

Cigarette Reduction and Switching Behavior by Menthol Cigarette Preference and Menthol Heated Tobacco Product Use Among Adults Who Smoke Cigarettes

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Center for Research and Technology
Tobacco Science Research Conference
September 24-27, 2023

Introduction

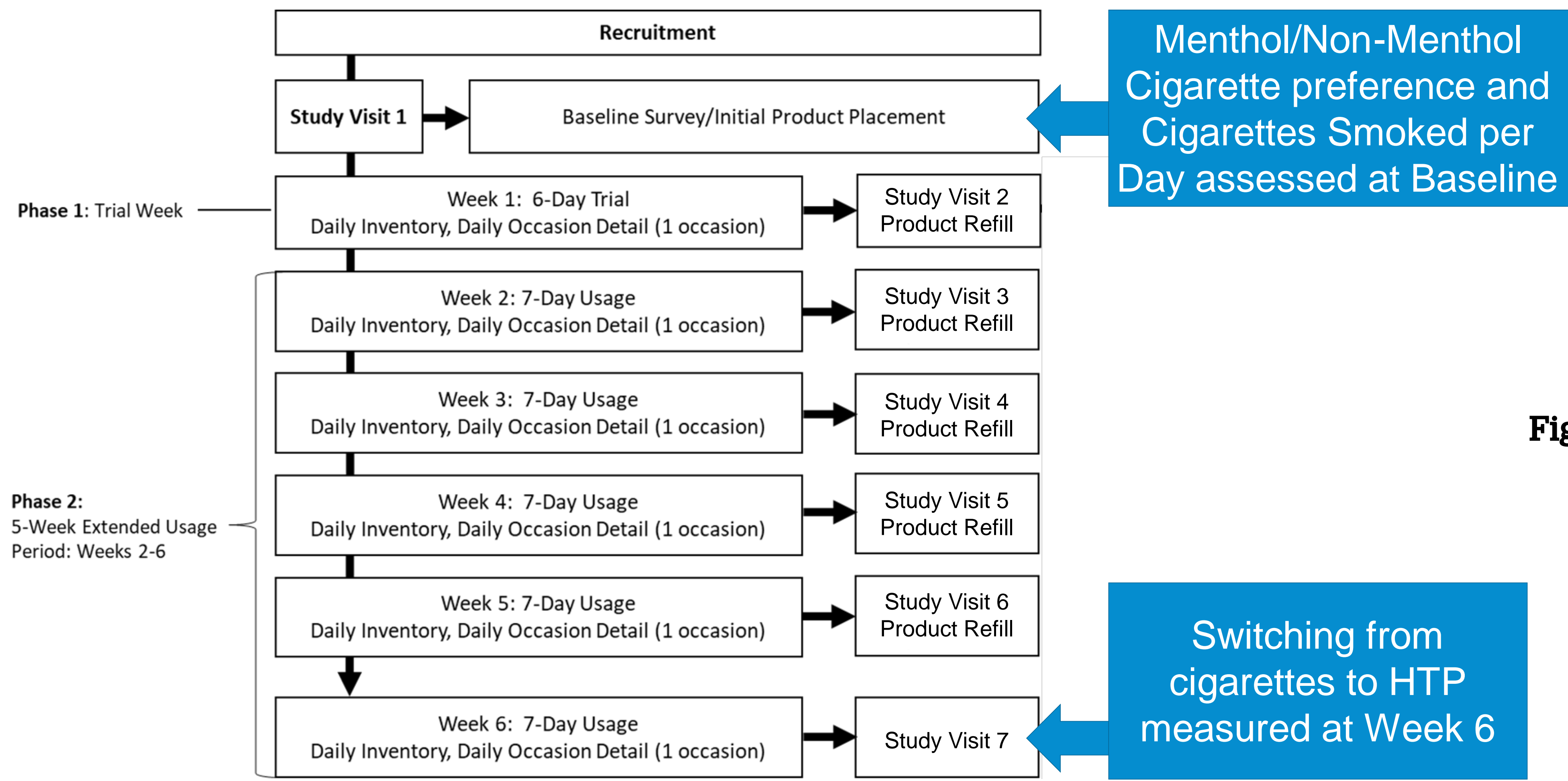
Heated tobacco products (HTPs) deliver nicotine with significantly lower toxicant levels relative to combustible cigarettes.¹ Availability of a portfolio of HTPs (i.e., menthol & non-menthol versions) may help adults who smoke (AS) reduce consumption of or completely switch away from combustible cigarettes. We examined whether smoking reduction or switching was associated with menthol versus non-menthol HTP use or menthol versus non-menthol cigarette preference.

Methods

Study Design

Shown in Figure 1, we conducted a six-week observational study of HTP among AS not planning to quit. All were offered free choice of a portfolio of HTPs (1 non-menthol and 2 menthol) for at home ad-libitum use.

Figure 1. Study Flow



Phase 1: Six-day trial period; participants received 2 packs of each variety for trial & identification of preferred variety(ies).

Phase 2: Five-week extended use period; participants had free choice of all available varieties, ≤14 packs per week.

Participants

AS (n=615) 21-64 years old who self-reported smoking cigarettes within 30 days of enrollment (every day or some days) with ≥100 lifetime cigarettes smoked. All were recruited from existing third-party databases of AS who previously expressed interest participating in consumer research. Target quotas based on Altria Client Services' Adult Tobacco Consumer Tracker² set for sex, age, race/ethnicity, education, and US region. Sample demographics are presented in Table 1.

Primary Outcomes and Analyses

Cigarette Reduction as the percent change in cigarettes smoked per day, from Baseline to Week 6

- Analysis of Covariance (ANCOVA) compared percent change in cigs/day between menthol and non-menthol smokers, controlling for baseline cigs/day and menthol HTP stick use in Week 6 (i.e., % of all WK6 HTP sticks that were menthol)
- ANCOVA compared percent change in cigs/day between WK6 HTP Stick Use Groups (Exclusive Menthol, Mix Menthol & Non-Menthol, Exclusive Non-Menthol) controlling for baseline cigs/day and number of HTP sticks used in Week 6

Switching Behavior defined as no cigarettes smoked in Week 6 and continued HTP study product use in Week 6

- Two-tailed independent sample t-test compared switching between menthol and non-menthol smokers
- Logistic Regression compared probability of switching between menthol and non-menthol smokers as a function of their menthol HTP stick use in Week 6 (ranging 0% [exclusive non-menthol use] to 100% [exclusive menthol use])
 - controlling for age, sex, baseline cigs per day (CPD), race, and total number of HTP sticks used in Week 6

Results

CPD Reduction by Preference for Menthol versus Non-Menthol Cigarettes (Baseline to Week 6)

There was a statistically significant difference in percent reduction in CPD from Baseline to Week 6 between menthol (-77%) vs non-menthol cigarette (-61%) preference groups, $F(1,610)=12.3$, $p<0.001$.

Menthol and Non-Menthol HTP Stick Use in Week 6 (Figure 2)

Most menthol smokers (73%) exclusively used menthol HTP; 37% of non-menthol smokers exclusively used non-menthol HTP.

CPD Reduction by Menthol and Non-Menthol HTP Stick Use in Week 6 (Figure 3)

There was a statistically significant effect of HTP Stick Use Groups on percent reduction in CPD, $F(2,610)=4.6$, $p=0.01$. Exclusive Menthol and Mix Menthol & Non-Menthol each had significantly greater reductions than Exclusive Non-Menthol.

Switching Behavior by Preference for Menthol versus Non-Menthol Cigarettes

There was statistically significant greater switching among AS who preferred menthol cigarettes (47%) than those who preferred non-menthol cigarettes (30%), $t(613)=4.2$, $p<0.001$.

Switching Behavior by Preference for Menthol/Non-Menthol Cigarettes and Week 6 Menthol HTP Use

There was a statistically significant interaction of menthol/non-menthol cigarette preference and Week 6 menthol HTP stick use on probability of switching, Wald $\chi^2(1)=4.4$, $p=0.04$. Shown in Figure 4, the probability of switching among those who prefer menthol cigarettes (green line) was relatively stable across percent of Menthol HTP Stick Use, 77% to 71%. However, there was a steeper slope for those who preferred non-menthol cigarettes (red line), increasing in probability of switching from 48% at exclusive Non-Menthol HTP Use (far left x-axis) to 66% probability of switching at exclusive Menthol HTP Use (far right x-axis).

Figure 4. Estimated Probability of Switching in Week 6 by Week 6 Menthol HTP Stick Use

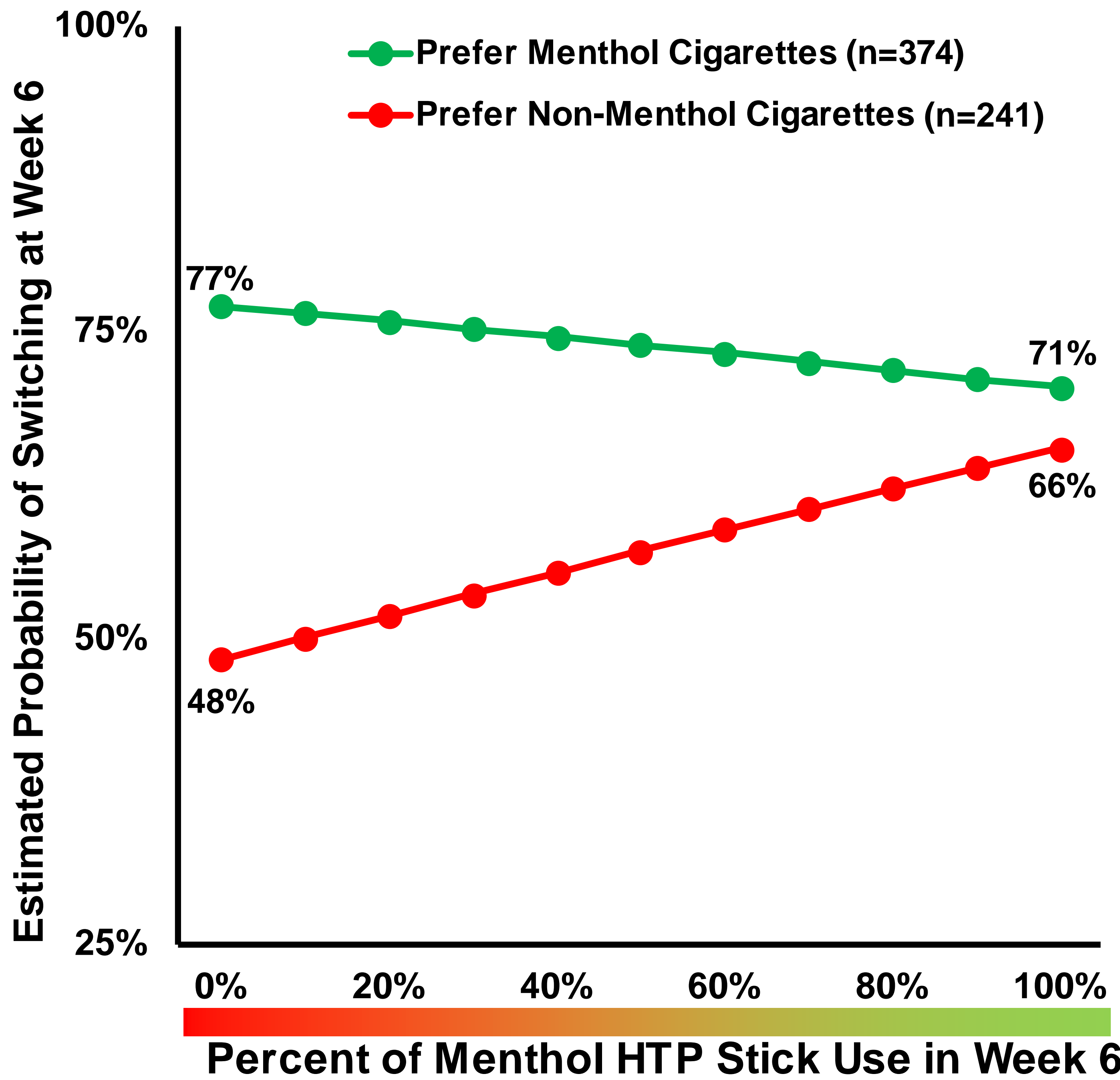


Figure 2. Week 6 HTP Stick Use by Menthol Cigarette Preference

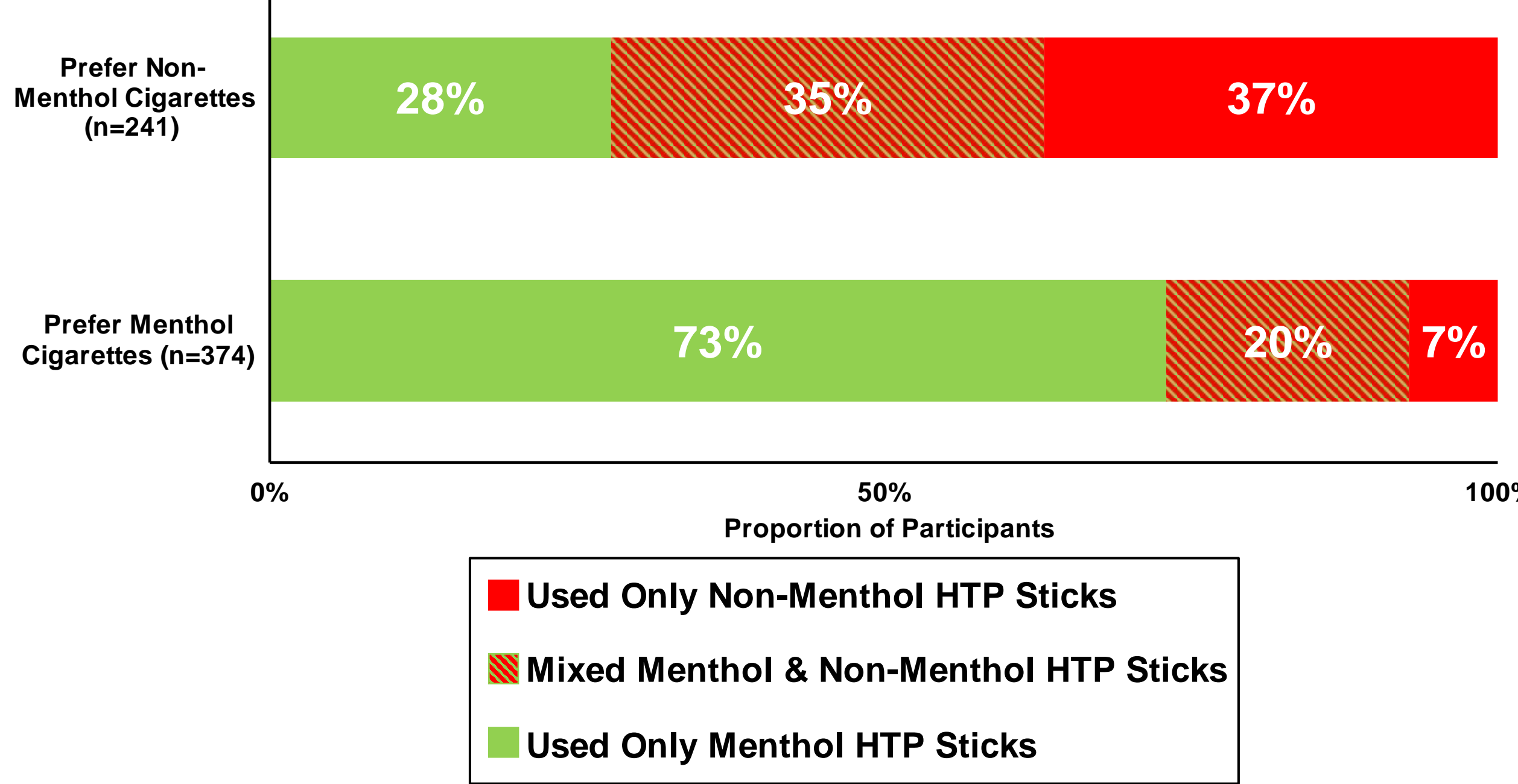


Figure 3. Percent Change in CPD by Week 6 HTP Stick Use

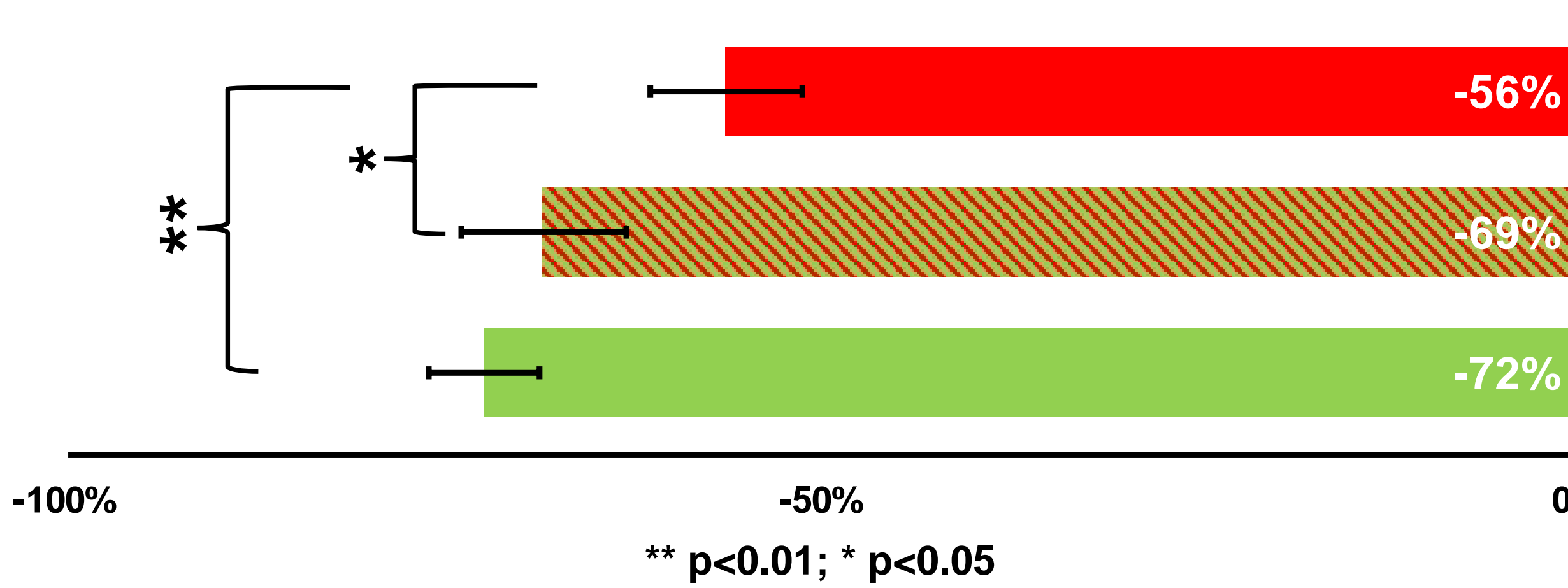


Table 1. Sample Demographics

	Sex		Race/Ethnicity				Age	Baseline CPD
	Female	Male	NH White	NH Black	Hispanic	Other		
Prefer Menthol Cigs (n=374)	211 (56.4%)	163 (43.6%)	183 (48.9%)	102 (27.3%)	55 (14.7%)	34 (9.1%)	40.9 (10.3)	15.0 (13.6)
Prefer Non-Menthol Cigs (n=241)	121 (50.2%)	120 (49.8%)	188 (78.0%)	14 (5.8%)	32 (13.3%)	7 (2.9%)	43.9 (10.3)	13.7 (10.3)
Overall (n=615)	332 (54.0%)	283 (46.0%)	371 (60.3%)	116 (18.9%)	87 (14.1%)	41 (6.7%)	42.1 (10.4)	14.5 (12.4)

Note: Values are frequency (row percent) or mean (SD); NH=Non-Hispanic; CPD=Cigarettes per Day

Conclusions

- AS who preferred menthol cigarettes had significantly greater CPD reduction and switching than those preferring non-menthol.
- Menthol HTP stick use was not exclusive to AS who preferred menthol cigarettes.
 - 63% of AS who preferred non-menthol cigarettes used menthol HTP sticks; only 27% of AS who preferred menthol cigarettes used non-menthol HTP sticks.
- Menthol HTP use was associated with greater CPD reduction and switching.
- Probability of switching increased for AS who preferred non-menthol cigarettes when using more menthol HTP sticks.
- Limitations include use of an observational (i.e., uncontrolled) study design, free study product provision, use of non-probability sampling, self-reported study product use, and lack of biochemical verification of switching.

Overall, these results suggest that the continued availability of menthol HTPs may offer harm reduction potential for AS not interested in quitting, regardless of preference for menthol or non-menthol cigarettes.

References

- Akiyama, Y., & Sherwood, N. (2021). Systematic review of biomarker findings from clinical studies of electronic cigarettes and heated tobacco products. *Toxicology Reports*, 8, 282-294.
- <https://sciences.altria.com/library/adult-tobacco-consumer-tracker>

