Original investigation

Does Smoking Intensity Predict Cessation Rates? A Study of Light-Intermittent, Light-Daily, and Heavy Smokers Enrolled in Two Telephone-Based Counseling Interventions

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Abstract

Introduction: Though many interventions have been shown to be effective in helping smokers quit, outcomes may differ between light and heavy smokers. We identified differences in baseline characteristics and post-intervention cessation rates among smoker groups at two safety-net hospitals.

Methods: We retrospectively analyzed cessation rates in 1604 patients randomized to either a quit-line referral (1–2 telephone counseling sessions) or intensive counseling program (seven telephone sessions). Participants were stratified into light-intermittent (smoked on ≤ 24 of last 30 days), light-daily (smoked on $>24/30$ days, 1–9 cigarettes per day [CPD]), or heavy smokers (smoked on $>24/30$ days, ≥ 10 CPD). We compared baseline characteristics between smoker types using chi-squared tests, then identified predictors of 30-day abstinence using a multivariable model.

Results: Compared with light-daily and light-intermittent smokers, heavy smokers were more likely to be white, male, concomitant e-cigarette users, to have high-risk alcohol use, to have used quitting aids previously, to have current or lifetime substance use (excluding cannabis), and have lower confidence in quitting. However, in multivariable analysis, smoker type was not significantly associated with cessation. The statistically significant predictors of cessation at 6 months were higher confidence in quitting and enrollment in the intensive counseling intervention.

Conclusions: Smoker type (light-intermittent, light-daily, or heavy) does not independently predict success in a cessation program. However, smoker type is strongly associated with patients' confidence in quitting, which may be one predictor of cessation.

Implications: This study of two safety-net hospitals emphasizes that the number of cigarettes smoked per day does not independently predict smoking cessation. Additionally, heavy smokers are at highest risk for the detrimental health effects of tobacco, yet have lower confidence and motivation to quit. Confidence in quitting may be one factor that affects cessation rates; however, further study is needed to identify which other attributes predict cessation. These findings suggest that smoker type may still be a useful proxy for predicting cessation and that interventions specifically designed for and validated in heavy smokers are needed to better aid these individuals.

Introduction

Numerous smoking cessation interventions are effective in helping smokers to quit,¹ but it is not clear how generalizable these studies are to people who only smoke a few cigarettes per day (CPD) or are non-daily smokers. Light or low-rate smokers, commonly defined as individuals using 1–9 CPD, comprise 23% of the smoking population in the United States, a proportion that continues to increase.² A further distinction can be made between “light-daily” and “light-intermittent” smokers, the latter group defined as those who do not smoke cigarettes every day. Most cessation interventions study participants simply as one cohort, despite marked baseline differences between these subgroups.

Light smokers (1–9 CPD) differ in many ways from heavy smokers. Light smokers are more likely to be female, members of minorities, single, physically active, of older age at smoking onset, and have higher education levels.^{3,4} Light smokers are also more likely to have smoking restrictions at home or in the workplace than heavy smokers.⁵ Specifically, light-intermittent smokers (also called non-daily, occasional, or very light smokers) have higher education levels and a healthier diet than other smoker groups.^{4,6} Differences in cessation trends and behaviors have also been suggested: Light-daily smokers are more likely to have been abstinent for at least 1 year in the past, more likely to attempt to quit, and more likely to succeed in their attempt, and light-intermittent smokers are more likely still to successfully quit.^{7,8}

We previously conducted a comparative effectiveness study (CHART-NY), which randomized hospitalized smokers to either referral to the state quitline consisting of 1–2 sessions of phone counseling or intensive phone counseling consisting of seven telephone sessions administered by study staff. The study demonstrated higher abstinence rates in the intensive counseling arm than the quitline referral arm at both 2 months (29% vs. 21%) and 6 months (37% vs. 32%).⁹

Although smoking cessation counseling programs have shown efficacy, it is unknown how the cessation rates in these programs vary among light-daily, light-intermittent, and heavy smokers. The few previous studies comparing these smoker groups have yielded mixed findings.^{10–12} In addition, there may be unique differences in the characteristics of smokers within the population served by the inpatient safety-net hospitals (Bellevue Hospital Center and the Manhattan Veterans Affairs Hospital) studied in CHART-NY. Safety-net hospitals like these provide care to a population with disproportionately low income and high uninsured rates. The two hospitals studied here also see high rates of unstable housing, mental health conditions, and substance use disorders. Therefore, in this secondary analysis of the CHART-NY study, we aim to (1) compare baseline characteristics of light-intermittent, light-daily, and heavy smokers, (2) compare quitting outcomes in intensive counseling versus quitline referral interventions stratified by smoker type, and (3) determine whether smoker type (light-intermittent, light-daily, and heavy) was a predictor of quitting, as well as identify other predictors of smoking cessation among those who participated in these interventions.

Methods

Participants

This is a secondary data analysis of the CHART-NY study, a randomized trial comparing multi-session telephone counseling delivered

by study staff versus referral to state quitline counseling at two safety-net hospitals in New York City. Participants were hospitalized smokers at Bellevue Hospital Center (NYC Health and Hospitals system) or the Veterans Affairs (VA) New York Harbor Healthcare System. Current smokers were identified by physician or nurse assessment and documentation in the electronic medical record.

Potential participants were screened for eligibility at the bedside. All inpatients with any reason for admission were eligible if they (1) were over 18 years of age, (2) smoked tobacco during the prior 30 days, (3) had an active US phone number, and (4) were able to provide consent in English, Spanish, or Mandarin. Patients were excluded if they used only smokeless tobacco, were pregnant or breastfeeding, were discharged to an institution (eg, prison, nursing home), or did not have the cognitive or physical ability to consent or participate in the study. In the parent study, 64% of 15 750 patients approached were ineligible, and 29% of the eligible patients chose to enroll. A total of 1618 patients were randomized to either quitline referral or intensive smoking cessation. The quitline referral arm consisted of 1–2 sessions of phone counseling via the state quitline, whereas the intensive phone counseling arm consisted of seven proactive telephone sessions administered by study staff. Eligible patients provided written informed consent at the bedside. In the current analysis, we included all participants from the parent study who had response data for the “cigarettes per day” variable.

Outcomes

The primary outcome measures were the 30-day abstinence rates at 2 and 6 months. Secondary outcomes included quit attempts during the study period, as well as use of quitting aids during the study period, defined as use of nicotine replacement therapies, varenicline, or bupropion.

Measures

Patient Surveys

Participants completed a bedside survey at the time of enrollment that assessed tobacco use and history, including sociodemographic characteristics, smoking history (eg, CPD, years smoking, prior quit attempts, other tobacco products used, prior use of nicotine replacement therapy, varenicline, or bupropion), insurance status, marital status, living situation, education, immigration status, employment status, history of alcohol and/or substance use, history of chronic pain, admission type (psychiatric vs. non-psychiatric), and health-care utilization in the past 6 months. Participants were asked for their own perceived health status, confidence in quitting, and plan to quit smoking after discharge, with categorical response options. Further detail on the CHART-NY study design, including the survey, is available in a protocol article.¹³

Participants completed telephone follow-up surveys 2 and 6 months after randomization. The 2-month telephone follow-up survey assessed smoking status, use of quitting aids during the study period, and perceptions of the counseling. The 6-month follow-up survey reassessed the measures asked on the enrollment survey and reevaluated smoking status and quitting aid use.

For this analysis, participants were categorized as either light-intermittent smokers, light-daily smokers, or heavy smokers. Light-intermittent smokers were defined as participants who reported smoking on less than or equal to 24 of the last 30 days. Light-daily smokers were defined as those who smoked on more than 24 of the last 30 days and smoked 1–9 CPD. Heavy smokers are defined as

Table 1. Baseline Characteristics of Heavy, Light-Intermittent, and Light-Daily smokers

	Light smokers		Heavy smokers ^a	<i>p</i> Value
	Intermittent smokers ^a	Daily smokers ^a		
	(<i>n</i> = 238)	(<i>n</i> = 475)	(<i>n</i> = 891)	
Age—mean (SD)	50.0 (14.0)	48.2 (13.7)	47.7 (13.0)	.020
Years smoking—mean (SD)	25.9 (15.2)	25.5 (15.1)	27.2 (14.0)	.068
CPD—mean (SD)	4.0 (2.1)	5.0 (1.9)	18.6 (9.3)	<.0001
Race				<.0001
White	24% (56)	22% (101)	38% (332)	
Black	46% (109)	47% (220)	30% (266)	
Indian	2% (4)	2% (11)	2% (16)	
Asian	3% (8)	2% (9)	4% (33)	
Pacific	<1% (1)	<1% (2)	<1% (1)	
Other	16% (37)	20% (93)	19% (167)	
Multi-race	9% (20)	7% (34)	7% (59)	
Hispanic ethnicity	33% (78)	38% (179)	35% (307)	.335
Male gender	72% (171)	76% (359)	82% (732)	.001
Site				.723
Bellevue	69% (164)	72% (341)	71% (633)	
VA	31% (74)	28% (134)	29% (258)	
Insurance				.958
Private	8% (18)	9% (44)	8% (75)	
Public	46% (109)	47% (220)	46% (407)	
VA	31% (74)	29% (134)	29% (258)	
No insurance	16% (37)	16% (73)	17% (150)	
Marital				.782
Married/living with partner	22% (53)	23% (109)	21% (187)	
Separated/divorced/widowed	37% (87)	34% (158)	34% (303)	
Never married	41% (97)	43% (205)	45% (397)	
Living situation				.119
Own/rent apartment or home	76% (167)	71% (311)	75% (595)	
Transitional housing/staying with family/SRO	15% (33)	18% (77)	15% (119)	
Sleeping in shelters, street, etc.	6% (14)	8% (37)	9% (74)	
Institution	3% (6)	3% (11)	1% (7)	
Born outside United States	25% (59)	25% (118)	19% (166)	.010
Employed	29% (69)	25% (120)	30% (270)	.157
Education				.113
Less than high school	28% (67)	27% (128)	23% (202)	
High school graduate/GED	24% (58)	30% (142)	28% (248)	
Some college/associate's degree	30% (71)	29% (136)	34% (304)	
4-y college graduate or higher education	18% (42)	14% (65)	15% (137)	
Chronic pain in last 6 mo	43% (71)	45% (141)	44% (269)	.924
AUDIT-C				.002
Low risk	63% (149)	57% (269)	54% (483)	
Medium risk	28% (66)	25% (121)	24% (218)	
High risk	10% (23)	18% (85)	21% (190)	
Health level				.901
Very good or excellent	30% (66)	27% (116)	27% (213)	
Good	30% (66)	30% (133)	31% (247)	
Fair or poor	40% (89)	43% (188)	42% (333)	
Admitting service at enrollment				<.0001
Psychiatry	29% (68)	35% (166)	45% (397)	
Non-psychiatry	71% (169)	65% (309)	55% (493)	
E-cigarette use	8% (17)	16% (70)	21% (163)	<.0001
Lifetime cannabis use	31% (74)	34% (163)	35% (308)	.593
Current cannabis use	78% (186)	77% (367)	81% (722)	.222
Lifetime use of other substances ^b	25% (60)	29% (137)	40% (353)	<.0001
Current use of other substances ^b	66% (156)	63% (301)	74% (657)	.0001
Ever quit for >1 d intentionally	85% (202)	83% (393)	80% (711)	.161
Attempted to quit in last 12 mo	69% (139)	61% (239)	53% (375)	<.0001
History of quitting aid use (Any NRT, varenicline, or bupropion)	55% (131)	64% (305)	74% (658)	<.0001
Other smokers at home	37% (87)	39% (184)	40% (358)	.888
Smoking restrictions in the home	60% (143)	57% (271)	48% (425)	.001

Table 1. Continued

	Light smokers			<i>p</i> Value
	Intermittent smokers ^a	Daily smokers ^a	Heavy smokers ^a	
	(<i>n</i> = 238)	(<i>n</i> = 475)	(<i>n</i> = 891)	
High support in quitting ^c	72% (171)	64% (300)	69% (606)	.052
Time to first cigarette				<.0001
Within 5 min	15% (36)	30% (140)	57% (509)	
6–30 min	15% (36)	20% (94)	21% (190)	
31–60 min	10% (23)	14% (64)	10% (92)	
After 60 min	60% (142)	37% (176)	11% (100)	
Confidence for quitting				<.0001
Not at all confident	4% (9)	8% (36)	12% (109)	
A little confident	9% (22)	16% (77)	16% (145)	
Somewhat confident	22% (52)	26% (122)	26% (230)	
Fairly confident	18% (42)	18% (83)	18% (157)	
Very confident	48% (113)	33% (153)	28% (248)	
Post-discharge quit plan				<.0001
I plan to stay quit when I leave	47% (112)	24% (114)	24% (217)	
I plan to try to quit when I leave	41% (97)	58% (276)	56% (502)	
I don't know if I'm going to quit	9% (21)	13% (63)	14% (123)	
I do not plan to quit	3% (8)	4% (20)	5% (48)	

AUDIT-C = Alcohol Use Disorders Identification Test; NRT = nicotine replacement therapy; SRO = single room occupancy; VA = Veterans Affairs hospital.

All statistics are presented as % within smoker group (*n*), and all single-category variables show the proportion of participants who responded “Yes” to a given characteristic, unless otherwise indicated. Continuous variables are presented as a mean (SD). *N* = 1604. Bolded values are significance of *p* < 0.05.

^aLight-intermittent: smoked on less than or equal to 24 of last 30 days, light-daily: smoked on more than 24/30 days, 1–9 CPD, heavy smokers: smoked on more than 24/30 days, at least 10 CPD.

^bOther substances: cocaine, hallucinogens, sedatives, opioids, prescription stimulants, methamphetamines, or inhalants.

^cWhen asked “How much support for quitting do you have from people around you?,” participants who answered, “a lot” or “a fair amount” rather than “very little” or “none” were defined to have a high level of support.

those who smoked on more than 24 of the last 30 days and smoked 10 CPD or more. We chose a cutoff of less than or equal to 24 of the last 30 days so as not to misclassify heavy smokers who stopped smoking several days before hospital admission because of feeling acutely ill.

Analysis

First, baseline demographic characteristics and other risk factors were compared among light-intermittent, light-daily, and heavy smokers, using chi-squared tests for categorical variables or the Kruskal–Wallis test for ordinal/continuous variables. Second, unadjusted abstinence rates were compared between interventions, stratified by smoker type, using a chi-squared test. Finally, a multivariate logistic regression model was constructed to quantify the effects of smoker type (light-intermittent, light-daily, or heavy) and the effects of intervention groups (intensive counseling versus quitline) when adjusting for other factors. Variables included in the multivariate analysis were those with a *p* value of <.10 in the baseline characteristics comparison. A two-sided *p* value of <0.05 was considered statistically significant. All statistical analyses were performed using SAS 9.4 (SAS Institute Inc, Cary, NC).

Results

Of 1618 participants included in the parent study, 14 were excluded because of missing response data for CPD. Therefore a total of 1604 participants were included in this analysis. Of these, 14.9% were light-intermittent smokers, 29.6% were light-daily smokers, and

55.6% were heavy smokers. Follow-up response rates at 2 months were 67.2%, 69.7%, and 62.6% in light-intermittent, light-daily, and heavy smokers, respectively, and the difference between group was statistically significant in a chi-squared test (*p* = .02). Response rates at 6 months were 68.1%, 70.5%, and 64.9% for light-intermittent, light-daily, and heavy smokers, respectively, and these differences were not statistically significant (*p* = .10).

Table 1 shows the baseline characteristics of the study population, by smoker group. Heavy smokers were more likely to be white, male, concomitant e-cigarette users, to have high-risk alcohol use (assessed with AUDIT-C), to have used quitting aids in the past, and to have current or lifetime substance use (excluding cannabis). Heavy smokers also reported lower confidence in quitting and were less likely to have a post-discharge plan to quit. Light-intermittent smokers were more likely to be born outside the United States, to be hospitalized for a non-psychiatric reason, to have smoking restrictions in the home, and to have attempted to quit in the last year. Light-intermittent, light-daily, and heavy smokers were similar in ethnicity, insurance type, marital status, education, employment status, and living situation; there was no significant association between smoking group and self-reported health status, current or lifetime cannabis use, or presence of other smokers in the home.

Abstinence Rates

Table 2 compares 30-day abstinence rates and secondary outcome measures between intervention groups, stratified by smoker type. In light-intermittent smokers at 2 months, 30-day abstinence rates were significantly lower for quitline participants compared with

Table 2. Comparison of Quitting Outcomes in Quitline Versus Intensive Counseling Interventions, Stratified by Smoker Type

Outcome	Light-intermittent smokers			Light-daily smokers			Heavy smokers		
	Quitline ^a (<i>n</i> = 105)	Intensive ^a (<i>n</i> = 133)	<i>p</i> Value	Quitline ^a (<i>n</i> = 256)	Intensive ^a (<i>n</i> = 219)	<i>p</i> Value	Quitline ^a (<i>n</i> = 449)	Intensive ^a (<i>n</i> = 442)	<i>p</i> Value
30-d abstinence at 2 mo	24% (17)	43% (38)	.010	23% (41)	33% (49)	.049	19% (52)	23% (64)	.211
30-d abstinence at 6 mo	39% (28)	54% (49)	.068	36% (64)	43% (68)	.198	27% (76)	29% (88)	.559
Attempted to quit at least once during study period	85% (33)	78% (29)	.483	86% (88)	72% (54)	.019	73% (138)	71% (141)	.693
Used any quitting aids during study period (NRT, bupropion, or varenicline)	32% (23)	45% (41)	.115	41% (72)	53% (84)	.026	53% (148)	59% (174)	.139

NRT = nicotine replacement therapy. Bolded values are significance of $p < 0.05$.

All values are shown as % within smoker group (*n*).

^aQuitline: referral to the state quitline, consisting of 1–2 sessions of phone counseling.

Intensive: enrollment in seven proactive telephone counseling sessions administered by study staff.

intensive counseling participants (23.6% vs. 43.2%, $p = .01$). This gap shrank at the 6-month follow-up survey, with 30-day abstinence rates of 39.4% and 53.9% in quitline and intensive arms, respectively ($p = .07$).

In light-daily smokers at 2 months, 30-day abstinence rates were again significantly lower in quitline participants than in intensive counseling participants ($p = .048$). Similarly, this difference was no longer significant at 6-month follow-up ($p = .20$).

In heavy smokers, there was no significant difference in 30-day abstinence rates between intervention arms at either 2 months or 6 months.

Secondary Outcomes

In light-daily smokers, participants in the intensive counseling arm were more likely to use quitting aids during the study period ($p = .03$). In heavy smokers and light-intermittent smokers, there was no difference in use of quitting aids during the study period.

In light-daily smokers, participants in the quitline arm were more likely to have made at least one quit attempt during the study period ($p = .02$). In heavy smokers and light-intermittent smokers, there was no difference in the proportion of participants making at least one quit attempt.

Predictors of Cessation

A total of 795 participants (50% of the study sample) were included in the multivariable regression analysis, shown in Table 3. The remaining was excluded for missing explanatory or outcome variable data. When controlled for other variables, smoker type was not a statistically significant predictor of 30-day abstinence at 6 months. The significant predictors of 30-day abstinence at 6 months were higher confidence in quitting and enrollment in the intensive counseling arm. A history of quitting aid use was negatively associated with 30-day abstinence.

Discussion

In this analysis, light-intermittent smokers enrolled in an intensive counseling cessation program were significantly more likely to quit than light-intermittent smokers referred to the state quitline. This differential was not found in heavy smokers or in light-daily smokers at 6-month follow-up.

In this multivariable analysis, smoker group (light-intermittent, light-daily, or heavy) was not independently a significant predictor of 30-day abstinence at 6 months. Prior studies have demonstrated mixed findings in cessation rates when comparing light and heavy smokers. In a randomized trial of Latino smokers enrolled in motivational interviewing cessation interventions, there was no difference in cessation rates between light and heavy smokers.¹⁰ A retrospective analysis of French smokers enrolled in counseling or pharmacotherapy interventions found light smokers to be less likely to be abstinent at follow-up than heavy smokers.¹¹ Both of these studies also found no difference in motivation measures in light and heavy smokers. An analysis by Ylloja et al.¹² did find that light smokers were significantly more likely to quit after post-discharge counseling and pharmacotherapy interventions but noted that the heavy smoker group had significantly higher rates of depression and alcohol abuse—two risk factors for treatment failure in smokers.^{14,15} These findings may reflect the idea that it is not the number of cigarettes smoked per day that predicts cessation. Rather, difference in outcomes between the smoker types is likely explained by other characteristics and risk factors.

In our multivariable regression, confidence to quit was associated with 30-day abstinence; however, each increasing “level” of confidence was not clearly associated with a higher likelihood of abstinence. Though the relationship between confidence and smoking cessation is only moderately associated in this analysis, prior studies have observed confidence to be a statistically significant determinant of smoking cessation. In a study of smokers participating in a combined group session and telephone counseling cessation program, participants with higher pre-intervention confidence were

Table 3. Predictors of 30-day abstinence at 6-month follow-up, *N* = 795

Variable		Odds ratio (95% CI)
Smoker type ^a	Light-intermittent	Ref.
	Light-daily smoker	1.10 (0.67, 1.80)
	Heavy smokers	0.73 (0.40, 1.31)
Intervention ^b	Quitline	Ref.
	Intensive	1.46 (1.04, 2.03)
Sex	Male	Ref.
	Female	0.89 (0.59, 1.35)
Race and ethnicity	Non-Hispanic White	Ref.
	Hispanic	0.87 (0.53, 1.41)
	Non-Hispanic Black	0.94 (0.58, 1.51)
	Non-Hispanic Asian	1.65 (0.50, 5.46)
Born outside United States	Non-Hispanic Other	1.47 (0.70, 3.08)
	Yes	1.26 (0.82, 1.93)
Admitting service at enrollment	Non-psychiatric	Ref.
	Psychiatric	1.01 (0.67, 1.52)
Alcohol Risk (AUDIT-C)	Low risk	Ref.
	Moderate risk	0.98 (0.66, 1.45)
	High risk	1.27 (0.78, 2.07)
History of quitting aid use	Yes	0.61 (0.42, 0.87)
E-cigarette use	Yes	0.99 (0.66, 1.45)
Current substance use ^c	Yes	0.75 (0.51, 1.11)
Lifetime substance use ^c	Yes	0.89 (0.57, 1.38)
Smoking restrictions at home	There are no restrictions	Ref.
	There are some restrictions	0.85 (0.52, 1.37)
	Restricted	1.21 (0.84, 1.74)
High support in quitting ^d	Yes	0.85 (0.59, 1.22)
Confidence in quitting	Not at all confident	Ref.
	A little confident	3.10 (1.32, 7.28)
	Somewhat confident	2.38 (1.05, 5.38)
	Fairly confident	1.40 (0.59, 3.28)
Post-discharge quit plan	Very confident	5.47 (2.44, 12.22)
	Do not plan to quit	Ref.
	Don't know	0.79 (0.24, 2.59)
	Plan to try to quit	1.35 (0.46, 3.96)
Age	Plan to stay quit	2.46 (0.82, 7.37)
		1.02 (1.00, 1.04)
Years smoking		0.99 (0.97, 1.01)

AUDIT-C = Alcohol Use Disorders Identification Test. Bolded values are significance of $p < 0.05$.

^aLight-intermittent: smoked less than or equal to 24 of last 30 days.

Light-daily: smoked more than 24/30 days, 1–9 CPD.

Heavy smokers: smoked more than 24/30 days, at least 10 CPD.

^bQuitline: referral to the state quitline, consisting of 1–2 sessions of phone counseling.

Intensive: enrollment in seven proactive telephone counseling sessions administered by study staff.

^cSubstances: cocaine, hallucinogens, sedatives, opioids, prescription stimulants, methamphetamines, or inhalants.

^dHigh support: when asked “How much support for quitting do you have from people around you?”, participants who answered, “a lot” or “a fair amount” rather than “very little” or “none” were defined to have a high level of support.

more likely to be abstinent at 20-week follow-up.¹⁶ Similarly, a retrospective observational study demonstrated that higher confidence in quitting was a predictor of successful cessation at 2-year follow-up period with no specific cessation intervention.¹⁷ Smoker “self-efficacy” is a more commonly studied measure of patient self-confidence and in prior studies has been assessed with either a single-item query of “How confident” a patient is in becoming or staying abstinent or with a multiple-item questionnaire. In a meta-analysis of 192 studies of self-efficacy, patients who quit smoking at follow-up had mildly higher pre-quit self-efficacy levels. The relationship was noted to be stronger when self-efficacy was assessed after quitting—in other words, self-efficacy or self-confidence is a stronger predictor of remaining abstinent than of becoming abstinent.¹⁸

Despite only a moderate relationship between confidence and cessation rates in this study, higher confidence in quitting was notably a quality highly associated with the light-intermittent smokers group in the baseline characteristics comparison. The higher quit rates seen in the light-intermittent group therefore may be related to their higher confidence and motivation or may be attributable to other qualities not captured in our data.

The CHART-NY study demonstrated a significantly higher overall abstinence rate in the intensive counseling arm than the quitline referral arm at 6 months (37% vs. 32%). However, our results suggest that this differential is attributable primarily to the higher quit rates in light-intermittent smokers in the intensive counseling arm. In comparison, heavy smokers enrolled in intensive counseling did

not have significantly higher abstinence rates compared with heavy smokers enrolled in the quitline. In addition, 30-day abstinence rates among light-intermittent smokers in both study arms were higher than the overall abstinence rates found in CHART-NY (54% compared with 37% in the intensive counseling arm and 39% compared with 32% in the quitline arm). Meanwhile, abstinence rates in heavy smokers were lower than the overall average, suggesting that much of the quit rate captured in the parent study is reflective of successful cessation in light-intermittent smokers.

Given these observations, smoker type may still be a useful proxy for likelihood to quit, and specialized programs targeted toward heavy smokers are needed to better aid in cessation for these individuals. The intensive counseling program studied here may be best targeted toward light-intermittent smokers. Given that smoker type was not independently a predictor of cessation, it is not certain what characteristic is attributable for the relative cessation success among light-intermittent smokers and the lower cessation rates in heavy smokers. Higher confidence in quitting in light-intermittent smokers may be one factor.

A history of quitting aid use prior to the study period was negatively associated with successful cessation during the study. This may represent a marker of patients who have had prior unsuccessful attempts to quit and have particular difficulty with cessation.

In prior studies, the effect of a combined pharmacotherapy and counseling intervention resulted in substantial abstinence rates among heavy smokers—Shiffman et al. reported abstinence rates of 22%–28% in a combined nicotine replacement therapy + counseling intervention; Gonzales et al. reported rates of 30% in bupropion + counseling and 44% in varenicline + counseling.^{19,20} These studies suggest that a combination approach may be more efficacious in heavy smokers. A Cochrane meta-analysis also estimated that behavioral support as an adjunct to pharmacotherapy may increase cessation rates by 10%–25%.²¹ Therefore, future investigations using interventions that include both pharmacotherapy and counseling are needed to better compare post-intervention cessation rates in light versus heavy smokers.

Finally, in this population, the proportion of light-daily and light-intermittent smokers combined was about 45%. This rate falls between the national average of 23% and the New York City rate of 73% in 2008.²² This may reflect the higher prevalence of heavy smoking in lower income groups such as the patient population of the safety-net hospitals in this study.

This study has several strengths, including a large sample and the examination of an infrequently studied population that is sociodemographically diverse and includes a high proportion of individuals with mental health and substance use disorders.

There are also several limitations. Most prominently, this is a post-hoc analysis rather than a pre-specified analysis, and the findings are therefore more susceptible to play of chance. However, our findings are consistent with prior literature studying similar outcomes. Also, in the absence of a control group, it is difficult to distinguish participants who would have quit without a program from those whose abstinence is attributable to the interventions, especially as light smokers are more likely to attempt to quit and more likely to successfully quit without intervention.⁷ Therefore, the outcome differences found between light-intermittent, light-daily, and heavy smokers may be overestimated. Finally, the predictor analysis included 50% of the total participants because of incomplete survey response data in the remainder. A higher completed response rate may result in a more representative predictor analysis.

Conclusions

This study of two safety-net hospitals demonstrates that smoker type (light-intermittent, light-daily, or heavy) does not independently predict success in telephone counseling cessation programs. Lower confidence in quitting in heavy smokers may play a part; however, further study is needed to delineate the characteristics that result in the significant differential in cessation rates.

In addition, abstinence rates reported after smoking cessation programs may overestimate the true efficacy of these programs in heavy smokers. Given that heavy smokers are at higher risk for the detrimental health effects of tobacco, interventions specifically designed for and validated in heavy smokers are needed to better aid these individuals.^{23,24}

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Declaration of Interests

None declared.

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