



Short communication

Associations of race and ethnicity with tobacco messaging exposures and tobacco use among bisexual and pansexual women

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A B S T R A C T

Within the lesbian and bisexual community, bisexual women have the highest prevalence of tobacco use, and Black and Latina women are much more likely to use tobacco than their heterosexual peers. Research on tobacco use among bisexual women is limited to descriptions of prevalence in this population. We evaluated associations between race/ethnicity, exposure to pro- and anti-tobacco messages, and tobacco use outcomes among bisexual and pansexual women. We recruited a sample of N = 382 bisexual and pansexual women in the United States using the online survey platform, Prolific. Participants reported sociodemographics, exposure to pro- and anti-tobacco messaging, receipt of coupons, and ever and current use of cigarettes, e-cigarettes, and other tobacco products. We modeled associations between race/ethnicity, pro- and anti-tobacco messaging exposures, and tobacco use outcomes. Unadjusted results indicated differences in prevalence of tobacco use by race/ethnicity, with White women having the highest prevalence of ever using each product, but Black women having the highest prevalence of current cigar smoking and any tobacco use. Associations between race and tobacco use were attenuated in adjusted analyses. Receiving coupons was strongly associated with current use of cigarettes (aOR = 8.02; 95% CI [3.55, 18.1]), e-cigarettes (aOR = 7.26; 95% CI [3.55, 14.9]), and any tobacco (aOR = 5.04; 95% CI [2.44, 10.4]). In conclusion, unadjusted differences in prevalence of tobacco use across race/ethnic groups were attenuated after controlling for pro- and anti-tobacco messaging exposures. Receiving tobacco coupons was consistently associated with current tobacco use among bisexual and pansexual women. Restrictions on coupons could promote health equity.

1. Introduction

Lesbian and bisexual women (LBW) have a higher prevalence of tobacco use than heterosexual women (Li et al., 2021; Wheldon et al., 2018; Ridner et al., 2019) (e.g., 37.7% for bisexual, 31.7% for lesbian, and 16.6% for heterosexual women (Li et al., 2021)). One reason for tobacco use inequities is targeted marketing of tobacco products to the lesbian, gay, bisexual, and transgender (LGBT) community (Emory et al., 2019; Tan et al., 2021; Dilley et al., 2008). LBW report greater exposure to tobacco advertisements, promotional marketing, and pro-tobacco messages than heterosexual women (Emory et al., 2019; Tan et al., 2021; Dilley et al., 2008). In spite of increased pro-tobacco messaging exposures, few anti-tobacco messaging campaigns are targeted to LGBT people (Lee et al., 2014). The Food and Drug Administration launched

its first large-scale anti-tobacco effort aimed at LGBT young adults, *This Free Life*, in 2016; however, LBW were less aware of the campaign than gay men (Food and Drug Administration. *This Free Life Campaign*. Published, 2021; Guillory et al., 2021).

LBW are not a monolith, and disparities in tobacco use and advertisement exposures exist within this group. Bisexual women, in particular, have the highest prevalence of tobacco use among all women (Li et al., 2021; Ridner et al., 2019; Johnson et al., 2016; McCabe et al., 2018; Emory et al., 2016), and they report greater exposure to tobacco advertisements than lesbian (and heterosexual) women (Tan et al., 2021). Additionally, the distribution of tobacco use according to race and ethnicity differs for LBW vs. heterosexual women. For example, Black and Latina heterosexual women are less likely than their White counterparts to use tobacco (McCabe et al., 2018). Within the LGBT

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community, however, the prevalence of tobacco use is similar for Black, Latina, and White women (McCabe et al., 2018). Black and Latina LBW might be doubly-targeted by the tobacco industry; not only are they targeted due to their sexual orientation, but they also have increased exposure to tobacco advertising than White women (Tan et al., 2021).

Evaluation of tobacco use at the intersection of sexual orientation and race is primarily limited to descriptive studies reporting prevalence of tobacco use. However, inferential studies assessing associations between race, exposure to pro- and anti-tobacco messages, and tobacco use outcomes—especially among bisexual women who carry the largest burden of tobacco use—are needed. Understanding modifiable mechanisms behind the high prevalence of tobacco use among bisexual women in general, and Black and Latina bisexual women in particular, is necessary to inform policies and interventions to reduce tobacco use disparities. Our objectives were to 1) evaluate associations between race/ethnicity and exposure to pro- and anti-tobacco messaging, and 2) evaluate associations between race/ethnicity and tobacco use behaviors, controlling for exposure to pro- and anti-tobacco messaging.

2. Methods

2.1. Setting, participants, and design

In January 2021, we recruited N = 501 LBW using the online crowdsourcing survey platform, Prolific. In comparison to other crowdsourcing survey platforms, data collected via Prolific are high quality and similar to college student survey samples (Peer et al., 2017) and probability samples (Jeong et al., 2019; Kraemer et al., 2017). Eligible participants lived in the United States; identified their current gender as female, genderqueer, or non-binary (genderqueer or non-binary participants were only eligible if their sex assigned at birth was female); self-identified as lesbian, bisexual, or another non-heterosexual orientation; and were between the ages of 18 and 30 years.

Participants completed a Qualtrics survey, which assessed their sociodemographics, pro- and anti-tobacco messaging exposures, and tobacco use behaviors. For the current study, we restricted the sample to bisexual and pansexual women due to small counts of lesbian and other non-heterosexual racial/ethnic minority women (final N = 382).

Participants provided informed consent. The Ohio State University Institutional Review Board classified this study as exempt from review.

2.2. Measures

2.2.1. Sociodemographics

Sexual orientation was assessed by asking participants which of the following best describes them: “Straight or heterosexual,” “lesbian or gay,” “bisexual,” and “other non-heterosexual identity.” Bisexual participants and those who entered “pansexual” for “other” sexual orientation (n = 23) were included in analyses.

Gender identity was assessed by asking participants if they identified as: “female,” “male,” “transgender female/transgender woman,” “transgender male/transgender man,” “genderqueer/gender non-conforming/gender expansive,” “non-binary,” or “other.” Participants who selected “female,” “transgender female/transgender woman,” “genderqueer/gender non-conforming/gender expansive,” or “non-binary” were included.

Participants reported their *race and ethnicity*, and mutually-exclusive categories were created for “Black (non-Latina),” “Latina,” “White (non-Latina)” and “Other/Multiple.” Participants reported their *total yearly income*, and responses were recoded into <\$20,000, \$20,000 to <\$40,000, and ≥\$40,000 groups. *Student status* was assessed by asking participants if they were currently a student. Finally, participants reported their *age* in years.

2.2.2. Tobacco messaging exposures

Participants were asked how often they see *advertisements for tobacco* and *advertisements for e-cigarettes* on the internet, in magazines, and at convenience stores (Centers for Disease Control and Prevention. National Youth Tobacco Survey (NYTS). Published, 2020). Response options included “I don’t use/read/go to the internet/magazines/convenience stores,” “never,” “rarely,” “sometimes,” “most of the time,” and “always.” Responses for the same medium were collapsed for tobacco and e-cigarettes, and were then dichotomized to improve cell size: 1) “I don’t use...,” “never,” and “rarely;” and 2) “sometimes,” “most of the time,” and “always.”

Participants reported whether they had *received coupons* for cigarettes, e-cigarettes, cigars, shisha or hookah tobacco, snus, other types of smokeless tobacco, or some other tobacco product in the past 12 months. Responses were collapsed across products: receipt of a coupon for any tobacco product in the past year vs. none.

Exposure to *anti-tobacco messaging* was assessed by asking participants if they had seen or heard advertisements for *The Real Cost* and *This Free Life* campaigns in the past year (Centers for Disease Control and Prevention. National Youth Tobacco Survey (NYTS). Published, 2020). Response options included “yes,” “no,” and “not sure.”

2.2.3. Tobacco use

Ever use of tobacco products was assessed by asking participants if they had used cigarettes, e-cigarettes, cigars or cigarillos, hookah, or smokeless tobacco, even just once. Participants who reported ever use of a product were asked to report how many days of the past 30 days they had used the product. These items were combined to create three-level variables for cigarette smoking, e-cigarette use, cigar smoking, and any tobacco product use: 1) never use, 2) ever, but not current (i.e., not past 30-day) use, and 3) current use.

2.3. Statistical analysis

Distributions of each variable were compared across race/ethnic groups using chi-square or Fisher’s exact test (categorical variables) or one-way ANOVA (age). Next, we used purposeful selection (Hosmer et al., 2013) to build multinomial logistic regression models that estimated adjusted associations between race/ethnicity and each three-level tobacco use variable except for cigar smoking, which could not be evaluated due to small cells. Separate adjustment sets were identified for each model. We ran the same models among bisexual, cisgender women exclusively as a sensitivity analysis. An alpha of 0.05 was used to assess statistical significance (an alpha of 0.1 was used to denote marginal statistical significance). Stata/SE version 16.1 was used for all analyses.

3. Results

3.1. Participant characteristics

Participants were 23.6 years old on average. The sample was 60% White, 8.9% Black, 11.8% Latina, and 19.4% Other/Multiple race. Participants predominantly had low incomes and half were students. Nearly one quarter received a tobacco coupon in the past year (22.0%), and 83.3% reported seeing tobacco advertisements at convenience stores sometimes or more often. Over one-third (37.9%) reported exposure to *The Real Cost*, and 7.8% reported exposure to *This Free Life*, in the past year. Two-thirds had ever used a tobacco product: 47.3% had ever smoked cigarettes, 51.7% had used e-cigarettes, and 31.1% smoked cigars. Nearly one quarter of participants (24.0%) were current users of any tobacco product: 10.7% currently smoked cigarettes, 18.3% currently used e-cigarettes, and 2.9% currently smoked cigars.

3.2. Unadjusted associations between race/ethnicity, tobacco messaging exposure, and tobacco use

Distributions of cigarette smoking, e-cigarette use, cigar smoking, and any tobacco use differed according to race/ethnicity (Table 1). Descriptively, White women reported higher prevalence of ever or current use for most tobacco products, but Black women had the highest prevalence of current cigar smoking and any tobacco product use. In general, women of "Other/Multiple" race/ethnicity had the lowest prevalence of current tobacco use, except Latina women had the lowest prevalence of current cigar smoking. Differences in the distributions of pro- and anti-tobacco messaging exposures across race/ethnic groups were marginally significant or non-significant (Table 1).

3.3. Adjusted associations between race/ethnicity, tobacco messaging exposure, and tobacco use

Associations between race/ethnicity and cigarette smoking outcomes were attenuated to non-significance after controlling for age, income, exposure to *The Real Cost*, and receipt of tobacco coupons (Table 2). Increasing age was associated with higher odds of ever (vs. never) and current (vs. never) cigarette smoking. Income category of \$20,000 to <\$40,000 (vs. <\$20,000) was associated with higher odds of ever (vs. never) cigarette smoking. Receiving coupons was associated with increased odds of current (vs. never) cigarette smoking.

Associations between race/ethnicity and e-cigarette use outcomes were attenuated to non-significance after controlling for income, exposure to *The Real Cost*, receipt of tobacco coupons, and seeing tobacco advertisements at convenience stores sometimes or more often. Having a yearly income between \$20,000 and <\$40,000 was associated with increased odds of ever (vs. never) and current (vs. never) e-cigarette use. Being unsure about exposure to *The Real Cost* was associated with reduced odds of current (vs. never) e-cigarette use. Receiving tobacco coupons was associated with increased odds of current (vs. never) e-cigarette use.

Overall associations between race/ethnicity and any tobacco use outcomes remained statistically significant after adjustment for age, income, and receipt of tobacco coupons. Black and Other/Multiple race/ethnicity women had reduced odds of ever (vs. never) tobacco use than White women, but no differences were detected for odds of current (vs. never) tobacco use according to race/ethnicity. Increasing age was associated with higher odds of ever (vs. never) tobacco use. Finally, receiving coupons was again associated with higher odds of current (vs. never) tobacco use.

3.4. Sensitivity analysis

N = 343 bisexual, cisgender women were included in the sensitivity analysis. Results within this subsample were similar to results in the larger sample, with point estimates being close and few results changing from statistically significant to marginally significant (Supplementary Table).

4. Discussion

In unadjusted analyses, we identified differences in the prevalence of cigarette smoking, e-cigarette use, cigar smoking, and any tobacco use according to race/ethnicity in a sample of bisexual and pansexual women. Adjusted analyses revealed that the prevalence of ever and current tobacco use was largely similar across racial and ethnic groups, and that receiving tobacco coupons was most strongly associated with current use of cigarettes, e-cigarettes, or any tobacco product.

Our results add to the limited but growing literature describing tobacco use and modifiable risk factors for tobacco use at the intersection of sexual orientation and race. In addition to being doubly-targeted by the tobacco industry's efforts to sell their products to LBW and racial/

Table 1
Characteristics of bisexual and pansexual women enrolled in online survey via Prolific, stratified by race and ethnicity, 2021.

	White (non-Latina) N = 229	Black (non-Latina) N = 34	Latina N = 45	Other or Multiple N = 74	p-value ^a
Gender (%)					0.54
Cis-gender female	96.5	94.1	100.0	94.6	
Transgender female	1.3	0.0	0.0	1.4	
Genderqueer/non-conforming	0.4	2.9	0.0	0.0	
Non-binary	1.8	2.9	0.0	4.1	
Income (self, %)					0.84
<\$20,000	56.8	67.7	60.0	62.2	
\$20,000 to <\$40,000	20.5	20.6	22.2	18.9	
≥\$40,000	22.7	11.8	17.8	18.9	
Student in high school or college (%)	46.3	55.9	53.3	56.8	0.35
Age (mean [SD])	24.1 [3.5]	23.6 [4.0]	23.3 [3.6]	22.6 [3.2]	0.01
Received tobacco coupons in past year (%)	25.9	21.9	19.1	11.8	0.09
Frequency of seeing tobacco advertisements... on the internet (%)					0.10
Never/rarely	67.3	70.6	48.9	63.5	
Sometimes/most of the time/always ...in magazines (%)	32.8	29.4	51.1	36.5	0.45
Never/rarely	71.6	79.4	71.1	79.7	
Sometimes/most of the time/always ...at convenience stores (%)	28.4	20.6	28.9	20.3	0.31
Never/rarely	14.9	11.8	20.0	23.0	
Sometimes/most of the time/always	85.2	88.2	80.0	77.0	0.07
Saw/heard advertisements for <i>The Real Cost</i> in past year (%)					0.67
No	38.0	55.9	53.3	51.4	
Yes	39.7	38.2	33.3	35.1	
Not sure	22.3	5.9	13.3	13.5	
Saw/heard advertisements for <i>This Free Life</i> in past year (%)					0.03
No	63.8	79.4	71.1	68.9	
Yes	9.2	5.9	4.4	6.8	
Not sure	27.1	14.7	24.4	24.3	
Cigarette smoking (%)					0.03
Never smoker	45.4	61.8	57.8	67.6	
Ever, not current smoker	42.4	26.5	31.1	27.0	
Current smoker	12.2	11.8	11.1	5.4	
E-cigarette use (%)					0.03
Never user	43.2	55.9	46.7	62.2	
Ever, not current user	38.9	17.7	31.1	24.3	
Current user	17.9	26.5	22.2	13.5	
Cigar smoking (%)					<0.001
Never smoker	63.3	70.6	71.1	83.8	
Ever, not current smoker	34.5	14.7	28.9	14.9	
Current smoker	2.2	14.7	0.0	1.4	
Any tobacco use^b (%)					0.003
Never user	28.4	44.1	31.1	48.7	

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Table 1 (continued)

	White (non- Latina) N = 229	Black (non- Latina) N = 34	Latina N = 45	Other or Multiple N = 74	p- value ^a
Ever, not current user	47.6	17.7	42.2	35.1	
Current user	24.0	38.2	26.7	16.2	

^a P-values were calculated using chi-square or Fisher’s exact tests (categorical variables) and ANOVA (continuous variables).

^b Any tobacco use included use of cigarettes, e-cigarettes, cigars, smokeless tobacco, or hookah.

ethnic minority women (Emory et al., 2019; Tan et al., 2021; Dilley et al., 2008), racial or ethnic minority bisexual and pansexual women are also in the position to experience stressors related to both racism and homophobia (Gruskin et al., 2008). Increased stressors can contribute to using tobacco as a coping mechanism and increase the difficulty of cessation (Gruskin et al., 2008). This intersection of stressors for racial/ethnic minority bisexual and pansexual women might partially explain why a greater proportion of ever tobacco users in racial/ethnic minority groups were current users than was observed for White bisexual and pansexual women.

As has been reported elsewhere (Choi et al., 2018), receiving coupons was strongly associated with current tobacco use in this sample. Receiving tobacco coupons is associated with increased risk of progression from experimentation to current tobacco use, and with increased risk of continuing to smoke over time (Choi et al., 2018). Young adults often receive coupons through direct mail/email (Choi et al., 2018; Choi et al., 2018; Osman et al., 2019), and direct mail

coupons are the most likely to be redeemed (Osman et al., 2019). The overall proportion of participants receiving tobacco coupons was higher than we expected for White, Black, and Latina participants in this study, given the distribution of current tobacco use among our participants (Choi et al., 2018). This might be due to targeted tobacco marketing by sexual orientation (Rose et al., 2018), and thus policies restricting tobacco coupons or coupon redemption could promote health equity in this population.

Our results are subject to the following limitations. First, without a heterosexual group of participants, we were unable to model whether associations between race/ethnicity, tobacco advertisement exposures, and tobacco use outcomes differed between bisexual/pansexual vs. heterosexual women. Second, we had to exclude lesbian and other women with non-heterosexual identities due to small cell sizes; the associations we identified might not generalize to these groups. Additionally, we were unable to make comparisons according to gender identity due to small cell sizes. Third, due to the cross-sectional design, we could not assess temporality of exposure to pro- and anti-tobacco messaging and tobacco use behaviors.

5. Conclusion

Bisexual women experience the highest prevalence of tobacco use among women (Li et al., 2021). Our adjusted results generally align with prior research (McCabe et al., 2018) that has reported little difference in the prevalence of tobacco use across race/ethnic groups within this population. Given the higher-than-expected prevalence of receiving tobacco coupons and strong associations between receiving coupons and current tobacco use in our sample, policies restricting tobacco coupons might promote health equity for bisexual and pansexual women overall.

Table 2

Adjusted associations between race and ethnicity, pro- and anti-tobacco advertising/marketing exposures, and tobacco use behaviors among bisexual and pansexual women, 2021^a.

	Cigarette aOR (95% CI)		p-value ^b	E-cigarette aOR (95% CI)		p-value ^b	Any Tobacco aOR (95% CI)		p-value ^b
	Ever vs. never	Current vs. never		Ever vs. never	Current vs. never		Ever vs. never	Current vs. never	
Race and ethnicity			0.22			0.11			0.01
Black non-Latina (ref: White [non-Latina])	0.46 (0.19, 1.15)	0.68 (0.18, 2.49)		0.35 (0.13, 0.96)	1.08 (0.40, 2.88)		0.26 (0.09, 0.75)	1.30 (0.52, 3.27)	
Latina (ref: White [non-Latina])	0.56 (0.25, 1.23)	0.67 (0.19, 2.36)		0.72 (0.33, 1.58)	1.04 (0.39, 2.76)		0.78 (0.35, 1.74)	1.08 (0.42, 2.75)	
Other/Multiple (ref: White [non-Latina])	0.44 (0.22, 0.87)	0.50 (0.15, 1.66)		0.44 (0.22, 0.85)	0.60 (0.25, 1.46)		0.41 (0.21, 0.78)	0.49 (0.21, 1.11)	
Age (1-year increase)	1.19 (1.10, 1.29)	1.23 (1.08, 1.40)	<0.001	—	—	—	1.16 (1.07, 1.25)	1.10 (1.00, 1.21)	0.002
Income			0.13			0.009			0.16
\$20,000 to <\$40,000 (ref: <\$20,000)	2.25 (1.18, 4.28)	1.63 (0.61, 4.40)		2.32 (1.22, 4.40)	2.84 (1.32, 6.09)		1.88 (0.90, 3.96)	2.36 (1.04, 5.34)	
≥\$40,000 (ref: <\$20,000)	1.28 (0.67, 2.45)	0.67 (0.22, 2.02)		0.79 (0.42, 1.51)	0.61 (0.25, 1.45)		0.94 (0.48, 1.85)	0.72 (0.31, 1.67)	
Exposure to The Real Cost in past year			0.25			0.03			—
Yes (ref: No)	0.86 (0.48, 1.54)	1.45 (0.59, 3.38)		1.41 (0.81, 2.43)	0.65 (0.32, 1.31)		—	—	
Not sure (ref: No)	0.67 (0.34, 1.34)	0.38 (0.11, 1.26)		0.77 (0.38, 1.55)	0.24 (0.09, 0.68)		—	—	
Received tobacco coupons in past year			<0.001			<0.001			<0.001
Yes (ref: No)	1.63 (0.87, 3.07)	8.02 (3.55, 18.1)		1.91 (0.98, 3.67)	7.26 (3.55, 14.9)		1.14 (0.54, 2.37)	5.04 (2.44, 10.4)	
Frequency of seeing tobacco advertisements at convenience stores			—			0.35			—
Sometimes/most of the time/always (ref: Never/rarely)	—	—		1.37 (0.71, 2.61)	1.87 (0.74, 4.73)		—	—	

Abbreviations: aOR = adjusted odds ratio; CI = confidence interval

Bold denotes statistically significant difference from reference group at an alpha of 0.05.

^a N = 382 bisexual women were recruited using the online survey platform, Prolific. Purposeful variable selection (Hosmer et al., 2013) was used to build adjusted models, and thus adjustment variables differed across outcome models. Variables without point estimates for a given model were not included in that model.

^b P-values reported here represent the overall statistical significance of respective variables in the multinomial logistic regression model.

6. Data availability statement

The data underlying this article will be shared on reasonable request to the corresponding author.

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CRedit authorship contribution statement

Brittney Keller-Hamilton: Conceptualization, Methodology, Formal analysis, Data curation, Writing – original draft, Project administration. **Elise M. Stevens:** Conceptualization, Methodology, Writing – review & editing. **Amelia Wedel:** Methodology, Writing – review & editing. **Devin T. LaPolt:** Writing – review & editing. **Alexis Miranda:** Writing – review & editing. **Theodore L. Wagener:** Funding acquisition, Writing – review & editing. **Joanne G. Patterson:** Conceptualization, Methodology, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pmedr.2021.101657>.

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