

Differences in Switching Away from Cigarettes and JUUL Use Characteristics among Adult Menthol and Nonmenthol Smokers Who Purchased the JUUL System

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Introduction

- Menthol cigarettes comprise approximately 35% of the United States market (Delnevo et al., 2020)
- Smoking mentholated (vs. nonmentholated) cigarettes is associated with lower rates of smoking cessation and increased levels of nicotine dependence (TPSAC, 2011; Villanti et al., 2017)
- While prevalence of smoking nonmentholated cigarettes has declined in the US over the last two decades, prevalence of menthol cigarette smoking has remained stable or even increased (Delnevo et al., 2014; Giovino et al., 2015; Villanti et al., 2016)
- Recent data demonstrates that a significantly larger proportion of menthol (vs. nonmenthol) smokers report using Electronic Nicotine Delivery Systems (ENDS) in menthol/mint flavors (Rostron et al., 2020)
- The current 1-year longitudinal observational study of adult smokers who purchased the JUUL System (“JUUL”) assessed if smokers of mentholated (vs. nonmentholated) cigarettes differed in:
 - Switching away from cigarettes
 - JUUL use characteristics, including preferred flavors

Methods

- A sample of US adults (age ≥ 21 years) who purchased a JUUL Starter Kit in a retail store or online between June and October 2018 were invited to participate in the Adult JUUL Switching and Smoking Trajectories (ADJUSST) Study (Shiffman et al., 2021)
- Study inclusion criteria were:
 - Age ≥ 21 years
 - Purchased a JUUL Starter Kit for the first time within past seven days
 - Permanent residency in the US
 - Not employed or related to an employee of Juul Labs, Inc
- After the baseline assessment, participants were invited to complete 1-, 2-, 3-, 6-, 9- and 12-month follow-ups.
- This secondary analysis of the ADJUSST focused on established smokers at baseline (smoked ≥ 100 cigarettes, smoked in past 30 days, smoked some days or every day) with data on menthol cigarette preference at baseline and smoking at ≥ 1 follow-up
- At each follow-up past-30-day switching was operationalized as a “No” response to the question, “In the past 30 days, have you smoked a cigarette, even one or two puffs?”
- Analyses utilized repeated-measure logistic regression models to assess associations of menthol (vs. nonmenthol) smoking and past-30-day switching (yes/no) across the six follow-up assessments

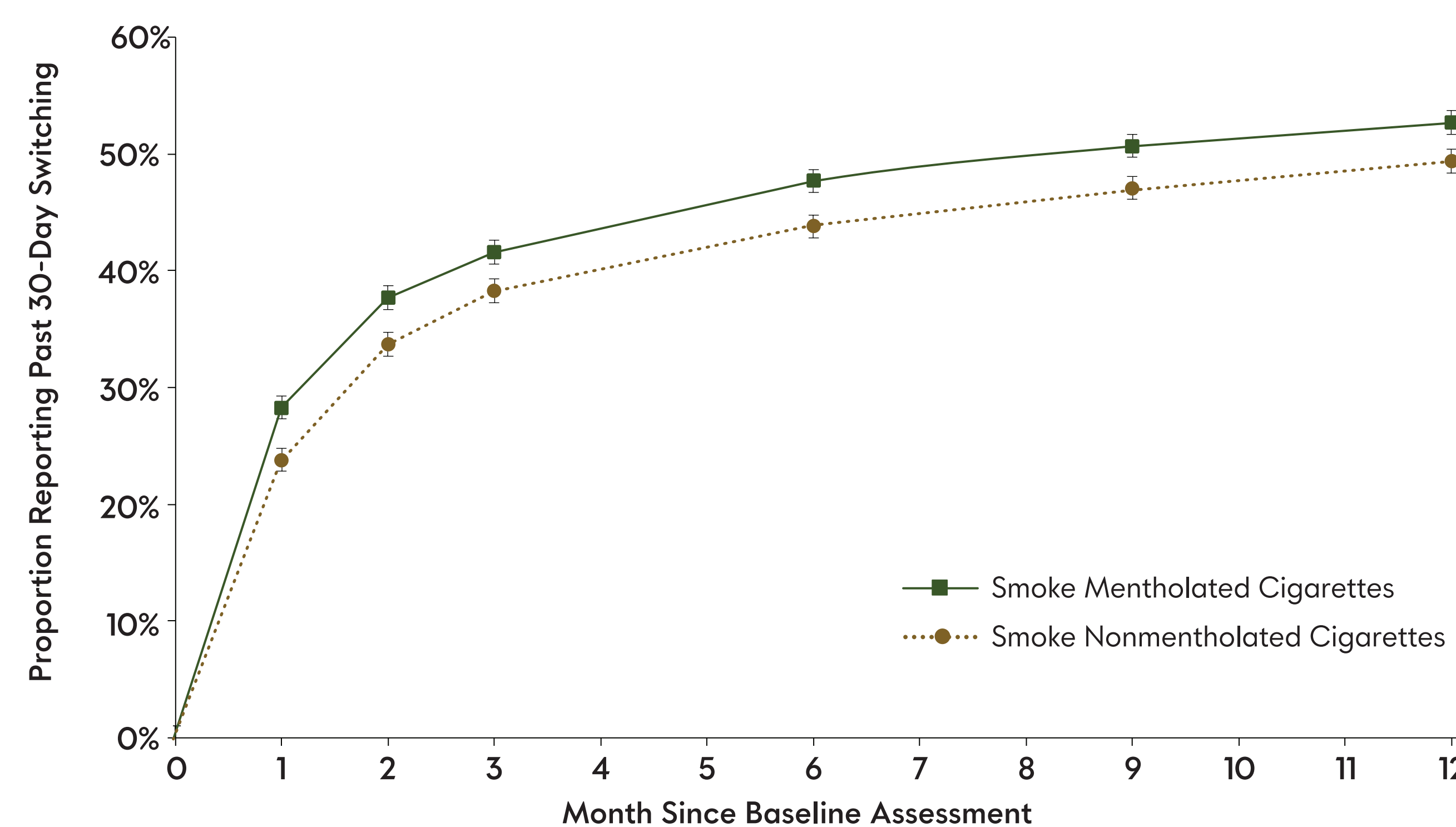
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Results

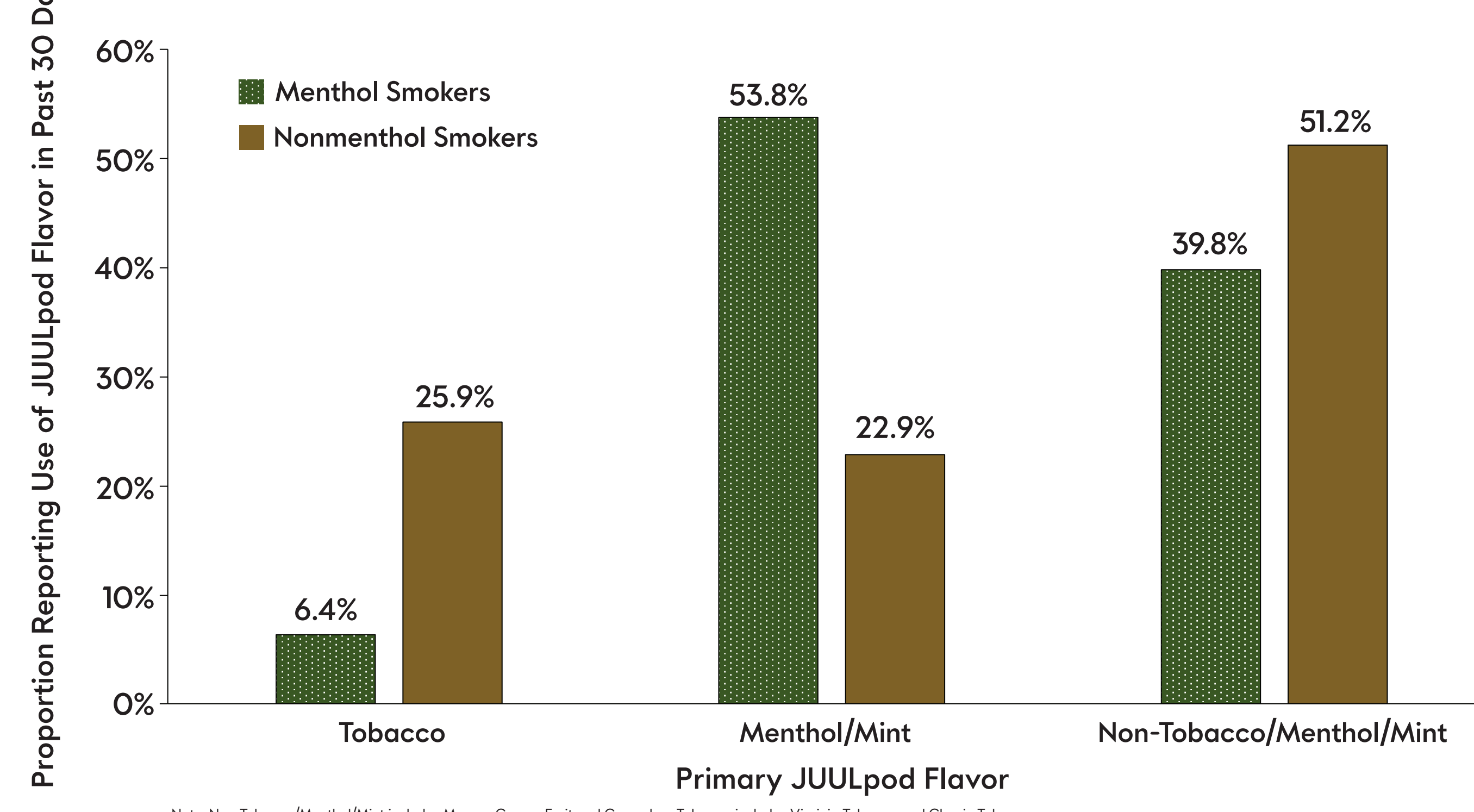
- Adult smokers of nonmentholated cigarettes were the majority (58.8%; N=8,842; mentholated=41.2%; N=6,194)
- At each of the six follow-ups, a greater proportion of menthol (vs. nonmenthol) smokers reported past-30-day switching; aggregated across all six follow-ups 42.6% of menthol smokers, compared to 38.8% of nonmenthol, reported switching (**Figure 1**)
- In the unadjusted model, menthol smokers had 17% greater odds of switching across all follow-up assessments (OR[95% CI]=1.17[1.11, 1.23]).
- After adjustment for all sociodemographic, smoking and JUUL use characteristics, the association remained significant (OR[95% CI]=1.13[1.05, 1.20]).
- There were significant differences in primary JUULpod flavor used across follow-ups: 53.8% of menthol smokers primarily used Menthol/Mint JUULpods, compared to 22.9% of nonmenthol smokers; only 6.4% of menthol smokers used tobacco flavors (vs. 25.9% of nonmenthol smokers) and 51.2% of nonmenthol smokers used non-Tobacco/Menthol/Mint flavors (vs. 39.8% of menthol smokers; **Figure 2**)
- Although there were several statistically significant differences in sociodemographic and smoking characteristics between menthol and nonmenthol smokers, the magnitude of these differences were generally small.

Figure 1. Proportion of Participants Reporting Switching by Menthol Cigarette Smoking across 12-Month Follow-Up Period (Mean±SE)



Note: Menthol Smokers: 1-Month, N=4725; 2-Month, N=4722; 3-Month, N=4580; 6-Month, N=4054; 9-Month, N=4274; 12-Month, N=4166. Nonmenthol Smokers: 1-Month, N=4725; 2-Month, N=4690; 3-Month, N=4488; 6-Month, N=3842; 9-Month, N=3905; 12-Month, N=3785. The menthol smoking × time from baseline (i.e., follow-up assessment) interaction term was not significant (p=0.24).

Figure 2. Primary JUULpod Flavor Used in Past 30 Days by Menthol Smoking Across Follow-Up



Note: Non-Tobacco/Menthol/Mint includes Mango, Creme, Fruit and Cucumber. Tobacco includes Virginia Tobacco and Classic Tobacco. Primary JUULpod flavor used in the past 30 days was aggregated across all 6 follow-ups.

Table 1. Sample Characteristics by Menthol Smoking

Sociodemographic Characteristics	Menthol Smokers (N=6,194)	Nonmenthol Smokers (N=8,842)	Difference (p-value) ^a	Effect Size ^b
Age, yr, mean (SD)	30.86 (9.70)	33.72 (11.04)	<0.001	0.02
Sex				
Male	3,040 (49.3)	5,043 (57.3)		
Female	3,094 (50.2)	3,710 (42.2)	<0.001	0.005
Transgender	29 (0.5)	41 (0.5)		
Race/Ethnicity				
Non-Hispanic White	4,298 (73.4)	6,847 (82.2)		
Non-Hispanic African-American	299 (5.1)	103 (1.2)	<0.001	0.01
Non-Hispanic Asian	316 (5.4)	469 (5.6)		
Non-Hispanic Other Race	312 (5.3)	335 (4.0)		
Hispanic Ethnicity	631 (10.8)	575 (6.9)		
Marital status				
Married	1,517 (24.8)	2,674 (30.6)		
Divorced, separated or widowed	780 (12.8)	1,348 (15.4)	<0.001	<0.004
Never married	3,816 (62.4)	4,714 (54.0)		
Highest level of education completed				
High school graduate or less education	1,772 (30.7)	2,168 (25.8)	<0.001	0.01
Some college or associate degree	2,638 (45.7)	3,549 (42.3)		
Bachelor's degree or more education	1,359 (23.6)	2,682 (31.9)		
Annual household income				
Less than \$50,000	3,136 (58.0)	3,830 (49.0)	<0.001	0.01
\$50,000-\$100,000	1,513 (28.0)	2,447 (31.3)		
Greater than \$100,000	754 (14.0)	1,546 (19.8)		
Smoking Characteristics at Baseline				
No. days smoked in past 30 days, mean (SD)	23.80 (9.03)	23.90 (9.17)	0.54	<0.001
No. cigarettes smoked per day, mean (SD)	10.87 (7.76)	11.74 (8.23)	<0.001	0.003
Duration of regular smoking, yr, mean (SD)	10.78 (9.35)	13.69 (11.02)	<0.001	0.02
Cigarette dependence, mean (SD)	3.04 (1.06)	3.08 (1.06)	0.03	<0.001
Plan to quit smoking in next 30 days	2,637 (44.9)	3,579 (42.6)	0.007	<0.001
JUUL Use Characteristics across Follow-Up^d				
No. days used JUUL in past 30 days, mean (SD)	24.60 (8.34)	24.64 (8.32)	0.47	<0.001
No. times used JUUL per day, mean (SD)	11.47 (12.32)	10.72 (11.51)	<0.001	0.001
JUUL dependence, Mean (SD)	2.43 (0.95)	2.44 (0.93)	0.09	<0.001
Primary JUULpod flavor used in past 30 days				
Tobacco ^e	1,558 (6.4)	8,895 (25.9)	<0.001	0.08
Menthol/Mint	13,108 (53.8)	7,843 (22.9)		
Non-Tobacco/Menthol/Mint ^f	9,698 (39.8)	17,583 (51.2)		

Note: N=15,036. Denominators or sample size may be less than column heads due to missing data.
^aDifferences by menthol smoking were tested with χ^2 tests for categorical variables and one-way analysis of variance for continuous variables.
^bUncertainty coefficient (categorical variables) or R² (continuous variables).
^cAdapted from Tobacco Dependence Index in PATH adult survey (Range: 1-5).
^dTime-varying variables (assessed at all follow-up assessments, variables aggregated [categorical] or averaged [continuous] across all follow-ups).
^eVirginia and Classic Tobacco.
^fMango, Creme, Fruit, Cucumber.
 Uncertainty coefficient represents the proportional reduction in error when values of participant characteristics are used to predict menthol smoking. R² is an effect size indicator for continuous variables, expressing the percentage of variance in the continuous variable that is accounted for by the differences between respondent groups. For both effect-size estimates, lower values represent weaker relationships, with 0 representing no relationship and 1.0 a perfect relationship.

Conclusions

- Switch rates, while high among both adult menthol and nonmenthol smokers (>49% at 12 months), were significantly higher among menthol smokers across 1-year follow-up, even after statistical adjustment for sociodemographic, smoking and JUUL use characteristics.
- Over twice as many menthol (vs. nonmenthol) smokers used JUUL in Menthol/Mint flavors.
- This finding regarding flavor preference is consistent with behavioral economic research (e.g., discrete choice experiments, experimental tobacco marketplace) suggesting that menthol smokers prefer menthol-flavored ENDS products (Denlinger-Apte et al., 2020; Shang et al., 2020; Stein et al., 2018)
- Availability of ENDS in menthol flavors may be particularly important for smokers of mentholated cigarettes who would not otherwise quit.