



Racial/ethnic differences in daily, nondaily, and menthol cigarette use and smoking quit ratios in the United States: 2002 to 2016

Andrea H. Weinberger^{a,b}, Daniel P. Giovenco^c, Jiaqi Zhu^d, Joun Lee^{a,e}, Rachel S. Kashan^a,
Renee D. Goodwin^{d,f,g,*}

^a Ferkauf Graduate School of Psychology, Yeshiva University, Bronx, NY, USA

^b Department of Epidemiology & Population Health, Albert Einstein College of Medicine, Bronx, NY, USA

^c Department of Sociomedical Sciences, Mailman School of Public Health, Columbia University, New York, NY, USA

^d Institute for Implementation Science in Population Health, The City University of New York, New York, NY, USA

^e Department of Clinical Psychology, Teachers College, Columbia University, New York, NY, USA

^f Department of Epidemiology and Biostatistics, Graduate School of Public Health and Health Policy, The City University of New York, New York, NY, USA

^g Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, USA

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ABSTRACT

In the United States (US), racial/ethnic groups differ in cigarette smoking behaviors. We examined changes in cigarette prevalence and quit ratios over 15 years by racial/ethnic group (Non-Hispanic (NH) White, NH Black, Hispanic, NH Other). Data were drawn from the 2002–2016 National Survey on Drug Use and Health (NSDUH) public use data files and analyzed in 2018. Linear time trends of the prevalence of daily, nondaily, and menthol cigarette use and quit ratios (i.e., proportion of former smokers among lifetime smokers) were assessed using logistic regression models. 19.35% of NH White persons were daily smokers in 2016; this prevalence was significantly higher than all other groups (NH Black 10.99%, Hispanic 6.81%, NH Other 9.10%). Menthol use was significantly more common among NH Black individuals than all other groups in every year from 2002 to 2016 (2016: NH Black 23.38%, NH White 14.52%, Hispanic 10.49%, NH Other 8.97%). From 2002 to 2016, daily and nondaily smoking decreased significantly among all groups. The rate of decline of nondaily smoking was more rapid among Hispanic than NH White individuals while the rate of menthol smoking decline was more rapid among NH White than among Hispanic individuals. The quit ratio did not change significantly from 2002 to 2016 among NH Black individuals (31% to 35%) in contrast to a significant increase among NH White (2002, 45%; 2016, 50%) and Hispanic (2002, 33%; 2016, 41%) individuals. Further progress in tobacco control for vulnerable groups may need to include innovative strategies to address these concerning trends.

1. Introduction

While persons from all racial/ethnic groups experience deleterious health consequences from cigarette smoking, there is evidence of tobacco-related disparities among racial/ethnic minority groups (Lortet-Tieulent et al., 2017; USDHHS, 1998; Fagan et al., 2007). Broad differences in cigarette smoking patterns by race/ethnicity have been documented in the United States (US), which may contribute to these inequities (Wang et al., 2018a). Therefore, more in-depth information on racial/ethnic-specific patterns in cigarette use and quitting behaviors, including differences in trends over time using the most recent data available, are needed in order to inform the next steps toward

reducing racial/ethnic disparities in smoking and tobacco-related disease.

US data suggest that the prevalence of current cigarette smoking is similar among Non-Hispanic (NH) White and NH Black individuals (14.9–15.2%), lower among Hispanic individuals (9.9%), and higher among American Indian/Alaskan Native individuals (24.0%) and individuals who identify as more than one race (20.6%) (Wang et al., 2018a). In addition to racial/ethnic differences in the overall prevalence of current cigarette smoking, there may be differences in specific types of smoking behavior, such as nondaily cigarette smoking. Nondaily smokers comprise an increasing proportion of cigarette smokers (Jamal et al., 2015; Edwards et al., 2010; Nguyen and Zhu, 2009;

* Corresponding author at: Department of Epidemiology and Biostatistics, CUNY Graduate School of Public Health and Health Policy, 55 West 125th Street, Rm 611, New York, NY 10027, USA.

E-mail addresses: andrea.weinberger@einstein.yu.edu (A.H. Weinberger), dg2984@cumc.columbia.edu (D.P. Giovenco), jz2783@columbia.edu (J. Zhu), joun.lee@einstein.yu.edu (J. Lee), rkashan@mail.yu.edu (R.S. Kashan), renee.goodwin@sph.cuny.edu (R.D. Goodwin).

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Hassmiller et al., 2003), but only a few studies have examined racial/ethnic differences in these patterns, with mixed results. Some evidence suggests that NH Black and Hispanic persons in the US are more likely to report nondaily smoking than NH Whites (Wang et al., 2018b). Moreover, approximately two-thirds of Hispanic individuals who smoke and half of NH Black individuals who smoke report nondaily smoking, compared to one-third of NH White individuals who smoke (USDHHS, 2014). One study using National Health Interview Survey, however, data found a greater increase in nondaily smoking from 1998 to 2010 among NH White than NH Black persons (Wang et al., 2018b). Because cigarette use is unsafe at any level, a deeper understanding of trends in nondaily use and its potential impact on health disparities is warranted (Schane et al., 2010; Inoue-Choi et al., 2019). Further, the prevalence of menthol cigarette use, associated with reduced cessation (Villanti et al., 2017; Smith et al., 2014; Okuyemi et al., 2007; Levy et al., 2011; Foulds et al., 2010; Delnevo et al., 2011), differs between racial/ethnic groups, with menthol use being significantly more common among NH Black persons compared to other groups (Giovino et al., 2015; Rath et al., 2016; Cohn et al., 2019). While overall cigarette use had decreased over time, it is not clear whether and to what degree the prevalence of menthol smoking has been similarly affected and/or whether declines in menthol use have been similar across racial/ethnic groups. A more detailed understanding of recent trends in daily, nondaily, and menthol smoking by race/ethnicity is needed to monitor disparities (e.g., examine whether disparities are decreasing or increasing over time for specific subgroups) and identify public health and clinical intervention opportunities.

In addition to examining patterns of diverse smoking behaviors between sociodemographic groups, it is also critical to monitor trends in quitting over time. While more NH Black individuals report making quit attempts than NH White individuals (Babb et al., 2017; Kulak et al., 2016), rates of successful quitting and sustained abstinence are lower among NH Black persons than NH White and Hispanic persons (Babb et al., 2017; Kulak et al., 2016; Fu et al., 2008). The smoking quit ratio has increased in the general population over time (Jamal et al., 2015); however, it is not known whether the quit ratios are equitable in direction and speed across all racial/ethnic groups.

The purpose of this study was to extend our knowledge of and provide novel information about racial/ethnic differences in cigarette smoking and quitting using repeated waves of cross-sectional data from national samples of US persons age 12 and older. The first aim of the study was to examine racial/ethnic differences in the prevalence of current daily, nondaily, and menthol cigarette use and cigarette smoking quit ratios in 2016 among persons in the US. Based on the previous research cited above, we hypothesized that there would be a higher prevalence of daily cigarette smoking among NH White and NH Black individuals than among Hispanic individuals, a higher prevalence of nondaily cigarette smoking among NH Black and Hispanic individuals than among NH White individuals, and a higher prevalence of menthol cigarette smoking among NH Black individuals than among other racial/ethnic groups. The second aim of the study was to examine trends in the prevalence of cigarette use and quit ratios by race/ethnicity among persons in the US from 2002 to 2016.

2. Methods

2.1. Study population

This study analyzed data from the National Survey on Drug Use and Health (NSDUH) which collects annual cross-sectional data from US male and female civilian non-institutionalized persons age 12 and older in each of the 50 states and the District of Columbia (Center for Behavioral Health Statistics and Quality, 2017). Data were extracted from the public data portal (<http://datafiles.samhsa.gov/>) for the years 2002 through 2016. The datasets from each year were concatenated adding a variable for the survey year. For the analyses of daily and

nondaily cigarette smoking prevalence; the analytic sample for 2016 was $n = 48,785$ and for 2002 to 2016 combined was $n = 720,214$. Participants who responded to questions about menthol cigarette smoking were included in the analyses of menthol prevalence (2016: $n = 43,931$; 2002 to 2016 combined: $n = 550,067$). Respondents who were 18 years old or older and reported lifetime and former cigarette smoking were included in the analyses of quit ratios (2016: $n = 15,551$ lifetime cigarette smokers, $n = 5543$ former cigarette smokers; 2002 to 2016 combined: $n = 238,518$ lifetime cigarette smokers, $n = 67,035$ former cigarette smokers).

2.2. Measures

2.2.1. Cigarette smoking prevalence

Individuals who reported smoking at least 100 lifetime cigarettes and at least 1 cigarette within the past 30 days were classified as current (i.e., past-month) smokers. Current smokers were then subdivided by frequency of smoking. Those who reporting smoking 1 to 29 out of the past 30 days were classified as current nondaily smokers and those who smoked 30 out of the past 30 days were classified as current daily smokers consistent with other research (Pacek and McClemon, 2018; Goodwin et al., 2018).

2.2.2. Menthol smoking prevalence

Current (i.e., past-month) menthol cigarette smoking prevalence was assessed using the following question: “Were the cigarettes you smoked during the past 30 days menthol?” Individuals who answered “Yes” to this question were classified as current menthol smokers. Because the assessment of current menthol cigarette smoking changed in 2004, data are presented for current menthol cigarette smoking from 2004 to 2016.

2.2.3. Smoking quit ratio

Respondents were classified as lifetime cigarette smokers if they reported having smoked 100 or more lifetime cigarettes. Respondents were classified as former smokers if they reported having smoked 100 or more lifetime cigarettes and no cigarette smoking in the past year. The definition of former smokers was meant to capture persons with long-term abstinence and to be consistent with other research on quit ratios using the NSDUH (Streck et al., 2018; Weinberger et al., 2019). The cigarette smoking quit ratio was calculated as the proportion of former smokers among lifetime smokers and is considered a measure of total cessation in a population.

2.2.4. Race/ethnicity

Race/ethnicity was classified as four non-overlapping groups: NH White (reference group), NH Black (Black or African-American), Hispanic (Hispanic or Latino/a), and NH Other (i.e., NH Native American or Alaskan Native, NH Native Hawaiian or Other Pacific Islander, NH Asian, NH more than one race). Racial/ethnic categories were based on National Institutes of Health and National Institute on Minority Health and Health Disparities categories (e.g., <https://www.nimhd.nih.gov/about/overview/>) and other epidemiologic research on race/ethnicity (e.g., (Wang et al., 2018a; Wang et al., 2018b)).

2.2.5. Demographics

Demographic covariates were: age (12 to 17 years old as reference, 18 to 25 years old, 26 to 34 years old, 35 or older for cigarette and menthol smoking prevalence analyses; 18 to 25 years old as reference, 26 to 34 years old, 35 or older for smoking quit ratio analyses), gender (male as reference, female), and education (some high school or less as reference, high school graduate, some college or more, 12–17 years old). With regard to education, youth who were still attending school and adults age 18 and older who did not complete high school were each classified in their own category (“12–17 years old” and “some high school or less”, respectively).

2.3. Statistical analysis

To estimate the cigarette smoking prevalence over time among those 12 and older by race/ethnicity, the prevalence of current (i.e., past-month) daily cigarette smoking and associated standard errors were calculated for each year from 2002 to 2016 among the whole population, and stratified by race/ethnicity. Time trends in the prevalence of daily cigarette smoking stratified by race/ethnicity were tested using logistic regression with continuous year as the predictor for the linear time trend. These analyses were conducted twice: first with no covariates (unadjusted) and then while adjusting for age, gender, and education. To determine whether there were differential time trends in daily cigarette smoking by race/ethnicity, additional logistic regressions were run that included the 2-way interaction of year by race/ethnicity overall (NH White, NH Black, Hispanic, NH Other) and group-specific (NH White versus NH Black, NH White versus Hispanic, NH White versus NH Other) if the overall model was found to be significant. The same analyses were then repeated first with current (i.e., past-month) nondaily cigarette smoking and then with current (i.e., past month) menthol cigarette smoking in place of daily cigarette smoking.

To estimate the quit ratio over time among those 18 and older by race/ethnicity, the proportion of former smokers and associated standard errors among lifetime smokers, stratified by race/ethnicity, were calculated for each year from 2002 to 2016. Time trends in the probability of being a former smoker stratified by race/ethnicity were tested using logistic regression with continuous year as the predictor for the linear time trend. To determine whether there were differential time trends in quit ratio by race/ethnicity, additional logistic regressions were run that included the 2-way interaction of year by race/ethnicity (NH White, NH Black, Hispanic, NH Other).

All analyses were performed incorporating the NSDUH sampling weights and controlling for the complex clustered sampling using SAS-callable SUDAAN Version 11.0.1 (RTI International, Research Triangle Park, NC; <http://www.rti.org/sudaan/>), which used the Taylor series estimation methods to provide accurate standard errors. As our analyses used data from 15 NSDUH years (13 NSDUH years for menthol cigarette smoking), we divided the survey weights by 15 (or 13) to obtain nationally representative estimates.

3. Results

3.1. Daily cigarette smoking prevalence by race/ethnicity

3.1.1. Daily cigarette smoking prevalence in 2016 by race/ethnicity

See Table 1 for the prevalence of daily cigarette smoking in 2016 by race/ethnicity. Compared to NH White respondents (19.35%), the prevalence of current daily cigarette smoking in 2016 was significantly lower for NH Black (10.99%), Hispanic (6.81%), and NH Other (9.10%) respondents. The higher daily cigarette smoking prevalence for NH White respondents compared to other groups was significant in unadjusted and adjusted analyses.

3.1.2. Trends in daily cigarette smoking prevalence from 2002 to 2016 by race/ethnicity

See Fig. 1 and Supplementary Table 1 for the prevalence of daily cigarette smoking from 2002 to 2016 by race/ethnicity. The prevalence of daily smoking decreased from 2002 to 2016 for each race/ethnicity group. The year by group interaction was not significant suggesting that there were no differences in the speed of decrease in daily smoking prevalence over time by race/ethnicity.

3.2. Nondaily cigarette smoking prevalence by race/ethnicity

3.2.1. Nondaily cigarette smoking prevalence in 2016 by race/ethnicity

See Table 1 for the prevalence of nondaily cigarette smoking in 2016 by race/ethnicity. The prevalence of current nondaily cigarette smoking in 2016 was highest among NH Black respondents (11.23%), followed by NH White (9.81%) and Hispanic (8.07%) respondents. The prevalence was lowest for NH Other respondents (7.13%). Compared to NH White respondents, the prevalence of nondaily smoking was significantly lower for Hispanic and NH Other respondents and significantly higher for NH Black respondents (see Table 1). After adjusting for demographics, the prevalence of nondaily smoking was significantly less common among Hispanic and NH Other respondents compared to NH White respondents. NH Black respondents did not differ significantly from NH White respondents in nondaily smoking.

3.2.2. Trends in nondaily cigarette smoking prevalence from 2002 to 2016 by race/ethnicity

Each racial/ethnic group experienced a significant decrease in the prevalence of nondaily smoking from 2002 to 2016 in both unadjusted and adjusted analyses (See Fig. 2 and Supplementary Table 2). The year by group interaction was significant in both unadjusted and adjusted

Table 1

The association of current daily cigarette, nondaily cigarette, and menthol cigarette smoking by race/ethnicity in 2016 (NSDUH, age 12 and older).

	NH White		NH Black		Hispanic		NH other ^a		NH Black vs. NH White		Hispanic vs. NH White		NH Other ^a vs. NH White	
	%	s.e.	%	s.e.	%	s.e.	%	s.e.	Unadjusted OR (95% CL) ^b	Adjusted OR (95% CL) ^{b,c}	Unadjusted OR (95% CL) ^b	Adjusted OR (95% CL) ^{b,c}	Unadjusted OR (95% CL) ^b	Adjusted OR (95% CL) ^{b,c}
Current daily cigarette smoking	19.35	0.44	10.99	0.56	6.81	0.39	9.10	0.63	0.51 (0.45, 0.58)	0.39 (0.34, 0.45)	0.30 (0.27, 0.34)	0.20 (0.17, 0.23)	0.42 (0.35, 0.49)	0.49 (0.41, 0.58)
Current non-daily cigarette smoking	9.81	0.33	11.23	0.58	8.07	0.53	7.13	0.89	1.14 (1.09, 1.19)	0.92 (0.80, 1.05)	0.94 (0.90, 0.99)	0.61 (0.50, 0.75)	0.68 (0.64, 0.73)	0.75 (0.57, 0.99)
Current menthol cigarette smoking	9.50	0.31	19.34	0.62	8.13	0.52	7.33	0.74	2.29 (2.07, 2.52)	1.37 (1.22, 1.54)	0.84 (0.73, 0.98)	0.49 (0.41, 0.59)	0.75 (0.60, 0.95)	0.64 (0.50, 0.81)

Key: CL, confidence limits; NH, non-Hispanic; NSDUH, National Survey on Drug Use and Health; OR, odds ratio; s.e., standard error.

^a Note: NH Other included respondents who identified as NH Native American/Alaskan Native, NH Native Hawaiian/Other Pacific Islander, NH Asian, and NH more than one race.

^b OR compares smoking versus non-smoking.

^c Adjusted for age (12–17 years old, 18–25 years old, 26–34 years old, 35 years old and older), gender (male, female), and education (less than high school, high school graduate, some college or more, 12–17 years old).

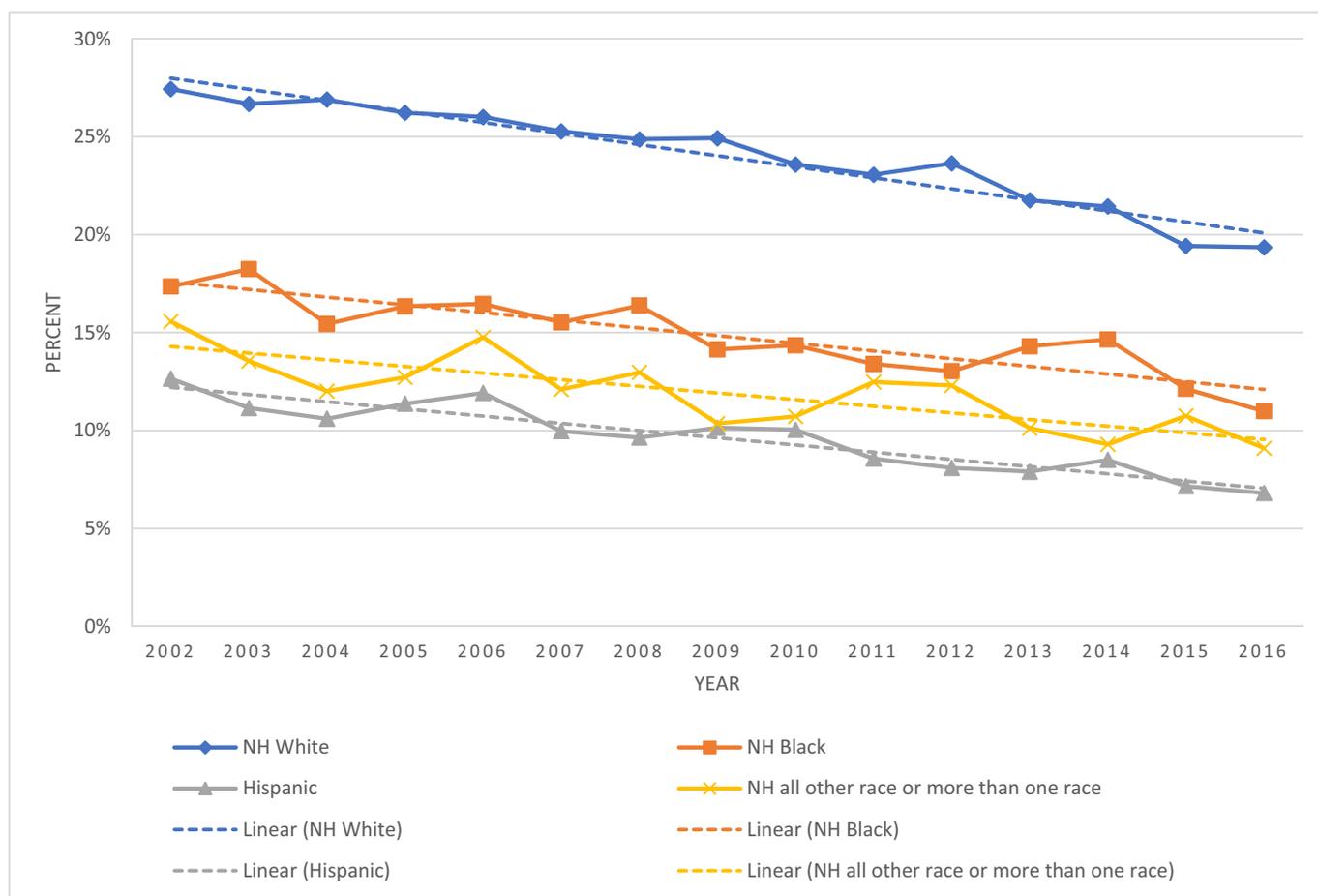


Fig. 1. Prevalence of past-month daily cigarette smoking from 2002 to 2016 by race/ethnicity (National Survey on Drug Use and Health, age 12 and older).

analyses suggesting that the decrease in nondaily smoking prevalence over time was more rapid among Hispanic respondents than among NH White participants.

3.3. Menthol cigarette smoking prevalence by race/ethnicity

3.3.1. Menthol cigarette smoking prevalence in 2016 by race/ethnicity

See Table 1 for the prevalence of menthol cigarette smoking in 2016 by race/ethnicity. The prevalence of menthol cigarette smoking in 2016 by racial/ethnic group was highest among NH Black respondents (19.34%) followed by NH White respondents (9.50%), Hispanic respondents (8.13%), and then NH Other respondents (7.33%). Compared with NH White respondents, the menthol smoking prevalence was significantly higher among NH Black respondents and significantly lower among Hispanic and NH Other respondents (see Table 1). Odds ratios remained significant after adjusting for demographics.

3.4. Trends in menthol cigarette smoking prevalence from 2004 to 2016 by race/ethnicity

The prevalence of current menthol cigarette use significantly decreased from 2004 to 2016 for NH White and NH Black respondents in both unadjusted and adjusted analyses (See Fig. 3 and Supplementary Table 3). While the decreases in current menthol cigarette use from 2004 to 2016 were not significant in unadjusted analysis for Hispanic and NH Other respondents, these trends were significant after adjusting for demographics. The year by group interaction was significant in adjusted analyses and comparisons suggested that the decrease in menthol cigarette smoking over time was more rapid among NH White respondents than among Hispanic respondents.

3.5. Smoking quit ratio from 2002 to 2016 by race/ethnicity

No significant change was observed in the quit ratio from 2002 to 2016 among NH Black respondents in unadjusted analyses (See Fig. 4 and Supplementary Table 4). In contrast, there was a significant increase in the quit ratio from 2002 to 2016 for NH White, Hispanic, and NH Other respondents in unadjusted analyses. After adjusting for demographics, there was no change in quit ratios over time for NH Black and NH Other respondents and an increase in quit ratios for NH White and Hispanic respondents.

4. Discussion

This study was the first to examine racial/ethnic differences in smoking prevalence of a range of cigarette use categories (i.e., daily, nondaily, menthol cigarette smoking) and smoking quit ratios among a representative sample of US persons in from 2002 to 2016. Analyzing these patterns of cigarette use revealed novel information about differences by race/ethnicity and smoking behavior that might have been obscured by examining any smoking as a single outcome and without stratification by race/ethnicity.

With regard to smoking behavior in 2016, daily cigarette smoking was approximately twice as common among NH White persons than among NH Black and NH Other persons and three times higher among NH White relative to Hispanic persons. These data are partially consistent with other data (Wang et al., 2018a) indicating higher prevalences of smoking among NH White and NH Black persons compared to Hispanic persons. On the other hand, our results differ from the report of similar prevalences of smoking for NH White and NH Black individuals from the same data (Wang et al., 2018a). While the

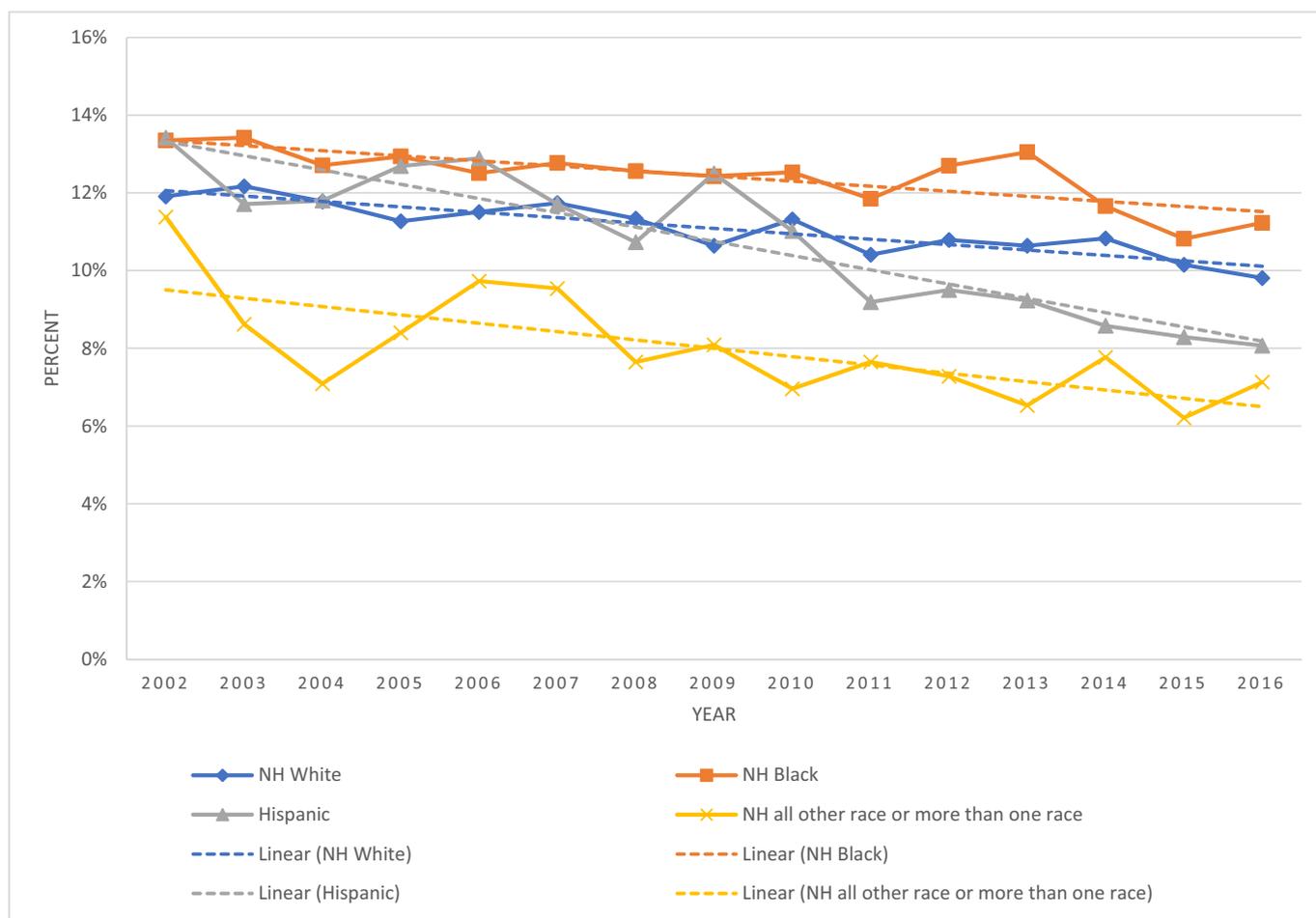


Fig. 2. Prevalence of past-month nondaily cigarette smoking from 2002 to 2016 by race/ethnicity (National Survey on Drug Use and Health, age 12 and older).

prevalence of nondaily cigarette smoking in 2016 were more similar among racial/ethnic groups than daily smoking, some group differences emerged. In a previous study (Wang et al., 2018b) that pooled US data from 1998, 2000, 2005, and 2010, NH Black and Hispanic individuals reported higher prevalences of nondaily smoking than NH White individuals. In contrast, our more recent data suggested higher prevalences of nondaily smoking among NH Black and NH White individuals compared to Hispanic and NH Other individuals. Our findings related to the use of menthol cigarettes among NH Black individuals is consistent with several previous studies (Giovino et al., 2015; Rath et al., 2016; Cohn et al., 2019).

This study provided new information about trends in daily and nondaily cigarette use and menthol cigarette use. Daily cigarette smoking declined over time across racial/ethnic groups with no differences among groups. Nondaily smoking also declined over time across racial/ethnic groups; however, the decrease was greater among Hispanic individuals than NH White individuals. Using more recent data, these new findings extend the work of a prior study that examined trends in nondaily cigarette use from 1998 to 2010 (Wang et al., 2018b) and found greater increases in nondaily smoking among NH White than NH Black persons. The prevalence of menthol smoking decreased among all racial/ethnic groups; with more rapid declines among NH White than Hispanic individuals. Despite declines, the prevalence of menthol cigarette use was consistently over twice as high among NH Black individuals as compared to all other racial/ethnic groups in every year assessed.

The current study also provided novel results on quit ratios from 2002 to 2016 by race/ethnicity. Quit ratios did not change significantly from 2002 to 2016 among NH Black persons in both unadjusted and

adjusted analyses and among NH Other persons in adjusted analyses, whereas quit ratios increased significantly among NH White and Hispanic persons over this period. As quit ratios did not change for NH Black smokers, it is important to identify variables that may impede this group's quitting behavior. Menthol cigarettes, which are commonly used by NH Black smokers, are associated with greater nicotine dependence and decreased smoking cessation success (Villanti et al., 2017; Smith et al., 2014; Okuyemi et al., 2007; Levy et al., 2011; Foulds et al., 2010; Delnevo et al., 2011), with poorer outcomes for NH Black versus other racial/ethnic group menthol users (Levy et al., 2011; Foulds et al., 2010; Stahre et al., 2010; Gandhi et al., 2009). Menthol is also suggested to play a key role in the “smoker's paradox” of NH Black individuals reporting lower smoking prevalence than other groups yet experiencing equal or greater health-related consequences (Alexander et al., 2016). Other reasons for these disparities in cessation rates are not entirely understood, but may be driven by reduced access to and use of cessation therapies; psychosocial stressors such as financial strain, perceived discrimination, and neighborhood stress; and greater exposure to tobacco industry marketing and promotions (Trinidad et al., 2011; Kendzor et al., 2018; Slopen et al., 2012; Moran et al., 2017).

Our results suggest a decline in the prevalence of smoking among NH Black persons, yet no change in the quit ratios was observed over the same time period. The juxtaposition of these two findings suggests a decline in the initiation rate among NH Black persons. Indeed, there has been an observed decline in the percentage of adolescents reporting cigarette smoking (Inoue-Choi et al., 2019) with a more rapid decline among NH Black adolescents (Oredein and Foulds, 2011). It should be noted that cigars and cigarillos, combusted tobacco products similar in risk to cigarettes, are more commonly used among NH Black teens and

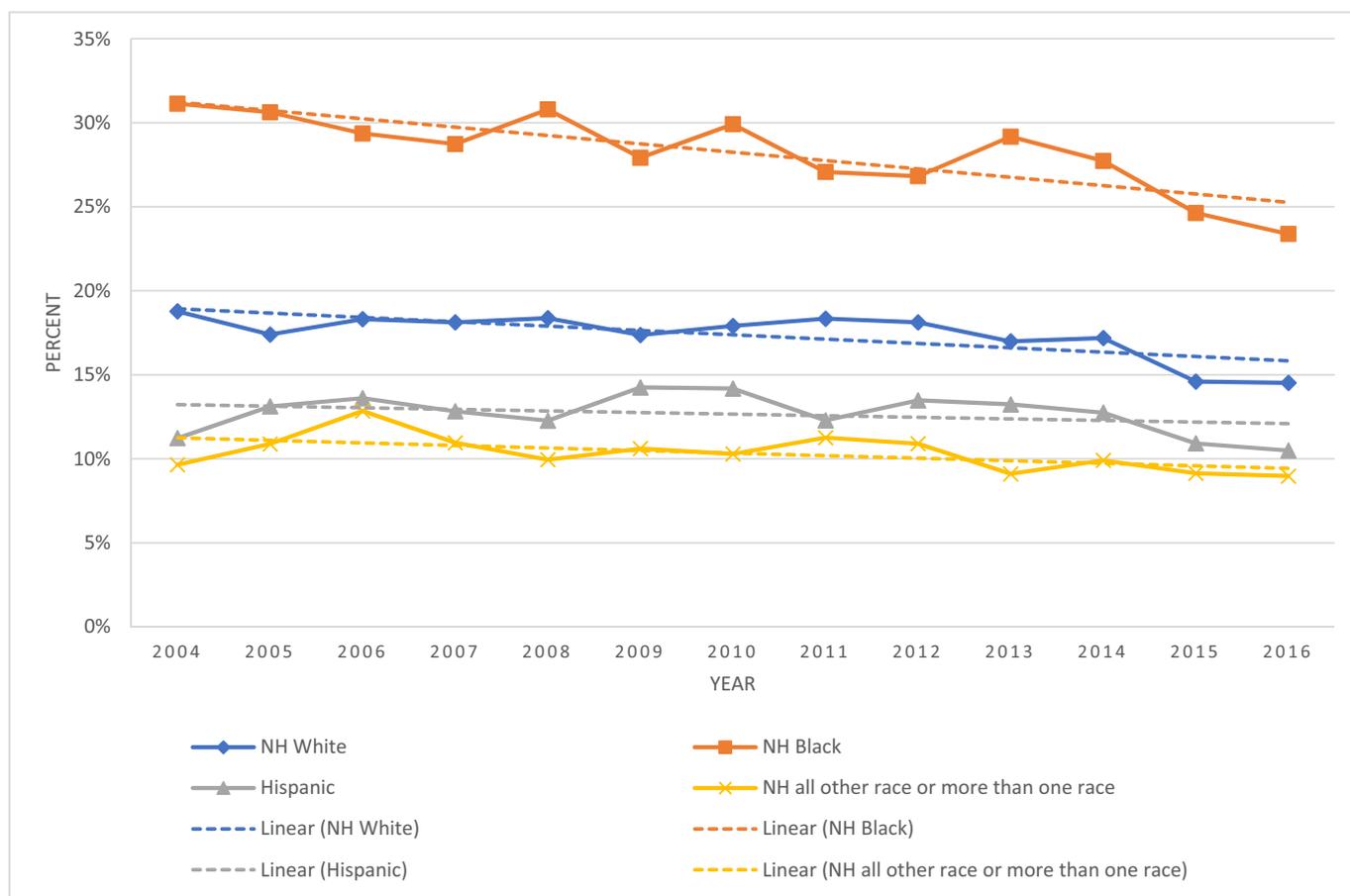


Fig. 3. Prevalence of past-month menthol cigarette smoking from 2004 to 2016 by race/ethnicity (National Survey on Drug Use and Health, age 12 and older).

adults compared to other racial/ethnic groups (Wang et al., 2018a; Gentzke et al., 2019). Our findings do not account for a potential “shift” in preference to these products. Understanding the larger context of smoking behavior among NH Black persons, including use of non-cigarette products, would help to direct resources to areas of smoking behavior that might have the greatest impact in improving long-term smoking consequences.

The prevalence of daily cigarette smoking was lower among Hispanic individuals than among other racial/ethnic groups and the prevalence of nondaily cigarette smoking was lower among Hispanic persons than NH White persons. These data are consistent with other data on current smoking (Wang et al., 2018a) but differ from older US data suggesting higher nondaily smoking prevalences among Hispanic persons than among NH White persons (Wang et al., 2018b). It should be noted that smoking prevalences and cessation can vary substantially by Hispanic subgroup (e.g., Puerto Rican, Cuban, Mexican) (Kaplan et al., 2014; Martell et al., 2016) and by other factors such as gender and acculturation. With regard to gender, Hispanic men report higher prevalences of smoking than Hispanic women (Jamal et al., 2018; Pérez-Stable et al., 2001). In addition, greater acculturation has been associated with greater daily cigarette smoking (especially among women) (Kaplan et al., 2014; Pérez-Stable et al., 2001; Kondo et al., 2016; Bethel and Schenker, 2005) while lower acculturation is associated with greater nondaily cigarette smoking (Pulvers et al., 2018; Merzel et al., 2015). Additional research should examine differences in smoking and quit rate trends over time by subgroup to identify disparities that might be masked by examining Hispanics as a single group to determine the groups that need to be targeted through public health and clinical efforts.

The current study has a number of limitations. First, due to cell

sizes, several racial/ethnic groups were combined to form the NH Other group including those with the highest (e.g., NH American Indian/Alaska Native) and lowest (e.g., NH Asian) smoking prevalences (Wang et al., 2018a). This hinders our ability to investigate these high-risk groups. Second, the NSDUH included repeated cross-sectional waves of data so we were not able to examine individual trends in smoking and quitting over time. Third, we were also not able to examine details of quit attempts and smoking patterns (e.g., types of quit attempts, lengths of quit attempts, reasons for relapse). Fourth, the definition of former smokers captured individuals who had abstained from smoking for at least one year (i.e., those in long-term abstinence maintenance (Baker et al., 2016)). Examining race and trends in quitting and smoking relapse among persons who have more recently quit (e.g., using data from clinical trials studies) might yield findings pertinent to preventing short-term relapse and would be a fruitful avenue for future study. In addition, the category of daily smoking may have included persons who reported near-daily smoking (e.g., smoking 29 out of 30 days in a month) and future research should examine these trends using alternative definitions of nondaily smoking. Finally, smoking status was based on self-report with may be impacted by a number of biases and reporting errors.

5. Conclusions

While quit ratios appear to be increasing overall in the population, this trend is not experienced equally by all racial/ethnic groups. For NH Black individuals, quit ratios appear to be static rather than increasing as among other groups. This is a population that has historically experienced significant disparities in smoking-related health consequences. In addition, daily cigarette smoking was much higher for NH

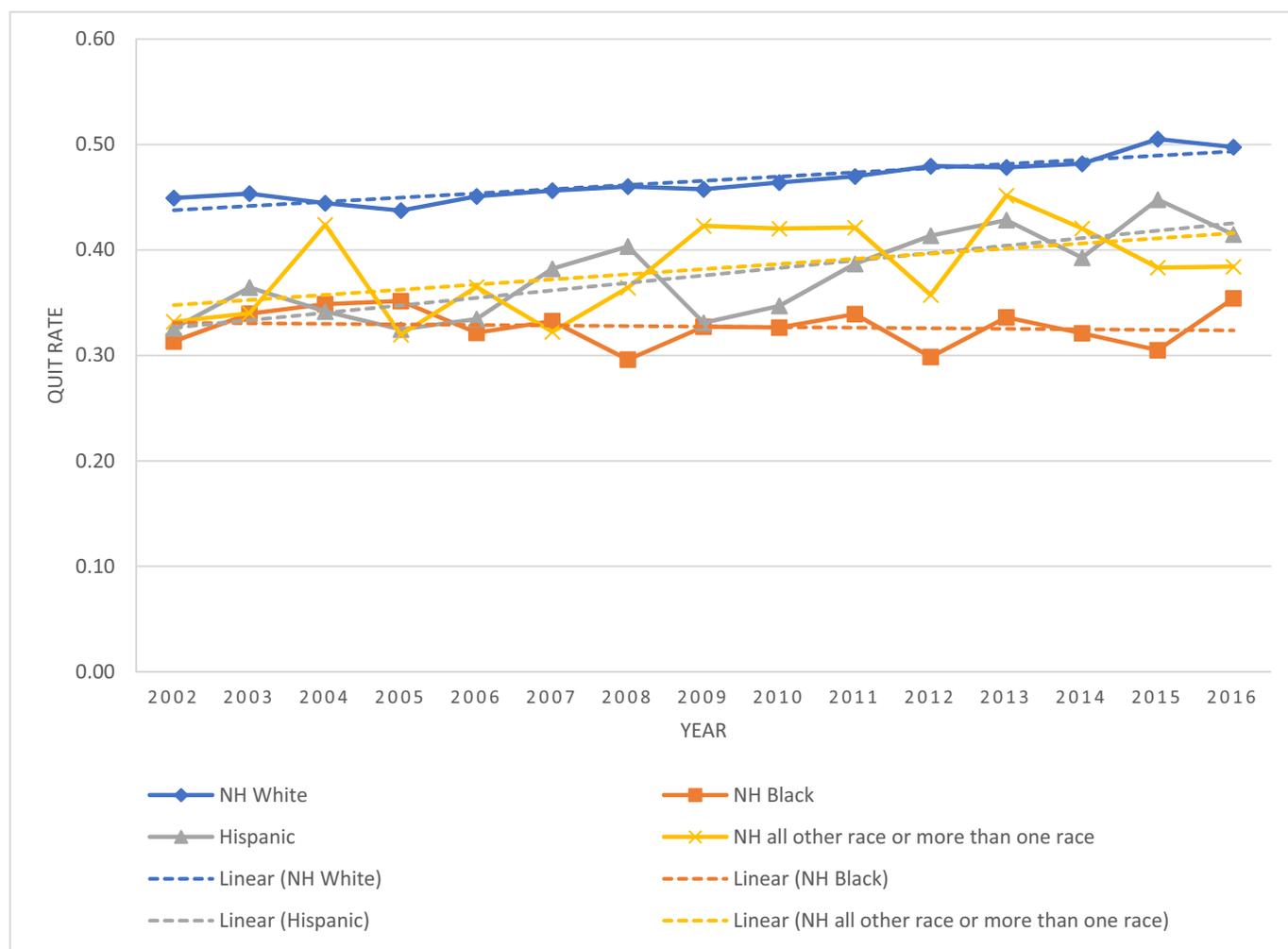


Fig. 4. Cigarette quit ratios from 2002 to 2016 by race/ethnicity (National Survey on Drug Use and Health, age 12 and older). Note: Quit ratio was defined as the ratio of former smokers (i.e., 100 or more lifetime cigarettes and no past-year cigarette smoking) to lifetime smokers (i.e., 100 or more lifetime cigarettes).

White individuals and menthol cigarette smoking was much higher for NH Black individuals than for other racial/ethnic groups. Next steps in tobacco control may require developing innovative and tailored strategies to address these concerning trends.

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Disclaimers

None

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Author contributions

Dr. Goodwin and Dr. Weinberger conceived the study. Dr. Goodwin developed the statistical analysis plan and contributed to the interpretation of the data and the drafting of the manuscript. Dr. Weinberger contributed to the statistical analysis plan and the interpretation of the

data, and wrote the first draft of the manuscript. Ms. Zhu conducted the statistical analysis. Dr. Giovenco, Mr. Lee, and Ms. Kashan contributed to the drafting of the manuscript.

Previous presentations

Portions of these data were presented at the 2018 meeting of the Society for Research on Nicotine and Tobacco.

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Conflicts of interest

None

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ypmed.2019.04.009>.

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