Original Report:
Cancer-Related Behaviors, Attitudes, Knowledge and Perceptions

Comparison of E-Cigarette Use among Menthol and Non-Menthol Smokers: Findings from a Community Based Sample

Monica Webb Hooper, PhD[1];
Sabrina L. Smiley, PhD, MPH, MCHES[2]

Objective: E-cigarette use is increasing among adult cigarette smokers. With the availability and variety of appealing characteristics, including menthol flavor, e-cigarette use patterns may differ among menthol and non-menthol cigarette smokers. This study compared e-cigarette knowledge and use between current menthol and non-menthol smokers aged ≥18 years.

Design: Current adult cigarette smokers (N=223; *M*=42.1 years; *SD*=12.2; 68% menthol smokers) recruited in South Florida completed an interviewer-administered survey via telephone during June to November 2014.

Main Outcome Measures: E-cigarette use (ever-use, past 30-day use, past 30-day flavored e-cigarette use, and past 30-day mentholated e-cigarette use), consideration of e-cigarette use for quitting/reduction of cigarettes, and knowledge assessments. Bivariate and multivariate analyses tested associations with menthol smoking.

Results: Menthol smokers were more likely to be African American or Hispanic (P<.001) and report lower income (P=.02) and education (P<.001) than non-menthol smokers. Adjusted analyses found no association between menthol cigarette use and e-cigarette ever-use. However, menthol smokers demonstrated less e-cigarette knowledge (P<.01) and were more likely to consider using e-cigarettes to quit/reduce smoking (AOR=3.89, CI:1.55-9.78). Among ever-users, there was no association between menthol cigarette use and past 30-day e-cigarette use, yet menthol smokers were more likely to use menthol flavored e-cigarettes (AOR=6.65, CI: 1.94-12.78).

Conclusions: Our findings suggest that, compared with current non-menthol smokers, current menthol smokers are more likely to consider using e-cigarettes to help quit/reduce smoking, and are more likely to use menthol flavored e-cigarettes. Further research is needed to better examine low e-cigarette knowledge among menthol smokers, which may represent an important intervention target. *Ethn Dis*. 2018;28(3):153-160; doi:10.18865/ed.28.3.153.

Keywords: Smoking; Menthol Cigarettes; Non-menthol Cigarettes; E-Cigarettes; E-Cigarette Knowledge

Introduction

Menthol cigarettes represent about one-third of the tobacco cigarette market share.[1] While the overall prevalence of cigarette smoking has declined in the United States, the prevalence of menthol smoking has stagnated or increased.[2] The use of menthol cigarettes is associated with indices of greater nicotine dependence and a lower likelihood of cessation,[3] even among treatment seekers.[4] Thus, this sub-group of smokers may be drawn to alternative and emerging tobacco products, including electronic cigarettes (e-cigarettes), which are often used as cessation devices.[5,6] E-cigarette use is growing rapidly in the United States and is increasing among cigarette smokers.[7] National survey findings indicate that among current or former cigarette smokers, the prevalence of ever-use of e-cigarettes is more than 30%.[8] However, to our knowledge, the e-cigarette evidence base has not focused exclusively on e-cigarette use among current menthol cigarette smokers.

The parallels between menthol cigarette use(ers) and e-cigarette use(ers) suggest that research on their relationship is warranted. First, consumer perceptions of menthol cigarettes include the belief that they are healthier compared with non-menthol cigarettes.[9] A similar belief has been found among consumers in comparisons of e-cigarettes vs combustible cigarettes.[10,11] E-cigarettes are marketed as a reduced-risk alternative to cigarette smoking,[12]

[1] Case Comprehensive Cancer Center, Case Western Reserve University, Cleveland, OH
[2] Keck School of Medicine, Department of Preventive Medicine, University of Southern California, Health Sciences Campus, Los Angeles, CA

Address correspondence to Monica Webb Hooper, PhD; Case Comprehensive Cancer Center; Case Western Reserve University School of Medicine; 10900 Euclid Avenue, Cleveland, OH 44106; 216.368.6895; monica.hooper@case.edu

yet even with the concentration of cigarette toxicants lower than cigarettes,[13] e-cigarettes are not absent exposure to potentially health damaging contents[14] or health risks.[15,16] It is possible that lower health risk perceptions may be due to a lack of knowledge regarding e-cigarette nicotine and chemical content, and government regulations.[17]

Second, historically, racial/ethnic minorities, women, and adolescents have been tobacco industry targets for flavored products, notably menthol cigarettes.[9] E-cigarettes are also available in multiple flavors, such as blueberry, caramel, and cherry. In 2012, Lorillard Inc., the largest manufacturer of menthol cigarettes in the United States, became the first tobacco company to enter the e-cigarette market with the acquisition of Blu Ecigs©, which are available in menthol flavorings.[18] This is critical because approximately 80% of African American cigarette smokers use menthol cigarettes and many consume Lorillard brands, including Newport menthol cigarettes.[19] With growing expenditures on e-cigarette advertising,[20] it is plausible that African Americans and other smokers with a high prevalence of menthol cigarette use may be subject to targeted marketing for menthol flavored e-cigarettes. Indeed, Roberts et al[21] found that e-cigarette and menthol cigarette point-of-sale promotions were greater in predominantly African American vs White neighborhoods. Early evidence suggests that e-cigarette marketing to potentially vulnerable populations is positively associated with use.[22] Thus, research on e-cigarette use among menthol smokers is needed as e-cigarettes have the potential to be a considerable part of the tobacco product market.

The present study explored e-cigarette knowledge, use (ever-use, past 30-day use, past 30-day flavored e-cigarette use, and past 30-day mentholated e-cigarette use), and consideration of e-cigarettes to reduce or quit smoking among current cigarette smokers.

The Present Study

To our knowledge, no published studies have examined e-cigarette use and knowledge by menthol cigarette use. To address this knowledge gap, the present study explored e-cigarette knowledge, use (ever-use, past 30-day use, past 30-day flavored e-cigarette use, and past 30-day mentholated e-cigarette use), and consideration of e-cigarettes to reduce or quit smoking among current cigarette smokers. We sought to compare menthol smokers to non-menthol smokers because: a) menthol smokers may be particularly vulnerable to targeted marketing of mentholated e-cigarettes because they are conditioned to prefer this flavor; and b) findings may be informative for targeted intervention development. Because no previous research has focused on these questions, we conducted an initial cross-sectional exploratory investigation.

Methods

Participants and Data Collection

Participants (N=300) were current and former adult cigarette smokers recruited in South Florida from June to November 2014 via online postings (ie, Craigslist, Facebook) and email listservs, flyers, community events (eg, health fairs), and partnerships with community organizations. Given our interest in e-cigarette and menthol smoking relationships, we targeted our recruitment efforts to attract a racially/ethnically diverse sample. Data for our study were limited to current smokers (smoked at least 100 lifetime cigarettes and current daily or non-daily smoking[23]) who were aged ≥18 years, and able to speak English or Spanish (n=223). We excluded respondents from the same household as a previous participant or whose cognitive impairment impeded survey completion. Following verbal informed consent, eligible participants completed a 20-minute interviewer-administered survey over the telephone (4% [n=9] of participants completed the measures in Spanish) and were mailed a $10 gift card. The University of Miami Institutional Review Board approved this study.

Table 1. Demographic characteristics by menthol smoking status

	Menthol cigarette smoking			
	Total	Yes	No	
	N=223	n=151	n=72	P
Age, mean (SD)	41.7 (12.2)	40.9 (12.2)	42.5 (12.6)	.36
Sex				.74
Female	62% (139)	62% (93)	64% (46)	
Male	38% (84)	38% (58)	36% (26)	
Marital status				.42
Unmarried/single	59% (131)	62% (93)	53% (38)	
Married/living with a partner	19% (43)	18% (28)	21% (15)	
Separated/divorced/widowed	22% (49)	20% (30)	26% (19)	
Annual household income				.02[a]
<$10,000	37% (82)	44% (65)	24% (17)	
$10,001-$20,000	19% (42)	19% (28)	20% (14)	
$21,001-$40,000	28% (61)	25% (37)	34% (24)	
≥$40,001	16% (35)	13% (19)	22% (16)	
Education				<.001[a]
HS diploma/GED or less	49% (110)	58% (88)	31% (22)	
Greater than high school/GED	51% (113)	42% (63)	69% (50)	
Race/ethnicity				<.001[a]
White (non-Hispanic)	26% (58)	13% (19)	54% (39)	
Black/African American (non-Hispanic)	46% (102)	63% (95)	10% (7)	
Hispanic (any race)	28% (63)	24% (37)	36% (26)	

HS, high school; GED, graduate equivalency degree.
a.Statistically significant.

Measures

Demographics

Participants self-reported age, sex, marital status, annual household income, education, and race/ethnicity.

Menthol Cigarette Use

A single item assessed whether the usual cigarettes smoked over the past 30-days was a menthol brand (yes or no).

E-Cigarette Knowledge

A 14-item measure was developed for our study, which assessed knowledge of e-cigarette contents, chemicals, vapor, types of devices, and safety. Items were rated on a 3-point scale, including "true," "false," or "not sure" options. A general knowledge subscale assessed knowledge of the contents and types of e-cigarette devices (5 items; alpha = .72; alpha = .73 in Spanish) For example, "There are different kinds of e-cigarettes," and "E-cigarettes use liquid nicotine." A risk-related knowledge subscale assessed knowledge of e-cigarette safety and risk (4 items; alpha = .70; alpha = .72 in Spanish). For instance, "E-cigarettes are completely safe to use," and "E-cigarettes may be bad for a person's health." Correct responses were scored as "1" and incorrect or "not sure" responses were scored as "0." The total score (alpha = .70; alpha = .72 in Spanish) and subscale scores were used in the analyses.

E-Cigarette Use

All participants were asked whether they had ever used an e-cigarette (yes or no) and whether they were considering using e-cigarettes to reduce or quit smoking (yes or no). Among e-cigarette ever-users, single items assessed e-cigarette use at least once in the past 30- days (yes or no), past 30-day use of ≥ 1 flavored e-cigarette (yes or no), and past 30-day use of ≥ 1 mentholated e-cigarette (yes or no).

Statistical Analyses

Analyses were conducted using IBM SPSS Statistics 22. Preliminary analyses included descriptive statistics (means, standard deviations, proportions) for the overall sample and by menthol cigarette use (yes or no). Differences in demographic factors by menthol cigarette use were evaluated using chi-squared tests and analyses of variance (ANOVAs) for categorical

Table 2. Adjusted analyses of e-cigarette use knowledge by menthol smoking status

	Menthol Smoking Status			
	Total	Yes	No	
	N=223	n=151	n=72	
	M (SD)	M (SD)	M (SD)	P
E-cigarette knowledge total (0-14)	7.24 (2.7)	6.79 (2.6)	8.18 (2.7)	.001[a]
E-cigarette knowledge general (0-5)	3.07 (1.3)	2.85 (1.3)	3.54 (1.2)	.001[a]
E-cigarette risk-related knowledge (0-4)	2.43 (1.7)	2.18 (1.6)	2.94 (1.6)	.019[a]

Analyses adjusted for demographics. Results did not differ when administered in Spanish.
a. Statistically significant.

and continuous variables, respectively. Chi-squared tests were conducted to examine bivariate relationships between menthol cigarette use (menthol vs non-menthol) and e-cigarette use variables. Analyses of covariance (ANCOVAs), adjusting for demographics in block 1, tested differences in e-cigarette knowledge between menthol and non-menthol smokers. Multivariate logistic regression analyses, adjusting for demographics in block 1, tested the independent associations between menthol cigarette use and the odds of: 1) e-cigarette ever-use; 2) consideration of e-cigarette use to reduce or quit smoking; 3) past 30-day use; 4) past 30-day flavored e-cigarette use; and 5) past 30-day menthol e-cigarette use. Alpha was set at .05 (we did not adjust for multiple tests in this exploratory investigation).

Results

Study participants were racially/ethnically diverse, and 68%(151) were current menthol cigarette smokers. Participants were middle-aged, mostly female, single, and had completed at least high school. Thirty-seven percent of participants reported a household income <$10,000. As shown in Table 1, menthol cigarette smokers reported lower annual household income, $\chi^2(3)=9.3$, P=.02, and fewer years of education compared with non-menthol smokers $\chi^2(3)=20.1$, P<.001. There were also racial/ethnic differences in menthol cigarette use. African American/Black (93%) and Hispanic (59%) participants were more likely to smoke mentholated cigarettes compared with Whites (33%), $\chi^2(2)=64.9$, P<.001. Menthol cigarette use did not differ significantly by age, sex, or marital status.

Menthol Smoking and E-Cigarette Knowledge

Multivariate analyses controlling for demographics tested group differences between menthol and non-menthol smokers in e-cigarette knowledge (Table 2). We found significant group differences in the three measures of e-cigarette knowledge. Specifically, menthol smokers demonstrated less total knowledge about e-cigarettes [F (1, 213)=11.19, P=.001], less general knowledge [F (1,213)=11.04, P=.001], and less risk-related knowledge [F (1, 213)=6.73, P=.01] compared with non-menthol smokers.

Menthol Smoking and E-Cigarette Use

More than two-thirds (66%) of participants had ever used an e-cigarette. Bivariate analyses (Table 3) indicated that menthol cigarette smokers were significantly less likely to have ever used an e-cigarette, compared with non-menthol smokers, $\chi^2(1)=6.2$, P=.01. However, menthol smokers were more likely to consider using e-cigarettes to reduce or quit smoking than non-menthol smokers, $\chi^2(1)=9.9$, P=.002. Non-menthol smokers reported greater past 30-day e-cigarette use and flavored e-cigarette use relative to menthol smokers, although the differences were not significant. However, there was a significant difference in past 30-day mentholated e-cigarette use, such that a greater proportion of menthol cigarette smokers reported mentholated e-cigarette use compared with non-menthol smokers, $\chi^2(1)=19.23$, P<.001.

Multivariable analyses examined the independent associations between menthol cigarette use and e-cigarette use (Table 4). After controlling for covariates, e-cigarette ever-use was unrelated to menthol cigarette use. Controlling for demographics and menthol cigarette use, we found that

Table 3. Unadjusted analyses of e-cigarette use by menthol smoking status among current smokers

	Menthol Smoking Status			
	Total	**Yes**	**No**	
	N=223	**n=151**	**n=72**	**P**
Ever used an e-cigarette (yes)	66% (148)	61% (92)	78% (56)	.01[a]
Considering using e-cigarette to reduce or quit smoking (yes)	82% (183)	88% (132)	71% (51)	.002[a]
E-cigarette ever-users	**Total**	**Yes**	**No**	**P**
	N=148	**n=92**	**n=56**	
Used an e-cigarette in the past 30 days (yes)	51% (75)	46% (42)	60% (33)	.09
Past 30 days used flavored e-cigarette (yes)	39% (58)	38% (35)	41% (23)	.65
Past 30 days used menthol e-cigarette (yes)	29% (43)	42% (39)	7% (4)	<.001[a]

a. Statistically significant.

participants with household income levels between $21,001 and $40,000 were more than twice as likely to report ever using e-cigarettes compared with those with incomes <$10,000. After controlling for demographics, menthol smokers were almost four times more likely to be considering using e-cigarettes to reduce or quit smoking relative to non-menthol smokers. Participants who identified as Hispanic were significantly less likely to consider using e-cigarettes in an attempt to quit smoking. Menthol cigarette use was not associated with past 30-day e-cigarette use; however, there was a significant inverse association between completing at least

Table 4. Multivariable logistic regressions of e-cigarette use and considering use

	E-cig ever use[a]		Considering use to quit[a]		Past 30-day e-cig Use[b]		Flavored e-cig[b]		Menthol e-cig[b]	
	AOR	**(95% CI)**	**AOR**	**(95% CI)**	**AOR**	**(95% CI)**	**AOR**	**(95% CI)**	**AOR**	**(95% CI)**
Characteristic										
Smoking Status										
Non-menthol smoker		Reference		Reference		Reference		Reference		Reference
Menthol smoker	.80	(.35-1.86)	3.89[c]	(1.55-9.78)	.55	(.26-1.14)	.79	(.36-1.73)	6.65[c]	(1.94-12.78)
Age	.97[c]	(.94-0.99)	1.01	(.98-1.05)	1.00	(.98-1.03)	.98	(.96-1.01)	1.00	(.97-1.03)
Sex										
Female		Reference		Reference		Reference		Reference		Reference
Male	1.29	(.67-2.47)	.57	(.25-1.27)	1.18	(.64-2.18)	.85	(.44-1.64)	1.29	(.63-2.67)
Annual household income										
Under $10,000		Reference		Reference		Reference		Reference		Reference
$10,001-$20,000	.79	(.35-1.78)	1.20	(.37-3.90)	1.01	(.41-2.51)	1.23	(.47-3.24)	.73	(.24-2.26)
$21,001-$40,000	2.07	(.89-4.85)	1.36	(.42-4.41)	2.70[c]	(1.20-6.09)	2.37	(.99-5.67)	1.73	(.68-4.39)
$40,001 or more	2.04	(.67-6.20)	.08	(.09-1.13)	2.81	(1.06-7.46)	2.66	(.95-7.45)	3.26[c]	(1.05-10.09)
Education										
<HS diploma/GED		Reference		Reference		Reference		Reference		Reference
≥HS diploma	1.22	(.62-2.41)	4.51[c]	(1.06-12.68)	.77	(.38-1.53)	.68	(.33-1.43)	.91	(.41-2.03)
Race/ethnicity										
White		Reference		Reference		Reference		Reference		Reference
African American/Black	.41	(.15-1.11)	1.30	(.36-4.65)	.74	(.30-1.83)	.62	(.24-1.60)	1.19	(.39-3.65)
Hispanic (any race)	.85	(.32-2.26)	.27[c]	(.09-.78)	.98	(.43-2.23)	.83	(.35-1.95)	.86	(.27-2.74)

E-Cig, electronic cigarette; HS, high school; GED, graduate equivalency degree; Black/African American=non-Hispanic.
Adjusted odds ratio (AOR) of less than 1.0 indicates decreased odds of e-cigarette use.
a. N=223 current smokers.
b. n=148 e-cigarette ever users.
c. Statistically significant.

a high school education and recent e-cigarette use. Among those who reported e-cigarette use, associations between the recent use of flavored e-cigarettes were not significant for any of the demographic factors or menthol cigarette use. However, even after adjusting for covariates, menthol cigarette use was positively related to past 30-day use of mentholated e-cigarettes. Compared with non-menthol smokers, those who smoked menthol brand cigarettes were more than eight times more likely to endorse recent use of mentholated e-cigarettes.

Menthol smokers in this study were also more likely to be of lower socioeconomic status compared with non-menthol smokers.

Discussion

This study, to our knowledge, was the first to compare e-cigarette use and knowledge between menthol and non-menthol cigarette smokers. Among respondents, e-cigarette use (both ever-use and current use) was high. These findings are consistent with previous research,[24,25] which reported dramatic growth in both ever-use and current use of e-cigarettes among US adults. Unadjusted analyses indicated that menthol cigarette smokers were significantly less likely to have ever used an e-cigarette compared with non-menthol smokers. This difference was no longer significant after adjusting for demographics. However, menthol cigarette smokers, irrespective of whether they had ever used an e-cigarette, were significantly more likely to consider future e-cigarette use as a method of smoking reduction or cessation in both bivariate and multivariate analyses. Among ever-users, there were no associations between smoking menthol cigarettes and past 30-day use of e-cigarettes or the use of flavored e-cigarettes. However, menthol smokers were significantly more likely to use mentholated e-cigarettes compared with non-menthol smokers. This finding is consistent with evidence showing that mentholated e-cigarettes appeal to current and former menthol smokers.[26] Finally, menthol smokers reported less e-cigarette knowledge relative to non-menthol smokers. We note that these relationships were observed over and above potential confounding factors such as age, sex, race/ethnicity or socioeconomic status (SES).

Consistent with previous research, racial/ethnic minorities (African Americans and Hispanics) were more likely to smoke menthol cigarettes compared with Whites[27] and African Americans were less likely to be former smokers.[28] Menthol smokers in this study were also more likely to be of lower SES compared with non-menthol smokers. Thus, our analyses controlled statistically for sociodemographics to allow examination of the independent associations with menthol cigarette smoking. With the growing popularity of e-cigarettes and the tobacco industry's marketing of these products, increasing our understanding of factors associated with their uptake in menthol smoking populations has implications for the regulation of flavors in e-cigarettes and menthol in combustible tobacco products.

Despite the lack of an independent association between ever-initiating e-cigarette use and menthol cigarette use, ever-use among menthol smokers exceeded 60%. This finding is comparable to the high prevalence of ever-use observed in community-based groups in substance abuse treatment settings,[29] inpatient medical clinics,[30] preoperative clinics,[31] and from the local community.[32] Importantly, menthol smokers were more likely to indicate consideration of e-cigarette use specifically to quit smoking. This finding is consistent with prior studies,[12] which have shown that e-cigarettes have been marketed as an alternative to smoking cigarettes, and that adult cigarette smokers commonly report using them for quitting or reduction of smoking.

Our study may represent a signal that menthol cigarette smokers, relative to smokers of non-menthol cigarettes, may have particular interest in mentholated e-cigarettes to quit smoking. The harm reduction perspective would suggest that moving to menthol-flavored e-cigarettes vs mentholated combustible cigarettes could benefit public health. The anti-e-cigarette view, in contrast, would suggest that e-cigarette use is unrelated to smoking cessation,[33] or may reduce the chances of quitting.[34] Thus, attempts to quit

smoking completely or "switch" to mentholated e-cigarettes may not be successful and may result in dual use.

Moreover, menthol smokers scored lower on our measures of e-cigarette knowledge. As much of the consumer knowledge about e-cigarettes is generated from media-based sources and sales-related marketing,[35] awareness of the contents and safety of e-cigarettes may be generally lacking. This finding is consistent with the lack of knowledge reported in previous research among current adult e-cigarette users[35] and among young adults.[17] However, findings from our study reveal that menthol smokers appear to know even less about these products than non-menthol smokers. Thus, lower knowledge may further represent vulnerability to e-cigarette marketing and use and may be an important target for future prevention and/or intervention efforts.

Study Limitations

Findings from this study should be interpreted in light of its limitations. As no previous research has focused on adult menthol smokers' e-cigarette use and knowledge compared with non-menthol smokers, this study was exploratory in nature with a relatively small sample size. We sought to obtain an initial snapshot of e-cigarette use among menthol smokers, using a cross-sectional design and recruitment of a convenience sample. Although our sample of adult smokers may be more similar to samples seen in clinic-based interventions or community cessation programs, we acknowledge that future research is needed using longitudinal assessments and random-sampling methods. We recommend the analysis of data drawn from nationally representative surveys to replicate the current findings.

Conclusion

In conclusion, our findings confirm existing evidence regarding e-cigarette use and knowledge among current adult cigarette smokers and extends our understanding of this phenomenon among menthol smokers. In particular, examination of menthol smokers revealed that, while menthol cigarette use was unrelated to e-cigarette use, menthol smokers were more likely to consider e-cigarettes as a smoking reduction/cessation aid and were also more likely to report less e-cigarette knowledge. These findings highlight the importance of targeted public health interventions and public education campaigns. Smoking cessation efforts must address e-cigarettes and should be tailored with consideration of menthol and non-menthol cigarette smokers.

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Our research was approved by the University of Miami institutional review board and all procedures followed were in accordance with the ethical standards of the IRB and the Helsinki Declaration of 1975, as revised in 2000. Verbal informed consent was obtained from all participants in the study.

Conflict of Interest

No conflicts of interest to report.

Author Contributions

Research concept and design: Webb Hooper; Data analysis and interpretation: Webb Hooper, Smiley; Manuscript draft: Webb Hooper, Smiley; Statistical expertise: Webb Hooper, Smiley; Administrative: Webb Hooper; Supervision: Webb Hooper.

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