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Menthol cigarette use in substance use disorder treatment before and after implementation of a county-wide flavoured tobacco ban

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ABSTRACT

Introduction This study examined the impact of a San Francisco City and County ban on all flavoured tobacco products, including menthol cigarettes, among clients in residential substance use disorder (SUD) treatment.

Methods We conducted cross-sectional surveys of clients at two residential SUD programmes before the County began enforcing the ban (n=160) and twice after enforcement began (n=102, n=120). The samples were compared on demographic characteristics, smoking status, smoking behaviours and the proportion reporting menthol as their usual cigarette. Menthol smokers were asked whether they smoked only menthol cigarettes, mostly menthol, both menthol and non-menthol or mostly non-menthol. Post-ban samples were asked about awareness of the ban and access to menthol cigarettes.

Results In multivariate analyses, we found no evidence that the ban was associated with decreased number of cigarettes per day or increased readiness to quit among current smokers. However, odds were lower post-ban for reporting menthol as the usual cigarette (OR=0.80, 95% CI 0.72 to 0.90), and for smoking only menthol cigarettes (OR=0.19, 95% CI 0.18 to 0.19). Perhaps most importantly, and with the ability to influence all other findings, 50% of self-identified menthol smokers reported purchasing menthol cigarettes in San Francisco nearly 1 year after the ban was implemented.

Conclusion In subgroups where smoking has remained elevated, like those receiving SUD treatment, local menthol bans may have only modest impacts on smoking behaviour. Broader regional, state or national bans, that effectively restrict access to menthol products, may be needed to show stronger effects on smoking behaviour.

INTRODUCTION

As part of the 2009 Family Smoking Prevention and Tobacco Control Act, the Food and Drug Administration (FDA) banned most cigarette flavourings,¹ excepting menthol. The FDA Tobacco Product Scientific Advisory Committee (TPSAC), reviewing available research, found that menthol cigarettes increase experimentation and transition to regular smoking among youth, contribute to nicotine addiction among youth and make quitting smoking more difficult among African-American smokers.² In a further independent review, the FDA concluded that menthol smokers showed higher levels of nicotine addiction and were less successful at quitting smoking as compared with non-menthol smokers.³ Menthol enables smokers to draw smoke deeper into their lungs, and inhibits nicotine metabolism,

which may explain why menthol smokers are more heavily addicted to nicotine and have more difficulty quitting smoking.²

Some populations are disproportionately affected by menthol cigarettes. Youth receive the greatest attention in tobacco control because preventing the uptake of smoking among youth reduces the future burden of illness. Yet some adult populations smoke menthol cigarettes disproportionately due to aggressive and targeted marketing among African-Americans, Latinos and women.⁴⁻⁵ While the proportion of all US smokers who smoke menthol cigarettes was 38.8%, menthol smoking rates were 43.5% among women, 46.9% among Hispanics and 84.6% among African-American smokers.⁶ Among smokers with serious mental illness 57% reported smoking menthol,⁷ and among smokers in substance use treatment 53.3% reported smoking menthol.⁸ One study of smokers in treatment for cocaine dependence found that, compared with non-menthol smokers, menthol smokers were less likely to be abstinent from stimulants post-treatment, prompting the suggestion that menthol cigarettes may play a role in cocaine dependence.⁹

To reduce uptake of smoking among youth and mitigate health effects among adult smokers,¹⁰ some regions have banned menthol cigarettes. Turkey banned manufacture of menthol cigarettes in 2019, extending to retail sales in 2020. Brazil and Chile banned menthol cigarettes, but these bans have not been implemented due to legislative challenges. In May 2020, the European Union (EU) implemented its ban on the sale of menthol cigarettes in accordance with the 2014 Tobacco Product Directive.¹¹ Multiple Canadian provinces banned menthol tobacco products in 2017,¹² followed shortly thereafter by a federal ban. In the USA, multiple local bans have been implemented, for example, Chicago banned the sale of menthol and other flavoured tobacco products within 500 feet of public schools, and Massachusetts passed a state-wide ban on the sale of menthol cigarettes in 2020.¹³⁻¹⁵

There are few data concerning how such bans impact smoking behaviour. Intentional studies, which ask menthol users how they would change smoking behaviour in response to a ban, report that 12% to 32% would switch to non-menthol cigarettes, 16% to 40% would quit smoking and 24% to 35% would find a way to obtain menthol cigarettes regardless of a ban, though these estimates vary widely by country and demographic characteristics.¹⁶⁻¹⁹ One study surveyed menthol smokers



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before and after a menthol ban in Ontario, Canada. Before the ban 14% thought they would quit smoking and, 1 month post-ban, 29% reported having quit.²⁰ A later Ontario study found that daily menthol smokers, compared with non-menthol smokers, were significantly more likely to self-report quitting 1 year after the ban.²¹

There are no reports concerning how menthol bans may affect smoking among persons with substance use or mental health problems, but there is reason to think they may respond differently from general population smokers. Persons with substance use or mental health diagnoses smoke at higher rates,^{22 23} smoke more heavily,²⁴ have more difficulty quitting^{25 26} and suffer disproportionately high tobacco-related mortality.^{27 28} These groups also show higher tobacco demand intensity and lower price elasticity, making them less sensitive to taxation strategies designed to reduce consumption.²⁹ Compared with reductions in smoking prevalence in the general US population, smoking prevalence among substance use and mental health populations has remained relatively unchanged over time.^{30 31} As both smoking and use of menthol cigarettes are concentrated in these groups, it becomes important to understand their response to innovative policy strategies.

In 2017, San Francisco, California, passed a ban on the sale of all flavoured tobacco products, including menthol cigarettes. Initially suspended after RJ Reynolds forced a voter referendum,³² the ban was passed in June 2018, and enforcement began in January 2019. Based on routine inspections at retail sites, the San Francisco Department of Public Health (DPH) reported that an average of 80% of retailers had stopped selling all flavoured tobacco products by December 2019, in compliance with the ban.³³ This paper reports on three cross-sectional samples of persons enrolled in San Francisco substance use disorder (SUD) treatment programmes recruited before (wave 1) and after (wave 2 and wave 3) the ban was implemented.

METHODS

Study design

Data were collected from two residential SUD treatment programmes as part of a community-based study exploring smoking cessation interventions. One programme included men only, and the other was a mixed-gender programme serving persons with both substance use and mental health disorders. Clients in these programmes were surveyed in June 2018 (wave 1, pre-ban), about 6 months before the ban on the sale of flavoured tobacco products was enforced. Cross-sectional samples were surveyed again in May 2019 (wave 2, post-ban) and in November 2019 (wave 3, post-ban). We use the date that the County began enforcing the ban, 1 January 2019, as the implementation date (figure 1).

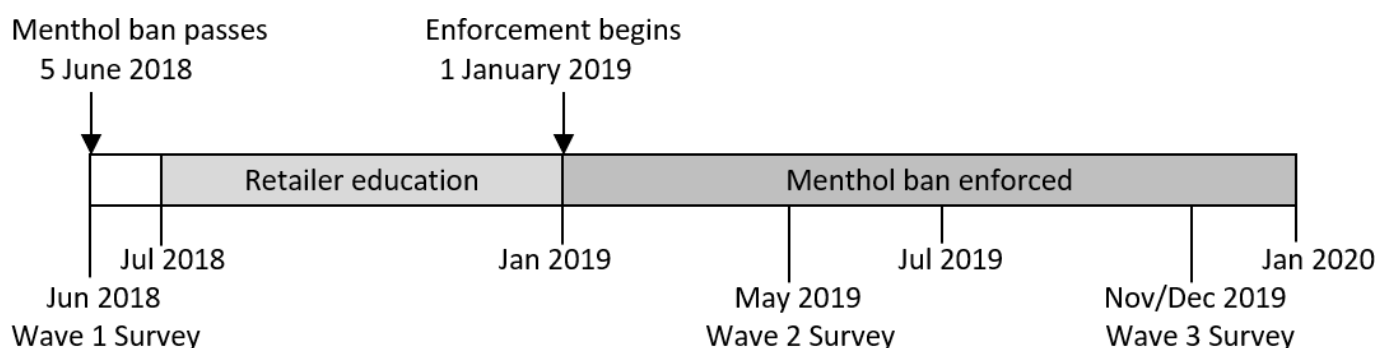


Figure 1 Timeline of San Francisco's menthol ban and data collection.

Participants

Eligible were all clients enrolled in the SUD treatment programmes at the time of each data collection. The site director reported the total client census at each visit, for use in determining survey participation rates. Research staff visited each programme, and all clients present in the programme during the site visit were invited to participate.

Procedures

One staff member in each programme acted as a liaison to the research team. The site liaison coordinated client contact either by using sign-up sheets or by ensuring that clients were available at the time of the site visit. Data collection site visits were completed in 1 to 2 days per programme. Data collection occurred in groups of up to 10 clients at a time. Research staff explained the study and reviewed a study information sheet with clients as a group, and then gave each client an iPad survey with a pre-populated research ID number. The survey began with the study information sheet, and participants used a button to consent or decline participation. The survey took about 30 minutes to complete, participation was anonymous and no data were collected for clients who declined. Each respondent received a US\$20 gift card.

Measures

Demographic characteristics included age, gender, race/ethnicity, education, whether participants entered treatment for substance use, substance use and mental health or other reasons, and the primary drug for which participants entered treatment. Race/ethnicity categories were Hispanic/Latino, Black/African-American, non-Hispanic White and Multiracial/Other. Education was coded to less than high school, high school or equivalent, and some college or technical/trade school. Primary drug was categorised as alcohol, stimulants (amphetamine/methamphetamine, crack/cocaine), opiates and other. Some participants (n=17) self-reported that they were in treatment for mental health or criminal justice reasons, and did not report a primary drug problem. These cases were included in the 'other' primary drug category for analysis.

Current smoking status was defined as having smoked 100 cigarettes in lifetime and also reporting 'yes' to the question 'do you currently smoke cigarettes?'³⁴ To verify non-smoking status, expired breath carbon monoxide (CO) was measured after completion of the survey using a handheld piCO+ Smokerlyzer.³⁵ The Society for Research on Nicotine and Tobacco recommends using a CO cut-point in the range of 4 to 10 parts per million (ppm), depending on the measurement purpose and other factors known to influence CO readings.³⁶ Because

smoking is highly prevalent in SUD treatment and persons are likely to be exposed to secondhand smoke, we used ≤ 9 ppm to verify non-smoking status. A few cases ($n=17$, 4.2%) self-reported non-smoking status but registered expired CO above the cut-point. Smoking behaviour measures were not available for these discordant cases, so they were treated as non-smokers in the main analysis. However, we also conducted sensitivity analyses removing these 17 discordant cases.

Current cigarette smokers were asked about smoking behaviours that may be influenced by the menthol and other flavouring ban. These included the number of cigarettes per day (CPD) they smoked, whether they had quit smoking for at least 24 hours in the past year and whether they were thinking of quitting smoking within the next 30 days as a measure of readiness to quit.³⁷ To differentiate self-identified menthol smokers, current smokers were asked to describe their 'usual cigarette' as menthol or non-menthol. Menthol smokers were asked how they smoke menthol cigarettes (only menthol, mostly menthol, both, mostly non-menthol or 'don't know'). Cases reporting 'don't know' ($n=5$) were set to missing for analyses.

At waves 2 and 3, post-ban, current smokers were asked if they were aware of the menthol ban, and reasons why they may have reduced smoking, including the reason that their preferred flavour or brand of cigarettes was not available. Post-ban, menthol smokers were asked how the ban affected their smoking (smoke less, smoke menthol cigarettes the same as before, switched to non-menthol cigarettes, no impact). Last, menthol smokers were asked where they had obtained menthol cigarettes in the past month.

Data analysis

To ensure independent samples, wave 2 and wave 3 surveys asked the respondent if they had taken the survey before, and 21 cases responding 'yes' were removed from analyses. Included in the analyses were 382 clients surveyed at wave 1 ($n=160$), wave 2 ($n=102$) and wave 3 ($n=120$).

We first compared the three samples on demographic characteristics (age, gender, race/ethnicity, education), smoking status and primary drug for which participants entered treatment by using analysis of variance for continuous variables and χ^2 test/Fisher's exact test for categorical variables. Second, for current smokers, we summarised five smoking behaviours across waves, using means and SD for continuous variables and frequencies and percentages for categorical variables. These include CPD, past year quit attempt, thinking of quitting and reporting menthol as their usual cigarette and (for menthol smokers) how participants smoked menthol cigarettes. Next, multivariate regression models were used to assess change in each smoking behaviour across waves, one model for each outcome. Logistic regression was used for dichotomous outcomes, and Poisson regression for count outcome (CPD). All models adjusted for demographic characteristics (age, gender, race/ethnicity, education, primary drug), and also accounted for nesting clients within treatment programme. Generalised estimating equation methods were applied to adjust for correlated data. We conducted two sensitivity analyses to assess the robustness of multivariate findings. We re-ran each multivariate model after excluding 17 cases who self-reported non-smoking status but blew expired CO above the 9 ppm cut-point, and after excluding 17 cases who reported that they were in treatment for reasons other than treatment for a primary substance use problem. Last, we summarised responses to post-ban survey questions related to awareness of the ban, self-reported impact

post-ban, and access to menthol cigarettes. All analyses were conducted using SAS V.9.4.

RESULTS

Comparison of demographic characteristics across waves

As a proportion of all clients living in the two programmes at the time of data collection, survey participation rates were 93% at wave 1, 86% at wave 2 and 85% at wave 3. Across all waves, a total of five clients declined to participate. All participants, collapsed across waves, had a mean age of 43.8 (SD=11.9), were mostly (81.1%) men and nearly half (45.6%) had some education beyond high school. The sample was 31.4% African-American, 30.4% non-Hispanic White, 24.6% Hispanic and 13.6% of other, or multiple, racial/ethnic backgrounds. Most participants (71.2%) were current cigarette smokers. The three samples differed only on primary drug for which they entered treatment, such that, in wave 2, there were fewer cases in treatment for alcohol use and more cases in treatment for other reasons (table 1).

Comparison of smoking behaviour across waves

Table 2 shows the number of current smokers, and smoking behaviour variables, at each wave. For menthol smokers, the table reports the proportion smoking only menthol, mostly menthol, both or mostly non-menthol.

Table 3 shows results of pairwise comparisons between waves, based on multivariate regression analyses controlling for demographic characteristics, and adjusting for nesting of participants within programme. In table 3, how participants smoked menthol cigarettes is dichotomised to only menthol versus all other response codes. To interpret table 3, it is helpful to consider the percentages reported in table 2. For example, among current smokers, number of CPD increased and then decreased, but wave 3 (post-ban) did not differ from wave 1 (pre-ban). The odds of thinking of quitting smoking, among current smokers, were lower post-ban (OR=0.44, 95% CI 0.29 to 0.67). These results suggest no observable impact of the ban on CPD, or readiness to quit smoking.

There were two findings that appear consistent with decreasing availability of flavoured tobacco products, including menthol cigarettes. First, the likelihood that smokers reported menthol as their usual cigarette was lower at wave 2 (OR=0.80, 95% CI 0.72 to 0.90), compared with wave 1. Second, the likelihood that menthol smokers smoked only menthol cigarettes was lower at wave 3, as compared with both wave 1 (OR=0.19, 95% CI 0.18 to 0.19) and wave 2 (OR=0.32, 95% CI 0.12 to 0.89). In sensitivity analyses removing 17 cases who had discordant self-report versus expired CO smoking status, and removing 17 cases who said they were in treatment for reasons other than a primary substance use problem, the pattern of results was unchanged (data not shown).

Awareness, impact and access

Table 4 summarises participant response to questions, asked post-ban, concerning awareness of the ban, response to the ban and access to menthol cigarettes. We show only data only for wave 3, as there were no differences in responses between waves, and wave 3 responses occurred furthest from when the ban was implemented. Among all smokers, post-ban, 82% were aware of the menthol ban. Asked the main reason why they may have reduced their smoking, very few (6.8%) said they reduced smoking because their preferred flavour or brand was not available. Among current menthol smokers post-ban, 16.7% reported

Table 1 Demographics and sample characteristics of substance use disorder treatment clients across survey waves

	Mean (SD) or n (%)				χ^2/F (df)	P value
	Total (n=382)	Wave 1 pre-menthol ban June 2018 (n=160)	Wave 2 post-menthol ban May 2019 (n=102)	Wave 3 post-menthol ban November 2019 (n=120)		
Age	43.8 (11.9)	43.0 (11.1)	44.9 (12.4)	43.9 (12.4)	0.79 (2)	0.454
Sex*						0.244†
Male	309 (81.1%)	128 (80.5%)	83 (81.4%)	98 (81.7%)		
Female	60 (15.8%)	29 (18.2%)	13 (12.8%)	18 (15.0%)		
Other	12 (3.2%)	2 (1.3%)	6 (5.9%)	4 (3.3%)		
Race/ethnicity					6.03 (6)	0.420
Hispanic	94 (24.6%)	43 (26.9%)	24 (23.5%)	27 (22.5%)		
Black or African-American	120 (31.4%)	45 (28.1%)	36 (35.3%)	39 (32.5%)		
White or Caucasian	116 (30.4%)	44 (27.5%)	33 (32.4%)	39 (32.5%)		
Other/multiple	52 (13.6%)	28 (17.5%)	9 (8.8%)	15 (12.5%)		
Education					0.55 (4)	0.968
Less than high school/GED	90 (23.6%)	36 (22.5%)	25 (24.5%)	29 (24.2%)		
High school diploma or GED equivalent	118 (30.9%)	48 (30.0%)	31 (30.4%)	39 (32.5%)		
Some college or technical/trade school	174 (45.6%)	76 (47.5%)	46 (45.1%)	52 (43.3%)		
Current cigarette smoker	272 (71.2%)	114 (71.3%)	69 (67.7%)	89 (74.2%)	3.37 (4)	0.498
Primary drug*					12.64 (6)	0.049
Alcohol	82 (21.5%)	40 (25.0%)	12 (11.9%)	30 (25.0%)		
Stimulants	169 (44.4%)	70 (43.8%)	47 (46.5%)	52 (43.3%)		
Opiates	86 (22.6%)	37 (23.1%)	23 (22.8%)	26 (21.7%)		
Other	44 (11.6%)	13 (8.1%)	19 (18.8%)	12 (10.0%)		
Programmes					2.14 (2)	0.343
Site 1	165 (43.2%)	76 (47.5%)	40 (39.2%)	49 (40.8%)		
Site 2	217 (56.8%)	84 (52.5%)	62 (60.8%)	71 (59.2%)		

*Gender has missing data for one case at wave 1. Primary drug has missing data for one case at wave 2.

†Fisher's exact test

χ^2 , chi-square test; F, Fisher's exact test.

smoking less, and all others reported either smoking menthol the same as before, switching to non-menthol or no impact. Last, at 11 months after the DPH began enforcing the ban, 50% of

menthol smokers reported recent purchase of menthol cigarettes in San Francisco.

Table 2 Smoking behaviour of substance use disorder treatment clients across survey waves

	Mean (SD) or n (%)		
	Wave 1 pre-menthol ban June 2018 (n=114)	Wave 2 post-menthol ban May 2019 (n=69)	Wave 3 post-menthol ban November 2019 (n=89)
Current smokers only			
Cigarettes smoked per day	9.5 (6.5)	11.6 (7.5)	9.3 (5.9)
Past year quit attempt	70 (61.4%)	41 (59.4%)	51 (58.0%)
Thinking of quitting in the next 30 days	53 (46.5%)	19 (27.9%)	32 (36.4%)
Usual cigarette is menthol	55 (48.3%)	29 (42.0%)	36 (40.0%)
Menthol smokers only			
In past month, describe how you smoke menthol cigarettes:			
Only menthol	28 (53.9%)	10 (34.5%)	7 (20.6%)
Mostly menthol	7 (13.5%)	10 (34.5%)	12 (35.3%)
Both menthol and non-menthol	17 (32.7%)	8 (27.6%)	12 (35.3%)
Mostly non-menthol	0 (0.0%)*	1 (3.5%)	3 (8.3%)*

*Total does not add to column total due to missing data for two to three cases.

DISCUSSION

We surveyed samples of persons enrolled in two residential SUD treatment programmes before and after the implementation of a local tobacco flavouring ban, which included a ban on sale of menthol cigarettes. Smoking prevalence in the sample is not analysed or interpreted in this report, due to the small sample size and the cross-sectional design. However, associations that are conditional on measurable qualities of the sample, such as current smoking status, can be interpreted. Among current smokers, we found no evidence that the ban was associated with decreased CPD, increased past year quit attempts, or with increased readiness to quit smoking. In findings that may be consistent with the flavouring ban, respondents were less likely to report menthol as their usual cigarette post-ban, and self-identified menthol smokers were less likely to report smoking only menthol cigarettes. When current menthol smokers were asked how the ban affected their smoking behaviour, a small proportion said they reduced smoking, while most reported continuing to smoke menthol cigarettes at the same rate or switching to non-menthol cigarettes. Perhaps most importantly, 50% of self-identified menthol smokers reported purchasing menthol cigarettes in San Francisco nearly 1 year after the ban was implemented. While this study did not test associations with different levels of compliance, it seems likely that observed

Table 3 Multivariate regression models of changes in tobacco use behaviour across survey waves

	(Wave 2 vs Wave 1 ^(ref))#§		(Wave 3 vs Wave 1 ^(ref))#§		(Wave 3 vs Wave 2 ^(ref))#§	
	Odds/mean ratios (95% CI)	P value	Odds/mean ratios (95% CI)	P value	Odds/mean ratios (95% CI)	P value
Cigarettes smoked per day**	1.15 (1.11 to 1.19)	0.0001	0.97 (0.86 to 1.10)	0.665	0.85 (0.77 to 0.93)	<0.001
Past year quit attempt***	0.89 (0.56 to 1.43)	0.642	0.80 (0.71 to 0.91)	<0.001	0.90 (0.64 to 1.27)	0.547
Thinking of quitting in the next 30 days**	0.44 (0.29 to 0.67)	<0.001	0.62 (0.23 to 1.69)	0.352	1.41 (0.79 to 2.51)	0.249
Usual cigarette is menthol**	0.80 (0.72 to 0.90)	0.0002	0.81 (0.32 to 2.00)	0.640	1.00 (0.45 to 2.22)	0.998
Only smoke menthol cigarette in the past month††	0.58 (0.21 to 1.63)	0.303	0.19 (0.18 to 0.19)	<0.0001	0.32 (0.12 to 0.89)	0.029

Controlled for nesting of participants within programmes.

Presented are ORs for dichotomous outcomes and mean ratios for count outcome.

*Wave 2, post-menthol ban, May 2019.

†Wave 1, pre-menthol ban, June 2018.

‡Wave 3, post-menthol ban, November 2019.

§Smokers only.

¶Menthol smokers only.

Ref, reference category.

associations may be stronger where compliance with a ban is greater.

There are several reasons why this local flavouring ban may have, so far, had limited impact on smoking behaviour among persons in SUD treatment. A broader regional ban, such as the provincial ban in Ontario and subsequent federal ban, may more thoroughly restrict access to menthol cigarettes. In Chaiton *et al*,²¹ 22% of daily menthol smokers reported purchasing menthol cigarettes 1 year post-ban, at which point a federal ban had been implemented in addition to the provincial ban, as compared

with 50% in the current study examining a smaller, county-wide ban. Until the FDA bans menthol cigarettes in the USA, or until the number of local bans achieve critical mass in a region, the impact of menthol bans on smoking prevalence may be muted. Further, smokers enrolled in SUD treatment differ from general population smokers. As a group they have higher smoking prevalence²² smoke more heavily²⁴ and have more difficulty quitting smoking.²⁵ In other populations, the implications of menthol smoking may differ. For example, a recent study of smokers from eight countries in the EU found that menthol smokers were less dependent than non-flavoured cigarette smokers, which could lead to greater quitting success among menthol smokers.³⁸ Nevertheless, studies have shown that switching to non-menthol cigarettes in response to a menthol ban is likely among general population smokers, and may be a more likely alternative to quitting for persons in SUD treatment.^{16 19 21}

The sample consists of convenience samples of two residential treatment programmes at three points in time. These may not be representative of people attending residential treatment programmes in San Francisco, or elsewhere. The cross-sectional design also limits interpretation. For these reasons we have not tested or interpreted change in smoking prevalence over time, except as a descriptive characteristic. Findings reported here concern smokers in SUD treatment, and do not generalise to the overall smoking population. Eleven months after enforcement of the flavouring ban started, and at a time when the county reported high compliance among retailers, half of menthol smokers reported recent local purchase of menthol cigarettes. While there may be error in both the compliance estimate and the recent purchase estimate, it seems that some menthol smokers still found local retail access to menthol cigarettes, suggesting circumvention of the ban. Tobacco companies have also responded to menthol bans elsewhere with tactics designed to undermine them, including introducing menthol accessories not covered by the bans and intentionally packaging non-menthol alternatives to attract menthol smokers.^{39 40} Last, this paper concerns established adult smokers. It offers no data, inference or conclusion regarding how the ban may affect adolescent smoking.

Menthol cigarettes, and the failure of the FDA to ban menthol cigarettes to date, are contentious issues, and there are many likely positive effects of menthol bans. They may reduce uptake

Table 4 Attitudes toward flavouring ban, access to menthol cigarettes and self-report impact on smoking

	Wave 3 post-menthol ban November 2019
Current smokers only (n=89)	
Are you aware there is a ban on the sale of menthol cigarettes in San Francisco? (yes)	73 (82.0%)
What is the main reason for reducing your smoking?	
Preferred flavour or brand is not available	6 (6.8%)
Cost of a pack of cigarettes	11 (12.5%)
Health concerns	49 (55.7%)
Other reason	13 (14.8%)
I have not tried to reduce or quit smoking	9 (10.2%)
Menthol smokers only (n=36)	
In the past month, where have you obtained menthol cigarettes? (select all that apply)	
I purchased them from a store in San Francisco	18 (50.0%)
I purchased them from store outside San Francisco	13 (36.1%)
A friend or family member	7 (19.4%)
Other	2 (5.6%)
Has the ban on the sale of menthol cigarettes in San Francisco affected your cigarette smoking?	
I smoke less because of the ban	6 (16.7%)
I smoke menthol cigarettes about the same as before	16 (44.4%)
I switched to non-menthol cigarettes because of the ban	11 (30.6%)
No impact	3 (8.3%)

As there were no differences between responses for waves 2 and 3, only wave 3 data are shown. The survey question concerning main reason for reducing smoking had one case with missing data.

of combustible cigarette smoking among youth, they may reduce tobacco-related health disparities in populations targeted by menthol advertising, and they may galvanise communities to further regulate tobacco at local or regional levels. They may increase quitting smoking, as shown in Ontario²¹ and, by removing menthol's potentiating effect on nicotine, they may facilitate later quitting among those who continue to smoke. The tobacco control community ardently anticipates these outcomes, and we hope that future research may convincingly demonstrate such outcomes. Our findings, however, are cautionary. In subgroups where smoking has remained elevated despite decades of tobacco control regulation, like those receiving substance use treatment, local menthol bans alone maybe insufficient to limit access to menthol cigarettes and promote cessation among current smokers. Stronger impacts on adult smoking, if they occur at all, may require regional, state or national bans that effectively restrict access to menthol-flavoured products, along with targeted interventions to help menthol users quit smoking.

What this paper adds

- ▶ There are few data concerning how menthol bans impact smoking behaviour among adult smokers.
- ▶ No studies to date have investigated how high prevalence smoking subgroups, such as those with substance use or mental health problems, respond to local menthol bans.
- ▶ Adults enrolled in residential treatment for substance use disorder were surveyed before and after a menthol ban was implemented in San Francisco, California.
- ▶ Post-ban, as compared with pre-ban, smokers showed no change in number of cigarettes smoked per day, and no change in the proportion who were thinking of quitting smoking.
- ▶ Post-ban, as compared with pre-ban, smokers were less likely to report menthol cigarettes as their preferred cigarette, and less likely to report smoking only menthol cigarettes.
- ▶ Nearly 1 year after the ban was implemented, 50% of menthol smokers reported recent purchase of menthol cigarettes in San Francisco, suggesting limited compliance.
- ▶ A federal ban on menthol cigarettes, or a critical mass of local or regional bans, may be needed to prevent circumvention and reduce smoking behaviour in subgroups where smoking remains prevalent.

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REFERENCES

- 1 U.S. Food and Drug Administration. *Family smoking prevention and tobacco control act. Public Law*, 2018: 111–31. <https://www.fda.gov/tobacco-products/rules-regulations-and-guidance/family-smoking-prevention-and-tobacco-control-act-table-contents>
- 2 TPSAC. *Menthol cigarettes and public health: review of the scientific evidence and recommendations*. Rockville, MD: US Department of Health and Human Services, Food and Drug Administration, 2011.
- 3 U.S. Food and Drug Administration. *Preliminary scientific evaluation of the possible public health effects of menthol versus Nonmenthol cigarettes*. Silver Spring, MD: Center for Tobacco Products, Food and Drug Administration, 2013.
- 4 Gardiner PS. The African Americanization of menthol cigarette use in the United States. *Nicotine Tob Res* 2004;6(Suppl 1):S55–65.
- 5 Landrine H, Klonoff EA, Fernandez S, et al. Cigarette advertising in black, Latino, and white magazines, 1998-2002: an exploratory investigation. *Ethn Dis* 2005;15:63–7.
- 6 Villanti AC, Mowery PD, Delnevo CD, et al. Changes in the prevalence and correlates of menthol cigarette use in the USA, 2004-2014. *Tob Control* 2016;25:i14–20.
- 7 Young-Wolff KC, Hickman NJ, Kim R, et al. Correlates and prevalence of menthol cigarette use among adults with serious mental illness. *Nicotine Tob Res* 2015;17:285–91.
- 8 Gubner NR, Williams DD, Pagano A, et al. Menthol cigarette smoking among individuals in treatment for substance use disorders. *Addict Behav* 2018;80:135–41.
- 9 Winhusen TM, Adinoff B, Lewis DF, et al. A tale of two stimulants: mentholated cigarettes may play a role in cocaine, but not methamphetamine, dependence. *Drug Alcohol Depend* 2013;133:845–51.
- 10 Gardiner P, Clark PI. Menthol cigarettes: moving toward a broader definition of harm. *Nicotine Tob Res* 2010;12(Suppl 2):S85–93.
- 11 WHO. Advisory note: banning menthol in tobacco products. WHO Study Group on tobacco product regulation (TobReg); 2016.
- 12 Brown J, DeAtley T, Welding K, et al. Tobacco industry response to menthol cigarette bans in Alberta and Nova Scotia, Canada. *Tob Control* 2017;26:e71–4.
- 13 Mass.gov. 2019 tobacco control law, 2019. Available: <https://www.mass.gov/guides/2019-tobacco-control-law>
- 14 Glantz SA, Gardiner P. Local movement to ban menthol tobacco products as a result of federal inaction. *JAMA Intern Med* 2018;178:711–3.
- 15 City of Chicago. Amendment of Chapter 4-64 of municipal code by adding new section 4-64-098 regarding flavored tobacco products and amending Section 4-64-180 (a) No person shall sell tobacco products or accessories within 100 feet of any building, school or child care facility; (b) No person shall sell tobacco products at any location within 500 feet of public, private or parochial elementary school or secondary school, 2013. Available: <https://www.chicago.gov/content/dam/city/depts/bacp/tobacco/flavoredtobaccord04212014.pdf>
- 16 O'Connor RJ, Bansal-Travers M, Carter LP, et al. What would menthol smokers do if menthol in cigarettes were banned? Behavioral intentions and simulated demand. *Addiction* 2012;107:1330–8.
- 17 Pearson JL, Abrams DB, Niaura RS, et al. A ban on menthol cigarettes: impact on public opinion and smokers' intention to quit. *Am J Public Health* 2012;102:e107–14.
- 18 Rose SW, Ganz O, Zhou Y, et al. Longitudinal response to restrictions on menthol cigarettes among young adult us menthol smokers, 2011-2016. *Am J Public Health* 2019;109:1400–3.
- 19 Zatoński M, Herbec A, Zatoński W, et al. Characterising smokers of menthol and flavoured cigarettes, their attitudes towards tobacco regulation, and the anticipated impact of the tobacco products directive on their smoking and quitting behaviours: the EUREST-PLUS ITC Europe surveys. *Tob Induc Dis* 2018;16:A4.
- 20 Chaiton M, Schwartz R, Cohen JE, et al. Association of Ontario's ban on menthol cigarettes with smoking behavior 1 month after implementation. *JAMA Intern Med* 2018;178:710–1.
- 21 Chaiton MO, Nicolau I, Schwartz R, et al. Ban on menthol-flavoured tobacco products predicts cigarette cessation at 1 year: a population cohort study. *Tob Control* 2020;29:341–347.
- 22 McClure EA, Acquavita SP, Dunn KE, et al. Characterizing smoking, cessation services, and quit interest across outpatient substance abuse treatment modalities. *J Subst Abuse Treat* 2014;46:194–201.
- 23 Prochaska JJ, Das S, Young-Wolff KC. Smoking, mental illness, and public health. *Annu Rev Public Health* 2017;38:165–85.

- 24 Ward KD, Kedia S, Webb L, *et al.* Nicotine dependence among clients receiving publicly funded substance abuse treatment. *Drug Alcohol Depend* 2012;125:95–102.
- 25 Stein MD, Caviness CM, Kurth ME, *et al.* Varenicline for smoking cessation among methadone-maintained smokers: a randomized clinical trial. *Drug Alcohol Depend* 2013;133:486–93.
- 26 Ranjit A, Latvala A, Kinnunen TH, *et al.* Depressive symptoms predict smoking cessation in a 20-year longitudinal study of adult twins. *Addict Behav* 2020;108:106427.
- 27 Bandiera FC, Anteneh B, Le T, *et al.* Tobacco-related mortality among persons with mental health and substance abuse problems. *PLoS One* 2015;10:e0120581.
- 28 Colton CW, Manderscheid RW. Congruencies in increased mortality rates, years of potential life lost, and causes of death among public mental health clients in eight states. *Prev Chronic Dis* 2006;3:A42.
- 29 Farris SG, Aston ER, Zvolensky MJ, *et al.* Psychopathology and tobacco demand. *Drug Alcohol Depend* 2017;177:59–66.
- 30 Steinberg ML, Williams JM, Li Y. Poor mental health and reduced decline in smoking prevalence. *Am J Prev Med* 2015;49:362–9.
- 31 Weinberger AH, Gbedemah M, Wall MM, *et al.* Cigarette use is increasing among people with illicit substance use disorders in the United States, 2002–14: emerging disparities in vulnerable populations. *Addiction* 2018;113:719–28.
- 32 Yang YT, Glantz S. San Francisco voters end the sale of flavored tobacco products despite strong industry opposition. *Ann Intern Med* 2018;169:708–9.
- 33 Vyas P, Ling P, Gordon B, *et al.* Compliance with San Francisco's flavoured tobacco sales prohibition. *Tob Control* 2021;30:227–30.
- 34 CDC. National center for health statistics. Adult tobacco use information. National health interview survey; 2017.
- 35 Bedfont Scientific Ltd. piCO monitor, 2018. Available: <https://www.bedfont.com/shop/smokerlyzer/pico>
- 36 Benowitz NL, Bernert JT, Foulds J, *et al.* Biochemical verification of tobacco use and abstinence: 2019 update. *Nicotine Tob Res* 2020;22:1086–97.
- 37 DiClemente CC, Prochaska JO, Fairhurst SK, *et al.* The process of smoking cessation: an analysis of precontemplation, contemplation, and preparation stages of change. *J Consult Clin Psychol* 1991;59:295–304.
- 38 Herbeć A, Zatoński M, Zatoński WA, *et al.* Dependence, plans to quit, quitting self-efficacy and past cessation behaviours among menthol and other flavoured cigarette users in Europe: the EUREST-PLUS ITC Europe surveys. *Tob Induc Dis* 2018;16.
- 39 Hiscock R, Silver K, Zatoński M, *et al.* Tobacco industry tactics to circumvent and undermine the menthol cigarette ban in the UK. *Tob Control* 2020;29:e138–42.
- 40 Borland T, D'Souza SA, O'Connor S, *et al.* Is blue the new green? Repackaging menthol cigarettes in response to a flavour ban in Ontario, Canada. *Tob Control* 2019;28:e7–12.