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Onset and Persistence of Daily Smoking: The Interplay of Socioeconomic Status, Gender, and Psychiatric Disorders

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Abstract

Gains in reducing the prevalence of smoking observed over the past 40 years have been substantially lower among lower socioeconomic status (SES) groups and women. In parallel, there have been strong and consistent associations of psychiatric disorders with SES, gender, and smoking. Yet few studies have examined the interrelations among these factors to identify their unique and shared contributions. In this study we examine (1) to what degree SES and gender predict new onset of daily smoking and persistence during the current period when rates of smoking have been stable overall; and (2) given the association of psychiatric disorders with gender, SES, and cigarette smoking, to what degree psychiatric disorders explain or alter the associations between gender, SES, and cigarette smoking.

Methods: Longitudinal data for U.S. adults come from Waves 1 (2001-2002) and 2 (2003-2004) of the National Epidemiologic Study of Alcohol and Related Conditions ($n=34,653$). DSM-IV mood, anxiety, and substance use disorders were assessed with AUDADIS-IV. Logistic regression was used to estimate risk of transitions to daily smoking and persistence over the 3-year follow-up.

Results: Gender, education, occupation, anxiety disorders, and substance use disorders (SUD) independently predicted the onset of daily smoking at W2, with greater gender differences observed at lower levels of education. However, no interactions were found between active psychiatric disorders and either gender or SES in predicting the onset of daily smoking. Only being Native American/Alaskan, having an active SUD, and number of cigarettes smoked per day predicted persistence of daily smoking at W2.

Keywords

daily smoking; smoking persistence; longitudinal; psychiatric disorders; socioeconomic status; gender

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1. Introduction

In the United States, the prevalence of current cigarette smoking has dropped substantially since the publication of the 1964 U.S. Surgeon General's landmark report on the link between cigarette and excess mortality (U.S. Surgeon General's Advisory Committee, 1964): falling from approximately 42% of adults in 1965 to 24% in the late 1990s (CDC, 2007a). Over this period there were important shifts in the characteristics of smokers in the general population. One such change is that the rates of cigarette smoking for women and men have become more alike. In 1965, the rate of current smoking among women was 33.7% compared with 51.9% for men, an 18 percentage point difference (CDC, 2007a). By 1991 this difference had shrunk to approximately 4.6 percentage points (23.5% and 28.1% for women and men, respectively (CDC, 2007a) due to a differential decrease in prevalence over this period: a 30.7% change for women versus a 45.9% change for men. The most recent National Health Interview Survey (NHIS) estimates (2007) indicate continued but relatively small differences in rates of current smoking between women (17.4%) and men (22.3%) (CDC, 2008).

In contrast to the narrowing gap in smoking prevalence between women and men, the gap in prevalence of current cigarette smoking between socioeconomic status (SES) groups has become greater over time. In 1965 the prevalence of current smoking by number of years of education among adults 25 years of age or older was 35% for those with 16 or more years, 45% for those with 12 or 13-15 years, and 42% for those with less than 12 years of education (Giovino et al., 1994). By 1991 all education levels showed substantial reductions in prevalence of current smoking. However, these reductions were larger among those with more versus less education: 61%, 43%, 32%, and 25% reduction in prevalence for those with 16 or more, 13-15, 12, and less than 12 years of education, respectively. This gap in prevalence by education, as well as a prevalence gap by poverty status, has persisted since 1983 (CDC, 2004). Estimates from the 2007 NHIS indicate that less than 10% of those with a college degree or more education were current smokers, approximately 21% of those with some college or a high school degree, 44% of those with a General Equivalency Degree (GED), and 23% of those with less than 12 years of education were current smokers (CDC, 2008). In parallel, in 2006, 20% of adults at or above the poverty line and 29% of those below the poverty line were current smokers (CDC, 2008).

As these gaps in smoking prevalence have developed, numerous studies have documented associations between various indicators of SES (e.g., education, occupation, and income) and lifetime and current smoking, as well as persistence of smoking, based on cross-sectional and/or retrospectively reported data (Escobedo and Peddicord, 1996; Gilman et al., 2003; Gilman et al., 2008; Hu et al., 2006; Lawrence et al., 2007; Pierce et al., 1989). Given the retrospective nature of these studies, it remains unclear whether the associations between smoking outcomes and indicators of SES arise from unaccounted-for confounding variables (Khwaja et al., 2007), self-selection of those likely to smoke cigarettes into low SES occupations (Lawrence et al., 2007), or if something about low socioeconomic status (e.g., low education, particular occupational environments, or low income and the stress associated with it) causes an increased risk of becoming a cigarette smoker or persisting in smoking once started.

Psychiatric disorders may be one such set of confounding factors that influences these relationships as they have been associated with cigarette smoking, low socioeconomic status, and gender. Little data are available on possible changes in degree of association between psychiatric disorders and cigarette smoking as the prevalence of smoking has declined (Johnson and Breslau, 2006; Murphy et al., 2003). Johnson and Breslau (2006) demonstrated a modest association between depression and regular smoking among the 1957 high school graduate cohort in the Wisconsin Longitudinal study (OR=1.4, 95% CI 1.2–1.6), suggesting that the association exists even among cohorts from a time when smoking was relatively normative.

However, using the repeated cross-sectional surveys from the Stirling County Study, Murphy et al. (2003) found that the association between current smoking and current depression was not statistically significant in the 1952 and 1970 surveys but was significant and of a larger magnitude in the 1992 survey (OR ~ 3.0, 95% CI 1.7 – 5.2 for moderate and heavy smoking). They conclude that the association between depression and cigarette smoking has increased as rates of smoking in the general population have fallen. Regardless of a possible increase in the strength of association during the decline in current smoking in the United States, research since the 1980s has consistently demonstrated a strong link between psychiatric disorders, such as mood, anxiety, and substance use, and the onset of regular cigarette smoking (Alvarado and Breslau, 2005; Breslau et al., 1993a, b; Breslau et al., 2004a, b; Hu et al., 2006; Ilomaki et al., 2008; Kollins et al., 2005).

Although psychiatric disorders are associated with onset of cigarette smoking, they are also concentrated among those of lower socioeconomic status. Using years of education as a proxy for socioeconomic status, Kessler and colleagues (1994) found that those with a high school education or less had nearly double the risk of any past-year mood, anxiety, or substance use disorder compared with those with at least a college education. This pattern also held for self-reported income, and had held in other studies as well, such as the National Comorbidity Survey Replication (Kessler et al., 2005), and the National Household Survey of Drug Use and Health (SAMHSA, 2008). Significant disparities in rates of psychiatric disorders between males and females have also been observed, with males less likely to exhibit past year mood and anxiety disorders compared with females, but more likely to have externalizing disorders such as substance use and antisocial personality disorder (Kessler et al., 2005; Kessler et al., 1994). Few studies have explicitly examined the degree to which socioeconomic or gender disparities in smoking may be explained by their common link to psychiatric disorders or alternatively that the link between psychiatric disorders and smoking may be contributed to by low socioeconomic status where cognitive and emotional resources can be significantly strained.

Taking these trends and associations together, there are two key questions regarding the interplay of gender, SES, and psychiatric disorders in the onset and maintenance of smoking in the current historic period. First, during the current period when rates of smoking have been stable overall, as has the prevalence gap by SES measures (CDC, 2006, 2007a, 2008), to what degree do SES and gender predict new onset of daily smoking and continued persistence? Second, given the association of psychiatric disorders with gender, SES, and cigarette smoking, to what degree do psychiatric disorders explain or alter the associations between gender, SES, and cigarette smoking?

In this study we take advantage of the unique opportunity provided by Wave 2 follow-up of The National Epidemiologic Study of Alcohol and Related Conditions (NESARC), (Grant et al., 2004b) to prospectively examine the transitions to daily smoking and the persistence of daily smoking in a longitudinal, nationally representative sample that was collected during the period when reduction in U.S. adult smoking prevalence has stalled: Wave 1 collected during 2001-2002 and Wave 2 during 2004-2005. These data allow us to not only address questions regarding the continued and prospective association of gender, SES, and psychiatric disorders with new onset and persistence of daily smoking but may also indicate specific “at risk” population subgroups where prevention and treatment efforts should be emphasized in order to achieve the national smoking reduction objective of 12% smoking prevalence (U.S. DHHS, 2000).

2. Methods

2.1 Sample

The NESARC is a representative sample of the noninstitutionalized population aged 18 or older residing in the contiguous United States, the District of Columbia, Alaska, and Hawaii. The NESARC complex sample design includes stratification and clustering, as well as oversampling population subgroups. Post-stratification weights were derived from the 2000 Census to ensure that the sample was representative of the U.S. population (Grant et al., 2004a; Grant et al., 2003b). Between August 2001 and May 2002, in-person computer-assisted interviews (CAI) were conducted by interviewers from the U.S. Census Bureau. The research protocol and informed consent procedure was approved by the Institutional Review Boards from the U.S. Census Bureau and the U.S. Office of Management and Budget. The overall Wave 1 response rate was 81% ($n = 43,093$) (Grant et al., 2004a; Grant et al., 2003b).

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) conducted a longitudinal follow-up of original NESARC participants from August 2004 through September 2005, approximately 3 years after participants' initial interview (Grant and Kaplan, 2005). Of the 43,093 participants in Wave 1, more than 3,000 (3,134) were ineligible for Wave 2 because they were institutionalized, permanently physically disabled, mentally impaired, deployed as a member of the U.S. Armed Forces during the study period, deceased, deported, or had permanently moved out of the country. Among the 39,959 eligible persons, 34,653 were interviewed in Wave 2--for a Wave 2 response rate of 86.7%. The response rate over both Waves 1 and 2 is 70.2% (Grant and Kaplan, 2005).

To examine transitions to daily smoking and potential persistence of daily smoking between Waves 1 and 2, this study was limited to the 34,653 NESARC participants who were interviewed at both Waves. Two outcomes were examined in this longitudinal sample: (1) new onset daily smoking among those who had no lifetime history of daily smoking at Wave 1; (2) persistence of daily smoking among those who were current daily smokers at Wave 1. Table 1 provides a summary of the characteristics of the total follow-up sample and each of these "at risk" subsamples.

2.2 Measures

Demographics and Socioeconomic Status Indicators—Demographic variables measured in the NESARC that were examined in this study include gender, race/ethnicity, marital status, and full-time student status. Race/ethnicity was determined by self-report of Hispanic versus non-Hispanic descent and among those non-Hispanics, self-report of White, Black, Native American /Alaskan, or Asian/Pacific Islander descent.

Three indicators of socioeconomic status were examined: (1) level of education completed; (2) household income; and (3) occupation. In each case Wave 1 current responses were used to predict Wave 2 outcomes. Current/most recent occupation was assessed by 15 categories. Six categories of occupation were created based on the Bureau of Labor Statistics Major Occupational Groups (MOGs) (U.S. Census Bureau and Bureau of Labor Statistics, 2002): (1) Professional/Managerial/Technical (MOGs A and B); (2) Sales and Administrative Support (MOGs C and D); (3) Laborers (MOGs E-H); (4) Services (MOGs K and L); (5) Other, which included Farming, Forestry, Fishing, and Military occupations; and (6) Never in the Labor Force (i.e., never working for pay in a family business or farm).

Psychiatric Diagnoses—The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 2000) diagnoses were generated using the Alcohol Use Disorder and Associated Disabilities Interview Schedule—version 4 (AUDADIS-IV), which has been shown

to have high reliability and validity (Grant et al., 2001; Grant et al., 2003a). All diagnoses included in this study followed exclusionary criteria for illness and substance use induced. To examine the more proximal effects of psychiatric disorders on transitions in daily smoking, we focused on disorders that were active within the past 12 months of the Wave 1 interview.

Common psychiatric diagnoses were grouped into three broad classifications following DSM-IV nomenclature: mood, anxiety, and substance use disorders. Mood disorders included major depression, dysthymia, and mania/hypomania. Anxiety disorders included generalized anxiety disorder, panic disorder, agoraphobia, social phobia, and specific phobia. Substance use disorders included abuse and/or dependence for alcohol, marijuana, amphetamines, opioids, sedatives, tranquilizers, cocaine, inhalants, hallucinogens, heroin, and other drugs.

2.3 Analysis

All analyses were conducted using SAS-callable SUDAAN release 9.0 (RTI International, 2003) to account for the weighting and complex sampling structure of the NESARC. Taylor-series linearization was used to adjust the standard errors of parameter estimates. Wave 2 weights were used as specified in the NESARC data notes for analyses of the linked Wave 1 and Wave 2 NESARC data (Grant, 2008). In addition to accounting for sampling design and permitting generalization to the noninstitutionalized U.S. population aged 18 or older, the Wave 2 sample weights make adjustments to estimates to account for noninterviews of persons interviewed for Wave 1 but ineligible for Wave 2 (see 2.1 Sample section) (Grant and Kaplan, 2005).

Logistic regression was used to estimate the risk of new onset daily smoking at Wave 2 associated with demographic, SES, and psychiatric disorder variables among those without a lifetime history of daily smoking at Wave 1. Bivariate associations were estimated initially, and a multivariable model was built sequentially using a backward elimination procedure in which a multivariable model including all predictors was estimated (full model), all nonsignificant predictors were dropped and then individually added back to the model to test for variable specific improvement in model fit using likelihood ratio chi-square test (Hosmer and Lemeshow, 2000). The final reduced model included all variables that produced the best model fit and was tested against the full model. All potential interactions with gender, SES, and psychiatric disorders were tested, regardless of whether a statistically significant main effect was present. This process yielded a final model that accounted for all possible statistically significant adjusted associations with onset of daily smoking among these variables in this nationally representative data set. Using parallel procedures, logistic regression was also used to estimate the risk of smoking persistence at Wave 2 among current daily smokers at Wave 1. All persistence analyses were adjusted for age at onset of daily smoking and years since onset of daily smoking reported at Wave 1.

3. Results

3.1 Onset of Daily Smoking

An estimated 60.4% (se = 0.7) of participants interviewed at both Waves 1 and 2 of the NESARC had never smoked daily by their Wave 1 interview ($n = 21,226$) and thus constitute those at risk for new onset of daily smoking. The overall incidence of new onset daily smoking was 2.5% (se = 0.1) over the 3-year period between Waves 1 and 2 ($n = 508$).

Table 2 presents the results of bivariate and multiple variable logistic regressions examining the risk of becoming a daily smoker. Adjusting for substantial age and marital status effects, level of education had the strongest association with onset of daily smoking. Compared with those with at least a 4-year college degree, odds of onset of daily smoking increased in a dose

response fashion from two times among those with a 2-year college degree to more than four times among those with less than a high school degree. In spite of this strong association, occupation was also associated with onset of daily smoking, suggesting that both indicators of socioeconomic status contribute to excess risk of daily smoking. Being female and having an anxiety disorder that was active at Wave 1 reduced risk of daily smoking onset, though both were only marginally significant ($p = 0.05$). Finally, having an active substance use disorder (SUD) modestly increased the risk of daily smoking onset at Wave 2 in the main effects multivariable model.

Two interactions were identified for risk of daily smoking onset: (1) between gender and level of education ($p = 0.06$) and (2) between having an active SUD and anxiety disorder ($p = 0.02$). Stratifying by gender it appears that the increased risk of daily smoking onset associated with lower levels of education is somewhat reduced among women compared to men, particularly at the lowest levels of education (see Table 3). The interaction between active SUD and anxiety disorders suggests that in the absence of a co-occurring SUD, those with an anxiety disorder at Wave 1 were nearly 60% less likely to onset daily smoking than were those without either disorder class (OR = 0.43 95% CI 0.23 – 0.78). In contrast, those with co-occurring SUD and anxiety disorders were approximately twice as likely to become daily smokers compared with those without either (OR = 2.22 95% CI 1.01 – 4.91). The increased risk of daily smoking onset among those with only SUD was not statistically significant (OR = 1.44 95% CI 0.96 – 2.17). Although the risk of daily smoking onset associated with indicators of SES were somewhat larger for younger age groups (e.g. level of education among those 35 or fewer years of age) neither these nor any other interactions between any of the variables examined were statistically significant ($p > 0.10$: data available upon request).

3.2 Persistence of Daily Smoking

At Wave 1, 19.9% (se = 0.5) of adults in the United States were estimated to be current daily smokers. Of these, 85.1% (se = 0.6) persisted as daily smokers 3 years later at Wave 2 (unweighted $n = 5,546$ of 6,547). No indicators of SES were associated with persistence in either the bivariate or multiple variable models, adjusting for age at onset of daily smoking and years since onset of daily smoking (see Table 4). Only race/ethnicity, active SUD, and number of cigarettes smoked per day were associated with persistence of daily smoking. Native Americans/Alaskans were twice as likely to persist and Hispanic Americans were 40% less likely to persist compared with Whites. Those with an active SUD were at modest increased risk of persistence (~ 35%). However, those who smoked more than 10 cigarettes per day were one and a half to two times as likely to persist as those who smoked 1 to 5 cigarettes per day. We tested for interactions between all of the variables examined here, including age at onset of daily smoking and years since onset of daily smoking at Wave 1: none were statistically significant ($p > 0.10$).

The association between DSM-IV nicotine dependence and daily smoking persistence was also examined, finding a significant bivariate association (OR = 1.33, 95% CI 1.11 – 1.59). However, number of cigarettes smoked per day showed a stronger association with persistence than nicotine dependence, and when both were included in the multiple variable model, the association with nicotine dependence was no longer statistically significant (OR = 1.13, 95% CI 0.94 – 1.35).

4. Discussion

In this longitudinal study of a nationally representative sample of U.S. adults 18 years of age or older, we addressed two primary questions: (1) to what extent do gender and indicators of SES prospectively affect onset and persistence of daily smoking in the current historic period; and (2) does the presence of active psychiatric disorders influence the relationships of SES and

gender to onset and persistence of daily smoking? For onset of daily smoking, we found that both lower levels of education and lower status occupations independently increased the risk of becoming a new daily smoker over the 3-year period between Waves 1 and 2, with strong and modest effect sizes, respectively. Additionally, it appeared that the modestly lower risk of daily smoking onset among women compared with men differed significantly by level of education with the magnitude of this gender difference greatest among those who had not graduated high school and no significant gender difference among those who had at least graduated high school. Active anxiety and SUDs, respectively, decreased and increased the risk of daily smoking onset independent of the effects of gender and indicators of low SES. In contrast, neither indicators of SES nor gender were associated with persistence of daily smoking in either bivariate or multiple variable models, nor did they interact with the three primary risk factors for persistence of smoking found here: race/ethnicity, any active SUD, or number of cigarettes smoked per day.

Over the past 4 decades the prevalence of current smoking among adults in the United States has decreased by 50.9%: from 42.4% in 1965 to 19.8% in 2007 (CDC, 2008; Giovino et al., 1994). However, that decrease has neither been uniform across the population nor has it continued uniformly over time. Since 1965 the gains in reducing the prevalence of smoking have been substantially lower among lower SES groups. The resulting enlarged gap in prevalence of current cigarette smoking by level of education has continued without significant alteration into the mid-2000s (CDC, 2004, 2007a, b, 2008). Paralleling this stability in prevalence rates by level of education since the 1990s, approximately 80% of the total reduction in the prevalence of current smoking occurred between 1965 and 1990 (CDC, 2007b), after which progress slowed and there was no statistically significant reduction in smoking prevalence between 1999 and 2007. In spite of the relative stability of the overall prevalence of current smoking as well as the differences in prevalence by level of education, the prospective results of this study suggest that lower SES (as measured by both level of education and occupation status) continues to increase the risk of new onset of daily smoking in the 2000s. In contrast, there was no evidence that likelihood of persistence among daily smokers was associated with any indicator of SES. Thus, of the two mechanisms by which differences in smoking prevalence by SES could be maintained or grow (higher onset and/or lower cessation rates), only increased risk of onset--not increased risk of persistence--was supported by these data.

By virtue of their prospective nature, the results of this study add to our understanding of the relationship between indicators of SES and onset and persistence of daily smoking. Although the cross-sectional associations between cigarette smoking and education, and occupation and income have been well established, it has remained unclear whether these correlates of smoking are likely to have causal effects (Gilman et al., 2008; Lawrence et al., 2007). Finding a prospectively increased risk of new onset daily smoking associated with level of education attained and occupation at Wave 1 does not establish that causal relationship, but it is consistent with (1) the hypothesis that there is something about having less education and being in particular occupations that independently increases future risk of daily smoking; and (2) that prevention efforts targeted to lower SES groups may be important to reinvigorating reductions in the prevalence of cigarette smoking among U.S. adults. The interaction between gender and education found here, in which lower educated men were at particularly high risk of new onset daily smoking, further emphasizes the potential importance of targeted prevention efforts in high-risk population subgroups. It is also noteworthy that relationships between indicators of SES and onset of daily smoking were unaffected by psychiatric disorders, though these disorders were potential "third factors" that could explain the association of SES and daily smoking.

In contrast with the results for onset of daily smoking, neither gender nor indicators of SES were associated with persistence of daily smoking in these prospective analyses. These results are consistent with null findings examining the cross-sectional association of occupation and household income with being a former smoker among ever smokers in a nationally representative sample of young adults (Lawrence et al., 2007); but they are inconsistent with results (Hu et al., 2006; Gilman et al., 2008) that showed retrospective associations of lower educational attainment with being a current nicotine-dependent smoker among ever nicotine-dependent smokers and smoking persistence among ever weekly smokers, respectively. Differences in results between this and prior studies of educational attainment and persistence may have resulted from differing definitions of smoking (weekly, daily, or nicotine dependent), the prospective versus retrospective data in this study, differing age cohorts, or the relatively short follow-up period in this study.

4.1 Limitations

One limitation of this study was the relatively short follow-up period of approximately 3 years. Although the number of individuals who made the transitions to new onset of daily smoking ($n = 508$) and to no longer smoking daily ($n=1,001$) at Wave 2 are relatively large, the short follow-up period may limit the representativeness of these individuals relative to the population that make such transitions over the life course. An additional limitation is that our analyses do not represent that portion of the population that would have onset daily smoking before the age of 18 since the NESARC is nationally representative of the U.S. population 18 years of age or older. However, it should be noted that onset of daily smoking at 18 years of age or older is not unusual. Among lifetime daily smokers in the NESARC at Wave 1, 54.2% ($se = 0.6$) reported onset of daily smoking at age 18 or older. Finally, in our analysis of persistence of smoking, we were unable to examine quit attempts as an outcome or smoking persistence among those daily smokers who had attempted to quit. Thus we could not test for the potential differences in making a quit attempt or in success of such attempts by gender, SES, or active psychiatric disorders. The analyses of persistence in this study were more broadly based, incorporating all stages of change in smoking status into the dichotomous persistence versus cessation.

4.2 Conclusions

In this longitudinal study of a nationally representative sample of noninstitutionalized adults in the United States, gender, indicators of SES, and psychiatric disorders continue to influence new onset of daily smoking during the 2000s when the overall rate of current smoking appears to be stalled. Although gender and level of education interacted, there appeared to be no interplay between active psychiatric disorders and either gender or indicators of SES in predicting daily smoking onset. Although gender, level of education, and SUDs were associated with reductions in cigarettes smoked per day between Waves 1 and 2, neither gender nor any indicators of SES were associated with persistence of daily smoking. Thus the results of this study support an increased emphasis on smoking prevention among those in lower SES groups but a more universal approach to interventions and treatment among all groups of daily smokers.

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Table 1
 Sample Characteristics of the NESARC* Follow-up Sample at Wave 1: Total Sample, Never Daily Smokers, and Current Daily Smokers

Characteristic	Total Follow-up Sample (N = 34,653)		Never Daily Smokers at Wave 1 (N = 21,226)		Current Daily Smokers at Wave 1 (N = 6,547)		
	N [†]	% (SE) [‡]	N [†]	% (SE) [‡]	N [†]	% (SE) [‡]	
Gender	Male	14564	47.9(0.3)	7968	43.8(0.4)	3055	52.7(0.8)
	Female	20089	52.1(0.3)	13258	56.2(0.4)	3499	47.3(0.8)
Age	18-24	3958	13.0(0.3)	2783	15.1(0.4)	896	15.2(0.6)
	25-34	6260	18.5(0.3)	4415	21.1(0.4)	1246	20.6(0.6)
	35-44	7514	21.2(0.3)	4820	21.9(0.4)	1587	24.2(0.7)
	45-54	6512	18.8(0.3)	3640	17.4(0.4)	1428	20.6(0.6)
	55-64	4405	12.3(0.2)	2197	9.9(0.2)	869	12.3(0.5)
65+	6004	16.2(0.3)	3371	14.6(0.4)	528	7.2(0.4)	
Race/ethnicity	White	20174	70.9(1.5)	11187	65.9(1.9)	4235	76.2(1.2)
	Black	6577	11.0(0.7)	4345	12.5(0.8)	1214	10.3(0.8)
	Native Am./Alaskan	580	2.2(0.2)	276	1.8(0.2)	181	3.5(0.4)
	Asian/Pacific Is.	966	4.3(0.5)	738	5.6(0.6)	110	2.2(0.4)
	Hispanic American	6356	11.6(1.2)	4680	14.2(1.6)	814	7.8(0.7)
	Married	17401	59.2(0.5)	10799	59.7(0.7)	2626	49.9(0.8)
Marital Status	Living w/someone	1012	3.3(0.2)	564	2.9(0.2)	315	5.6(0.4)
	Widowed	3056	6.0(0.1)	1881	6.0(0.2)	384	4.1(0.2)
	Divorced	4369	8.5(0.2)	2142	6.4(0.2)	1257	14.2(0.5)
	Separated	1139	2.0(0.1)	613	1.7(0.1)	328	3.3(0.2)
	Never married	7676	20.5(0.5)	5227	23.3(0.6)	1644	23.0(0.8)
Full-time Student	Yes	3200	9.1(0.2)	19235	89.0(0.3)	6142	93.1(0.4)
	No	2652	8.7(0.2)	1991	11.0(0.3)	412	6.9(0.4)
Education							

Characteristic	Total Follow-up Sample (N = 34,653)		Never Daily Smokers at Wave 1 (N = 21,226)		Current Daily Smokers at Wave 1 (N = 6,547)	
	N [†]	%(SE) [‡]	N [†]	%(SE) [‡]	N [†]	%(SE) [‡]
4y College degree+	8480	25.6(0.7)	6003	30.6(0.8)	776	11.3(0.6)
2y College degree	3140	9.1(0.2)	1908	9.0(0.3)	600	9.2(0.5)
Some college	7334	21.6(0.3)	4340	21.1(0.4)	1501	23.0(0.7)
HS degree	8688	25.3(0.5)	5168	24.2(0.6)	1875	29.5(0.8)
Some HS/GED	4639	12.7(0.3)	2265	9.3(0.3)	1435	22.0(0.7)
< HS	2372	5.7(0.3)	1542	5.8(0.4)	367	5.1(0.4)
Household Income						
70k +	7248	26.1(0.7)	4797	28.6(0.9)	925	17.8(0.8)
50-69k	5286	17.0(0.3)	3261	16.6(0.4)	907	16.8(0.6)
30-49k	8343	23.9(0.4)	5022	23.1(0.4)	1661	26.2(0.7)
15-29k	7369	18.9(0.4)	4270	17.6(0.5)	1616	22.3(0.6)
0-14k	6407	14.1(0.4)	3876	14.1(0.4)	1445	16.9(0.6)
Occupation						
Professional/Managerial/Technical	11680	34.7(0.5)	758	37.0(0.7)	1814	28.2(0.8)
Sales and Admin Support	5509	15.9(0.3)	3393	16.2(0.4)	1095	16.0(0.6)
Laborers	4986	15.3(0.4)	2608	12.6(0.4)	1385	24.0(0.8)
Services	5012	13.9(0.3)	3113	14.2(0.4)	1126	16.7(0.6)
Other	755	2.5(0.2)	482	2.6(0.2)	126	2.2(0.3)
Never in labor force	6711	17.6(0.4)	4049	17.4(0.5)	1008	13.0(0.5)
Any Active Mood Disorder [§]						
No	31288	90.8(0.2)	19475	92.4(0.3)	5526	84.9(0.6)
Yes	3365	6.2(0.2)	1751	7.7(0.3)	1028	15.1(0.6)
Any Active Anxiety Disorder [§]						
No	30643	88.8(0.3)	19092	90.5(0.3)	5465	83.6(0.6)
Yes	4010	11.2(0.3)	2134	9.5(0.3)	1089	16.4(0.6)
Any Active SUD [§]						
No	31677	90.9(0.3)	19936	93.6(0.3)	5402	81.4(0.6)
Yes	2976	9.2(0.3)	1290	6.5(0.3)	1152	18.6(0.6)

Characteristic	Total Follow-up Sample (N = 34,653)	Never Daily Smokers at Wave 1 (N = 21,226)	Current Daily Smokers at Wave 1 (N = 6,547)
	N [†]	N [†]	N [†]
	%(SE) [‡]	%(SE) [‡]	%(SE) [‡]

* The National Epidemiologic Study of Alcohol and Related Conditions (NESARC) (Grant et al., 2004b).

[†]The number of subjects presented is unweighted to allow assessment of subgroup sample sizes.

[‡]Percentages were weighted and standard errors corrected for the NESARC's complex sampling design using SUDAAN.

[§]Individuals meeting DSM-IV diagnoses for disorders in the 12 months prior to their interview were considered to have active disorders. Mood disorders included major depression, dysthymia, and mania/hypomania. Anxiety disorders included generalized anxiety disorder, panic disorder, agoraphobia, social phobia, and specific phobia. Substance use disorders included abuse and/or dependence for alcohol, marijuana, amphetamines, opioids, sedatives, tranquilizers, cocaine, inhalants, hallucinogens, heroin, and other drugs.

Table 2

Risk of New Onset of Daily Smoking at Wave 2 among Never Daily Smokers at Wave 1 ($N = 21,226$): Bivariate and Multiple Variable Models

Characteristic	% w/ Onset of Daily Smoking (SE) [†]	Bivariate Risks	Main Effects Multivariable Model
		OR (95% CI) [‡]	OR (95% CI) [‡]
Gender			
Male	3.1 (0.2)	1.0	1.0
Female	2.1 (0.2)	0.66 (0.53 - 0.82)	0.78 (0.61 - 1.00)
Age			
18-24	6.8 (0.6)	1.0	1.0
25-34	2.4 (0.4)	0.33 (0.23 - 0.48)	0.61 (0.41 - 0.91)
35-44	2.5 (0.3)	0.35 (0.26 - 0.47)	0.70 (0.50 - 0.98)
45-54	1.6 (0.2)	0.23 (0.16 - 0.32)	0.47 (0.31 - 0.71)
55-64	1.4 (0.3)	0.19 (0.12 - 0.31)	0.36 (0.21 - 0.62)
65 ⁺	0.4 (0.1)	0.05 (0.03 - 0.11)	0.08 (0.03 - 0.19)
Race/ethnicity			
White	2.2 (0.2)	1.0	1.0
Black	4.3 (0.5)	2.01 (1.47 - 2.74)	1.22 (0.89 - 1.69)
Native Am./Alaskan	4.3 (1.7)	2.01 (0.88 - 4.60)	1.64 (0.69 - 3.89)
Asian/Pacific Is.	2.4 (0.6)	1.11 (0.67 - 1.85)	1.14 (0.67 - 1.92)
Hispanic American	2.6 (0.4)	1.20 (0.83 - 1.72)	0.64 (0.43 - 0.94)
Marital Status			
Married	1.5 (0.2)	1.0	1.0
Living w/someone	1.8 (0.6)	1.22 (0.61 - 2.43)	0.73 (0.35 - 1.51)
Widowed	0.7 (0.2)	0.47 (0.27 - 0.83)	1.18 (0.56 - 2.49)
Divorced	2.8 (0.4)	1.90 (1.34 - 2.70)	1.81 (1.26 - 2.60)
Separated	5.0 (1.4)	3.51 (1.86 - 6.63)	2.60 (1.38 - 4.89)
Never married	5.6 (0.4)	3.94 (3.05 - 5.08)	1.97 (1.43 - 2.70)
Full-time Student			
Yes	2.2 (0.1)	1.0	+
No	5.1 (0.6)	2.38 (1.77 - 3.19)	
Education			
4y College degree ⁺	0.9 (0.2)	1.0	1.0
2y College degree	2.3 (0.4)	2.54 (1.46 - 4.41)	2.11 (1.20 - 3.72)
Some college	3.4 (0.4)	3.83 (2.47 - 5.94)	2.40 (1.52 - 3.78)
HS degree	3.1 (0.3)	3.57 (2.37 - 5.39)	2.78 (1.82 - 4.24)
Some HS/GED	4.9 (0.6)	5.64 (3.60 - 8.83)	4.27 (2.67 - 6.83)
< HS	2.5 (0.7)	2.87 (1.53 - 5.36)	4.31 (2.27 - 8.19)
Household Income			
70k ⁺	1.4 (0.2)	1.0	+

Characteristic	% w/ Onset of Daily Smoking (SE) [†]	Bivariate Risks	Main Effects Multivariable Model
		OR (95% CI) [‡]	OR (95% CI) [‡]
	50-69k	2.4 (0.3)	1.68 (1.09 - 2.59)
	30-49k	2.6 (0.3)	1.84 (1.26 - 2.67)
	15-29k	3.5 (0.4)	2.46 (1.56 - 3.88)
	0-14k	3.7 (0.4)	2.66 (1.74 - 4.08)
Occupation			
	Professional/Managerial/Technical	1.4 (0.2)	1.0
	Sales and Admin Support	3.3 (0.4)	1.50 (1.04 - 2.19)
	Laborers	4.2 (0.6)	1.57 (1.07 - 2.28)
	Services	3.7 (0.5)	1.47 (1.02 - 2.13)
	Other	2.2 (1.0)	1.02 (0.39 - 2.66)
	Never in labor force	2.1 (0.3)	1.64 (1.15 - 2.35)
Any Active Mood Disorder [§]			
	No	2.5 (0.2)	+
	Yes	2.8 (0.5)	1.11 (0.72 - 1.69)
Any Active Anxiety Disorder [§]			
	No	2.6 (0.2)	1.0
	Yes	1.8 (0.4)	0.62 (0.39 - 0.99)
Any Active SUD [§]			
	No	2.3 (0.1)	1.0
	Yes	5.8 (0.9)	1.69 (1.17 - 2.44)

[†] Percentages were weighted and standard errors corrected for the NESARC's complex sampling design using SUDAAN.

[‡] OR = odds ratio; 95% CI = 95% confidence interval.

[§] Individuals meeting DSM-IV diagnoses for disorders in the 12 months prior to their interview were considered to have active disorders. Mood disorders included major depression, dysthymia, and mania/hypomania. Anxiety disorders included generalized anxiety disorder, panic disorder, agoraphobia, social phobia, and specific phobia. Substance use disorders included abuse and/or dependence for alcohol, marijuana, amphetamines, opioids, sedatives, tranquilizers, cocaine, inhalants, hallucinogens, heroin, and other drugs.

⁺ Dropped from multivariable model through backward elimination procedure. The reduced model fit significantly better than the full multivariable model ($G = 16.6$, 6 df, $p < 0.02$), and inclusion of nonsignificant predictors did not meaningfully alter estimates for those included in the reduced model.

Table 3

Risk of New Onset of Daily Smoking at Wave 2 among Never Daily Smokers at Wave 1 ($N = 21,226$): Effects of Education Stratified by Gender

Education	% w/ Onset of Daily Smoking (SE) [†]	Stratified Risks
		OR (95% CI) [‡]
Women (13,258)		
4y College degree+	0.8 (0.2)	1.0
2y College degree	1.7 (0.4)	2.09 (0.97 - 4.52)
Some college	3.4 (0.5)	4.39 (2.37 - 8.12)
HS degree	2.4 (0.3)	3.07 (1.71 - 5.51)
Some HS/GED	2.8 (0.5)	3.60 (1.88 - 6.88)
< HS	1.2 (0.4)	1.51 (0.66 - 3.48)
Men (7,968)		
4y College degree+	1.0 (0.2)	1.0
2y College degree	3.2 (0.9)	3.24 (1.59 - 6.63)
Some college	3.2 (0.6)	3.35 (1.91 - 5.89)
HS degree	4.1 (0.6)	4.30 (2.51 - 7.36)
Some HS/GED	7.8 (1.2)	8.38 (4.77 - 14.71)
< HS	4.8 (1.8)	5.06 (2.02 - 12.72)

[†] Percentages were weighted and standard errors corrected for the NESARC's complex sampling design using SUDAAN.

[‡] OR = odds ratio; 95% CI = 95% confidence interval.

Table 4
Risk of Smoking Persistence at Wave 2 among Daily Smokers at Wave 1 ($N = 6,547$): Initial and Final Regression Models

Characteristic	% w/ Persistence of Daily Smoking (SE) [†]	Adjusted Risk	Main Effects Multivariable Model
		OR (95% CI) [‡]	OR (95% CI) [‡]
Gender			
Male	85.1 (0.9)	1.0	+
Female	85.1 (0.8)	1.02 (0.85 - 1.23)	
Race/Ethnicity			
White	86.4 (0.6)	1.0	1.0
Black	82.7 (1.9)	0.79 (0.61 - 1.03)	0.96 (0.74 - 1.24)
Native Am./Alaskan	91.9 (2.4)	2.04 (1.01 - 4.13)	2.05 (1.00 - 4.20)
Asian/Pacific Is.	73.5 (6.2)	0.45 (0.23 - 0.88)	0.56 (0.28 - 1.11)
Hispanic American	75.7 (2.2)	0.51 (0.39 - 0.67)	0.61 (0.46 - 0.81)
Marital Status			
Married	84.4 (0.8)	1.0	+
Living w/someone	83.5 (2.4)	0.94 (0.65 - 1.35)	
Widowed	84.5 (2.3)	1.17 (0.79 - 1.74)	
Divorced	87.2 (1.2)	1.29 (1.03 - 1.62)	
Separated	88.9 (2.3)	1.45 (0.88 - 2.42)	
Never married	85.3 (1.2)	1.05 (0.82 - 1.35)	
Full-time Student			
Yes	85.2 (0.6)	1.0	+
No	83.8 (2.2)	0.90 (0.62 - 1.29)	
Education			
4y College degree ⁺	83.0 (1.7)	1.0	+
2y College degree	85.6 (2.0)	1.18 (0.79 - 1.75)	
Some college	84.4 (1.2)	1.09 (0.82 - 1.46)	
HS degree	85.9 (1.0)	1.21 (0.91 - 1.61)	
Some HS/GED	87.2 (1.1)	1.31 (0.97 - 1.76)	
< HS	78.6 (3.4)	0.73 (0.46 - 1.15)	
Household Income			
70k ⁺	85.1 (1.4)	1.0	+
50-69k	84.5 (1.4)	0.95 (0.71 - 1.27)	
30-49k	83.6 (1.2)	0.90 (0.68 - 1.20)	
15-29k	86.6 (1.0)	1.11 (0.85 - 1.46)	
0-14k	86.2 (1.2)	1.13 (0.84 - 1.50)	
Occupation			
Professional/Managerial/Technical	85.5 (1.0)	1.0	+

Characteristic	% w/ Persistence of Daily Smoking (SE) [†]	Adjusted Risk	Main Effects Multivariable Model
		OR (95% CI) [‡]	OR (95% CI) [‡]
Sales and Admin Support	84.9 (1.4)	0.99 (0.76 - 1.30)	
Laborers	84.8 (1.3)	0.94 (0.72 - 1.23)	
Services	86.5 (1.2)	1.09 (0.83 - 1.45)	
Other	82.5 (4.2)	0.79 (0.44 - 1.41)	
Never in labor force	83.8 (1.5)	0.88 (0.66 - 1.17)	
Any Active Mood Disorder [§]			
No	84.6 (0.7)	1.0	+
Yes	88.1 (1.2)	1.33 (1.03 - 1.70)	
Any Active Anxiety Disorder [§]			
No	84.6 (0.7)	1.0	+
Yes	87.6 (1.2)	1.27 (0.99 - 1.63)	
Any Active SUD [§]			
No	84.4 (0.7)	1.0	1.0
Yes	88.2 (1.2)	1.26 (0.97 - 1.63)	1.35 (1.07 - 1.71)
Number of Cigarettes Smoked per Day			
1-5	76.6 (2.1)	1.0	1.0
6-10	80.9 (1.3)	1.26 (0.97 - 1.63)	1.17 (0.90 - 1.52)
11-15	85.2 (1.9)	1.69 (1.16 - 2.47)	1.48 (1.01 - 2.17)
16-20	88.8 (0.8)	2.39 (1.80 - 3.18)	2.09 (1.57 - 2.79)
20 ⁺	88.6 (1.3)	2.27 (1.58 - 3.26)	1.94 (1.34 - 2.81)

[†] Percentages were weighted and standard errors corrected for the NESARC's complex sampling design using SUDAAN.

[‡] OR = odds ratio; 95% CI = 95% confidence interval. All estimates adjusted for age at onset of daily smoking and years since onset of daily smoking.

[§] Individuals meeting DSM-IV diagnoses for disorders in the 12 months prior to their interview were considered to have active disorders. Mood disorders included major depression, dysthymia, and mania/hypomania. Anxiety disorders included generalized anxiety disorder, panic disorder, agoraphobia, social phobia, and specific phobia. Substance use disorders included abuse and/or dependence for alcohol, marijuana, amphetamines, opioids, sedatives, tranquilizers, cocaine, inhalants, hallucinogens, heroin, and other drugs.

⁺ Dropped from multivariable model through backward elimination procedure. The reduced model fit significantly better than the full multivariable model ($G = 29.7, 23 \text{ df}, p < 0.01$), and inclusion of nonsignificant predictors did not meaningfully alter estimates for those included in the reduced model.