Associations Between Comorbid Health Conditions and Quit Outcomes Among Smokers Enrolled in a State Quitline, Arizona, 2011-2016

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Abstract

Objective: Smokers with comorbid health conditions have a disproportionate burden of tobacco-related death and disease. A better understanding of differences in quit rates among smokers with comorbid health conditions can guide tailoring of quitline services for subgroups. The objective of this study was to examine self-reported tobacco cessation rates among Arizona Smokers' Helpline callers with chronic health conditions (CHCs) and/or a mental health condition (MHC).

Methods: We analyzed data from quitline telephone callers (n = 39 779) who enrolled in and completed at least 1 behavioral counseling session (ie, coaching call). We categorized callers as CHC only (cardiovascular disease/respiratory-related/cancer; 32%), MHC only (eg, mood/anxiety/substance dependence; 13%), CHC + MHC (25%), or no comorbid condition (30%). We assessed 30-day abstinence at 7-month follow-up for 16 683 clients (41.9%). We used logistic regression analysis to test associations between comorbidity and quit outcomes after controlling for relevant variables (eg, nicotine dependence).

Results: Overall quit rates were 45.4% for those with no comorbid condition, 43.3% for those with a CHC only, 37.0% for those with an MHC only, and 33.3% for those with CHC + MHC. Compared with other groups, the CHC + MHC group had the lowest odds of quitting (adjusted odds ratio = 0.60; 95% confidence interval, 0.52-0.69).

Conclusion: Having a comorbid condition was associated with lower quit rates, and smokers with co-occurring CHCs and MHCs had the lowest quit rates. Quitlines should evaluate more intensive, evidence-driven, tailored services for smoking cessation among callers with comorbid conditions.

Keywords

smoking, tobacco cessation, health services, health promotion

Nicotine dependence is an addictive and chronic relapsing disorder. In a study of smokers from 2000-2015, more than half of cigarette smokers in the United States reported quitting for at least 24 hours,[1] but few remained smoke-free for more than 6 months, according to a 2008 study.[2] A study in 2016 showed that an average smoker attempts to quit at least 30 times before successfully quitting for 1 year or longer.[3] Smoking continues to be the leading preventable cause of death and disease in the United States[4] because of the number of co-occurring health conditions that are associated with smoking. Most smokers have at least 1 co-occurring chronic health condition (CHC), and smoking is an independent and modifiable risk factor for diabetes, hypertension, chronic obstructive pulmonary disease (COPD), and several cardiovascular diseases.[5] Smoking prevalence is also high among those with a mental health condition (MHC),[6] and smokers with an MHC have lower quit rates than smokers without an MHC.[7] Although rates of smoking have declined since 2009

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among the general population,[4] smokers with such comorbid health conditions continue to have challenges to successful cessation.[8,9]

Tobacco cessation quitlines are a pragmatic and cost-efficient strategy to deliver evidence-based cessation interventions. Compared with in-person behavioral counseling, the remote nature of quitline services eliminates barriers to access to care among economically disadvantaged, rural, and other traditionally hard-to-reach groups of smokers.[10,11] Quitlines offer various cessation services, ranging from a single brief counseling session to multiple proactive counseling telephone calls that integrate pharmacotherapy with cessation coaching. Callers receive training in problem solving, urge management, and coping skills and program support from paraprofessionals, thus blending elements of evidence-based strategies of behavior change (eg, motivational interviewing, cognitive behavioral therapy). Strong evidence supports the effectiveness of such telephone-based tobacco cessation counseling. A systematic review in 2013 found that smokers who received multiple proactive quitline counseling sessions were 40% more likely to quit successfully than people who received lesser assistance (eg, self-help materials, single telephone call).[11]

Although quitlines are an effective way to promote a smoking behavior change, interest in examining the impact of quitlines on smoking outcomes among smokers with an existing comorbid health condition (ie, a CHC and/or an MHC) is increasing. A study examining the prevalence of CHCs among quitline callers found evidence of poor tobacco cessation outcomes in smokers with asthma, COPD or emphysema, coronary artery disease, or diabetes.[12] Another study in 2015 showed that callers using quitline services not only had higher-than-average prevalence rates of MHCs, but those with an MHC were also less likely to quit at follow-up than those without an MHC.[13] Although evidence of co-occurrence of smoking and CHCs and MHCs exists,[14] few studies have examined the impact of such co-occurrence on cessation outcomes among smokers who access quitline services.

The objective of this study was to extend the current knowledge of the associations between comorbid conditions and cessation outcomes among smokers enrolled in a state quitline, the Arizona Smokers' Helpline (ASHLine). Identifying any differentiating associations between smoking outcomes in callers who reported a CHC, an MHC, or a combination thereof may provide valuable information to quitlines and enhance public health efforts to reach this high-risk group, identify barriers to quitting, and improve service delivery.

Methods

We collected data from clients who enrolled in ASHLine and completed at least 1 coaching call from January 2011 through April 2016 (n = 39 779) (ASHLine, unpublished data, 2011-2016). Trained survey staff members conducted all assessments using standardized protocols. Client information collected at the time of program enrollment included data on demographic characteristics, tobacco use history, and self-reported comorbid conditions. We collected data on quit outcomes via telephone interviews at the 7-month follow-up—a standard practice among quitlines. Following North American Quitline Consortium guidelines,[15] we based quit rates on the responder rate (ie, the number of clients who reported quitting divided by the number of follow-up survey respondents). Because the study used deidentified client data, the University of Arizona's institutional review board deemed the study exempt.

The ASHLine Protocol

ASHLine is a state-funded quitline that supports tobacco cessation for all smokers in Arizona (http://www.ashline.org). Callers either proactively contact the ASHLine or are referred to the program by their health care providers. Once enrolled, an assigned tobacco cessation coach calls the client to initiate the behavior change process. Coaches use motivational interviewing and evidence-based cognitive behavioral strategies to provide up to 3 months of telephone counseling. Motivational interviewing focuses on exploring and resolving ambivalence about smoking behavior change and centers on motivational processes in the individual that can facilitate behavior change. Cognitive behavioral strategies involve the use of techniques such as self-regulation and working collaboratively with clients to identify triggers to smoking and develop alternate healthy coping strategies to manage urges to smoke (use of stimulus and urge control strategies). Clients are provided with tips for quitting smoking, strategies to prepare for a quit day while in the program, and techniques to prevent relapse. In addition to coaching, ASHLine provides up to 4 weeks of free nicotine replacement therapy in the form of patches, gum, or lozenges to those interested and eligible to use nicotine replacement therapy. To qualify for free nicotine replacement therapy, clients must not be pregnant or breastfeeding at the time of enrollment, must not have a history of a heart condition, and must be non-Medicaid beneficiaries. Medicaid clients are encouraged and navigated to obtain nicotine replacement therapy from their primary care providers. Clients who reported any of the aforementioned disqualifying health concerns were required to obtain a physician's approval for ASHLine to provide nicotine replacement therapy.

Measures

Primary outcome. We determined quit status at the 7-month follow-up assessment. Clients reporting not using tobacco in the past 30 days were defined as having quit.

Independent variable. Clients self-reported comorbid conditions at enrollment. CHCs included treatment for any of the following conditions: asthma, COPD, diabetes, heart disease, hypertension, or cancer. We measured the presence of an

MHC by using a single question: "Are you currently diag-nosed with mental health or emotional challenges such as anxiety disorder, bipolar disorder, alcohol/drug abuse, or schizophrenia?" To those who answered yes, we further asked if they were in treatment for these conditions. We categorized clients as having a CHC only, an MHC only, at least 1 CHC and an MHC (ie, any 1 of the CHCs and an MHC), or no comorbid condition (ie, callers who did not report having any of the aforementioned CHCs or MHCs).

Controlling variables. The covariates we included in the model were based on scientific literature. Demographic characteristics were client age (continuous variable; range, 14-106), sex (female or male), race (nonwhite or white), ethnicity (non-Hispanic or Hispanic), education (≤high school diploma or >high school diploma), and insurance status (insured, uninsured, or underinsured). We measured nicotine dependence using the Fagerström Test of Nicotine Dependence (scored on a scale from 1-10 in which 0-4 = low, 5 = moderate, and 6-10 = high nicotine dependence).[16] Program use variables included use of nicotine replacement therapy in the program (self-reported at follow-up) and number of coaching calls completed in the program (dichotomized at ≥5).[17]

Statistical Analysis

We used Pearson χ^2 tests and analyses of variance to test differences in baseline characteristics across the categories of CHCs and MHCs. We used unadjusted and adjusted logistic regression models to estimate odds ratios (ORs) and 95% confidence intervals (CIs) of smoking cessation at 7-month follow-up by comorbid conditions, compared with clients who had no comorbid conditions. Adjusted models included the variables listed previously.

Because of the high dropout rate that is common after quitline enrollment (and before the first coaching call), we conducted sensitivity analyses using multiple imputation with chained equations.[18] The imputation model used all variables that were included in the primary analysis, as well as other variables associated with the outcome, dropout, or both: age, nicotine dependence, sex, race, ethnicity, education, social support (poor/fair vs good/very good/excellent), referral type (self or other), underinsured or no insurance, nicotine replacement therapy use (yes or no), age started tobacco, and chronic disease category, as defined previously. We created, analyzed, and combined 25 complete data sets.

To further investigate the effects of multiple co-occurring CHCs and MHCs on quitting, we conducted exploratory analyses by recategorizing our sample into no comorbid condition, only 1 CHC, multiple CHCs (but no MHC), 1 MHC only, 1 CHC + 1 MHC, and multiple CHCs + 1 MHC. We hypothesized that this ordering would correspond to decreasing odds for 30-day cessation. Adjusted logistic regression models similar to those described previously were fit.

We analyzed data using SAS version 9.4.[19] All tests were 2-sided, and we considered $P < .05$ to be significant.

Results

Of the 39 779 quitline participants, most were white (n = 29 033, 72.9%), were non-Hispanic (n = 33 287, 83.6%), and had low or moderate scores for nicotine dependence (median score = 5) (Table 1). A total of 27 932 (70.2%) clients reported having at least 1 CHC or an MHC, 12 868 (32.3%) had a CHC only, 5124 (12.9%) had an MHC only, and 9940 (25.0%) had an MHC and a CHC. We found significant differences across nearly all baseline characteristics. In general, the group with no comorbid conditions was younger, had lower scores for nicotine dependence, smoked less, and was more likely to be male, nonwhite, Hispanic, and less educated than the groups with a CHC and/or an MHC. The CHC + MHC group had higher rates of COPD, asthma, and hypertension than the CHC-only group.

At 7-month follow-up, we assessed 16 683 (41.9%) clients; clients completed an average of 3 coaching calls while in the program, and most clients reported using nicotine replacement therapy (Table 2). At follow-up, the 30-day tobacco cessation rates were 45.4% for those with no comorbid condition, 43.3% for those with 1 CHC, 37.0% for those with any MHC, and 33.3% for those with a CHC + MHC. Clients with no comorbid condition had higher odds of being abstinent at 7 months than clients with a CHC or an MHC in both unadjusted and adjusted models (Table 2). The adjusted odds of having quit at follow-up, compared with the no comorbid condition group, were the lowest for the CHC + MHC group (adjusted OR [aOR] = 0.60; 95% CI, 0.52-0.69), followed by the MHC-only group (aOR = 0.70; 95% CI, 0.60-0.82), and the CHC-only group (aOR = 0.86; 95% CI, 0.76-0.98). Odds ratios were similar between unadjusted and adjusted models, except for the CHC group, where the aOR was further from the null than the OR. Results from the sensitivity analysis were similar, although these ORs were slightly closer to the null value than the aORs.

Results were similar in our exploratory analyses. Compared with the no comorbid condition group, the odds of quitting were similar for clients with 1 CHC (aOR = 0.87; 95% CI, 0.75-0.99) or multiple CHCs (but no MHC) (aOR = 0.85; 95% CI, 0.73-0.99). However, clients who had an MHC had lower odds of quitting than clients in the no comorbid condition group: clients with an MHC (aOR = 0.70; 95% CI, 0.59-0.82), clients with an MHC and 1 CHC (aOR = 0.67; 95% CI, 0.56-0.79), and clients with an MHC and multiple CHCs (aOR = 0.54; 95% CI, 0.45-0.63).

Discussion

Nicotine dependence is an addictive disorder, and even with available treatments, long-term abstinence rates rarely exceed 35%.[2] The ongoing use of tobacco may contribute to a high prevalence of tobacco-related chronic and health conditions. In our sample, more than 70% of clients reported having at least 1 comorbid condition. Consistent with previous research, smokers with a CHC or MHC were less likely

Table 1. Baseline characteristics of clients enrolled in the Arizona Smokers' Helpline, by presence or absence of chronic or mental health conditions, 2011-2016[a]

Characteristics	Total (n = 39 779)	No Comorbid Condition[b] (n = 11 847)	CHC[b] Only (n = 12 868)	MHC[c] Only (n = 5124)	CHC[b] + MHC[c] (n = 9940)	P Value[d]
Age, mean (SD), y	50.0 (14.1)	45.2 (13.6)	55.9 (13.4)	43.3 (13.0)	51.5 (12.5)	<.001
Fagerström score, mean (SD)[e]	4.7 (2.3)	4.5 (2.3)	4.6 (2.3)	4.9 (2.3)	5.2 (2.2)	<.001
Cigarettes per day, mean (SD)	17.4 (10.6)	16.7 (9.3)	17.5 (10.3)	16.9 (10.1)	18.3 (12.6)	<.001
Sex						<.001
Male	17 188 (43.5)	6103 (51.9)	6116 (47.9)	1886 (37.0)	3083 (31.2)	
Female	22 329 (56.5)	5648 (48.1)	6664 (52.1)	3213 (63.0)	6804 (68.8)	
Race						<.001
White	29 033 (73.0)	8218 (69.4)	9324 (27.5)	3890 (75.9)	7601 (76.5)	
Nonwhite	10 746 (27.0)	3629 (30.6)	3544 (27.5)	1234 (24.1)	2339 (23.5)	
Ethnicity						<.001
Hispanic	6492 (20.1)	2505 (25.1)	1919 (18.3)	819 (19.9)	1249 (16.2)	
Non-Hispanic	25 855 (79.9)	7483 (74.9)	8596 (81.8)	3291 (80.1)	6485 (83.8)	
Education						<.001
≤High school diploma	17 753 (45.8)	5427 (47.2)	5863 (46.9)	2136 (42.6)	4327 (44.5)	
>High school diploma	20 984 (54.2)	6066 (52.8)	6639 (53.1)	2882 (57.4)	5397 (55.5)	
Insurance						<.001
Insured	18 412 (53.0)	5663 (55.3)	6592 (58.5)	2126 (47.7)	4031 (46.0)	
Uninsured or underinsured	16 312 (47.0)	4575 (44.7)	4673 (41.5)	2331 (52.3)	4733 (54.0)	
Type of CHC						
Cancer	3179 (14.2)	—	1812 (14.3)	—	1367 (14.0)	.59
COPD	6327 (28.2)	—	3199 (25.2)	—	3128 (32.1)	<.001
Heart disease	3901 (17.4)	—	2228 (17.5)	—	1673 (17.1)	.40
Asthma	7783 (34.4)	—	3642 (28.5)	—	4141 (42.0)	<.001
Diabetes	5493 (24.4)	—	3045 (23.9)	—	2448 (24.9)	.07
Hypertension	12 831 (56.7)	—	7385 (57.8)	—	5446 (55.3)	<.001
Had ≥1 CHC[b]	12 444 (46.9)	—	6427 (43.2)	—	6017 (51.5)	<.001

Abbreviations: CHC, chronic health condition; COPD, chronic obstructive pulmonary disease; MHC, mental health condition.
[a]Data source: Arizona Smokers' Helpline (unpublished data). All values are number (percentage), unless otherwise indicated. Not all participants answered all questions, so numbers in each category may not sum to number in the column header. Percentages are based on the number of participants who answered the question. Missing baseline data ranged from 0%-5%.
[b]CHCs were asthma, COPD, diabetes, heart disease, hypertension, or cancer.
[c]MHCs were anxiety disorder, depression, bipolar disorder, substance use, or schizophrenia.
[d]P values were determined by analyses of variance. P < .05 was considered significant.
[e]Fagerström Test of Nicotine Dependence.[16] Scores ranged from 0-10 (0-4 = low nicotine dependence, 5 = moderate nicotine dependence, and 6-10 = high nicotine dependence).

Table 2. Assessment of program use among clients at 7-month follow-up, Arizona Smokers' Helpline, by presence or absence of chronic and mental health conditions, 2011-2016[a]

Program Use	Total	No Comorbid Condition	CHC[b] Only	MHC[c] Only	CHC[b] + MHC[c]	P Value[d]
Participated in baseline	39 779	11 847	12 868	5124	9940	
Participated in 7-month follow-up[e]	16 683 (41.9)	4709 (39.8)	5731 (44.5)	2003 (39.1)	4240 (42.7)	<.001
Tobacco cessation medication	13 058 (78.3)	3714 (78.9)	4463 (77.9)	1552 (77.5)	3329 (78.5)	<.001
Used	9940 (76.1)	3006 (80.9)	3435 (77.0)	1141 (73.5)	2358 (70.8)	
Did not use	3118 (23.9)	708 (19.1)	1028 (23.0)	411 (26.5)	971 (29.2)	
No. of coaching calls completed, mean (SD)	3.9 (3.5)	3.5 (3.1)	4.0 (3.5)	3.7 (3.4)	4.2 (4.0)	<.001

Abbreviations: CHC, chronic health condition; MHC, mental health condition.
[a]Data source: Arizona Smokers' Helpline (unpublished data). All values are number (percentage), unless otherwise indicated. Percentages were based on the number of participants who answered the question at follow-up.
[b]CHCs were asthma, chronic obstructive pulmonary disease, diabetes, heart disease, hypertension, or cancer.
[c]MHCs were anxiety disorder, depression, bipolar disorder, substance use, or schizophrenia.
[d]P values were determined by using Pearson χ^2 tests and analyses of variance. P < .05 was considered significant.
[e]Percentages for medication use were based on the number of participants with 7-month follow-up data who answered the question. Missing medication rates ranged from 21.1%-22.5%.

Table 3. Association between comorbid health conditions and 30-day quit outcomes of clients enrolled in the Arizona Smokers' Helpline, 2011-2016[a]

Group	Quit Rate, % (95% CI)	OR (95% CI)	Adjusted OR (95% CI)[b]	Sensitivity, OR (95% CI)[c]
No comorbid condition[d]	45.4 (44.0-46.9)	1 [Reference]	1 [Reference]	1 [Reference]
CHC[d] only	43.3 (42.0-44.6)	0.92 (0.85-0.99)	0.86 (0.76-0.98)	0.92 (0.84-1.00)
MHC[e] only	37.0 (34.9-39.2)	0.72 (0.64-0.79)	0.70 (0.60-0.82)	0.77 (0.69-0.86)
CHC[d] + MHC[e]	33.3 (32.0-34.8)	0.60 (0.55-0.66)	0.60 (0.52-0.69)	0.67 (0.62-0.73)

Abbreviations: CHC, chronic health condition; MHC, mental health condition; OR, odds ratio.
[a]Data source: Arizona Smokers' Helpline (unpublished data).
[b]Adjusted for age, Fagerström score, sex, race, ethnicity, insurance status, cessation medication use, and coaching calls ($\geq$5).
[c]Multiple imputation, combined results of 25 imputed data sets.
[d]CHCs were asthma, chronic obstructive pulmonary disease, diabetes, heart disease, hypertension, or cancer.
[e]MHCs were anxiety disorder, depression, bipolar disorder, substance use, or schizophrenia.

to quit than those who had no co-occurring conditions.[12,20-22] Moreover, the odds of quitting were significantly lower for those reporting a CHC and an MHC (aOR = 0.60) than for those reporting no comorbid condition. Individuals with an MHC often report having a CHC and vice versa.[23] In our population, 65% of those with an MHC also reported having a CHC. The results of our exploratory analysis further suggest that having an MHC with a CHC may be an additive barrier to cessation, which in turn can disproportionately increase the risk of smoking-related illness and death. Although the pathways associated with comorbidity of CHCs and MHCs are complex and bidirectional,[24] clients who have both CHCs and MHCs have a greater burden of symptoms, increased functional impairment, poorer health consequences, and lower smoking cessation outcomes compared with those who do not have an existing health condition.[25-27]

Although CHCs and MHCs co-occur in smokers, few services address the needs of this high-risk population. Despite evidence that tobacco cessation can improve mental health,[28] smokers with MHCs face unique barriers to quitting, which is partly attributed to provider beliefs, attitudes, and misperceptions about quitting among people with MHCs (eg, interference with sobriety, inability to quit).[29] Additionally, cessation medication use differed across the groups, with 76.1% of the group with no comorbid conditions reporting using cessation medication compared with 70.8% in the CHC + MHC group, suggesting that use of medication may be a potential barrier to successful abstinence. Based on our findings, a priority area for quitlines is to identify barriers to and facilitators for tobacco cessation medication uptake and adherence and implement tailored protocols to meet client needs. Although not definitive, such protocols could include increasing the number of counseling sessions, allowing a longer duration of nicotine replacement therapy, using cessation medications that also target mood (eg, bupropion), and adjusting psychiatric medications during and after smoking cessation.[7,30] Moreover, although quitline staff members are not generally licensed to provide mental health treatments, they can be trained on appropriate procedures for referral to mental health care providers, who in turn can evaluate the individual's need for prescription medications.

Another strategy to optimize smoking behavior change outcomes among smokers with comorbid conditions is through provider referral. Most smokers visit a health care provider each year, and physician advice is associated with smokers' intentions to quit. Thus, health care providers are uniquely positioned to connect tobacco users with evidence-based treatment services (ie, quitlines). Increasing evidence supports the effectiveness of such brief physician advice in motivating tobacco users to quit.[10,31-33] However, health care professionals may be missing opportunities to refer smokers to evidence-based cessation services. In our sample, provider referral rates for the callers with any health condition (CHC and/or MHC) ranged from 22%-27%, indicating a missed opportunity to capitalize on teachable moments. Quitlines are well positioned to work with health care providers who serve smokers with comorbid conditions by providing technical assistance and consultation for systems change, offering education to promote provider interventions, and implementing systems to identify and document the tobacco status of all patients.

Finally, smoking is a multifaceted, complex, chronic relapsing disorder that requires multiple modes of intervention and population-level strategies to optimize cessation success. Apart from changes in health systems, other multipronged integrated tobacco cessation interventions could focus on social factors (ie, changing norms about quitting smoking among high-risk populations) and individual-level changes (ie, specialized behavioral support to address key barriers and provide additional support to promote smoking behavior change). Although implementing such integrated strategies can be complex, understanding the multidimensional nature of smoking cessation in people with comorbid conditions is a first step to developing and implementing comprehensive interventions that may improve cessation rates for these high-risk clients.

Strengths and Limitations

This study had several strengths. First, the study expanded the knowledge of tobacco cessation among smokers with CHCs and/or MHCs using a large sample of quitline clients. Second, all clients had access to the program-based protocols for engagement in tobacco cessation services. Finally, a

rigorous sensitivity analysis included all clients enrolled in the program, thereby increasing the generalizability of the results to smokers who use quitline services.

The study also had several limitations. First, to reduce client burden, we used a single-item question to assess the treatment of anxiety disorders, depression, bipolar disorder, substance use, and/or schizophrenia. Thus, we were not able to examine how having multiple MHCs would influence cessation outcomes. Future studies should examine differences in quitting among those with specific MHCs. Second, the response rate for this study was 40%, which is consistent with quitlines nationally.[34] Future studies should investigate the effects of various retention procedures to minimize client dropout (eg, retention mailers, increasing frequency of contact during follow-up periods). Finally, quit outcomes at 7 months were self-reported and were not biochemically verified to validate the self-reported quit rates; however, studies show high correlation between self-reported and bioverified quit reports.[35]

Conclusion

This study found a high prevalence of comorbid conditions among people enrolled in a state smoking quitline. Quitline clients with both CHCs and MHCs had the lowest quit rates. These findings support developing interventions that help smokers with MHCs, particularly those with a coexisting CHC, to quit.[34] Implementation of multilevel interventions at the individual and provider levels, improved service coordination with mental health care providers, and medication and coaching adjustments all hold promise to increase tobacco cessation in this high-risk group.

Declaration of Conflicting Interests

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