Psychiatric Disorders and Stages of Smoking

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Background: *We examined the role of DSM-III-R psychiatric disorders in predicting the subsequent onset of daily smoking, smokers' progression to nicotine dependence, and the persistence of smoking.*

Methods: *The Tobacco Supplement of the National Comorbidity Survey was administered to a representative subsample of 4414 persons 15–54 years of age. DSM-III-R psychiatric disorders and information on age of onset of psychiatric disorders, daily smoking, and smoking cessation were ascertained with the World Health Organization's Composite International Diagnostic Interview.*

Results: *Preexisting psychiatric disorders that have not remitted (i.e., active disorders) predicted an increased risk for the first onset of daily smoking and for smokers' progression to nicotine dependence. The increased risk applied across most of the disorders examined in the study, including major depression, anxiety disorders, and substance use disorders. Persons with four or more active disorders were at higher risk for daily smoking (2.1 vs. 1.4) and for nicotine dependence (2.9 vs. 1.4) than were persons with one active disorder. With few exceptions, remitted (i.e., past) disorders did not predict the subsequent onset of daily smoking. Preexisting psychiatric disorders did not influence smokers' potential for quitting; the persistence of smoking in the year preceding the interview was unrelated to history of psychiatric disorders.*

Conclusions: *The results suggest the possibility of additional and previously unrecognized public health benefits of early treatment of mental disorders, in that persons with various mental disorders whose illness had remitted were not at increased risk for daily smoking, in contrast with persons with active disorders.* Biol Psychiatry 2004;55:69–76

Key Words: Smoking, nicotine dependence, smoking persistence, psychiatric disorders

Associations between smoking and psychiatric disorders have been reported in clinical and epidemiologic studies (Anda et al 1990; Breslau et al 1991; Covey et al 1994; Glassman et al 1990; Hughes et al 1986; Kendler et al 1993). Both causal and noncausal explanations have been proposed (Glass 1990; Glassman 1993; Hughes 1988; Kendler et al 1993). Causal explanations are 1) psychiatric disorders increase the risk for smoking and decrease the potential for quitting; and 2) smoking increases the risk for the subsequent onset of psychiatric disorders. A noncausal explanation for the association is that it results from shared environmental or genetic factors that predispose to both smoking and psychiatric disorders. Recently, Lasser et al (2000) reported on the association of smoking with psychiatric disorders, using data from the National Comorbidity Survey (NCS), which measured a wide range of psychiatric disorders in a nationally representative sample of the United States. They reported that for almost all of the psychiatric disorders included in the survey, persons with lifetime history of the disorder had higher rates of lifetime and current smoking and lower quit rates, compared with persons who have never suffered from a mental illness. Lasser et al (2000) did not use age-of-onset data and did not consider the temporal order between the onset of psychiatric disorders and the onset of smoking. Consequently, it is unclear whether the smoking–mental illness associations they report reflect a higher propensity for smoking in persons with mental illness, as opposed to reflecting the effect of smoking on the onset and course of various mental disorders. The possibility that the association reflects the effects of smoking on psychiatric disorders is underscored by evidence that smoking is associated with an increased risk for the subsequent onset of drug use disorders, anxiety disorders, and major depression (Breslau and Klein 1999; Breslau et al 1993, 1998; Johnson et al 2000; Kandel et al 1986).

Using the NCS data, we sought to resolve this uncertainty by taking into account the temporal order between the onset of psychiatric disorders and the onset of smoking, applying survival analysis methods with time-dependent variables. We focused on the role of *preexisting* psychiatric disorders in predicting the subsequent first onset of daily smoking, the progression to nicotine dependence, and the persistence of smoking. (The potential role of smoking in predicting the subsequent onset of psychiatric disorders will be examined in a separate report.) We separated preexisting disorders into *active* versus *past* (i.e., remitted), according to the time that they were last experienced relative to the onset of daily smoking. That is, a preexisting disorder that was last experienced 1 or more years before daily smoking began was defined as past, whereas a preexisting disorder that continued in the year when daily smoking began was defined as active.

Although causal explanations can be tested only in randomized experiments, analyses of observational data that take into account the temporal order between postulated predictors and outcomes can lend support to some explanations and discredit others. Failure to find evidence that a preexisting psychiatric disorder predicts the subsequent onset of daily smoking, progression to dependence, or smoking persistence would argue against the hypothesis that the disorder plays a causal role in these smoking stages. However, evidence that a preexisting psychiatric disorder when active predicts the subsequent onset of daily smoking, nicotine dependence, or smoking persistence suggests the possibility that the disorder plays a causal role; however, this latter line of evidence (in contrast with evidence of "no effect") is less definitive with respect to causality, because it could also be accounted for by noncausal explanations, outlined as follows.

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Evidence that persons with active, but not past, psychiatric disorders are at increased risk for daily smoking (or another smoking stage), although consistent with a causal explanation, might also reflect shared susceptibilities. This is so because, at any point in time, persons with an active disorder are likely to have suffered a more chronic disorder than are persons whose disorder has remitted, a difference that might reflect a more severe genetic or acquired shared susceptibility. On the other hand, evidence that persons with active *and* persons with past disorders are at a similarly increased risk for daily smoking (or another smoking stage), although consistent with a noncausal, shared-risk-factors explanation, also might reflect irreversible effects of a psychiatric disorder. Despite these uncertainties, these types of evidence are useful for generating hypotheses as to the potential of psychiatric treatment interventions. Specifically, evidence that persons with active *and* persons with past disorders are both at elevated risk of smoking would suggest that treatment of the disorder would not reduce the risk of smoking, regardless of whether shared susceptibility or irreversible causal effects of a psychiatric disorder accounted for this observation. Conversely, evidence that only persons with active but not persons with past disorder are at an elevated risk for smoking would suggest the possibility that effective treatments of the disorder might reduce the risk of daily smoking. Results from treatment trials, in turn, could elucidate causal pathways that link active disorders with smoking. For example, a reduced risk of smoking in effectively treated psychiatric patients whose disorder remitted would argue in favor of a causal effect and against a shared-risk-factors explanation.

Methods and Materials

Sample

The sampling scheme of the NCS has been described in detail previously (Kessler 1995). Briefly, the NCS is a stratified multistage area probability sample of 8098 persons 15–54 years of age selected from the non-institutionalized population of the United States. Data were gathered between September 1990 and March 1992. The Tobacco Supplement, which elicits information on smoking and nicotine dependence, was administered in the second half of the survey to 4414 NCS respondents. Because the NCS fieldwork was conducted in replicates, each designed to be a representative national sample, data from the Tobacco Supplement subsample is representative of the United States population.

Assessment

A modified version of the World Health Organization's Composite International Diagnostic Interview (WHO-CIDI) (World Health Organization 1990) was used to ascertain psychiatric disorders according to DSM-III-R. The WHO-CIDI is a structured interview designed to be used by trained interviewers who are not clinicians. Most WHO-CIDI–DSM-III-R diagnoses have good reliability and validity (Kessler et al 1998b). Mania and nonaffective psychosis are exceptions and are not used in this analysis. The section on nicotine dependence inquires first as to whether the respondents have ever smoked daily for a month or more. Persons who answer positively are asked about the DSM-III-R defining symptoms of dependence.

The NCS' definitions of onset of daily smoking, nicotine dependence, and persistence versus quitting have been described previously (Breslau et al 2001). Briefly, onset of daily smoking is defined as the age at which daily smoking for a month or more first occurred. Onset of nicotine dependence is defined as the age at which symptoms of dependence endorsed by the respondent first occurred among daily smokers who have met the DSM-IIIR criteria for nicotine dependence. Smokers were defined as persistent if they reported that the last time they smoked fairly regularly was within the year preceding the interview, as opposed to smokers who reported that they last smoked more than 1 year preceding the interview.

Statistical Analysis

The data were weighted to adjust for variation in the probabilities of selection and nonresponse and to approximate the data to the United States population on key sociodemographic characteristics (Kessler 1995). Discrete time survival analyses with time-dependent covariates (Efron 1988) were used to predict the onset of daily smoking and the progression to nicotine dependence associated with preexisting psychiatric disorders. The advantage of survival analysis for estimating the risk of an outcome (e.g., daily smoking) in one group relative to another is that it permits taking into account differences in the period of risk across individuals. For example, persons who were 15 years of age at the time of the interview had lived through fewer years in which daily smoking could have begun, compared with persons aged 25 and older. The added advantage of survival analysis with time-dependent covariates is that it allows consideration of independent variables whose value for any given person may change over time. For example, a person's psychiatric status (the independent variable) can change from "no major depression" to "major depression" at any time until the age of onset of daily smoking or age at interview (whichever comes first). A respondent contributes to the "no major depression" person-years pool until daily smoking begins, the onset of major depression, or time of interview (whichever comes first). Once major depression occurs, the respondent starts contributing to the "major depression" person-years pool until daily smoking begins or time of interview (whichever comes first). The parameter estimates are regression coefficients from which odds ratios (ORs) can be obtained. The OR represents an estimate of the relative risk for an outcome (e.g., daily smoking) in persons with the risk factor, compared with persons without the risk factor (e.g., persons with preexisting major depression vs. persons with no preexisting major depression). Survival analysis with time-dependent covariates have been applied in numerous studies based on the NCS and other epidemiologic studies that have used similar diagnostic interview data (e.g., Breslau et al 1997, 2000; Chilcoat and Breslau 1998; Kendler et al 2000, 2001; Kessler et al 1996, 1998a; Trinkoff et al 1990).

We present estimates for 10 psychiatric disorders, each calculated in a separate survival model, which included race/ethnicity, gender, education (as time dependent) and age (grouped into 10-year intervals) as covariates. Conduct and antisocial personality disorders were not included, because information on age of onset and offset are unavailable. This exclusion is in addition to the exclusion of mania and nonaffective psychosis, for which reliability and validity were inadequate (Kessler 1998b).

To take into account the complex survey design of the NCS, the 95% confidence intervals (CI) of ORs and Wald χ^2 tests were computed with Jackknife Repeated Replications method, implemented in user-developed SAS macros (SAS 6.0, SAS Institute, Cary, NC) (Kish and Frankel 1974). In all models, interactions between age groups and psychiatric disorders and between gender and psychiatric disorders were tested, but none were detected.

Table 1. Relative Risks of Daily Smoking by Preexisting Psychiatric Disorders: Overall, Active, and Past[a]

		Any Preextisting Disorder[b]	Active[b]	Past[b]
Depressive Disorders	Major depression	1.5[c] (1.1–2.1)	1.6[c] (1.2–2.3)	.6 (.2–2.2)
	Dysthymia	1.6[c] (1.04–2.5)	1.6[c] (1.01–2.5)	1.5 (.5–4.0)
Anxiety Disorders	Agoraphobia	1.3 (.8–1.9)	1.4 (.9–2.2)	.1[c] (.01–.4)
	GAD	1.9[c] (1.05–3.7)	2.1[c] (1.1–3.9)	ne
	Simple phobia	1.6[c] (1.3–1.8)	1.5[c] (1.3–1.8)	.9 (.1–5.8)
	Social phobia	1.5[c] (1.2–1.7)	1.3[c] (1.1–1.6)	2.8[c] (1.4–5.4)
	Panic disorder	.9 (.5–1.8)	.9 (.5–1.6)	1.7 (.3–10.4)
	PTSD	2.1[c] (1.6–2.9)	2.0[c] (1.4–2.9)	2.5[c] (1.6–4.1)
Substance Use Disorders	Alcohol A/D	1.4[c] (1.1–1.7)	1.5[c] (1.2–1.9)	.5 (.2–1.2)
	Drug A/D	1.6[c] (1.2–2.2)	1.8[c] (1.3–2.5)	.9 (.4–2.2)

$N = 4414$. Data are presented as adjusted odds ratios (95% confidence interval). GAD, generalized anxiety disorder; ne, can not be estimated owing to small number of person- years; PTSD, posttraumatic stress disorder; A/D, abuse/depression.

[a]Adjusted odds ratios from discrete time survival models with disorder as time dependent, adjusted for race, sex, education and age.

[b]Preexisting disorder is defined as first onset at least 1 year before onset of daily smoking; "Any" combines active and past. The distinction between active and past preexisting disorder is defined by whether or not the disorder had remitted prior to the year that daily smoking began.

[c]$p < .05$.

In the analyses predicting *daily smoking*, time was defined as chronologic age. A psychiatric disorder was defined as *preexisting* if the first onset occurred 1 year or more before daily smoking began. Cases in which the onset of the disorder occurred in the same year as the onset of daily smoking were represented by a separate term. We do not present same-year estimates because of the indeterminate temporal relationship between the onset of the psychiatric disorder and the onset of daily smoking in these cases. A preexisting disorder was coded as *past* (remitted) if symptoms of the disorder were last experienced 1 year or more before the onset of daily smoking and as *active* if symptoms continued in the year of onset of daily smoking. Thus, both active and past disorders began 1 year or more before daily smoking began; they differ in the age of offset in relation to the onset of daily smoking. The models yield estimates of the risk for daily smoking in persons with a preexisting disorder, active and past, relative to persons with no history of the disorder up to the age at which daily smoking began.

In the absence of year-by-year information on the status of a disorder, we assumed that the disorder was active during all the intervening years from the first onset to year of "final" offset, as of the time of assessment. A similar approach was applied in previous analyses in which a distinction between active and past was made, for example, the analysis by Kessler et al (1998a) of the comorbidity of panic and depression in the NCS. The inability to identify intermittent years of remission between onset and offset of disorders is a limitation of the results presented here. However, misclassifying intermittent years of remission as years of active (rather than past) disorder is unlikely to have resulted in overestimating the risk of daily smoking associated with active disorders. First, such errors would have inflated the person-year pool on which the odds for daily smoking associated with an active disorder were estimated. Second, the failure to detect cohort differences in the association of psychiatric disorders with onset of daily smoking argues against a bias, as it is chiefly in older age groups that the period from first onset of a disorder to last offset would include intermittent years of remission. Third, it should be kept in mind that the relevant period here is from onset of a disorder until onset of daily smoking in persons who had not smoked daily. Intermittent years of remission are unlikely to have occurred during this period, because daily smoking generally begins in adolescence and rarely after age 24 (Breslau et al 2001).

In the survival analyses predicting *nicotine dependence among daily smokers*, time was defined as number of years since onset of daily smoking. Preexisting disorders were defined by their temporal relationship to daily smoking, as described above. Psychiatric disorders with onset *after* the year in which daily smoking began (but before onset of nicotine dependence) were included as time-dependent covariates to control for their effects. These models yield estimates of the risk for nicotine dependence in persons with a psychiatric disorder that predated daily smoking (relative to persons with no history of the disorder), adjusted for potential mediating processes secondary to daily smoking (e.g., drug use disorder).

Logistic regressions were used to predict *smoking persistence* (vs. abstinence) in the year preceding the interview by history of preexisting disorders. Smoking persistence was defined as 12-month prevalence among lifetime smokers who began to smoke daily at least 2 years before the interview. Preexisting disorders were defined by their temporal relationship with daily smoking, as described above. Estimates were adjusted for race, gender, education at time of interview, age at onset of daily smoking, and number of years since onset of daily smoking.

Person-Years in the Survival Analysis

The lifetime prevalence of daily smoking for at least 1 month was 49.4%. Of those who ever smoked daily, 48% progressed to nicotine dependence; 71% of daily smokers continued to smoke "fairly regularly" within the past year (Breslau et al 2001). The number of person-years in survival analyses predicting daily smoking was 100,280. The number of person-years contributed by persons with preexisting psychiatric disorders varied across disorders. Within disorders, the proportions of person-years in the active (vs. past) categories ranged from 67% (alcohol and drug use disorders) to 86% (agoraphobia, dysthymia). The total number of person-years in the survival analyses of nicotine dependence was 29,734, representing the number of years since the onset of daily smoking of respondents who have ever smoked daily for at least 1 month. (For more detailed information, see Appendices 1 and 2.)

Results

Predicting the Onset of Daily Smoking

Table 1 presents first the estimates of the risk for daily smoking in persons with preexisting disorders, regardless of

Table 2. Relative Risks of Smokers' Transition to Nicotine Dependence by Preexisting Psychiatric Disorders: Overall, Active, and Past[a]

		Any Preexisting Disorder[b]	Active[b]	Past[b]
Depressive Disorders	Major depression	2.0[c] (1.3–3.1)	2.2[c] (1.4–3.4)	ne
	Dysthymia	.9 (.4–2.0)	1.2 (.6–2.5)	ne
Anxiety Disorders	Agoraphobia	1.8[c] (1.1–2.9)	1.8[c] (1.1–2.9)	ne
	GAD	1.8 (.9–3.2)	1.8 (.9–3.5)	ne
	Simple phobia	1.8[c] (1.4–2.3)	1.8[c] (1.4–2.3)	13.6[c] (6.3–30.0)
	Social phobia	1.8[c] (1.4–2.3)	1.8[c] (1.3–2.4)	1.6 (.7–3.5)
	Panic disorder	1.8 (.9–3.3)	1.4 (.7–2.8)	5.8[c] (3.0–11.6)
	PTSD	1.7[c] (1.2–2.5)	2.1[c] (1.3–3.2)	0.7 (.2–1.9)
Substance Use Disorders	Alcohol A/D	1.8[c] (1.2–2.6)	1.7[c] (1.2–2.5)	5.2[c] (1.8–15.5)
	Drug A/D	1.7[c] (1.2–2.5)	1.5 (.9–2.4)	4.1[c] (2.1–8.1)

$N = 2129$. Data are presented as adjusted odds ratios (95% confidence interval). GAD, generalized anxiety disorder; ne, can not be estimated owing to small number of person-years; PTSD, posttraumatic stress disorder; A/D, abuse/depression.

[a]Adjusted odds ratios from discrete time survival models, adjusted for race, sex, education and age.

[b]Preexisting disorder is defined as first onset at least 1 year before onset of daily smoking; "Any" combines active and past. The distinction between active and past preexisting disorder is defined by whether or not the disorder had remitted prior to the year that daily smoking began.

[c]$p < .05$.

whether they were active or past, in the first column, and then by active and past in the second and third columns, respectively. With the exception of agoraphobia and panic disorder, each active psychiatric disorder predicted a significantly increased risk for the subsequent first onset of daily smoking (Table 1). In contrast, past disorders generally did not predict the subsequent onset of daily smoking. Two anxiety disorders, social phobia and posttraumatic stress disorder, predicted a significantly increased risk for daily smoking in past cases, as they did in active cases.

Odds ratio for the subsequent onset of daily smoking in persons with one or more active disorders, compared with persons with no active disorder was 1.4 (95% CI 1.2–1.7). A gradient relationship was observed between the number of active disorders and the onset of daily smoking; compared with persons with no active disorder, the odds ratio for daily smoking in persons with only one active disorder was 1.3 (95% CI 1.04–1.6) and in persons with four or more, 2.2 (95% CI 1.4–3.4). (Wald χ^2 (3 df) for number of active disorders among persons with one or more disorders was 19.0, $p < .05$.)

Predicting Smokers' Progression to Nicotine Dependence

Table 2 presents estimates of smokers' progression to dependence in persons with preexisting disorders (i.e., disorders that predated daily smoking), active and past, in the first column, and then by whether they were active or past in the second and third columns, respectively. A significantly increased risk for the transition to nicotine dependence among daily smokers was observed in relation to a wide range of *active* disorders, including major depression, most anxiety disorders, and alcohol abuse or dependence (Table 2). Simple phobia and alcohol use disorder predicted smokers' progression to nicotine dependence in both active and past cases. Past but not active drug use disorders predicted nicotine dependence.

Odds ratio for the transition to nicotine dependence in daily smokers with at least one active disorder compared with no active disorder was 1.8 (95% CI 1.5–2.1) ($p < .05$). A gradient relationship was observed between the number of active disorders and nicotine dependence, with ORs increasing from 1.5 (95% CI 1.1–2.0) for one disorder to 2.5 (95% CI 1.3–4.6) for four or more. (Wald χ^2 (3 df) for number of active disorders among persons with one or more disorders was 27.1, $p < .05$.)

Predicting the Persistence of Smoking

Logistic regressions were used to investigate whether disorders that predated the onset of daily smoking predicted smoking persistence in the 12 months preceding the interview, controlling for age of smoking onset, time since onset, and sociodemographic variables. Psychiatric disorders that predated the onset of daily smoking did not predict smoking persistence in the year preceding the interview (Table 3). Estimates could not be calculated for three anxiety disorders because of small numbers. The OR for persistence associated with one or more active disorders was not significant, and number of active disorders was unrelated to persistence.

Discussion

Our findings should be evaluated in light of the following limitations. First, the NCS data are cross-sectional and thus are subject to recall error; however, tests of interactions indicated that the associations did not vary across age groups of the NCS, despite differences in the length of recall period. A related limitation is the absence of year-by-year information on the status of disorders from first onset to the last year in which symptoms occurred. As described under Methods and Materials, intervening years from year of first onset to the last year of symptom occurrence were coded as active, although in some instances there might have been intermittent years of remission. Errors of this type are unlikely to overestimate the odds of daily smoking or nicotine dependence associated with active disorders, for the reasons outlined above. Resolution of these uncertainties requires longitudinal studies that begin in early adolescence with frequent reassessments well into adulthood.

Second, because the NCS did not inquire about smoking initiation, we are unable to separate the role of preexisting psychiatric disorders in smoking initiation from their role in the progression to daily smoking. An influence by depressive/anxious *symptoms* on smoking initiation in adolescents was reported by Patton et al (1998). Other longitudinal studies on adolescents have reported no influence by depressive symptoms on smoking initiation (Goodman and Capitman 2000; Wu and Anthony 1999). Instead, they reported evidence of an influence only in the reverse direction, that is, by smoking one increases in depressive symptoms.

In this study, we estimated the extent to which psychiatric disorders that predated the time at which daily smoking began predicted subsequent stages of smoking. This strategy provides a rigorous test of the role of psychiatric disorders not only in smoking onset but also in the transition to dependence and to quitting, unconfounded by disorders that might have followed

Table 3. Odds Ratios of Smoking Persistence by Preexisting Psychiatric Disorders: Overall, Active and Past[a]

		Any Preexisting Disorder[b]	Active[b]	Past[b]
Depressive Disorders	Major depression	.8 (.4–1.2)	.9 (.5–1.8)	.2 (.03–1.6)
	Dysthymia	.5 (.2–1.4)	1.3 (.5–3.1)	.3 (.01–2.0)
Anxiety Disorders	Agoraphobia	1.8 (.8–4.1)	1.6 (.8–3.3)	ne
	GAD	.8 (.3–1.9)	.7 (.1–3.6)	ne
	Simple phobia	1.4 (.9–2.0)	1.4 (.8–2.5)	3.3 (.8–12.4)
	Social phobia	1.3 (.8–1.8)	1.4 (.9–2.1)	.7 (.2–2.9)
	Panic disorder	.3 (.1–1.3)	.8 (.1–6.7)	ne
	PTSD	.9 (.3–1.5)	1.2 (.5–2.9)	.4 (.1–1.4)
Substance Use Disorders	Alcohol A/D	.7 (.4–1.1)	.9 (.5–1.7)	1.7 (.3–11.1)
	Drug A/D	.9 (.5–1.5)	.8 (.5–1.3)	1.9 (.4–9.0)

$N = 2129$. Data are presented as adjusted odds ratios (95% confidence interval). GAD, generalized anxiety disorder; ne, can not be estimated owing to small number of person-years; PTSD, posttraumatic stress disorder; A/D, abuse/depression.

[a]Adjusted odds ratios from logistic regression models, adjusted for race, sex, education, age of onset of daily smoking, and number of years from onset of daily smoking.

[b]Preexisting disorder is defined as first onset at least 1 year before onset of daily smoking: "Any" combines active and past. The distinction between active and past preexisting disorder is defined by whether or not the disorder had remitted prior to the year that daily smoking began.

(and thus might have been influenced by) daily smoking. We found that the majority of preexisting psychiatric disorders, *when active*, predicted the subsequent onset of daily smoking and smokers' progression to dependence; however, variations across disorders were observed. In the case of major depression, active but not past disorder predicted subsequent onset of daily smoking and progression to dependence, suggesting the possibility that major depression is a causal risk factor for daily smoking. An alternative interpretation is that active cases, which tend to be more chronic than remitted cases, might reflect a stronger genetic or acquired susceptibility to depression and smoking.

In the case of agoraphobia and panic disorder, the results rule out a causal explanation, in that neither disorder predicted the subsequent onset of daily smoking. Similar results were reported previously (Breslau and Klein 1999; Johnson et al 2000). The finding of an increased risk for nicotine dependence in persons with past panic disorder is an exception to the observed pattern of no effect of panic disorder on daily smoking or nicotine dependence. The finding is difficult to interpret, and the most parsimonious explanation is that it is a chance finding. Two anxiety disorders—social phobia and posttraumatic stress disorder—predicted the subsequent onset of daily smoking in both active and remitted cases, leaving open the possibility that the association is due to shared antecedent factors or that these disorders exert an irreversible effect on the susceptibility to daily smoking.

In the case of alcohol use disorder, the findings that both active and past disorders predicted smokers' progression to dependence is consistent with evidence of familial and genetic vulnerability across a variety of substance use disorders, including nicotine dependence, reported in recent family and twin studies (Bierut et al 1998; Merikangas et al 1998; True et al 1999; Tsuang et al 1998). Past but not active drug use disorder also predicted smokers' progression to dependence, suggesting the possibility that cessation of drug use might induce greater smoking intensity.

Although we found that none of the disorders examined here predicted smoking persistence, the negative findings on major depression and alcohol use disorder warrant comment. The negative finding on major depression is in accord with a previous report based on prospective and retrospective data from a community sample, which showed that history of major depression did not decrease smokers' potential for quitting and remaining abstinent for a year or more (Breslau et al 1998). Two prospective studies examined the effects of *depressive symptoms* (in contrast with major depression) on smoking cessation in the general population and reported conflicting results (Anda et al 1990; Salive and Blazer 1993). Neither study established that the depressive symptoms had preceded the onset of smoking. Reports from clinical studies have provided inconsistent evidence on the differential success of cessation treatment between smokers with and without history of major depression (Covey et al 1999; Ginsberg et al 1995; Glassman et al 1988, 1993; Hall et al 1994, 1998; Hayford et al 1999; Munoz et al 1997; Niaura et al 1999). Statistically significant short-term effects were observed in two studies (Glassman et al 1988, 1993). Other studies reported no significant short-term effects (Covey et al 1999; Ginsberg et al 1995; Hall et al 1998; Hayford et al 1999; Munoz et al 1997; Niaura et al 1999). Studies that measured long-term outcomes found no significant effects of history of major depression on cessation (Covey et al 1999; Ginsberg et al 1995; Hall et al 1994, 1998). A recent meta-analysis has concluded that the available evidence provides no support for a relationship between history of depression and smoking cessation (Hitsman et al, in press).

We found no relationship between active alcohol use disorder and smoking persistence, in contrast with a previous study of a community sample, which found a decreased potential for quitting in smokers with active alcohol use disorder (Breslau et al 1996). Methodologic differences may account for the disparity in the results of the two studies. Specifically, the previous study did not require that the onset of alcohol use disorder precede the onset of daily smoking, unlike this study. In another community-based survey, the authors suggested that lifetime history of alcohol use disorder might be associated with a reduced lifetime rate of quitting; however the results were only suggestive, with borderline significance in men and not significant in women (Covey et al 1994).

Our findings that the role of psychiatric disorders varies across stages of smoking, chiefly between onset and progression to dependence, on the one hand, and persistence, on the other, should come as no surprise. Previous research has documented that different stages of smoking, as well as use of other substances, might be preceded by unique conditions, although the mechanisms that might account for these differences are not entirely clear (Breslau et al 1998; Heath et al 1993; Madden et al 1999; Newcomb and Bentler 1989; True et al 1997).

Our analysis goes beyond demonstrating an association between mental illness and daily smoking, as reported by Lasser et

al (2000), based also on the NCS. Using age of onset data and survival analysis methods, we found that a wide range of preexisting psychiatric disorders, when active, predict the subsequent first onset of daily smoking. Furthermore, smokers whose preexisting psychiatric disorders had not remitted at the time of onset of daily smoking were more likely to become nicotine dependent. The topic of nicotine dependence was not addressed by Lasser et al. Those authors reported positive associations between smoking persistence and a wide range of mental disorders. Their analysis did not distinguish between disorders that began before the onset of smoking and disorders that followed the onset of smoking. Furthermore, it is unclear whether associations between smoking persistence and psychiatric disorders would be observed if estimates were adjusted for potential confounders, such as education, age of smoking onset, or number of years since onset of daily smoking.

The possibility remains that smokers with bipolar disorder, schizophrenia, or other psychotic illnesses, unlike smokers with major depression, anxiety disorders, or substance use disorders, are less likely to quit and thus could benefit from specialized treatment approaches. The results suggest the possibility of previously unrecognized public health benefits of early treatment of mental disorders, in that persons with major depression or substance use disorders whose illness had remitted were not at increased risk for daily smoking, in contrast with persons with active disorders.

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Appendix 1. Descriptive Data on Number of Person-Years and Subjects by Demographic Characteristics

	Daily Smoking ($n = 4414$)				Nicotine Dependent ($n = 2183$)				Persist ($n = 2129$[b])			
	Nonsmoking Years py = 98096		Year of onset py = 2183		Nondependent Years py = 28734		Year of Onset py = 1049		Persist $n = 1513$		Quit $n = 616$	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Gender												
Male	54.2	.01	54.4	.02	57.5	.02	54.1	.02	53.9	.02	56.0	.02
Female	45.8	.01	45.6	.02	42.5	.02	45.9	.02	46.1	.02	44.0	.02
Age Group (years)												
15–24	17.8	.01	14.4	.01	3.5	.00	13.1	.01	16.4	.01	3.3	.00
25–34	30.0	.01	31.8	.01	21.2	.01	34.5	.02	35.2	.01	25.0	.02
35–44	31.9	.01	31.0	.01	35.3	.02	31.6	.02	28.8	.01	38.9	.02
45–54	20.3	.01	22.9	.01	40.1	.02	20.8	.02	19.6	.01	32.8	.02
Race/Ethnicity												
White	73.0	.02	80.4	.02	81.7	.02	82.9	.02	78.7	.01	85.6	.02
Black	11.8	.01	8.7	.01	9.5	.02	7.0	.01	9.6	.01	6.4	.00
Hispanic	11.3	.02	7.8	.01	5.8	.01	7.5	.01	8.0	.01	6.3	.00
Other	4.0	.01	3.1	.01	3.0	.01	2.6	.02	3.7	.00	1.7	.00
Education												
Less than high school	73.6	.01	74.0	.01	29.7	.02	32.3	.02	27.2	.01	9.6	.01
High school graduate	11.2	.01	10.7	.01	35.6	.02	37.1	.02	41.7	.01	38.3	.02
Some college or grad.	8.4	.00	12.0	.01	20.0	.01	20.2	.02	21.6	.01	22.2	.02
Advanced degree	6.8	.00	3.3	.00	14.6	.01	10.4	.02	9.5	.00	29.9	.01

Weighted estimates presented. Nonsmoking years: all person-years in which the time dependent covariate is 0. Year of onset: the first year in which the time dependent covariate switches to 1. Persist: Those who have smoked daily and smoked in past year. Quit: Those who have smoked daily but did not smoke in past year. Standard errors less than .01 noted as .00. py, number of person years.

[a] Data used in logistic regression equation.

[b] Cases excluded because of smoking onset within past year.

Appendix 2. Descriptive Data on Number of Person-Years and Subjects by Psychiatric Disorders

		Daily Smoking (n = 4414)				Nicotine Dependence (n =2183)				Persistence[a] (n= 2129[b])			
		Nonsmoking Years py = 98096		Year of Onset py = 2183		Nondependent Years py = 28,685		Year of Onset py = 1,049		Persist n = 1513		Quit n = 616	
Disorder	Status	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Depression	Active	2.3	.00	4.4	.00	2.5	.01	5.0	.01	5.9	.01	4.5	.01
	Past	.6	.01	.2	.00	.1	.00	.0	.00	.3	.00	.4	.00
Dysthymia	Active	.9	.00	1.5	.00	.9	.00	1.0	.01	2.1	.00	1.3	.00
	Past	.3	.01	.2	.00	.1	.00	.0	.00	.4	.00	.4	.00
Agoraphobia	Active	1.2	.00	2.2	.01	1.7	.00	2.9	.01	2.7	.01	1.4	.01
	Past	.2	.01	.2	.00	.0	.00	.0	.00	.0	.00	.0	.00
GAD	Active	.6	.00	1.7	.00	1.0	.00	2.0	.00	1.6	.00	1.6	.00
	Past	.2	.01	.3	.00	.1	.00	.0	.00	.2	.00	.1	.00
PTSD	Active	1.4	.01	3.2	.01	1.7	.01	4.4	.01	3.9	.01	2.3	.01
	Past	.3	.00	.9	.00	1.0	.00	.5	.00	.9	.00	1.5	.00
Panic	Active	.4	.01	.4	.00	.2	.00	.5	.01	1.0	.00	.8	.00
	Past	.1	.00	.1	.00	.0	.00	.2	.00	.1	.00	.1	.00
Simple Phobia	Active	4.4	.01	8.3	.02	7.2	.01	11.3	.01	9.6	.01	6.6	.01
	Past	.2	.01	.2	.00	.0	.00	.4	.00	.2	.00	.1	.00
Social Phobia	Active	4.0	.01	7.9	.02	6.0	.01	11.3	.01	9.6	.01	6.1	.01
	Past	.6	.01	1.6	.00	0.9	.00	1.3	.01	1.4	.00	1.2	.00
Alcohol Abuse/Depression	Active	2.1	.01	4.8	.01	3.3	.00	5.4	.01	9.2	.01	8.6	.01
	Past	.9	.01	.3	.00	.1	.00	.5	.00	.3	.00	.1	.00
Drug Abuse/Depression	Active	.9	.01	9.8	.01	1.9	.00	3.4	.01	5.0	.01	4.6	.01
	Past	.7	.01	.5	.00	.1	.00	.8	.01	.6	.00	.2	.00

Weighted estimates presented. Standard errors less than .01 noted as .00. py, number of person years; GAD, generalized anxiety disorder; PTSD, posttraumatic stress disorder.

[a]Data used in logistic regression equation.

[b]Cases excluded because of smoking onset within past year.