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Lifetime Depression, Other Mental Illness, and Smoking Cessation

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Abstract

Objectives—In this study, we attempt to elucidate the relationship between lifetime mental illness (LMI), particularly a depression diagnosis, and smoking cessation.

Methods—Data were drawn from a previous study and include LMI, demographics, mood, and smoking cessation outcomes. We evaluated the relationship between multiple LMIs and smoking cessation at 7 months post-intervention, and depression in combination with another LMI.

Results—At 7 months, the adjusted odds of cessation for those with one LMI, including depression, were 0.74 ($p = .102$), and for those with 2+ LMIs, 0.69 ($p = .037$), both in comparison with participants who reported no history of LMI. Among those with 2+ LMIs, the adjusted odds of cessation for those with a depression diagnosis were 0.34 ($p = .007$) compared to those whose multiple LMIs did not include depression.

Conclusions—Among smokers seeking cessation treatment, those who had 2+ LMIs were at greater risk of relapse, an effect particularly marked in smokers with depression. This study adds to the literature examining the potential impact of LMI on smokers' ability to quit by considering the potential impact of 2+ LMIs and highlights the potential impact of depression as a risk factor for continued smoking.

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Human Subjects Statement

This study was exempt from Institutional Review Board approval. This study has been approved by the US Office of Management and Budget, Office of Information and Regulatory Affairs, approval #0925-0642-12.

Conflict of Interest Statement

There are no conflicts of interest to report.

Disclaimer

The views and opinions expressed in this paper are those of the authors and do not necessarily represent the views, official policy, or position of the US Department of Health and Human Services or any of its affiliated institutions or agencies.

Keywords

depression; health behavior; mental health; new technology; smoking cessation

Individuals with any mental illness (AMI) have a much higher smoking prevalence rate than individuals without AMI. According to data from the 2012–2014 National Survey on Drug Use and Health, approximately 20.7% of the population of the United States (US) without AMI smoked cigarettes in the past month, compared to 33.3% of the US population with AMI.¹ Although individuals with AMI make up only 20% of the total US population, people with AMI smoke a disproportionately high number of cigarettes: From 2009 to 2011, an estimated 31% of cigarettes smoked in the US were smoked by people with AMI.² Smoking prevalence rates also differ by mental illness type; for example, people with psychological distress, such as phobias and fears, have lower smoking rates (34.3% current smokers) than those with schizophrenia (88% current smokers).³ Limited research on the effect of the number of serious mental illness diagnoses suggests that smoking prevalence increases with multiple diagnoses (one study found prevalence rates of 39.4% with no mental illness, 55.3% with one diagnosis, 67.6% with 2, and 89.3% with 3) and that individuals with multiple diagnoses are more likely to be heavy smokers.⁴ Smoking has significant health impacts on this population. Research suggests that individuals with AMI are likely to experience tobacco-related death at younger ages than the general population^{5,6} and that the most common causes of death (heart disease, cancer, and lung disease) among populations with mental illnesses all can be caused by smoking.^{7,8}

Research indicates that people with AMI share similar distributions across the stages of change as smokers without AMI, and that smokers with and without AMI are equally motivated to quit and make quit attempts.^{4,9–15} National epidemiological data suggest similar patterns of interest in quitting and quit attempts: 67.4% of those with AMI compared to 68.2% of those without AMI are interested in quitting, and 53.0% of those with AMI and 55.5% of those without an AMI diagnosis make a quit attempt.¹⁰ Randomized control trials have shown that cessation interventions commonly used to treat patients without AMI are also effective for individuals with AMI,¹¹ and one meta-analysis suggests commonly used treatments are also appropriate for those with severe mental illness.¹⁶ Baker et al¹⁷ found that a treatment regimen including nicotine replacement therapy (NRT), motivational interviewing, and cognitive behavior therapy was most effective among individuals with AMI if all treatment sessions were completed. Banham et al¹⁸ reported that short-term cessation rates for individuals with AMI improved when they used bupropion (RR = 2.77; 95% confidence interval [CI] = 1.48–5.16) or a combination of NRT and behavioral support (RR = 2.74; 95% CI = 1.10–6.81) compared to no cessation treatment, without compromising their mental health outcomes. Kinnunen et al¹⁹ found that nicotine gum was significantly more effective than placebo in helping depressed smokers quit (12.5% quit with a placebo vs 29.5% with nicotine gum).

Although interest in cessation among people with AMI is similar to that among people without AMI, and clinical trial findings suggest cessation treatment is effective for patients with AMI, healthcare providers, and particularly treating physicians, often overlook this

population's needs for cessation treatment, despite the American Psychiatric Association's recommendations for integrating smoking cessation into psychiatric care.^{11,14,20,21} Moreover, people with AMI appear to have more difficulty quitting smoking and sustaining cessation.¹⁰ Available evidence suggests that people with certain types of mental illness (such as anxiety, depression, bipolar disorder, and substance use disorders) often experience more difficulty quitting than people without AMI, despite using similar quitting resources.^{4,22,23}

Previous research found that between 35% and 45% of patients with a mental health diagnosis suffer from multiple diagnoses.²⁴ Individuals with multiple mental illness diagnoses tend to have lower cessation rates than smokers with one mental illness, but this trend has not been shown to be statistically significant.^{4,23} Multiple comorbid psychiatric conditions have been linked to poor health outcomes and negative health behaviors.^{25,26} Compared to other mental illnesses, diagnosed depression is particularly detrimental, being associated with poorer perceived health, greater likelihood of drug and substance use, and increased morbidity and mortality rates.^{25,27–29}

The literature shows that individuals with depression have higher rates of smoking than individuals without depression.³⁰ The relationship between depression and smoking cessation is less clear.³¹ Smokers with depression may seek cessation treatment more often than non-depressed smokers,¹⁵ and much higher rates of depression occur among patients seeking smoking cessation (approximately 25–64%)^{31–33} than among the non-smoking population (7.6% of those aged 12 and over).³⁴ Smokers with depression may experience more difficulty quitting than those without depression, although motivation to quit is similar in both groups.¹⁵ Many studies show that smokers with depression are less likely to quit than smokers without AMI,^{19,22,33,35,36} but others indicate that depression does not have a negative impact on smoking cessation.^{12,15,37–39} Other studies suggest that the severity of depression prior to smoking cessation treatment is associated with poorer cessation outcomes.^{40,41} The role that depression plays in maintaining cessation also can be difficult to interpret.^{31,37,42}

Despite the lack of clarity on the relationship between depression and cessation, the Public Health Service Clinical Practice Guidelines⁴³ and a toolkit for treating tobacco dependence in populations with behavioral health issues¹³ indicate that treating smokers' underlying depression with cognitive behavioral therapy and antidepressants can improve cessation rates, especially when combined with NRT.

Previous research has established that AMI has an impact on smoking cessation, but few studies have evaluated the effect of multiple diagnoses or have focused on the impact on smoking cessation of a specific diagnosis, such as depression, in conjunction with other mental illnesses in individuals with multiple diagnoses.¹² In the current study, we sought to evaluate the potential effects of multiple mental illness diagnoses through analyses of smokers with no, one, or 2 or more mental illness conditions. Given that many individuals experience multiple mental illnesses and that the rates of depression are higher in smokers than non-smokers, we also attempted to improve understanding of the effects of a depression diagnosis, in conjunction with an additional mental illness diagnosis, on smoking cessation.

Whereas many previous studies define AMI as diagnosable currently or in the past year, this study is unique in that it uses any lifetime mental illness (LMI) diagnosis.

In this study, we use data from a previous multi-intervention cessation trial⁴⁴ to accomplish the following primary aims: (1) to describe the LMI diagnoses in the sample of people who visited a smoking cessation website and expressed interest in quitting; (2) to examine whether participants with LMI are less likely to attempt to quit than those without LMI, and specifically, whether having 2 or more comorbid LMI diagnoses reduces self-reported abstinence at 7 months; (3) to assess the impact of a lifetime diagnosis of depression, in conjunction with other LMIs, on smoking cessation; and (4) to determine the smoking cessation interventions in the parent study that were particularly helpful among individuals with LMI, especially among smokers with depression.

METHODS

Data

Data for these analyses were drawn from a parent clinical study that used a factorial design to randomly assign 1034 smokers to “on” or “off” conditions of 5 cessation interventions: (1) access to a smoking cessation website; (2) telephone counseling; (3) motivational emails; (4) nicotine mini-lozenges; and (5) a self-help brochure.⁴⁴ The randomization scheme resulted in 32 different combinations of intervention components. The parent study evaluated the main and interactive effects of the 5 different smoking interventions and found that the use of nicotine mini-lozenges and the smoking cessation website resulted in increased abstinence from smoking.⁴⁴

Participants

Potential participants were recruited by the University of Wisconsin Center for Tobacco Research and Intervention from an online smoking cessation website. Participants were included if they smoked at least 5 cigarettes per day, were older than 17, desired to quit in the next 30 days but were not currently trying to quit, had access to a personal phone and the Internet, and were willing and able to use the cessation treatments provided in the study. A total of 1034 participants were included in both the parent and current study.

Measures

Data were collected at 4 assessment time points. Following the inclusion screener, baseline data were collected from all participants. Participants also were asked to complete 3 longer assessment surveys emailed at months 1, 3, and 7. Participants were compensated a maximum of \$95 if they completed all 4 assessments. For the purpose of this study, only data from baseline and the 7-month follow-up were analyzed.

Baseline data collected included demographics (age, employment status, race, sex, and marital status), medical history (including mental health history), and history of smoking, alcohol use, and other substance use. The month 7 assessment collected data on smoking cessation (tobacco use in the past 8 weeks), cessation tools used during quit attempt,

smoking dependence, mood, and use of prescribed interventions. Approximately 20% of participants were lost to follow-up at 7 months.

Smoking outcome—The primary smoking outcome measure was self-reported smoking status at 7 months post-recruitment. Participants were categorized as smokers or nonsmokers based on their response to the survey item: “Did you smoke at all over the past 8 weeks?”

Lifetime mental health diagnoses—Mental health status was self-reported at baseline. Participants were asked: “Have you ever been diagnosed with or treated for any of the following by a medical or psychological professional?” Response options included alcohol abuse, anxiety disorder, attention deficit disorder (ADD), bipolar disorder, depression, drug abuse, panic disorder, post-traumatic stress disorder (PTSD), and schizophrenia. LMI diagnoses were categorized for this analysis by the number of diagnoses a participant had (0, 1, or 2 or more).

Nicotine dependence—Participants’ level of nicotine dependence was based on their responses to 2 survey items at baseline: “Sometimes I feel like cigarettes rule my life” (continuous variable, scale from 1 to 7) and “About how many cigarettes do you now smoke each day?” (continuous variable).

Quit smoking aids—Participants were randomly assigned to the website, brochure, emails, telephone counseling, and nicotine lozenges conditions. Participants were not restricted from using other non-intervention smoking cessation resources. To assess the use of other resources, at month 7, participants were asked: “Which of the following methods have you used to help you to try to quit using tobacco over the past 12 weeks?” For this analysis, responses for self-reported use of other non-intervention smoking cessation resources were collapsed to “NRT use” (including nicotine gum, nicotine patch, nicotine nasal spray, nicotine inhaler, nicotine lozenge, but excluding the lozenge intervention condition), “prescription medication” (including Zyban/bupropion and Chantix/varenicline), and “state quitlines.”

Mood—Participants’ mood was characterized using an adaptation of the Positive and Negative Affect Schedule (PANAS), focusing on the positive affect score. The score was based on the mean responses to the following Likert scale questions at baseline: “Felt strong in the past 24 hours,” “Felt enthusiastic in the past 24 hours,” and “Felt determined in the past 24 hours.” Possible responses ranged from “1 - Very slightly or not at all” to “5 - Extremely.”

Statistical Analysis

Three separate analyses were conducted to determine the effect of LMI on reported abstinence at 7 months. Chi-square tests and analysis of variance were used to test for differences in demographic characteristics across the intervention conditions and the number of self-reported LMI diagnoses. Analyses were conducted using IBM SPSS 21 and data from baseline and from the 7-month follow-up time point. Participants with missing data were excluded from the analysis and accounted for less than 5% of the total participants.

Covariates for each of the 3 adjusted models described below included: intervention condition (“on” or “off” condition for each of the 5 interventions: (1) website, (2) phone counseling, (3) emails, (4) lozenges, and (5) brochure; use of NRT (excluding the intervention lozenges); use of a quitline (excluding the intervention phone counseling); use of prescription medications, measures of nicotine dependence (“cigarettes rule my life” and average cigarettes per day); and positive affect score. Additional demographic variables also were included: age, employment status, race, sex, and marital status. These covariates were included based on statistically significant correlations with abstinence and LMI, and because previous literature had identified these factors as important predictors of cessation. Additional potential covariates were excluded based on correlations failing to reach significance with abstinence or LMI. Within all analyses, interactions between interventions and between intervention and other cessation tools were examined, odds ratios (OR) were analyzed, and each multivariate logistic regression model was built using a backwards stepwise method.

Analysis 1 assessed the effect of the number of LMI diagnoses on reported abstinence at 7 months compared to no LMI diagnoses. An OR and its 95% confidence interval were determined.

Analysis 2 assessed the effects of a depression diagnosis on reported abstinence at 7 months among participants with 2 or more LMI diagnoses. Depression diagnosis was added as a covariate. An OR for depression effects and 95% confidence interval were determined for individuals who quit compared to those who did not.

Analysis 3 assessed if there was variation in cessation outcomes at 7-month follow-up based on intervention assignment in the parent study and on use of cessation aids by participants who reported a lifetime depression diagnosis and quit smoking compared to those who did not quit. An OR of cessation techniques’ effects on cessation and 95% confidence intervals were determined.

RESULTS

Sample Characteristics

Lifetime mental illness and abstinence at 7 months—Table 1 provides an overview of the study sample characteristics (N = 1034). Over half of the participants in this study reported an LMI diagnosis (maximum number of diagnoses was 7). In the sample, 22.5% (N = 233) had one diagnosis, and 31.8% (N = 329) had 2 or more diagnoses. Of those with 2 or more diagnoses, 102 participants had 3 diagnoses, 36 had 4 diagnoses, 21 had 5 diagnoses, 6 had 6 diagnoses, and 5 participants had all 7 LMI diagnoses (0.5% of sample). Individual LMI diagnoses were, in general, highly correlated with one another, implicating possible co-occurrence, with the exceptions of ADD and schizophrenia, ADD and panic disorders, ADD and alcohol abuse, schizophrenia and anxiety disorders, and panic disorders and drug abuse. Depression was the most common LMI diagnosis: 75.0% (N = 424) of people with LMI were diagnosed with depression (Figure 1). In people with more than one diagnosis, depression or anxiety was the most common comorbid diagnosis. Twenty-eight percent of all study participants (N = 290) reported abstinence at 7 months. People with no LMI were

more likely to report abstinence at 7 months (31.4%) than people with one or more LMI diagnoses (one LMI, 24.9%; 2 or more, 25.5%), although these differences were not statistically significant.

Demographics—Table 1 also provides the chi-square and ANOVA correlations between the number of LMI diagnoses and demographic variables. Statistically significant associations were found for employment status, race, sex, marital status, and positive affect. Mean age was not significantly different between LMI groups (total mean, 39.3 years; SD = 12.3), and participants were evenly distributed across all age groups. There were no statistically significant differences in intervention condition assignment across any of the demographic variables.

Logistic Regression Analyses

Table 2 shows the findings from the 3 multivariate logistic regression analyses.

Analysis 1 (full sample, N = 987)—After we controlled for demographic variables, nicotine dependence, and treatment conditions, people with 2 or more LMIs were significantly less likely to have quit smoking at 7 months than people with no LMI (OR = 0.69; 95% CI = 0.49, 0.98). A similar trend was seen among people with one LMI when compared to those with no LMI, and the relationship approached statistical significance (OR = 0.74; 95% CI = 0.51, 1.06).

Regardless of LMI status or assigned intervention condition, people who reported using NRT at any time in the past 7 months were more likely to have quit than people who did not use NRT (OR = 1.72; 95% CI = 1.30, 2.30). However, no statistically significant differences were found for the effect of treatment condition on cessation, including receiving a 2-week supply of NRT lozenges. One intervention condition, receiving motivational emails, had the opposite reaction and reduced the odds of quitting (OR = 0.69; 95% CI = 0.52, 0.92). We found employment status to be a near significant predictor of abstinence at 7 months – individuals who were out of work or unable to work were more likely to report abstinence (OR = 1.34; 95% CI = 0.99, 1.81, and OR = 1.50; 95% CI = 0.93, 2.42, respectively). The self-reported feeling of “cigarettes rule my life” was also found to be a near significant predictor – the higher respondents scored, the lower their abstinence (OR = 0.93; 95% CI = 0.86, 1.01).

Analysis 2 (2 or more LMI diagnoses, N = 320)—The second analysis was restricted to the sample with 2 or more LMI diagnoses. For this analysis, the variable distinguishing multiple LMIs was not included due to covariance. People with a comorbid depression history were significantly less likely to have quit smoking at 7 months than people with comorbid diagnoses other than depression (OR = 0.34; 95% CI = 0.16, 0.75) (Table 2). Individuals who reported a history of depression were less likely to have quit smoking at 7 months (OR = 0.71; 95% CI = 0.53, 0.972, data not shown) than those without a history of depression. Receiving motivational emails was associated with significantly decreased cessation at 7 months (OR = 0.42; 95% CI = 0.24, 0.73). The differential use of other treatment conditions was not statistically significant. Higher cigarette dependence as

determined by the “cigarettes rule my life” score was associated with lower rates of reported abstinence at 7 months (OR = 0.85; 95% CI = 0.73, 0.99).

The analysis also detected an interaction between self-reported use of phone counseling and NRT. Regardless of intervention assignment, people who had used phone counseling and NRT in the past 7 months showed a near significant ($p = .057$) trend in doubling quit rates compared to those who used neither (OR = 2.08; 95% CI = 0.98, 4.41).

Additional analyses were conducted using each of the comorbid conditions where sample sizes were large enough. The only statistically significant findings were for depression. Data for all other analyses are not shown.

Analysis 3 (depression diagnosis, N = 404)—The sample for the third analysis was restricted to people who had been diagnosed with depression at some point in their lifetime. NRT use, regardless of assigned condition, was the only factor in the model that was significantly associated with the increased likelihood of quitting (OR = 2.38; 95% CI = 1.49, 3.80). Near significant relationships also were found between reduced quit rates and higher cigarette dependence (OR = 0.89; 95% CI = 0.78, 1.02; $p = .08$), and between reduced quit rates and having comorbid diagnoses (OR = 0.65; 95% CI = 0.40, 1.05; $p = .08$). None of the assigned intervention conditions showed a statistically significant differential effect on cessation.

DISCUSSION

In this study, we did not recruit participants who had LMI diagnoses, nor did we exclude participants who had multiple LMIs. Despite this, more than half of the smokers in this sample had one or more self-reported LMI diagnoses. Rates of lifetime depression were similar to the high rates of current depression seen in patients seeking smoking cessation treatment,^{24,26} and were consistent with previous findings that individuals with AMI have higher rates of smoking,^{1,3,7} are interested in quitting,^{10–12,14} and use the Internet to search for health information to help them quit.⁴⁵

One of the statistically significant findings from this study is that 31.8% of the sample had a history of 2 or more mental illness diagnoses and were less likely to quit than participants with no mental illnesses. A similar, yet non-statistically significant trend in likelihood of quitting was seen for those with only one LMI when compared to those with no LMI. Previous research shows mixed results for cessation rates in samples with high rates of mental illness; however, many of these studies do find that cessation rates among people with AMI are lower than for those without AMI.^{10,46} This analysis suggests that smokers with multiple LMI diagnoses may be particularly at risk for continued smoking after a quit attempt. People with multiple LMIs may have unique needs regarding cessation that require additional support.

Our research explores a gap in the literature by assessing the impact on cessation of a lifetime diagnosis of 2 or more comorbid mental illnesses in addition to a single lifetime mental illness diagnosis. Limited data are available from national public health surveys regarding the type or number of mental illnesses, and many research studies collapse mental

health variables into the presence of any diagnosis. Additionally, previous cessation research often has excluded people with AMI. Even in cessation studies that include people with AMI, individuals with 2 or more comorbid mental illnesses are often excluded or the variable is collapsed. Not accounting for the impact and type of multiple mental illnesses may provide a partial explanation as to why researchers reach contradictory conclusions about whether AMI negatively impacts cessation rates. A more nuanced assessment about the possible effects of the number and type of AMI diagnoses is needed.

When the study sample was restricted to individuals with a history of 2 or more LMIs, those with a comorbid diagnosis of depression had lower rates of successful cessation at 7 months than those with a comorbid LMI other than depression. Previous studies have reported on the negative impact of depression on smoking cessation. The current study extends these findings and looks at depression in the context of 2 or more LMIs. Our results indicate that depression in combination with other LMI diagnoses predicts poorer smoking abstinence rates, as some previous research shows.^{19,22,33,36,40,41} Our analyses were unable to determine differential participant characteristics that in conjunction with a depression diagnosis may have affected who was able to quit. Future research should attempt to determine if there is something innately different about those who are able to quit smoking. The effects of a lifetime diagnosis of depression coupled with other LMIs may be distinct from the effects of other mental illnesses. Further research is needed to understand the relationships between depression multiple diagnoses, and smoking cessation.

In this study, we could not distinguish between current mental illness episodes and historic episodes, which may impact the results of these analyses. Additionally, no data were available for the onset or duration of mental illness. The variability in severity and duration of mental illnesses makes the classification of LMI difficult to interpret. In the case of depression, literature suggests that the severity of active depression can affect cessation outcomes negatively.^{40,41} Given that our sample likely included individuals with active depression, as well as those with a lifetime history of depression that was not currently active, our findings may underestimate the true impact of current depression. Nevertheless, a lifetime diagnosis of depression was still shown to have statistically significant negative impacts on participants' ability to quit. Similarly, other studies find that a diagnosis of lifetime depression can affect the current quality of life even in the absence of current mental illness.⁴⁸ The current study's finding of a significant relationship between smoking cessation and lifetime depression diagnosis in conjunction with another mental illness highlights the need for further research on this topic.

The literature also shows that current depression and comorbid mental illness have a strong relationship with nicotine dependence.^{47,49,50} Whereas the finding using LMI did not reach statistical significance in our sample, a continuous, inverse relationship existed between nicotine dependence (constructed using the variable "cigarettes rule my life") and cessation: Increased nicotine dependence resulted in decreased cessation rates among those with 2 or more LMIs (15% cessation decrease) and among those with depression (11% cessation decrease) as compared with the entire sample (7% cessation decrease). It is possible that inability to reach statistical significance is related to use of lifetime mental illness instead of current mental illness.

Clinical treatment guidelines for cessation among smokers with depression suggest using psychotherapy and pharmacotherapy.⁵¹ Comparisons of individuals who used this combination versus those who did not use it were not statistically significant predictors of cessation at 7 months, which could be attributable to participants' low engagement in the assigned phone counseling and NRT treatment conditions (discussed in detail in Fraser et al⁴⁴). This area warrants further exploration.

When the relative utility of various types of cessation treatment was examined in a secondary analysis, self-reported NRT use was found to be the strongest predictor of cessation at 7 months, regardless of LMI status. Interestingly, although the self-reported use of NRT was associated with cessation in all analyses, being assigned to the NRT treatment condition was not associated with cessation. This may be due to the similar pattern of NRT use for those who were assigned NRT (39.6% reported using NRT when assigned to the lozenge intervention) versus those not assigned to the NRT condition (42.5% of those not assigned to the lozenge intervention reported using NRT). Among people diagnosed with depression, the only difference seen in cessation treatments was for those who used NRT compared to those who did not use NRT. The finding that NRT may be of particular use to people with depression is consistent with the literature.¹⁹

Limitations of this study include the reliance on self-report of smoking cessation and LMI diagnosis. This study may be affected by self-report bias, as it was not possible to confirm individual patients' smoking cessation or LMI diagnoses. The strength of future studies can be improved by confirming smoking cessation via biochemical verification and including questions from validated mental health screening tools within the baseline assessment. As with the existing body of smoking cessation literature using LMI diagnoses, this study could not distinguish between current episodes and historic episodes, which may impact the results of these analyses. Another limitation is that because the sample for the parent study was recruited from a smoking cessation website, the results may not extend to smokers in the general population. Finally, using a factorial design to look at the effects of individual interventions meant that small sample size and low participant engagement with the assigned interventions may have affected the power of this analysis to detect differences between groups.

A large percentage of individuals with LMI enrolled in the parent study via a publicly available smoking cessation website, suggesting that such sites should include information on mental illness and smoking. Although research indicates that cessation tools intended for the general population may be effective for smokers with AMI, such smokers likely have additional treatment needs. As Moock⁴⁵ suggests, using the Internet to provide support to people with AMI at any time or place allows health professionals to reach individuals who may be less likely to engage in treatment through conventional methods. Although our findings may not be generalizable, they support the potential for Internet-based resources as a means of engaging smokers with AMI in cessation treatment. Additional research should be conducted to improve understanding of the relationship between multiple mental illnesses and health-seeking behavior, and the potential of mobile health interventions to support cessation.

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Figure 1. Distribution of Mental Illness Diagnoses (N = 1034)

Note.

LMI = lifetime mental illness; ADD = attention deficit disorder; PTSD = post-traumatic stress disorder. “Two or more LMI diagnoses” is the number of individuals with that diagnosis who also had one or more co-occurring LMI diagnoses.

Table 1
Sample Characteristics and Chi-square/ANOVA Association with Number of Lifetime Mental Illnesses

	Mental Health				p-value	Total N (%)
	No LMI (N = 472) N (%)	1 LMI (N = 233) N (%)	2+ LMI (N = 329) N (%)			
Total	472 (45.6)	233 (22.5)	329 (31.8)			1034 (100)
Cessation at 7 Months					.09	
Quit Status						
Yes	148 (31.4)	58 (24.9)	84 (25.5)			290 (28)
No	324 (68.6)	175 (75.1)	245 (74.5)			744 (72)
Age					.70	
<30	131 (27.8)	57 (24.5)	88 (26.7)			276 (27)
30–39	126 (26.7)	60 (25.8)	93 (28.3)			279 (27)
40–49	94 (19.9)	56 (24.0)	76 (23.1)			226 (22)
50	121 (25.6)	60 (25.8)	72 (21.9)			253 (24)
Employment Status					< .001	
Employed	262 (55.3)	125 (53.6)	121 (36.8) ^c			507 (49)
Out of Work	193 (40.9)	83 (35.6)	131 (39.8)			407 (39)
Unable to Work	18 (3.8) ^d	25 (10.7) ^d	77 (23.4) ^d			120 (12)
Demographics					.05	
Race						
White	387 (83.8)	199 (86.1)	291 (89.8) ^e			877 (86)
Non-white	75 (16.2)	32 (13.9)	33 (10.2) ^e			140 (14)
Sex					.002	
Female	298 (63.1)	158 (67.8)	247 (75.1) ^e			703 (68)
Male	174 (36.9)	75 (32.2)	82 (24.9) ^e			331 (32)
Marital Status					< .001	
Never Married	99 (21.2)	61 (26.2)	97 (29.7) ^e			257 (25)
Married/Domestic	260 (55.7)	93 (39.9) ^f	124 (37.9) ^f			477 (46)
Sep/Div/Wid	108 (23.1)	79 (33.9) ^f	106 (32.4) ^f			293 (29)

		Mental Health				
Self-reported Treatment Use		No LMI (N = 472)	1 LMI (N = 233)	2+ LMI (N = 329)	p-value	Total
		N (%)	N (%)	N (%)		N (%)
	Total	472 (45.6)	233 (22.5)	329 (31.8)		1034 (100)
NRT Use (Excluding Lozenges)						
	Yes	180 (38.1)	94 (40.3)	151 (45.9)	.09	425 (41)
	No	292 (61.9)	139 (59.7)	178 (54.1)		609 (59)
		Mean (SD)	Mean (SD)	Mean (SD)	ANOVA	Mean (SD)
Cigarettes rule my life (baseline) ^a						
		5.41 (1.79)	5.68 (1.63)	5.60 (1.73)	0.11	5.52 (1.74)
Positive Affect ^b						
		3.10 (1.00)	2.67 (1.04) ^f	2.75 (1.06) ^f	< .001	2.89 (1.04)

Note

^a : Scale: 1= not at true of me at all, 7=extremely true of me

^b : Composite Scale: 1=did not feel strong, determined, and/or enthusiastic in past 24 hours, 5=Felt strong, determined, and/or enthusiastic

^c : 2+ LMI is significantly different (p < .05) from 1 LMI and 0 LMI

^d : All 3 LMI variables are significantly different (p < .05)

^e : 2+ LMI is significantly different (p < .05) from 0 LMI. 1 LMI is not significantly different from 0 MI or 2+ LMI

^f : 1 LMI and 2+ LMI are significantly different (p < .05) from 0 MI, but not significantly different from each other

Table 2

Backwards Stepwise Logistic Regression Analyses: Predicting Cessation at 7 Months

Variables in the Equation	Analysis 1: Full Sample (N = 987) OR (95% CI)	Analysis 2: Individuals With 2+ LMI ^a (N = 320) OR (95% CI)	Analysis 3: Individuals Diagnosed With Depression (N = 404) OR (95% CI)
Number of Mental Illness Diagnoses			
No Mental Illness (ref)	1.00	n/a	n/a
One Mental Illness	0.74 (0.51, 1.06) ⁺	n/a	1.00
Two ⁺ Mental Illnesses	0.69 (0.49, 0.98)[*]	n/a	0.65 (0.40, 1.05) ⁺
Diagnosed or Treated for Depression			
No Depression (ref)	n/a	1.00	n/a
Depression	n/a	0.34 (0.16, 0.75)^{**}	n/a
Employment			
Employed (ref)	1.00	–	–
Out of Work	1.34 (0.99, 1.81) ⁺	–	–
Unable to Work	1.50 (0.93, 2.42) ⁺	–	–
Motivational Emails (Treatment Condition)			
No Motivational Emails (ref)	1.00	1.00	–
Motivational Emails	0.69 (0.52, 0.92)^{**}	0.42 (0.24, 0.73)^{**}	–
NRT Use in Past 7 Months			
No NRT (ref)	1.00	–	1.00
NRT Use	1.72 (1.30, 2.30)^{***}	–	2.38 (1.49, 3.80)^{***}
Sex			
Female (ref)	–	1.00	–
Male	–	0.58 (0.29, 1.15)	–
“Cigarettes rule my life”	0.93 (0.86, 1.01) ⁺	0.85 (0.73, 0.99)[*]	0.89 (0.78, 1.02) ⁺
Positive Affect	–	1.19 (0.92, 1.15)	–

Note.

Variable(s) entered for all models: Multiple mental illnesses, age, cigarettes per day, “cigarettes rule my life”, employment status, sex, marital status, medication use, positive mood, NRT use, race/ethnicity, intervention condition (phone counseling, booklet, motivational emails, lozenges, and website), and intervention condition interactions (ie, email and lozenges, website and phone counseling). Models included all treatment interactions, of which none were significant. In analysis 2 the phone counseling and NRT use neared significance (p = .057).

LMI = lifetime mental illness; OR = odds ratio; CI = confidence interval; NRT = nicotine replacement therapy; – = variable not significant in the model.

Bold values indicate p < .05. Indicated significance levels:

⁺ p .1,

^{*} p < .05,

^{**} p < .01,

^{***} p < .001.

^a: Analysis 2 did not include multiple LMIs as one of the covariates in the models because the sample for the model was restricted to people who had 2+ LMIs.