



# Menthol cigarette smoking among individuals in treatment for substance use disorders



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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.

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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,  $p = 0.003$ ), 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 general population smokers. Regulatory policies targeting the manufacture, marketing, or sale of menthol cigarettes may benefit vulnerable populations, including smokers in SUD treatment.

## 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, Johnson, Hair, Rath, & Villanti, 2016; Young-Wolff, Hickman III, Kim, Gali, & Prochaska, 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

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population.

Individuals with substance use disorders (SUD) are among these groups vulnerable to tobacco use; they have a higher rate of tobacco use (Guydish, Yu, Le, Pagano, & Delucchi, 2015; McKee & Weinberger, 2013), and poorer smoking cessation outcomes than smokers in the general population (Baca & Yahne, 2009; Reid et al., 2011; Thurgood, McNeill, Clark-Carter, & Brose, 2016). Tobacco-related diseases are among the leading causes of death for persons with SUD (Bandiera, Anteneh, Le, Delucchi, & Guydish, 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, Lock, Cohen, Holtgrave, & Li, 2016), and menthol may encourage smoking initiation (Carpenter, Wayne, Pauly, Koh, & Connolly, 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, Hooper, Pletcher, & Okuyemi, 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 (Cheyne, Dorfman, Daynard, Mejia, & Gottlieb, 2014; TPSAC, 2011).

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, Liu, Ha, Jordt, & Morris, 2011). In a cross-over study, smoking mentholated cigarettes was found to inhibit nicotine metabolism resulting in slower clearance of nicotine (Benowitz, Herrera, & Jacob III, 2004), an effect that was also observed using in vitro cell studies (MacDougall, Fandrick, Zhang, Serafin, & Cashman, 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 et al., 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, Henriksen, Rose, Moreland-Russell, & Ribisl, 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 & 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 \$2000 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

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