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Gender and Menthol Cigarette Use in the United States: A Systematic Review of the Recent Literature (2011 – May 2017)

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Abstract

Purpose of review—To summarize current research on gender differences in mentholated cigarette use and related outcomes. Secondly, to summarize literature on gender differences in mentholated cigarette use and related outcomes among Black smokers.

Recent findings—Women smokers are more likely to use menthol cigarettes than men. Other than prevalence, there is a paucity of research on gender differences in menthol related outcomes (e.g., cessation, disease). Among both women and men, menthol preference is stable during adolescence and young adulthood. A substantial portion of both women and men who smoke menthol report an expectation of quitting should menthol be banned. We did not identify any studies of gender differences in mentholated cigarette use among Black smokers.

Summary—Despite public health relevance, there is little current research on gender differences in mentholated cigarette use, other than studies of prevalence, and very little research on gender differences among Black smokers, including prevalence.

Keywords

Gender; Women; Race; Menthol; Cigarette; African American

INTRODUCTION

Tobacco use remains the leading cause of preventable death in the United States, resulting in over 480,000 premature deaths and \$289 billion in healthcare expenditures each year (1).

Based on 2012–2014 estimates, approximately 39% of cigarette smokers use mentholated cigarettes, an increase from a reported 35% in 2008–2010 (2).

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Compliance with Ethics Guidelines

Conflict of Interest

Philip H. Smith, Ezinne Akpara, Raisa Haq, Mark El-Miniawi, and Azure B. Thompson declare they have no conflict of interest.

Human and Animal Rights and Informed Consent

This article does not contain any studies with human or animal subjects performed by any of the authors.

Previous evidence suggests women smokers are more likely to use menthol cigarettes than men who smoke. Using a nationally representative sample of adults in the United States from 2008–2010, Giovino et al. estimated that approximately 40% of women smoke mentholated cigarettes compared to 31% of men (3). Coinciding with this greater prevalence of use is evidence found in tobacco industry documents indicating that advertising of mentholated cigarettes directly targets women (4).

Menthol use is also extraordinarily high among Black smokers in the U.S. Recent evidence suggests 89% of non-Hispanic Black cigarette smokers used mentholated cigarettes, compared to 26% of White smokers (3). Multiple reviews have summarized literature on racial/ethnic differences in outcomes related to mentholated cigarette use (e.g., cessation, health outcomes, correlates), focusing on Black smokers (5, 6). This recognition has fueled ongoing dialogue of whether the U.S. Food and Drug Administration (FDA) should ban menthol flavoring from tobacco products (5, 7).

Despite greater prevalence of menthol use among women than men in the U.S., comparatively less attention has been given to the issue of gender differences in menthol-related smoking outcomes or the biological or social correlates of the use of menthol. For example, the FDA's summary report on the public health consequences of mentholated tobacco products places comparatively little emphasis on the issue of gender and menthol cigarette use while focusing primarily on race and ethnicity in relation to menthol use (6). This difference is perhaps due to less general concern over gender-based disparities in tobacco-related outcomes among the tobacco control community (8, 9) as well as the comparatively smaller difference in menthol use prevalence among women versus men than is seen between Black and White smokers in the U.S. Yet, the approximately ten percentage point difference in prevalence of menthol cigarette use among women compared to men in the U.S, for example, is not marginal in terms of public health relevance. Furthermore, despite the evidence of greater prevalence of menthol use among both women and among Black smokers, and previous evidence that menthol use is particularly common among Black women (10) previous reviews have paid little attention to gender differences in menthol-related smoking outcomes and correlates among Black smokers.

The purpose of this systematic review was to examine recent literature on menthol cigarette use (2011 through April, 2017) in the U.S. in order to summarize current research on gender differences in mentholated cigarette use, available biological and social correlates, and related outcomes among the general population of smokers and among Black smokers specifically. We categorized this literature into one or more of the following: 1) prevalence of menthol cigarette use; 2) initiation of menthol cigarette use; 3) cessation of menthol cigarette use; 4) biological and social correlates of menthol cigarette use.

METHODS

Search procedures, inclusion criteria, and data extraction

We searched Medline in April, 2017 using the following search terms: Menthol AND (cigarette* OR smok*) AND ((women or female) OR (black OR African American)), and limited our search to articles published from 2011–2017. Abstracts and then full manuscripts

were examined for inclusion. Study inclusion criteria consisted of: 1) data on one of the following: menthol use prevalence, initiation, cessation, correlates of menthol use, or health outcomes associated with menthol use, 2) studies that reported on one of the above outcomes by gender among smokers overall or among Black smokers specifically, and 3) studies conducted in the U.S. We used Qualtrics to systematically extract data on country, study inclusion criteria, sample characteristics, study design, relevant measures, and results.

RESULTS

Search results

Our search returned 139 results, of which 11 were duplicates. Of the remaining 128 publications, 57 were identified for full article review. Of these 57, 16 were included in our review. These 16 articles are summarized in Table 1. Regarding results by gender, we identified nine publications reporting on the prevalence of menthol use (3, 11–18), one publication on initiation (17), three publications on cessation (19–21), one publication on biological correlates and one on social correlates (14, 22), and one study of health outcomes (23). We did not identify any publications on gender differences in menthol cigarette use, biological or social correlates of use, or related outcomes among Black smokers.

Prevalence—Studies of both youth and adults consistently report greater prevalence of menthol use among current smokers for women/girls compared to men/boys. Prevalence estimates among men ranged from 8.2% to 30.5%, while estimates among women ranged from 22.7% to 69.5%, depending on study sample and year of publication. The highest prevalence among women was found in a study of Minnesota Quitline callers from 2009–2011 (13). We did not identify any estimates published since 2011 of gender differences in the prevalence of menthol use among Black smokers.

Initiation—Villanti and colleagues examined initiation of menthol use in the context of whether male or female youth and young adults in the U.S. were more or less likely to switch from non-menthol to menthol cigarettes (17). Using data from the National Youth Smoking Cessation Survey (ages 16–24), the researchers found no difference in the likelihood of switching from non-menthol to menthol cigarettes between women (6.6%) and men (7.2%). Findings suggest that menthol use prevalence may be established early in smoking trajectories with minimal switching of preference for either women or men, although it is difficult to draw conclusions from one investigation. We found no studies of gender differences in smoking initiation among Black smokers.

Cessation—None of the identified studies directly assessed gender differences in the association between menthol use and cigarette smoking cessation. Two investigations reported on menthol smokers' perceptions of whether they would quit smoking should menthol be banned in the U.S.; i.e., if they were no longer able to smoke menthol cigarettes (19, 20). Neither study found a difference between women and men in their reported likelihood of quitting smoking, should menthol flavoring be banned, after adjusting for covariates such as sociodemographic characteristics, current motivation to quit smoking, and nicotine dependence. Pearson and colleagues (20) found a difference prior to adjusting for

these covariates, with 44% of women and 33% of men who smoked menthol cigarettes reporting they would quit smoking if menthol cigarettes were banned. One additional study used clinical trial data to examine differences between White and Black pregnant women in the association between menthol smoking and likelihood of quitting (21). The study found that women who smoked menthol were substantially less likely to successfully quit among White [Odds Ratio (OR) = 0.19] smokers. The OR for Black women was similar in size (OR = 0.33) but was not statistically significant, suggesting the study was underpowered for the analyses. These investigations provide little evidence on differences in the association between menthol smoking and quitting by gender. We found no studies of gender differences in smoking cessation among Black smokers.

Biological and social correlates—Oncken and colleagues conducted a secondary analysis of clinical trial data reported on a study of gene variants and the likelihood of menthol use among Hispanic and non-Hispanic women (22). The investigation focused on the TAS2R38 taste-receptor gene, haplotypes of which are associated with variation in taste sensitivity to bitterness. Regardless of Hispanic ethnicity, the researchers found a dose-response relationship between the number of TAS2R38 haplotypes and the likelihood of smoking mentholated cigarettes.

One investigation of a nationally representative sample from the U.S. (National Adult Tobacco Survey 2009–2010) found a greater prevalence of menthol use among LGBT women compared to heterosexual women, while there was no such difference found among men (14).

These very limited findings suggest that among women there may be variation in these specific factors related to menthol smoking, and there is a need to understand biological and social correlates of menthol cigarette use among women. We found no studies of gender differences in correlates of menthol cigarette use among Black smokers.

Health outcomes—One investigation of adults aged 40–79 used cohort data from southern states in the U.S. (Southern Community Cohort Study, 2002–2009) to examine gender differences in association between menthol use and the incidence of lung cancer in the cohort (23). Among women, menthol smoking compared to non-menthol smoking (?) was associated with lower likelihood of lung cancer incidence (OR = 0.43). Among men, the association was non-significant (OR = 0.77), although the gender difference did not reach statistical significance. This finding suggests that among women menthol use or patterns of use may be less dangerous in its association with lung cancer, more-so than among men, although it is difficult to draw conclusions from one investigation. We found no studies of gender differences in menthol-related health outcomes among Black smokers.

DISCUSSION

Current research consistently shows that in the U.S., women smokers are more likely than men to use mentholated cigarettes. This difference in prevalence is well established; however, there is a paucity of recent research on gender difference in the initiation of menthol use, biological and social correlates of menthol use, menthol cigarette cessation, or

related health outcomes. Extant studies have suggested that menthol use preference is established early on, with little switching for either women or men, with estimates of switching among youth around 6% (17). Although not included in this review, Kasza and colleagues reported a similar finding with perhaps even lower switching among adults in the U.S (16).

Should menthol flavoring be banned in the U.S., it is likely that a sizable portion of both women and men would quit smoking as a result (19, 20). However, it is unclear if this finding would apply equally across racial/ethnic subgroups. Among women, genetic predisposition to smoking is likely, in part, based on taste preference and sensitivity to bitter flavor, suggesting that prevalence of menthol use is in part biologically driven (22) although gender differences in this prevalence were not documented in recent literature. There may also be social factors that increase the likelihood of menthol smoking, such as identifying as LGBT (14).

Our review did not identify any recent studies of gender differences in the prevalence of menthol use, biological or social correlates, or related outcomes among Black smokers. Given the very little current empirical research on this topic, the aspiring researcher has a number of potentially relevant research questions from which to choose. One potential area of importance is on the study of gender, race/ethnicity, nicotine metabolism, and mentholated cigarette use. Research has documented that smoking mentholated cigarettes inhibits nicotine metabolism (24), and there are well established gender (25) and racial/ethnic (26) differences in nicotine metabolism. For example, among Black smokers greater CYP2A6 activity (i.e., nicotine metabolism) is related to greater cigarette consumption (27).

From sociological and psychological perspectives, a number of topics are relevant including sexual preference-, racial/ethnic-, and gender-based discrimination (28, 29) as well as stress (30) and trauma (31). There are several useful frameworks for conducting research on gender differences in menthol use among the general population of smokers as well as specifically Black smokers, particularly when framing the issue in the context of health disparities. Herbert and colleagues provide a conceptual framework for distinguishing “differences” from “disparities,” as well as suggestions for methodological approaches when conducting disparity-focused research (32). Leventhal and colleagues proposed a Sociopharmacological model for tobacco addiction, which places emphasis on the interaction between physiology-level pharmacological processes and the contexts that shape the relationship between pharmacology and behavior (33). Adler & Stewart’s health behavior theory-based heuristic model provides epistemological guidance on disparities as well as pathways linking socioeconomic status, gender and race, environmental resources and constraints, and psychological influences (34). Such factors are then related to access to healthcare, environmental exposures, health behaviors, and physiological responses that in turn determine health outcomes. Intersectionality, has been a fruitful framework for generating knowledge in the field of health disparities research and praxis (35), despite challenges in clearly defining the concept. Definitions of intersectionality are varied, but generally take a disparity group-member’s perspective as an individual with multiple intersecting identities that are influenced by and subject the individual to systems of oppression. Consequently, and despite epistemological challenges, intersectionality may be

particularly useful in the study of menthol use among Black women.. Reports included in this review were quantitative investigations; however, qualitative research has potential to uncover highly important information regarding menthol use. For example, in the U.K. Moodie and colleagues conducted focus groups and uncovered misperceptions of menthol use including the belief that menthol cigarettes are cleaner, fresher, and safer than standard non-menthol cigarettes (36). Similar conclusions were drawn from previous qualitative research specifically conducted among Black smokers in the U.S. (37).

Conclusions

The primary conclusion that can be drawn from this systematic review is that despite a wealth of evidence that women are more likely to smoke menthol cigarettes than men, there is very little current research on gender differences on correlates of menthol use or related outcomes. Gender differences in menthol use among Black smokers is a highly relevant but understudied topic of research – our review did not identify a single investigation published between 2011 and April, 2017. As noted by Anderson and colleagues,(4) the irony inherent in the lack of attention to these topics among researchers is that the U.S. the tobacco industry clearly understands the relevance of focusing on gender as well Black smokers in their advertising; yet the tobacco control community has paid relatively little attention to gender differences in menthol cigarette use beyond its prevalence, or among Black smokers. Research in this area holds promise for informing public health intervention that addresses racial/ethnic and gender-related disparities in cigarette smoking and related outcomes.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance
 - Of major importance
1. U.S. Department of Health and Human Services. The Health Consequences of Smoking - 50 years of progress: A Report of the Surgeon General. Atlanta, GA: 2014.
 2. Villanti AC, Mowery PD, Delnevo CD, Niaura RS, Abrams DB, Giovino GA. Changes in the prevalence and correlates of menthol cigarette use in the USA, 2004–2014. *Tobacco control*. 2016; 25:ii14–ii20. This study provides a relatively up-to-date and in-depth examination of prevalence trends for menthol cigarette use in the U.S., as well as sub-group differences and correlates of use. [PubMed: 27729565]
 3. Giovino GA, Villanti AC, Mowery PD, Sevilimedu V, Niaura RS, Vallone DM, et al. Differential trends in cigarette smoking in the USA: is menthol slowing progress? *Tobacco Control*. 2015; 24(1): 28–37. [PubMed: 23997070]
 4. Anderson SJ. Marketing of menthol cigarettes and consumer perceptions: a review of tobacco industry documents. *Tobacco Control*. 2011; 20(Suppl 2):ii20–ii8. [PubMed: 21504928]
 5. Giovino GA, Gardiner PS. Understanding tobacco use behaviors among African Americans: Progress, critical gaps, and opportunities. *Nicotine Tob Res*. 2016; 18(Suppl 1):S1–S6. This review and critical analyses places the issue of menthol cigarette use among Black smokers in a broader context of smoking, generally. The review also provides expert opinion on advantageous directions for future research. [PubMed: 26980859]
 6. U.S. Food and Drug Administration. Preliminary scientific evaluation of the possible public health effects of menthol versus nonmenthol cigarettes. 2013. [Available from: <https://www.fda.gov/downloads/UCM361598.pdf>] This report provides a wealth of information on menthol use and

related health outcomes, with assessments of the quality of evidence for different topics (e.g., the association between menthol use and likelihood of cigarette smoking cessation)

7. Malone RE. It's the 21st century: Isn't it past time to ban menthol cigarette sales? *Tobacco Control*. 2017; 26(4):359–60. [PubMed: 28663522]
8. Smith PH, Bessette AJ, Weinberger AH, Sheffer CE, McKee SA. Sex/gender differences in smoking cessation: A review. *Preventive medicine*. 2016; 92:135–40. [PubMed: 27471021]
9. Smith MV, Ramsay C, Mazure CM. Understanding disparities in subpopulations of women who smoke. *Current addiction reports*. 2014; 1(1):69. [PubMed: 24533257]
10. Allen B Jr, Unger JB. Sociocultural correlates of menthol cigarette smoking among adult African Americans in Los Angeles. *Nicotine Tob Res*. 2007; 9(4):447–51. [PubMed: 17454699]
11. Curtin GM, Sulsky SI, Van Landingham C, Marano KM, Graves MJ, Ogden MW, et al. Patterns of menthol cigarette use among current smokers, overall and within demographic strata, based on data from four U.S. government surveys. *Regul Toxicol Pharmacol*. 2014; 70(1):189–96. [PubMed: 24997230]
12. Delnevo CD, Gundersen DA, Hrywna M, Echeverria SE, Steinberg MB. Smoking-cessation prevalence among U.S. smokers of menthol versus non-menthol cigarettes. *Am J Prev Med*. 2011; 41(4):357–65. [PubMed: 21961462]
13. D'Silva J, Boyle RG, Lien R, Rode P, Okuyemi KS. Cessation outcomes among treatment-seeking menthol and nonmenthol smokers. *Am J Prev Med*. 2012; 43(5 Suppl 3):S242–8. [PubMed: 23079223]
14. Fallin A, Goodin AJ, King BA. Menthol cigarette smoking among lesbian, gay, bisexual, and transgender adults. *Am J Prev Med*. 2015; 48(1):93–7. [PubMed: 25245795]
15. Hickman NJ 3rd, Delucchi KL, Prochaska JJ. Menthol use among smokers with psychological distress: findings from the 2008 and 2009 National Survey on Drug Use and Health. *Tobacco Control*. 2014; 23(1):7–13. [PubMed: 22821797]
16. Kasza KA, Hyland AJ, Bansal-Travers M, Vogl LM, Chen J, Evans SE, et al. Switching between menthol and nonmenthol cigarettes: findings from the U.S. Cohort of the International Tobacco Control Four Country Survey. *Nicotine Tob Res*. 2014; 16(9):1255–65. [PubMed: 24984878]
17. Villanti AC, Giovino GA, Barker DC, Mowery PD, Sevilimedu V, Abrams DB. Menthol brand switching among adolescents and young adults in the National Youth Smoking Cessation Survey. *Am J Public Health*. 2012; 102(7):1310–2. [PubMed: 22594728]
18. Hooper MW, Zhao W, Byrne MM, Davila E, Caban-Martinez A, Dietz NA, et al. Menthol cigarette smoking and health, Florida 2007 BRFSS. *Am J Health Behav*. 2011; 35(1):3–14. [PubMed: 20950154]
19. O'Connor RJ, Bansal-Travers M, Carter LP, Cummings KM. What would menthol smokers do if menthol in cigarettes were banned? Behavioral intentions and simulated demand. *Addiction*. 2012; 107(7):1330–8. [PubMed: 22471735]
20. Pearson JL, Abrams DB, Niaura RS, Richardson A, Vallone DM. A ban on menthol cigarettes: impact on public opinion and smokers' intention to quit. *Am J Public Health*. 2012; 102(11):e107–14. [PubMed: 22994173]
21. Reitzel LR, Nguyen N, Cao Y, Vidrine JI, Daza P, Mullen PD, et al. Race/ethnicity moderates the effect of prepartum menthol cigarette use on postpartum smoking abstinence. *Nicotine Tob Res*. 2011; 13(12):1305–10. [PubMed: 21622498]
22. Oncken C, Feinn R, Covault J, Duffy V, Dornelas E, Kranzler HR, et al. Genetic vulnerability to menthol cigarette preference in women. *Nicotine Tob Res*. 2015; 17(12):1416–20. [PubMed: 25832883]
23. Blot WJ, Cohen SS, Aldrich M, McLaughlin JK, Hargreaves MK, Signorello LB. Lung cancer risk among smokers of menthol cigarettes. *J Natl Cancer Inst*. 2011; 103(10):810–6. [PubMed: 21436064]
24. Benowitz NL, Herrera B, Jacob P. Mentholated cigarette smoking inhibits nicotine metabolism. *Journal of Pharmacology and Experimental Therapeutics*. 2004; 310(3):1208–15. [PubMed: 15084646]

25. Benowitz NL, Lessov-Schlaggar CN, Swan GE, Jacob P. Female sex and oral contraceptive use accelerate nicotine metabolism. *Clinical Pharmacology & Therapeutics*. 2006; 79(5):480–8. [PubMed: 16678549]
26. Rubinstein ML, Shiffman S, Rait MA, Benowitz NL. Race, gender, and nicotine metabolism in adolescent smokers. *Nicotine Tob Res*. 2013; 15(7):1311–5. [PubMed: 23239845]
27. Mwenifumbo JC, Sellers EM, Tyndale RF. Nicotine metabolism and CYP2A6 activity in a population of black African descent: Impact of gender and light smoking. *Drug and Alcohol Dependence*. 2007; 89(1):24–33. [PubMed: 17161559]
28. Borrell LN, Roux AVD, Jacobs DR, Shea S, Jackson SA, Shrager S, et al. Perceived racial/ethnic discrimination, smoking and alcohol consumption in the Multi-Ethnic Study of Atherosclerosis (MESA). *Preventive medicine*. 2010; 51(3):307–12. [PubMed: 20609433]
29. Wiehe SE, Aalsma MC, Liu GC, Fortenberry JD. Gender differences in the association between perceived discrimination and adolescent smoking. *Am J Public Health*. 2010; 100(3):510–6. [PubMed: 20075313]
30. Jackson JS, Knight KM, Rafferty JA. Race and unhealthy behaviors: chronic stress, the HPA axis, and physical and mental health disparities over the life course. *Am J Public Health*. 2010; 100(5): 933–9. [PubMed: 19846689]
31. Smith PH, Oberleitner LM, Smith KM, McKee SA. Childhood adversity interacts with adult stressful events to predict reduced likelihood of smoking cessation among women but not men. *Clinical Psychological Science*. 2016; 4(2):183–93. [PubMed: 27026829]
32. Hebert PL, Sisk JE, Howell EA. When does a difference become a disparity? Conceptualizing racial and ethnic disparities in health. *Health Affairs*. 2008; 27(2):374–82. [PubMed: 18332492]
33. Leventhal AM. The sociopharmacology of tobacco addiction: implications for understanding health disparities. *Nicotine Tob Res*. 2015; 18(2):110–21. [PubMed: 25890832]
34. Adler NE, Stewart J. Health disparities across the lifespan: meaning, methods, and mechanisms. *Annals of the New York Academy of Sciences*. 2010; 1186(1):5–23. [PubMed: 20201865]
35. Jackson JW. Explaining intersectionality through description, counterfactual thinking, and mediation analysis. *Social Psychiatry and Psychiatric Epidemiology*. 2017; 52(7):785–93. [PubMed: 28540515]
36. Moodie C, Ford A, Mackintosh A, Purves R. Are all cigarettes just the same? Female’s perceptions of slim, coloured, aromatized and capsule cigarettes. *Health Educ Res*. 2015; 30(1):1–12. [PubMed: 25341674]
37. Richter P, Beistle D, Pederson L, O’Hegarty M. Small-group discussions on menthol cigarettes: listening to adult African American smokers in Atlanta, Georgia. *Ethnicity and Health*. 2008; 13(2):171–82. [PubMed: 18425713]

Table 1

Summary of publications on mentholated cigarette use and related outcomes by gender and the intersection of gender and black/African American race/ethnicity, published between 2011 and April, 2017

Study	Design	Sample	Results
<i>Prevalence</i>			
Curtin et al. (2014)	CS	U.S.; compiled results from 4 nationally representative surveys: National Health and Nutrition Examination Survey (NHANES; 1999–2010); National Survey on Drug Use and Health (NSDUH; 2000–2009); National Health Interview Survey (NHIS; 2005 and 2010); Tobacco Use Supplement-Current Population Survey (TUS-CPS; 2003 and 2006/2007)	<p><i>Prevalence of menthol, among current (past month) smokers aged at least 20 years:</i></p> <p><u>NHANES</u> Women: 31.2% Men: 20.7% (p-value for difference < 0.05)</p> <p><u>NSDUH</u> Women: 33.8% Men: 26.3% (p-value for difference < 0.05)</p> <p><u>NHIS</u> Women: 34.2% Men: 25.1% (p-value for difference < 0.05)</p> <p><u>TUS-CPS</u> Women: 32.4% Men: 23.6% (p-value for difference < 0.05)</p> <p><i>Prevalence of menthol, among current (past month) smokers aged 12–19 years:</i></p> <p><u>NHANES</u> Women: 25.7% Men: 18.7% (p-value for difference non-significant)</p>
Delnevo et al. (2011)	CS	U.S.; Tobacco Use Supplement of the Current Population Survey (2003, 2006–2007); area probability sampling design; current smokers or those who quit in past 5 years; overall response rate 92%–97%; n = 71,193	<p><i>Prevalence of menthol, current smokers and those who quit in past 5 years:</i></p> <p>Women: 32.0% (95% CI = 31.4, 32.6) Men: 22.8% (95% CI = 22.3, 23.4) (p < 0.05)</p>
D'Silva et al. (2012)	CS	U.S.; Quitline callers (ClearWay Minnesota); called September 2009 – July 2011; registered for counseling services; n = 6257	<p><i>Prevalence of menthol use:</i></p> <p>Women: 69.5% (95% CI = 66.7, 72.1) Men: 30.5% (95% CI = 27.9, 33.3) (p < 0.05)</p>
Fallin et al. (2015)	CS	U.S.; National Adult Tobacco Survey (2009–2010); landline and cellphone survey of non-institutionalized adults aged at least 18, current cigarette smokers. Estimates provided for overall sample (n = 16,116), LGBT (n = 650), and heterosexual (n = 15,466)	<p><i>Prevalence of menthol among current smokers:</i></p> <p>Women: 32.8% Men: 25.5% AOR = 1.63 (95% CI = 1.51, 1.75) LGBT Women: 42.9% LGBT Men: 30.0% Heterosexual Women: 32.4% Heterosexual Men: 25.3%</p>
Giovino et al. (2015)	CS	U.S.; 2004–2010 National Survey on Drug Use and Health; representative sample of U.S. households; current (past month) smokers; n = 40,841 for 2008–2010 estimates	<p><i>Prevalence of menthol among current (past month) smokers (2008–2010):</i></p> <p>Women: 39.7% (95% CI = 38.1, 41.19) Men: 31.4% (95% CI = 30.2, 32.6)</p>
Hickman et al. (2014)	CS	U.S., National Survey on Drug Use and Health (2008–2009); representative sample of U.S. households; current (past month) smokers; n = 24,157	<p><i>Prevalence of menthol, among current (past-month) smokers:</i></p> <p>Women: 37.5% (95% CI = 36.7, 38.3) Men: 29.6% (95% CI = 28.8, 30.4) AOR (women vs. men): 1.59 (95% CI = 1.42, 1.77; p < 0.0001)</p>
Kasza et al. (2014)	CS	U.S., Australia, U.K., Canada; International Tobacco Control – Four Country Survey; current smokers (100+ cigs in lifetime, smoked in past 30 days); n = 5,932	<p><i>Prevalence of menthol, among current smokers:</i></p> <p>Women: 30% Men: 23% OR (men vs. women) = 0.63; 95% CI = 0.55, 0.71</p>
Villanti et al. (2012)	CS	U.S.; National Youth Smoking Cessation Survey (2003); random-digit-dial; 16–24 year-olds, ever smoked 20 lifetime cigarettes, smoked at least once during the previous 3 days. CASRO response rate = 41.8%; n = 1,045	<p><i>Prevalence of menthol, among current smokers:</i></p> <p>Women: 34.6% (95% CI = 29.92, 39.34) Men: 29.2% (95% CI = 24.83, 33.55)</p>
Webb Hooper et al. (2011)	CS	U.S., Florida Behavioral Risk Factor Surveillance System (2007); households with landline telephones; current smokers contacted through follow-up survey; n = 3,396	<p><i>Prevalence of menthol, among current smokers:</i></p> <p>Women: 28.6% Men: 21.0%</p>

Study	Design	Sample	Results
			AOR (women vs. men) = 1.62; 95% CI = 1.34, 1.97; $p < 0.001$
<i>Initiation</i>			
Villanti et al. (2012)	CS	U.S.; National Youth Smoking Cessation Survey (2003); random-digit-dial; 16–24 year-olds, ever smoked 20 lifetime cigarettes, smoked at least once during the previous 3 days. CASRO response rate = 41.8%; $n = 1,045$	Did not find difference between male and female youth smokers in the likelihood of switching from non-menthol to menthol. Men: 7.2% (95% CI = 4.36, 10.00) Women: 6.6% (95% CI = 3.69, 9.41)
<i>Cessation</i>			
O'Connor et al. (2012)	CS	U.S.; Web survey conducted through Global Market Insite, Inc.; current smokers aged 14–65 years; $n = 471$	Did not find a difference between male and female smokers in the likelihood of reporting 'I would try to quit smoking' if menthol cigarettes were banned. Women: 37.0% Men: 35.7% AOR (men vs. women) = 0.87 (95% CI = 0.41, 1.83)
Pearson et al. (2012)	CS	U.S.; June 2010 panel of Knowledge Networks' KnowledgePanel; Nationally representative sample; adults aged 18 and older; randomly sampled panel, with response rate of 64.5%; surveyed all current smokers and 20% of former and never smokers; $n = 2,649$	Women were more likely to report they would try to quit if menthol cigarettes were banned prior to, but not after, adjusting for covariates. Women: 44.0% (95% CI = 36.1, 52.1) Men: 33.1% (95% CI = 24.8, 42.6) OR (women vs. men) = 1.59 (95% CI = 0.94, 2.68) AOR (women vs. men) = 0.92 (0.46, 1.84)
			Did not find a difference between male and female smokers in likelihood of reporting would switch to non-menthol brand and try to quit if menthol cigarettes were banned. Women: 24.0% (95% CI = 17.9, 31.5) Men: 26.6% (95% CI = 18.5, 36.7) OR (women vs. men) = 0.87 (95% CI = 0.49, 1.59) AOR (women vs. men) = 1.01 (95% CI = 0.50, 2.06)
Reitzel et al. (2011)	P	U.S.; Pregnant women enrolled in smoking abstinence clinical trial; at least 18 years old; smoked at least 1 cigarette daily for the year prior to pregnancy; stopped smoking during pregnancy or within 2 months of becoming pregnant. Excluded high-risk pregnancies; $n = 251$.	Significant differences between racial/ethnic groups in association between menthol use and abstinence. "White menthol users were less likely to maintain continuous abstinence than White non-menthol users." <u>White</u> : OR = 0.19 (95% CI = 0.04, 0.89) "The relationships between menthol use and continuous abstinence were not significant among the other racial/ethnic subgroups in adjusted analyses..." <u>Black</u> : OR = 0.33 ($p = 0.08$) <u>Latina</u> : OR = 1.58 ($p = 0.35$)
<i>Biological and/social correlates</i>			
Fallin et al. (2015)	CS	U.S.; National Adult Tobacco Survey (2009–2010); landline and cellphone survey of non-institutionalized adults aged at least 18, current cigarette smokers. Estimates provided for overall sample ($n = 16,116$), LGBT ($n = 650$), and heterosexual ($n = 15,466$)	Greater prevalence of menthol among LGBT Women compared to heterosexual women (42.9% vs. 32.4%). Difference not found among men
Oncken et al. (2015)	CS	U.S.; Pregnant women enrolled in clinical trial for smoking cessation; $n = 323$	Among both non-Hispanic and Hispanic women, dose-response association between number of Proline-Alanine-valine (PAV) haplotypes variations of TAS2R38 (taste-receptor gene) and menthol smoking. <u>Non-Hispanic</u> 0 PAV: 34%; 1 PAV: 59%; 2 PAV: 85% <u>Hispanic</u> 0 PAV: 90%; 1 PAV: 95%; 2 PAV: 100%
<i>Health outcomes</i>			
Blot et al. (2011)	CC	U.S.; Southern Community Cohort Study; 2002–2009; adults aged 40–79 years; nested case-control study of incident lung cancer ($n = 440$) and matched controls; $n = 2213$	Menthol cigarettes were associated with lower incidence of lung cancer among women but not men, although gender difference was non-significant ($p = 0.45$) Women: OR (menthol vs. non-menthol) = 0.43 (95% CI = 0.24, 0.75) Men: OR (menthol vs. non-menthol) = 0.77 (95% CI = 0.49, 1.23)

Note: Regarding study design, CS = cross-sectional; P = prospective; Q = qualitative; CC = case-control. OR = odds ratio; AOR = adjusted odds ratio; 95% CI = 95% confidence interval.

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