

HOW DOES ACCULTURATION INFLUENCE SMOKING BEHAVIOR AMONG LATINOS? THE ROLE OF EDUCATION AND NATIONAL BACKGROUND

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Introduction: As Latinos acculturate, they are assumed to smoke at higher rates. This study investigated the relationship between acculturation level, educational attainment, and cigarette smoking by gender and national background among Latinos.

Methods: Data from the 2009-2012 National Health Interview Survey were analyzed and participants included 1,111 Cubans, 813 Dominicans, 13,281 Mexicans, and 2,197 Puerto Ricans. Multivariable logistic regression was used to model acculturation and educational predictors of current smoking, stratified by gender and national background. Acculturation level was categorized into less acculturated, bicultural, and more acculturated by combining birthplace and language preference. Current cigarette smoking was defined by self-reported use every day or some days among those who ever smoked at least 100 cigarettes.

Results: Most respondents were interviewed in English (62%) and had a high school education or less (60%), but only 39% were US-born. Overall, 17.8% of men and 9.6% of women reported current smoking. By national background, smoking prevalence was highest among Puerto Ricans (16% of women and 23% of men) and lowest among Dominicans (6% of women and 10% of men). More acculturated Mexican women and men had significantly higher odds of current smoking (OR=2.94; 95% CI=2.01, 4.31 and OR=1.88; 95% CI=1.39, 2.55; respectively). Mexican men who were more acculturated and had greater levels of educational attainment had lower odds of smoking (OR=.84; 95% CI=.74, .96).

Conclusions: The relationship between acculturation and health behaviors among Latinos is influenced by education and

INTRODUCTION

Latinos are the largest racial/ethnic minority group in the United States,^{1,2} have an adverse socioeconomic profile compared with Whites,³ are diverse in national background with variation in health behaviors,^{4,5} and have a low overall smoking prevalence of 9.9%.⁶ However, smoking prevalence is known to differ by gender, immigrant generation, national background, acculturation level, educational attainment, and household income. Almost twice as many Latino men (13.1%) than women (7.1%) report current smoking in national surveys, and in

the limited studies that compare national backgrounds, Puerto Ricans had the highest prevalence while Dominicans had the lowest prevalence compared with Cubans, Mexicans, and Central and South Americans.^{7,8}

There is a broadly accepted paradigm that increased acculturation to US mainstream culture leads to more adverse health-related behaviors among Latinos and this is mostly supported by comparisons of immigrants with US-born Latinos.^{9,10} However, this assumption is not consistently supported by available data and analyses are uncommon that incorporate measures of socio-

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economic status as well as acculturation and immigrant generation. In studies of smoking behavior, most have found that more acculturated Latinas are more likely to smoke,¹¹⁻²⁰ but among Latino men findings between acculturation level and current smoking have been mixed.^{11,21} Possible explanations for the differential gender effects of acculturation may be that most studies on smoking among

Our main objective was to assess the interactive effects of acculturation level and educational attainment as well as acculturation level and family income to poverty ratio on current smoking.

Latinos have not been disaggregated by national background nor accounted for any measure of socioeconomic status such as years of formal education or household income.²²

Patterns of smoking among Latinos are similar to those of Whites when stratifying by level of household income,⁸ although differences by national background have been observed.¹⁴ Smoking prevalence tends to be lower among higher income groups.^{8,14} However, in contrast to Whites, Latinos with a higher level of education are not always at a lower risk of current smoking.⁸ Early re-

search showed that Cuban, Mexican, and Puerto Rican women with six or fewer years of formal education had a lower smoking prevalence compared with those with seven or more years and, among men, the rates were similar by education.¹⁴ This lower smoking rate for Latinos with less than 9th grade education persists in more recent studies.⁸ Smoking behavior data among participants in the Hispanic Community Health Study/Study on Latinos (HCHS/SOL) found that, compared with those with a less than 9th grade education, those with some high school education were almost 50% more likely to smoke, and those with a bachelor's degree or higher were about 30% less likely to smoke.⁸ How greater levels of education may protect against smoking with increasing acculturation among women and men of different Latino national backgrounds has not been examined to our knowledge.

Assimilation is not a linear process for contemporary immigrant populations in the United States. Classical theories of assimilation expect that as an immigrant population settles and grows in the host country, assimilation into society will progress in a linear manner and lead to poorer health through the uptake of unhealthy behavior.^{23,24} An example of this is the paradigm of increased acculturation and adverse health-related behaviors among Latinos.^{9,10} However, other research has suggested that assimilation of an immigrant population into mainstream US society is influenced by socioeconomic mobility. Therefore, the impact on health may occur in several segmented forms.^{25,26} One of these segmented forms may lead to

the immigrant population achieving economic advancement with intentional preservation of their community's values and solidarity and thus remain less acculturated.²⁷ This theory of segmented assimilation offers the opportunity to identify what factors prevent some immigrant groups, and not others, from becoming susceptible to adverse outcomes.²⁷ Given previous research on differences in smoking by acculturation level, educational attainment, household income, and national background, it would be valuable to apply the framework of segmented assimilation to assess the relationships of these factors jointly. This approach is especially relevant to address possible explanatory pathways in the Latino Paradox and needs sufficient sample size of Latinos with higher socioeconomic status. Understanding how the key factors of acculturation level, educational attainment, and household income interact may help public health and clinician stakeholders create effective smoking cessation and prevention programs to target specific populations.

Some research has studied the relationship between acculturation and smoking among individual Latino national backgrounds.^{11,22} However, none, to our knowledge, have investigated educational attainment or household income in this relationship by national background. Two recent articles used National Health Interview Survey (NHIS) data to evaluate smoking behavior²⁸ or smoking cessation²⁹, but neither reported data by national background. In order to investigate the relationship between gender, acculturation level, educational attainment, and household

income by national background, we used four years of data from NHIS. Our main objective was to assess the interactive effects of acculturation level and educational attainment as well as acculturation level and family income to poverty ratio on current smoking. We hypothesized that a) greater acculturation level would increase the likelihood of current smoking, especially among women; b) educational attainment of high school or greater would decrease the likelihood of current smoking; c) greater family income to poverty ratio would decrease the likelihood of current smoking; and d) the relationship between acculturation level and current smoking would be modified by educational attainment and/or family income to poverty ratio and differ by national background.

METHODS

National Health Interview Survey

The National Health Interview Survey (NHIS)³⁰ is a nationally representative survey of households. It employs a complex, multistage sampling methodology to assess health status, health care access, and progress toward national health objectives. The number of adults surveyed each year from 2009-2012 ranged between 27,157 and 34,525. Public use data, available on the NHIS website,³⁰ from Latino adult (aged ≥ 18 years) participants of the 2009-2012 NHIS were analyzed in 2015. As public use data from NHIS are de-identified, our analyses did not necessitate review by an institutional review board.

Demographic Characteristics

Age in years, gender (men, women), marital status (never, divorced, separated, widowed, married or living with partner) and birthplace (US-born, foreign-born) were assessed by self-report in all survey years. Educational attainment was categorized as less than 9th grade, 9th to 11th grade, high school diploma or equivalent, some college or associate degree, and bachelor's degree or higher. The following categories were used to quantify the ratio of household family income to poverty threshold: <1.00 , $1.00-1.99$, $2.00-3.49$, and ≥ 3.50 . National background groups included participants identifying as Cuban, Dominican, Mexican, and Puerto Rican. Latinos identifying as any other national background were excluded from background-specific analyses due to the lower sample size for most of the 16 different countries. However, analyses were also conducted among Latinos overall in order to make comparisons with previous research. Language preference was determined by choice of language in response to survey.

Acculturation Level

Acculturation level was operationalized using the limited number of related items available in NHIS data. Based on previous research^{26,31} using NHANES or multistate data, responses to birthplace and language preference, which is the predominant factor in the conceptualization of ethnic identity among Latinos,^{32,33} were selected to define acculturation categories. Three categorical levels of acculturation were established: 1) less acculturated (foreign-born

and preferred Spanish); 2) bicultural (US-born and preferred Spanish or foreign-born and preferred English); and 3) more acculturated (US-born and preferred English). The bicultural category was created to improve statistical power for that group and follows the approach used by Sundquist and colleagues.³¹ Overall, the measure contributes to the framework of segmented assimilation by approximating immigrant generation, for which specific data to separate second and third generations are not available in NHIS for the 39% who were US-born. It allows for the most acculturated (probable second or third generation) and bicultural (possible second generation or first generation who moved to the United States as a young child or early adolescent) to be compared with the least acculturated (probable first generation who moved to the United States as a late adolescent or adult).

Cigarette Smoking

Current smoking was assessed using established items available in NHIS data. These items have been identified as the best measures to assess current smoking.³⁴ Participants who self-reported having ever smoked at least 100 cigarettes in their lifetime and were currently smoking every day or some days, were defined as current smokers.

Statistical Analyses

Descriptive analyses, bivariate comparisons by gender and multivariable logistic regression stratified by gender and national background were used. Within each gender, means and standard errors were cal-

culated for continuous variables and frequencies were calculated for all categorical variables. T-tests and chi-square tests evaluated gender-specific differences in sample characteristics.

Multivariable logistic regression was used to model acculturation, educational, and income predictors of current smoking. Two models were constructed. Predictors

of current smoking were assessed among women (Model 1) and men (Model 2) stratified by national background. Both models were adjusted for age and marital status. For both models, we tested interaction terms between acculturation level and educational attainment as well as between acculturation level and family income to poverty ratio.

Survey data analysis procedures were utilized to account for the complex stratified sampling in NHIS.³⁵ Data from 2009-2012 were combined to increase our sample size and the precision of estimates. Sampling weights were used to adjust variance estimates. All analyses were conducted using Stata, Version 11.2 (Stata-Corp LP, College Station, Texas).

Table 1. Sociodemographic characteristics of Latino adults, National Health Interview Survey, 2009-2012

Characteristic	Total		Women		Men	
	n = 20,993		n = 11,541		n = 9,452	
	Number (weighted %)		Number (weighted %)		Number (weighted %)	
Mean age in years and standard error	40.2	.17	41.0	.21 ^b	39.3	.21 ^b
Age (categories)						
18-34 years	8,071	(43)	4,397	(41) ^b	3,674	(44) ^b
35-49 years	6,817	(32)	3,681	(31) ^b	3,136	(32) ^b
50-64 years	3,721	(17)	2,046	(18) ^b	1,675	(17) ^b
≥65 years	2,384	(8)	1,417	(10) ^b	967	(7) ^b
Married/living with partner	11,291	(61)	5,859	(60) ^b	5,432	(63) ^b
Educational attainment						
< 9 th grade	4,494	(20)	2,379	(19)	2,115	(21) ^b
9 th to 11 th grade	3,657	(17)	2,028	(17)	1,629	(18) ^b
High school diploma or equivalent	5,353	(27)	2,857	(26)	2,496	(27) ^b
Some college or associate's degree	4,829	(24)	2,817	(26)	2,012	(22) ^b
Bachelor's degree or higher	2,477	(12)	1,377	(12)	1,100	(12) ^b
Ratio of family income to poverty threshold						
< 1.00	5,844	(26)	3,652	(30)	2,192	(23) ^b
1.00-1.99	5,456	(29)	2,900	(28)	2,556	(30) ^b
2.00-3.49	4,164	(24)	2,098	(23)	2,066	(26) ^b
≥ 3.50	3,432	(21)	1,681	(20)	1,751	(22) ^b
Language of interview						
Spanish-only	5,653	(24)	3,091	(24)	2,562	(24)
English and Spanish	2,816	(14)	1,528	(14)	1,288	(14)
English-only	12,503	(62)	6,908	(62)	5,595	(62)
Born in the United States	7,797	(39)	4,389	(38)	3,408	(38)
Acculturation level ^a						
Less acculturated	5,333	(23)	2,917	(23)	2,416	(22)
Bicultural	8,579	(42)	4,614	(42)	3,965	(44)
More acculturated	7,042	(35)	3,984	(35)	3,058	(34)
National background						
Cuban	1,111	(4)	617	(4) ^b	494	(4) ^b
Dominican	813	(4)	533	(4) ^b	280	(3) ^b
Mexican	13,281	(65)	7,138	(63) ^b	6,143	(66) ^b
Puerto Rico	2,197	(10)	1,317	(11) ^b	880	(9) ^b
Central and South American	3,591	(17)	1,936	(17) ^b	1,655	(17) ^b

a. Less acculturated refers to persons who responded to the survey in Spanish and were born outside of the United States. Bicultural includes persons who responded to the survey in Spanish and were born in the United States, persons who responded to the survey in English and were born outside of the United States, and persons who responded to the survey in a mix of Spanish and English. More acculturated refers to persons who responded to the survey in English and were born in the United States.
b. P<.001, statistically significant difference between women and men.

RESULTS

Descriptive Characteristics

In the 2009-2012 NHIS, 20,993 participants self-identified as Latino (55% women and 45% men) (Table 1). Mean age in the sample was 40.2 years and a greater proportion of men than women were married or living with a partner (63% compared with 60%; $P < .001$) For both genders, more than 60% of participants had a high school level of education or less and the majority had a family income of less than 200% of the poverty threshold. While most Latinos were

interviewed only in English (62%), less than half (39%) were born in the United States. Mexicans were the largest national background (65%), followed by Puerto Ricans (10%).

Current Smoking Prevalence by Gender

The overall smoking prevalence in this sample was 17.8% for men and 9.6% for women. Bivariate analyses between sociodemographic characteristics and current smoking showed some differences in smoking prevalence between women and men (Table 2). Among women, current

smoking was more prevalent among those with more than a 9th grade education (10%) and did not vary through having some college education, although those with a bachelor's degree or higher smoked at a lower rate. Smoking prevalence was greatest among men with a 9th grade to high school graduate level of education, compared with those with less or more education, and was lowest for men with a bachelor's degree or higher. Among both men and women, smoking prevalence consistently decreased with greater family income to poverty ratio. A higher propor-

Table 2. Smoking prevalence among Latino adults, stratified by gender, National Health Interview Survey, 2009-2012

Characteristic	Women		Men	
	Number (weighted %)		Number (weighted %)	
Predictors				
Educational attainment				
< 9 th grade	138	(5)	335	(15)
9 th to 11 th grade	233	(10)	356	(22)
High school diploma or equivalent	317	(10)	537	(21)
Some college or associate's degree	316	(10)	312	(14)
Bachelor's degree or higher	98	(6)	111	(9)
Ratio of family income to poverty threshold				
< 1.00	412	(10)	444	(19) ^b
1.00-1.99	260	(8)	464	(18) ^b
2.00-3.49	201	(9)	364	(17) ^b
≥ 3.50	132	(7)	265	(14) ^b
Acculturation level ^a				
Less acculturated	184	(6)	356	(15)
Bicultural	335	(6)	627	(15)
More acculturated	586	(13)	683	(21)
National background				
Cuban	90	(13)	91	(19)
Dominican	35	(6)	24	(10)
Mexican	625	(8)	1,117	(17)
Puerto Rican	241	(16)	210	(23)
Central and South American	116	(6)	229	(13)
Covariates				
Age (continuous, years)	40.2	(0.55)	38.2	(0.39)
Marital status				
Never married/separated/divorced/widowed	693	(93)	822	(85)
Married/living with partner	414	(7)	849	(15)

a. Less acculturated refers to persons who responded to the survey in Spanish and were born outside of the United States. Bicultural includes persons who responded to the survey in Spanish and were born in the United States, persons who responded to the survey in English and were born outside of the United States, and persons who responded to the survey in a mix of Spanish and English. More acculturated refers to persons who responded to the survey in English and were born in the United States.
 b. $P < .01$, statistically significant difference between women and men.

tion of men compared with women reported current smoking in each Latino population group but was most marked between Mexican men and women (Table 2). Puerto Rican men and women had the highest smoking rates followed by Cubans. For both women and men, smoking prevalence was highest among the more acculturated (13% and 21%, respectively).

Predictors of Current Smoking among Women by National Background

Among all Latinas, 9th to 12th grade level of education was associated with an increased risk of current smoking, although the trend for pro-

teective effects of a bachelor's degree or higher was not significant. Multivariable models also showed differences in the associations between sociodemographic characteristics and current smoking among women from four national backgrounds (Table 3). The significantly higher odds of smoking for women with a 9th to 11th grade education was shown among Cubans (OR=4.69; 95%CI=1.51, 14.55) and Mexicans (OR=1.53; 95% CI=1.07, 2.21), but not among Dominicans or Puerto Ricans. A family income to poverty ratio of ≥ 3.50 was significantly protective of current smoking among Mexican (OR=.60; 95% CI=.39, .93) and Puerto Rican

women (OR=.27; 95% CI=.11, .69).

Latinas categorized as more acculturated were also more likely to be current smokers. However, the significantly higher level of acculturation was associated with almost a three-fold increase in the odds of current smoking only among Mexican women (aOR=2.94; 95% CI=2.01, 4.32) and not the other national background groups.

Predictors of Current Smoking among Men by National Background

Latino men having a 9th to 11th grade level of education had higher odds of current smoking, and those

Table 3. Multivariable logistic regression results predicting current smoking among Latino women (Model 1), stratified by national background, National Health Interview Survey, 2009-2012

Characteristic	Cuban	Dominican	Mexican	Puerto Rican	Central and South American
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Predictors					
Educational attainment					
< 9 th grade	Reference	Reference	Reference	Reference	Reference
9 th to 11 th grade	4.69 (1.51, 14.55)	1.05 (.38, 2.87)	1.53 (1.07, 2.21)	1.54 (.84, 2.83)	7.08 (1.97, 25.52)
High school diploma or equivalent	2.06 (.67, 6.09)	.55 (.13, 2.33)	1.38 (.97, 1.99)	1.53 (.79, 2.95)	8.92 (2.99, 26.63)
Some college or associate's degree	1.92 (.81, 4.54)	.55 (.15, 1.96)	1.54 (.99, 2.39)	1.08 (.50, 2.31)	7.57 (2.46, 23.32)
Bachelor's degree or higher	.88 (.26, 3.04)	.12 (.01, 1.28)	.78 (.46, 1.32)	.78 (.34, 1.78)	10.33 (3.14, 33.96)
Ratio of family income to poverty threshold					
< 1.00	Reference	Reference	Reference	Reference	Reference
1.00-1.99	.64 (.39, 1.04)	.78 (.28, 2.16)	.95 (.72, 1.27)	.61 (.36, 1.04)	.87 (.39, 1.93)
2.00-3.49	.65 (.37, 1.16)	1.01 (.43, 2.40)	.88 (.65, 1.18)	.61 (.28, 1.35)	1.29 (.55, 3.03)
≥ 3.50	1.19 (.47, 3.00)	.25 (.02, 2.65)	.60 (.39, .93)	.27 (.11, .69)	1.00 (.39, 2.55)
Acculturation level^a					
Less acculturated	Reference	Reference	Reference	Reference	Reference
Bicultural	.63 (.26, 1.50)	1.01 (.34, 3.03)	1.08 (.74, 1.59)	.93 (.47, 1.82)	.65 (.29, 1.43)
More acculturated	.90 (.31, 2.58)	3.19 (1.00, 10.13)	2.94 (2.01, 4.32)	1.19 (.58, 2.44)	.98 (.32, 2.99)
Covariates					
Age (continuous)	.99 (.97, 1.00)	.99 (.96, 1.03)	1.01 (1.00, 1.01)	1.00 (.99, 1.01)	1.00 (.98, 1.01)
Marital status					
Never married/separated/divorced/widowed	Reference	Reference	Reference	Reference	Reference
Married/living with partner	.82 (.48, 1.41)	.09 (.02, .40)	.84 (.68, 1.04)	.93 (.59, 1.48)	.58 (.34, .98)

CI, confidence interval; OR, odds ratio.

a. Less acculturated refers to persons who responded to the survey in Spanish and were born outside of the United States. Bicultural includes persons who responded to the survey in Spanish and were born in the United States, persons who responded to the survey in English and were born outside of the United States, and persons who responded to the survey in a mix of Spanish and English. More acculturated refers to persons who responded to the survey in English and were born in the United States.

with some college or more education had significantly lower odds of current smoking compared with participants with less than 9th grade education. Table 4 shows multivariable models by national background for men. In general, results for educational attainment were in a protective direction for Cuban, Mexican, and Puerto Rican men. One exception to this trend was among Mexican men with a level of education between 9th to 11th grade (OR=1.30; 95% CI=1.00, 1.68). Compared with less than a 9th grade level of education, a high school diploma or equivalent was protective of current smoking among Cubans (OR=.36; 95% CI=.16, .80). Some college and

a bachelor's degree or higher were also protective of current smoking for Cuban (OR=.16; 95% CI=.05, .53 and OR=.10; 95% CI=.03, .37), Mexican (OR=.66; 95% CI=.49, .90 and OR=.50; 95% CI=.31, .80), and Puerto Rican men (OR=.34; 95% CI=.14, .82 and OR=.15; 95% CI=.05,0.48).

When acculturation level was assessed in the overall sample, more acculturated men had higher odds of being current smokers. However, this finding was only significant among Mexican (OR=1.88; 95% CI=1.39, 2.55) and Dominican (OR=11.49; 95% CI=1.64, 84.56) men with increased odds of current smoking among the more acculturated.

Interactions between Acculturation Level and Education or Family Income to Poverty Ratio

When interaction terms were assessed for women, among Dominican women the effect of acculturation on smoking increased with increasing education level (OR=4.44; 95% CI=1.77, 11.14; Table 5) and among Cuban women, the effect of acculturation on smoking decreased as the family income to poverty ratio increased (OR=.71; 95% CI=.52, .97). Additionally, among Mexican men, the effect of acculturation on smoking decreased with increasing level of education (OR=.84; 95% CI=.74,

Table 4. Multivariable logistic regression results predicting current smoking among Latino men (Model 2), stratified by national background, National Health Interview Survey, 2009-2012

Characteristic	Cuban	Dominican	Mexican	Puerto Rican	Central and South American
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Predictors					
Educational attainment					
< 9 th grade	Reference	Reference	Reference	Reference	Reference
9 th to 11 th grade	.91 (.20, 4.18)	.64 (.05, 7.51)	1.30 (1.00, 1.68)	.96 (.43, 2.14)	.94 (.47, 1.88)
High school diploma or equivalent	.36 (.16, .80)	.90 (.12, 6.62)	1.16 (.88, 1.53)	.62 (.28, 1.37)	1.30 (.76, 2.22)
Some college or associate's degree	.16 (.05, .53)	.96 (.15, 6.08)	.66 (.49, .90)	.34 (.14, .82)	.98 (.52, 1.84)
Bachelor's degree or higher	.10 (.03, .37)	.81 (.10, 6.36)	.50 (.31, .80)	.15 (.05, .48)	.65 (.33, 1.29)
Ratio of family income to poverty threshold					
< 1.00	Reference	Reference	Reference	Reference	Reference
1.00-1.99	1.58 (.78, 3.19)	.49 (.18, 1.34)	.96 (.76, 1.22)	.84 (.45, 1.55)	1.02 (.66, 1.60)
2.00-3.49	1.16 (.39, 3.46)	.18 (.03, 1.05)	.84 (.64, 1.09)	.72 (.37, 1.42)	1.13 (.69, 1.86)
≥ 3.50	.82 (.30, 2.23)	.09 (.02, .45)	.77 (.58, 1.04)	.56 (.28, 1.13)	1.36 (.73, 2.51)
Acculturation level^a					
Less acculturated	Reference	Reference	Reference	Reference	Reference
Bicultural	1.59 (.86, 2.96)	2.17 (.48, 9.83)	1.09 (.86, 1.38)	1.43 (.67, 3.07)	1.05 (.71, 1.56)
More acculturated	1.56 (.39, 6.23)	11.79 (1.64, 84.56)	1.88 (1.39, 2.55)	1.47 (.65, 3.34)	1.56 (.84, 2.87)
Covariates					
Age (continuous)	.99 (.98, 1.01)	1.00 (.97, 1.04)	1.00 (.99, 1.00)	.98 (.96, .99)	1.00 (.98, 1.02)
Marital status					
Never married/separated/divorced/widowed	Reference	Reference	Reference	Reference	Reference
Married/living with partner	1.00 (.43, 2.34)	1.42 (.51, 3.96)	.81 (.67, .98)	.84 (.51, 1.38)	1.07 (.71, 1.61)

CI, confidence interval; OR, odds ratio.

a. Less acculturated refers to persons who responded to the survey in Spanish and were born outside of the United States. Bicultural includes persons who responded to the survey in Spanish and were born in the United States, persons who responded to the survey in English and were born outside of the United States, and persons who responded to the survey in a mix of Spanish and English. More acculturated refers to persons who responded to the survey in English and were born in the United States.

.96) and with increasing family income to poverty ratio (OR=.83; 95% CI=.73, .95). Interaction terms in all other models failed to reach statistical significance (Table 5).

DISCUSSION

To our knowledge, this is the first national study that evaluates the contributing roles of acculturation, education, and household income on current smoking among a nationally representative sample of Latinos from four national background groups. Our findings provide new insights in how mobility on the socioeconomic status spectrum may interact with the uptake of US mainstream culture in influencing smoking behavior in both Latino men and women and by national background. Almost all prior studies have found a significant increased risk of acculturation on the smoking behavior of Latinas.¹¹ Our

analyses confirmed this overall effect but found that it was restricted to women of Mexican national background only and not present among Cuban, Dominican, and Puerto Rican women consistent with a recent meta-analysis of 26 studies published between 1990 and 2010.²² Although the effect of acculturation on smoking behavior among Latino men has, for the most part, been somewhat protective or absent in prior studies,^{11,21} our analyses showed significant increased odds of current smoking among more acculturated men. However, this finding was only significant for Mexican, and possibly Dominican, men in the national background-specific analysis, although sample size of other groups may have limited the ability to identify a significant association. In general, previous findings that identified a significant association between acculturation level and smoking behavior among Latino women or men may be driven mostly by the associa-

tions found among Mexican Americans and not be applicable to Latinos from other national backgrounds.

The relationship between acculturation and health behaviors among Latinos needs to be evaluated by level of educational attainment, or another measure of socioeconomic status such as the ratio of family income to poverty threshold, in addition to national background. In isolation, increased acculturation level was associated with increased smoking among both Mexican women and men in our analyses. However, increased acculturation coupled with a higher level of education or family income to poverty ratio was associated with lower rates of current smoking among Mexican men and Cuban women as we had hypothesized. These findings are novel and important observations in understanding the relationship with acculturation among Latinos, especially in the context of the Latino Paradox

Table 5. Interaction term results predicting current smoking among Latino women (Model 1) and men (Model 2), stratified by national background, National Health Interview Survey, 2009-2012

	Cuban	Dominican	Mexican	Puerto Rican	Central and South American
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Model 1					
Women					
Interaction Terms					
Acculturation ^{by} educational attainment	1.13 (.78, 1.64)	4.44 (1.77, 11.14)	1.10 (.93, 1.31)	.78 (.56, 1.08)	.89 (.58, 1.37)
Acculturation ^{by} ratio of family income to poverty threshold	.71 (.52, .97)	.51 (.24, 1.06)	.87 (.73, 1.04)	1.01 (.70, 1.45)	.76 (.49, 1.17)
Model 2					
Men					
Interaction Terms					
Acculturation ^{by} educational attainment	.63 (.40, 1.01)	.70 (.35, 1.39)	.84 (.74, .96)	.84 (.58, 1.22)	1.25 (.84, 1.86)
Acculturation ^{by} ratio of family income to poverty threshold	1.40 (.88, 2.25)	1.06 (.55, 2.05)	.83 (.73, .95)	.99 (.66, 1.47)	1.06 (.80, 1.40)

CI, confidence interval; OR, odds ratio.

showing lower rates of disease outcomes and longer life expectancy in the aggregated population.^{9,10} The assumption that increased acculturation will lead to less healthy behaviors among Latinos may, in large part, be blunted and reversed by increasing educational attainment or reducing poverty in the population. Our data provide empirical support for this dynamic interaction among men. Additionally, other differences were observed among Latinos from other national backgrounds that will require further study.

Smoking prevalence in the countries of background of the study participants ranged widely. Men in Cuba have the highest prevalence (52.7%) followed by men in Mexico (20.8%), Dominican Republic (18.8%), and Puerto Rico (16.4%). Between these countries, the highest prevalence among women was also in Cuba (17.8%) followed by Dominican Republic (9.4%), Puerto Rico (6.8%), and Mexico (6.6%).³⁶ Smoking prevalence across Central and South America ranged widely from 40% of men in Chile to 2.1% of women in Honduras.³⁶ Although smoking rates were higher for men in most countries than their respective counterparts, among women the rates were similar. The impact of immigrant arrival on smoking status has been evaluated using NHIS data and confirmed that Latino immigrants maintained lower rates of current smoking compared with US-born Latinos.²⁸ Furthermore, in that study, longer duration in the United States is associated with lower odds of smoking among men. Duration of residence in the

United States has often been used as a proxy for acculturation and thus our findings are consistent. Future research on the impact on second and third generations of Latinos accounting for acculturation and socioeconomic mobility is needed.

National data have shown that, in the general US population, the demographic group at highest risk for smoking cigarettes are persons with less than a high school education, categorized as 9th to 11th grades.³⁷ Because so few US-born adults report having had less than a 9th grade education, this group lacks significant representation in national surveys. However, among Latino respondents in NHIS, we found that about 20% reported less than a 9th grade education, thus allowing a comparison of this lower level of educational attainment as it influences smoking behavior. Among women and men, we found that smoking prevalence was lower among those with educational attainment levels at the extremes (eg, less than 9th grade and bachelor's degree or higher) and highest among those with educational attainment levels in between. This inverted U-shaped relationship of educational attainment and smoking in both men and women adds granularity to this association that would not be possible to see with samples of US Whites and African Americans only because very few persons have less than 9th grade education.

In our study, analyses by national background revealed that being of Mexican background with a high level of acculturation was a significant factor in predicting current smoking. Representing about

65% of the Latino population in the United States,³⁸ Mexicans may be more influenced than other Latinos by the tobacco industry's strategy to target Latinos with pro-tobacco marketing.³⁹ Our findings demystify some of the mixed findings of previous research on acculturation level and smoking among men by showing that the relationship differs for certain national backgrounds.

...increased acculturation coupled with a higher level of education or family income to poverty ratio was associated with lower rates of current smoking among Mexican men and Cuban women as we had hypothesized.

Additionally, the differences we observed for Mexican women add to our existing knowledge of this relationship among Latinas overall.

Our results showed that national background, in addition to gender, played a substantial role in the relationship between acculturation level, educational attainment, family income to poverty ratio, and current smoking. These findings showed that the relationship between acculturation level and smoking is not

linear, therefore challenging the assumption^{9,10} that as Latinos become more acculturated, they will engage in less healthy behaviors. In fact, the interaction finding among Mexican men supports the hypothesis that increased educational attainment or reduced poverty can function to promote healthy behaviors even in the setting of greater acculturation.²⁷ This segmented assimilation would imply that Mexican men with greater educational attainment or less poverty may also maintain some of their community's values, such as protective health behaviors like not smoking, as they acculturate to the US mainstream culture.

The social norms around smoking may differ for Latinos by gender and national background. It may be less acceptable for men to smoke in the United States as they acculturate because of tobacco control policies. However, women may be "liberated" from traditional gender roles and be susceptible to tobacco industry promotions to smoke,³⁹ as they increasingly identify with being part of the US mainstream society. Educational attainment and household income also play a role by gender, where certain women are more likely to smoke if they are more educated and others are less likely to smoke if they are further away from poverty, as may be indicated by our findings among Dominican and Cuban women, respectively. These may be related to increasing independence and economic opportunity that come with living in the United States.

One of the strengths of our study was its assessment of smoking prevalence among Latinos from

different national backgrounds in a nationally representative sample. Most investigations into tobacco use behaviors among Latinos have not reported results disaggregated by national background. Another strength is our use of birthplace and language preference to create a simple three-level categorical measure of acculturation that takes advantage of already collected data.

Limitations

Some limitations of this research were related to our use of NHIS data. NHIS assesses smoking behavior by self-report, which may not capture individuals who do not perceive themselves as having ever smoked at least 100 cigarettes because they smoke only a few cigarettes per day and not every day. Additionally, the categories of national background provided by NHIS did not allow us to assess relationships among Latinos from Central and South American backgrounds. Therefore, results for other national backgrounds were only included in the aggregated analyses. Caution should be exercised when interpreting some estimates due to their small sample sizes, especially the national backgrounds of Dominicans and Central and South Americans. NHIS is a cross-sectional survey, which prevented us from determining the temporality of the relationships we assessed. Lastly, the concept of acculturation, and higher versus lower levels of it, does not have a consistent impact across domains of health behaviors with differences found by gender. Therefore, findings for smoking behavior may run counter to findings for other health behaviors.

CONCLUSIONS

Smoking prevalence among Latinos is known to differ by gender, national background, acculturation level, educational attainment, and household income. In order to create effective smoking cessation and prevention programs to target specific populations, we need to better understand how these key sociodemographic drivers and markers influence current smoking. Acculturation level and educational attainment, as well as acculturation level and household income, have an interactive influence on current smoking that differs by gender and national background. Our findings suggest that public health and clinician stakeholders should consider taking these factors into account when designing new or adapting existing tobacco control strategies.

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CONFLICT OF INTEREST

No conflicts of interest to report.

AUTHOR CONTRIBUTIONS

Research concept and design: Rodriquez, Fernández, Pérez-Stable; Acquisition of data: Rodriquez; Data analysis and interpretation: Rodriquez, Fernández, Livaudais-Toman, Pérez-Stable; Manuscript draft: Rodriquez, Fernández, Livaudais-Toman, Pérez-Stable; Statistical expertise: Rodriquez, Fernández, Livaudais-Toman; Acquisition of funds: Rodriquez, Pérez-Stable; Administrative: Rodriquez; Supervision: Fernández, Pérez-Stable

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