

## Financial Strain and Cancer Risk Behaviors among African Americans

Pragati S. Advani<sup>1,3</sup>, Lorraine R. Reitzel<sup>4</sup>, Nga T. Nguyen<sup>2</sup>, Felicia D. Fisher<sup>4</sup>, Elaine J. Savoy<sup>5</sup>, Adolfo G. Cuevas<sup>6</sup>, David W. Wetter<sup>1</sup>, and Lorna H. McNeill<sup>1</sup>

### Abstract

**Background:** African Americans suffer disproportionately from the adverse consequences of behavioral risk factors for cancer relative to other ethnic groups. Recent studies have assessed how financial strain might uniquely contribute to engagement in modifiable behavioral risk factors for cancer, but not among African Americans. The current study examined associations between financial strain and modifiable cancer risk factors (smoking, at-risk alcohol use, overweight/obesity, insufficient physical activity, inadequate fruit and vegetable intake, and multiple risk factors) among 1,278 African American adults (age,  $46.5 \pm 12.6$  years; 77% female) and explored potential mediators (stress and depressive symptoms) of those associations.

**Methods:** Logistic regression models were used to examine associations between financial strain and cancer risk factors. Analyses were adjusted for age, sex, partner status, income, educational level, and employment status. Analyses involving overweight/obesity status additionally controlled for fruit and vegetable intake and physical activity. Nonparametric bootstrapping procedures were used to assess mediation.

**Results:** Greater financial strain was associated with greater odds of insufficient physical activity ( $P < 0.003$ ) and smoking ( $P = 0.005$ ) and was positively associated with the total number of cancer risk factors ( $P < 0.0001$ ). There was a significant indirect effect of both stress and depressive symptoms on the relations of financial strain with physical inactivity and multiple risk factors, respectively.

**Conclusions:** Future interventions aimed at reducing cancer disparities should focus on African Americans experiencing higher financial strain while addressing their stress and depressive symptoms.

**Impact:** Longitudinal studies are needed to assess the temporal and causal relations between financial strain and modifiable behavioral cancer risk factors among African Americans. *Cancer Epidemiol Biomarkers Prev*; 23(6); 967–75. ©2014 AACR.

### Introduction

Cancer is a major public health problem in the United States (1). Although statistics indicate an approximate 20% decline in cancer death rates by the year 2009 from their peak in 1991 (1), considerable disparities still exist in terms of people benefiting from this falling trend. For instance, overall cancer incidence and death rates are higher among African American men than white men for every cancer site (1). Several factors are known to con-

tribute toward an increased risk of cancer incidence and associated mortality among African American adults, including smoking, at-risk use of alcohol, being overweight or obese, insufficient physical activity, and inadequate fruit and vegetable intake (1–4). For example, African Americans tend to have higher prevalence of obesity and overweight-related diseases as compared with other racial/ethnic groups (5, 6). Unhealthy dietary habits and lower rates of physical activity have also been cited as contributing to their higher burden of chronic diseases relative to whites (6, 7). In addition, African American smokers are more susceptible to cancer than white smokers, and experience more difficulty quitting smoking (8, 9). Because reducing prevalence of these behavioral cancer risk factors among African Americans is an essential strategy to reduce overall cancer-related health disparities, research focused on better understanding of their specific determinants is needed.

Socioeconomic status (SES) is a widely acknowledged social determinant of health and health-related behaviors. Markers of SES include an individual's education, occupation, and income, which affect health insurance status and access to health services (2, 10, 11). Literature suggests

**Authors' Affiliations:** Departments of <sup>1</sup>Health Disparities Research and <sup>2</sup>Biostatistics, The University of Texas MD Anderson Cancer Center; <sup>3</sup>Department of Health Promotion and Behavioral Sciences, The University of Texas School of Public Health; <sup>4</sup>Department of Educational Psychology, College of Education and <sup>5</sup>Department of Psychology, College of Liberal Arts and Social Sciences, The University of Houston, Houston, Texas; and <sup>6</sup>Department of Psychology, College of Liberal Arts & Sciences, The Portland State University, Portland, Oregon

**Corresponding Author:** Lorraine R. Reitzel, Health Program, Department of Educational Psychology, College of Education, University of Houston, 491 Farish Hall, Houston, TX 77204-5029. Phone: 713-743-6679; Fax: 713-743-4996; E-mail: Lreitzel@uh.edu

doi: 10.1158/1055-9965.EPI-14-0016

©2014 American Association for Cancer Research.

that individuals with lower SES experience worse health outcomes compared with those with higher SES (12, 13). Moreover, racial/ethnic disparities for major cancer sites, including colorectal, breast, and prostate, are largest in the lowest SES groups (14). Lower SES is also associated with a higher prevalence of several modifiable risk factors for cancer, including smoking (15), being overweight/obese (15, 16), lower rates of physical activity (17), and intake of unhealthy diet (15). Unfortunately, African Americans often tend to fall in the lower SES group, predisposing them to an increased risk of worse health outcomes relative to other ethnic groups (18).

Recently, research on social determinants of health has gone beyond traditional indicators of SES to consider how more nuanced socioeconomic factors might affect health and health behaviors. One factor of interest is financial strain. Financial strain, also known as income inadequacy, represents an individual's unfavorable subjective perception of their income to needs ratio (19), and although perhaps most relevant to those of lower SES can be applicable to individuals across the income spectrum. Literature suggests that financial strain is considered a better predictor of mortality than other SES indicators, particularly among African Americans (20). Financial strain is tied to increased unmet health needs and thus increased mortality among older African American adults (20). Likewise, financial strain has been linked to several modifiable cancer risk factors such as higher smoking rates (21–25), lower cessation rates (26), at-risk use of alcohol (22, 23, 25, 27, 28), obesity (29), and unhealthy dietary habits (25). However, limited studies have focused on these associations specifically in the context of the African American population.

Furthermore, studies have shown that there are multiple pathways by which an individual's financial status affects health behaviors (12). Financial strain is associated with psychosocial factors such as higher stress (22, 30) and depressive symptoms (30–34). On the other hand, stress and depression have been causally associated with unhealthy behaviors (35). These relations are also consistent with theoretical models suggesting that lower financial status might engender higher perceived stress and depressive symptoms, which contribute to unhealthy behaviors (12, 36). However, no studies to our knowledge have addressed potential indirect effects of stress and/or depressive symptoms on the association between financial strain and several cancer risk factors among a large sample of African American adults.

The purpose of the current study was to examine the unique association of financial strain with several modifiable behavioral cancer risk factors (i.e., smoking, at-risk use of alcohol, being overweight/obese, insufficient physical activity and inadequate intake of fruits and vegetables) in a large sample of church-going African American adults. Because more than 50% of African American adults attend church on a weekly basis (37), and because church settings offer an acceptable and sustainable infrastructure for the delivery of interventions to affect

modifiable behavioral cancer risk factors (e.g., 38, 39), studies among African American church-goers are of particular interest. An exploratory aim of the current study was to assess whether significant associations between financial strain and cancer risk behaviors were attributable to stress and/or depressive symptoms. On the basis of the previous literature in this area, we hypothesized that greater financial strain would be associated with higher odds of engagement in behavioral cancer risk factors, and that stress and depressive symptoms would yield significant indirect effects in these associations.

## Materials and Methods

### Participants and procedures

Data were from the second year of a longitudinal cohort study focused on elucidating factors associated with cancer risk among African Americans. This was the first year that financial strain items were administered. Participants comprised a convenience sample recruited from a large church in Houston, Texas. Recruitment was accomplished through printed and televised media within the church and in-person solicitation. Individuals were eligible to participate if they were 18 years of age or older, resided in the Houston area, had a functional telephone number, and attended church.

Participants ( $N = 1,501$ ) completed a computerized survey at the church during the first year of data collection, and were contacted a year later to participate for a second time. In total, 1,375 participants (91.6% of the original cohort) participated in the second year of data collection. Participants were compensated with a \$30 gift card following the survey procedures. Only participants with complete data on the measures described below ( $N = 1,278$ ; 85.1% of the original cohort) were included in the current study. Data were collected between January and August 2010.

### Measures

**Sociodemographics.** Sociodemographics included age, sex, partner status (married/living with partner or single/widowed/divorced), total annual household income ( $< \$40,000$ ,  $\$40,000$ – $79,999$ , or  $\geq \$80,000$ ), educational level ( $<$ Bachelor's degree, Bachelor's degree, or  $\geq$ Master's degree), and employment status (employed or unemployed).

**Financial strain.** The Financial Strain Questionnaire consisted of 7 items adapted from an economic strain measure to assess the degree to which it was financially difficult for participants to afford food, clothing, housing, major items (e.g., car), furniture/household equipment, leisure activities, and bills at the moment (40). Response categories were 1 = no difficulty, 2 = some difficulty, and 3 = great difficulty. Total scores could range from 7 to 21, with higher scores indicative of greater financial strain. Cronbach's alpha for the Financial Strain Questionnaire in this sample was 0.90.

**Smoking status.** Smoking status was assessed with survey items resulting in classification as a current smoker (smoked  $\geq 100$  cigarettes in lifetime and currently smoke)

or former smoker/never smoker (i.e., smoked  $\geq 100$  cigarettes in lifetime but quit or smoked  $< 100$  cigarettes in lifetime).

**At-risk alcohol use.** Alcohol use was assessed using the Alcohol Quantity and Frequency Questionnaire, a self-report measure of the average alcohol consumption on each day of the week over the last 30 days. Males were classified as at-risk drinkers if they consumed an average of  $> 14$  drinks per week, and females were classified as at-risk drinkers if they consumed an average of  $> 7$  drinks per week (41).

**Overweight/obesity.** Overweight/obesity status was determined based on staff-administered height and weight measurements, which were converted to body mass index (BMI;  $\text{kg}/\text{m}^2$ ). Participants with a BMI  $\geq 25$  were considered overweight/obese.

**Insufficient physical activity.** Physical activity was assessed with the International Physical Activity Questionnaire-Short Format (IPAQ). The IPAQ is a self-report questionnaire used to measure the amount of time spent in moderate activity, vigorous activity, and walking during the past 7 days (42). Time spent engaging in each type of activity was multiplied by the corresponding metabolic equivalent (MET) value, which is a metric used to quantify energy expenditure (43). MET minutes were summed to represent the total weekly MET minutes spent in physical activity. Data were cleaned and processed, and participants were classified as engaging in low or moderate/high rates of physical activity during the previous week based on recommended guidelines (44). Participants reporting low rates of physical activity were categorized as insufficiently physically active.

**Inadequate fruit and vegetable intake.** Fruit and vegetable intake was assessed with the NCI Five-A-Day fruit and vegetable questionnaire (45). This questionnaire yielded a continuous variable of daily fruit and vegetable servings that was positively skewed. Consequently, participants were classified as meeting recommendations for daily intake ( $\geq 5$  servings of fruits and vegetables a day) or not meeting recommendations for daily intake ( $< 5$  servings of fruits and vegetables a day).

**Perceived stress.** The Perceived Stress Scale-4 (PSS-4) is a 4-item self-report scale that asks respondents to indicate how often they experience certain situations, such as "In the last month, how often have you felt that you were unable to control the important things in your life?" and "In the last month, how often have you felt confident about your ability to handle your personal problems?" (reverse scored; ref. 46). Response categories were: 0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, and 4 = very often. Responses were summed with a potential range of 0 to 16, where higher scores indicate greater perceived stress. Cronbach's alpha for the PSS-4 in this sample was 0.75.

**Depressive symptoms.** The Center for Epidemiological Studies Depression 10-item scale (CESD-10) was used to assess the degree of depressive symptoms experienced over the past week (47, 48). Items include "I was bothered

by things that usually don't bother me" and "I felt hopeful about the future" (reversed scored). Response categories were: 0 = rarely or none of the time ( $< 1$  day), 1 = some or a little of the time (1–2 days), 2 = occasionally or a moderate amount of time (3–4 days), and 3 = all the time (5–7 days). Responses were summed with a potential range of 0 to 30, where higher scores indicate more depressive symptoms. Cronbach's alpha for the CESD-10 in this sample was 0.53.

**Total number of risk factors.** The total number of modifiable cancer risk factors was determined by summing the number of risk factors for which the specified criteria were met (i.e., current smoker, at risk use of alcohol, being overweight/obese, insufficient physical activity and inadequate intake of fruits and vegetables). Scores could range from 0 to 5.

### Statistical analysis

Preliminary analyses included descriptive statistics, followed by  $\chi^2$  tests and ANOVAs to assess for any significant differences between included and excluded participants on the variables of interest, as data allowed. Differences in financial strain by each behavioral cancer risk factor and the total number of cancer risk factors were assessed using t tests and a linear regression.

The main aim of this study was to examine associations between financial strain and modifiable cancer risk factors. Main analyses consisted of a series of five logistic regression analyses, each including a respective binary outcome variable (i.e., smoking status, alcohol use status, overweight/obesity status, physical activity and fruit and vegetable intake), and a linear regression analysis focused on the continuous outcome variable comprised of the total number of cancer risk factors. All main analyses were adjusted for age, sex, partner status, total annual household income, educational level, and employment status. Analyses involving overweight/obesity status additionally controlled for fruit and vegetable intake and physical activity. Statistical significance was conservatively set at  $P \leq 0.008$  due to multiple comparisons (Bonferroni correction:  $P = 0.05/6$  regressions).

An exploratory aim of this study was to examine whether perceived stress or depressive symptoms were potential mechanisms explaining significant variance in any significant main analyses. Indirect effects were examined using a covariate-adjusted nonparametric, bias-corrected bootstrapping procedure (49), which generated an empirical approximation of the sampling distribution of the product of the estimated coefficients in the indirect paths using 5,000 resamples from the data set. Conventional significance values ( $P \leq 0.05$ ) were used for these analyses. All analyses were performed using Statistical Analysis Software version 9.3 (SAS Institute).

## Results

### Preliminary analyses

Of the 1,375 potential participants, 1,278 provided complete data on all measures and comprised our final

sample. Table 1 reports participant characteristics and differences between participants who were included versus excluded. Included and excluded participants differed with regard to gender ( $P = 0.0028$ ), education ( $P = 0.0006$ ), employment status ( $P = 0.0215$ ), smoking status ( $P = 0.0112$ ), fruit and vegetable intake ( $P = 0.0356$ ), and the total number of risk factors ( $P = 0.0023$ ). Included participants ( $n = 1,278$ ) were 46.5 ( $\pm 12.6$ ) years of age on average, predominately women (77.31%), were less likely to be smokers (OR, 0.44; 95% CI, 0.23–0.84), but more likely to endorse inadequate fruit and vegetable intake (OR, 1.67; 95% CI, 1.03–2.68). Included participants also

reported more cancer risk factors than excluded participants (mean = 2.1 vs. 1.8). Included and excluded participants did not differ with regard to financial strain, at-risk alcohol use, overweight/obesity, insufficient physical activity, perceived stress, or depressive symptoms.

Table 2 reports unadjusted differences in financial strain by individual and the combined total number of cancer risk factors. There were significant differences in all cases except overweight/obesity status. Specifically, financial strain was significantly higher among those who currently smoked ( $P = <0.0001$ ), practiced at risk use of alcohol ( $P = 0.008$ ), were insufficiently physically

**Table 1.** Characteristics of participants included and excluded from study analysis

Characteristics	Participants included ( $n = 1,278$ )		Participants excluded ( $n = 97$ )		<i>P</i>
	<i>n</i> (mean)	% (SD)	<i>n</i> (mean)	% (SD)	
Age	(46.5)	(12.6)	(47.2)	(14.9)	0.6097
Sex					
Male	290	22.69	35	36.08	0.0028
Female	988	77.31	62	63.92	
Educational level					
<Bachelor's degree	609	47.65	64	67.37	0.0006
= Bachelor's degree	392	30.67	22	23.16	
≥Master's degree	277	21.67	9	9.47	
Partner status					
Married/living with partner	574	44.91	46	47.42	0.6321
Single/widowed/divorced	704	55.09	51	52.58	
Employment status					
Employed	961	75.20	62	64.58	0.0215
Unemployed	317	24.80	34	35.42	
Annual household income					
<\$40,000	327	25.59	20	28.57	0.4010
\$40,000–\$79,900	465	36.38	29	41.43	
≥\$80,000	486	38.03	21	30	
Smoking status					
Current smoker	75	5.87	12	12.37	0.0112
Never smoked/quit	1203	94.13	85	87.63	
At-risk alcohol user					
Yes	67	5.24	7	7.29	0.3910
No	1211	94.76	89	92.71	
Overweight/obese					
Yes	1076	84.19	77	80.21	0.3053
No	202	15.81	19	19.79	
Physical activity					
Insufficiently active	349	27.31	7	21.21	0.4369
Sufficiently active	929	72.69	26	78.79	
Fruit and vegetable intake					
Inadequate	1057	82.71	72	74.23	0.0356
Adequate	221	17.29	25	25.77	
Financial strain	(11.2)	(3.9)	(11.1)	(3.8)	0.7915
Perceived stress	(4.6)	(3.0)	(4.5)	(3.1)	0.9421
Depressive symptoms	(9.2)	(3.6)	(9.1)	(3.7)	0.7088
Total number of CRFs	(2.1)	(0.8)	(1.8)	(0.7)	0.0023

Abbreviation: CRFs, cancer risk factors.



**Table 2.** Unadjusted differences in financial strain by individual and total number of cancer risk factors

Cancer risk factors	Financial strain		P
	Mean	SD	
Smoking status			
Current smoker	13.07	4.21	<0.0001
Never smoked/quit	11.06	3.84	
At-risk alcohol user			
Yes	12.40	4.44	0.0080
No	11.11	3.85	
Overweight/obese			
Yes	11.24	3.89	0.2210
No	10.87	3.90	
Physical activity			
Insufficiently active	11.71	3.99	0.0027
Sufficiently active	10.98	3.83	
Fruit and vegetable intake			
Inadequate	11.29	3.87	0.0252
Adequate	10.65	3.97	
Total number of CRFs <sup>a</sup>			
0	9.10	3.28	<0.0001
1	10.55	3.82	
2	11.11	3.82	
3	11.75	3.89	
4	13.51	4.35	
5	14.00	9.89	

Abbreviation: CRFs, cancer risk factors.

<sup>a</sup>The variable of CRFs was treated as a continuous variable in our analysis. It is presented here in categories for better understanding of the difference of financial strain among participants experiencing fewer total CRFs versus those experiencing more CRFs.

active ( $P = 0.0027$ ), and ate inadequate fruit and vegetables ( $P = 0.0252$ ), respectively. In addition, greater financial strain was associated with more cancer risk factors ( $P = <0.0001$ ).

### Main analyses

In adjusted analyses, greater financial strain was significantly associated with higher odds of insufficient physical activity ( $\beta = 0.052$ ,  $SE = 0.018$ ,  $\chi^2 = 8.90$ ,  $P < 0.003$ ; AOR, 1.05; 95% CI, 1.02–1.05) and smoking ( $\beta = 0.089$ ,  $SE = 0.032$ ,  $\chi^2 = 7.85$ ,  $P = 0.005$ ; AOR, 1.09; 95% CI, 1.03–1.16) and was positively associated with the total number of cancer risk factors ( $\beta = 0.032$ ,  $SE = 0.006$ ,  $t = 5.30$ ,  $P < 0.0001$ ). Financial strain was not significantly associated with overweight/obesity ( $P = 0.012$ ), fruit and vegetable intake ( $P = 0.029$ ), or at-risk alcohol use ( $P = 0.152$ ) in adjusted analyses using our adjusted threshold for statistical significance.

### Exploratory analyses

Exploratory analyses indicated a significant indirect effect for both stress and depression on the association between financial strain and physical activity (indirect effect estimate for stress = 0.015,  $SE = 0.007$ ; 95% CI, 0.002–0.030; indirect effect estimate for depression = 0.012,  $SE = 0.005$ ; 95% CI, 0.010–0.03). Likewise, there was a signifi-

cant indirect effect for both stress and depression on the association between financial strain and the total number of cancer risk behaviors (indirect effect estimate for stress = 0.009,  $SE = 0.002$ ; 95% CI, 0.004–0.014; indirect effect estimate for depression = 0.007,  $SE = 0.002$ ; 95% CI, 0.004–0.011). Specifically, greater financial strain was associated with greater perceived stress and more severe depressive symptoms ( $P < 0.001$ ), which were each associated with a higher likelihood of insufficient physical activity and more risk factors for cancer in covariate-adjusted analyses ( $P < 0.08$ ). No significant indirect effects arose for stress or depressive symptoms in the association between financial strain and smoking status. See Figures 1 and 2 for associated path information.

### Discussion

Financial strain was significantly associated with greater odds of insufficient physical activity and smoking; and was positively associated with the total number of cancer risk factors among African American adults. Although the current study was cross-sectional and cannot speak to causality, exploratory analyses suggested that stress and depressive symptoms may play significant indirect role in the associations between financial strain and insufficient

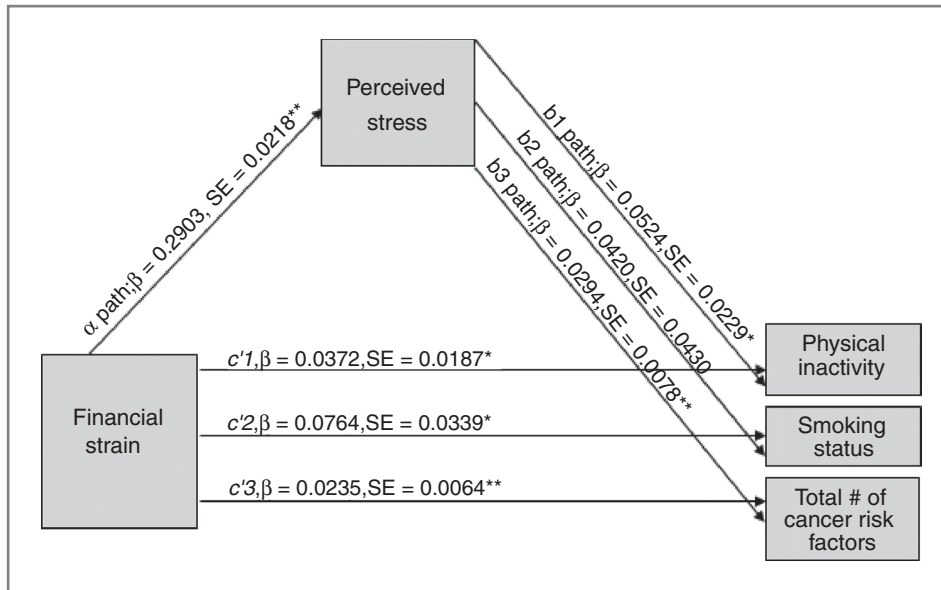


Figure 1. Hypothesized conceptual model of the direct ( $c'$  paths) and indirect effect ( $ab$  paths) of financial strain on cancer risk factors through perceived stress as a proposed mediator. \*\*,  $P < 0.01$ ; \*,  $P < 0.05$ .

physical activity and financial strain and total number of cancer risk factors. These indirect relations are consistent with theoretical models suggesting that lower financial status might engender higher perceived stress and depressive symptoms, which contribute to unhealthy behaviors (12, 36). To the best of our knowledge, this is the first study to examine associations between financial strain and several modifiable behavioral cancer risk factors among a large sample of African American adults. The current study suggests that financial strain may be an important determinant of modifiable cancer risk behaviors among African Americans given that associations were significant even after controlling for the influence of several traditional SES indicators such as income, educa-

tion, and employment status. Although the current participants were church-going African American adults, potentially limiting generalizability of findings, studies suggest that more than 50% of African American adults attend church on a weekly basis (37).

Insufficient physical activity is considered as important as overweight and obesity in its contribution to several chronic conditions, including cancer, and is associated with overall morbidity and mortality (7). Therefore, it is necessary to understand common barriers to physical activity and identify strategies to promote increased physical activity among African American adults. This is especially important because African Americans have lower physical activity levels than other ethnic groups

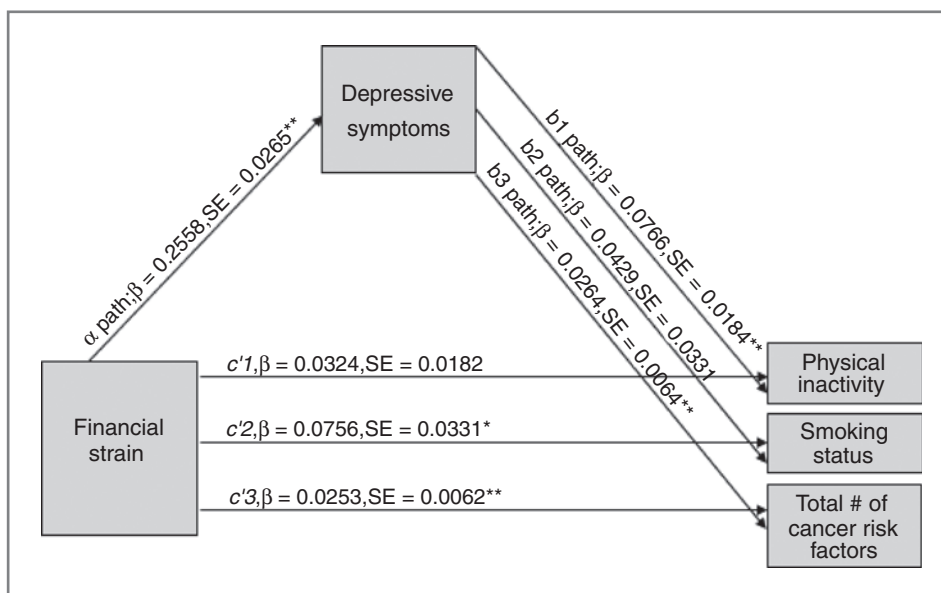


Figure 2. Hypothesized conceptual model of the direct ( $c'$  paths) and indirect effect ( $ab$  paths) of financial strain on cancer risk factors through depressive symptoms as a proposed mediator. \*\*,  $P < 0.01$ ; \*,  $P < 0.05$ .

(50). Results suggest that interventions to promote physical activity may be especially targeted toward African Americans reporting financial strain, receiving government benefits, or otherwise exhibiting unfavorable income-to-needs ratios to reduce health disparities. For example, church-based ministries could provide church attendees assistance with financial planning, increase their physical activity levels through coordinated group activities, and offer support to reduce symptoms of stress and depression. Limited studies have specifically focused on African Americans' cancer risk behaviors while simultaneously addressing their concerns related to financial strain, stress, and depression. The current study suggests the potential need for such a focus.

Financial strain was also significantly associated with increased odds of smoking, even after accounting for SES indicators and demographic characteristics. Quitting smoking is not only an important cancer prevention behavior, but it can also help to alleviate financial strain by eliminating the need to spend money on cigarettes. Several studies have been focused on tailored cessation interventions for African Americans, and research suggests that church settings offer an acceptable and sustainable infrastructure for the delivery of cessation treatment (38, 39). Therefore, church leadership and health-focused ministries should encourage and facilitate smoking cessation attempts among the congregation via the provision of health education, material aid for cessation, or referrals to state or community resources for quitting smoking. Free or low cost services may present fewer barriers to implementation among smokers experiencing financial strain. In our sample, stress and depressive symptoms were not implicated in the relation between financial strain and smoking status. Future research should seek to understand the mechanisms that underlie this association (e.g., tobacco dependence), inasmuch as such knowledge might improve treatment strategies.

The potential mediating role of stress and depressive symptoms between the association of financial strain and total number of cancer risk factors among African American adults is especially concerning because African Americans not only tend to fall in the low SES group (18) but also generally tend to experience higher stressful events than the other ethnicities (51). Although lifetime prevalence of depression among this population is lower as compared with whites; among those who are affected, it is usually untreated and is more severe and disabling (52). In addition, research suggests that African Americans may be likely to engage in cancer-related risk behaviors (e.g., at risk alcohol use) as a result of stress or depressive symptoms (53). Future studies should consider implementing specific interventions to reduce overall stress and depressive symptoms among African American adults to help eliminate or reduce the potential mediating role of these psychosocial determinants between financial strain and multiple modifiable cancer risk factors.

Limitations of this study include the cross-sectional design, which precludes causal inference. Because parti-

cipants were largely church-going African American women from Houston, results may not generalize to dissimilar samples. Future studies including larger proportions of African American men might examine whether relations between financial strain and modifiable cancer risk factors are moderated by sex. In particular, results may not generalize to those who do not attend church. Although social and spiritual support likely varies among church-goers, individuals who attend church may experience more support overall than those who do not. Because greater social and spiritual support may help to buffer the effects of financial strain on cancer risk behaviors, the associations between these variables may differ (e.g., be stronger) among those who do not attend church. In addition, the frequency of church attendance, which might affect perceived social or spiritual support, was not included in these analyses but might also be relevant to the strength of associations. Also, although the number of participants excluded from the present analyses due to missing data was small, they differed from the included participants on several factors, including smoking status and fruit and vegetable intake. Consequently, additional studies using longitudinal designs, random sampling techniques, and diverse samples are needed to confirm causal associations between financial strain and cancer risk factors. In addition, although the CESD-10 is widely used to measure depressive symptoms, lower internal consistency in this sample suggest reliability issues that might have affected its associations with financial strain and cancer risk factors. Results should be interpreted in light of this limitation. Finally, the current study assessed only a few behavioral risk factors for cancer, and other factors such as intake of high fat food (15), engaging in unprotected sexual behaviors (54, 55), infrequent use of sun-protective clothing or sunscreen (56), and nonadherence to recommended prophylactic vaccinations to prevent cancer (e.g., HPV vaccine; ref. 57) were not included. It may be of interest to examine how financial strain is associated with these cancer risk factors in future studies. Similarly, the current study explored only two potential psychosocial mechanisms (stress and depression), and other potential mechanisms might be important to include in future studies (e.g., neighborhood disadvantage, social support, negative affect and mastery, tobacco dependence (58, 59).

In conclusion, the current study was one of the first to examine associations between financial strain and several modifiable cancer risk factors while exploring the indirect effects of psychosocial mechanisms among a large church-based cohort of African American adults. African Americans represent 13.6% of the U.S. population and are the second largest ethnic minority group in the country (60). Consequently, disparities in cancer incidence and mortality experienced by African Americans are an important area of future study. Findings from our study may be helpful in guiding future work in this area, and may inform interventions focused on reducing financial strain and cancer health disparities experienced by African Americans.

## Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

## Disclaimer

The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of the project supporters.

## Authors' Contributions

**Conception and design:** P.S. Advani, L.R. Reitzel, A.G. Cuevas, D.W. Wetter

**Development of methodology:** P.S. Advani, D.W. Wetter, L.R. Reitzel  
**Acquisition of data (provided animals, acquired and managed patients, provided facilities, etc.):** P.S. Advani, D.W. Wetter, L.H. McNeill

**Analysis and interpretation of data (e.g., statistical analysis, biostatistics, computational analysis):** P.S. Advani, N.T. Nguyen, L.R. Reitzel, D.W. Wetter

**Writing, review, and/or revision of the manuscript:** P.S. Advani, L.R. Reitzel, N.T. Nguyen, F.D. Fisher, E.J. Savoy, D.W. Wetter, L.H. McNeill

**Administrative, technical, or material support (i.e., reporting or organizing data, constructing databases):** P.S. Advani, L.R. Reitzel

**Study supervision:** P.S. Advani, L.R. Reitzel, L.H. McNeill

## Acknowledgments

The authors thank the research staff at The University of Texas MD Anderson Cancer Center for assistance with implementation of the original project; the Patient-Reported Outcomes, Survey, and Population Research Shared Resource at The University of Texas MD Anderson Cancer Center, which was responsible for scoring the survey measures

## References

- Siegel R, Naishadham D, Jemal A. Cancer statistics, 2013. *CA Cancer J Clin* 2013;63:11–30.
- Ward E, Jemal A, Cokkinides V, Singh GK, Cardinez C, Ghafoor A, et al. Cancer Disparities by Race/Ethnicity and Socioeconomic Status. *CA Cancer J Clin* 2004;54:78–93.
- Calle EE, Rodriguez C, Walker-Thurmond K, Thun MJ. Overweight, obesity, and mortality from cancer in a prospectively studied cohort of US adults. *N Engl J Med* 2003;348:1625–38.
- MacInnis RJ, English DR, Hopper JL, Giles GG. Body size and composition and the risk of gastric and oesophageal adenocarcinoma. *Int J Cancer* 2006;118:2628–31.
- Cossrow N, Falkner B. Race/ethnic issues in obesity and obesity-related comorbidities. *J Clin Endocrinol Metab* 2004;89:2590–4.
- James D. Factors influencing food choices, dietary intake, and nutrition-related attitudes among African Americans: application of a culturally sensitive model. *Ethn Health* 2004;9:349–67.
- Blair SN, Brodney S. Effects of physical inactivity and obesity on morbidity and mortality: current evidence and research issues. *Med Sci Sports Exerc* 1999;31:S646–S62.
- Royce JM, Hymowitz N, Corbett K, Hartwell TD, Orlandi MA. Smoking cessation factors among African Americans and whites. COMMIT Research Group. *Am J Public Health* 1993;83:220–6.
- Haiman CA, Stram DO, Wilkens LR, Pike MC, Kolonel LN, Henderson BE, et al. Ethnic and racial differences in the smoking-related risk of lung cancer. *N Engl J Med* 2006;354:333–42.
- Cella D, Orav E, Kornblith A, Holland J, Silberfarb P, Lee K, et al. Socioeconomic status and cancer survival. *J Clin Oncol* 1991;9:1500–9.
- Segnan N. Socioeconomic status and cancer screening. *IARC Sci Publ* 1997:369–76.
- Adler NE, Ostrove JM. Socioeconomic Status and Health: What We Know and What We Don't. *Ann N Y Acad Sci* 1999;896:3–15.
- Keppel KG, Pearcy JN, Wagener DK. Trends in racial and ethnic-specific rates for the health status indicators: United States, 1990–98. *Health People* 2000 Stat Notes 2002:1–16
- Chu KC, Miller BA, Springfield SA. Measures of racial/ethnic health disparities in cancer mortality rates and the influence of socioeconomic status. *J Natl Med Assoc* 2007;99:1092.
- Wardle J, Jarvis M, Steggle N, Sutton S, Williamson S, Farrimond H, et al. Socioeconomic disparities in cancer-risk behaviors in adolescence: baseline results from the Health and Behaviour in Teenagers Study (HABITS). *Prev Med* 2003;36:721–30.
- James SA, Fowler-Brown A, Raghunathan TE, Van Hoewyk J. Life-Course Socioeconomic Position and Obesity in African American Women: The Pitt County Study. *Am J Public Health* 2006;96:554–60.
- Ford ES, Merritt RK, Heath GW, Powell KE, Washburn RA, Kriska A, et al. Physical activity behaviors in lower and higher socioeconomic status populations. *Am J Epidemiol* 1991;133:1246–56.
- Nelson A. Unequal treatment: confronting racial and ethnic disparities in health care. *J Natl Med Assoc* 2002;94:666.
- Oakes JM, Rossi PH. The measurement of SES in health research: current practice and steps toward a new approach. *Soc Sci Med* 2003;56:769–84.
- Szanton SL, Allen JK, Thorpe RJ, Seeman T, Bandeen-Roche K, Fried LP. Effect of financial strain on mortality in community-dwelling older women. *J Gerontol B Psychol Sci Soc Sci* 2008;63:S369–S74.
- Grafova IB. Financial strain and smoking. *J Fam Econ Iss* 2011;32:327–40.
- Grossi G, Perski A, Lundberg U, Soares J. Associations between financial strain and the diurnal salivary cortisol secretion of long-term unemployed individuals. *Integr Physiol Behav Sci* 2001;36:205–19.
- Shaw BA, Agahi N, Krause N. Are changes in financial strain associated with changes in alcohol use and smoking among older adults? *J Stud Alcohol Drugs* 2011;72:917–25.
- Siahpush M, Borland R, Scollo M. Smoking and financial stress. *Tob Control* 2003;12:60–6.
- VanKim NA, Laska MN. Socioeconomic disparities in emerging adult weight and weight behaviors. *Am J Health Behav* 2012;36:433–45.
- Kendzor DE, Businelle MS, Costello TJ, Castro Y, Reitzel LR, Cofta-Woerpel LM, et al. Financial strain and smoking cessation among racially/ethnically diverse smokers. *Am J Public Health* 2010;100:702–6.
- Peirce RS, Frone MR, Russell M, Cooper ML. Relationship of financial strain and psychosocial resources to alcohol use and abuse: The mediating role of negative affect and drinking motives. *J Health Soc Behav* 1994;35:291–308.

used in this research; and especially the church leadership and participants, whose efforts made this study possible.

## Human Subjects Statement

Study procedures were approved by the Institutional Review Board at The University of Texas MD Anderson Cancer Center, and written informed consent was obtained from all participants.

## Grant Support

Data collection and management were supported by funding from the University Cancer Foundation; the Duncan Family Institute through the Center for Community-Engaged Translational Research; the Ms Regina J. Rogers Gift; Health Disparities Research Program; the Cullen Trust for Health Care Endowed Chair Funds for Health Disparities Research; the Morgan Foundation Funds for Health Disparities Research and Educational Programs (all to D.W. Wetter); and the National Cancer Institute at the NIH through The University of Texas MD Anderson's Cancer Center Support Grant (P30 CA016672). Manuscript development was further supported by institutional funds from The University of Texas MD Anderson Cancer Center and publication fees were supported by institutional funds from the University of Houston (to L.R. Reitzel).

The costs of publication of this article were defrayed in part by the payment of page charges. This article must therefore be hereby marked *advertisement* in accordance with 18 U.S.C. Section 1734 solely to indicate this fact.

Received January 15, 2014; revised March 14, 2014; accepted March 31, 2014; published OnlineFirst April 16, 2014.



28. Pearlin LI, Radabaugh CW. Economic strains and the coping function of alcohol. *Am J Sociol* 1976;82:652-63.
29. Siahpush M, Huang TTK, Sikora A, Tibbits M, Shaikh RA, Singh GK. Prolonged financial stress predicts subsequent obesity: results from a prospective study of an Australian national sample. *Obesity* 2014;22: 616-21.
30. Mendes de Leon CF, Rapp SS, Kasl SV. Financial strain and symptoms of depression in a community sample of elderly men and women: A longitudinal study. *J Aging Health* 1994;6:448-68.
31. Lynch JW, Kaplan GA, Shema SJ. Cumulative impact of sustained economic hardship on physical, cognitive, psychological, and social functioning. *N Engl J Med* 1997;337:1889-95.
32. Price RH, Choi JN, Vinokur AD. Links in the chain of adversity following job loss: how financial strain and loss of personal control lead to depression, impaired functioning, and poor health. *J Occup Health Psychol* 2002;7:302-12.
33. Zimmerman FJ, Katon W. Socioeconomic status, depression disparities, and financial strain: what lies behind the income-depression relationship? *Health Econ* 2005;14:1197-215.
34. Krause N. Chronic financial strain, social support, and depressive symptoms among older adults. *Psychol Aging* 1987;2:185.
35. Ng DM, Jeffery RW. Relationships between perceived stress and health behaviors in a sample of working adults. *Health Psychol* 2003; 22:638.
36. Gallo LC, Matthews KA. Understanding the association between socioeconomic status and physical health: do negative emotions play a role? *Psychol Bull* 2003;129:10.
37. Gallup. Newton F. Americans' church attendance inches up in 2010; 2010 [cited 2014 Oct 29]. Available from: <http://www.gallup.com/poll/141044/americans-church-attendance-inches-2010.aspx>.
38. Webb MS. Treating tobacco dependence among African Americans: a meta-analytic review. *Health Psychol* 2008;27:S271.
39. Campbell MK, Hudson MA, Resnicow K, Blakeney N, Paxton A, Baskin M. Church-based health promotion interventions: evidence and lessons learned. *Annu Rev Public Health* 2007;28:213-34.
40. Pearlin LI, Menaghan EG, Lieberman MA, Mullan JT. The stress process. *J Health Soc Behav* 1981;337-56.
41. Allen JP, Wilson VB. Assessing alcohol problems: A guide for clinicians and researchers, 2nd edition. Bethesda, MD: US Department of Health and Human Services, National Institute on Alcohol Abuse and Alcoholism (NIH Publication No. 03-3745); 2003.
42. Craig CL, Marshall AL, Sjoström M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003;35:1381-95.
43. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc* 2000;32:S498-S504.
44. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ); 2005. Available from: <http://www.ipaq.ki.se/>.
45. Subar AF, Heimendinger J, Patterson BH, Krebs-Smith SM, Pivonka E, Kessler R. Fruit and vegetable intake in the United States: The baseline survey of the Five A Day for Better Health Program. *Am J Health Promot* 1995;9:352-60.
46. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385-96.
47. Radloff LS. The CES-D scale a self-report depression scale for research in the general population. *Appl Physiol Meas* 1977;1:385-401.
48. Andresen EM, Malmgren JA, Carter WB, Patrick DL. Screening for depression in well older adults: Evaluation of a short form of the CES-D. *Am J Prev Med* 1994;10:77-84.
49. Preacher KJ, Hayes AF. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behav Res Methods* 2008;40:879-91.
50. Cassetta JA, Boden-Albala B, Sciacca RR, Giardina E-GV. Association of education and race/ethnicity with physical activity in insured urban women. *J Womens Health* 2007;16:902-8.
51. Businelle M, Mills B, Chartier K, Kendzor D, Reingle J, Shuval K. Do stressful events account for the link between socioeconomic status and mental health? *J Public Health* 2013 Jun 13.[Epub ahead of print].
52. Williams DR, Gonzalez HM, Neighbors H, Nesse R, Abelson JM, Sweetman J, et al. Prevalence and distribution of major depressive disorder in African Americans, Caribbean blacks, and non-Hispanic whites: results from the National Survey of American Life. *Arch Gen Psychiatry* 2007;64:305.
53. Cooper ML, Russell M, Skinner JB, Frone MR, Mudar P. Stress and alcohol use: moderating effects of gender, coping, and alcohol expectancies. *J Abnorm Psychol* 1992;101:139.
54. Lemp GF, Hirozawa AM, Givertz D, Nieri GN, Anderson L, Lindegren ML, et al. Seroprevalence of HIV and risk behaviors among young homosexual and bisexual men. *JAMA* 1994;272:449-54.
55. Heck JE, Berthiller J, Vaccarella S, Winn DM, Smith EM, Shan'gina O, et al. Sexual behaviours and the risk of head and neck cancers: a pooled analysis in the International Head and Neck Cancer Epidemiology (INHANCE) consortium. *Int J Epidemiol* 2010;39: 166-81.
56. Coups EJ, Manne SL, Heckman CJ. Multiple skin cancer risk behaviors in the US population. *Am J Prev Med* 2008;34:87-93.
57. Saslow D, Castle PE, Cox JT, Davey DD, Einstein MH, Ferris DG, et al. American Cancer Society Guideline for human papillomavirus (HPV) vaccine use to prevent cervical cancer and its precursors. *CA Cancer J Clin* 2007;57:7-28.
58. Kendzor DE, Businelle MS, Mazas CA, Cofta-Woerpel LM, Reitzel LR, Vidrine JI, et al. Pathways between socioeconomic status and modifiable risk factors among African American smokers. *Int J Behav Med* 2009;32:545-57.
59. Lincoln KD. Financial strain, negative interactions, and mastery: Pathways to mental health among older African Americans. *J Black Psychol* 2007;33:439-62.
60. Bureau USC. Facts for features: Black (African-American); 2012 [cited 2013 September 3]. Available from: [http://www.census.gov/newsroom/releases/archives/facts\\_for\\_features\\_special\\_editions/cb12-ff01.html](http://www.census.gov/newsroom/releases/archives/facts_for_features_special_editions/cb12-ff01.html).