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The effect of race/ethnicity and adversities on smoking cessation among U. S. adult smokers

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ABSTRACT

Introduction: Black and Hispanic individuals in the US experience more socioeconomic adversities that are associated with disparities in tobacco use and cessation than White individuals. This study examined if racial/ethnic differences in smoking abstinence were mediated by socioeconomic (SES) adversities.
Methods: Data from 7,101 established smokers were identified in Wave 1 (2013–2014) of the Population Assessment of Tobacco and Health (PATH) and followed to Wave 4 (2016–2018). The study outcome was cigarette abstinence at Wave 4. The main independent variable was race/ethnicity (Non-Hispanic White [White], Non-Hispanic Black [Black] and Hispanic). The mediators were five measures of SES adversities (unemployment, poverty, difficulty with money, lower education level, lack of health insurance). A weighted Generalized Structural Equation Model (GSEM) was used to estimate the total, direct, and indirect effect of race/ethnicity on the odds of quitting mediated by the five SES adversities. This model was adjusted by study covariates, including health and smoking characteristics.
Results: The indirect effect of race/ethnicity on cessation showed that differences in quitting between Black and White individuals as well as Hispanic and White individuals were mediated by SES adversities. However, the differences in quitting between Hispanic and Black individuals were not mediated by SES adversities. Black and Hispanic individuals were less likely to quit than White individuals, but Hispanic individuals were more likely to quit than Black individuals. There were no direct effects between Black or Hispanic individuals compared to White individuals. Those with higher SES were more likely to quit compared to those with lower SES.
Discussion: Smoking abstinence is higher in White individuals compared to Black and Hispanic individuals and is mediated by SES adversities. However, smoking abstinence is higher among Hispanic individuals compared to Black individuals and it is not mediated by SES adversities. Future studies should consider the role of other factors, such as psychosocial support, racism, discrimination, and stress over the life course in explaining differences in smoking abstinence between Black and Hispanic individuals.

1. Introduction

Racial/ethnic differences along the tobacco use continuum have been well-documented in the United States (Fagan, Moolchan, Lawrence, Fernander, & Ponder, 2007). Smoking prevalence of Non-Hispanic Black (referred to as Black) individuals is similar to that of Non-Hispanic White (referred to as White) individuals (14.9% and 15.5% respectively in 2019), but Hispanic individuals have lower smoking prevalence (8.8%) (Cornelius et al., 2020). Black and Hispanic individuals who smoke are also more likely to be lighter smokers than their White counterparts (Sakuma et al., 2021; Trinidad, Pérez-Stable, White, Emery, & Messer, 2011). Yet, Black individuals are less likely to quit smoking than their White counterparts, despite also having greater interest in quitting and a greater number of previous quit attempts (Babb, Malarcher, Schauer, Asman, & Jamal, 2017; Kulak, Cornelius, Fong, & Giovino, 2016; Trinidad et al., 2011). On the other hand,

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Hispanic individuals are equally likely as White individuals to quit and twice as likely to quit as their Black counterparts (Babb et al., 2017; Trinidad et al., 2011).

Although racial/ethnic disparities in smoking cessation are well documented, less work explores why the disparities exist using nationally representative samples. Socioeconomic status (SES) may, in part, explain this disparity. Black and Hispanic individuals have historically experienced and continue to experience discrimination, segregation and institutionalized racism (Jones, 2000; Williams & Mohammed, 2013). These dimensions manifest in many ways, including differential access to key opportunities that impact SES such as education, employment, housing, medical care and social mobility, which are associated with a lower probability to quit smoking (Williams & Mohammed, 2013; Williams, Priest, & Anderson, 2016). For example, high segregation is associated with greater probability to smoke during pregnancy among Black women due to greater likelihood for targeted tobacco-related advertisement, lower access to smoking cessation services, and other stressors that are related to their geographical segregation (Bell, Zimmerman, Mayer, Almgren, & Huebner, 2007). Importantly, lower median household income and higher proportion of Hispanic residents in the census tract is associated with greater local availability of tobacco products (Siahpush, Jones, Singh, Timsina, & Martin, 2010). Another study showed that multiple major discrimination events such as not being hired for a job or being fired is associated with lower smoking abstinence among Latino smokers (Kendzor, Businelle, & Reitzel, 2014).

Adult smokers with well-established indicators of low SES such as unemployment, income below the poverty level, low educational level and no health insurance are less likely to quit smoking relative to their peers with higher SES (National Center for Chronic Disease Prevention and Health Promotion, 2014; Businelle, Kendzor, & Reitzel, 2010; Kendzor, Businelle, & Costello, 2010; Leventhal, Bello, Galstyan, Higgins, & Barrington-Trimis, 2019; Reid, Hammond, Boudreau, Fong, & Siahpush, 2010). Most of these SES adversities are disproportionally observed among Black and Hispanic individuals compared to their White counterparts (Assari & Mistry, 2018; Kendzor et al., 2012, 2014; Trinidad et al., 2011; Webb Hooper & Kolar, 2015) and may partly account for racial/ethnic differences in quitting smoking between White individuals compared to Black and Hispanic individuals. Further, evidence supported by the Minorities Diminished Returns (MDR) framework shows that even factors associated with greater smoking abstinence such as higher SES may be less protective for Black and Hispanic individuals (Assari, 2018a; Assari, 2018b).

There is a need for more evidence on the underlying mechanisms behind the smoking abstinence differences between White individuals compared to Black or Hispanic individuals, and to examine if SES adversities mediate this relationship. Further, Black and Hispanic individuals have similar SES measures commonly associated with lower smoking abstinence (Kendzor, Businelle, & Reitzel, 2014; Trinidad et al., 2011; Webb Hooper & Kolar, 2015). Yet, Black individuals are less likely to quit smoking. There are no studies showing if SES adversities also help explain the difference in abstinence between Black and Hispanic individuals.

The Population Assessment of Tobacco and Health (PATH) study is a nationally representative longitudinal cohort that provides an unprecedented opportunity to examine the mediating effect of SES adversities on the association between race/ethnicity and smoking abstinence. We set out to examine whether socioeconomic adversities mediate smoking abstinence differences between Black and White smokers, Hispanic and White smokers as well as Black and Hispanic smokers. We hypothesized that socioeconomic adversities would mediate smoking abstinence differences between Black and White smokers, and Hispanic and White smokers, but not between Black and Hispanic smokers given their similar SES adversities.

2. Methods

2.1. Data

The Population Assessment of Tobacco and Health (PATH) is a longitudinal cohort with a nationally representative household sample of noninstitutionalized youth (12–17 years old) and adults (18 years old and older) in the U.S. that oversamples tobacco smokers, young adults and African Americans. Wave 1 was administered in 2013–2014, and respondents were followed in 2014–2015 (Wave 2), 2015–2016 (Wave 3), 2016–2018 (Wave 4), and 2018–2019 (Wave 5). PATH assesses tobacco use, health outcomes, tobacco control measures, and other information that can impact tobacco regulations or are associated with tobacco use. We used the public-use files from the first cohort of PATH Wave 1 (2013–2014) followed through Wave 4 (2016–2018) in this study (Hyland et al., 2017; Tourangeau, Yan, Sun, Hyland, & Stanton, 2019; United States Department of Health Human Services, 2020). Wave 5 data were not included as it was not available at the time of data analysis.

2.2. Sample selection criteria

The study sample included non-Hispanic Black (n = 1118), non-Hispanic White (n = 4976), and Hispanic (n = 1007) individuals who were adults 18 years and older, current established smokers at Wave 1 and who had complete smoking status at Wave 4, for a total of 7101 individuals. Current established smokers were defined by PATH as those who smoked 100 cigarettes in their lifetime and currently smoke every day or some days. Non-smokers at Wave 1 were excluded from the study. See Supplementary material for detailed sample selection criteria.

2.3. Cigarette abstinence

The focal outcome was 30-day cigarette abstinence at Wave 4. Cigarette abstinence was defined as not smoking even one puff in the past 30 days and self-reporting currently smoking “not at all”.

2.4. Race/Ethnicity

The focal predictor was self-reported race/ethnicity in Wave 1 categorized into mutually exclusive categories as non-Hispanic White (referred as White), non-Hispanic Black (referred as Black), and Hispanic at Wave 1. Individuals who identified as non-Hispanic other were not included in this study.

2.5. Adversities

Adversities were defined as low performance on all measures of socioeconomic status self-reported at Wave 1. The selection of these measures was informed by prior investigations of salient socioeconomic predictors of smoking cessation and included unemployment, low educational status, poverty, shortage of money, and lack of health insurance (Babb et al., 2017; Businelle et al., 2010; Kendzor et al., 2010; Leventhal et al., 2019; Margerison-Zilko & Cubbin, 2013; Trinidad et al., 2011). All adversities were dichotomized (1 = Yes; 0 = No). The adversities are described in Table 1.

2.6. Covariates

Covariates included demographic and health characteristics at Wave 1 that are associated cigarette use (Cornelius, Wang, Jamal, Loretan, & Neff, 2020; Higgins, Kurti, & Redner, 2016), including: sex, age category (18–24; 25–34; 35–54; 55+) (treated as categorical as provided by the PATH data), self-reported health (Excellent, Very Good, Good, Fair, Poor, treated as continuous in the regression analysis and as categorical in the descriptive analysis), heavy alcohol use defined as binge drinking

Table 1
Description of the seven adversities included in the study.

Adversity	Description
Unemployment	Respondents that answered "Does not currently work for pay" to the question "Which best describes your current job or paid employment status?". Those who did not currently work for pay due to school or retirement were not classified as unemployed.
Low Educational Level	Respondents with less than high school completed.
Poverty	Defined as annual household income below poverty level based on the 2015 Health and Human Services poverty guidelines for the U.S. (<100% of poverty guideline) (United States Department of Health Human Services, 2020).
Shortage of Money	Respondents that answered "yes" to the question "because of shortage of money were you unable to pay any important bills on time, such as rent, electricity, or telephone bills?"
Lack of health insurance	Respondents that were not currently covered by any private or public health insurance.

5 or more days in the past 30 days based on the US Substance Abuse and Mental Health Services Administration classification (Yes vs. no) (Substance Abuse and Mental Health Services Administration, 2017), and disability defined as "Yes" if respondent reported "limits/difficulty" with ANY of these activities "lifting 10 lb, walking up 10 steps, walking 3 blocks, standing 20 min, bending or stooping, reaching overhead, and using fingers to grasp" due to health (yes vs. no). Binge drinking and disability were included as covariates as these measures were significantly associated with lower likelihood to quit smoking in a previous study that also examined socioeconomic adversities (Leventhal et al., 2019). Smoking characteristics at Wave 1 were also included: number of years smoking regularly (continuous), number of cigarettes smoked per day (continuous), cigarettes smoked within 30 min of waking up (yes vs. no), regular menthol cigarette use (yes vs. no).

2.7. Statistical analysis

All statistical analyses were conducted with Wave 4 single-wave longitudinal adult weights from the PATH Wave 1 cohort with replication variance estimation using Fay's adjustment (0.3) for balanced repeated replication (BRR), as recommended by the PATH user guide to account for nonresponse and oversampling (United States Department of Health Human Services, 2020). The analysis was conducted with STATA 16 (College Station, TX). A two-sided statistical significance at the 0.05 level was used.

Weighted demographic, health and smoking characteristics at Wave 1 were compared by race/ethnicity using Rao-Scott adjusted chi-square tests and one-way ANOVA. Socioeconomic adversities were also compared by race/ethnicity using Rao-Scott adjusted chi-square tests. Weighted bivariate analysis were conducted to evaluate differences in cigarette abstinence at Wave 4 by each adversity using Rao-Scott adjusted chi-square tests. Cigarette abstinence was also calculated by each adversity and race/ethnicity.

Survey-weighted generalized structural equation models were used to test the combined mediation effect of all socioeconomic adversities on the association between race/ethnicity and smoking cessation at Wave 4, adjusted for the other study covariates. We report the total effect of race/ethnicity on cigarette abstinence without the mediating effect of SES adversities, the direct effect of race/ethnicity controlling for SES adversities, and the indirect effect of race/ethnicity through the mediating variables of SES adversities. It was not possible to conduct multiple imputation as there are not well-established methods for multiple imputation with generalized structural equation models that allow for complex survey data such as PATH. However, the generalized SEM model is able to use some observations that are not complete as it uses the method of equation wise deletion (StataCorp, 2021).

3. Results

3.1. Descriptive characteristics

Hispanic individuals were more likely to be men, younger, and to have fair or poor health than Black and White Individuals. Hispanic individuals were also more likely to have lower educational level, no health insurance, and heavy alcohol use compared to their White and Black counterparts (Table 2). Black individuals were more likely to be unemployed, classified in poverty and report shortage of money compared to their White and Hispanic counterparts (Table 2). Poverty was the most common adversity, reported by over half of Black individuals (55.2%), 49.4% of Hispanics, and 32.5% of White individuals.

White individuals reported fewer adversities on average compared to their Black and Hispanic counterparts and were more likely to report no adversities (37.1% for Whites, 19.1% for Blacks and 20.8% for Hispanics). No difference in the average number of adversities was reported between Black and Hispanic individuals and both were more likely to report 2 + adversities (Table 2).

Hispanic individuals were the most likely to report 30-day

Table 2
Characteristics of current established smokers by race/ethnicity, PATH Wave 1.

Characteristics	NHW (N = 4,976)	NHB (N = 1,118)	HISP (N = 1,007)	p-value
Sex				
Male	52.7	58.3	60.3	<0.001
Female	47.3	41.7	39.7	
Age				
18–24	13.6	10.3	19.8	<0.001
25–34	24.7	21.5	28.2	
35–54	39.5	41.7	37.1	
55+	22.1	26.5	14.9	
Self-reported health				
Excellent or Very Good	35.8	32.8	30.6	0.001
Good	42.9	41.6	41.8	
Fair or Poor	21.3	25.6	27.6	
Heavy alcohol use	12.7	9.9	14.4	0.05
Disability	22.7	26.4	20.4	0.02
Adversities				
Unemployment	24.5	32.3	24.4	<0.001
Poverty*	32.5	55.2	49.4	<0.001
Low Education (<HS)	13.6	22.2	27.8	<0.001
No Health Insurance	23.7	25.0	37.7	<0.001
Shortage of Money*	26.3	42.9	33.5	<0.001
Average number of adversities (SD)	1.16 (1.1)	1.70 (1.3)	1.65 (1.3)	<0.001
Total Number of Adversities				
0	37.1	19.1	20.8	<0.001
1	28.6	26.3	26.4	
2	19.6	28.6	27.1	
3	10.6	18.4	18.5	
4	3.7	6.6	6.4	
5	0.4	0.9	0.8	
Smoking Characteristics				
Average years smoked regularly (SD)*	22.2 (14.1)	21.9 (14.8)	16.4 (14.7)	<0.001
Average number of cigarettes smoked per day (SD)	16.4 (22.3)	16.1 (40.2)	14.3 (47.9)	0.5
% First cigarette within 30 min of waking up	64.3	63.3	40.1	<0.001
% Menthol smoker*	28.5	83.0	47.2	<0.001

*Variables missing in more than 5% of the sample.
NHW: Non-Hispanic White; NHB: Non-Hispanic Black; HISP: Hispanic.

abstinence from smoking at Wave 4, followed by White and Black individuals (21.1%, 16.0%, and 12.2%, respectively). Those with any of the adversities were less likely to quit by Wave 4 (Appendix Table 1). The greatest difference in the probability to quit was between those who were employed compared to those unemployed (17.8% vs. 11.1%, $p < 0.001$). Those with greater number of adversities were also less likely to quit (20.4% quit rate for 0 adversities and 8.3% for 5 adversities, $p < 0.001$). There was no significant interaction between adversities and race/ethnicity (Appendix Table 1).

3.2. Regression analysis

There was a significant indirect effect on the relationship between race/ethnicity and smoking abstinence mediated through SES adversities for Black and Hispanic individuals compared to White individuals (Table 3). Compared to White individuals, Black individuals were less likely to quit smoking (OR: 0.51, 95% CI: 0.35; 0.68). The significant mediators for Black individuals were unemployment, poverty and low education. Compared to White individuals, Hispanic individuals were also less likely to quit smoking (OR: 0.54, 95% CI: 0.38; 0.75). The mediators for Hispanic individuals were low education and poverty (Table 3). However, the indirect effect mediated through SES adversities was not significant for Hispanic individuals compared to Black individuals (OR: 1.06, 95%CI: 0.80; 1.40) (not shown in tables), meaning that the examined SES adversities did not mediate the difference in abstinence between Hispanic and Black individuals in this sample.

The direct effect of race/ethnicity on smoking abstinence adjusting for SES adversities and all the other covariates was not significant for Black and Hispanic individuals compared to White individuals (Table 3). However, the direct effect for Hispanic individuals compared to Black individuals was significant, where Hispanic individuals were significantly more likely to quit (OR: 1.45, 95%CI: 1.02; 2.06) (not shown in tables). The direct effect for SES adversities showed that those classified with unemployment, poverty and low education were less likely to quit than those without these adversities (Table 3).

Table 3
Total, Direct and Indirect Effect of SES adversities and race/ethnicity on Smoking Abstinence, N = 6,387.

	Indirect Effect OR (95% CI)		Direct Effect OR (95% CI)	Total Effect OR (95% CI)
Race/ Ethnicity	NHB	HISP		
Non-Hispanic White	(Ref)	(Ref)	(Ref)	(Ref)
Non-Hispanic Black	**0.51 (0.38; 0.68)**		0.80 (0.57; 1.12)	**0.41 (0.28; 0.60)**
Hispanic		**0.54 (0.38; 0.75)**	1.17 (0.87; 1.56)	**0.63 (0.43; 0.92)**
Adversities				
Unemployment	**0.87 (0.79; 0.97)**	0.97 (0.91; 1.04)	**0.68 (0.55; 0.86)**	
Poverty	**0.72 (0.57; 0.91)**	**0.81 (0.69; 0.95)**	**0.73 (0.60; 0.90)**	
Low Education, < HS	**0.85 (0.72; 0.99)**	**0.76 (0.59; 0.98)**	**0.76 (0.56; 0.98)**	
No Health Insurance	0.98 (0.94; 1.02)	0.91 (0.81; 1.02)	0.85 (0.70; 1.03)	
Shortage of Money	0.97 (0.85; 1.11)	0.99 (0.92; 1.05)	0.96 (0.78; 1.17)	

Models adjusted by sex, age, self-reported health, alcohol use, disability, average years smoked regularly, first cigarette smoked within 30 min of waking up and menthol use.
NHW: Non-Hispanic White; NHB: Non-Hispanic Black; HISP: Hispanic.

The total effect of race/ethnicity on smoking abstinence without the mediation of SES adversities showed that Black individuals and Hispanic individuals were less likely to quit smoking compared to White individuals (OR: 0.41, 95%CI: 0.28; 0.60 and OR: 0.63, 95%CI: 0.43; 0.92, respectively) (Table 3). The total effect of race/ethnicity on smoking abstinence for Hispanic individuals without the mediation of SES adversities compared to Black individuals is that Hispanic individuals have 1.54 greater odds to quit (OR: 1.54, 95%CI: 1.02; 2.33) (not shown in tables).

4. Discussion

As hypothesized, we found that socioeconomic adversities significantly mediated the smoking abstinence differences for Black and Hispanic individuals compared to White individuals. Further, we also observed that SES adversities did not mediate the differences in smoking abstinence between Hispanic and Black individuals such that even after accounting for the indirect effect of SES and the direct effect of other covariates, Hispanic individuals were more likely to quit than their Black counterparts.

Overall, the magnitude of the mediation effect for Black and Hispanic individuals compared to White individuals is similar. However, the adversities that mediate the relationship varied between groups. For Black individuals, the effect was largely mediated by poverty, followed by unemployment and low education. The mediators for Hispanic individuals were low education and poverty. Further, the comparison between the indirect effects to the total effect showed that for Black individuals, it becomes harder to quit when accounting for the adversities whereas for Hispanic individuals it becomes easier to quit when accounting for the adversities (compared to White individuals). These results show that the same mediators have a different underlying mechanism in each group.

The descriptive results showed that Hispanic individuals had greater abstinence rates than their White and Black counterparts. However, the regression results showed that the direct effect for Hispanic individuals was not significant compared to White individuals. These results may be driven by the fact that Hispanic individuals are more likely to be light or intermittent smokers. Our results showed that Hispanic individuals were less likely to smoke their first cigarette within the first 30 min after waking up and had been smoking for fewer years, although we did not observe a difference in average number of cigarettes smoked by race/ethnicity. Despite the null direct effect, the indirect effect operating through the mediators showed that Hispanic individuals were less likely to quit than their White counterparts.

The difference in smoking abstinence between Black and Hispanic smokers was not mediated by SES adversities and was significant after accounting for the covariates. The greater smoking abstinence among Hispanic individuals was observed even though Black and Hispanic individuals had a similar average number of adversities, with both groups having more adversities than White individuals. In light of the main results that the SES mediators for Black individuals are different than for Hispanic individuals, the persistent disparity in smoking abstinence between Black and Hispanic individuals may be due to different barriers to quit for these individuals and that may be unmeasured in this study. Although SES helps explain racial/ethnic differences, there are other aspects of race that go beyond SES and that may help explain differences between Black and Hispanic individuals (Williams et al., 2016). Examples of these risk factors are exposure to adversities in childhood or young adulthood, racism, migration, neighborhood or community-level risks, psychosocial stressors, among others that were not considered in this study (Braveman, Cubbin, & Egerter, 2005; Williams et al., 2010, 2016). The study results suggest more work is needed comparing tobacco-related disparities between Black and Hispanic smokers.

One of the limitations of this study is the sample size of racial/ethnic minorities among those who quit smoking by Wave 4. This limits further examination of differences by sex or origin within each race/ethnicity.

These groups are not monoliths and further detail of the race/ethnicity variable is needed in future studies. For example, there is a need to understand smoking cessation behaviors within Hispanic individuals and how it differs for those foreign-born vs. U.S. born and by country of origin; as there is evidence that smoking prevalence differs by these characteristics (Kaplan, Bangdiwala, & Barnhart, 2014). Another limitation of this study is that adversities are only measured at baseline and these may vary over time. Similarly, cigarette abstinence is only measured at one Wave and only captures 30-day cigarette abstinence, which does not include long-term cessation of cigarettes nor it includes other tobacco products.

This study has important implications. It shows that the differences in smoking abstinence between Black and White individuals as well as Hispanic and White individuals were mediated by SES adversities in the PATH study. Further, it also showed that although Black and Hispanic individuals had similar adversities, Hispanic individuals were more likely to quit than Black individuals, and that SES adversities did not mediate this relationship. Although adversities mediate some racial/ethnic disparities in smoking cessation, there is a need to go beyond the adversity measures assessed, and focus on measures that address root causes of disparities such as racism, discrimination, and stress over the life course. These measures should be incorporated in population-based studies such as the PATH study to better understand smoking cessation differences by race/ethnicity.

Declaration of Competing Interest

Author Christopher Schmid has received money for consulting from a legal firm for a product sold by Boehringer-Ingelheim and Eli Lilly. They have also given talks and have consulted for Pfizer and for AngioDynamics. This consultant work is not associated with the work in this study. Author Jasjit S. Ahluwalia serves as a consultant and has equity in a start-up company Respira Technologies. This is a start-up company developing smoking cessation medications through the FDA. They currently do not have a product that is available for sale. All other authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2022.107332.

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