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Menthol cigarette smoking among individuals in treatment for substance use disorders

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Abstract

There are higher rates of menthol cigarette smoking within certain population subgroups. Limited research has examined menthol use among individuals in treatment for substance use disorders (SUD), a population with a high prevalence of cigarette smoking, poor smoking cessation outcomes, and high tobacco disease burden. Survey data were collected from 863 smokers sampled from 24 SUD treatment programs affiliated with the NIDA Clinical Trials Network (CTN) in the United States. Prevalence of menthol cigarette smoking was examined for the sample. Bivariate and multivariate analyses were used to examine demographic and tobacco use characteristics associated with menthol cigarette smoking. Overall, the prevalence of menthol smoking among individuals in SUD treatment was 53.3%. Smoking menthol versus non-menthol cigarettes was associated with being female (AOR = 1.61, $p = 0.003$), being African American (AOR = 7.89, $p < 0.001$), Hispanic/Latino (AOR=3.39, $p<0.001$), and lower odds of having a college degree (AOR=0.49, $p=0.015$). Controlling for demographic factors, menthol smokers were more likely to report marijuana (AOR=3.33, $p<0.007$) as their primary drug compared to alcohol. Lastly, menthol smokers were more likely to report interest in getting help for quitting smoking (AOR=1.53, $p=0.01$), although they were not more likely to report making a past year quit attempt. In conclusion, use of menthol cigarettes was higher among smokers in SUD treatment than in

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Contributors

N.R.G, D.D.W and J.G developed the idea for this manuscript and the data analytic plan. N.R.G conducted the analyses with consultation from J.G. The primary draft of this manuscript was written by N.R.G and D.D.W. with consultation, feedback, and editing assistance by J.G. A.P, and B.K.C. All authors have contributed to and approved the final manuscript.

Conflict of interest

All authors declare that they have no conflicts of interest.

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general population smokers. Regulatory policies targeting the manufacture, marketing, or sale of menthol cigarettes may benefit vulnerable populations, including smokers in SUD treatment.

Keywords

Drug; Alcohol; Dependence; Nicotine; Mentholated; Vulnerable; Tobacco; Substance use disorder

1. Introduction

Approximately 30% of all cigarette smokers in the United States (U.S.) smoke menthol cigarettes, though a higher prevalence of menthol smoking has been found among subgroups (Caraballo & Asman, 2011; SAMHSA, 2011). In the U.S., 83% of African-American smokers used menthol cigarettes, compared to 32% of Hispanic/ Latino and 24% of non-Hispanic White smokers (Lawrence et al., 2010; SAMHSA, 2011). Menthol cigarette smoking is also higher among women compared to men (36% vs. 28%), and among individuals of lower versus higher socioeconomic status (Lawrence et al., 2010). A higher prevalence of menthol cigarette smoking (57%) was reported among individuals with serious mental illness (Cohn et al., 2016; Young-Wolff et al., 2015), suggesting menthol cigarette use may be high among other populations that are vulnerable to tobacco use compared to smokers in the U.S. general population.

Individuals with substance use disorders (SUD) are among these groups vulnerable to tobacco use; they have a higher rate of tobacco use (Guydish et al., 2015; McKee & Weinberger, 2013), and poorer smoking cessation outcomes than smokers in the general population (Baca and Yahne et al, 2009; Reid et al., 2011; Thurgood et al., 2016). Tobacco-related diseases are among the leading causes of death for persons with SUD (Bandiera et al., 2015; Hurt et al., 1996). Among individuals in SUD treatment, smoking prevalence ranges from 65% to 90% (Guydish et al., 2011, 2015; Richter & Arnsten, 2006), significantly higher than the 15% prevalence within the general U.S. population (CDC, 2015). Although smoking prevalence has decreased among the general population, there is a continued public health need to reduce cigarette smoking among specific populations where tobacco use remains high.

Menthol flavored cigarettes are often used by young adults and new smokers (for review see Feirman et al., 2016), and menthol may encourage smoking initiation (Carpenter et al., 2005; Klein et al., 2008). Menthol may also contribute to cigarette dependence and difficulty in quitting among established smokers, particularly African American menthol smokers (Foulds et al., 2010; Keeler et al., 2017; SAMHSA, 2011). The Food and Drug Administration (FDA) Tobacco Products Scientific Advisory Committee (TPSAC) found sufficient evidence to conclude that menthol smokers are less successful in quitting than non-menthol smokers (TPSAC, 2011). In 2009 the FDA banned all non-tobacco “characterizing” cigarette flavors except menthol (Anderson, 2011; FDA, 2009), and more recently considered banning menthol flavored cigarettes (TPSAC, 2011; Cheyne et al., 2014).

Menthol may intensify tobacco use and dependence both through its flavorant effect (reducing the harshness of cigarettes, and serving as a sensory cue) and through pharmacological interactions with nicotine (Ahijevych & Garrett, 2004; Lee & Glantz 2011; TPSAC, 2011; Yerger, 2011). Specifically, menthol reduces some of the aversive taste and irritant effects of tobacco smoke through activation of transient receptor potential Ankyrin 1 (TRPA1; Ha et al., 2015; Willis et al., 2011). In a cross-over study, smoking mentholated cigarettes was found to inhibit nicotine metabolism resulting in slower clearance of nicotine (Benowitz et al., 2004), an effect that was also observed using in vitro cell studies (MacDougall et al., 2003); and mice (Ha et al., 2015). In addition, studies found greater upregulation of nicotinic acetylcholine receptors (nAChRs) in the brains of menthol versus non-menthol smokers (Brody et al., 2013), which the authors attribute to higher nicotine exposure in the former group. However, in a preclinical mouse model, menthol alone, or in combination with nicotine, resulted in upregulation of nAChRs located on midbrain dopamine neurons, involved in reward-related behavior (Henderson, 2016). These findings suggest that menthol, in addition to being a flavorant, may contribute to tobacco use and dependence.

Little research has examined the prevalence and correlates of menthol cigarette smoking among individuals with drug and alcohol dependence. Among a sample of 43 cocaine dependent smokers, 75% smoked menthol cigarettes (Wiseman & McMillan, 1998). A larger study of 301 cocaine dependent smokers found that 67% smoked menthol cigarettes (Winhusen, et al., 2013). Winhusen et al. (2013) also found that menthol cigarette smoking was higher among cocaine dependent compared to methamphetamine dependent smokers, suggesting there may be differences in menthol smoking between different drug treatment populations. However, apart from these two studies, there has been little research on the relationship between menthol cigarette smoking and use of different drugs of abuse.

The higher prevalence of menthol cigarette smoking by certain subgroups may be due in part to targeted marketing by tobacco companies (Anderson, 2011). This includes African Americans (Gardiner, 2004; Richardson et al., 2015), Latinos (Fernandez et al., 2005; Landrine et al., 2005), women (Lee & Glantz, 2011) and individuals living in lower socioeconomic neighborhoods (Lee et al., 2015). Newport brand cigarettes currently have the largest U.S. market share among menthol smokers (Caraballo & Asman, 2011). However, to our knowledge brand preference among menthol and non-menthol smokers in SUD treatment has not been examined.

The goals of this study were to: (1) examine prevalence of menthol cigarette smoking in a national sample of persons enrolled in SUD treatment; (2) explore demographic and tobacco use characteristics associated with menthol versus non-menthol cigarette smoking; and (3) to examine cigarette brand preference and advertising exposure among menthol versus non-menthol smokers.

2. Methods

2.1 Participants and Recruitment Procedure

Data were collected as part of a larger study that explored tobacco use among individuals in SUD treatment through three annual surveys conducted in 24 SUD treatment centers (10 residential, 7 methadone maintenance, and 7 outpatient clinics) affiliated with the NIDA (National Institute on Drug Abuse) Clinical Trials Network (CTN). Participating clinics were selected to be representative of addiction treatment centers in the NIDA CTN. CTN programs may differ from non-CTN programs and for this reason the sample may not be nationally representative. For example, a comparison of methadone programs within and outside the CTN found that CTN programs were more likely to be non-profit programs, to have more employees and a higher patient census, and to have patient populations that were more often on Medicaid, unemployed, and involved in the criminal justice system (Ducharme and Roman, 2009). All sites were located in the U.S. and had at least 60 active clients when screened for eligibility. A detailed description of clinic selection and recruitment is reported in Guydish et al. (2016). The 2015 survey, from which we drew the data reported here, sampled 1127 individuals from a total estimated population of 6801 clients served by these programs. The number of participants recruited per clinic ranged from 31 to 55, with a median of 48. We recruited a convenience sample within each clinic during on-site visits. All clients at each center (regardless of smoking status) were eligible to participate in the survey as long as they were physically present the day of the site visit and had been in treatment at that center for at least 10 days. All participants completed informed consent procedures, each participant received a \$20 gift card for participating, and each treatment program received a \$2,000 program incentive following the site visit. All procedures were approved by the Institutional Review Board of the University of California, San Francisco.

2.2 Procedure & Measures

Surveys were prepared using Qualtrics™ (Provo, Utah) software and were self-administered during an onsite visit to each clinic, from April to December 2015, using iPads linked to a secure university server.

Survey items in the current analysis included demographic information (age, gender, race/ethnicity, employment status, education, clinic type), and primary drug for which the client sought treatment. Race/ethnicity categories used in the current analyses were non-Hispanic White; non-Hispanic Black/African American, Hispanic/Latino, or Multiracial/Other. Individuals were also asked to report their general health (using a scale from excellent to poor) and the number of days in the past month their mental and physical health was not good (CDC, 2014).

Self-reported smoking status was characterized as current, former, or never cigarette smoker. Current smokers reported the number of cigarettes smoked per day (CPD), smoking days/week, time to first cigarette after waking (TTFC), whether they made a serious quit attempt in the past year lasting at least 24 hours (yes/no), and whether they ever used nicotine replacement therapy (NRT; yes/no). Readiness to quit smoking cigarettes was assessed by

categorizing participants into one of three pre-action stages of change based on Prochaska & DiClemente (1983): (a) Precontemplation - no intention to quit smoking within the next 6 months; (b) Contemplation – intention to quit within the next six months; and (c) Preparation – intention to quit within the next 30 days. Current smokers also reported if they had interest in getting help to quit smoking at their current treatment program (yes/no). TTFC was used as a measure of nicotine dependence (Baker et al., 2007). Menthol smokers were identified as those reporting their usual cigarette as menthol (versus non-menthol). To assess cigarette brand preferences and exposure to tobacco marketing, current smokers were also asked to report their usual brand of cigarette, the brand of their favorite cigarette advertisement, and the brand of cigarette advertisement they had seen most frequently in the past 30 days.

2.3 Data Analysis

Of the total sample (N=1127), there were 863 current cigarette smokers used in the current analyses. Excluded from analysis were former (n=166) and never (n=96) smokers. Bivariate analyses compared menthol versus non-menthol cigarette users across demographic and tobacco use variables; t-tests were conducted for continuous variables, and Pearson's chi-square tests were used for categorical variables. Means are presented $\pm$ standard deviation (SD).

Next, we created a logistic regression model to identify variables that may be independently associated with menthol versus non-menthol cigarette use. The model included variables identified in the bivariate analysis at $p < 0.10$ and included age, sex, race/ethnicity, education, primary drug, general health, days poor mental health, cigarettes per day, and interest in quitting smoking.

Cigarette brand preference and advertising exposure between menthol and non-menthol smokers were analyzed separately. All statistical analyses were performed using SPSS 24 (IBM Corporation, Armonk, NY, USA).

3. Results

3.1 Sample characteristics

The sample of smokers (n=863) was 53.4% male, 57.1% non-Hispanic White, 17% African American, and 12.9% Hispanic/Latino, with a mean age of 37.7 ± 11.5 years. For education, 24.2% had less than a high school degree, 64.7% had a high school degree or GED equivalent, and 11.2% had a college degree. For treatment program type, 39.9% were in residential, 26.4% in outpatient, and 33.7% in methadone treatment programs.

3.2 Bivariate analyses: Prevalence and correlates of menthol cigarette smoking

Of 863 current smokers in SUD treatment, 53.3% (n=460) reported menthol cigarettes as their preferred type of cigarette. The prevalence of menthol smoking differed by racial/ethnic group. Among non-Hispanic White smokers, 41.8% used menthol cigarettes. In contrast, 70.3% of Hispanic/Latino smokers and 82.3.0% of African American smokers used menthol cigarettes.

Bivariate comparisons between menthol and non-menthol smokers are presented in Table 1. For menthol smokers 44.8% were non-Hispanic White, 26.3% were African American, and 17.0% were Hispanic/Latino. In contrast, non-menthol smokers were 71.2% non-Hispanic White, 6.5% African American, and 8.2% Hispanic/Latino. A larger percent of menthol versus non-menthol smokers were women (58.7% vs. 41.3%). Menthol versus non-menthol smokers were also slightly younger ($t_{(861)} = -3.46$, $p=0.001$), and less likely to have obtained a college degree ($X^2_{(2, N=860)} = 25.42$, $p<0.001$).

Menthol cigarette smoking was associated with differences in primary drug for which participants sought treatment ($X^2_{(5, N=862)} = 41.07$, $p<0.001$). Menthol smokers were less likely to be in treatment for alcohol and more likely to be in treatment for marijuana. We did not find a difference in menthol smoking for clinic type.

Smoking menthol cigarettes was associated with differences in self-reported health assessments. A higher proportion of menthol (33.8%) versus non-menthol (24.9%) smokers reported being in excellent or very good health ($X^2_{(2, N=853)} = 9.89$, $p=0.007$). Menthol smokers reported having fewer days in the past month with poor mental health ($t_{(844)} = -2.45$, $p=0.01$), though there was no difference in the number of days with poor physical health.

Lower CPD was reported by menthol versus non-menthol smokers ($t_{(861)} = -2.65$, $p=0.008$); though there was no difference in the number of smoking days per week, or in time to first cigarette after waking, a measure of cigarette dependence. Menthol smokers also reported greater interest in getting help to quit smoking at their current treatment program ($X^2_{(1, N=860)} = 9.61$, $p=0.002$); though there was no difference in readiness to quit smoking or in the proportion that made a quit attempt in the past year.

3.3 Logistic regression model: correlates of menthol cigarette smoking

A logistic regression model (Table 2) was used to determine which variables identified in the bivariate analyses (p -value <0.10) differed between menthol versus non-menthol cigarette smokers after adjusting for age, sex, race/ethnicity, education, primary drug, general health, days with poor mental health, cigarettes per day, and interest in getting help to quit smoking. After adjusting for these variables, menthol users were more likely to be younger (AOR = 0.97, $p < 0.001$), female (AOR = 1.61, $p = 0.003$), African American (AOR=7.89, $p<0.001$) or Hispanic/Latino (AOR=3.39, $p<0.001$) versus non-Hispanic White, and less likely to have a college degree as their highest level of education (AOR=0.49, $p=0.015$).

Adjusting for these demographic variables, menthol (versus non-menthol) smokers remained more likely to report marijuana (AOR=3.33, $p < 0.007$) compared to alcohol as the primary drug for which they were in treatment. Menthol smokers also remained more likely to report interest in getting help to quit smoking at their current drug treatment program (AOR=1.53, $p=0.01$). However, there was no difference between menthol and non-menthol smokers for general health, days of poor mental health in the past month, or CPD.

3.4 Cigarette brand preference and marketing exposure

There were significant differences in brand preference and marketing exposure between menthol and non-menthol smokers (Table 3). Among the overall sample of smokers in SUD treatment (both menthol and non-menthol), Newport and Marlboro cigarettes predominated as the preferred brands. Menthol cigarette smokers were significantly more likely to report Newport as their preferred cigarette brand (menthol = 57.8%, non-menthol = 11.2%), while non-menthol smokers were more likely to report Marlboro (non-menthol = 44.2%, menthol = 10.7%) as their preferred cigarette brand.

There were also differences in brand exposure. Menthol smokers were more likely to report having seen Newport advertisements most frequently in the past 30 days (menthol=46.5%, non-menthol=28.0%), while non-menthol smokers were more likely to report seeing Marlboro advertisements most frequently (non-menthol=44.4%, menthol=31.3%). Similarly, among menthol smokers Newport was mostly likely to be reported as their favorite cigarette advertisement (menthol=56.3%, non-menthol=8.2%), while non-menthol smokers' favorite advertisement was Marlboro (non-menthol=52.1%, menthol=16.1%).

4. Discussion

In this sample of current smokers in SUD treatment, the prevalence of menthol cigarette smoking overall was 53%, which is higher than that in general population smokers (national average ~30%; Caraballo & Asman, 2011; Lawrence et al., 2010; SAMHSA, 2011). Use of menthol cigarettes may contribute to disproportionate tobacco use and disease burden among smokers with drug use co-morbidities. The current study extends previous research reporting higher use of Menthol cigarettes among certain demographic groups (Caraballo & Asman, 2011; SAMHSA, 2011; Lawrence et al., 2010), and special populations vulnerable to tobacco use including individuals with serious mental illness (Cohn et al., 2016; Young-Wolf et al., 2015) or mental distress (Hooper et al., 2011). As mentioned earlier, the FDA previously considered regulations on menthol cigarettes (Cheyne et al., 2014; TPSAC, 2011). If menthol contributes to initiation, dependence, and difficulty in quitting, then regulations on menthol additives and marketing of menthol cigarettes may confer public health benefit to multiple populations where smoking prevalence remains high, including those with SUD.

Menthol versus non-menthol smokers in this sample were more likely to be female and identify as African American or Hispanic/ Latino, consistent with findings reported for non-addiction treatment samples (Lawrence et al., 2010; Caraballo & Asman, 2011; SAMHSA, 2011). However, the prevalence of menthol cigarette smoking among African Americans in our sample was similar to that of African American smokers in the general population (82.3% versus 83%), while menthol smoking in our sample was higher among non-Hispanic White smokers (41.8% versus 24%), and Hispanic/Latino smokers (70.3% versus 32%) versus general population smokers (Lawrence et al., 2010). This suggests that the higher rate of menthol use among persons in our drug treatment sample was driven in part by a higher rate of menthol smoking among Hispanic/Latino and non-Hispanic White smokers.

Menthol cigarette smoking was associated with difference in primary drug for which patients were in treatment. Being in treatment for marijuana versus alcohol was associated with smoking menthol versus non-menthol cigarettes. In the logistic regression model, no other differences were found for primary drug and menthol cigarette use, though there was a trend for greater menthol use among individuals reporting cocaine/ crack versus alcohol ($p = 0.06$) as the primary drug for which they were in treatment. Studies among adolescents have found smoking menthol cigarettes was associated with higher likelihood of using marijuana (Azagba & Sharaf, 2014; Kong et al., 2013). Inquiry into possible pharmacological interactions between menthol and marijuana is merited. High prevalence of menthol smoking among individuals in treatment for cocaine use was previously reported (Winhusen, et al., 2013). A qualitative study of cocaine users who smoke cigarettes found that menthol smokers reported increased sensorimotor or stimulating effects as a frequent reason for why they preferred menthol versus non-menthol cigarettes (Wiseman & McMillan, 1998). However, this is a complex relationship as racial and demographic factors are also associated with differences in drug use and primary drug for which individuals are in treatment (Niv et al., 2009). Research using preclinical models may help to determine if there are unique pharmacological interactions between menthol cigarettes and different drugs of abuse, which could potentially inform future smoking cessation interventions.

Menthol smokers reported greater interest in getting help to quit smoking while in their current drug treatment program, but there was no difference in readiness to quit smoking, or the proportion reporting a quit attempt in the past year. In general, the majority of all smokers are interested in quitting (Gollust et al., 2008). African American menthol smokers have reported greater motivation to quit smoking compared to both African American non-menthol smokers and non-African American smokers, but this motivation did not translate into greater success with quitting (Keeler et al., 2017). Among individuals in SUD treatment, menthol smokers may be an important population to target with smoking cessation services, highlighting the need for improved smoking cessation treatment among this population.

In this study sample there was a clear preference for Newport cigarettes among menthol smokers and a preference for Marlboro cigarettes among non-menthol smokers. These data are consistent with Newport cigarettes being the preferred brand among general population menthol smokers (Caraballo & Asman, 2011). Menthol smokers also reported seeing Newport cigarette advertisements the most in the past month while non-menthol smokers reported seeing Marlboro advertisements the most in the past month. However, it is important to note that recall bias may contribute to differences in self-reported marketing exposure in our sample. Despite this limitation, the data indicate a clear difference in brand preference between menthol and non-menthol smokers in SUD treatment and a systematic study of marketing exposure among this population is warranted. Regulations targeting advertising and marketing exposure may be a point of intervention in efforts to reduce menthol cigarette use among special populations vulnerable to tobacco use.

One study limitation was that menthol cigarette preference was self-reported, and it is possible that some individuals smoked both menthol and non-menthol cigarettes. However, levels of switching between menthol and non-menthol smokers have been reported as low (Kasza, et al., 2014), suggesting the majority of established adult smokers use either menthol

or non-menthol cigarettes. We did not explore possible differences in smoking behavior by clinic type, for example, whether restrictions on smoking in residential treatment programs may affect smoking behavior in those settings. However, as we found no difference for prevalence of menthol smoking by clinic type ($\chi^2=2.20$, $p=0.33$), we expect that any clinic-related differences in smoking behavior would affect both menthol and non-menthol smokers equally. Although clinics participating in our study were selected to be representative of drug treatment centers in the NIDA CTN, we recruited a convenience sample within each clinic site, and the client sample may not be nationally representative. Methadone clinics were one of the three treatment program types surveyed in our study. For this reason, there was a higher prevalence of individuals reporting opiates and reduced prevalence of alcohol as the primary drug for which treatment was received compared to other surveys among individuals in treatment for drug and alcohol dependence (CBHSQ, 2017). Distribution of race and ethnicity was similar to that of clients in SAMHSA's national treatment databases, though our study had a higher proportion of women (CBHSQ, 2017). Although there are a number of challenges to sampling individuals within active drug treatment, our study design allowed for data collection from a large sample of individuals currently in treatment.

In summary, we found a high prevalence of menthol cigarette use among individuals in addiction treatment. Menthol cigarette smoking may contribute to tobacco use disparities among individuals with SUD. Regulatory policies targeting the manufacturing, marketing, or sale of menthol cigarettes may benefit certain special populations of smokers, including those with SUD, where the prevalence and health burdens of smoking are high.

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HIGHLIGHTS

- Examined menthol cigarette smoking by individuals with substance use disorders (SUDs)
- We surveyed 24 substance abuse treatment centers in the United States (863 smokers).
- 53.2% of smokers used menthol cigarettes, higher than the general population (~30%).
- Regulatory policies targeting menthol cigarettes may benefit smokers with SUDs.

Table 1

Sample characteristics of menthol and non-menthol cigarette smokers in SUD treatment

Variable	Menthol (n=460)	Non-menthol (n=403)	χ^2/t	<i>p</i>
Age, M $\pm$ SD	36.4 $\pm$ 10.9	39.1 $\pm$ 12.0	-3.46	0.001
Sex, % female	58.7 %	41.3 %	8.83	0.003
Race/Ethnicity, %				
Non-Hispanic White	44.8 %	71.2 %		
Non-Hispanic Black/African American	26.3 %	6.5 %	89.61	<0.001
Hispanic or Latino	17.0 %	8.2 %		
Multiracial/Other	12.0 %	14.1 %		
Education, %				
< High school (HS)	26.2 %	21.9 %	25.40	<0.001
HS or GED equivalent	67.7 %	61.2 %		
College degree	6.1 %	16.9 %		
Primary drug, %				
Alcohol	15.7 %	23.8 %		
Amphetamine/Methamphetamine	9.6 %	12.7 %		
Cocaine/Crack	13.9 %	6.2 %	41.07	<0.001
Marijuana	9.6 %	2.2 %		
Opiates	46.6 %	50.4 %		
Other	4.6 %	4.7 %		
Clinic type, %				
Residential	50.3 %	49.7 %	2.20	0.33
Methadone	54.6 %	45.4 %		
Outpatient	56.1 %	43.9 %		
General health, %				
Excellent or very good	33.8 %	24.9 %	9.89	0.007
Good	40.7 %	50.0 %		
Fair or poor	25.5 %	25.1 %		
Days with poor physical health (past month), M $\pm$ SD	5.6 $\pm$ 9.0	6.5 $\pm$ 9.9	-1.47	0.14
Days with poor mental health (past month), M $\pm$ SD	8.1 $\pm$ 9.8	9.8 $\pm$ 10.6	-2.45	0.01
Cigarettes smoked per day, M $\pm$ SD	12.7 $\pm$ 8.4	14.2 $\pm$ 8.6	-2.65	0.008
Smoking days/week, M $\pm$ SD	6.5 $\pm$ 1.3	6.6 $\pm$ 1.2	-1.53	0.13
Time to first cigarette, %				
Within 5 min of waking	40.7 %	37.5 %		
6–30 min of waking	35.3 %	42.2 %	4.66	0.20
31–60 min of waking	13.3 %	10.7 %		
After 60 min of waking	10.7 %	9.7 %		
Readiness to quit smoking, %				
Preparation	27.6 %	23.4 %	2.52	0.28
Contemplation	35.7 %	35.6 %		
Precontemplation	36.7 %	41.0 %		

Variable	Menthol (n=460)	Non-menthol (n=403)	χ^2/t	<i>p</i>
Made a cigarette quit attempts in the past year, M $\pm$ SD	47.8%	44.4%	1.00	0.32
Interest in getting help to quit smoking at current treatment program, % yes	60.1 %	39.9 %	9.61	0.002

Data collected from April to December 2015 in 24 SUD treatment centers affiliated with the NIDA CTN.

Table 2

Logistic regression model of factors associated with menthol cigarette smoking

Variable	AOR	95% CI	P value
Age	0.97	0.96, 0.99	<0.001 *
Sex			
Male (ref)	-	-	-
Female	1.61	1.17, 2.20	0.003 *
Race/Ethnicity, %			
Non-Hispanic White (ref)	-	-	-
Non-Hispanic Black/African American	7.89	4.53, 13.75	<0.001 *
Hispanic or Latino	3.39	2.03, 5.55	<0.001 *
Multiracial/Other	1.52	0.95, 2.45	0.08
Education			
< High school (ref)	-	-	-
High school or GED equivalent	1.24	0.85, 1.79	0.26
College degree	0.49	0.27, 0.87	0.02 *
Primary Drug			
Alcohol (ref)	-	-	-
Amphetamine/Methamphetamine	0.84	0.46, 1.54	0.58
Marijuana	3.33	1.40, 7.92	0.007 *
Cocaine/Crack	1.86	0.97, 3.55	0.06
Other	1.08	0.45, 2.55	0.87
Opiates	1.43	0.93, 2.19	0.11
General Health			
Fair or poor (ref)	-	-	-
Good	1.31	0.85, 2.02	0.23
Excellent or Very good	0.82	0.56, 1.20	0.31
Days poor mental health (Past month)	0.99	0.99, 1.03	0.19
Cigarettes smoked per day	1.01	0.98, 1.00	0.48
Interested in getting help to quit smoking at current treatment program			
No (ref)	-	-	-
Yes	1.53	1.11, 2.12	0.01 *

Data collected from April to December 2015 in 24 SUD treatment centers affiliated with the NIDA CTN.

Ref = reference category, AOR = adjusted odds ratio, CI = confidence interval,

* p<0.05.

Bold indicated p<0.05.

Table 3

Brand preference and exposure among menthol and non-menthol smokers in substance abuse treatment

Variable	Menthol (n=460)	Non-menthol (n=403)	χ^2/t	p
Usual cigarette brand, %				
Marlboro	10.7 %	44.2 %	262.6	<0.001
Newport	57.8 %	11.2 %		
Camel	5.4 %	6.9 %		
Pall Mall	3.9 %	7.2 %		
Kool	1.7 %	0.0 %		
L&M	7.2 %	6.0 %		
Maverick	5.0 %	3.0 %		
Other	8.3 %	21.6 %		
Brand of favorite cigarette advertisement, %				
Marlboro	16.1 %	52.1 %	242.45	<0.001
Newport	56.3 %	8.2 %		
Camel	12.8 %	19.1 %		
Other	5.4 %	9.4 %		
Decline to answer	9.3 %	11.2 %		
Cigarette advertisement seen the most frequently (past 30 days), %				
Marlboro	31.3 %	44.4 %	33.3	<0.001
Newport	46.5 %	28.0 %		
Camel	10.0 %	10.2 %		
Other	5.2 %	7.9 %		
Decline to answer	7.0 %	9.4 %		