

THE ROLE OF FINANCIAL STRAIN AND EDUCATIONAL ATTAINMENT ON SMOKING ABSTINENCE OF AFRICAN AMERICANS AND WHITES WHO SMOKE

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Objective: To examine if reduced financial strain and higher educational attainment would confer less advantage for successful cessation among African Americans than for White individuals.

Design: A secondary data analysis of the Quit2Live study, a smoking cessation intervention for individuals who smoke.

Setting: Recruited participants from a metropolitan city in the Midwest.

Participants: The sample included 224 African American and 225 White individuals who smoke.

Methods: We implemented a logistic regression analysis and a two-way interaction of the combined financial strain and educational attainment variable and race on smoking abstinence.

Main Outcome Measures: Our outcome variable was cotinine-verified smoking abstinence at the end-of-treatment (week 12). Our explanatory variables were a combination of financial strain (high, low) and educational attainment (high, low).

Results: About 25% of the study participants were low financial strain and high education, 41% high financial strain and high education, 23% high financial strain and low education, and 11% low financial strain and low education. A greater proportion of African Americans vs Whites were in the high financial strain/low educational attainment category (28% vs 18%, $P = .01$). Participants with high financial strain and low educational attainment had substantially lower odds of abstinence (OR = .29 [95% CI: .12, .68]) compared to participants with low financial strain and high educational attainment. Contrary to our hypothesis, race did not moderate this association.

INTRODUCTION

In 2019, about 34.1 million US adults aged ≥ 18 years smoked cigarettes.¹ Cigarette use is highest among certain subgroups, including American Indian/Alaska Native (20.9%), individuals with a General Educational Development (GED) degree (35.3%), and those with an annual household income of $< \$35,000$ (21.4%).¹ While the prevalence of smoking in the United States has decreased over time, disparities in smoking abstinence persist in racial groups. Past-year quit attempts are higher among African Americans (63.4%) compared to other racial groups.² However, Af-

rican Americans are less likely to quit in the past year compared to Whites³ and have quit ratios (46.1%) considerably lower than Whites (63.9%).² These race differences in abstinence routinely persist in clinical trials where access to and utilization of care are equalized,⁴ suggesting that there are underlying factors that prevent African Americans from successfully quitting.

While African American and White individuals who smoke have a number of predictors of smoking abstinence in common, such as higher household income, homeownership, educational attainment beyond a high school degree, and having health insurance,⁵ other factors influencing smoking abstinence

Conclusion: Findings highlight the constraining role of high financial strain and low educational attainment, irrespective of race, on smoking abstinence among smokers actively engaged in a quit attempt. *Ethn Dis.* 2022;32(3):223-230; doi:10.18865/ed.32.3.223

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vary by racial groups. Due to targeted and predatory marketing by the tobacco industry,⁶ smoking has been normalized in African American communities and preferences for menthol cigarette brands such as Newport have been racialized as the “Black cigarette.”⁷ In addition, experiencing different forms of discrimination has been well-documented to contribute to stress, increasing the likelihood of smoking and decreasing the likelihood of abstinence. For example, discrimination related to darker skin color among men⁸ and race⁹ for African Americans has been associated with smoking and decreased odds of smoking abstinence. Similarly, findings have been found for Whites concerning physical appearance¹⁰ and work-related discrimination.¹¹

Despite the availability of smoking cessation programs, the efficacy and accessibility of these programs between African Americans and Whites vary. According to national data, 60.2% of White individuals who smoke and 55.7% of African American individuals who smoke received advice to quit from their health care providers in 2015.² However, only 34.3% of Whites and 28.9% of African Americans received smoking cessation counseling and/or medication.² Studies illuminate that racial inequities among African Americans is a result of the lack of smoking cessation promotion in African American communities,¹² paucity of culturally sensitive smoking cessation interventions in African American populations that also acknowledges within-group heterogeneity,¹³ and historical and contemporary experiences of racism in health care settings.¹⁴

The Minorities’ Diminished Returns (MDRs) theory provides a po-

tential framework to understand racial disparities in smoking cessation. The MDR posits that certain socioeconomic and psychological resources (eg, higher employment, income, educational attainment, social network, neighborhood safety) are less protective on health outcomes for marginalized populations because of systemic forms of oppression such as racism.¹⁵ For example, studies that have employed MDR found that higher educational attainment was less of a protective factor for second-hand smoking in the workplace¹⁶ and a negative relationship on tobacco harm knowledge¹⁷ for African Americans and Hispanic individuals compared to their White counterparts. Similarly, higher income had less of a protective effect on smoking status for immigrants¹⁸ than US-born individuals. These studies demonstrate that resources such as educational attainment and income may be less protective for racial and ethnic minorities, but MDR has not, to our knowledge, been applied to smokers actively engaged in a quit attempt as part of a clinical trial.

The present study extends the literature by exploring the combined effects of financial strain and educational attainment as potential predictors of why smoking abstinence disparities exist between racial and ethnic minorities. Studies have used known indicators and proxies for socioeconomic status (SES) or, within the frames of MDR, resources, such as income, educational attainment, and employment status. However, few clinical trials have explored the role of financial strain on smoking abstinence.^{5,19} Financial strain has been defined as problems in being able to afford basic necessities such as food, housing, and bills.²⁰ It is related

but not independent of income because financial strain not only takes into account a household’s income but also additional financial responsibilities that an individual may have that can cause or lessen economic strain.²¹ Data indicate that, in the United States, adults facing financial strain who are living below the federal poverty level, smoke at higher rates than the general population.^{22,23} This suggests that having greater financial strain, including less available income, does not facilitate abstinence from smoking due to the inability to afford cigarettes. Similarly, although attempts to quit smoking are made at similar rates when comparing individuals above and below the federal poverty level, rates of successfully quitting smoking are much lower among those below the poverty level.²³

The goal of our study was to determine whether the combined advantages of reduced financial strain and increased educational attainment differentially predicted biochemically verified abstinence from smoking following a quit attempt as a function of race. Based on MDR, we hypothesized that reduced financial strain and higher educational attainment would confer less advantage for successful cessation among African Americans than it would for White individuals.

METHODS

Participants

We conducted secondary data analysis from Quit2Live, a five-year prospective intervention, stratified on self-reported race (African American, White), age (<40, ≥40 years old), and sex (men, women).²⁴ The data we

analyzed were based on imputation of those lost to follow-up as smokers, N=449 (n=224 African Americans; n=225 White). Specifically, as is standard in the field,²⁵ the parent study^{5,24} imputed those lost to follow-up as smokers and examined verified abstinence for completers-only at week 12. The same pattern of findings emerged in both analyses. Given that imputing those lost to follow up as smokers is the more conservative approach, this article is based on imputing those lost to follow-up as smokers (n=449). Data for the other variables of interest were collected at baseline and were obtained from everyone (ie, no missing data, n=449). Participants received 12 weeks of varenicline, six weeks of counseling on smoking cessation through week 16, and follow-up through week 26. Further information on the study design and results has been published elsewhere.²⁴ This study was approved by the institutional review boards at the Medical Center, University of Toronto, and University of California, San Francisco.

Measures

Dependent Variable

The primary outcome was self-reported 7-day point prevalence smoking abstinence, biochemically verified by salivary cotinine levels of ≤ 15 ng/ml at end-of-treatment (week 12²⁶).

Independent Variables

Financial strain was measured using a single-item question, "At the end of the month, considering all of your bills and living expenses, do you have?" Responses were: some money left, just enough money to make ends

meet, and not enough money to make ends meet. This measure was a part of the economic strain model²⁷ and has been validated into a single-item measure by other studies.²⁸ We created a binary variable modeled from previous studies²⁹ and categorized some money left at the end of the month as "low financial strain," and just enough money and not enough money to make ends meet as "high financial strain."

Educational attainment was measured with the question, "What is the highest grade or year of school you completed?" Responses were assessed through four categories: less than high school, high school graduate or GED, some college or tech school, and college graduate or higher. We defined less than or equal to a high school graduation as "low educational attainment," and some college or higher as "high educational attainment." The reason for this cut-off is data-driven. Namely, this definition is considered standard within the field given consistent evidence that individuals with a high school degree or less have a higher smoking prevalence than among those with some college or higher.³⁰

We then combined financial strain and educational attainment and created four categories to understand the compounding effect of these measures into: 1) low financial strain and high educational attainment; 2) low financial strain and low educational attainment; 3) high financial strain and high educational attainment; and 4) high financial strain and low educational attainment.

Moderator

Race was self-reported as non-Hispanic White or African American.

Covariates

Covariates included sex (male or female), age, annual household income per household member (household member/\$1,000), employment status (unemployed or retired, employed full-time, employed part-time, student/homemaker), home ownership (not a homeowner, homeowner), neighborhood problems (range: 10-30)³¹ with higher scores indicating more neighborhood problems, and the number of study visits completed (range: 0-6 visits). Income, home ownership, neighborhood problems, and study visits were included because they were shown as significant predictors of smoking cessation from the parent study.⁵ We included employment status because it is a potential confounder.

Statistical Analyses

We analyzed the descriptive characteristics of variables used in the study and conducted a bivariate analysis of smoking abstinence at week 12 and our independent variables using chi-square and t-tests as appropriate. We then conducted logistic regression analyses in three models by first examining financial strain and educational attainment on the odds of abstinence from smoking, then adjusting for race in the second model, and the covariates in the third model. In addition, we also included a two-way interaction term between the combined measure of financial strain and educational attainment and race. We also implemented a post-hoc analysis with Bonferroni correction to examine if there are any meaningful differences between each of the financial strain and educational attainment

categories by race. To assess for multicollinearity, we used the mean Variance Inflation Factor (VIF) for all of the models which were all below 2.0. As previously suggested in other studies, a mean VIF of 4 through 10 indicates high multicollinearity.³² We used Stata 16 SE for data analysis.

RESULTS

Table 1 shows the characteristics of the participants (N=449). Informed by the study's design, race (African American = 224; White = 225) and sex (men = 225 and women = 224) of participants were equivalent. Study

participants were 41.9 years old (SD = 11.7) on average. The average household income of participants per household member was \$28,565 (SD = \$19,839). Close to half of the participants were employed full-time (49%), and about three-fourths reported not owning a home (74%). Participants reported neighborhood problem mean score of 14.49 (SD = 4.22). The mean number of completed visits among participants was 4.8 (SD = 1.7) out of six visits.

At end-of-treatment on week 12, 25% of the participants were abstinent from smoking. Racial differences in financial strain and educational attainment revealed 33% of Whites

and 17% of African Americans were categorized as low financial strain and high educational attainment (Table 2), whereas 18% of Whites and 28% of African Americans were categorized as high financial strain and low educational attainment.

In Table 3, the results of the unadjusted logistic regression showed that participants with high financial strain and low educational attainment (OR = .20 [95% CI: .10, .42]) and high financial strain and high educational attainment (OR = .56 [95% CI: .34, .93]) were less likely to abstain from smoking compared to participants with low financial strain and high educational attainment. In the fully adjusted model,

Table 1. Characteristics of African American and White participants, N=449

	Observations (%) or mean (SD)	Smoking abstinence ^b observations (%) or mean (SD)	P ^c
Financial strain & educational attainment ^a			<.001
Low financial strain & high education	111 (24.72)	41 (36.94)	
Low financial strain & low education	48 (10.69)	12 (25.00)	
High financial strain & high education	186 (41.43)	46 (24.73)	
High financial strain & low education	104 (23.16)	11 (10.58)	
Race, n (%)			<.001
White	225 (50.11)	70 (31.11)	
African American	224 (49.89)	40 (17.86)	
Sex, n (%)			.979
Male	225 (50.11)	55 (24.44)	
Female	224 (49.89)	55 (24.55)	
Age, average	41.85 (11.66) ^d	43.92 (11.80)	<.03
Income (household member/\$1000)	28,565 (19,839) ^d	15.86 (10.14)	<.0001
Employment status, n (%)			<.004
Unemployed or retired	119 (26.50)	16 (13.45)	
Employed full-time	219 (48.78)	68 (31.05)	
Employed part-time	70 (15.59)	17 (24.29)	
Student/homemaker	41 (9.13)	9 (21.95)	
Home ownership, n (%)			<.001
Not a homeowner	334 (74.39)	65 (19.46)	
Homeowner	115 (25.61)	45 (39.13)	
Neighborhood problems, mean (SD)	14.49 (4.22)	13.64 (3.29)	<.01
Study visits completed, mean (SD)	4.80 (1.72)	5.81 (.53)	<.0001

a. Financial strain: low (some money left at the end of the month); high (just enough money and not enough money to make ends meet); Educational attainment: low (less than or equal to HS degree); high (some college or higher)

b. Only abstinent participants are reported.

c. Chi-square and t-tests.

Table 2. Characteristics of financial strain and educational attainment by race, N=449

	White observations (%)	African American observations (%)	P ^a
Financial strain & educational attainment			
Low financial strain & high education	74 (32.89)	37 (16.52)	.0001
Low financial strain & low education	17 (7.56)	31 (13.84)	.04
High financial strain & high education	93 (41.33)	93 (41.52)	.97
High financial strain & low education	41 (18.22)	63 (28.12)	.01

a. Post-hoc analysis with Bonferroni-adjusted p-values.

which included race and all other covariates, participants with high financial strain and low educational attainment (OR = .29 [95% CI: .12, .68]) remained less likely to abstain from smoking. Race did not moderate this association.

In our post-hoc analysis, we found statistically significant differences between African American and White individuals who smoke in the categories: low financial strain and high educational attainment (P = .0001), low financial strain and low educational attainment (P = .04), and high financial strain

and low education (P = .01; Table 2).

In a descriptive fashion, despite lack of a significant race by strain/education interaction on abstinence, we also examined smoking abstinence rates by race and financial strain and educational attainment (Figure 1). Among smokers with low financial strain and high educational attainment (most protective) and high financial strain and low educational attainment (least protective), proportions of smoking abstinence were higher for White participants compared to African Americans, respectively.

DISCUSSION

This study applied the MDR conceptual framework to the issue of racial disparities in smoking abstinence by examining if the combined advantages of reduced financial strain and higher educational attainment differed by race. Consistent with our nation's history of past and present day forms of systemic racism, among which major consequences include economic injustice and poorer access to education for African Americans,^{33,34} we found that a great-

Table 3. Logistic regression of financial strain and educational attainment on smoking abstinence, N=449

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Financial strain & educational attainment (ref low financial strain & high education)			
Low financial strain & low education	.57 (.27, 1.22)	.68 (.31, 1.48)	.84 (.34, 2.12)
High financial strain & high education	.56 (.34, .93) ^a	.61 (.37, 1.03)	.59 (.32, 1.10)
High financial strain & low education	.20 (.10, .42) ^c	.23 (.11, .49) ^c	.29 (.12, .68) ^b
Race (ref White)			
African American		.55 (.35, .87) ^a	.64 (.36, 1.12)
Sex (ref Male)			
Female			.98 (.58, 1.66)
Age			1.00 (.97, 1.02)
Income (household member/\$1000)			1.00 (.99, 1.00)
Employment status (ref unemployed or retired)			
Employed full-time			1.90 (.88, 4.07)
Employed part-time			1.73 (.72, 4.20)
Student/homemaker			1.73 (.57, 5.22)
Home ownership (ref not a homeowner)			
Homeowner			2.53 (1.37, 4.66) ^b
Neighborhood problems			.92 (.86, .99) ^a
Study visits completed			3.20 (2.18, 4.70) ^c

a. P < .05

b. P < .01

c. P < .001

Smoking Abstinence at Week 12

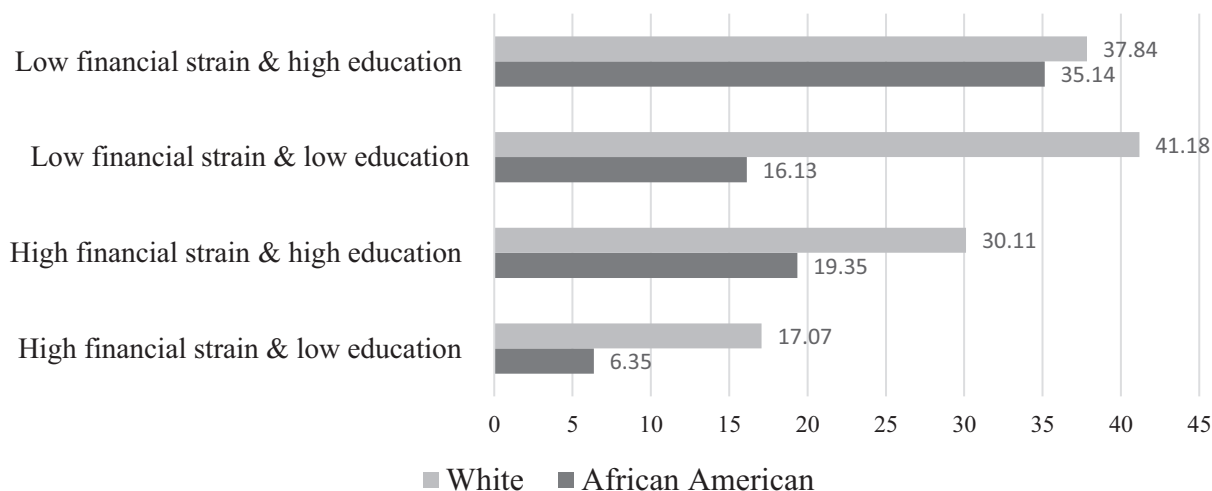


Figure 1. A descriptive analysis of racial characteristics of smoking abstinence at week 12 by financial strain and educational attainment. Note that race did not moderate the association between financial strain/educational attainment and smoking abstinence ($P > .05$).

er proportion of African Americans vs Whites experienced high financial strain and low educational attainment category (28% vs 18%, respectively; $P = .01$). However, contrary to MDR, race did not moderate the relationship between financial strain and educational attainment on smoking abstinence.

Having less financial strain and higher educational attainment did not differ by race in their likelihood of smoking cessation. This finding is consistent in previous studies that found that while financial strain and lower educational attainment are associated with reduced odds of smoking abstinence, differences by race were not statistically significant, were not tested, or did not use a racially and ethnically diverse sample.^{19,35} Despite these findings, national data still reveal a prominent gap in smoking cessation rates by race,^{2,3} indicating more studies need to be conducted to understand the under-

lying factors explaining these inequities. Our study did find that, compared to participants with low financial strain and high educational attainment, those with high financial strain and low educational attainment have 81% reduced odds of abstinence after adjusting for covariates. Individuals in this category constitute the majority of people who use cigarettes in the country.¹

Most studies on smoking cessation also evaluated financial strain and educational attainment separately. Our study extends the literature on the effects of financial strain and educational attainment by capturing these factors' combined and intersectional effects and their association with smoking abstinence. Experiencing high financial strain and having low educational attainment simultaneously have certain implications. For example, individuals in this category may face rent and utility bills and other financial responsibili-

ties at the end of each month, without the resources to cover these expenses.³⁶ Moreover, individuals with lower educational attainment may be less qualified from applying for jobs that would provide them a higher income which would lessen their financial strain.³⁷ Interestingly, we found that 41% of the participants were categorized with high financial strain and high educational attainment showing that having higher educational degrees does not necessarily protect someone from experiencing high financial strain. Numerous factors may explain this phenomenon such as high student loan debts among college graduates that further contribute to financial strain, with higher student loans among African Americans compared to Whites.³⁸

Experiencing financial strain and having access to education are interconnected and are explained by systems of oppression, namely racism,

which is why we observed a higher proportion of African Americans than Whites who experienced high financial strain and had low educational attainment in our study (28% vs 18%). The lasting effects of redlining and its enduring presence today placed African Americans and other people of color in neighborhoods with lower property tax which help fund public schools situated in these neighborhoods.³⁹ With less funding than affluent neighborhoods with higher property tax values, students in these schools suffer higher achievement gaps and higher attrition rates.⁴⁰ In addition, lower educational attainment limits high-paying job opportunities, which places individuals with lower educational attainment in low-wage jobs that make them more likely to experience financial strain.

Study Limitations

Our study has some limitations. While the item used to measure financial strain has been validated by previous studies, it has certain limitations given that it is a self-reported measure. Furthermore, we further collapsed the three categories into two categories which may restrict the nuances of those having some money left, just enough money, and not enough money at the end of the month, though these binary categories have been used in other studies. The lack of power in our study may have further limited our ability to detect moderated effects. Finally, since this study specifically recruited African American and White individuals who smoke in a city in the midwestern region of the United States, results obtained may not generalize to all populations of African American and White individuals who smoke.

CONCLUSION

In conclusion, examining financial strain and educational attainment and associations with smoking cessation provides a more nuanced understanding of the possible interactive effects of financial strain and educational attainment including the potentially moderating role of race. Irrespective of race, those experiencing high financial strain who had low educational attainment had decreased odds of abstinence from smoking whereas those experiencing low financial strain who had high educational attainment had increased odds. Contrary to the MDR framework, protective effects of reduced financial strain and educational attainment did not vary as a function of race. Future studies should consider assessing systemic factors related to racism and other forms of oppression that contribute to stressors experienced by African Americans who smoke to design interventions that address these additional barriers to quitting to close the racial gap in smoking cessation rates.

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CONFLICT OF INTEREST

J. Ahluwalia received sponsored funds for travel expenses as a speaker for the 2021 annual GTNF conference. Ahluwalia serves as a consultant and has equity in a start-up company, Respira Technologies.

AUTHOR CONTRIBUTIONS

Research concept and design: Maglalang, Avila, Ahluwalia, Alexander, Nollen; Acquisition of data: Nollen; Data analysis and interpretation: Maglalang, Avila, Ahluwalia, Murphy, Alexander, Nollen; Manuscript draft: Maglalang, Avila, Ahluwalia, Murphy, Alexander, Nollen; Statistical expertise: Maglalang, Avila; Acquisition of funding: Nollen; Supervision: Ahluwalia, Murphy, Alexander

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