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Examining the effects of illicit drug use on tobacco cessation outcomes in the helping hand 2 randomized controlled trial

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Abstract

Background—Individuals with substance use disorders (SUD) smoke at higher rates and have higher tobacco-related mortality than the general population. Despite having an interest in smoking cessation, smokers with SUDs may have greater difficulty quitting.

Methods—Analysis of data from a RCT testing a post-discharge smoking cessation intervention for hospitalized cigarette smokers interested in quitting. Past 7-day tobacco abstinence was self-reported at 1, 3, and 6 months and biochemically confirmed at 6 months post-discharge. Other drug use was assessed at baseline by self-report or a past-year discharge diagnosis of SUD. Multiple logistic regression compared tobacco cessation outcomes among participants with no recreational drug use (NDU; n=942) vs. marijuana only (MU; n=284) vs. other illicit drugs (IDU; n=131).

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Contributors

All authors have contributed to the development of the project and manuscript. All authors have also read and approved the final manuscript. WKB and LHE contributed to the development of the experimental design. MNK assisted with analyses and interpretation. AJQ implemented the experimental design and prepared the manuscript.

Conflict of Interest

No conflicts of interest declared by any author.

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Results—Groups differed at baseline on age, gender, race, education, other household smokers, alcohol use, and anxiety/depression (all $p<.05$). Confirmed 6-month tobacco abstinence was lower among IDU than NDU participants (9% vs 18%, $p=.01$; AOR=0.43, CI: 0.22–0.84) after adjustment for study arm, smoking characteristics, demographics, quality of life, alcohol use and MU. Confirmed 6-month abstinence did not differ significantly between MU vs. NDU participants (14% vs 18%, $p>.05$; AOR=0.77, CI:0.51–1.14). Counseling and medication use did not differ significantly among groups at any follow-up.

Conclusions—Hospitalized smokers who planned to stop smoking after discharge and used cessation assistance were less successful if they had used illicit drugs in the past year, but not if they had only used marijuana. More intensive or tailored interventions may be required to address smoking in this population.

Keywords

Inpatients; hospitalization; smoking cessation; nicotine dependence; substance use

1. Introduction

Tobacco smoking is the leading cause of preventable death in the U.S. (USDHHS, 2014). While smoking prevalence in the general population of smokers has declined to 15% (Jamal et al., 2016), prevalence remains much higher among vulnerable populations such as those with co-morbid drug dependence. Smoking rates in substance users vary between 65–94%, with the highest rates observed among opioid-dependent individuals and those enrolled in inpatient addiction treatment programs (Guydish et al., 2011, 2016; Richter et al., 2002). Substance users are more likely to die of tobacco-related disease compared to the general population, and substance users who smoke are four times more likely to die prematurely relative to substance users who do not smoke (Bandiera et al., 2015; Hser et al., 1994).

The high prevalence of smoking among substance users does not stem from disinterest in quitting smoking. Substance users, including hospitalized substance users, report an interest in quitting smoking and make quit attempts (Clemmey et al., 1997; Katz et al., 2008; Richter et al., 2001). Furthermore, smoking cessation treatment does not appear to jeopardize substance use outcomes, and may increase long-term sobriety (Dunn et al., 2009; Hurt et al., 1994; Prochaska et al., 2004; Shoptaw et al., 2002; Thurgood et al., 2016).

Providing smoking cessation interventions during substance abuse treatment and recovery can increase smoking abstinence (Thurgood et al., 2016), but substance users generally have lower absolute tobacco quit rates than non-users (Breslau et al., 1996; Hays et al., 1999; Hughes, 1993; Humfleet et al., 1999; McClure et al., 2015; Richter et al., 2002; Lasser et al., 2000).

The majority of published studies on smoking cessation interventions among substance users have been conducted in addiction treatment settings. Less is known about whether smokers with substance use can benefit from smoking cessation interventions that are designed for the general population and provided in the context of routine health care. Numerous smoking cessation interventions have been developed for hospitalized smokers (See Riley et

al., 2012, for a review), but, to our knowledge, none have focused on inpatients with recent substance use (Rigotti et al., 2012).

Recently, several states have decriminalized marijuana resulting in greater perceived acceptability and use of this smoked drug (Cerdeira et al., 2015; Marist College Institute for Public Opinion, 2017). How changes in the legal status of marijuana will influence tobacco smoking and quitting is uncertain. Research suggests that marijuana use does not reduce smoking cessation even when accounting for alcohol use (Humfleet et al., 1999; Metrik et al., 2011; Peters et al., 2012; Rabin et al., 2016), but less is known about outcomes among hospitalized marijuana users. Therefore, we will examine quit rates in this group separately.

Hospitalization provides a good opportunity to quit smoking because hospital policies require smokers to abstain temporarily from tobacco use when a health threat may increase their motivation to quit. In the general population, starting a smoking cessation intervention in the hospital increases smoking cessation rates after discharge (Rigotti et al., 2012). The present investigation aims to examine whether smokers with past year co-morbid substance use differ from non-substance using smokers in response to a cessation intervention beginning during hospitalization and continuing after discharge. We examine data from a multi-center randomized controlled trial of a smoking intervention for the general population of hospitalized smokers. It demonstrated the efficacy of a post-discharge intervention in improving self-reported tobacco abstinence rates at 1 and 3 months compared to standard care (Rigotti et al., 2016). We hypothesized that participants with recent illicit drug use would have lower quit rates than participants not using illicit drugs. With regard to exclusive marijuana users, we aimed to test the hypothesis that recent marijuana use among hospitalized users not seeking treatment for substance use, would decrease tobacco quit rates.

2. Material and methods

We analyzed data from the Helping HAND 2 Trial (HH2; NCT01714323), a multi-site randomized clinical trial conducted at 3 U.S. hospitals: Massachusetts General Hospital (MGH) in Boston, MA; University of Pittsburgh Medical Center (UPMC) in Pittsburgh, PA; and North Shore Medical Center (NSMC) in Salem, MA. Full study methodology has been published (Reid et al., 2015). This study was approved by Institutional Review Boards of Partners HealthCare (for MGH and NSMC) and at UPMC.

2.1 Participants

Inpatients were eligible for participation if they were > 18 years old, daily smokers (when smoking normally in the month prior to hospital admission), had smoked within the past 30 days, received >5 minutes of smoking cessation counseling in the hospital, planned to try to quit smoking following discharge, and were willing to accept free smoking cessation pharmacotherapy at discharge. Participants were excluded if they did not have access to a telephone, did not speak English, had a psychiatric or cognitive impairment which precluded informed consent, were admitted to inpatient obstetric or psychiatric units, were admitted for an intravenous drug overdose, were medically unstable or had a life expectancy of less than one year. All eligible participants were offered pharmacotherapy and counseled by a tobacco

cessation counselor at their bedside to help manage nicotine withdrawal symptoms and offer cessation assistance.

2.2 Study Conditions

After providing informed consent, participants were randomly assigned to Sustained Care or Standard Care. In the Standard Care condition, participants received advice to call a free telephone quit line and a tailored recommendation for post-discharge pharmacotherapy. Participants randomized to the Sustained Care intervention received a free, refillable, 30-day supply of their choice of Food and Drug Administration (FDA)-approved tobacco cessation medication at hospital discharge as well as five automated interactive voice response (IVR) calls post-discharge. These automated calls allowed interested participants to be immediately transferred to a telephone quitline for counseling or medication refills.

2.3 Measures

2.3.1 Baseline Demographic and Smoking Characteristics—The baseline survey, conducted during the hospitalization, assessed demographic variables (age, gender, race/ethnicity, education), tobacco use (cigarettes smoked per day, past 30-day use of other tobacco products, time to first cigarette of the day from the Fagerstrom Test for Nicotine Dependence [FTND; Fagerstrom, and Schneider, 1989]), prior quit attempts, use of tobacco cessation treatments, intention to quit following discharge, perceived importance of and confidence in quitting (5-point Likert scales), and presence of another smoker at home. Depression and anxiety were assessed using a 4-item screening measure (PHQ-4; Melchior et al., 1993). Quality of life was assessed using the Euro-Qol-A (EQ-5D; EuroQol Group, 1990). Discharge diagnoses of a smoking-related disease (e.g., myocardial infarction, chronic obstructive pulmonary disease) were abstracted from the medical record using a definition consistent with the 2014 U.S. Surgeon General's Report.

2.3.2 Baseline Drug and Alcohol Use—The baseline survey included questions on illicit drug and alcohol use in the past year. Alcohol use was assessed using the Alcohol Use Disorder Identification Test-Consumption (AUDIT-C; Bush et al., 1998). We created a post-hoc composite indicator of heavy alcohol use combining the AUDIT-C score with discharge diagnosis of alcohol use or dependence not in remission (ICD-9 codes 303.00, 303.01, 303.02, 303.9, 303.90, 303.91, 303.92, 305.00, 305.01, 305.02). Participants were classified as heavy alcohol users if they had a discharge diagnosis or an AUDIT-C score ≥ 7 (the median score among participants with an alcohol-related discharge diagnosis). Participants were also asked to report their recreational drug use in the past year including "marijuana or hashish," "cocaine or crack," "stimulants that were not prescribed by your doctor like amphetamines, uppers, speed, crank, crystal meth, or bam," and "opioids that were not prescribed by your doctor like heroin, morphine, codeine, or opium." Participants responded "Yes," "No," or "Don't know," to interviewer-administered drug use questions on the baseline survey. Injection drug use was assessed by asking about participants' lifetime and past year use. Discharge diagnoses of drug dependence (i.e., ICD-9 codes 304.0, 304.1, 304.2, 304.3, 304.4, 304.6) were abstracted from the medical record.

2.3.3 Follow-up Assessment—Telephone surveys were administered by research staff at 1, 3, and 6 months after hospital discharge to assess use of tobacco products and tobacco treatment. At each call, participants were asked about their use of tobacco in the past 7 days (7-day point prevalence). Participants who reported past 7-day abstinence from tobacco at 6-months were asked to provide a mailed saliva sample to assay for cotinine, a nicotine metabolite, to verify self-reported abstinence, and were compensated \$50 for providing the sample. Participants who reported NRT use were asked to provide an in-person measurement of expired air carbon monoxide (CO). Self-reported abstinence was considered verified if saliva cotinine was <10 ng/ml or CO <9 ppm (Hughes et al., 2003). Tobacco treatment was defined as any use of FDA-approved pharmacotherapy or cessation counseling that was delivered in person, by telephone or Internet or from a healthcare provider. Participants were compensated \$20 for each completed follow-up survey.

2.3.4 Defining Drug Use—For this analysis, individuals were grouped into non-tobacco drug use categories using the baseline survey and discharge diagnosis codes. Participants were classified as other “Illicit drug users (IDU)” if they had an ICD-9 discharge diagnosis code of past-year illicit drug dependence (i.e., cocaine, opioids, sedative/hypnotic/anxiolytic, stimulants, other specified drug dependence) or reported past year use of those drugs on the baseline survey. Participants who did not meet the criteria for IDU but did have a discharge diagnosis of marijuana dependence or reported past year marijuana use on the baseline survey were classified as “Marijuana-only users (MU).” ICD-9 discharge diagnoses of drug dependence “in remission” were ignored. Participants who met neither the IDU or MU criteria were classified as “Not drug users (NDU).”

2.4 Main Outcomes

The primary outcome, consistent with the parent trial, was biochemically-confirmed past 7-day tobacco abstinence reported at the 6 month follow-up survey. Secondary outcomes included self-reported 7-day point prevalence at 1, 3, and 6 months, and post-discharge use of tobacco treatment (i.e., pharmacotherapy or counseling).

2.5 Statistical Analysis

We assessed differences in baseline characteristics between drug use groups using chi-squared tests, Wilcoxon rank sum tests, Kruskal-Wallis tests and one-way ANOVA. We present self-reported quit rates at 1, 3, and 6 months, and confirmed abstinence at 6 months, assessing differences by non-tobacco drug use group using chi-squared tests. In these analyses, nonrespondents and those failing to provide a sample for confirmation were considered smokers. We used multivariable logistic regression to assess the effect of non-tobacco drug use group on confirmed abstinence controlling for study arm and baseline characteristics. The model included study arm, age, gender, marital status (married/partnered vs. not), education (<12th grade/GED vs. more), time to first cigarette (< 5 minutes vs. longer), smoking level (< 10 cpd vs. more), smoking-related discharge diagnosis, presence of a smoker in the home, intention to quit post-discharge (will try to vs. plan to quit), and heavy alcohol use. Interactions between non-tobacco drug use group and study arm were not significant in a preliminary model and omitted from the final model. We also did an analysis using all available self-reported past 7-day abstinence in a repeated measures logistic

regression including the same predictors. We report rates of sustained abstinence defined as confirmed quit at 6 months and self-reported past 7-day abstinence at 1 and 3 months. We present several measures of post-discharge utilization of cessation support. Among those who responded to at least one follow-up survey, we compare rates of ever using any cessation support (individual, group, internet-based, or from a healthcare provider) by non-tobacco drug use group using chi-squared tests. Among intervention participants, we compared rates of ever accepting an IVR call, and ever requesting counseling or medication support during the IVR call, by non-tobacco drug use group using chi-squared tests.

All analyses were conducted using Stata (StataCorp. 2015. Stata Statistical Software: Release 14. College Station, TX: StataCorp LP.)

3. Results

1357 smokers were enrolled across the 3 HH2 study sites. Of those, 942 (69%) participants were categorized as NDU, 284 (21%) as MU, and 131 (10%) as IDU. Of the 131 participants identified as IDU, 54 were identified only by self-report, 37 only by discharge diagnosis code, and 40 by both. Of the 284 participants identified as MU, 253 were identified only by self-report, 3 only by discharge diagnosis code, and 28 by both. On average, there were significant differences by non-tobacco drug use category (i.e., NDU, MU, IDU) on age, gender, race, educational attainment, presence of a smoker in the home, heavy alcohol use and anxiety and depression scores, but not on measures of nicotine dependence or past tobacco cessation efforts (Table 1). The NDU were older, more likely to be white, less likely to be heavy alcohol users, and better educated than the MU and IDU groups ($p < .05$). MU and IDU groups were similar in age, race and gender, but participants with IDU were less likely to have completed college and had more anxiety/depression symptoms than those with MU. Survey response rates were 81%, 77% and 75% at 1, 3, and 6 months, respectively, and did not differ by study arm ($p > .05$).

There were no significant differences in the percentage of biochemical samples returned across the categories of non-tobacco drug use ($p > .05$), but significant differences were observed between self-reported abstinence and biochemical verification, with a larger percentage of IDU self-reporting tobacco abstinence at 6-months that was not biochemically confirmed ($p = .007$). The agreement between self-report and biochemical verification did not differ by the type of sample provided (i.e., salivary cotinine vs. breath CO, $p = .141$).

Figure 1 displays the tobacco quit rates at each follow-up assessment by non-tobacco drug use category. At 6 months, both self-reported and confirmed tobacco abstinence varied significantly across the 3 groups (both $p = .02$). Abstinence rates were highest for the NDU group, intermediate for the MU group and lowest for the IDU group. A similar pattern was observed at 1 and 3 months but was not statistically significant ($p = .45$ and $p = .20$, respectively). In pairwise comparisons, quit rates were higher for NDU than IDU for both self-reported and confirmed abstinence at 6 months (both $p = .01$). The difference between NDU and MU was not statistically significant for either measure, but the higher abstinence rate of MU vs. IDU approached statistical significance at 6 months for both self-report and confirmed measures.

We used multiple logistic regression analysis to examine the effect of baseline drug use on biochemically-confirmed tobacco abstinence at 6-month follow-up, adjusting for study arm, level of nicotine dependence, cigarettes smoked/day, age, gender, race, marital status, education, smoking-related disease discharge diagnosis, quality of life, smoking policy in the home, having a plan to quit following discharge, heavy alcohol use and MU. In this analysis, participants with IDU were much less likely to have confirmed tobacco abstinence than participants with NDU (AOR=0.43, CI: 0.22–0.84, $p=.01$; Table 2). In this model, the odds of 6-month confirmed abstinence was lower among participants with MU than those with NDU but did not reach statistical significance (AOR=0.77, CI:0.51–1.14, $p=.19$). Other factors independently associated with confirmed tobacco abstinence were strength of intention to quit post-discharge, having a smoking-related disease discharge diagnosis, and less nicotine dependence represented by number of cigarettes smoked per day (Table 2). The lower abstinence rate of participants with IDU vs. NDU was also statistically significant (AOR=0.58, CI: 0.36–0.92, $p=.02$) in a multivariate model that substituted self-reported past 7-day abstinence for confirmed abstinence at 6 months. The 6-month self-reported abstinence rate of participants with MU did not differ significantly from those with NDU (AOR=0.90, CI:0.66–1.23, $p=.52$) in this model. In both multivariate models predicting confirmed and self-reported abstinence at 6 months, heavy alcohol use was not a statistically significant predictor of tobacco quit rates compared to NDU (AOR=0.97, CI: 0.65–1.43, $p=.87$; AOR=0.90, CI: 0.66–1.23, $p=.51$, respectively). We found consistent results in an alternate analysis that used repeated measures logistic regression to examine the effect of baseline drug use on past 7-day point prevalence abstinence across the three follow-up assessments and adjusted for the same covariates as in the primary analysis. Participants with IDU were less likely to have confirmed tobacco abstinence than participants with NDU (AOR=0.72, CI: 0.49–1.03, $p=.08$; Table 2) with results approaching significance. Sustained abstinence at 6 months differed by drug use category (54%, 46% and 36% for NDU, MU, and IDU, respectively, $p=.045$).

There were no significant differences at any follow-up assessment in the use of pharmacotherapy or counseling, comparing NDU vs. any non-tobacco drug use ($ps>.05$). Across all follow-up assessments, 68%, 68%, and 73% of NDU, MU and IDU reported using any nicotine replacement therapy following discharge ($p=.44$) and 7%, 9%, and 5%, respectively, reported using any prescription cessation medication following discharge ($p=.36$). Similarly, there were no differences at any follow-up assessment in counseling use after discharge across the categories of non-tobacco drug use on ($ps>.05$). Across all follow-up assessments and collapsed across study arm, 31%, 30%, and 30% of NDU, MU and IDU reported engaging in any counseling post-discharge (i.e., individual, group, internet-based, via healthcare provider). In the Sustained Care intervention condition, there were no significant differences in IVR use between the three non-tobacco drug use categories ($ps>.05$), with 86%, 88%, and 79% of NDU, MU and IDU being reached by the IVR system, 54%, 58%, and 57% requesting medication refills, and 33%, 29%, and 32% requesting counseling from a quit coach, respectively.

4. Discussion

This secondary analysis of a smoking cessation intervention for hospitalized smokers who intended to quit after discharge examined differences in smoking cessation outcomes among smokers with past year co-morbid illicit drug use vs. exclusive marijuana use vs. no drug use. Although the groups did not differ in their use of cessation pharmacotherapy or counseling after discharge, smokers with IDU were less successful in quitting at 6 months than smokers with either MU only or NDU. The tobacco abstinence rates of cigarette smokers who used marijuana exclusively were not significantly different than those of smokers who reported not using any illicit drugs.

Our findings are consistent with previous literature establishing that substance users are interested in quitting and make attempts to quit smoking (Clemmey et al., 1997; Richter et al., 2001). Less use of the cessation intervention does not explain the lower quit rates among illicit drug users in our sample. The lower quit rates in this study might be attributable to substance users' additional vulnerabilities and risk factors. At baseline, smokers with IDU were younger, less educated, had higher anxiety and depression scores and heavier alcohol use than smokers with NDU or MU. Many of these are characteristics have been independently associated with less success in quitting (Lasser, 2000; Vangeli et al., 2011). However, the lower cessation rate of smokers with IDU persisted after multivariate adjustment for these factors, suggesting that other factors may mediate the poorer outcomes of smokers with IDU when trying to quit tobacco use.

The results of this investigation are consistent with previous literature demonstrating lower tobacco cessation rates among illicit drug users compared to non-drug users. Quit rates among illicit drug users were less than half that of non-users in a nationally-representative cross-sectional survey that did not account for use of smoking cessation treatment (Richter et al., 2002). This aligns with the 9% vs 18% abstinence rates observed in the present study among NDU and IDU at 6 months. To increase quit rates among illicit drug users, our data suggest that interventions need to be more intensive and/or specifically tailored to substance users.

Although smokers with illicit drug use in our multivariate analyses had poorer cessation outcomes than smokers with no other drug use, smokers with marijuana only use did not. These results are consistent with previous findings demonstrating that relative to tobacco-only use, concurrent use of marijuana and tobacco is not associated with poorer cessation outcomes (Peters et al., 2012; Rabin et al., 2016). Determining the effect of marijuana use by tobacco smokers trying to quit will be important as states increasingly decriminalize marijuana use (Annas, 2014). Past year heavy alcohol use was also not predictive of tobacco abstinence in the multivariate analyses. This finding stands in contrast with previous literature demonstrating that alcohol use disorders were associated with less smoking abstinence and more relapse (Weinberger et al., 2013).

Smoking cessation is infrequently addressed in substance use treatment clinics (Friedmann et al., 2008) and in routine health care settings (Kruger et al., 2012; Tong et al., 2010). Tobacco cessation services are needed in both settings. Given the low quit rates among IDU

in this trial, hospital-based interventions would probably be more effective if they targeted the subset of smokers also using illicit drugs for a more intensive or longer intervention. In any setting, tobacco treatment interventions may benefit from being tailored to the unique risk factors of substance users such as having a high level of nicotine dependence, lower educational attainment and psychiatric and medical co-morbidities (Hughes, 1993; Kessler et al., 1994; Richter et al., 2002; Burling et al., 1997; Saxon et al., 2003).

Our study has several limitations. Our definition of substance use was based on any use in the past 12-months and did not capture recency of use or severity of use. Further, we did not collect data on drug use after baseline. However, our definition of substance use is consistent with the time frame used in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV TR; APA, 2000) which corresponds with ICD-9 codes used in the present analysis. Additionally, we did not verify patients' ICD-9 codes to confirm substance use; however, ICD-9 codes have been shown to be a valid proxy for identifying patients with substance use disorders (Harris et al., 2011). The parent trial excluded smokers admitted to the inpatient psychiatric unit or those admitted for intravenous drug overdose. Our findings cannot be generalized to these populations who smoke at higher rates and have more difficulty quitting (Cook et al., 2014; Jackson et al., 2015; Richter et al., 2001). Our baseline survey asked about the use of opioids that were not prescribed by a doctor, which missed the group of individuals abusing opioids prescribed by their doctor (USDHHS, 2013). Finally, only 10% of our sample used illicit drugs in the past year, which limited our statistical power to compare outcomes between non-tobacco drug use groups in this study. In particular, the lack of a statistically significant difference in tobacco abstinence rates between smokers with MU and NDU may be due to our sample size. Future studies should examine the utility of established smoking cessation interventions provided during routine health care for substance users using a larger sample size of substance users.

5.0 Conclusions

This analysis adds to prior work showing poorer quit rates among smokers with co-morbid illicit substance use by demonstrating that this relationship exists in a unique treatment context, a hospital admission. Among hospitalized smokers interested in quitting tobacco use and offered a smoking cessation intervention after discharge, smokers who used illicit drugs had a 57% lower odds of quitting smoking despite utilizing post-discharge smoking cessation resources at a similar rate to those not using drugs or using marijuana only. No differences in quit rates were observed between cigarette smokers with or without past-year use of marijuana only but no other illicit drugs. Smokers with co-morbid illicit drug use may benefit from smoking cessation interventions of higher intensity and duration or those tailored to substance users' unique risk factors.

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Highlights

- The Experimental Tobacco Marketplace (ETM) is an online market used in abuse liability research that mimics the real world.
- At higher cigarette prices, males purchased more e-cigarettes, Snus, and dip than females.
- Evaluation of nicotine replacement products should be considered for males and females.

Figure 1.
Past 7-day tobacco abstinence by categories of non-tobacco drug use

Table 1

Baseline characteristics of study participants by non-tobacco drug use category

Non-Tobacco Drug Use					p-values		
	No Drug Use (NDU) (n=942)	Marijuana -Only Use (MU) (n=284)	Other Illicit Drug Use (IDU) (n=131)	Overall	NDU vs. MU	MU vs IDU	NDU vs. IDU
%	69	21	10				
Demographics							
Age (M ± SD)	51.8 ± 12.3	45.2± 12.2	44.5±11.8	<.001	<.001	.602	<.001
Male (%)	45.9	63.0	59.5	<.001	<.001	.497	.003
Race (%)				<.001	<.001	.902	.026
White	77.8	66.6	67.2				
Black	12.2	16.6	17.6				
Other	10.0	16.9	15.3				
Education (%)				<.001	.001	.050	.004
<High school/GED ^a	17.1	26.8	25.2				
High school diploma	31.0	25.0	35.1				
Some college	36.0	34.2	34.4				
4 years of college	15.9	14.1	5.3				
Smoking Characteristics							
Cigarettes/Day (M ± SD)	16.1 ± 10.0	15.9 ± 10.5	15.1 ± 8.4	.691			
Smoke within 5 min of waking (%)	41.3	45.4	48.9	.163			
Confidence in quitting (M ± SD)	3.2 ± 0.96	3.1 ± 1.0	3.0 ± 1.0	.134			
Plan to stay quit (%) ^b	48.6	48.9	44.3	.627			
Ever tried to quit (%)	90.3	88.7	89.3	.373			
Smoking related disease discharge diagnosis (%)	35.6	29.6	29.8	.104			
Lives with other smokers (%)	45.5	51.8	61.7	.001	.063	.060	.001
Ever used pharmacotherapy (%)	72.0	65.1	71.0	.086			
Ever used cessation support (non-pharmacological) (%)	25.0	24.7	21.4	.672			
Psychosocial							
EQ-5D excellent or good ^c (%)	46.4	46.1	36.2	.087	.947	.057	.029

	Non-Tobacco Drug Use			p-values		
	No Drug Use (NDU) (n=942)	Marijuana -Only Use (MU) (n=284)	Other Illicit Drug Use (IDU) (n=131)	NDU vs. MU	MU vs IDU	NDU vs. IDU
PHQ-4 ^d (M ± SD)	4.6 ± 3.4	4.8 ± 3.4	6.0 ± 3.7	.147	.003	<.001
AUDIT-C ^e (Median (IQR))	1 (0-4)	3 (1-6)	1 (0-5)	<.001	.008	.332
Discharge diagnosis of alcohol dependence or abuse (%)	9.0	13.4	16.8	.032	.358	.005
Composite heavy alcohol use indicator ^f (%)	16.4	27.8	29.8	<.001	.682	<.001
Study Characteristics						
Study Site (%)						
MGH	66.3	21.8	11.9			
NSMC	66.5	22.9	10.6			
UPitt	73.3	19.4	7.3			
Arm (%)						
Intervention	68.1	22.7	9.3	.289		
Control	70.8	19.2	10.0			

^aGED, general educational development

^bParticipants were asked about their plan to quit smoking following hospital discharge. Eligible participants indicated that they planned to stay quit or to try to stay quit post-discharge.

^cEQ-5D, the EuroQol instrument measuring quality of life

^dPHQ-4, Patient Health Questionnaire measuring anxiety and depression

^eAUDIT-C, Alcohol Use Disorders Identification Test-Consumption assessing alcohol consumption

^fParticipants are considered to abuse alcohol if they have an AUDIT-C score 7 or a discharge diagnosis of alcohol dependence or abuse, not in remission.

Table 2

Factors associated with biochemically-confirmed tobacco abstinence at 6 months and past 7-day point prevalence abstinence over time. Multiple logistic regression and repeated measures logistic regression analysis.

	Biochemically-confirmed tobacco abstinence at 6 months		Past 7-day point prevalence at 1, 3, 6 mo	
	Odds Ratio (Confidence Interval)	p-value	Odds Ratio (Confidence Interval)	p-value
Substance Use				
<i>None</i>	1.00		1.00	
<i>Marijuana-Only</i>	0.77 (0.51–1.14)	.191	0.94 (0.72–1.23)	.664
<i>Illicit Drug</i>	0.43 (0.22–0.84)	.013	0.72 (0.49–1.03)	.075
<i>Heavy Alcohol Use^a</i>	0.97 (0.65–1.43)	.867	0.89 (0.68–1.16)	.381
Demographics				
White	0.69 (0.48–1.00)	.051	0.80 (0.62–1.04)	.091
Smoking Characteristics				
Smoke > 10 cigs/day	0.67 (0.47–0.96)	.029	0.99 (0.77–1.28)	.938
Smoking related disease				
discharge diagnosis ^b	2.13 (1.54–2.95)	<.001	1.74 (1.39–2.18)	<.001
Plan to quit post-discharge ^c	2.05 (1.50–2.81)	<.001	2.26 (1.84–2.78)	<.001

Note. Multivariate analysis was adjusted for study arm, level of nicotine dependence (item one of the FTND^d), age, gender, marital status, education, quality of life (EQ-5D^e) and the presence of a smoker in the home.

^aHeavy alcohol use was defined by an AUDIT-C total score ≥ 7 or a discharge diagnosis of alcohol abuse or dependence, not in remission.

^bSmoking-related diseases are those enumerated in the 2014 U.S. Surgeon General's Report. These include neoplasms (ICD-9 codes 140–151, 157, 161, 162, 180, 188, 189, 204–208), cardiovascular diseases (ICD-9 410–414, 390–398, 415–417, 420–429, 430–438, 440–448), respiratory diseases (ICD-9 480–492, 496), and perinatal conditions (ICD-9 765, 769, 798.0).

^cAt baseline, participants were asked about their plan to quit smoking following hospital discharge. Eligible participants indicated that they planned to stay quit or to try to stay quit post-discharge.

^dFTND, Fagerstrom Test for Nicotine Dependence (Fagerstrom, and Schneider, 1989)

^eEQ-5D, Euro-Qol-A quality of life questionnaire (EuroQol Group, 1990)