences in sociodemographics, other substance use (alcohol, binge drinking, marijuana, and other tobacco products) in the past 30 days, and psychosocial factors (e.g., smoking attitudes, perceived harm) among these subgroups of students ($p<.001$). Among current smokers, there were significant differences in the average number of cigarettes smoked per day, recent quit attempts, self-identification as a smoker, self-efficacy, and motivation to quit ($p<.001$). After controlling for sociodemographics and other psychosocial factors, converted nondaily smokers were more likely to be ready to quit in the next month versus consistent nondaily smokers (OR=2.15, CI 1.32, 3.49, $p=.002$). Understanding differences among subgroups of young adults with different smoking histories and current behaviors is critical in developing interventions targeting psychosocial factors that may differentially impact cessation efforts among this population.

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I. Introduction

Tobacco use is the number one preventable cause of death in the United States. Each year, 443,000 people die prematurely from smoking in the U.S (Centers for Disease Control and Prevention, 2011). Despite preventive efforts, approximately 46 million people or 20.6% of the U.S. population smokes cigarettes (Centers for Disease Control and Prevention, 2011). Among young adults, 18-24, approximately 20.1% smoke cigarettes (Centers for Disease Control and Prevention, 2011).

In terms of the costs of smoking, there are a significant amount of economic costs associated with cigarette smoking. For instance, during 2000-2004, smoking was responsible for approximately $193 billion in health-related economic loses in the U.S., with $96 billion in direct medical costs and $97 billion in lost productivity (Centers for Disease Control and Prevention- Economic Facts, 2011). Furthermore, the total economic costs, in direct medical costs and lost productivity, associated with smoking are approximately $10.47 per pack of cigarettes sold in the U.S. (Centers for Disease Control and Prevention- Economic Facts, 2011).

In terms of the health effects of smoking, cigarette smoking is known to cause many types of cancer including cancers of the lung, esophagus, larynx, mouth, throat, kidney, bladder, pancreas, stomach, and cervix and is one of the leading causes of death from cancer. Smoking also causes heart disease, stroke, aortic aneurysm, and asthma (National Cancer Institute, 2011).

Quitting smoking can substantially reduce the risk of cancer, heart disease, chronic obstructive pulmonary disease, and other diseases that are caused by smoking (National Cancer Institute, 2011). Although all individuals that quit smoking will reduce their risk of

disease, individuals that quit before the age of 30 will reduce their chances of dying prematurely from smoking related diseases by more than 90 percent (National Cancer Institute, 2011); therefore, it is important to focus cessation efforts on young adults. It is especially important to focus cessation efforts towards young adults since young adulthood represents a critical period for cigarette use, often including increased smoking rates or initiation of smoking (USDHHS, 2004).

Among American smokers, up to 33% smoke nondaily (Tindle & Shiffman, 2011) or smoke between 1 and 29 days out of every 30 (ACHA, 2009). Nondaily smoking represents a common smoking pattern among young adults, with 19.9% reporting smoking less than 30 days per month (Wortley, Husten, Trosclair, Chrismon, & Pederson, 2003). Nondaily smokers are more likely to be younger, a racial/ethnic minority, female, better educated, and higher-income when compared to daily smokers (Gilpin, Cavin, & Pierce, 1997; Hassmiller, Warner, Mendez, Levy, & Romano, 2003). Nondaily versus daily smokers have also been shown to be more likely to be ready to quit in the next month and confident that they can quit, but are less likely to consider themselves to be addicted (Gilpin et al., 1997). However, nondaily smokers have difficulty quitting smoking. One explanation is that difficulty quitting among nondaily smokers may be due to external stimuli rather than physical symptoms of nicotine dependence such as withdrawal and cravings (Tindle & Shiffman, 2011). Alternatively, some research suggests that even low-level smokers experience loss of autonomy over smoking and addiction (DiFranza, 2011; DiFranza et al., 2002; Ursprung & DiFranza, 2010); however, traditional models of addiction developed for daily smokers do not explain why nondaily smokers have difficulty quitting.

Nondaily smokers suffer from significant smoking-related morbidity and mortality compared to individuals who have never smoked (Jimenez-Ruiz, Kunze, & Fagerstrom,

1998; Luoto, Uutela, & Puska, 2000). According to the 2004 U.S. Surgeon General's Report on the health consequences of smoking, individuals that are exposed to low levels of tobacco are still at risk for cardiovascular disease, lung and gastrointestinal cancers, lower respiratory tract infections, cataracts, compromised reproductive health, and osteoporosis (USDHHS, 2004). Schane, Ling, and Glantz (Schane, Ling, & Glantz, 2010) conducted a systematic review of published research on the health outcomes of light and nondaily smoking. They documented that light and intermittent smoking carry nearly the same risk for cardiovascular disease as daily smoking (Bjartveit & Tverdal, 2005; Pope et al., 2009) and that the dose-response relationship between tobacco exposure and cardiovascular mortality is highly nonlinear (Pope et al., 2009). In addition, other research has documented that smoking 5 or more days per month is associated with shortness of breath and fatigue and smoking at least 21 days per month is associated with symptoms of cough and sore throat (An et al., 2009). Given the health consequences of nondaily smoking, promoting smoking cessation among low frequency smokers is important.

Previous research has found differences between nondaily smokers that are former daily smokers, termed "converted nondaily smokers", and nondaily smokers that have always been nondaily smokers, termed "consistent nondaily smokers." Consistent nondaily smokers smoke less days per month and smoke fewer cigarettes than converted nondaily smokers (Gilpin et al., 1997). In a recent study of adults, converted nondaily smokers, consistent nondaily smokers, and daily smokers were compared in relation to having attempted to quit smoking (Tindle & Shiffman, 2011). Tindle and Shiffman (2011) found that converted nondaily smokers were more likely to quit smoking when compared to consistent nondaily and daily smokers, although only 18% of consistent nondaily smokers and 27% of converted nondaily smokers were able to remain abstinent for at least 90 days. This research may

suggest that converted nondaily smokers may transition from daily smoking to nondaily smoking then to cessation. However, this study did not address young adult smokers representing these smoker categories. In fact, little is known about readiness to quit among these various types of smokers in the young adult population.

The current study utilizes an existing data set to examine 1) the differences in psychosocial factors and substance use among college students representing varying trajectories of smoking and 2) factors associated with readiness to quit smoking among current smokers representing differing smoking patterns. The first aim is addressed using the Problem Behavior Theory (Jessor & Jessor, 1977) as the theoretical framework. The Problem Behavior Theory (Jessor & Jessor, 1977) suggests that multiple factors contribute to problem behaviors, including (1) the perceived-environment system, involving social controls, models, and support; (2) the personality system, involving values, expectations, beliefs, attitudes, and orientations toward self and society; and (3) the behavior system, encompassing both problem and conventional behaviors. Considering these explanatory systems, engaging in health-compromising behaviors (e.g., substance use) has demonstrated associations with factors such as social influences (Fagan, Eisenberg, Stoddard, Frazier, & Sorensen, 2001; St. Lawrence, Brasfield, Jefferson, Allyene, & Shirley, 1994), depressive symptoms (Hallfors, Waller, Bauer, Ford, & Halpern, 2005; Windle & Windle, 2001), and attitudes about and perceived harm of substance use (Grube, Morgan, & McGree, 1986; Macy, Chassin, & Presson, 2011; Sherman, Rose, & Koch, 2003; Zlatev, Pahl, & White, 2010).

Second, this study focuses on factors associated with readiness to quit smoking among current smokers (consistent nondaily, converted nondaily, and daily smokers) and thus is guided by the Transtheoretical Model (TTM) (J. O. Prochaska, Redding, Harlow,

Rossi, & Velicer, 1994; J. O. Prochaska & Velicer, 1997; J. O. Prochaska, Velicer, et al., 1994). At the core of the TTM are the stages of change (i.e., stages along a continuum of readiness to change a problem behavior). According to this framework, changes in smoking behaviors occur when individuals have strong positive intentions and motivation to change (Haukkala, Uutela, Vartiainen, McAlister, & Knekt, 2000). Prior research has consistently documented that readiness to quit predicts subsequent quit attempts and cessation (Amodei & Lamb, 2004; Biener & Abrams, 1991; Kleinjan et al., 2009). The TTM incorporates a series of intervening or outcome variables, including self-efficacy (i.e., confidence in the ability to change across problem situations (Bandura, 1986)) (Fishbein et al., 2001; Orlando, Tucker, Ellickson, & Klein, 2004; Tucker, Ellickson, & Klein, 2002) and situational temptations to engage in the problem behavior (e.g., social situations).

Guided by these theoretical frameworks, this study aimed to 1) examine sociodemographics, psychosocial factors, smoking-related characteristics and other substance use among subgroups of college students representing five trajectories of smoking (nonsmokers, quitters, consistent nondaily smokers [i.e., those who were never daily smokers], converted nondaily smokers [i.e., those who are former daily smokers], and daily smokers); and 2) examine smoking category as it relates to readiness to quit smoking among current smokers (i.e., consistent nondaily, converted nondaily, and daily smokers), controlling for other important sociodemographic and smoking-related factors.

Research questions for this study include the following: 1) What differences in psychosocial factors and other substance use exist among college students representing five trajectories of smoking (nonsmokers, quitters, consistent nondaily smokers, converted nondaily smokers and, daily smokers)? 2) What differences in smoking-related characteristics exist among current smoking college students representing three trajectories of smoking

(consistent nondaily smokers, converted nondaily smokers, and daily smokers)? 3) What factors are correlated to readiness to quit among current smoking college students representing three trajectories of smoking (consistent nondaily smokers, converted nondaily smokers, and daily smokers)?

II. Literature Review

As this study will focus on college students representing five trajectories of smoking, this literature review will aim to examine previous literature examining individuals of differing smoking trajectories.

In the 1997 article "Adult smokers who do not smoke daily", Gilpin, Cavin, and Pierce compare converted nondaily smokers and consistent nondaily smokers to daily smokers in terms of factors associated with addiction (Gilpin, Cavin, & Pierce, 1997). The data source for this survey was the 1990 California Tobacco Survey (CTS), which was a population based, random-digit dialed telephone survey. There were 42,790 households contacted to complete an interview. A stratified random sample of the 1990 participants, or 4,642 participants, were interviewed again in 1992. Data was collected in both 1990 and 1992 in order to examine the stability of nondaily smoking.

The authors found that approximately 66% of consistent nondaily smokers continued to smoke occasionally from 1990 to 1992; however, only 40% of converted nondaily smokers continued to smoke occasionally from 1990 to 1992. The authors also found that consistent nondaily smokers smoke less than converted nondaily smokers, are younger, more likely to be White and Hispanic, and to have started smoking regularly at 20 years of age or older. Compared to daily smokers, consistent nondaily smokers were less likely to view themselves to be addicted. Converted nondaily smokers were found to be more educated than daily smokers. Compared to converted nondaily smokers, daily smokers

were more likely to perceive themselves to be addicted and to worry about the amount of money they spend on cigarettes; they were less likely to have quit a year or more, to be ready to quit in the next month, and less confident that they could quit.

In the 2009 article "Intermittent smokers who used to smoke daily: A preliminary study on smoking situations," Nguyen and Zhu compare daily smokers, consistent nondaily smokers, and converted nondaily smokers in terms of demographics, smoking-related characteristics and situations where each group is more likely to smoke (Nguyen & Zhu, 2009). The data source for this study was the 2002 California Tobacco Survey. Participants included 9,455 adults aged 18-29. Daily smokers had less education and were less likely to report getting cigarettes from other individuals when compared to both nondaily smoker groups. Consistent nondaily smokers were most likely to be Hispanic. Compared to consistent nondaily smokers, daily smokers started smoking at a younger age, had smoked longer, smoked more cigarettes per day, and among males, they were more likely to smoke when taking a break from work or school. Compared to consistent nondaily smokers, converted nondaily smokers smoked more days per month, smoked more cigarettes per day, and among males, they were more likely to smoke while socializing or at parties. Compared to daily smokers, consistent nondaily smokers were more likely to state that they only smoked when other people were smoking.

In the 2011 article "Smoking Cessation Behavior Among Intermittent Smokers Versus Daily Smokers", Tindle and Shiffman compare consistent nondaily smokers, converted nondaily smokers, and daily smokers in terms of cessation (Tindle & Shiffman, 2011). The data source for this survey was the 2003 Tobacco Use Supplement to the Current Population Survey. Participants included 29,192 individuals. The authors found that both consistent and converted nondaily smokers were more likely to have made a quit attempt in

the past year when compared to daily smokers. However, 82% of consistent nondaily smokers and 73% of converted nondaily smokers failed in their quit attempts, or staying abstinent for more than 90 days. Converted nondaily smokers were the most likely to quit smoking, indicating that converted nondaily smoking may be a transitory phase from daily smoking to quitting.

In the 2012 article, "Characteristics and Smoking Patterns of Intermittent Smokers" Shiffman et al. compare converted nondaily smokers to consistent nondaily smokers and all nondaily smokers to daily smokers in terms of demographics, smoking history, and smoking behavior (Siffman, Tindle, Li, School, Dunbar, & Mitchell-Miland, 2012). Participants included 515 individuals who were recruited through advertisements and promotions and were from the Pittsburgh, PA area. Data was collected using questionnaires. Compared to daily smokers, nondaily smokers were younger, more likely to be female, educated, and have a higher income; they smoked more "light" cigarettes, had a later age of initiation, reported more quit attempts, had a greater longest duration of quitting and were more likely to smoke more cigarettes on Friday or Saturday when compared to the rest of the week. Furthermore, they were more likely to smoke socially and when consuming alcohol and report stricter workplace and home smoking policies. Lastly, they had average carbon monoxide levels that were about 1/3 that of daily smokers. Compared to nondaily smokers, daily smokers smoked more cigarettes per day, identified more as a smoker and scored higher on the Fagerström Test of Nicotine Dependence (FTND).

Compared to converted nondaily smokers, consistent nondaily smokers were younger, more likely to be male, and reported longer duration of abstinence. Compared to consistent nondaily smokers, converted nondaily smokers were more likely to be African American, smoke mentholated cigarettes, have more friends that smoke and have higher

smoker identity; they smoked on a greater proportion of days, smoked more cigarettes per day, smoked for a longer period of time, had a higher lifetime consumption, a higher score on the FTND, and higher carbon monoxide concentrations.

Previous research has found differences between daily smokers, converted nondaily smokers, and consistent nondaily smokers. Previous research has consistently found that daily smokers have less education, smoke more cigarettes per day, and identify more as a smoker when compared to nondaily smokers. Furthermore, when compared to consistent nondaily smokers, converted nondaily smokers have been found to be more likely to be ready to quit and to smoke more cigarettes per day. Although previous research has been conducted on differences between daily smokers, consistent nondaily smokers, and converted nondaily smokers, there is a lack of research that has been conducted specifically on the young adult, 18-24, and college student populations.

In order to address this gap in the literature, this study aimed to 1) examine sociodemographics, psychosocial factors, smoking-related characteristics, and other substance use among subgroups of college students representing five trajectories of smoking (nonsmokers, quitters, consistent nondaily smokers [i.e., those who were never daily smokers], converted nondaily smokers [i.e., those who are former daily smokers], and daily smokers); and 2) examine smoking category as it relates to readiness to quit smoking among current smokers (i.e., consistent nondaily, converted nondaily, and daily smokers), controlling for other important sociodemographic and smoking-related factors.

III. **Method**

The current study is a secondary data analysis of an online survey that was administered in Fall 2010 to college students in Georgia. The survey contained 230 questions

on a variety of health-related topics, including: alcohol consumption, tobacco use, mental health, diet, and physical activity. The survey took approximately 20-25 minutes to complete.

A. Participants

Participants were recruited from six colleges (three four-year universities, three two-year community/technical colleges) in the Southeast, specifically in the state of Georgia. Random samples of 5,000 students at each school were invited to complete the survey. Two of the six schools had enrollment of less than 5,000 students; thus, all students at these two schools were invited to participate (total invited N=24,055). Of students who received the invitation to participate, 4,849 (20.1%) returned a completed survey; however, only 4,438 participants had complete data on their smoking behaviors and were included in this study.

B. Measures

Demographic characteristics assessed included students' age, gender, ethnicity, highest parental educational attainment, and type of school attended (two-year vs. four-year). Highest parental educational attainment was categorized as less than Bachelors degree versus Bachelors degree or higher based on the distribution of parental educational attainment.

Smoking Behaviors. Participants were asked, "In the past 30 days, on how many days did you smoke a cigarette (even a puff)?" (ACHA, 2008; CDC, 1997). Using the ACHA and the Substance Abuse and Mental Health Associations (ACHA, 2009; Office of Applied Studies, 2006) definitions, we categorized students who reported smoking on all 30 days of the past month as daily smokers and those who smoked from 1 to 29 days of the past 30 days as nondaily smokers. They were also asked, "Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days?" Using these two questions, we created five subgroups: 1) nonsmokers who had never been daily smokers (i.e., nonsmokers); 2) nonsmokers who were former daily smokers (i.e., quitters); 3) nondaily smokers who had

never been daily smokers (i.e., consistent nondaily smokers); 4) nondaily smokers who were former daily smokers (i.e., converted nondaily smokers); and 5) daily smokers.

They were also asked, "On the days that you smoke, how many cigarettes do you smoke on average?" Nicotine dependence was assessed using a single question regarding time to first cigarette (i.e., within 30 minutes of waking versus after) from the Fagerström Test for Nicotine Dependence (FTND) (Heatherton, Kozlowski, Frecker, & Fagerström, 1991).

Other Substance Use. To assess other substance use, students were asked, "In the past 30 days, on how many days did you: Drink alcohol? Drink five or more alcoholic drinks on one occasion? Use chewing tobacco, snuff, or dip, such as Redman, Levi Garrett, Beechnut, Skoal, Skoal Bandits, or Copenhagen? Smoke cigars (Please do not include little cigars or cigarillos, such as Black and Milds, when answering this question)? Smoke little cigars (such as Black and Milds)? Smoke cigarillos (such as Swisher Sweets cigarillos)? Smoke tobacco from a water pipe (hookah)? Use marijuana (pot, weed, hashish, hash oil)?" These assessments were adopted from measures utilized by the American College Health Association (ACHA) surveys, National College Health Risk Behavior Survey (NCHRBS), and Youth Risk Behavior Survey (YRBS), and their reliability and validity have been documented by previous research (ACHA, 2008; CDC, 1997). These variables were dichotomized as have used versus have not used these substances in the past month. In addition, an aggregate variable for other tobacco use was created.

Smoking Attitudes. Attitudes toward smoking were assessed using the Smoking Attitudes Scale (Shore, Tashchian, & Adams, 2000), which is a 17-item questionnaire assessing attitudes toward smoking. The Smoking Attitudes Scale asked participants to rate on a 7-point scale how strongly they agree (1 = strongly disagree, 7 = strongly agree) with 17

smoking-related statements across four dimensions—interpersonal relationships with smokers, laws and societal restrictions on smoking in public places, health concerns, and the marketing and sale of cigarettes (Shore et al., 2000). For example, items included "second-hand smoke is a legitimate health risk" and "non-smokers should be more tolerant of smokers." Higher scores indicate more negative attitudes regarding smoking (i.e., more negative thoughts regarding relationships with smokers, more positive attitudes toward smoking restrictions, more negative attitudes regarding smoking-related health risks, and more negative attitudes regarding the marketing and sale of cigarettes). The scale produces significantly different scores for smokers and non-smokers, with smokers possessing consistently more favorable attitudes towards smoking related topics (Shore et al., 2000). The scale has good construct validity with subscale Cronbach's alphas ranging from 0.69 to 0.88 (Shore et al., 2000).

Perceived Harm. Participants were asked, "Do you believe there is any harm in having an occasional cigarette?" with response options of "yes" or "no" (Minnesota Department of Health, 2008).

Depressive Symptoms. Participants were asked to complete the Patient Health Questionnaire (PHQ-2) (Kroenke, Spitzer, & Williams, 2003), which is a 2-item depression screening tool, based on DSM-4 diagnostic criteria, assessing frequency of depressed mood and anhedonia over the past two weeks. Responses were rated on a 4-point Likert scale and range from "not at all" (0) to "nearly every day" (3). A total score ≥ 3 has been used to reflect clinical depression (Kroenke et al., 2003).

Social Aspects of Smoking. Participants were asked, "Did either of your parents smoke when you lived with them?" (Berg, An, et al., 2011) and "Out of your five closest friends,

how many of them smoke cigarettes?" (Maibach, Maxfield, Ladin, & Slater, 1996) to determine the extent to which their social network includes smokers.

Previous Quit Attempts. Participants were also asked, "During the past 12 months, how many times have you stopped smoking for one day or longer because you were trying to quit smoking?" (California Department of Health and Human Services. Tobacco Control Section, 1999). This variable was dichotomized as having made at least one quit attempt in the past year versus not having made an attempt to quit.

Readiness to Quit Smoking. Readiness to quit was assessed by asking "What best describes your intentions regarding quitting smoking?" Response options were "never expect to quit," "may quit in the future," "but not in the next 6 months," " will quit in the next 6 months," and "will quit in the next month" (J. O. Prochaska & DiClemente, 1984). For the present study, this variable was dichotomized as intending to quit in the next 30 days versus all other responses.

Social Smoking. To assess social smoking, participants were also asked, "In the past 30 days, did you smoke: mainly when you were with other people; mainly when you were alone, as often by yourself as with others, or not at all" (Moran, Wechsler, & Rigotti, 2004). This variable was dichotomized as "social smoking" (i.e., smoking mainly when with others) versus other responses.

Identification of a Smoker. Participants were asked, "Do you consider yourself a smoker?" (Berg et al., 2009).

Treatment Self-Regulation Questionnaire. Motivation to quit was measured using the 15-item Treatment Self-Regulation Questionnaire (TSRQ) (Ryan & Connell, 1989). The TSRQ contains items that measure autonomous motivation (6 items), controlled motivation (6 items), and amotivation (3 items). Participants were asked to indicate the extent to which

several motivators for change were relevant to them. Examples of items include: "Because I personally believe it is the best thing for my health" (autonomous motivation), "Because I would feel guilty or ashamed of myself if I smoked" (controlled motivation), and "I really don't think about stopping smoking" (amotivation). Responses ranged from "not at all true" to "very true" and were on a 7-point scale. Scores ranged from 15 to 105, with higher scores indicating greater motivation. Construct validity was established for the scale (Ryan & Connell, 1989).

Self-Efficacy Questionnaire. Self-efficacy was measured using the Smoking Self-Efficacy Questionnaire (SEQ-12) (Etter, Bergman, Humair, & Perneger, 2000). The SEQ-12 is a 12-item scale that measures confidence in one's ability to refrain from smoking in certain situations. The scale is two-dimensional with six items that measure abstinence self-efficacy for internal stimuli (e.g., "When I feel nervous") and six items that measure abstinence self-efficacy for external stimuli (e.g., "When having a drink with friends"). Responses ranged from "not at all sure" to "absolutely sure" and were on a 5-point Likert scale. SEQ-12 scores ranged from 12 to 60 with higher scores indicating greater self-efficacy. Reliability in test retest procedures was established for the scale along with content validity, construct validity, and predictive validity (Etter et al., 2000).

C. Procedure

In October, 2010, students at six colleges in the Southeast were recruited to complete an online survey. Students received an e-mail containing a link to the consent form with the alternative of opting out. Students who consented to participate were directed to the online survey. To encourage participation, students received up to three e-mail invitations to participate. As an incentive for participation, all students who completed the survey received entry into a drawing for cash prizes of $1,000 (one prize), $500 (two prizes),

and $250 (four prizes) at each participating school. The current analyses focused on the 4,438 participants that had complete data on their smoking behaviors. The Emory University Institutional Review Board approved this study, IRB# 00030631.

D. Analysis

Data for covariates was imputed if less than 10% of the data was missing by taking the mean of the other responses as the imputed value using the series mean command in SPSS. Any individual that did not have complete smoking data was excluded. Participant characteristics were summarized using descriptive statistics. Bivariate analyses were conducted to examine differences among groups in terms of sociodemographic, other substance use, psychosocial, and smoking-related factors, using chi-squared tests for categorical variables and ANOVA for continuous variables. We conducted post-hoc analyses to determine which comparisons were statistically different. We then examined smoking status (consistent nondaily smoker vs. converted nondaily smoker vs. daily smoker) in relation to readiness to quit in the next month using sequential binary logistic regression. We used blocked entry to create three models. Model A only included smoker category, Model B included smoker category plus sociodemographic variables, and Model C included smoker category and sociodemographic variables forced into the model, with psychosocial variables and smoking-related characteristics associated with readiness to quit at the $p<.10$ being entered using backwards stepwise entry. PASW 18.0 was used for all data analyses. Statistical significance was set at $\alpha = .05$ for all tests.

IV. Results

Table 1 highlights the participant characteristics. Overall, 63.8% (n = 3,094) were nonsmokers, 6.0% (n = 293) were quitters, 6.5% (n = 317) were consistent nondaily

smokers, 5.8% (n = 283) were converted nondaily smokers, and 9.3% (n = 451) were daily smokers.

Table 1 presents participant characteristics as well as bivariate analyses examining differences among the subgroups of college students. There were significant differences in sociodemographics such as age, gender, ethnicity, parental education, and type of school among the subgroups of college students by smoking status ($p<.001$). There were also significant differences in other substance use (alcohol, binge drinking, marijuana, and other tobacco products) in the past 30 days ($p<.001$). Lastly there were significant differences in psychosocial factors such as attitudes toward smoking, perceived harm of an occasional cigarette, depressive symptoms, and the number of parents and friends that smoke among the subgroups of college students by smoking status ($p<.001$). Post-hoc comparisons indicated significant differences ($p<.05$) among the groups in regard to most factors (see Table 1 Note).

Table 2 presents the bivariate analyses examining smoking-related factors among current (past 30 day) smokers. There were significant differences in the average number of cigarettes smoked per day, the number of smokers that smoke a cigarette within 30 minutes of waking, made quit attempts in the past 12 months, are ready to quit in the next month, are social smokers, and consider themselves to be a smoker among current smokers ($p<.001$). In addition, there were significant differences in intrinsic and extrinsic self-efficacy ($p<.001$), controlled motivation ($p<.001$), autonomous motivation ($p=.03$), and amotivation ($p=.002$) among current smokers. Lastly, there was a significant difference in the number of smokers that smoked mentholated cigarettes among current smokers ($p=.04$). Post-hoc comparisons indicated significant differences ($p<.05$) among the groups in regard to most factors (see Note in Table 2).

Prior to building the regression model indicating significant predictors of readiness to quit, we conducted bivariate tests to identify candidate predictors related to readiness to quit (significant at the p<.10 level). Potential predictor variables included: attitudes toward smoking, depressive symptoms, number of friends that smoke, average number of cigarettes smoked per day, number of days smoked in the past 30 days, intrinsic and extrinsic self-efficacy, controlled motivation, autonomous motivation, amotivation, perceived harm of an occasional cigarette, parents smoked, first cigarette within 30 minutes of waking, smoking mentholated cigarettes, quit attempts in the past 12 months, social smoking, and considering oneself a smoker.

Table 3 presents the sequential binary logistic regression models identifying factors significantly associated with readiness to quit. Model A indicated that daily smokers were less likely to be ready to quit when compared to consistent nondaily smokers (OR=0.12, CI 0.08, 0.19, p<.001). Model B indicated that daily smokers were less likely to be ready to quit when compared to consistent nondaily smokers (OR=0.12, CI 0.08, 0.20, p<.001) and that females were more likely to be ready to quit (OR=1.56, CI 1.12, 2.18, p=.009). Model C indicated that, after controlling for sociodemographics and other psychosocial factors, converted nondaily smokers were more likely to be ready to quit in the next month when compared to consistent nondaily smokers (OR=2.15, CI 1.32, 3.49, p=.002). Other factors associated with readiness to quit smoking in the next month included more negative attitudes towards smoking (OR=1.03, CI 1.02, 1.04, p<.001), fewer days smoked in the past 30 days (OR=0.94, CI 0.92, 0.97, p<.001), smoking the first cigarette within 30 minutes of waking (OR=2.11, CI 1.23, 3.62, p=.006), not considering oneself to be a smoker (OR=0.55, CI 0.32, 0.95, p=.03), and greater autonomous motivation (OR=1.04, CI 1.01, 1.06, p=.001). No other significant associations were found.

V. Discussion

A. Findings

The current research examined sociodemographic and psychosocial factors among college students with differing smoking trajectories. Most notably, we found that, among current smokers, converted nondaily smokers were more likely to be ready to quit smoking than consistent nondaily smokers, whereas consistent nondaily smokers and daily smokers were not statistically different in their intentions to quit, after controlling for sociodemographic, smoking-related, and other psychosocial characteristics.

Among nonsmokers, quitters, consistent nondaily smokers, converted nondaily smokers, and daily smokers, we found that, consistent with previous findings, nonsmokers included the greatest proportion of females (Ridner, 2005), 2005), Blacks (Patterson, Lerman, Kaufmann, Neuner, & Audrain-McGovern, 2004; Ridner, 2005), and four-year college students (Berg, An, et al., 2011; Sanem, Berg, An, Kirch, & Lust, 2009). Consistent with Problem Behavior Theory (Jessor & Jessor, 1977), nonsmokers were less likely to use alcohol, binge drink, smoke marijuana, or use other tobacco products than former or current smokers, which is also consistent with prior research (Patterson et al., 2004). Furthermore, nonsmokers had the most negative attitudes towards smoking (Shore et al., 2000), were the most likely to view smoking as harmful to your health, the least likely to have parents that smoked (Wetter et al., 2004), and had the fewest amount of friends that smoked (Ridner, 2005). Thus, nonsmokers experienced several factors, both interpersonally and intrapersonally, that are associated with reduced risk of smoking initiation. On the opposite end of the spectrum, daily smokers included the largest proportion of White smokers, which aligns with prior research (Berg, Wen, Cumming, Ahluwalia, & Druss, Unpublished Observations; Patterson et al., 2004). They were most likely to have parents that completed

less than a Bachelors degree and were also the most likely to attend a two-year school, which has been previously documented (Berg, An, et al., 2011; Sanem et al., 2009). They had the least negative attitudes towards smoking, were most likely to have parents that smoked, and had the greatest amount of friends that smoked, which has been shown previously (Ridner, 2005). These findings highlight that nonsmokers who have never smoked daily and current daily smokers in the young adult population might exemplify extreme opposite ends of a spectrum in terms of their smoking behaviors and the risk factors associated with smoking initiation and progression, which is in line with Problem Behavior Theory. In addition, quitters were the oldest subgroup, which may be reflective of the natural progression of smoking to cessation among some individuals (Tindle & Shiffman, 2011).

In terms of other substance use, consistent nondaily smokers were the most likely to smoke marijuana and use other tobacco products. Converted nondaily smokers were the most likely to use alcohol and binge drink. Prior research has documented the greatest proportion of substance use (e.g., alcohol and marijuana) and other tobacco use among nondaily smokers (Sutfin et al., In press), yet research has not documented differences in consistent versus converted nondaily smokers.

Another interesting finding is that converted nondaily smokers were the least likely of the five groups to view smoking as harmful to one's health but had the greatest intention to quit smoking. This may seem counterintuitive given that higher perceived harm tends to be associated with greater intent to quit smoking (Sherman et al., 2003). However, these findings might be reflective of their ability to reduce to a nondaily smoking pattern after regular daily use, and thus an impression that quitting smoking or reducing smoking is not as challenging as the other groups might perceive. Their lower levels of concern about the

harm of smoking may result from lower level current use of cigarettes relative to the risks of daily smoking.

Among consistent nondaily, converted nondaily, and daily smokers, significant differences were found in smoking-related characteristics such that consistent nondaily smokers seemed to represent the group with lowest risk in terms of their smoking levels and attitudes, whereas daily smokers represented the highest risk group. Consistent with prior research, consistent nondaily smokers smoked the fewest days per month (Gilpin et al., 1997), smoked the least amount of cigarettes per day (Gilpin et al., 1997; Tindle & Shiffman, 2011), and were the least likely to smoke within the first 30 minutes of waking (Tindle & Shiffman, 2011), whereas daily smokers smoked the most (Tindle & Shiffman, 2011) and were the most likely to smoke after waking (Tindle & Shiffman, 2011). Furthermore, consistent nondaily smokers were the least likely to consider themselves a smoker (Berg et al., 2009) and were most likely to smoke socially, whereas daily smokers were the most likely to consider themselves a smoker and were least likely to be social smokers (Berg et al., 2009).

Consistent nondaily smokers reported the highest controlled motivation, whereas daily smokers reported the lowest controlled motivation. Interestingly, however, consistent nondaily smokers also reported the greatest amotivation, which may reflect their tendency to not consider themselves a smoker. Consistent nondaily smokers had the highest self-efficacy to refrain from smoking, while daily smokers had the lowest (Patterson et al., 2004). However, in this sample, daily smokers were the most likely to have made a recent quit attempt, with the consistent nondaily smokers being the least likely. This last finding is in contrast with the prior research (Tindle & Shiffman, 2011) in which daily smokers were the least likely to have made a quit attempt and converted nondaily smokers were the most likely

to have attempted to quit. However, these findings were documented among adult smokers comprised of mostly adults over the age of 30.

Another noteworthy finding was that, while converted nondaily smokers were the least likely to smoke mentholated cigarettes, current daily smokers were the most likely to smoke mentholated cigarettes. Previous research has suggested that menthol may increase nicotine absorption (Ahijevych, 1999; Ahijevych & Parsley, 1999), indicating that menthol may make cigarettes more addictive and promote the maintenance of smoking, making it more difficult to quit smoking menthol cigarettes than plain cigarettes (Ahijevych & Garrett, 2004). However, prior research has been inconclusive with some research showing no relationship between menthol and successful cessation (Hyland, Garten, Giovino, & Cummings, 2002; Muscat, Richie, & Stellman, 2002) and some indicating menthol being associated with lower cessation rates or greater difficulty quitting (Harris et al., 2004; Okuyemi et al., 2004; Pletcher et al., 2006). The current findings highlight the need to examine this in the young adult years.

Guided by the Transtheoretical Model (J. O. Prochaska, Redding, et al., 1994; J. O. Prochaska & Velicer, 1997; J. O. Prochaska, Velicer, et al., 1994), the current research also examined psychosocial factors and smoking-related characteristics among current smokers and how these factors are related to readiness to quit. After controlling for sociodemographics, psychosocial variables, and smoking-related characteristics, converted nondaily smokers were twice as likely as consistent nondaily smokers to be ready to quit smoking in the next month. Acknowledging the differences indicated by bivariate findings compared to the multivariate findings, our data suggests that other psychosocial factors and smoking-related characteristics are critically important in understanding how these groups of nondaily smokers view their smoking and the need to quit. For example, smokers who

smoked their first cigarette within 30 minutes of waking (i.e., more nicotine dependent) were more likely to be ready to quit in the next month, suggesting that individuals that are addicted to smoking may feel a stronger need to quit. In contrast, however, those that smoked fewer days per month were more likely to be ready to quit. In addition, current smokers who did not consider themselves to be smokers, those who had more negative attitudes toward smoking, and those who had greater autonomous motivation to quit were more likely to be ready to quit in the next month. Thus, there might be some social stigma-related influence on readiness to quit smoking in this population

B. Conclusions

After controlling for sociodemographics, psychosocial variables, and smoking-related characteristics, converted nondaily smokers were twice as likely to be ready to quit smoking in the next month when compared to consistent nondaily smokers. This shows the importance of using a comprehensive assessment of differences between converted nondaily and consistent nondaily smokers and readiness to quit smoking. Since converted nondaily smokers show greater readiness to quit and converted nondaily smoking appears to be a transitory phase from daily smoking to smoking cessation, intervention efforts targeting converted nondaily smokers may help facilitate their transition from nondaily smoking to smoking cessation.

C. Strengths and Limitations

A strength of this study is the probability sampling that was used to obtain a representative sample of the college populations. In addition, participants were recruited from six different schools, including universities, community colleges, and technical schools that were located in rural and urban geographic locations in the efforts to develop a sample that would be representative of different college student populations. A third strength of this

study is the large sample size that is desirable for establishing statistically significant results. Finally, the ethnic diversity in our sample, specifically the large representation of Black students, is a strength of this study given the ethnic variability in smoking patterns.

Limitations to this study include limited generalizability due to recruitment at six colleges in the Southeast. An additional limitation is the relatively low response rate (20.1%), which may suggest response bias. However, previous research has found that the average email survey response rate is 24%, which is only slightly higher than the response rate for this survey (Sheehan, 2001). In addition, it is possible that some recruited students did not open the e-mail or had inactive accounts, which would influence the response rate. Furthermore, previous research has indicated that, despite lower response rates, internet surveys yield similar data regarding health behaviors compared to mail and phone surveys (An et al., 2007).

D. Implications and Recommendations

Behavioral science research should focus on performing a comprehensive assessment of differences between differing trajectories of smoking when conducting formative research. Furthermore, behavioral scientists should use research on differences between individuals representing varying trajectories of smoking to develop tailored interventions to each group that can assist in the transition of smoking to cessation. Future research on this topic should focus on recruiting larger samples from multiple sites in the U.S. in order to obtain participants that would be representative of the U.S. college student population. Furthermore, future research should explore other methods of recruitment, such as in-person, telephone, or recruitment through university administrators, that may result in higher response rates. Lastly, future research should aim to examine different trajectories of

smoking among nontraditional young adult populations such as non-college student populations that may have less access to tobacco-related health education.

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Table 1. Participant characteristics and bivariate analyses examining differences in sociodemographic and psychosocial factors among differing smoking histories

Variable	All participants N=4,438 M (SD) or N(%)	Nonsmokers N=3,094 M (SD) or N(%)	Quitters N=293 M (SD) or N(%)	Consistent nondaily smokers N=317 M (SD) or N(%)	Converted nondaily smokers N=283 M (SD) or N(%)	Daily smokers N=451 M (SD) or N(%)	p
Sociodemographics							
Age (SD)	23.54 (6.18)	22.59 (6.18)	29.69 (11.00)	21.63 (4.63)	24.21 (5.95)	26.97 (8.92)	<.001
Gender (%)							<.001
Male	1276 (28.8)	783 (25.3)	104 (35.5)	117 (36.9)	110 (38.9)	162 (35.9)	
Female	3162 (71.2)	2311 (74.7)	189 (64.5)	200 (63.1)	173 (61.1)	289 (64.1)	
Ethnicity (%)							<.001
White	2024 (45.6)	1100 (35.6)	206 (70.3)	173 (54.6)	200 (70.7)	345 (76.5)	
Black	1730 (39.0)	1486 (48.0)	46 (15.7)	83 (26.2)	52 (18.4)	63 (14.0)	
Parental Education (%)							<.001
< Bachelors	2756 (62.1)	1944 (62.8)	183 (62.5)	181 (57.1)	141 (49.8)	307 (68.1)	
≥ Bachelors	1682 (37.9)	1150 (37.2)	110 (37.5)	136 (42.9)	142 (50.2)	144 (31.9)	
Type of School (%)							<.001
Four-year	2754 (62.1)	2156 (69.7)	111 (37.9)	211 (66.6)	149 (52.7)	127 (28.2)	
Two-year	1684 (37.9)	938 (30.3)	182 (62.1)	106 (33.4)	134 (47.3)	324 (71.8)	
Psychosocial factors							
Attitudes Toward Smoking, Total (SD)	88.06 (18.06)	93.61 (14.89)	86.29 (19.08)	81.78 (13.67)	73.23 (14.93)	64.82 (16.09)	<..001
Interpersonal	21.98 (8.14)	24.75 (6.64)	21.01 (7.97)	18.61 (6.03)	14.51 (6.38)	10.65 (5.72)	<.001
Laws/Restrictions	35.68 (7.70)	36.95 (6.86)	35.56 (7.89)	35.11 (6.91)	32.46 (8.12)	29.53 (9.46)	<.001
Health concerns	17.83 (4.18)	18.45 (3.92)	17.61 (4.38)	16.94 (4.27)	16.13 (4.08)	15.36 (4.40)	<.001
Marketing	12.57 (5.00)	13.47 (4.81)	12.11 (5.37)	11.12 (4.18)	10.13 (4.53)	9.27 (4.71)	<.001
Harm of Occasional Cigarette (%)							<.001
No	1034 (23.3)	532 (17.2)	70 (23.9)	129 (40.7)	129 (45.6)	174 (38.6)	
Yes	3404 (76.7)	2562 (82.8)	223 (76.1)	188 (59.3)	154 (54.4)	277 (61.4)	
Depressive symptoms (SD)	1.24 (1.31)	1.16 (1.27)	1.19 (1.34)	1.44 (1.36)	1.45 (1.38)	1.50 (1.47)	<.001
Parents smoked (%)							<.001
No	2654 (59.8)	2037 (65.8)	129 (44.0)	203 (64.0)	136 (48.1)	149 (33.0)	

Yes	1784 (40.2)	1057 (34.2)	164 (56.0)	114 (36.0)	147 (51.9)	302 (67.0)	
Number of friends that smoke (SD)	1.47 (1.57)	0.98 (1.28)	1.82 (1.53)	1.94 (1.43)	2.69 (1.46)	3.52 (1.36)	<.001
Other Substance Use, Past 30 days							
Any alcohol use (%)							<.001
No	1925 (43.4)	1591 (51.4)	110 (37.5)	56 (17.7)	35 (12.4)	133 (29.5)	
Yes	2513 (56.6)	1503 (48.6)	183 (62.5)	261 (82.3)	248 (87.6)	318 (70.5)	
Any binge drinking (%)							<.001
No	3441 (77.5)	2642 (85.4)	213 (72.7)	161 (50.8)	141 (49.8)	284 (63.0)	
Yes	997 (22.5)	452 (14.6)	80 (27.3)	156 (49.2)	142 (50.2)	167 (37.0)	
Marijuana (%)							<.001
No	3795 (86.2)	2805 (91.5)	253 (86.6)	212 (67.5)	196 (70.0)	329 (73.3)	
Yes	606 (13.8)	261 (8.5)	39 (13.4)	102 (32.5)	84 (30.0)	120 (26.7)	
Other tobacco products (%)							<.001
No	3567 (82.0)	2747 (90.4)	237 (83.5)	117 (38.4)	161 (58.1)	305 (68.7)	
Yes	782 (18.0)	292 (9.6)	47 (16.5)	188 (61.6)	116 (41.9)	139 (31.3)	

Note: Bonferroni post-hoc comparisons indicated significant differences in all comparisons except the following: Age – no difference between Nonsmokers and Consistent nondaily smokers; ATS – Laws/Restrictions – no differences between Quitters and Consistent nondaily smokers; ATS – Health concerns – no differences between Quitters and Consistent nondaily smokers, Consistent nondaily smokers and Converted nondaily smokers, and Converted nondaily smokers and Daily smokers; ATS – Marketing – no differences between Quitters and Consistent nondaily smokers, Consistent nondaily smokers and Converted nondaily smokers, and Converted nondaily smokers and Daily smokers; PHQ-2 scores – no differences between Nonsmokers and Quitters, Quitters and Consistent nondaily smokers, Quitters and Converted nondaily smokers, Consistent and Converted nondaily smokers, Consistent nondaily and Daily smokers, Converted nondaily and Daily smokers; and Number of friends that smoke – no differences between Quitters and Consistent nondaily smokers.

Table 2. Bivariate analyses examining differences in smoking-related characteristics among differing smoking histories

Variable	Consistent nondaily smokers N=317 M (SD) or N(%)	Converted nondaily smokers N=283 M (SD) or N(%)	Daily smokers N=451 M (SD) or N(%)	p
Number of days smoked, past 30 (SD)	5.43 (6.21)	14.44 (9.99)	30.00 (0.00)	<.001
Ave. CPD (SD)	2.31 (4.67)	4.65 (5.36)	11.77 (7.14)	<.001
Menthol (%)				.04
No	150 (57.7)	147 (58.8)	206 (49.8)	
Yes	110 (42.3)	103 (41.2)	208 (50.2)	
First cigarette, 30 mins of waking (%)				<.001
No	251 (96.5)	223 (89.2)	190 (45.9)	
Yes	9 (3.5)	27 (10.8)	224 (54.1)	
Quit attempts, past 12 months (%)				<.001
No	40 (15.4)	10 (4.0)	4 (1.0)	
Yes	220 (84.6)	240 (96.0)	410 (99.0)	
Ready to quit in next month (%)				<.001
No	143 (55.0)	153 (61.2)	376 (90.8)	
Yes	117 (45.0)	97 (38.8)	38 (9.2)	
Social smoker (%)				<.001
No	53 (20.4)	122 (48.8)	354 (85.5)	
Yes	207 (79.6)	128 (51.2)	60 (14.5)	
Consider yourself a smoker (%)				<.001
No	273 (86.1)	124 (43.8)	6 (1.3)	
Yes	44 (13.9)	159 (56.2)	445 (98.7)	
Self-efficacy – Intrinsic (SD)	22.52 (7.38)	19.92 (6.55)	16.99 (8.31)	<.001
Self-efficacy – Extrinsic (SD)	21.78 (7.02)	19.61 (5.74)	17.17 (7.74)	<.001
TSRQ – Controlled motivation (SD)	27.05 (12.68)	24.18 (11.39)	21.11 (10.91)	<.001
TSRQ – Autonomous motivation (SD)	32.65 (8.95)	32.49 (9.07)	30.94 (9.96)	.03
TSRQ – Amotivation (SD)	6.75 (3.64)	5.76 (3.45)	5.86 (3.65)	.002

Note: Bonferroni post-hoc comparisons indicated significant differences in all comparisons except the following: TSRQ Autonomous motivation – no differences among the groups; and TSRQ Amotivation – no differences between Converted nondaily smokers and Daily smokers.

Table 3. Binary logistic regression model indicating factors associated with readiness to quit in the next month among current smokers

	Model A			Model B			Model C		
Variable	OR	CI	p	OR	CI	p	OR	CI	p
Smoking status									
Consistent nondaily smoker	Ref	--	--	Ref	--	--	Ref	--	
Converted nondaily smoker	0.78	0.55, 1.10	.16	0.80	0.55, 1.15	.23	2.15	1.32, 3.49	.002
Daily smoker	0.12	0.08, 0.19	<.001	0.12	0.08, 0.20	<.001	0.97	0.42, 2.28	.95
Age				0.99	0.96, 0.20	.49	0.98	0.95, 1.01	.23
Gender									
Male				Ref	--	--	Ref	--	
Female				1.56	1.12, 2.18	.009	1.28	0.89, 1.85	.19
Ethnicity									
White				Ref	--	--	Ref	--	
Black				0.94	0.61, 1.44	.76	1.15	0.72, 1.81	.55
Other				0.94	0.59, 1.53	.83	1.09	0.65, 1.84	.75
Parental education									
< Bachelors				Ref	--	--	Ref	--	
≥ Bachelors				0.87	0.62, 1.22	.43	0.83	0.58, 1.20	.33
Type of school									
Four-year				Ref	--	--	Ref	--	
Two-year				0.99	0.69, 1.42	.96	1.15	0.78, 1.72	.48
Attitudes toward smoking							1.03	1.02, 1.04	<.001
Number of days smoked, past 30							0.94	0.92, 0.97	<.001
First cigarette, 30 mins of waking									
No							Ref	--	
Yes							2.11	1.23, 3.62	.006
Consider yourself a smoker									
No							Ref	--	
Yes							0.55	0.32, 0.95	.03
Self-efficacy – Extrinsic							1.02	1.00, 1.05	.07
TSRQ – Autonomous motivation							1.04	1.01, 1.06	.001

Model A: Nagelkerke $R^2 = 0.200$; Model B: Nagelkerke $R^2 = 0.212$; Model C: Nagelkerke $R^2 = 0.345$