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Probability and predictors of relapse to smoking: Results of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC)

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Abstract

Background—The goal of this study was to estimate rates of relapse to smoking in the community and to identify predictors of relapse.

Methods—Data were drawn from the Waves 1 and 2 of the National Epidemiologic Survey of Alcohol and Related Conditions (NESARC). Logistic regression analyses were used to estimate the probability of relapse at Wave 2 among individuals who were abstinent at Wave 1 given length of abstinence as well as the presence of several sociodemographic, psychopathologic and substance use-related variables at Wave 1.

Results—The risk for relapse among individuals who had been abstinent for 12 months or less at the baseline assessment was above 50%. Among individuals who had been abstinent for over a year, risk of relapse decreased hyperbolically as a function of time, and stabilized around 10% after 30 years of abstinence. Although several sociodemographic, psychopathologic and tobacco-related variables predicted relapse in univariate analyses, only younger age at cessation and shorter duration of abstinence independently predicted risk of relapse in multivariable analyses.

Conclusions—The first year after a quit attempt constitutes the period of highest risk for relapse. Although the risk for relapse decreases over time, it never fully disappears. Furthermore, younger age at smoking cessation also increases the risk for relapse. This information may help develop more targeted and effective relapse prevention programs.

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Contributors

Carlos Blanco and Mayumi Okuda designed the study and wrote the Grant. Olaya García-Rodríguez and Ludwing Flórez-Salamanca provided summaries of previous research. Shang-Min Liu undertook the statistical analysis and Olaya García-Rodríguez and Roberto Secades-Villa wrote the first draft of the manuscript. All authors contributed to and have approved the final manuscript.

Conflict of Interest

All the authors declare that they have no conflicts of interest.

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Keywords

Smoking; tobacco; relapse; recurrence; probability; National Epidemiologic Survey of Alcohol and Related Conditions; NESARC

1. INTRODUCTION

Substantial decreases in the prevalence of tobacco use are widely considered one of the top ten public health achievements of the last decade (Centers for Disease Control and Prevention (CDC), 2011; Secades-Villa et al., 2013). Despite this progress, 20% of U.S. adults currently smoke (CDC, 2010) and cigarette smoking remains the first preventable cause of morbidity and mortality in the world (World Health Organization, 2009). Clearly, reduction of cigarette smoking continues to be one of the highest public health priorities.

Most current smokers report that they would like to quit and, when asked, almost half say that they tried to quit during the previous 12 months (CDC, 2009a). Unfortunately, most quit attempts fail, and relapse to smoking after either aided or unaided cessation is common. Prospective studies in clinical samples indicate that relapse curves often have a hyperbolic shape with higher rates of relapse shortly after quitting and decreasing probability of relapse with longer periods of abstinence (Hughes et al., 2004).

These studies suggest that some sociodemographic characteristics such as younger age (Harris et al., 2004; Osler and Prescott, 1998), poor health status (Piper et al., 2011b; Swan et al., 1997), lower socioeconomic status (Barbeau et al., 2004; Fernandez et al., 2006), greater body mass index (Swan et al., 1997) and not being married (Derby et al., 1994) increase the risk of relapse in clinical population. Higher severity of nicotine dependence, younger age at daily smoking, and prior quit attempts (Harris et al., 2004; Hurt et al., 2002; Ockene et al., 2000; Powell et al., 2010) also increase to the risk of relapse. Presence of psychiatric symptoms, mainly anxiety and depressive symptoms, has also been related to risk of relapse in most (Covey et al., 1997; Glassman et al., 1990, 1988; Piper et al., 2011a) although not all studies (Hitsman et al., 2003; Niaura et al., 1999).

Much less is known about the risk of relapse in the general population. The U.S. National Health and Nutrition Examination Study (NHANES; US Department of Health and Human Services, 1990) examined the probability of relapse in a nationally representative sample. It found that the probability of relapse was inversely related to the duration of abstinence. However, this study used a retrospective design, which is subject to risk of recall bias, did not examine predictors of relapse, and was conducted over 20 years ago, before recent changes in the prevalence of tobacco use. Other recent community-based studies as the ITC-4 (Herd et al., 2009) or the ATTEMP cohort study (Zhou et al., 2009), which include representative samples from four and five countries, respectively, found that relapse to smoking was associated with higher severity of nicotine dependence, presence of craving and withdrawal symptoms and lack of smoking cessation aids, but no relapse rates were provided.

We sought to build on prior knowledge, by examining rates and predictors of relapse to tobacco use using data from the two waves of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC), a large representative sample followed prospectively. A more accurate knowledge of how the time and predictors of relapse to tobacco use in general population may lead to a better understanding of smoking behavior and contribute to the improvement of treatment interventions by identifying those subjects with an elevated risk of relapse.

2. METHODS

2.1. Participants and procedures

Data were drawn from Waves 1 and 2 of the National Epidemiologic Survey on Alcohol and Related Conditions (NESARC; Grant and Kaplan, 2005; Grant et al., 2003b). Wave 1 was conducted in 2001–2002 and Wave 2 was conducted during 2004–2005. The NESARC Wave 1 target population consisted of civilian, non-institutionalized individuals aged 18 and older residing in households and group quarters. Blacks, Hispanics, and adults 18–24 were oversampled, with data adjusted for oversampling, household- and person-level non-response. The NESARC used a multistage stratified design in which primary sampling units were stratified according to certain sociodemographic criteria. The sampling frame for housing units is the Census 2000/2001 Supplementary Survey and that for group quarters is the Census 2000 Group Quarters Inventory. The overall survey response rate was 81%, yielding 43,093 respondents.

The Wave 2 interview was conducted approximately 3 years later. The mean interval between Wave 1 and Wave 2 interviews was 36.6 months. Excluding ineligible respondents (e.g., deceased), the response rate for Wave 2 was 86.7% ($n=34,653$; Grant et al., 2009). Data were collected using the Alcohol Use Disorder and Associated Disabilities Interview Schedule-DSM-IV (AUDADIS-IV; Grant et al., 2001). Computer algorithms produced DSM-IV diagnoses based on AUDADIS-IV data. Sampling weights were calculated in order to establish that the subsample of respondents reinterviewed at Wave 2 was representative of the original representative sample at Wave 1 and account for nonresponse as well as sample attrition. As described previously, adjustment for non-response was successful, as the Wave 2 respondents and the original target population did not differ on age, race-ethnicity, sex, socioeconomic status or the presence of any substance, mood, anxiety or personality disorder (Grant et al., 2009). Interviewing was conducted by trained U.S. Census Bureau Field Representatives through computer-assisted personal interviews in face-to-face household settings. Verification of the interviewers was conducted by regional supervisors who recontacted a random 10% of all respondents for quality control purposes. In addition, a randomly selected subset of respondents was reinterviewed with one to three complete sections of the Alcohol Use Disorder and Associated Disabilities Interview Schedule – DSM-IV (AUDADISIV). In the few cases when accuracy was uncertain, the data were discarded and a supervising interviewer repeated the interview. All procedures, including informed consent, received full human review and approval from the U.S. Census Bureau and U.S. Office of Management and Budget.

The sample for the present study was composed of all individuals with a lifetime history of daily smoking who were abstinent at the time of Wave 1 interview ($n=5,831$) and who also participated in Wave 2. To minimize the risk of recall bias that could be generated by included individuals who had been abstinent for a long time, we conducted sensitivity analyses including only individuals who had been abstinent less than one year ($n=572$). Because the results were similar, we present the results of the full sample. Results of the subsample are available upon request.

2.2. Measures

2.2.1. Cigarette use, abstinence and relapse—Smokers were defined as those subjects who reported having smoked 100 or more cigarettes in their entire life and who had been daily smokers at some point in their lives, following the National Health Interview Survey criteria defined by the Center for Diseases Control and Prevention (Centers for Disease Control and Prevention, 2009b). To be consistent with studies in clinical samples, abstinence was defined as having smoked the last cigarette at least 1 week prior to the

baseline assessment, i.e., the Wave 1 interview. This approach is similar to the 1-week point-prevalence abstinence definition used in most clinical trials (Fiore et al., 2008). A measure of continuous abstinence for abstinent participants in Wave 1 was recorded by asking them the most recent time when they had smoked. Relapse was defined as being abstinent in Wave 1, but smoking at least 100 cigarettes between Waves 1 and 2.

2.2.2. Sociodemographic characteristics—Sociodemographic characteristics assessed at Wave 1 included self-reported race/ethnicity (White, Black, Hispanic, Asian and Native American), gender, age, height and weight that were converted into body mass index (overweight – obese, BMI ≥ 25 versus not), urbanicity (urban vs. rural), nativity (U.S.-born vs. foreign-born), educational attainment (categorized for this study into less than high school, high school education or college education), individual income, marital status (categorized into married/living with someone, never married or divorced/separated/widowed), employment status (categorized into employed or unemployed) and overall health (categorized into poor to fair or good to excellent). The presence of 12 different stressful events (e.g., having been fired from a job) during the previous 12 months were also assessed using questions from the social readjustment rating scale (Holmes and Rahe, 1967).

2.2.3. Psychiatric disorders—Past year Axis I psychiatric disorders were assessed by the AUDADIS-IV. Mood disorders included major depressive disorder, dysthymia, bipolar I and bipolar II. Anxiety disorders included panic disorder, social anxiety disorder, specific phobia and generalized anxiety disorder. Conduct disorder and psychotic disorder were assessed on a lifetime basis at Wave 1. AUDADIS-IV methods to diagnose these disorders are described in detail elsewhere (Grant et al., 2005a, 2005b, 2005c; Hasin et al., 2005; Stinson et al., 2007). Axis II psychiatric disorders included avoidant, dependent, obsessive-compulsive, paranoid, schizoid, histrionic and antisocial personality disorders. They were assessed on a lifetime basis at Wave 1 and are described in detail elsewhere (Grant et al., 2005b). Personality disorders diagnoses required long-term patterns of social and occupational impairment.

Test-retest reliabilities for AUDADIS-IV DSM-IV Axis I and II diagnoses in the general population and clinical settings were fair to good ($\kappa = 0.40\text{--}0.77$; Canino et al., 1999; Grant et al., 2003b; Ruan et al., 2008). Convergent validity was good to excellent for all affective, anxiety, and personality disorders diagnoses (Grant et al., 2004; Hasin et al., 2005), and selected diagnoses showed good agreement ($\kappa = 0.64\text{--}0.68$) with psychiatrist reappraisals (Canino et al., 1999).

2.2.4. Substance use-related variables—Past year cannabis, alcohol or other drug use disorder (DUD) diagnoses were made according to the DSM-IV criteria using the AUDADIS-IV. Family history of alcohol use disorder (AUD) or drug use disorder (DUD) were also included as substance use-related covariates. The good to excellent test-retest reliability and validity of AUDADIS-IV SUD diagnoses is well documented in clinical and general population samples (Grant et al., 2003a; Hasin et al., 1997; Ruan et al., 2008).

Other questions queried about were self-reported age at tobacco first use (“about how old were you when you smoked your first full cigarette?”), number of cigarettes usually smoked per day (“thinking back over the entire period when you were smoking every day, about how many cigarettes/ did you usually smoke in a single day?”), age at onset of daily smoking (“about how old were you when you first started smoking cigarettes every day?”), duration of daily smoking (“for how long did you smoke this amount every day?”), age at smoking cessation (calculated subtracting current age minus time since last cigarette), having previous quitting attempts (“in your entire life, did you ever more than once want to stop or cut down on your tobacco use?”), having experienced withdrawal symptoms when

stopping or cutting down on tobacco use (“after stopping or cutting down on your tobacco use, did you ever a) feel depressed, b) have difficulty falling asleep or staying asleep?, c) have difficulty concentrating?, d) eat more than usual or gain weight?, e) become easily irritated, angry, or frustrated?, f) feel anxious or nervous?, g) feel your heart beating more slowly than usual?, h) feel more restless than usual?”), and duration of abstinence (“when was the most recent time you smoked a cigarette?”).

2.3. Analyses

Weighted means frequencies, and their respective 95% confidence intervals (CIs) were computed to derive prevalence, sociodemographic correlates, and clinical correlates of smoking abstinence. Comparisons of tobacco use-related characteristics between those respondents who participated in both Waves versus those who participated only in Wave 1 were performed using Student's *t* test for continuous variables, and the χ^2 test for categorical variables. Relationships between predictors and probability of relapse to tobacco use between Waves 1 and 2 were tested with univariate logistic regression models producing odds ratios (ORs) and 95% CIs. Variables reaching statistical significance at the 0.2 level in the univariate analyses were included in the multivariable models, yielding adjusted odds ratios (AORs) and 95% CIs. All analyses, including standard errors (SEs) and 95% CIs, were conducted in SUDAAN (Research Triangle Institute International, Research Triangle Park, N.C.) to take into account the complex survey design of the NESARC.

3. RESULTS

3.1. Sample characteristics

The majority of lifetime daily smokers who were abstinent at Wave 1 were male, 45 years or older, white, overweight or obese, living in urban areas, and U.S.-born. Most had at least some college education, an individual income below \$35,000, were married and currently employed, had a good to excellent self-perceived health status and had on average 1.4 stressful life events, with a range from 0 to 11, in the year preceding Wave 1 interview (Table 1).

Approximately 30% of the subjects had at least one psychiatric disorder during past year (21.5% reported an Axis I disorder and 14.7% an Axis II). Mood disorders were reported by 7.3% of the sample and anxiety disorders by 11.2%. Alcohol use disorders were reported by 5.7% of the sample, 0.8% had a cannabis use disorder and 1.2% reported other drug use disorders in the last year (Table 2).

The mean age of tobacco first use and age of onset of daily smoking were 16.1 and 18.6 years, respectively. The mean number of cigarettes smoked per day was 20.2 and the mean duration of daily smoking was 16.8 years. Age at smoking cessation was 38.8 years and mean duration of abstinence was 17.3 years. Almost 80% of the sample reported previous quitting attempts, and withdrawal symptoms were experienced by 65.2% of the sample. Family history of drug use disorder and family alcohol use disorder were reported by 47.4% and 41.9% of the sample, respectively (Table 2). Those participants who dropped out between Wave 1 and Wave 2 ($n=1,271$) differed from those in the present study by having older age of tobacco first use ($M = 16.7$ versus $M = 16.1$, $t = -2.97$, $p = .004$), older age of onset of daily smoking ($M = 19.0$ versus $M = 18.6$, $t = -2.24$, $p = .02$), longer mean duration of daily smoking ($M = 19.6$ versus $M = 16.8$, $t = -4.49$, $p < .001$), older age at smoking cessation ($M = 43.4$ versus $M = 38.8$, $t = -7.08$, $p < .001$) and having a lower percentage of previous quitting attempts (74.1% versus 78.5%, $\chi^2 = 6.83$, $p = .01$).

3.2. Rates of smoking relapse

Figures 1 and 2 show the percentage of participants who relapsed in Wave 2 as a function of duration of continuous abstinence in Wave 1. Figure 1 shows the relapse rate in Wave 2 among individuals with less than twelve months of abstinence in Wave 1, whereas Figure 2 shows the relapse rate in Wave 2 among individuals with more than one year of abstinence in Wave 1. The relapse rate for individuals who achieved up to eleven months of abstinence was consistently above 50%. After one full year of abstinence the risk of relapse was 47%, which decreased to 36% after two years of abstinence and to 25% after 5 years. The risk of relapse decreased more slowly in later years, and stabilized around 10% after 30 years of abstinence.

3.3. Predictors of smoking relapse

3.3.1. Univariate logistic regression models—Males were less likely to relapse than females. Similarly, individuals older than 30 years were at lower risk to relapse than those aged 18 to 29 years old. Being overweight also decreased the risk of relapse. Hispanics and Asians were at greater risk of relapse than Whites. Subjects who attended college education were more likely to relapse than those with an educational level below high school (Table 3).

Respondents with individual incomes above \$35,000 were less likely to relapse than those with incomes below \$20,000. By contrast, individuals who had never married were at a greater risk for relapse than those married. Respondents who were unemployed or had fair to poor health were less likely to relapse. Each additional stressful life event experienced in Wave 1 increased the odds of relapse at Wave 2 by 1.25 (Table 3).

All psychiatric disorders at Wave 1 increased risk for relapse at Wave 2, with the exceptions of major depressive disorder, social anxiety disorder, psychotic disorders and cluster C personality disorders. Longer duration of abstinence at Wave 1 decreased risk for relapse at Wave 2, whereas individuals with previous quitting attempts or who had experience withdrawal symptoms were more likely to relapse. There were no other tobacco-use related characteristics associated to relapse (Table 4).

3.3.2. Multivariable logistic regression model—After controlling for the effect of other covariates, only older age at smoking cessation and longer duration of abstinence significantly decreased risk of relapse at Wave 2 (Table 5).

4. DISCUSSION

We examined rates and predictors of relapse to smoking in a large, nationally representative sample of U.S. adults. The risk for relapse during the first 12 months of abstinence was over 50%, but after the first year, the risk decreased following a hyperbolic function, and stabilized around 10% after 30 years of abstinence. Furthermore, although in univariate analyses some sociodemographic, tobacco-related variables and most psychiatric disorders predicted increased risk of relapse, after adjusting for the effect of other covariates, only younger age at cessation and shorter duration of abstinence independently predicted risk of relapse.

The rate of relapse for subjects with less than twelve months of abstinence ranged between 54% and 67% indicating that the first year after a quit attempt constitutes the period of highest risk. The risk of relapse remained high during the first year of abstinence and did not decrease below 50% until achieving 12 months of abstinence, suggesting that relapse prevention strategies should be focused particularly in this first year after the quit date. After the first year of abstinence, the probability of relapse decreased following a hyperbolic

curve, indicating that the probability of relapse is inversely related to time in abstinence. Several complementary processes may explain the protective effect of a longer time in remission, including increased self-efficacy (Marlatt and Gordon, 1985; Schmitz et al., 1993), lower frequency and intensity of cravings and withdrawal symptoms (Piasecki et al., 2003), development of coping behaviors (Witkiewitz and Marlatt, 2004), desensitization to cues (Niaura et al., 1988), and molecular changes in the circuitry of addiction (Koob and Volkow, 2010).

The risk of relapse, though, never disappeared completely and remained at 10% yearly even after 30 years of abstinence. Reexposure to the pharmacological effects of nicotine during a lapse has been shown to reinstate drug seeking behavior in both animals (Chiamulera et al., 1996; Shaham et al., 1997) and humans (Brandon et al., 1990; Chornock et al., 1992). Dysregulation of neurochemical mechanisms involved in brain reward systems during the development of dependence (Koob, 2006), but also psychological factors such as craving increase after lapses (Shadel et al., 2011), the abstinence violation effect (Kirchner et al., 2012; Marlatt and Gordon, 1985), and associative mechanisms related to drug-associated cues present during a lapse may play an important role in relapse (Shaham et al., 2003).

In line with previous research, individuals who achieved one year of abstinence, had a probability of relapse of 47% at three-years follow-up, or an estimated annual relapse rate of 15.6, similar than the 10–15% risk of relapse reported by NHANES (US Department of Health and Human Services, 1990), and slightly higher than the 10% showed in a recent meta-analysis of clinical trials (Hughes et al., 2008). The higher estimates of our sample compared with data from clinical trials may be due to differences between clinical and community samples (Le Strat et al., 2011). Specifically, clinical trials often exclude individuals with comorbid psychopathology and subjects who smoke fewer than 10 cigarettes per day. Individuals with psychiatric disorders appear to be at increased risk for relapse (Degenhardt and Hall, 2001; George et al., 2002; Glassman et al., 1990; Piper et al., 2011a), whereas non-daily or occasional smokers have higher prevalence of cessation attempts, and therefore relapses episodes, than daily or regular smokers (Bancej et al., 2007; Oksuz et al., 2007).

Consistent with previous studies (Fernandez et al., 2006; Ockene et al., 2000; Piper et al., 2011b; Zhou et al., 2009), our univariate results showed that several sociodemographic, psychopathologic and tobacco-related variables predicted relapse. However, after adjusting for other covariates, the only variables that predicted risk for relapse in general population were younger age at cessation and shorter duration of abstinence. Younger age at cessation may be related to a lifestyle associated to greater exposure to high-risk situations (Shiffman et al., 1996), to live in a context that do not reinforces abstinence maintenance (Dawson et al., 2006; Derby et al., 1994) and also to a lower likelihood to experience health problems associated with smoking. In conjunction with higher rates of relapse during the first year of abstinence and the hyperbolic decrease in risk detected in our study, the findings of the multivariable regression suggest the need to devise interventions with high intensity early in abstinence, with progressive decrease in intensity over time. For example, contingency management interventions (Ledgerwood, 2008) may provide higher rewards early in treatment, to encourage patients during those times of highest vulnerability to relapse.

Our study has limitations common to most large-scale surveys. First, self report of cigarette and other substance use and psychiatric disorders are prone to social desirability and recall bias and not confirmed by objective methods. Second, individuals who did not participate in Wave 2 differed from those who participated in both Waves on some tobacco-related variables. However, most of those variables did not predict relapse, suggesting that the exclusion of those individuals should not significantly affect the conclusions of our study.

Third, some variables such as negative affective states, smoking cues, and lack of coping efforts after cessation that have been identified as proximal precipitants for relapse in clinical trials using Ecological Momentary Assessment (EMA; Allen et al., 2008; Powell et al., 2010; Shiffman et al., 2000; Shiffman and Waters, 2004; Zhou et al., 2009) could not be assessed in the NESARC due to its large sample size. Community studies focused on naturalistic follow-up of individuals who have recently ceased to smoke are needed to examine their role in relapse in non-clinical samples. Fourth, the NESARC did not collect information about specific smoking cessation aids that could be a relevant variable for smoking abstinence. Finally, time in abstinence was assessed retrospectively at Wave 1, which may have led to telescoping of memory and underestimation of the duration of abstinence. However, our outcome variables, were assessed prospectively thus decreasing the risk of recall bias.

Despite these limitations, our study is the first to provide prospective data on relapse rates by duration of abstinence in a representative U.S. general population. Although relapse risk decreases over time, risk for relapse is especially high during the first year. This highlights the need for specific interventions or strategies that help former smokers to prevent relapse during that period. More studies trying to find proximal predictors of relapse in the general population are necessary.

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Figure 1.
Relapse rate in Wave 2 among individuals with less than one year of abstinence in Wave 1

Figure 2.
Relapse rate in Wave 2 among individuals with more than one year of abstinence Wave 1

Table 1

Sociodemographic characteristics of individuals who reported smoking abstinence at NESARC Wave 1.
Univariate analyses

Characteristic	Smoking abstinence (n=5,831)		
	% /mean	95%CI	
Gender			
Female	44.2	42.5	45.8
Male	55.8	54.2	57.5
Age			
18–29	6.0	5.3	6.8
30–44	19.0	17.7	20.4
>45	75.0	73.5	76.4
Race/ethnicity			
White	82.2	80.0	84.1
Black	7.0	6.1	7.9
Hispanic	6.4	5.1	8.0
Asian	2.3	1.6	3.3
Native American	2.2	1.7	2.8
Overweight			
Yes	69.2	67.8	70.6
No	30.8	29.5	32.2
Urbanicity			
Urban	78.1	74.3	81.5
Rural	21.9	18.5	25.7
U.S. Born			
Yes	91.7	89.8	93.3
No	8.3	6.7	10.2
Education			
< High school	15.6	14.3	17.0
High school	30.0	28.4	31.6
College	54.4	52.5	56.3
Individual income			
\$0–\$19,999	40.3	38.7	41.9
\$20,000–\$34,999	24.6	23.0	26.1
\$35,000–\$69,999	26.0	24.6	27.4
\$70,000	9.2	8.0	10.5
Marital Status			
Married/living with someone	73.9	72.6	75.2

Characteristic	Smoking abstinence (n=5,831)		
	% /mean	95%CI	
Never married	7.2	6.4	8.0
Divorced/Separated/Widowed	19.0	17.9	20.1
Employment status			
Employed	55.2	53.6	56.8
Unemployed	44.8	43.2	46.4
Overall health			
Good to Excellent	80.9	79.6	82.2
Poor to Fair	19.1	17.9	20.4
Number of stressful life events in the last 12 months	1.4	1.4	1.5

95% CI: 95% Confidence Interval

Table 2

12-month prevalence of psychiatric disorders and tobacco use-related characteristics of individuals who reported smoking abstinence at NESARC Wave 1. Univariate analyses

Characteristic	Smoking abstinence (n=5,831)		
	% /mean	95%CI	
Any Psychiatric Disorder	29.4	27.8	31.0
Any Axis I disorder	21.5	20.2	22.9
Any Mood Disorder	7.3	6.5	8.1
Major Depressive Disorder	4.7	4.1	5.4
Bipolar	2.1	1.7	2.6
Dysthymia	1.2	0.9	1.6
Any Anxiety Disorder	11.2	10.2	12.3
Panic Disorder	1.8	1.4	2.2
Social Anxiety Disorder	3.0	2.5	3.6
Specific Phobia	7.5	6.7	8.3
Generalized Anxiety Disorder	1.7	1.3	2.2
Any Conduct Disorder	1.0	0.8	1.4
Any Psychotic Disorder	0.1	0.1	0.2
Any Personality Disorder	14.7	13.6	15.9
Cluster A	5.0	4.3	5.7
Cluster B	4.8	4.1	5.5
Cluster C	9.4	8.5	10.3
Cannabis Use Disorder	0.8	0.6	1.2
Alcohol Use Disorder	5.7	5.0	6.5
Drug Use Disorder	1.2	0.8	1.6
Tobacco use-related characteristics			
Age at tobacco first use	16.1	16.0	16.3
Age at onset of daily smoking	18.6	18.4	18.7
Cigarettes per day	20.2	19.6	20.7
Duration of daily smoking, years	16.8	16.4	17.2
Age at smoking cessation	38.8	38.4	39.2
Abstinence duration, years	17.3	16.9	17.7
Previous quitting attempts	78.5	77.1	79.9
Withdrawal symptoms	65.2	63.5	66.7
Family history of DUD	47.4	45.7	49.2
Family history of AUD	41.9	40.2	43.6

95% CI: 95% Confidence Interval; DUD: Drug Use Disorder; AUD: Alcohol Use Disorder

Table 3

Sociodemographic predictors of relapse among individuals who reported smoking abstinence at NESARC Wave 1. Univariate results of logistic regression

Characteristic	Odds ratio of relapse at Wave 2 (n=5,831)		
	OR	95%CI	
Gender			
Female	1.00	1.00	1.00
Male	0.75	0.60	0.92
Age			
18–29	1.00	1.00	1.00
30–44	0.24	0.17	0.33
>45	0.06	0.04	0.08
Race/ethnicity			
White	1.00	1.00	1.00
Black	1.18	0.86	1.60
Hispanic	1.57	1.07	2.29
Asian	2.65	1.34	5.27
Native American	1.74	0.85	3.57
Overweight			
Yes	1.00	1.00	1.00
No	1.43	1.12	1.84
Urbanicity			
Urban	1.00	1.00	1.00
Rural	0.98	0.76	1.26
U.S. Born			
Yes	1.00	1.00	1.00
No	1.25	0.83	1.86
Education			
< High school	1.00	1.00	1.00
High school	0.86	0.67	1.09
College	1.56	1.06	2.27
Individual income			
\$0–\$19,999	1.00	1.00	1.00
\$20,000–\$34,999	0.87	0.67	1.13
\$35,000–\$69,999	0.68	0.50	0.91
\$70,000	0.45	0.25	0.81
Marital Status			
Married/living with someone	1.00	1.00	1.00

Characteristic	Odds ratio of relapse at Wave 2 (n=5,831)		
	OR	95%CI	
Never married	3.92	2.86	5.38
Divorced/Separated/Widowed	0.95	0.72	1.26
Employment status			
Employed	1.00	1.00	1.00
Unemployed	0.47	0.37	0.60
Overall health			
Good to Excellent	1.00	1.00	1.00
Poor to Fair	0.69	0.49	0.96
Number of stressful life events in the last 12 months	1.25	1.18	1.33

OR: Odd ratios; 95% CI: 95% Confidence Interval

Table 4

12 month prevalence of psychiatric disorders and tobacco use-related predictors of relapse among individuals who reported smoking abstinence at NESARC Wave 1. Univariate results of logistic regression

Characteristic	Odds ratio of relapse at Wave 2 (n=5,831)		
	OR	95%CI	
Any Psychiatric Disorder	2.08	1.65	2.63
Any Axis I disorder	2.27	1.79	2.86
Any Mood Disorder	2.30	1.65	3.20
Major Depressive Disorder	1.39	0.87	2.21
Bipolar	4.00	2.35	6.81
Dysthymia	1.77	0.81	3.87
Any Anxiety Disorder	1.68	1.22	2.29
Panic Disorder	2.39	1.26	4.51
Social Anxiety Disorder	1.60	0.94	2.73
Specific Phobia	1.55	1.05	2.28
Generalized Anxiety Disorder	2.62	1.34	5.14
Any Conduct Disorder	3.19	1.37	7.44
Any Psychotic Disorder	2.93	0.60	14.35
Any Personality Disorder	1.70	1.26	2.31
Cluster A	2.15	1.39	3.32
Cluster B	2.27	1.52	3.38
Cluster C	1.08	0.68	1.72
Cannabis Use Disorder	5.80	2.22	15.19
Alcohol Use Disorder	2.57	1.83	3.62
Drug Use Disorder	6.44	3.25	12.75
Tobacco use-related characteristics			
Age of tobacco first use	0.97	0.94	1.00
Age at onset of daily smoking	0.97	0.95	1.00
Cigarettes per day	0.99	0.98	1.00
Duration of daily smoking, years	0.99	0.98	1.00
Age at smoking cessation	0.99	0.98	1.00
Abstinence duration, years	0.74	0.71	0.78
Previous quitting attempts	2.09	1.48	2.95
Withdrawal symptoms	1.60	1.24	2.07
Family history of DUD	1.14	0.91	1.43
Family history of AUD	1.10	0.88	1.39

OR: Odd ratios; 95% CI: 95% Confidence Interval; DUD: Drug Use Disorder; AUD: Alcohol Use Disorder

Table 5

Sociodemographic, 12 month prevalence of psychiatric disorders and tobacco use-related predictors of relapse among individuals who reported smoking abstinence at NESARC Wave 1. Multivariate results of logistic regression

Characteristic	Odds ratio of relapse at Wave 2 (n=5,831)		
	AOR	95%CI	
Tobacco use-related characteristics			
Age at smoking cessation	0.97	0.96	0.98
Abstinence duration, years	0.75	0.71	0.78

AOR: Adjusted odd ratios; 95% CI: 95% Confidence Interval