

## Original Investigation

# Trends in Smoking Among Adults With Mental Illness and Association Between Mental Health Treatment and Smoking Cessation

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**IMPORTANCE** Significant progress has been made in reducing the prevalence of tobacco use in the United States. However, tobacco cessation efforts have focused on the general population rather than individuals with mental illness, who demonstrate greater rates of tobacco use and nicotine dependence.

**OBJECTIVES** To assess whether declines in tobacco use have been realized among individuals with mental illness and examine the association between mental health treatment and smoking cessation.

**DESIGN, SETTING, AND PARTICIPANTS** Use of nationally representative surveys of noninstitutionalized US residents to compare trends in smoking rates between adults with and without mental illness and across multiple disorders (2004-2011 Medical Expenditure Panel Survey [MEPS]) and to compare rates of smoking cessation among adults with mental illness who did and did not receive mental health treatment (2009-2011 National Survey of Drug Use and Health [NSDUH]). The MEPS sample included 32 156 respondents with mental illness (operationalized as reporting severe psychological distress, probable depression, or receiving treatment for mental illness) and 133 113 without mental illness. The NSDUH sample included 14 057 lifetime smokers with mental illness.

**MAIN OUTCOMES AND MEASURES** Current smoking status (primary analysis; MEPS sample) and smoking cessation, operationalized as a lifetime smoker who did not smoke in the last 30 days (secondary analysis; NSDUH sample).

**RESULTS** Adjusted smoking rates declined significantly among individuals without mental illness (19.2% [95% CI, 18.7-19.7%] to 16.5% [95% CI, 16.0%-17.0%];  $P < .001$ ) but changed only slightly among those with mental illness (25.3% [95% CI, 24.2%-26.3%] to 24.9% [95% CI, 23.8%-26.0%];  $P = .50$ ), a significant difference in difference of 2.3% (95% CI, 0.7%-3.9%) ( $P = .005$ ). Individuals with mental illness who received mental health treatment within the previous year were more likely to have quit smoking (37.2% [95% CI, 35.1%-39.4%]) than those not receiving treatment (33.1% [95% CI, 31.5%-34.7%]) ( $P = .005$ ).

**CONCLUSIONS AND RELEVANCE** Between 2004 and 2011, the decline in smoking among individuals with mental illness was significantly less than among those without mental illness, although quit rates were greater among those receiving mental health treatment. This suggests that tobacco control policies and cessation interventions targeting the general population have not worked as effectively for persons with mental illness.

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Despite significant progress made in reducing tobacco use within the general population, individuals with mental illness smoke at rates approximately twice that of adults without mental disorders<sup>1,2</sup> and comprise more than half of nicotine-dependent smokers.<sup>2,3</sup> Smoking rates are even higher among individuals with multiple lifetime psychiatric diagnoses,<sup>2</sup> schizophrenia,<sup>4</sup> and other severe mental illnesses.<sup>5</sup> Mental illness is associated with higher levels of nicotine dependence, intensity of smoking, and smoking severity (ie, number of cigarettes/wk)<sup>6</sup> and with less success in quitting.<sup>2,7</sup> Smoking is believed to account for the majority of excess mortality among individuals with serious mental illness,<sup>8</sup> and life expectancy among people with severe mental illness is 25 years less than that among the general population.<sup>9</sup>

Recent studies suggest that smokers with mental illness are highly motivated to quit<sup>10</sup> and may do so without aggravating psychiatric symptoms if provided with appropriate support.<sup>11</sup> Evidence-based tobacco cessation modules and interventions that integrate mental health and substance abuse treatment<sup>12,13</sup> are now readily available and well suited to be integrated into psychotherapy.<sup>14</sup> However, it is rare for behavioral health specialists to incorporate behavioral interventions or pharmacological treatments to reduce patient smoking.<sup>15</sup>

To our knowledge, there have been no studies that examine smoking trends among persons with mental illness. The role of the mental health system in reducing rates of smoking within this key population is also poorly understood. We therefore compared smoking trends between 2004 and 2011 among individuals with and without mental illness and assessed whether these trends vary by treatment for mental illness and by type of diagnosis.

## Methods

### Smoking Prevalence Data

We analyzed a nationally representative, noninstitutionalized sample of adults 18 and older from the 2004-2011 Medical Expenditure Panel Survey (MEPS) Medical Provider and Household Components. Households selected for the MEPS are a subsample of households participating in the previous year's National Health Interview Survey. Approximately 15 000 individuals are newly surveyed each year to describe characteristics of the US population related to health care utilization, demographics, socioeconomic status, and health and mental health status. Response rates between 2004 and 2011 varied between 58.6% and 68.2%. All rates and model estimates were weighted to be nationally representative and account for sample design and survey nonresponse. Analyses were conducted using Stata release 12.0.<sup>16</sup> The study was approved by the Cambridge Health alliance institutional review board; the requirement for informed consent was waived.

Our dependent variable was current smoker status, determined by the response to the question "Do you currently smoke?" We considered individuals to have a mental health disorder or substance use disorder (referred to herein as "mental illness") if (1) during the survey year they made

an outpatient visit to a primary care professional or specialist, linked to the behavioral health *International Classification of Diseases, Ninth Revision (ICD-9)* codes 291, 292, and 295-314, or psychotherapy or mental health counseling, or a prescription drug fill for a behavioral health disorder<sup>17</sup>; (2) they scored more than 12 (possible scores, 0-24) on the Kessler 6-Item Psychological Distress Scale (K-6), a criterion predictive of a *Diagnostic and Statistical Manual of Mental Disorders (Fourth Edition)* mental disorder and severe impairment<sup>18</sup>; or (3) they scored more than 2 (possible scores, 0-6) on the Patient Health Questionnaire 2 (PHQ-2) depression symptom checklist, a sensitive (93%) and somewhat specific (75%) indicator for any depressive disorder.<sup>19</sup> We additionally measured smoking trends defining mental illness, using only criterion 1 and using only criteria 2 and 3. Additionally, we assessed smoking rates among those receiving treatment for episodic mood disorder (*ICD-9* code 296) or neurotic/anxiety disorders (*ICD-9* code 300).

To address missing data in variables other than current smoking in the MEPS (less than 1% missing on K-6, PHQ-2, and socioeconomic status variables), we implemented multiple imputation methods using the *mi* procedure in Stata. This technique creates 5 complete data sets, imputes missing values using a chained-equations approach, analyzes each data set, and uses standard rules to combine estimates and adjust standard errors for the uncertainty attributable to imputation.<sup>20,21</sup>

We adjusted for covariates that potentially confound the relationship between mental illness and cigarette smoking and that have documented association with smoking.<sup>22</sup> For the first covariate, race/ethnicity, we considered individuals of any race claiming to be of Hispanic origin as Hispanic. Others were classified as black, white, or other race by their responses to the question about race. Other covariates were age (18-24, 25-34, 35-44, 45-54, 55-64, 65-74, ≥75 years), sex, marital status (married, not married), income (<100% of the federal poverty level [FPL]; 100%-199% of FPL; 200%-399% of FPL; ≥400% of FPL), education (less than high school, high school graduate, some college, college graduate), employment status (employed, not employed), urbanicity (metropolitan statistical area with population >250 000), and insurance category (private, Medicare, Medicaid, other public insurance [ie, CHAMPVA], uninsured).

### Analysis of Smoking Prevalence

We first describe sociodemographic characteristics of our sample and present unadjusted differences of cigarette smoking between individuals with and without mental illness in each year between 2004 and 2011, measuring the significance of differences in trends using  $\chi^2$  tests.

We next estimated logistic regression models to assess smoking trends between 2004 and 2011 among individuals with and without mental illness, after adjustment for covariates, using the following empirical model:

$$E(Y = 1) = f[\beta_0 + \beta_1*(Mental\ Illness) + \beta_2*(Time) + \beta_3*(Mental\ Illness*Time) + \beta_4*(X)],$$

where  $Y$  is an indicator of current smoking and  $f$  is the inverse logistic function.  $Time$  is a vector of 2-year indica-

tors (2004-2005 [reference], 2006-2007, 2008-2009, 2010-2011) and  $X$  is a vector of the covariates described above.  $\beta_3$  indicates whether smoking trends differed by mental health status between 2004-2005 and each consecutive period. Goodness of fit was verified using Pregibon link test<sup>23</sup> and the modified Hosmer-Lemeshow test,<sup>24</sup> and F-adjusted mean residual goodness-of-fit statistics are presented.<sup>25</sup>

To convert coefficients on interaction variables into differences in the scale of interest (percentages),<sup>26</sup> we estimated predicted probabilities by period (for brevity, 2004-2005 and 2010-2011 are presented) and mental illness using the predictive margins method,<sup>27</sup> generating standard errors for each group and differences between groups using bootstrap methods.<sup>28</sup>  $P \leq .05$  (2-tailed) was considered statistically significant.

### Supplementary Analysis of Tobacco Cessation and Treatment

Data for the secondary analysis are from the National Survey on Drug Use and Health (NSDUH), which provides nationally representative estimates of smoking prevalence, behavioral health, and sociodemographic characteristics. We pooled 3 years of NSDUH data (2009-2011) to create a robust sample of adult ( $\geq 18$  years) respondents who reported smoking more than 100 cigarettes in their lifetime and experiencing mental illness in the past year. An individual was defined as a quitter or former smoker if he or she was a lifetime smoker and had smoked zero cigarettes during the past 30 days.<sup>29,30</sup> Mental illness was determined using a prediction formula developed by the Substance Abuse and Mental Health Services Administration<sup>31</sup> to identify any mental illness; severity (mild, moderate, serious) of mental illness was determined by combining data from the K-6 and the World Health Organization-Disability Assessment Schedule impairment scale. The prediction model successfully predicted mental illness and characterized 3 cutpoints of severity among a group of 1504 NSDUH respondents who received a detailed follow-up diagnostic interview.<sup>31</sup>

We estimated a logistic regression model of quitting smoking conditional on receiving any mental health treatment during the past year, receiving any substance abuse treatment during the past year, severity of mental illness (mild, moderate, serious), race/ethnicity, age, marital status, insurance status, employment status, urbanicity, education and income (categorized to be similar to the MEPS data above), and an indicator of any criminal activity (any lifetime arrest or any parole or probation in the previous year). We estimated 2 additional logistic regression models, replacing any mental health treatment with (1) past-year inpatient mental health treatment, defined as any hospitalization overnight or longer to receive treatment for mental illness; and (2) past-year outpatient mental health treatment, defined as any outpatient visit to a mental health clinic, private therapist, psychologist, psychiatrist, social worker, or counselor for the treatment of a mental illness. Goodness-of-fit tests and multiple imputation estimation strategies for missing data were conducted as described above.

## Results

### Trends in Smoking Prevalence

The 2004-2011 MEPS sample includes 165 269 respondents with nonmissing data on the item measuring current smoking status. Adults who received treatment for mental illness, had psychological distress, or had probable depression (“with mental illness”) differed from the remaining population (“without mental illness”) in racial/ethnic composition, sex, and other socioeconomic characteristics. Individuals with mental illness were more likely to be women, white, or unemployed and less likely to be married or uninsured than individuals without mental illness (Table 1). Unadjusted rates of smoking were higher among adults with mental illness (28.2% [95% CI, 27.7%-28.7%]) than among adults without mental illness (17.5% [95% CI, 17.3%-17.7%]) ( $P < .001$ ). Smoking rates among those receiving treatment for a mental health disorder were significantly lower (26.4% [95% CI, 25.8%-27.0%]) than among those screened as having severe psychological distress or probable depression (34.2% [95% CI, 33.5%-34.9%]) ( $P < .001$ ).

For individuals without mental illness, unadjusted smoking rates declined from 19.5% (95% CI, 18.9%-20.2%) to 15.6% (95% CI, 15.0%-16.1%) between 2004 and 2011 (Figure), whereas for those with mental illness, smoking rates declined from 28.8% (95% CI, 27.4%-30.2%) to 27.0% (95% CI, 25.7%-28.4%), a significant difference in difference of 2.2% (95% CI, 1.0%-3.0%) ( $P = .006$ ). Similar patterns were found among those with and without treatment linked to a mental health diagnosis, with and without severe psychological distress or probable depression, with and without diagnosed neurotic or anxiety disorder, and with and without depressive disorder (Figure).

The interaction between mental illness and the 2010-2011 periods (corresponding to  $\beta_3$  in the equation) was significantly positive ( $P = .004$ ) (Table 2), signifying differing smoking rate trends among individuals with and without mental illness, after adjustment for covariates. Age, sex, race/ethnicity, marital status, insurance, income, education, and urban residence were all significant predictors of current smoking status.

Model-predicted smoking rates that adjust for all covariates declined significantly over time among individuals without mental illness, decreasing from 19.2% (95% CI, 18.7%-19.7%) to 16.5% (95% CI, 16.0%-17.0%) ( $P < .001$ ), but did not change significantly among those with mental illness, decreasing only from 25.3% (95% CI, 24.2%-26.3%) to 24.9% (95% CI, 23.8%-26.0%) ( $P = .50$ ). This represents a significant difference in difference of 2.3% (95% CI, 0.7%-3.9%) ( $P = .005$ ) (Table 3). Similar patterns were found when comparing model-based smoking rates among individuals with and without treatment linked to a mental health diagnosis (Table 3) and those with and without psychological distress or probable depression (Table 3), although this latter difference in difference was not significant. Of note is that model-predicted smoking rates adjusting for all covariates were considerably lower than unadjusted rates for individuals with mental illness. This difference was especially marked among those with psychological

**Table 1. Descriptive Characteristics of Adult Medicare Expenditure Panel Survey Among Individuals With and Without Probable Mental Illness, 2004-2011 (N=165269)**

Characteristic	%				P Value <sup>c</sup>
	Treatment Linked to Mental Health Diagnosis <sup>a</sup> (n = 20 212)	Psychological Distress or Probable Depression <sup>b</sup> (n = 18 308)	Overall (n = 32 156)	No Mental Illness (n = 133 113)	
Smoker	26	34	28	17	<.001
Race/ethnicity					
White	83	65	75	68	<.001
Black	6	14	9	11	
Hispanic	8	15	11	14	
Other race	4	7	5	7	
Women	66	58	63	50	<.001
Married	50	44	48	56	<.001
Age, y					
18-24	7	10	9	13	<.001
25-34	14	15	15	19	
35-44	18	18	18	19	
45-54	23	21	22	19	
55-64	20	17	18	15	
65-74	10	8	10	9	
≥75	8	10	9	8	
Poverty status					
Below poverty	15	25	18	10	<.001
Near poverty	5	7	6	4	
Low income	14	19	16	13	
Middle income	30	29	30	31	
High income	37	20	31	42	
Education					
<High school graduate	17	30	21	16	<.001
High school graduate	31	35	32	30	
Some college	26	22	25	24	
College graduate	26	14	22	29	
Health insurance					
Medicare	21	20	20	16	<.001
Medicaid	17	25	18	8	
Private	54	37	49	61	
Other	0	1	0	0	
Uninsured	8	18	12	15	
Employment					
Employed	52	42	50	68	<.001
Unemployed	48	57	49	32	
Unknown or unreported	0	1	0	1	
Live in an MSA >250 000 population	82	81	82	84	<.001

Abbreviation: MSA, metropolitan statistical area.

<sup>a</sup> Treatment linked to a mental health diagnosis is defined as outpatient drug care or receiving a prescription drug for a mental health diagnosis.

<sup>b</sup> Psychological distress is defined as scoring more than 12 on the Kessler 6-Item Psychological Distress Scale; probable depression is defined as scoring more than 2 on the Patient Health Questionnaire 2.

<sup>c</sup> From  $\chi^2$  test of the differences between individuals with probable mental illness and no mental illness.

distress or probable depression, suggesting that compositional differences were a strong factor in the higher rates of smoking found among those with mental illness and, in particular, the much higher unadjusted rates within the subgroup with psychological distress or probable depression.

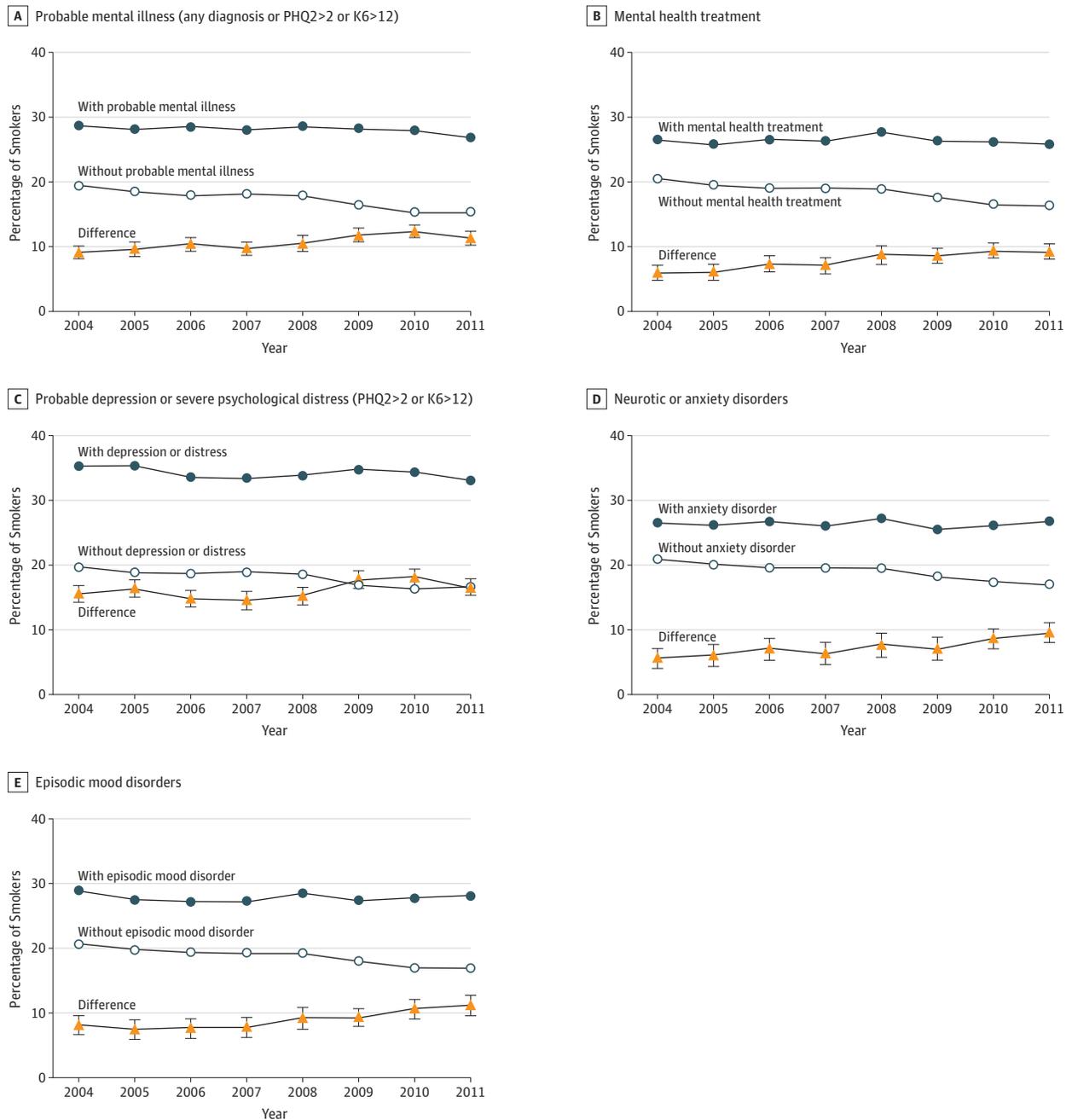
**Quit Rates Among Individuals With and Without Mental Health Treatment**

In the 2009-2011 NSDUH data, 14 111 individuals reported smoking more than 100 cigarettes in their lifetime and experiencing mental illness in the past year. Among these, 14 057 indi-

viduals had nonmissing quitting data, which is our final sample. The unadjusted rate of quitting smoking among those who received mental health treatment was 37.2% (95% CI, 35.1%-

39.4%) (Table 4), significantly higher than the 33.1% (95% CI, 31.5%-34.7%) quit rate among those who did not receive mental health treatment ( $P = .005$ ). Receiving any mental health

Figure. Trends in Smoking Rates Among Individuals With and Without Mental Illness, Mental Health Treatment, or Both<sup>a</sup>



Error bars indicate 95% confidence intervals. K-6 indicates Kessler 6-Item Psychological Distress Scale; PHQ-2, Patient Health Questionnaire 2.

A, Analysis included individuals with (median, 4091 [range, 3633-4319]) and without (median, 16 363 [range, 15 009-18 355]) probable mental illness.  $P < .01$  at 2010 and  $P < .05$  at 2011.

B, Analysis included individuals with (median, 2515 [range, 2353-2729]) and without (median, 17 909 [range, 16 259-19 992]) treatment linked to a mental health diagnosis.  $P < .05$  at 2010 and 2011.

C, Analysis included individuals with (median, 2333 [range, 1981-2522]) and

without (median, 17 669 [range, 16 254-19 692]) severe psychological distress or probable depression.

D, Analysis included individuals with (median, 1180 [range, 1126-1400]) and without (median, 19 232 [range, 17 516-21 343]) neurotic/anxiety disorder.

$P < .05$  at 2011. E, Analysis included individuals with (median, 1499 [range, 1388-1601]) and without (median, 18 899 [range, 17 203-21 115]) depressive disorder.  $P < .10$  at 2011.

<sup>a</sup> Mental health treatment included individuals who received outpatient care or a prescription drug for a mental health diagnosis.

treatment significantly increased the probability of having quit, after adjusting for substance use treatment, mental illness severity, and other covariates ( $P = .04$ ) (Table 5). Substance use treatment, age, illness severity, being married, higher income, higher education, no criminal history, and having Medicare insurance (compared with private insurance) were sig-

**Table 2. Logit Model Estimating Association Between Mental Illness and Current Smoker Status, After Adjustment for Time, Mental Illness, and Sociodemographic Characteristics (N=165269)<sup>a</sup>**

Characteristic	$\beta$ Coefficient, Log Odds (95% CI)	P Value
Mental illness <sup>b</sup>	0.41 (0.329 to 0.491)	<.001
Time		
2004-2005	1 [Reference]	
2006-2007	-0.05 (-0.107 to 0.014)	.13
2008-2009	-0.11 (-0.181 to -0.039)	.002
2010-2011	-0.20 (-0.267 to -0.133)	<.001
Mental illness $\times$ time		
Mental illness $\times$ 2006-2007	0.06 (-0.062 to 0.172)	.36
Mental illness $\times$ 2008-2009	0.08 (-0.042 to 0.205)	.20
Mental illness $\times$ 2010-2011	0.18 (0.062 to 0.298)	.004
Race/ethnicity		
White	1 [Reference]	
Black	-0.42 (-0.487 to -0.353)	<.001
Hispanic	-1.23 (-1.305 to -1.155)	<.001
Other race	-0.38 (-0.473 to -0.287)	<.001
Sex		
Men	1 [Reference]	
Women	-0.47 (-0.510 to -0.430)	<.001
Married	-0.48 (-0.529 to -0.431)	<.001
Age, y		
35-44	1 [Reference]	
18-24	-0.69 (-0.764 to -0.616)	<.001
25-34	-0.03 (-0.095 to 0.030)	.31
45-54	0.05 (-0.015 to 0.118)	.13
55-64	-0.26 (-0.332 to -0.188)	<.001
65-74	-0.67 (-0.808 to -0.532)	<.001
$\geq 75$	-1.73 (-1.891 to -1.569)	<.001
Insurance		
Private	1 [Reference]	
Medicare	-0.14 (-0.247 to -0.033)	.008
Medicaid	0.36 (0.299 to 0.421)	<.001
Other public	0.30 (0.001 to 0.599)	.05
Uninsured	0.49 (0.432 to 0.548)	<.001
Income		
Below poverty	1 [Reference]	
Near poverty	-0.12 (-0.198 to -0.042)	.002
Low income	-0.21 (-0.274 to -0.146)	<.001
Middle income	-0.28 (-0.344 to -0.216)	<.001
High income	-0.54 (-0.614 to -0.466)	<.001
Education		
<High school graduate	1 [Reference]	
High school graduate	-0.26 (-0.317 to -0.203)	<.001
Some college	-0.62 (-0.689 to -0.551)	<.001
College graduate	-1.49 (-1.572 to -1.408)	<.001
Live in an MSA >250 000 population	-0.08 (-0.147 to -0.013)	.03
Constant	0.35 (0.237 to 0.463)	<.001
F-adjusted test statistic	4.65	<.001

Abbreviations: MSA, metropolitan statistical area.  
<sup>a</sup> Data from the 2004-2011 Medical Expenditure Panel Survey, adults 18 or older.  
<sup>b</sup> Defined as having outpatient care or a prescription drug for a mental health diagnosis as well as those who scored more than 2 on the Patient Health Questionnaire 2 or scored more than 12 on the Kessler 6-Item Psychological Distress Scale.

Table 3. Estimated Trends in Smoking Among Individuals With and Without Probable Mental Illness (Adjusted for All Regression Model Covariates)

	Mental Illness		No Mental Illness	
	No. (%) [95% CI]	P Value	No. (%) [95% CI]	P Value
<b>Treatment linked to a mental health diagnosis, PHQ-2 Score &gt; 2, or K-6 Score &gt; 12<sup>a</sup></b>				
2004-2005	8404 (25.3) [24.2 to 26.3]		33 238 (19.2) [18.7 to 19.7]	
2010-2011	8206 (24.9) [23.8 to 26.0]		35 111 (16.5) [16.0 to 17.0]	
Difference over time, % (95% CI) <sup>b</sup>	-0.4 (-1.8 to 1.1)	.50	-2.7 (-3.4 to -2.0)	<.001
Difference in difference, % (95% CI) <sup>c</sup>			2.3 (0.7 to 3.9)	.005
<b>Treatment for mental health diagnosis</b>				
2004-2005	5114 (24.4) [23.0 to 25.7]		36 528 (19.7) [19.3 to 20.2]	
2010-2011	5239 (23.9) [22.5 to 25.3]		38 078 (17.1) [16.6 to 17.6]	
Difference over time, % (95% CI)	-0.5 (-2.4 to 1.4)	.71	-2.6 (-3.3 to -1.9)	<.001
Difference in difference, % (95% CI)			2.1 (0 to 4.2)	.048
<b>PHQ-2 &gt; 3 or K-6 &gt; 13</b>				
2004-2005	4980 (28.1) [26.8 to 29.5]		35 836 (19.4) [19.0 to 19.9]	
2010-2011	4550 (26.8) [25.2 to 28.3]		37 672 (17.3) [16.8 to 17.8]	
Difference over time, % (95% CI)	-1.4 (-3.4 to 0.7)	.21	-2.1 (-2.8 to -1.5)	<.001
Difference in difference, % (95% CI)			0.8 (-1.3 to 2.9)	.47

Abbreviations: K-6, Kessler 6-Item Psychological Distress Scale; PHQ-2, Patient Health Questionnaire 2.

<sup>a</sup> Treatment linked to a mental health diagnosis is defined as outpatient care for a mental health diagnosis or psychotropic drug use.

<sup>b</sup> Difference between the 2 designated periods, 2004-2005 and 2010-2011.

<sup>c</sup> Difference between people with mental illness and no mental illness in the difference over time.

nificant predictors of quitting smoking. Outpatient treatment was significantly positively associated with having quit ( $P = .006$ ), whereas inpatient treatment was not ( $P = .27$ ) (eTable in Supplement).

## Discussion

We have further characterized the association of mental illness and smoking,<sup>2,3,6</sup> demonstrating that recent decreases in US smoking rates have not been realized among individuals with mental illness, episodic mood disorder, or neurotic/anxiety disorder. The mechanisms that support persistently higher rates of smoking among individuals with mental illness are complex and remain understudied.<sup>32</sup> Patients with mental illness may attribute greater benefits and reward value to smoking compared with patients without psychiatric disorders<sup>33</sup> or may experience more difficult life circumstances, higher negative affect, or a relative lack of alternative rewards.<sup>32,34</sup> Identifying new interventions to address mechanisms specific to this population should be a priority for tobacco control policy.

We found higher rates of smoking among individuals with psychological distress or probable depression compared with those receiving treatment for a mental health diagnosis. This disparity may be explained, in part, by compositional differences between these groups. Compared with the group receiving treatment, the population screened as having psychological distress or probable depression was more likely to be unemployed men with lower income and education—all risk factors for tobacco use.<sup>35</sup>

Mental illness not only is an independent risk factor for smoking but is associated with a number of smoking-related risk factors, including higher poverty, lower education, and lower employment (Table 1). Because of these associations,

the provision of care to an individual diagnosed with mental illness should be seen as an opportunity for smoking prevention or cessation treatment. For many individuals receiving mental health treatment, interactions with mental health professionals (eg, psychologists, psychiatrists, mental health counselors) are their only access to preventive health counseling. Effective tobacco cessation treatments,<sup>12</sup> interventions that integrate mental health and substance abuse treatment,<sup>13</sup> and nicotine replacement therapies are now readily available and can dovetail easily with psychosocial treatments and prescription of psychotropic medications.

Our supplementary analysis found that individuals receiving mental health treatment are not only less likely to smoke but are more likely to quit, even after adjustment for mental health and sociodemographic factors. These results suggest that smokers can quit and remain abstinent from cigarettes during mental health treatment and that this is a promising setting to promote smoking cessation. It also indicates the importance of assisting smokers with mental illness in overcoming barriers to accessing mental health care (eg, insuring the uninsured, increasing the supply of mental health care professionals, improving linkages between primary care and mental health care) as a means to address smoking-related harm.<sup>36,37</sup>

However, the fact that smoking rates for individuals receiving mental health care have not experienced the same rates of decline as the general population suggests limited adoption of integrated treatments<sup>38</sup> and ongoing barriers to cessation treatment in mental health care settings.<sup>39</sup> Some primary care and behavioral health professionals continue to believe that smoking cessation can adversely affect psychiatric treatment.<sup>40</sup> Other barriers to cessation treatment include a lack of confidence that individuals with mental illness are willing and able to quit, failure to appreciate the health ef-

fects of smoking, and the normalized smoking culture found in many treatment settings.<sup>15,41</sup> Few mental health care professionals assess clients' tobacco use, advise and assist them in quitting, or arrange follow-up,<sup>42</sup> and most individuals with mental illness are not afforded the same cessation opportunities as the general population.<sup>15</sup>

**Table 4. Descriptive Statistics of 2009-2011 National Survey of Drug Use and Health (NSDUH)-Lifetime Smokers With Past-Year Mental Illness (N=14 057)<sup>a</sup>**

Characteristic	Received Treatment, No. (Weighted %)		P Value
	No (n = 8631)	Yes (n = 5426)	
<b>Dependent variable</b>			
Quit smoking	1896 (33.1)	1376 (37.2)	.005
<b>Independent variables</b>			
Women	4568 (50.9)	3703 (64.8)	<.001
<b>Age, y</b>			
18-25	4840 (20.7)	2256 (12.3)	<.001
26-34	1492 (22.3)	965 (18.0)	
35-49	1470 (27.7)	1449 (33.1)	
50-64	542 (18.7)	619 (28.9)	
≥65	259 (10.6)	127 (7.7)	
<b>Severity</b>			
Mild	4949 (62.2)	1895 (38.3)	<.001
Moderate	1822 (19.2)	1124 (20.3)	
Serious	1832 (18.6)	2397 (41.4)	
Married	2068 (36.5)	1695 (43.2)	<.001
<b>Education</b>			
<High school graduate	2001 (21.1)	1077 (16.9)	<.001
High school graduate	3221 (35.4)	1782 (30.8)	
Some college	2373 (27.4)	1680 (30.0)	
College graduate	1008 (16.1)	877 (22.3)	
<b>Race</b>			
White	5897 (74.8)	4310 (85.6)	<.001
Black	885 (10.7)	309 (6.4)	
Asian/Pacific Islander	201 (3.0)	59 (1.2)	
Hispanic	1005 (11.4)	396 (6.9)	
Any criminal activity	3230 (34.8)	2053 (35.4)	.63
<b>Income</b>			
Below poverty	2599 (24.1)	1606 (23.0)	.16
Near poverty	701 (8.2)	402 (7.0)	
Low income	1629 (18.0)	984 (18.0)	
Middle income	2077 (26.1)	1257 (25.4)	
High income	1597 (23.6)	1167 (26.6)	
<b>Insurance</b>			
Medicare	130 (3.6)	162 (5.6)	<.001
Medicaid/SCHIP	1407 (12.6)	1310 (19.4)	
Private	3593 (47.5)	2464 (50.2)	
Uninsured	2867 (28.7)	1023 (15.8)	
Other	606 (7.6)	457 (9.0)	
<b>Employment</b>			
Not employed	3265 (40.8)	2604 (51.5)	<.001
Employed	5338 (59.2)	2812 (48.5)	
Live in an MSA >250 000 population	7785 (92.7)	4914 (92.7)	>.99
<b>Among those with any past-year mental health care</b>			
Received outpatient care		53.0	
Received inpatient care		8.1 <sup>b</sup>	

Abbreviations: MSA, metropolitan statistical area; SCHIP, State Children's Health Insurance Program.

<sup>a</sup> Data from the 2009-2011 National Survey of Drug Use and Health, adult respondents smoking more than 100 cigarettes in their lifetime and predicted to have mild, moderate, or severe mental illness based on responses to the Kessler 6-Item Psychological Distress Scale and the World Health Organization-Disability Assessment Schedule.

<sup>b</sup> The remaining 38.9% of individuals with any past-year mental health care reported psychotropic medication use but no inpatient or outpatient visits.

There was no statistically significant association between inpatient mental health treatment and quitting rates, suggesting that smoking cessation may be particularly emphasized in this setting. Other studies report elevated smoking rates in inpatient settings compared with outpatient

settings.<sup>43,44</sup> Clinicians have historically tolerated smoking in inpatient settings, and cigarettes have even been provided to psychiatric patients to decrease agitation and encourage patient adherence.<sup>41</sup> Smoking cessation may be considered of less importance in those inpatient settings in which patients may

**Table 5. Multivariable Logit Regression of Quitting Smoking Conditional on Mental Health Treatment, Substance Abuse Treatment, Sex, Age, Severity, and Sociodemographic Characteristics Among Lifetime Smokers With Mental Illness (N=14 057)<sup>a</sup>**

Characteristic	Coefficient, $\beta$ : Log Odds (95% CI)	P Value
Mental health treatment	0.155 (0.007 to 0.303)	.04
Substance abuse treatment	-0.808 (-1.166 to -0.450)	<.001
Women	-0.089 (-0.238 to 0.059)	.24
Age, y		
18-25	1 [Reference]	
26-34	0.509 (0.338 to 0.680)	<.001
35-49	0.808 (0.647 to 0.969)	<.001
50-64	1.414 (1.217 to 1.611)	<.001
≥65	2.523 (2.160 to 2.886)	<.001
Severity		
Mild	1 [Reference]	
Moderate	-0.133 (-0.311 to 0.046)	.14
Serious	-0.276 (-0.441 to -0.111)	.001
Married	0.440 (0.290 to 0.590)	<.001
Education		
<High school graduate	1 [Reference]	
High school graduate	0.110 (-0.100 to 0.319)	.30
Some college	0.301 (0.085 to 0.517)	.006
College graduate	0.673 (0.428 to 0.918)	<.001
Race		
White	1 [Reference]	
Black	-0.009 (-0.263 to 0.246)	.94
Asian/Pacific Islander	0.153 (-0.304 to 0.610)	.51
Hispanic	0.181 (-0.083 to 0.444)	.18
Any crime	-0.422 (-0.574 to -0.270)	<.001
Income		
Below poverty	1 [Reference]	
Near poverty	0.249 (-0.048 to 0.546)	.10
Low income	0.250 (0.015 to 0.485)	.04
Middle income	0.378 (0.148 to 0.608)	.001
High income	0.586 (0.347 to 0.825)	<.001
Insurance		
Medicare	1 [Reference]	
Medicaid/SCHIP	-0.425 (-0.839 to -0.011)	.04
Private	-0.070 (-0.477 to 0.337)	.74
Uninsured	-0.462 (-0.879 to -0.045)	.03
Other	0.166 (-0.269 to 0.601)	.45
Employed	0.118 (-0.047 to 0.283)	.16
Live in a MSA >250 000 population	-0.073 (-0.316 to 0.171)	.56
Year		
2009	1 [Reference]	
2010	-0.049 (-0.215 to 0.117)	.57
2011	0.049 (-0.117 to 0.215)	.56
Constant	-2.009 (-2.467 to -1.551)	<.001
F-adjusted test statistic	2.45	.02

Abbreviations: MSA, metropolitan statistical area; SCHIP, State Children's Health Insurance Program.

<sup>a</sup> Data from the 2009-2011 National Survey of Drug Use and Health, adult respondents smoking more than 100 cigarettes in their lifetime and predicted to have mild, moderate, or severe mental illness based on responses to the Kessler 6-Item Psychological Distress Scale and the World Health Organization-Disability Assessment Schedule.

be undergoing treatment for acute exacerbations of severe mental disorders, although efforts for changing the smoking culture in such settings are under way.<sup>4,5</sup>

This study has several limitations. First, our findings are limited to a period (2004-2011) in which the decline in smoking among the general population was relatively small, so that the K-6 and PHQ-2 (administered for the first time in 2004) could be incorporated into the analysis. It is possible that the divergence in trends between individuals with and without mental illness is a recent phenomenon. Second, the MEPS does not contain structured diagnostic instruments to identify mental illness. Using available measures, we identified a 15% prevalence of mental illness, considerably lower than the 26% prevalence of any 12-month *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) disorder using structured diagnostic instruments in a 2002-2003 national survey.<sup>9</sup> Using the K-6 and PHQ-2 criteria to determine mental illness raises the possibility that mentally ill individuals with low levels of distress and depressive symptoms may be underrepresented, and smoking rates for the mentally ill may thus be underestimated. Including individuals receiving any psychotherapy or with filled prescriptions for any psychotropic drug may alternately miscategorize individuals with no or sub-threshold mental health disorder. Significantly, the identified trends were similar for both populations as well as within specific disorders.

Third, the MEPS excludes persons with mental illness who are institutionalized, potentially underestimating the overall prevalence of smoking in the US population. Fourth, the

supplementary NSDUH analysis does not allow for a causal determination of whether smoking cessation was influenced by mental health treatment, and it is possible that respondents quit tobacco use before mental health treatment was initiated. Interpretation of these findings should not rule out the possibility of reverse causality (individuals are more likely to initiate mental health care after quitting) or the possibility that unobserved variables explain the strong relationship between treatment and cessation.

Despite these limitations, our findings provide evidence of diverging trends in smoking rates among individuals with and without mental illness, and the findings remain robust to a number of different definitions of mental illness and among individuals receiving treatment for neurotic/anxiety and episodic mood disorders. Our analyses also identify that mentally ill lifetime smokers receiving mental health treatment were more likely to have quit smoking than their counterparts not receiving treatment.

## Conclusions

Between 2004 and 2011, the decline in smoking among individuals with mental illness was significantly less than among those without mental illness, although quit rates were greater among those receiving mental health treatment. This suggests that tobacco control policies and cessation interventions targeting the general population have not worked as effectively for those with mental illness.

### ARTICLE INFORMATION

**Author Contributions:** Dr Cook had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Cook, Wayne, Liu, Flores.

**Acquisition of data:** Cook.

**Analysis and interpretation of data:** Cook, Wayne, Kafali, Liu, Shu.

**Drafting of the manuscript:** All authors.

**Critical revision of the manuscript for important intellectual content:** Cook, Wayne, Kafali, Shu.

**Statistical analysis:** Cook, Kafali, Liu, Shu.

**Obtained funding:** Cook.

**Administrative, technical, or material support:** Cook, Kafali, Shu, Flores.

**Study supervision:** Cook.

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