

Original investigation

# Racial and Ethnic Differences in What Smokers Report Paying for Their Cigarettes

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## Abstract

**Introduction:** Smoking rates and tobacco-related health problems vary by race and ethnicity. We explore whether cigarette prices, a determinant of tobacco use, differ across racial and ethnic groups, and whether consumer behaviors influence these differences.

**Methods:** We used national Tobacco Use Supplement data from 23 299 adult smokers in the United States to calculate average reported cigarette pack prices for six racial and ethnic groups. Using multivariate regression models, we analyzed the independent effect of race and ethnicity on price, and whether these effects changed once indicators of carton purchasing, menthol use, Indian reservation purchase, and state market prices were incorporated.

**Results:** American Indians and whites pay similar amounts and report the lowest prices. Blacks, Hispanics, and Asians reported paying \$0.42, \$0.68, and \$0.89 more for a pack of cigarettes than whites. After accounting for differences in consumer behaviors, these gaps shrunk to \$0.27, \$0.29, and \$0.27, respectively, while American Indians paid \$0.38 more than whites. Pack buying was associated with \$0.99 higher per-pack prices than carton buying, which was most common among whites. Additionally, people who purchased off an Indian reservation reporting paying \$1.54 more than those who purchased on reservation.

**Conclusions:** Average reported cigarette prices vary by race and ethnicity, in part due to differences in product use and purchase location. Tobacco price policies, especially those that target low prices for multipack products or on Indian reservations may increase the prices paid by whites and American Indians, who smoke at the highest rates and pay the least per pack.

**Implications:** This study examines differences in reported prices paid by different racial and ethnic groups, using recent, national data from the United States. Results indicating that racial and ethnic groups that smoke at the highest rates (American Indians and whites) also pay the least are consistent with evidence that price is a key factor in cigarette use. Additional analysis finds that cigarette purchasing behaviors, especially carton buying and purchasing on Indian reservations, partially account for the documented price differences, and suggest that policies focused on bulk purchases (carton, multipack) and reservation prices have strong tobacco control potential.

## Introduction

Smoking prevalence and cessation rates differ significantly among some demographic groups.<sup>1,2</sup> For example, American Indians and

Alaska Natives smoke at significantly higher rates than all other racial and ethnic groups, while Asian Americans have the lowest prevalence of smoking compared to all other racial and ethnic groups.<sup>1</sup>

A key determinant of tobacco use is product price; higher prices are associated with reduced tobacco use initiation and consumption, as well as more successful cessation.<sup>3-6</sup> Previous research finds that raising tobacco unit prices by 20% is associated with more than a 7% decline in demand for tobacco products, a 3.6% decline in tobacco use prevalence, and a 6.5% increase in adult cessation.<sup>7</sup> Furthermore, in some analyses, blacks and Hispanics are more responsive to changes in cigarette prices than other groups.<sup>8-10</sup> Reviews of the effectiveness of various tobacco control strategies suggest that raising the price of tobacco products is one of the most effective tobacco control strategies in general,<sup>4,11</sup> and one of the most promising for reducing disparities in smoking.<sup>3,5,12</sup>

Consumers make choices about what types of tobacco products to purchase and where to make their purchases, and these choices can impact the prices they pay. Purchasing cartons, making purchases on Indian reservations, and traveling to a state where prices may be lower are all associated with paying lower prices.<sup>13,14</sup> For example, a recent study found that smokers saved an average of \$1.63 per pack by purchasing cartons instead of packs.<sup>14</sup> Purchasing mentholated cigarettes, on the other hand, is usually more expensive than buying similar non-mentholated cigarettes.<sup>15</sup> Evidence suggests that purchasing decisions may also vary by race and ethnicity, with non-Hispanic whites being more likely to purchase cartons than packs, and black smokers most likely to use mentholated cigarettes.<sup>13,14,16-18</sup> On the other hand, studies of the advertised prices of cigarettes show that they are cheaper in neighborhoods with more African Americans and low income residents.<sup>19-21</sup> As a result, they have access to cheaper cigarettes and may pay less than other groups.

Whether consumers from different racial and ethnic groups actually pay different prices, on average, for cigarettes has not been explicitly explored in the literature. Two studies of national data from 2006–2007 and 2009–2010 document \$0.21–\$0.23 higher pack prices for blacks and Hispanics, compared to whites. The models in these studies, however, were designed to explore the impact of purchasing behaviors on price, so these racial and ethnic differences are documented after accounting for differences in consumer behavior.<sup>15,22</sup> To better understand average price differences experienced by consumers, and to explore the contribution of purchasing behaviors on racial and ethnic price differences, multiple models that do and do not adjust for purchasing behaviors are needed. We use self-report data from a 2010–2011 nationally representative study to document differences in prices reported by smokers based on race and ethnicity, and then using a series of regression models, examine the extent to which purchase location and product type influence any observed price paid differences.

## Methods

### Tobacco Use Supplement

Data for this analysis were drawn from the 2010–2011 Tobacco Use Supplement (TUS) of the Current Population Survey. The TUS is a nationally representative survey of tobacco use, sponsored by the National Cancer Institute, that has been administered by the U.S. Census Bureau in conjunction with the Current Population Survey every 3 or 4 years since 1992. The 2010–2011 TUS data is based on interviews with adult members of Current Population Survey-participating households in May 2010, August 2010, or January 2011.<sup>23</sup> In addition to questions about cigarette consumption and other tobacco use behavior, the supplement includes several questions about the last pack of cigarettes purchased by the respondents,

including the price they paid, whether the purchase was part of a carton, and where they made their purchase. Although 35 422 smokers participated in the 2010–2011 TUS, we excluded people who answered on behalf of another household member ( $n = 7811$ ) and those who indicated they did not purchase their own cigarettes ( $n = 2322$ ), as neither group was asked price questions. Most non-proxy response smokers in each racial and ethnic group reported buying their own cigarettes, but being non-Hispanic white or black was associated with a 77% and 93% increase in the odds of self-purchase, compared to Hispanics. We also excluded: individuals who did not respond to cigarette price questions ( $n = 1337$ ); those who had missing data for key covariates ( $n = 447$ ); and those who reported paying extremely high ( $> \$25$ ) or extremely low ( $< \$1$ ) per pack prices for their last purchase ( $n = 196$ ), as has been done in other TUS price analyses,<sup>13</sup> to avoid biasing our results from potential data errors. The final analytic sample included 23 299 smokers.

## Measures

### Reported Prices Paid for a Pack of Cigarettes

Smokers were asked to record the price they paid, in dollars and cents, for their last package or carton of cigarettes, after using discounts or coupons. For those individuals who reported a price for a carton, rather than a pack, we divided their reported price by 10 to get a per pack price.<sup>24</sup>

### Race and Ethnicity

We created a six-category mutually exclusive indicator of race/ethnicity based on TUS race and Hispanic ethnicity questions. All respondents who indicated being of Hispanic ethnicity were categorized as Hispanic. Other respondents were categorized non-Hispanic white (white), non-Hispanic black (black), non-Hispanic Asian/Hawaiian Pacific Islander (Asian/HPI), non-Hispanic American Indian/Alaska Native (AI/AN), or other non-Hispanic race, including multi-race.

### Additional Explanatory Variables

To explore consumer behaviors that might explain any race or ethnicity-based variations in reported pack prices, we incorporated four additional measures, two specific to the product used by the consumer, and two specific to the place where a product was purchased. To ease interpretation, we coded all dichotomous variables to indicate the behavior thought to be associated with higher prices. The product variables indicated whether the respondent's last purchase was a carton (=0) or a pack (=1) and whether respondents usually smoke non-menthol (=0) or mentholated (=1) cigarettes. The first place variable indicated whether the respondent's last purchase was on an Indian reservation (=0) or off (=1). Finally, to account for area differences in tobacco prices due to taxes and other state market characteristics, we incorporated a measure of the average price for a cigarette pack in the state of purchase. Wave-specific measures of state average pack prices are derived from the Tax Burden on Tobacco (TBOT),<sup>25</sup> which tracks annual average prices (measured in November), as well as monthly adjustments to state tax rates. To account for state tax increases that occurred during the TUS data collection, we reduced the average state price by the amount of a tax increase if a tax hike was implemented after the interview month and before November. In supplemental analyses, we replace the state average price measure with one of two measures of the state cigarette excise tax (in dollars) in place at the time of the TUS interview in the state of purchase (one that used only state taxes, and one that incorporated local taxes of \$0.50 or higher). Quarterly state excise

taxes were downloaded from the State Tobacco Activities Tracking & Evaluation (STATE) system.<sup>26</sup> We found no substantial difference in our results when we incorporated tax measures instead of prices. Since the average pack price incorporates factors that might impact local prices in addition to taxes, such as cost of living, we used this measure in our final models.

### Control Variables

In analyses, we controlled for other characteristics possibly associated with race, ethnicity, prices, or smoking. Based on individual reports of age and educational attainment, we created three age groups (18–24, 25–64, ≥65) and four educational categories (<high school, high school graduate, some college/associates degree, bachelor's degree or more). In the TUS, individuals reported their household income in \$10 000 increments; to create an approximate measure of whether an individual lives in a household below or above the 2010 median income level of \$49 276, we categorized everyone who reported incomes of \$50 000–\$59 999 or higher as above the median income and everyone who reported incomes as \$40 000–\$49 999 or lower as below the median income.<sup>27</sup> In addition we control for the respondent's gender, and whether he or she lives in an urban area, determined by residence in a metropolitan statistical area.

We created two dichotomous variables to measure an individual's smoking frequency (based on whether they report smoking some days or every day) and smoking amount on the days smoked (less than or equal to a pack a day, or greater than a pack a day).

### Analyses

We calculated average reported pack prices, as well as frequency measures for product and place factors in the entire sample, and by race, ethnicity and other demographic characteristics. To assess differences between demographic groups, we conducted *t* tests comparing demographic categories to a referent group for each variable. To account for sampling design, frequency data and *t* tests are estimated using TUS replicate weights.<sup>23</sup>

To further assess racial and ethnic differences in reported pack prices, and the extent to which these might be explained by differences in products and purchase places, we employed a series of multivariate linear regression analyses. We first modeled the reported pack price as a function of race and ethnicity, controlling for other demographic characteristics and smoking behavior. From this model, we established initial price differences solely by race and ethnicity. In subsequent models, we then added each product and place factor to the basic model separately, to examine both the impact of those factors on reported pack prices in general, and whether the addition of each factor changes the estimated effect of race and ethnicity on reported pack prices. In a final model, we added all four product and place factors. To account for general state factors that influence tobacco prices, including tobacco growing history, and national trends in cigarette prices or inflation during the TUS implementation, we employed state and wave fixed effects in all analyses. Analyses were completed using Stata version 13.1 (StataCorp, College Station, TX).

### Results

Racial and ethnic demographics, as well as other characteristics of the analytic sample are described in Table 1. In weighted analyses, almost 75% of respondents were white, 11.5% were black,

9% were Hispanic, just over 2% are Asian/HPIs, and 1% are AI/ANs. Consistent with socioeconomic demographics of the US smoking population,<sup>1</sup> the majority of the sample reported below median income levels, no education beyond high school and living in an urban area.

TUS respondents in the analytic sample reported paying an average of \$5.20 per pack of cigarettes (Table 1). The majority of the sample (77%) bought their last pack individually rather than as part of a carton, almost a quarter of the sample (24.5%) reported usually smoking mentholated cigarettes, and nearly all respondents (96%) made their last purchase somewhere other than an Indian reservation. Compared to whites, respondents of other races and ethnicities reported paying a significantly higher average price per pack of cigarettes, with the exception of AI/ANs, who paid similar prices. Specifically, reported pack prices were \$0.42 higher for blacks, \$0.70 higher for Hispanics, \$0.92 higher for Asian/HPIs, and \$0.32 higher for other racial/ethnic groups than they were for whites. Among white respondents, 72.8% reported most recently purchasing a pack (vs. carton), which is significantly lower than the rate among blacks (92.4%), Hispanics (91.1%), and Asian/HPIs (83.7%). Menthol use was most prevalent among blacks (58.9%), followed by individuals in the other races/ethnicities category (28.8%), and *t* tests indicate these are all significantly higher than the prevalence rate for whites (19.9%). Off-reservation purchases were lowest among AI/ANs (70.9%); rates for other groups were all above 90%. Finally, Hispanics, Asian/HPIs, and other races/ethnicities all purchased their last pack in states with significantly higher average pack prices than the states in which whites made their purchases.

Results of the multivariate regression models are found in Table 2 and indicate similar differences in reported prices by demographic characteristics to those found in bivariate analyses, though price gaps are somewhat smaller. In the initial model that includes only demographic characteristics and smoking behaviors, pack prices reported by blacks, Hispanics, and Asian/HPIs are, on average, \$0.48, \$0.41, and \$0.34 higher, respectively, than those reported by whites. No significant differences in reported pack prices between whites and AI/ANs or other racial/ethnic groups are observed. Model 1 results also indicate that middle-aged and older adults paid an average of \$0.34 and \$0.65 less than younger adults, people with more education paid slightly more than smokers who had not graduated high school, higher income smokers reported paying an average of \$0.14 more per pack than those with lower incomes, and people living in urban areas paid \$0.13 more than those who did not. Heavier smokers (in terms of both frequency and amount) also reported paying lower prices than lighter smokers. No gender differences in reported pack prices were observed.

### Explanations of Product and Place

In the next models we separately add measures of pack (vs. carton) purchase (Model 2), menthol smoking (Model 3), Indian reservation purchase (Model 4), and average price in the purchase state (Model 5). As expected, single pack purchases, reported use of menthol cigarettes, and purchases made off-reservations are associated with higher reported pack prices, on average (\$0.99, \$0.16 and \$1.54, respectively). A one-dollar increase in average state pack prices is associated with an average \$0.52 increase in reported pack prices as well.

The inclusion of each of the two product measures results in slight changes to the association of racial and ethnic group with reported pack prices. Controlling for purchases in packs versus cartons (Model 2) reduces price gaps between whites and blacks (from \$0.48

**Table 1.** Purchasing Price and Behavior by Demographic Characteristics of Adult Smokers in the 2010–2011 Tobacco Use Supplement, United States, (*n* = 23 299)

	N (%)	Average price paid, USD	Product-related explanations		Place-related explanations	
			% Pack buyers (vs. carton)	% Menthol smokers	% Who did not purchase on an Indian reservation	Average price in purchase state, USD
Total sample	23 299	5.20 (0.02)	77.0 (0.4)	24.5 (0.3)	96.0 (0.2)	5.71 (0.01)
<b>Race</b>						
Non-Hispanic white (ref)	18 160 (74.5)	5.06 (0.02)	72.8 (0.5)	19.9 (0.4)	95.9 (0.2)	5.68 (0.01)
Non-Hispanic black	2245 (11.5)	5.48** (0.05)	92.4** (0.6)	58.9** (1.2)	98.3** (0.3)	5.63 (0.03)
Hispanic	1541 (9.0)	5.76** (0.06)	91.1** (0.8)	20.3 (1.2)	96.3 (0.6)	5.95** (0.03)
Non-Hispanic Asian/HPI	500 (2.3)	5.98** (0.11)	83.7** (2.1)	19.2 (1.9)	97.4 (0.9)	6.07** (0.06)
Non-Hispanic AI/AN	461 (1.0)	5.03 (0.12)	78.6 (3.0)	20.5 (2.6)	70.9** (3.8)	5.61 (0.07)
Other	501 (1.7)	5.38** (0.12)	73.3 (2.6)	28.8** (2.6)	93.4 (1.7)	5.91** (0.08)
<b>Income</b>						
Below median income (ref)	15 643 (67.7)	5.10 (0.02)	79.2 (0.5)	26.3 (0.6)	96.1 (0.3)	5.66 (0.01)
Above median income	7656 (32.3)	5.40** (0.02)	72.4** (0.5)	20.8** (0.4)	95.7 (0.3)	5.81** (0.02)
<b>Education</b>						
<High school (ref)	3757 (17.3)	5.01 (0.04)	79.5 (0.8)	26.1 (0.9)	95.3 (0.5)	5.61 (0.03)
High school grad	9397 (39.7)	5.13* (0.02)	76.6** (0.6)	25.7 (0.5)	96.1 (0.3)	5.71** (0.02)
Some college/associates degree	7346 (31.2)	5.24** (0.02)	77.1* (0.6)	24.6 (0.5)	95.9 (0.3)	5.72** (0.02)
Bachelor's degree	2799 (11.7)	5.62** (0.04)	74.5** (1.0)	18.0** (0.9)	96.9* (0.5)	5.84** (0.03)
<b>Age</b>						
18–24 (ref)	2055 (13.7)	5.48 (0.04)	93.1 (0.7)	31.9 (1.3)	97.4 (0.5)	5.71 (0.03)
25–64	19 044 (78.6)	5.19** (0.02)	76.6** (0.4)	23.7** (0.4)	96.0** (0.2)	5.72 (0.01)
≥65	2200 (7.8)	4.78** (0.06)	53.0** (1.3)	19.3** (1.0)	93.4** (0.7)	5.72 (0.04)
<b>Gender</b>						
Male (ref)	11 441 (49.1)	5.22 (0.02)	78.7 (0.5)	20.6 (0.5)	96.3 (0.2)	5.71 (0.01)
Female	11 858 (50.9)	5.18 (0.02)	75.0** (0.5)	29.1** (0.5)	95.6* (0.3)	5.71 (0.02)
<b>Urban residence</b>						
Does not live in an urban area (ref)	6124 (19.8)	4.71 (0.04)	71.1 (1.0)	21.5 (0.8)	94.5 (0.7)	5.47 (0.04)
Lives in an urban area	16 952 (80.2)	5.33** (0.02)	78.5** (0.4)	25.3** (0.4)	96.4** (0.2)	5.78** (0.01)

AI/AN = American Indian/Alaska Native; HPI = Hawaiian Pacific Islander. Unweighted *N*s, weighted means, and percentages. Asterisks indicate significant differences in *t* tests comparing means of sub-group to indicated referent group.

\**P* < .05; \*\**P* < .01.

to \$0.32), Hispanics (from \$0.41 to \$0.30), and Asians/HPIs (from \$0.34 to \$0.29), and the differences for AI/ANs and other racial and ethnic groups remain nonsignificant. Initial reported price differences based on age decrease, differences by income are slightly stronger (\$0.19 instead of \$0.14), and differences based on smoking levels nearly disappear. When menthol use is accounted for (Model 3), the gap in reported pack prices between whites and blacks decreases by six cents to \$0.42, while all other demographic differences remain within two cents of the Model 1 values. Fewer changes to racial and ethnic price gaps are obvious following inclusion of place-related factors, with one exception. Accounting for Indian reservation purchase behavior produces a \$0.52 significant difference in the average reported pack prices between AI/ANs and whites (Model 4). Accounting for the average price in a purchase state has a minimal effect on original demographic-price relationships (Model 5).

Model 6 incorporates all four product and place variables. Price gaps between whites and most racial and ethnic groups remain in this model, though are generally smaller than in any other models, with the exception of AI/ANs, whose price gap is illuminated only in the later models (Models 4 and 6) that account for reservation purchases.

## Discussion

In these analyses, we find that the prices that consumers pay for cigarettes differs by the race and ethnicity of the consumer, with

most non-white groups reporting paying \$0.49–\$0.89 more per pack than whites. Other demographic characteristics and consumer behavior appear to account for part, but not all, of these differences. The strongest behavioral factor appears to be higher rates of carton purchasing among non-Hispanic whites. When an indicator of pack versus carton purchasing is added to the model, price gaps between non-Hispanic whites and both non-Hispanic blacks and Hispanics drop by more than 25%.

These results suggest that policies that make cheap cigarette packs more expensive could raise the price for those groups currently paying the least. In particular, our analyses indicate that if the per pack price for cartons and packs sold individually were the same, whites would pay higher prices, more similar to those of other groups. As a policy strategy, however, banning carton sales has not been attempted. A more feasible approach to standardizing pack prices, regardless of number of packs purchased at once, may be to ban discounts on multipack purchases, as has been done in New York City and Providence.<sup>28</sup>

In addition, our results indicate that AI/ANs pay the same low prices for cigarette packs as whites, primarily because they are more likely to buy cigarettes on reservations. We find that purchasing packs on a reservation is associated with an average savings of more than \$1.50 per pack. Efforts to raise prices on cigarettes sold on reservations may be one strategy to reduce recreational tobacco use among a group with a particularly high smoking rate. Given the high

**Table 2.** Adjusted Linear Multivariate Regression Analyses Testing Associations of Race and Purchasing Decisions With Reported Paid Prices Among Adult Smokers in the 2010–2011 Tobacco Use Supplement, United States (*n* = 23 299)

	Product-related explanations			Place-related explanations		
	Model 1, B (SE)	Model 2, pack buyer (vs. carton), B (SE)	Model 3, menthol smoker, B (SE)	Model 4, purchasing off an Indian reservation, B (SE)	Model 5, average price in purchase state, B (SE)	Model 6, all product and place covariates, B (SE)
<b>Race/ethnicity</b>						
Non-Hispanic white (ref)	—	—	—	—	—	—
Non-Hispanic black	0.48** (0.03)	0.32** (0.03)	0.42** (0.03)	0.46** (0.03)	0.48** (0.03)	0.27** (0.03)
Hispanic	0.41** (0.04)	0.30** (0.04)	0.40** (0.04)	0.39** (0.04)	0.42** (0.04)	0.29** (0.03)
Non-Hispanic Asian/HPI	0.34** (0.06)	0.29** (0.06)	0.33** (0.06)	0.31** (0.06)	0.35** (0.06)	0.27** (0.06)
Non-Hispanic AI/AN	0.07 (0.07)	0.00 (0.06)	0.07 (0.06)	0.52** (0.07)	0.09 (0.07)	0.38** (0.06)
Other	0.07 (0.06)	0.07 (0.06)	0.06 (0.06)	0.08 (0.06)	0.08 (0.06)	0.08 (0.06)
<b>Income</b>						
Below median income (ref)	—	—	—	—	—	—
Above median income	0.14** (0.02)	0.19** (0.02)	0.14** (0.02)	0.14** (0.02)	0.14** (0.02)	0.19** (0.02)
<b>Education</b>						
<High school (ref)	—	—	—	—	—	—
High school grad	0.07** (0.03)	0.09** (0.02)	0.07** (0.03)	0.05* (0.02)	0.07** (0.03)	0.07** (0.02)
Some college or associates degree	0.16** (0.03)	0.17** (0.03)	0.15** (0.03)	0.14** (0.03)	0.15** (0.03)	0.15** (0.03)
Bachelor's degree	0.38** (0.03)	0.41** (0.03)	0.38** (0.03)	0.35** (0.03)	0.38** (0.03)	0.38** (0.03)
<b>Age</b>						
18–24 (ref)	—	—	—	—	—	—
25–64	–0.34** (0.03)	–0.19** (0.03)	–0.32** (0.03)	–0.31** (0.03)	–0.34** (0.03)	–0.18** (0.03)
≥65	–0.65** (0.04)	–0.29** (0.04)	–0.63** (0.04)	–0.59** (0.04)	–0.66** (0.04)	–0.26** (0.04)
<b>Gender</b>						
Male (ref)	—	—	—	—	—	—
Female	0.00 (0.02)	0.03 (0.02)	–0.02 (0.02)	0.01 (0.02)	0.00 (0.02)	0.03* (0.02)
<b>Urban residence</b>						
Does not live in an urban area (ref)	—	—	—	—	—	—
Lives in an urban area	0.13** (0.02)	0.11** (0.02)	0.13** (0.02)	0.09** (0.02)	0.13** (0.02)	0.08** (0.02)
<b>Smoking frequency</b>						
Some days (ref)	—	—	—	—	—	—
Everyday	–0.22** (0.02)	–0.04 (0.02)	–0.26** (0.02)	–0.20** (0.02)	–0.22** (0.02)	–0.09** (0.02)
<b>Smoking amount</b>						
≤1 pack a day (ref)	—	—	—	—	—	—
>1 pack a day	–0.27** (0.03)	–0.07* (0.03)	–0.27** (0.03)	–0.25** (0.03)	–0.28** (0.03)	–0.07* (0.03)
<b>Product</b>						
Pack buyer (vs. carton buyer)	—	0.99** (0.02)	—	—	—	0.89** (0.02)
Menthol smoker	—	—	0.16** (0.02)	—	—	0.13** (0.02)
<b>Place</b>						
Purchasing off an Indian reservation	—	—	—	1.54** (0.04)	—	1.24** (0.04)
Average price in purchase state	—	—	—	—	0.52** (0.05)	0.56** (0.04)

AI/AN = American Indian/Alaska Native; B = beta coefficient; HPI = Hawaiian Pacific Islander; SE = standard error. All models based on linear regression with state and wave fixed effects.

\**P* < .05; \*\**P* < .01.

poverty rates on many reservations,<sup>29,30</sup> any policies that potentially pose a financial burden on AI/AN smokers may be most appropriate if done in conjunction with increased availability of low cost cessation assistance.

We found little evidence that menthol use or average price in the state of purchase explained racial and ethnic differences in reported cigarette pack prices. Similar to other literature,<sup>18</sup> we document high rates of menthol use among some groups, including nearly 60% of black smokers. However, although menthol use was significantly associated with higher reported prices as hypothesized, the size of this effect (\$0.16) was relatively small. Banning mentholated products has been suggested as a tobacco control policy approach, in part because menthol users have a significantly harder time quitting and are less likely to switch to a less harmful product.<sup>31,32</sup> Our results

suggest that such a ban might result in slightly lower prices for menthol users who switch to non-mentholated products, but would not likely impact racial or ethnic cigarette price gaps.<sup>33,34</sup>

Average cigarette pack prices vary across states substantially, from \$4.55 in Missouri to \$10.07 in New York,<sup>35</sup> and our descriptive results indicate that average prices in states where Hispanics and Asian/HPIs bought cigarettes were somewhat higher. Yet, we observed little impact on racial and ethnic differences in prices when we add average prices to our regression models. Because our models employ state fixed effects, the effects of prices are based on within-state changes in price during a relatively short study period. Although prices did change within states, only a few of them changed substantively due to an excise tax increase. Research using data covering longer periods of time may be needed to better assess

the impact of state market conditions on racial and ethnic variation in reported prices. In addition, pricing policies that specifically target the low end of the pack price distribution, like minimum floor price laws similar to the one in New York City, might be more effective at reducing price variation than raising average prices through mechanisms like excise taxes.<sup>36</sup> If whites are often the beneficiaries of particularly cheap purchasing opportunities, as our data suggests, they may be the most impacted by minimum pricing laws. Additional research on the ways in which pricing markets are impacted by minimum price laws could be useful.

Even after accounting for all differences in product and place factors, however, blacks, Hispanics, and Asian/HPIs still pay \$0.28–\$0.29 more per pack than whites, raising questions about what else could account for racial and ethnic differences. One factor might be local pricing markets. Although we accounted for differences in average state cigarette prices, and whether the respondent lived in an urban area, smaller or more specific geographic areas may be important as well. Several cities, including New York City, Chicago and Anchorage, levy their own cigarette excise taxes, likely making cigarettes more expensive there than in other areas in the same state, and other cities. The majority of New York City's and Chicago's population are non-white, and Anchorage has higher than average rates of AI/ANs.<sup>37</sup> The city of purchase could be an important factor in racial and ethnic price variation, and an area for future research. Neighborhood pricing markets may also play a role. Previous research on differences in advertised prices by neighborhood composition have produced conflicting results.<sup>19,20,38</sup> For example, in a study of Minnesota stores and advertised prices, higher percentages of non-white populations were associated with significantly higher prices for discount and premium cigarettes, but not for menthol cigarettes.<sup>38</sup> Yet in a national study of stores, mentholated Newport cigarettes, as well as Marlboro and the cheapest brand in the store, were less expensive in neighborhoods with higher proportions of blacks.<sup>39</sup> Furthermore, Newport and Marlboro cigarettes were more expensive in neighborhoods with more Latino residents in this same study. A study in California also documented higher prices in cities with greater percentages of Hispanic residents.<sup>40</sup> The role of the local cigarette market in producing racial and ethnic variation in cigarette pricing deserves future attention.

Two other elements of the TUS survey prevented further exploration of price differences across racial and ethnic groups. First, the prices reported by TUS respondents incorporate discounts from coupons or other price promotions. If coupons are disproportionately used by white respondents, as has been reported elsewhere,<sup>16,41</sup> this could account for some of the price differences we observe. Second, respondents did not indicate the brand of cigarette they purchased when they reported the price they paid, and it is possible that brand differences could further account for price differences, if these vary by racial and ethnic groups. Average prices, prevalence of coupon use, and size of discounts vary across brands, so incorporating this information is important.<sup>42</sup>

Although not the explicit focus of this study, our analyses highlight other demographic differences in reported pack pricing that deserve further investigation. Higher income, more educated and younger respondents reported paying more for cigarettes than their lower income, less educated and older peers, whereas heavier smokers pay less than lighter smokers. Although most price differences across these demographic divisions were smaller than differences by race, they deserve further exploration, especially because differences in consumer behavior generally failed to explain them. The

one exception is related to smoking amount. The price difference between people who smoke more than one pack per day and those who smoke less disappears when carton purchasing is added to the model, suggesting that policies that ban multi-pack discounts may have a particularly strong impact on prices for heavier smokers.

Raising cigarette prices is one of the most effective means of reducing consumption. We find that whites and AI/ANs report paying the lowest prices for their last purchased pack of cigarettes. Tobacco control price policies, especially those that target particularly low prices for products bought in cartons, in cheaper markets, or on Indian reservations may therefore most strongly impact these groups. Since whites and AI/ANs also smoke at higher rates than other population groups, price policies may be important tools for reducing racial and ethnic differences in smoking prevalence.

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## Declaration of Interests

None declared.

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