Depressive Disorders Are Related to Nicotine Dependence in the Population But Do Not Necessarily Hamper Smoking Cessation

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Background: Evidence shows considerable comorbidity between nicotine dependence and depression. However, little is known from the population about specific factors involved. The goal was to analyze smoking, nicotine dependence, and depression cross-sectionally and to analyze whether or not depression predicts the sustenance of smoking after 3 years.

Method: A population-based random sample, representative for the adult population aged 18 to 64 years in a German region, was interviewed face to face (N = 4075). Among these were 2458 daily smokers, of whom 320 (13.0%) had a lifetime diagnosis of depression. Current smokers at baseline were followed up 36 months later. Measurements included DSM-IV diagnoses of depression and nicotine dependence by the Composite International Diagnostic Interview. Smoking cessation was defined as the abstinence from smoking for at least 4 consecutive weeks.

Results: The rate of subjects with a depressive disorder among female never nicotine dependents was 13.7% and among female current nicotine dependents 31.6% ($\chi^2 = 49.9$, df = 2, $p < .001$); the respective rate among male never nicotine dependents was 5.6% and among male current nicotine dependents 13.4% ($\chi^2 = 20.2$, df = 2, $p < .001$). Subjects with a lifetime history of depressive disorder revealed the same rate of smoking cessation after 3 years as those without a depressive disorder ($\chi^2 = 0.7$, df = 1, not significant). The use of nicotine replacement therapy was equally distributed among subjects with a depressive disorder and those without a depressive disorder ($\chi^2 = 0.03$, df = 1, not significant).

Conclusion: The risk for depression increases as the number of nicotine dependence symptoms increases or dependence criteria are fulfilled. Despite this association, depressed subjects may show the same prospect for smoking cessation as nondepressed subjects.

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There has long been evidence that smoking and nicotine dependence are more prevalent among people with a depressive disorder than among those without a depressive disorder.[1–3] However, the underlying mechanisms of this comorbidity are largely unknown, although single studies on behavioral and biological interactions have been performed.[1] Little is known about causal relationships between nicotine dependence and depression. In principle, smoking and nicotine dependence might cause depression or vice versa, or both disorders might depend on third factors, such as genetic influences. Evidence, including twin research, suggests that both smoking and major depressive disorder appear not to cause each other but to each be genetically predisposed.[4] One mechanism of interaction might be that smokers with a depressive disorder suffer from withdrawal more than those without a depressive disorder, and the antidepressive effect of nicotine might hamper smoking cessation. Studies particularly suited to provide evidence for this mechanism are population based and can reveal how large the problem of comorbidity is between depressive disorders, smoking, and nicotine dependence and to what extent this comorbidity might contribute to resistance to smoking cessation. Population-based studies are particularly well suited to analyze such relationships

since untreated patients, mild degrees of disease, and "subthreshold" diagnoses, i.e., disease criteria that are not numerous enough to fulfill the disease definition, are included. Only a few population-based studies are in existence, and they are limited by sample selection (narrow age range, female gender specific)[5,6] or scarce diagnostic information.[7,8] The samples up to this point are from nations in which the smoking rates have declined, but the rates of nicotine-dependent individuals may have remained stable or even increased.[9] One factor in addition to nicotine dependence that might contribute to dependence as a resistance against cessation is depression.

In a random sample of 1200 members of a health maintenance organization (HMO) consisting of members aged 21 to 30 years (mean age = 26 years), using the Diagnostic Interview Schedule (DIS), the lifetime prevalence of DSM-III-R major depression was 36.7% among nicotine-dependent daily smokers and 15.0% among nicotine nondependents (odds ratio [OR] = 3.17, 95% CI = 1.73 to 5.83).[6] Smokers with major depression reported more withdrawal symptoms than nondepressed smokers.[2] No differences between subjects with and without a depressive disorder were found according to the Fagerström Test for Nicotine Dependence (FTND),[10] which focuses on nicotine withdrawal. In a population survey[7] in which 6 of the DSM-IV criteria for dependence were approximated by single questions, major depressive episodes 12 months prior to the interview were estimated by screening scales that had been derived from a version of the Composite International Diagnostic Interview (CIDI). The rates of those who had a major depressive episode increased from never and former smokers to nondependent current cigarette smokers, up to current nicotine dependents (N = 39,994). Odds ratios adjusted for sociodemographic variables were 1.8 among nondependent and 3.1 among dependent current smokers for major depressive episode compared with never cigarette smokers. Another survey, carried out in the United Kingdom, in which 10,108 subjects were interviewed using an assessment of psychiatric disorders for lay interviewers,[11] revealed 3.7% with depression among the nicotine dependents compared with 1.2% among those who had no nicotine, alcohol, or drug dependence.[12]

It is unclear whether a past history of depression[13] may predict the sustenance or cessation of smoking.[14] In the study of young adult HMO members,[6] smoking cessation (abstinence for 12 months or longer) was measured 5 years after the baseline interview.[15] Smokers with major depressive disorder did not differ in the rate of smoking cessation from those without major depressive disorder after 5 years.[15] Among a population-based sample of 2004 women, drawn in New Zealand,[5] a random subsample (N = 314) received a psychiatric interview, the Present State Examination. Of these, 272 were reinterviewed 3 years later concerning their smoking behavior. Women who showed depression were more likely to be smokers 30 months later (63.2%) than women without a psychiatric disorder at baseline (22.7%). Population-based data from the National Health and Nutrition Examination Survey Follow-Up Study[16] collected 8 years after baseline revealed that the smokers with higher depression scores according to the Center for Epidemiological Studies Depression Scale (CES-D) were less likely to have quit 8 years later (10% had quit) compared with smokers who had been nondepressed at baseline (18% had quit).[8]

A treatment that might be particularly helpful for subjects with a depressive disorder is nicotine replacement therapy (NRT), which has been shown to be related to an improvement in the moods of patients with major depressive disorder after 4 days.[17] Among nonmedicated subjects with major depressive disorder, a 2-week NRT group showed less relapse than a placebo group.[18] However, NRT did not lead to fewer depressive symptoms.

Little is known from samples representative of an adult population with depression, using DSM-IV diagnoses,[19] about relationships between smoking status, lifetime number of cigarettes smoked, and details of nicotine dependence among women and men. The evidence is unclear as to whether depression according to DSM-IV may predict a low smoking cessation rate and whether the use of NRT might moderate this rate.

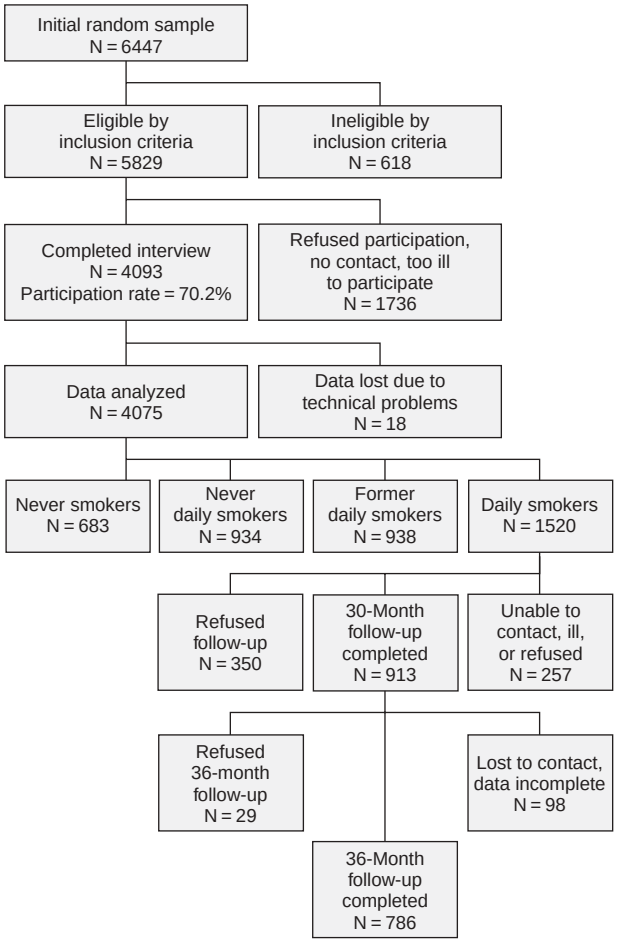
The goals of this article include examining in a population-based sample, aged 18 to 64 years, with standardized psychiatric diagnostic interviews, whether subjects with a DSM-IV depressive disorder show a higher "smoking-load" than subjects without a depressive disorder, i.e., the hypothesis was that the higher the number of years of smoking and cigarettes smoked, the lower the age at onset of smoking and the higher the number of nicotine dependence and nicotine withdrawal criteria related to the diagnosis of depression. We also wanted to examine the prediction of smoking cessation and utilization of NRT, the hypothesis being that depression predicts a low smoking cessation rate, with the exception that smokers with a depressive disorder who utilize NRT have a higher rate of cessation than those who do not.

METHOD

Sample and Procedures

Individuals aged 18 to 64 years living in the northern German 217,000-inhabitant city of Lübeck and 46 surrounding communities were eligible for the present study (Transitions in Alcohol Consumption and Smoking [TACOS][20]). A random sample was drawn from the communities' resident registration files, in which the addresses and other specific personal data of all persons residing in that section of Germany are included by law. The sample consisted of 6447 addresses (Figure 1). Of these, 618 (9.6%) did not fulfill the inclusion criteria (subject

Figure 1. Sampling Procedure



had moved out of the area, was not known at the registered address, was not of German nationality, was institutionalized, or was deceased). Of the remaining 5829 individuals, 4093 completed the baseline interview (participation percentage: 70.2%). Reasons for nonparticipation were refusal, no contact established, or severe disease.[21] The data of 4075 subjects could be analyzed. The female percentage was 49.8% and the mean age was 41.60 (SD = 1.34) years. The individuals were representative of the defined population with respect to demographic characteristics.[20,22]

The study had been designed as a cohort study. Data collection at baseline was carried out in 1996, and the follow-ups 30 and 36 months thereafter. Individuals with daily smoking for at least 4 consecutive weeks on the day of the baseline interview (t_0; N = 1520) were eligible for a 30-month follow-up (t_1). Of these, 350 had not given consent to be followed up, 110 had moved abroad or to an unknown address or were deceased, 68 could not be reached or were too ill to participate, and 79 refused to participate at t_1.[23] The procedure resulted in 913 individuals with valid information on smoking at t_1. For the second follow-up, carried out 36 months after baseline (t_2), all 913 participants were scheduled to be contacted. Of these, 29 refused, 77 were unknown at the registered address, 17 could not be contacted, and the data of 4 were incomplete and could not be analyzed. The final sample at t_2 included 786 individuals. There was no difference between the 786 participants in the follow-ups and the 734 nonparticipants according to either depression ($\chi^2 = 0.02$, df = 1, not significant) or nicotine dependence at baseline ($\chi^2 = 0.03$, df = 1, not significant). Among the 786 participants, 127 (16.2%) showed smoking cessation (abstinence from smoking for 4 or more consecutive weeks) between t_0 and t_2.

The baseline interview was conducted as a computer-aided personal interview, with 91.5% of the participants interviewed at their homes. At t_1, participants who in addition to smoking had shown at-risk alcohol consumption were visited at their homes. Smokers without at-risk alcohol consumption received a mailed questionnaire that was to be returned by the participant. Multiple contacts in the form of additional mailings, phone calls, and personal visits were used as necessary to increase the response rates. At t_2, all subjects were personally visited at their homes. The study followed the ethical principles of the American Psychological Association[24] and was approved by the ethics committee of the Medical University of Lübeck, where it was conducted. Individuals received written information about the study and were informed that they were free to participate and could withdraw at any time. The time points of the 2 follow-ups were chosen for reasons of analyzing long-term as well as short-term change in smoking behavior and the intention to change.

Measurements

At baseline, smoking status, DSM-IV[19] nicotine dependence, and DSM-IV depression were assessed with the computer-based Munich-Composite International Diagnostic Interview (M-CIDI),[25] the German version of the World Health Organization Composite International Diagnostic Interview.[26] Never smokers were defined as having never smoked in their life, neither cigarettes, cigars, nor a pipe. Never daily smokers had smoked on a daily basis for 4 weeks or less. Former daily smokers had smoked longer than 4 consecutive weeks daily in their life, but not during the last 4 weeks prior to the interview. Current daily smokers had smoked daily during the last 4 weeks prior to the interview. Pack-years of cigarettes smoked were calculated by the number of years smoked in life at t_0 multiplied by the number of cigarettes smoked per day at baseline divided by 20. Regarding nicotine dependence, those showing at least 3 criteria in the last 12 months prior to the interview were diagnosed as currently dependent, and those who had shown at least 3 criteria

before that time but not during the last 12 months were diagnosed as remitted dependents. Of the 8 withdrawal criteria according to DSM-IV, we included dysphoric or depressed mood, insomnia, irritability, frustration or anger, difficulty concentrating, restlessness, and increased appetite or weight gain in the data analysis. Anxiety and decreased heart rate were prevalent in less than 0.5% of the smokers and were therefore excluded. The FTND was used, with the sum score 0 to 2 assumed as very low, 3 to 4 as low, 5 as medium, and 6 to 10 as high or very high.[10] To determine the number of attempts to quit or reduce smoking, we asked whether the individual had ever tried to quit or cut down on smoking and, if yes, how many times. The diagnosis of depression covered major depressive disorder (DSM-IV 296.20–296.26, 296.30–296.36) and dysthymic disorder (DSM-IV 300.4). We used the diagnosis of depression for all subjects who had had a depressive disorder at any point during their lifetime. In the cross-sectional analysis of the baseline data, we present differences for subjects with a lifetime history of depressive disorder only, since no difference between subjects with remitted and current depressive disorder could be found according to the results shown, except in age and increased appetite or weight gain after smoking cessation.

After 36 months, data concerning daily smoking since baseline and NRT use were gathered. Abstinence at follow-up was defined as having not smoked for at least 4 consecutive weeks since baseline. Accordingly, not staying quit for at least 4 weeks since baseline was defined as maintenance of smoking. Utilization of NRT was determined by the question: "When you tried to quit or to reduce smoking, did you use: nicotine gum? (Yes/No), nicotine patch? (Yes/No)." We did not ask about bupropion use since it was not available for nicotine withdrawal therapy in Germany at the time of data collection.

Data Analysis

For univariate data analysis, we used chi-square tests and logistic regression analysis for examining differences among subjects with a depressive disorder. In addition to the chi-square tests, the effect size estimate (Cohen's w) was given, with less than .10 indicating no effect and .10 to .29 indicating a small effect size.[27] For multivariate data analysis, we used logistic regression with forward stepwise inclusion of the independent variables in the model. The data were analyzed using SPSS software, version 11.5 (SPSS, Inc., Chicago, Ill.). In this analysis, we used data of the baseline and the second follow-up only because of the time length.

RESULTS

Among the sample of 4075 subjects, 683 (16.8%) were never, 934 (22.9%) were never daily, a further 938 (23.0%) were former daily, and 1520 (37.3%) were current daily smokers. Among the 4075 individuals of the total sample, there were 469 (11.5%) who had received a lifetime diagnosis of depression according to DSM-IV. Among them, in 177 the diagnosis of depression was valid for the previous 12 months. The female ever daily smokers (N = 1081) included 217 (20.1%) with a lifetime diagnosis of depression, among them 86 with a 12-month diagnosis of depression and 191 with a lifetime diagnosis of major depressive disorder. Of these, 65 had a 12-month diagnosis of major depressive disorder. Of the male ever daily smokers (N = 1377), 103 (7.5%) had a lifetime diagnosis of depression. Among them, 41 had a 12-month diagnosis of depression and 84 (6.1%) had a lifetime diagnosis of major depressive disorder. Of these, 22 had a 12-month diagnosis of major depressive disorder.

The univariate cross-sectional analysis of the baseline data shows that the rate of individuals with a diagnosis of depression increased with the smoking status from never smokers, never daily, former daily, and up to current daily smokers. It increased by nicotine dependence from never, remitted, up to current nicotine dependence in women as well as men (Table 1). The effect sizes were small. For smoking status, there was a small effect size in women only. Female current smokers showed an odds ratio of 2.3, and male current smokers an odds ratio of 4.3 for a lifetime diagnosis of depression compared with never smokers (Table 2). No relationship between age and depression was found in either women or men. This finding is largely true also for the lifetime amount of cigarettes smoked, measured by pack-years, but women who said they had smoked for more than 35 pack-years showed an increased odds ratio compared with those who had smoked for less than 10 pack-years. Women smoking more than 20 cigarettes per day had an increased odds ratio for depression compared with those smoking 10 or fewer cigarettes per day. Women who started daily smoking at the age of 15 years or younger showed an odds ratio of 2.1 for depression compared with women with an onset of daily smoking later in life. No equivalent relationship was found for men.

The odds ratio for depression increased by the number of nicotine dependence and withdrawal symptoms. Compared with smokers who showed no dependence criteria, the odds ratios increased by the number of dependence criteria. Female smokers with 4 or more dependence criteria had an odds ratio of 4.4 and males had an odds ratio of 8.0 for depression. Similarly, the risk for depression increased according to the number of nicotine withdrawal criteria. Female smokers who showed 4 or more withdrawal criteria had an odds ratio of 5.4 and males an odds ratio of 8.4 for depression. For 4 single withdrawal criteria—dysphoric mood, insomnia, irritability, and restlessness—there were significant odds ratios among women, and for insomnia, irritability, difficulty concentrating, and increased appetite or weight gain, significant odds ratios

Table 1. Smoking Status, Nicotine Dependence, and Depression at Baseline

	Women With Depression[a]								Men With Depression[a]								Total Depression[a]							
	Yes		No		Statistic[b]				Yes		No		Statistic[b]				Yes		No		Statistic[b]			
Subject	N	%	N	%	χ^2	(df)	p	ES	N	%	N	%	χ^2	(df)	p	ES	N	%	N	%	χ^2	(df)	p	ES
Smoking status																								
Never	49	10.7	407	89.3					5	2.2	222	97.8					54	7.9	629	92.1				
Never daily	64	13.0	429	87.0					31	7.0	410	93.0					95	10.2	839	89.8				
Former daily[c]	59	6.3	303	83.7					30	5.6	514	94.4					89	9.8	817	90.2				
Current daily[d]	158	22.0	561	78.0	31.33	(3)	< .001	.12	73	8.8	760	91.2	14.10	(3)	< .01	.08	231	14.9	1321	85.1	30.23	(3)	< .001	.09
Total	330		1700						139		1906						469		3606					
Nicotine dependent[e]																								
Never	229	13.7	1442	86.3					87	5.6	1464	94.4					316	9.8	2906	90.2				
Remitted	29	22.0	103	78.0					19	7.5	233	92.5					48	12.5	336	87.5				
Current	71	31.6	154	68.4	49.92	(2)	< .001	.16	32	13.4	207	86.6	20.17	(2)	< .001	.10	103	22.2	361	77.8	61.74	(2)	< .001	.12
Total	329		1699						138		1904						467		3603					

[a]Lifetime depression, according to DSM-IV.[19]
[b]Pearson χ^2 (degrees of freedom), significance. Effect size: Cohen's w, less than .10 indicating no effect, .10–.29 indicating a small effect size.[27]
[c]Longer than 4 weeks but not during the last 4 weeks.
[d]At least the last 4 weeks.
[e]According to DSM-IV.[19]

were found in men. Among the smokers included in the analysis (N = 2458), 506 (20.6%) reported irritability, 348 (14.2%) restlessness, 116 (4.7%) difficulty concentrating, 48 (2.0%) insomnia, and 30 (1.2%) dysphoric mood. The FTND score showed an increased odds ratio for subjects who had an FTND score of 6 or higher. The number of quit attempts was unrelated to depression.

A logistic regression analysis with a forward stepwise inclusion of independent variables revealed that for women, 1 or more nicotine dependence symptoms, 2 or more nicotine withdrawal symptoms, and 1 single withdrawal criterion, insomnia, were related to a lifetime diagnosis of depression. The odds ratio for women was 2.8 (95% CI = 2.0 to 4.0). With the reference "no nicotine dependence symptoms," the odds ratio for subjects who had 1 or 2 nicotine dependence symptoms was 2.2 (95% CI = 1.0 to 4.6); for those with 3 or 4 symptoms, 2.7 (95% CI = 1.3 to 5.9); and for those with 5 or more, 5.7 (95% CI = 2.6 to 12.8). Two nicotine withdrawal criteria revealed an odds ratio of 1.6 (95% CI = 1.0 to 2.5) and 3 or more, an odds ratio of 4.8 (95% CI = 1.9 to 12.0). Smokers who had insomnia when not smoking showed an odds ratio of 2.5 (95% CI = 1.0 to 5.9) compared with those who did not experience this withdrawal criterion. The odds ratios were adjusted for smoking status, number of cigarettes and years smoked, age at onset of daily smoking, FTND sum score, and 5 single withdrawal symptoms except insomnia.

According to the longitudinal analysis, neither a lifetime nor a 12-month diagnosis of depression revealed a relationship with smoking cessation, and there was no difference in the abstinence rate. Furthermore, depressed subjects and nondepressed subjects did not differ in NRT use, either among quitters or among nonquitters (Table 3). The variables that had turned out to be related to depression at baseline did not predict smoking cessation 3 years later, except that smokers with 3 or 4 (as well as smokers with 1 or 2) nicotine-dependence symptoms had a lower probability of smoking cessation compared with smokers who had no dependence symptoms (OR = 0.4, 95% CI = 0.2 to 0.8, and OR = 0.5, 95% CI = 0.3 to 0.8, respectively).

DISCUSSION

A strong relationship between DSM-IV nicotine dependence and its severity, expressed by the number of dependence symptoms, is revealed by the data. This outcome supports earlier findings.[2] In addition, our data show that the risk for depression increases by the number of nicotine dependence symptoms, and it is also increased when only 1 or 2 dependence criteria are fulfilled. Only a minority of female smokers with a high FTND sum score have an increased probability of depression. The FTND seems to reflect one criterion of dependence, but this criterion is not likely to be involved in the interaction between dependence and depression.

The number of withdrawal symptoms is closely related to depression, with some more so than others. Our results show in more detail what has been found in young adults in a previous study,[2] but it must be kept in mind that the frequencies of each withdrawal criterion are different. Three of the criteria, increased appetite or weight gain, irritability, and restlessness, reveal a higher prevalence than others. Three further withdrawal symptoms are much less prevalent, in female as well as in male smokers: difficulty concentrating, insomnia, and dysphoric mood. Two additional criteria, anxiety and decreased heart rate, turned out to be relatively unimportant because of their prevalence in less than 0.5% of the smokers. Withdrawal criteria may be more or less mixed with criteria for depression, such as irritability and restlessness, increased appetite, and

Table 2. Lifetime Depression Versus No Depression by Smoking Status at Baseline

	Women With Depression[a] (N = 1081)				Men With Depression[a] (N = 1377)			
Subject Characteristic	N	OR	95% CI	p[b]	N	OR	95% CI	p[b]
Smoking status[c]								
Never	456		Reference		227			
Never daily	493	1.2	0.8–1.8	NS	441	3.4	1.3–8.8	< .05
Former daily	364	1.6	1.1–2.5	< .05	574	2.6	1.0–6.8	< .05
Current daily	717	2.3	1.6–3.3	< .001	803	4.3	1.7–10.8	< .01
Age, y								
18–30	270		Reference		269			
31–40	311	1.3	0.8–1.9	NS	347	0.8	0.5–1.5	NS
41–50	239	1.1	0.7–1.7	NS	315	0.6	0.3–1.1	NS
51–64	261	1.2	0.8–1.8	NS	446	0.8	0.5–1.3	NS
Pack-years of cigarettes smoked[d]								
≤ 10.00	460		Reference		404			
10.01–20.00	272	1.2	0.8–1.7	NS	298	1.2	0.7–2.2	NS
20.01–35.00	212	1.2	0.8–1.9	NS	306	1.5	0.8–2.6	NS
> 35.00	121	2.3	1.5–3.6	< .001	355	1.5	0.8–2.6	NS
Number of cigarettes smoked currently								
≤ 10	233		Reference		155			
11–20	371	1.4	0.9–2.2	NS	416	0.8	0.4–1.4	NS
≥ 21	113	2.6	1.5–4.4	< .001	232	0.5	0.3–1.1	NS
Age at onset of daily smoking, y[e]								
15 or younger	178	2.1	1.4–3.1	< .001	242	1.4	0.8–2.4	NS
16–17	309	1.1	0.7–1.6	NS	481	0.8	0.5–1.5	NS
18–19	226	1.1	0.7–1.7	NS	318	0.8	0.4–1.5	NS
20 or older	368		Reference		336			
Number of nicotine dependence criteria								
0	346		Reference		409			
1–2	396	1.6	1.1–2.4	< .05	546	2.1	1.0–4.0	< .05
2–3	225	2.3	1.5–3.6	< .001	293	4.3	2.2–8.5	< .001
4 or more	114	4.4	2.7–7.3	< .001	129	8.0	3.9–16.4	< .001
Number of nicotine withdrawal criteria[a]								
0	604		Reference		817			
1	246	1.8	1.3–2.7	< .01	309	1.3	0.8–2.3	NS
2–3	203	2.8	2.0–4.1	< .001	236	2.3	1.4–3.8	< .001
4 or more	28	5.4	2.5–11.7	< .001	15	8.4	2.8–25.5	< .001
Nicotine withdrawal symptoms[a]								
Dysphoric mood	21	5.3	2.2–12.7	< .001	9	3.4	0.7–16.8	NS
Insomnia	24	3.9	1.7–8.9	< .001	24	5.2	2.1–12.9	< .001
Irritability	258	2.0	1.4–2.8	< .001	248	1.7	1.1–2.8	< .05
Difficulty concentrating	47	1.6	0.9–3.1	NS	69	2.1	1.1–4.3	< .05
Restlessness	160	2.3	1.6–3.3	< .001	188	1.4	0.8–2.4	NS
Increased appetite or weight gain	316	1.8	1.3–2.4	NS	364	1.8	1.1–2.7	< .05
Fagerström Test for Nicotine Dependence sum score								
0–2	346		Reference		283			
3–4	229	1.1	0.8–1.7	NS	284	1.1	0.6–2.0	NS
5	70	1.6	0.9–2.9	NS	112	0.8	0.3–1.8	NS
6 or more	72	2.3	1.3–4.0	< .001	124	1.7	0.9–3.3	NS
Number of attempts to quit or to reduce								
0	176		Reference		256			
1	369	1.0	0.6–1.7	NS	473	0.6	0.3–1.2	NS
2–3	327	1.2	0.8–2.0	NS	356	1.4	0.8–2.5	NS
4 or more	194	1.5	0.9–2.6	NS	279	1.4	0.8–2.6	NS

[a]According to DSM-IV.[19]
[b]Significance of logistic regression coefficient b; NS = not significant.
[c]Whole sample, N = 4075.
[d]Number of years smoked in life times the number of cigarettes per day currently, divided by 20.
[e]At least 4 weeks in life.
Abbreviations: CI = confidence interval, OR = odds ratio.

insomnia. However, according to the wording of the standardized interview used in this study, each smoking-related symptom strictly referred to smoking. Because of the high prevalence rates of the withdrawal symptoms or consequences of smoking, such as irritability, restlessness, and increased appetite or weight gain, these are relevant to clinical practice and adequate treatment.

The multivariate analysis shows that there is one main factor related to depression, the severity of dependence and withdrawal, expressed by the number of dependence and withdrawal symptoms. In addition to the comorbidity of nicotine dependence and depression, smokers who have a depressive disorder might suffer from withdrawal more than smokers without a depressive disorder. With-

Table 3. Depression and Use of Nicotine Replacement Therapy (NRT) at Baseline and Abstinence From Smoking After 3 Years; N = 785

	Abstinent[b]		Smoked[c]			Statistic[d]	
Depression Status[a]	N	%	N	%	Total	χ^2	p
Lifetime							
Yes	22	18.8	95	81.2	117		
Used NRT[e]	2	18.2	9	81.8	11		
Did not use NRT[e]	19	19.8	77	80.2	96	0.02	NS[f]
No	105	15.7	563	84.3	668	0.70	NS[g]
Used NRT[e]	9	20.5	35	79.5	44	0.03	NS[h]
Did not use NRT[e]	83	14.6	485	85.4	568	1.09	NS[i]
						1.69	NS[j]
Within last 12 mo							
Yes	8	18.2	36	81.8	44		
No	119	16.1	622	83.9	741	0.14	NS[k]

[a]At baseline, according to DSM-IV.[19]
[b]Four weeks or longer continuously during the 36 months after baseline (N = 127).
[c]Not abstinent 4 weeks or longer continuously during the 36 months after baseline (N = 658).
[d]Pearson χ^2 (1 degree of freedom); NS = not significant.
[e]At baseline or at any time during the 36 months after baseline.
[f]Lifetime depressed subjects who used NRT vs. lifetime depressed subjects who did not use NRT.
[g]Individuals with lifetime depression vs. individuals without lifetime depression.
[h]NRT users who have been depressed vs. NRT users who have not been depressed.
[i]Nondepressed subjects who used NRT vs. nondepressed subjects who did not use NRT.
[j]Non-NRT users who have been depressed vs. non-NRT users who have not been depressed.
[k]Depressed subjects (12 months) who used NRT vs. depressed subjects (12 months) who did not use NRT.

drawal could aggravate depression, and depressed smokers might particularly seek the antidepressive effect of tobacco smoking. Altogether, the hypothesis that higher amounts of tobacco smoked, nicotine dependence, and a larger number of nicotine dependence and withdrawal criteria are related to depression is strongly confirmed by the data, particularly for nicotine dependence and withdrawal symptoms.

Depression does not predict the maintenance of smoking or quitting for either women or men. Smokers with a lifetime diagnosis of depression as well as those with a 12-month diagnosis of depression show the same rates of individuals who had quit for at least 4 consecutive weeks during the last 3 years. Among the men, there is no difference between depressed and nondepressed subjects either; there might even be a trend toward more quitters among the depressed subjects. These results confirm those found for young adults in the U.S. HMO sample.[15] Additionally, among both depressed and nondepressed subjects, more than 15% were quitters. Thus, considerable numbers of depressed subjects achieve abstinence from tobacco for at least 4 consecutive weeks. It should be taken into account that smoking relapse may take place predominantly during a depressive episode and that antidepressive treatment might help to maintain smoking abstinence. Altogether, it may be concluded from the prospective data that it is worthwhile in depressed subjects, just as in nondepressed subjects, to support the intention to quit.

No evidence could be found from our data that more depressed subjects than nondepressed subjects use NRT. Thus, without a large promotion of NRT, the rates of users turned out to be equal in the 2 groups although we cannot say whether depressed smokers would utilize NRT more than nondepressed smokers, if all smokers would have been encouraged to the same degree to do so. Our second hypothesis, according to which depression hampers smoking cessation, with the exception that depressed smokers who utilize NRT have a higher rate of cessation than depressed smokers who do not, was not confirmed by the data.

This study has several limitations. First, there may be selection bias in our sample due to data attrition from baseline to the 2 follow-up time points. However, those who did not participate in the 2 follow-up inquiries revealed neither more depression nor more nicotine dependence than those who participated. Depression and nicotine dependence were equally distributed among participants and nonparticipants. Second, there may have been an active interview bias insofar as symptoms of depression and nicotine withdrawal may have been insufficiently separated. However, the CIDI is divided into separate sections of questions concerning depression and nicotine dependence. The smoking questions clearly refer to smoking. Third, the results may be only partly valid for other nations. In Germany, and in the area in which the data were collected as well, no prevention with evidence of a population impact is provided. Fourth, our data do not include information about treatment of depression. Thus, we cannot say whether the equal distribution of the cessation rates among depressed and nondepressed subjects is the result of treatment among the depressed subjects. Fifth, smoking behavior has not been validated by other indicators, such as the presence of cotinine. However, recent evidence shows that in population-based samples the impact of the group of smokers who deny smoking or minimize the amount of tobacco smoked may be negligible since they do not significantly change the results.[28,29] Sixth, we assessed NRT use only in a rough way and had not included how long the individuals used the nicotine gum or patch. Finally, we did not control for any further psychiatric disorder.

Altogether, our data add to the existing knowledge that the relationship between smoking, nicotine dependence, and depression may be revealed not only for young adults but for the whole range of middle adult age, 18 to 64 years, in the general population. The number and type of withdrawal symptoms are involved in this relationship. Depression and dependence may interact in their accruement. However, the prospects for smoking cessation seem to be independent of this. Depressed subjects have the same propensity to live without tobacco smoking as do nondepressed subjects.

It may be concluded from the findings that depressed as well as nondepressed smokers should be encouraged to quit smoking. In depressed smokers, adequate treatment might help to motivate quitting. Screening and a differential diagnosis of smokers according to nicotine dependence and depression should be implemented in medical settings and treatment planned accordingly.

Disclosure of off-label usage: The authors have determined that, to the best of their knowledge, no investigational information about pharmaceutical agents has been presented in this article that is outside U.S. Food and Drug Administration–approved labeling.

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