

# Assessment of Actual Use Behavior for Flavored Nicotine Pouches Relative to Original Nicotine Pouches

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## Abstract

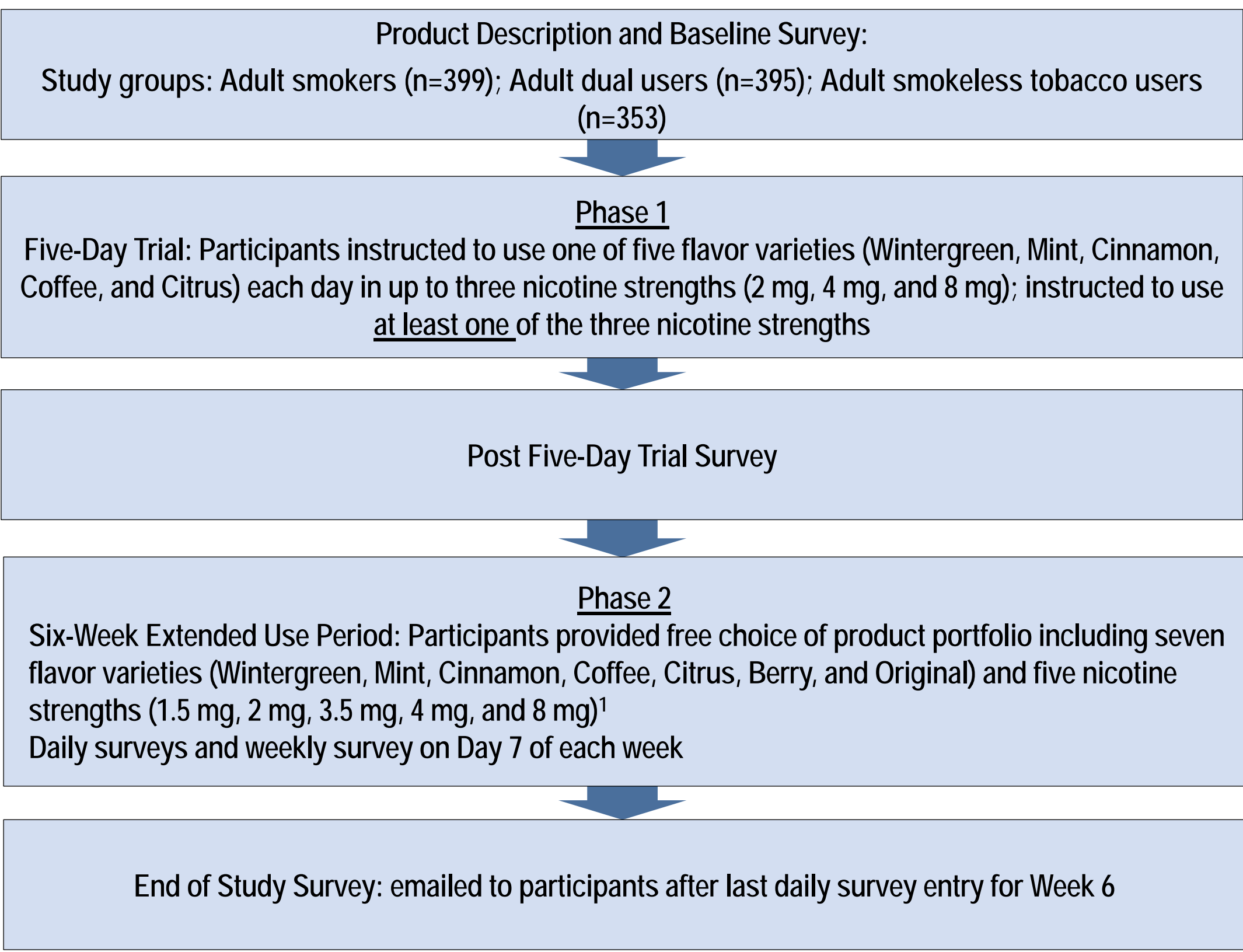
**Aim:** Empirical evidence is scarce regarding the potential impact of flavors in tobacco products on actual use behaviors. This study aimed to assess whether the use of flavor varieties (i.e., Berry, Cinnamon, Citrus, Coffee, Mint, and Wintergreen) may be associated with changes in *on!*® nicotine pouch (NP) consumption versus use of the Original products using data from a longitudinal study. **Methods:** Adult cigarette smokers (AS, n=399), dual users of cigarettes and smokeless tobacco (DU, n=395), and smokeless tobacco users (STU, n=353) received NP products to use under *ad libitum* conditions for 6 weeks. Daily diaries captured the number of pouches used and duration in the mouth for each NP flavor and nicotine level, as well as smoking and smokeless tobacco (ST) use behaviors. Mixed-effects generalized linear models were used to estimate associations between the use of each flavored product (vs. Original) and use behaviors. **Results:** Most participants used multiple flavors. No statistically significant differences were observed in the total number of NPs consumed per day or total minutes the NPs were kept in the mouth per day across all three user groups for comparisons between the six non-Original flavor varieties and the Original product. However, we noted exceptions with Mint and Wintergreen, both of which were associated with greater total minutes kept in the mouth per day among AS (model estimate=7.43 minutes; 95% CI=2.34 to 12.51 for Mint) and DU (estimate=7.60 minutes; 95% CI=2.35 to 12.85 for Wintergreen), respectively, representing an increase of ~1.4 minutes in the mouth per use occasion. Smoking and ST use behavior were comparable between users of flavored products and users of Original products, except for a few *inverse* associations (e.g., STU of Coffee flavored [vs. Original] products were less likely to use ST; OR=0.34; 95% CI=0.19 to 0.60). **Conclusion:** Our results suggest that use of flavored NPs is not associated with meaningful changes in NP consumption.

## Introduction

Nicotine pouches are nicotine-containing smoke-free products which do not contain any tobacco leaf. They offer noncombustible alternatives to adult smokers who are unable or unwilling to quit. Nicotine pouches, including *on!*®, are a growing category of tobacco products among adult tobacco consumers in the US. Nicotine pouches are typically available in various flavors. Empirical evidence is scarce regarding the potential impact exerted by flavors in tobacco products on actual use behaviors. The aim of this study was to assess whether the use of flavor varieties (i.e., Berry, Cinnamon, Citrus, Coffee, Mint, and Wintergreen) may be associated with increased *on!*® nicotine pouches consumption compared to use of Original products among adult tobacco users (≥21 years of age) using data from a longitudinal study with daily data collection for 6 weeks.

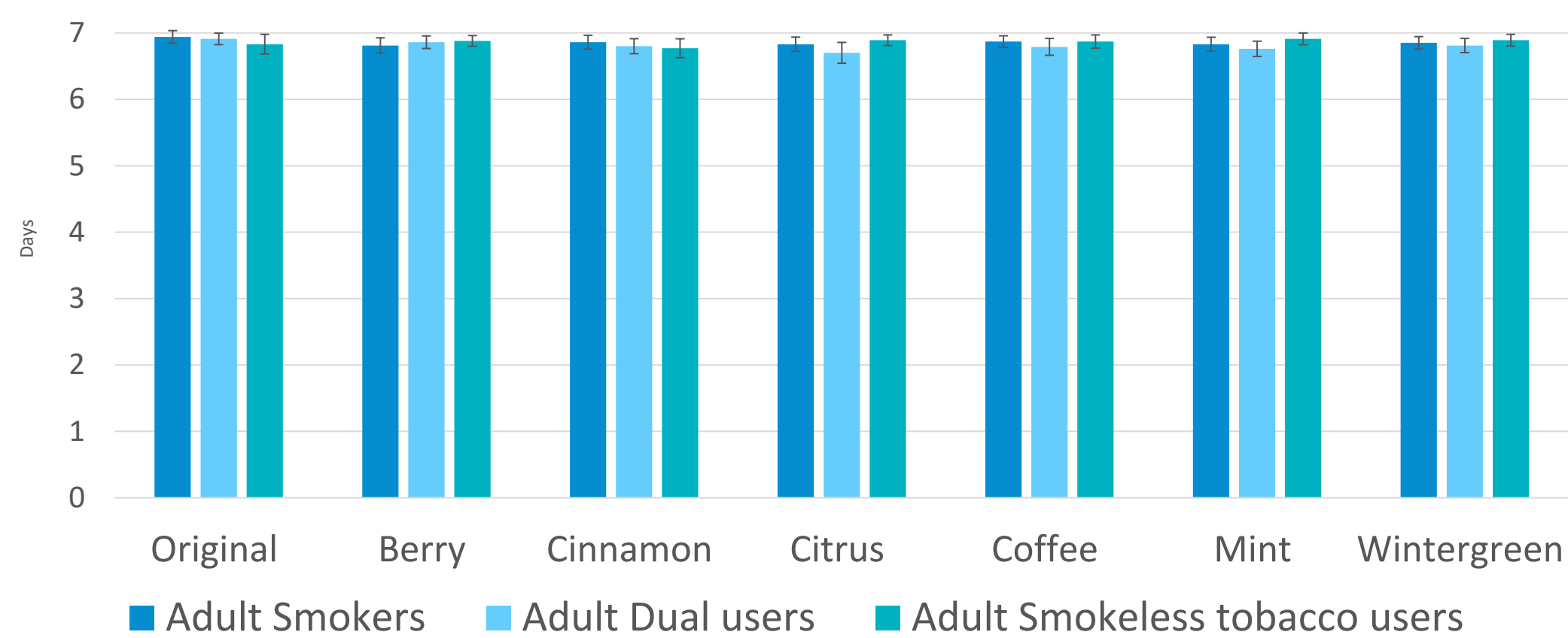
## Methods & Results

### Study Design



Most participants used *on!*® nicotine pouches every day.

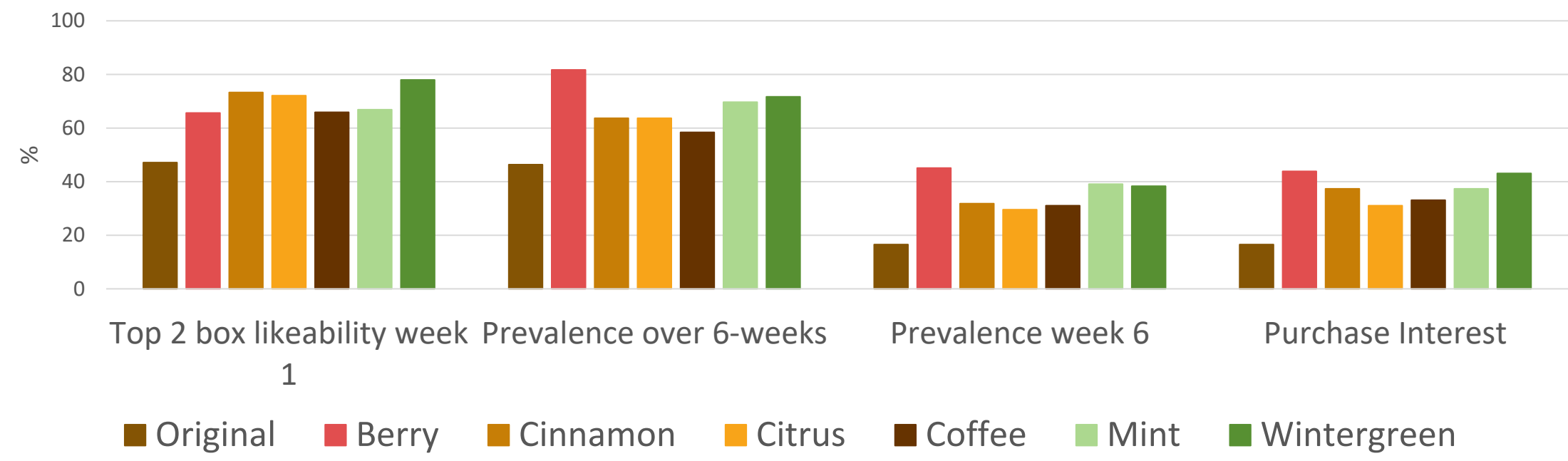
Figure 2. Mean number of days (95% CI) of *on!*® nicotine pouch use by flavor variety during week 6. Data from *on!*® Actual Use Study.



Smoking and smokeless tobacco use behavior were comparable between users of flavored products and users of Original products, except for a few *inverse* associations (e.g., STU of Coffee flavored [vs. Original] products were less likely to use ST; OR=0.34; 95% CI=0.19 to 0.60).

Most participants used multiple flavors and tended to prefer flavor varieties over Original. (Exclusive flavor use < 7% for any flavor variety in week 6)

Figure 1. Likeability, Use, and Purchase Interest (%) of *on!*® Nicotine Pouches by Flavor Variety among Adult Smokers during the 6-Week Trial.



No meaningful association between flavor use and consumption outcomes of *on!*® nicotine pouches.

Table 1. Estimated differences in *on!*® nicotine pouch use comparing each flavor with Original flavor using mixed-effects generalized linear regression. Data from *on!*® Actual Use Study.

	# of <i>on!</i> pouches consumed per day		# of minutes kept in mouth	
	Model 1 no covariates	Model 2 with covariates	Model 1 no covariates	Model 2 with covariates
	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)	Estimate (95% CI)
Adult Smokers				
Berry	1.03 (0.98, 1.08)	1.03 (0.99, 1.07)	5.51 (-0.93, 11.95)	5.16 (0.18, 10.14)
Cinnamon	1.00 (0.95, 1.06)	1.01 (0.96, 1.06)	3.02 (-4.68, 10.72)	2.47 (-3.49, 8.43)
Citrus	1.04 (0.98, 1.09)	1.04 (0.99, 1.10)	7.25 (0.96, 13.55)	6.95 (1.76, 12.14)
Coffee	1.01 (0.96, 1.06)	1.02 (0.97, 1.07)	3.59 (-3.32, 10.49)	3.07 (-2.64, 8.78)
Mint	1.04 (0.98, 1.10)	1.05 (1.00, 1.11)	6.62 (0.30, 12.94)	<b>7.43 (2.34, 12.51)</b>
Wintergreen	1.04 (0.98, 1.10)	1.04 (0.98, 1.10)	6.88 (0.29, 13.47)	5.20 (0.40, 10.00)
Adult Dual Users				
Berry	1.07 (1.01, 1.14)	1.02 (0.98, 1.08)	6.68 (-0.33, 13.69)	2.08 (-3.30, 7.46)
Cinnamon	1.05 (0.99, 1.12)	0.98 (0.93, 1.03)	5.90 (-1.71, 13.50)	0.16 (-6.50, 6.83)
Citrus	1.07 (0.99, 1.15)	1.03 (0.98, 1.08)	8.23 (-0.10, 16.56)	4.34 (-0.68, 9.37)
Coffee	1.04 (0.97, 1.11)	1.02 (0.96, 1.07)	5.57 (-4.27, 15.41)	2.32 (-4.00, 8.64)
Mint	1.07 (0.99, 1.15)	1.04 (0.99, 1.09)	7.24 (-1.92, 16.40)	3.86 (-1.41, 9.13)
Wintergreen	1.12 (1.04, 1.21)	1.06 (1.01, 1.12)	<b>13.90 (4.76, 23.04)</b>	<b>7.60 (2.35, 12.85)</b>
Adult Smokeless Tobacco Users				
Berry	1.00 (0.95, 1.07)	0.97 (0.92, 1.02)	2.25 (-4.63, 9.13)	0.24 (-5.23, 5.70)
Cinnamon	1.00 (0.93, 1.06)	0.99 (0.95, 1.04)	0.62 (-6.46, 7.71)	-2.14 (-8.15, 3.88)
Citrus	1.04 (0.96, 1.13)	1.00 (0.95, 1.04)	4.64 (-3.92, 13.19)	0.31 (-5.45, 6.06)
Coffee	1.06 (1.00, 1.12)	1.01 (0.97, 1.06)	9.16 (1.68, 16.64)	4.83 (-0.89, 10.55)
Mint	1.00 (0.95, 1.06)	0.99 (0.95, 1.04)	3.06 (-3.35, 9.47)	0.50 (-4.42, 5.43)
Wintergreen	0.99 (0.92, 1.06)	0.99 (0.94, 1.04)	1.90 (-5.17, 8.97)	0.50 (-4.82, 5.82)

CI: Confidence interval. Model 1 included indicator variables for the seven varieties and the time variable (day). Model 2 additionally included total nicotine of *on!*® pouches that day, number of cigarettes smoked that day, number of smokeless tobacco use occasions that day, cigarettes per day at screening, number of smokeless tobacco use occasions per day at screening, sex, age, race/ethnicity, income, and education. After Bonferroni adjustment for conducting six contrasts per model (0.5/6=0.008), p-values less than 0.008 are significant. Significant results in bold.

## Conclusion

Use of flavored nicotine pouches is common and is not associated with meaningful changes in nicotine pouch consumption compared to the Original variety.

## Strengths and Limitations

### Strengths:

- Ad lib use in a natural setting
- Daily diary provides more nuanced data for 6 weeks
- Mixed-effects models take into account repeated measures

### Limitations:

- Observational study design
- Non-probability sample
- Products were provided to participants

<sup>1</sup> 1.5 mg and 3.5 mg were labeled as 1 mg and 3 mg in the study

