

Exploring Risk Factors in Latino Cardiovascular Disease: The Role of Education, Nativity, and Gender

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Considerable interest in the cardiovascular health of Latinos has emerged during the past decade. Although cardiovascular disease (CVD) is the second leading cause of death behind cancer, the Latino mortality rate for CVD is lower than that of non-Hispanic Whites.^{1,2} Of the 4 major racial/ethnic groups, Latinos have the second highest morbidity-related CVD rate (26% for men and 32% for women).³ Relatively well established is that Mexican American groups have substantial risk factors, such as diabetes, obesity, and hypertension, which contribute to the development of CVD at some point during the life course, making them an important population in which to examine the association between risk factors and future cardiac events.

Much of the work on Latino health has focused on Mexicans, traditionally framing it as either a “Hispanic Health Paradox” (given their lower than expected socioeconomic status [SES], Latinos exhibit better health outcomes than non-Hispanic Whites)⁴ or a “Hispanic Healthy Immigrant Hypothesis” (foreign-born Latinos, primarily Mexicans, have a health advantage over US-born Mexicans).^{5,6} In this study, we move beyond the Hispanic Health Paradox to explore differences in CVD risk factors by examining educational gradients and the intersections of nativity and gender. An intersectional lens acknowledges coconstitutive dimensions of social inequality such as ethnic identity, gender, and SES to better understand how these social categories are associated with health.^{7–9} A paucity of empirical research exists on gender inequalities by nativity for Latinos. Most studies have been descriptive, finding gender inequalities across 3 domains: migration, acculturation processes, and health.^{10–12} CVD risk factors, such as hypertension, high waist circumference or high body mass index, and diabetes are most prevalent in Mexican American women.^{13–15} Prevalence rates for hypertension have indicated that Mexican American women have higher rates

Objectives. We examined 3 cardiovascular disease risk factors by nativity and gender, evaluating evidence for education and health behaviors in explaining the “Hispanic Health Paradox.”

Methods. We analyzed 2001–2008 National Health and Nutrition Examination Survey data for adults (n = 6032) to compare hypertension, high waist circumference, and diabetes for US- and foreign-born Mexican men and women. We controlled for age, depression, and health insurance.

Results. Cardiovascular disease risk factors differed by education, nativity, and gender. Higher education was associated with higher odds of hypertension and high waist circumference for men and women regardless of nativity. As education increased, the odds of diabetes increased for US-born women, showing a gradient for this population. Finally, foreign-born Mexican women with 5 to 19 years in the United States conferred the highest odds of having diabetes, whereas foreign-born men with less than 5 years in the United States had the lowest odds for high waist circumference and presence of diabetes.

Conclusions. Results contest assumptions of the Hispanic Health Paradox and suggest new approaches. New research can yield accurate information to ensure the development of appropriate interventions, decreasing health disparities endemic to a subgroup of Latinos. (*Am J Public Health.* 2014;104:1742–1750. doi:10.2105/AJPH.2013.301280)

than men regardless of nativity,¹⁶ and foreign-born Mexican men (9.8%) and women (16.1%) have lower prevalence rates than US-born Mexican men (17.1%) and women (20.1%).¹⁷

Estimates using 1999–2008 National Health and Nutrition Examination Survey data have shown prevalence rates for obesity at 45.1% for Mexican American women and 35.9% for Mexican American men.¹⁸ Moreover, Mexican Americans are twice as likely as non-Hispanic Whites to have been diagnosed with diabetes by a physician.¹⁹

Evidence on the social determinants of health has shown that SES measured by education, income, and occupation is strongly associated with lower mortality and better health outcomes at higher levels of the SES gradient.^{20–24} However, investigations of the SES gradient for Latinos have been inconclusive, showing either weak or nonexistent associations with educational attainment.^{25,26} Data are even more puzzling for foreign-born Latinos because reports have shown more modest associations between education and

health compared with those for US-born Latinos, Mexicans, and Central and South Americans.^{27–29}

To contribute to the scant literature on the Hispanic Health Paradox and CVD risks, we used 3 traditional risk factors (hypertension, high waist circumference [HWC], and diabetes) to investigate whether health advantages exist for foreign-born Mexican populations. We (1) empirically investigated the relationship between education, nativity, gender, time in the United States, and CVD risk factors and (2) assessed the extent to which the education gradient matters for Mexican Americans by gender and nativity in predicting high risk for future CVD events. Our major contributions with this article are examining and describing variations in health risk and extending current intersectional thinking on the health of Mexican-origin populations by moving beyond the generalized Hispanic Health Paradox to produce meaningful information and to ensure the development of appropriate CVD interventions to decrease health disparities that

are endemic to a subgroup of the Latino population.

METHODS

We use pooled data from the 2001–2008 National Health and Nutrition Examination Survey,³⁰ a representative cross-sectional survey designed to assess the health and nutritional status of adults. We included data for US- and foreign-born Mexicans aged 20 years and older and differentiated the data so that categories were mutually exclusive. US-born Mexicans include respondents born in 1 of the 50 states or Washington, DC. We considered respondents foreign-born if they were born in Mexico. The initial sample consisted of 5370 US-born Mexicans (2528 men and 2842 women) and 2752 foreign-born Mexicans (1414 men and 1338 women). Respondents with complete information on all variables yielded a sample of 6032.

Our outcome variables were hypertension, HWC, and diabetes. We based cut-off points for HWC and hypertension on clinical recommendations indicating high risk for CVD.^{31,32} HWC, a measurement of central obesity, was measured using a fiberglass tape crossing over the umbilicus and the superior iliac crests. Cut-off points were 83 centimeters for women and 89 centimeters for men. We used HWC because it has been shown to be a more robust measure of CVD risk for Mexicans.^{33–35} We used the mean of 2 measurements of systolic and diastolic blood pressure readings to measure hypertension (>140/90 mm Hg). For diabetes, respondents were asked, “Ever been told by a doctor or health professional that [you have/he or she has] diabetes or sugar diabetes?” Each CVD risk factor was a dichotomous variable (0 = no; 1 = yes). We dichotomized the HWC and hypertension variables because binary measures have been used extensively in other analyses and have several advantages over continuous parameterizations.³⁶ For variables with risk determined by high and low values, a continuous measure will not adequately assess whether individuals fall in either category, particularly when they are response variables. Because the CVD risk factors under study have well-established cut-off points designating clinical risk, dichotomizing the dependent variables reduces problems

associated with outliers. Therefore, our population included participants with hypertension (n = 451 men; n = 501 women), HWC (n = 1510 men; n = 3150 women), and diabetes (n = 217 men; n = 203 women).

Our independent variables included dichotomous variables for marital status (1 = married, 0 = unmarried) and gender (1 = male, 2 = female) and a categorical variable for time in the United States, for which 20 or more years was the reference group (1 = less than 5 years, 2 = 5–19 years, or 3 = 20 or more years in the United States). On the basis of existing theoretical guidance, we used education as our SES indicator,^{22,37–38} measured with 4 indicators of schooling with the highest indicator as the reference group (1 = <9 years, 2 = 9–11 years, 3 = high school diploma or some college, and 4 = bachelor’s degree and above). The three dichotomous health behavior variables included rigorous exercise more than 3 days per week (0 = no, 1 = yes), daily smoker (0 = no, 1 = yes), and heavy drinker consuming at least 5 or more alcoholic drinks per day (0 = no, 1 = yes). Control variables include a categorical variable for age (1 = 20–44 years, 2 = 45–54 years, 3 = 55–64 years, 4 = 65 or more years), a dichotomous variable for health insurance coverage (0 = no, 1 = yes), and the Depression Screener Questionnaire,³⁹ which is an index of 9 self-reported *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*⁴⁰ signs and symptoms for depression which are scored on a scale ranging from 0 (not at all) to 3 (nearly every day).

Data were analyzed using SAS 9.2 (SAS Institute, Cary, NC).⁴¹ We weighted descriptive statistics and regressions using the MEC weight provided by the National Health and Nutrition Examination Survey to account for the complex sampling design of pooled data. We adjusted the weight by dividing by the number of survey years (4) to obtain the average US civilian noninstitutionalized population so as to make generalizations about our population. We used binary logistic regression models to estimate adjusted odds ratios (AORs) and 95% confidence intervals (CIs) for predictors known to be associated with CVD risks for Mexicans stratified by nativity and gender. The first model estimated marital status and time in the United States. The additive model included educational attainment, and the third model

introduced health behaviors and interactions to determine the predictive accuracy of the best model for understanding the factors associated with CVD risks. Only significant interactions are reported in the tables. Separate models were run for men and women by nativity. All models controlled for age, Depression Screener Questionnaire, and health insurance. To investigate whether an education gradient existed, we estimated relative risk ratios (RRs) to examine which relationships occur with levels of education for Mexican-origin groups by gender and nativity.

RESULTS

A higher percentage of foreign-born Mexicans (59.4% of men, 63.1% of women) than US-born Mexicans (38% of men and women) were married (Table 1). Almost half (46.3% of men, 46.1% of women) of foreign-born Mexican men and women had spent 5 to 19 years in the United States. The majority of US-born Mexicans indicated having a high school diploma or some college education (57.0% of men, 62.2% of women). By contrast, the majority of foreign-born Mexican men and women had less than 9 years of education (45% of men, 46% of women). We observed few gender differences in health behaviors. Heavy drinking ranged from 4.8% to 6.8% across gender and nativity, which is consistent with national data that report low drinking and smoking rates,⁴² in addition to low levels of physical activity, for Mexican Americans.⁴³ Control variables showed younger age groups for both US- and foreign-born Mexicans regardless of gender and higher Depression Screener Questionnaire mean scores among foreign-born Mexican women. Overall, slightly more than half of both US- and foreign-born Mexicans had health insurance.

Traditional Risk Factors by Nativity for Men

Table 2 presents the weighted adjusted odds ratio for CVD risks for Mexican men by nativity. As shown, lower rates of hypertension were apparent for both foreign- and US-born married men compared with unmarried men (model 1). Time in the United States mattered most for recent immigrants, among whom the predicted odds of having hypertension was

TABLE 1—Weighted Percentage Distribution of the Sample by Mexican Nativity and Gender: National Health and Nutrition Examination Survey, United States, 2001–2008

Variable	US-Born		Foreign-Born	
	Men, % or Mean ±SD	Women, % or Mean ±SD	Men, % or Mean ±SD	Women, % or Mean ±SD
Married	38.1***	38.4***	59.4***	63.1***
Time in United States, y				
≤ 5	...	...	29.7***	28.5***
5–19	...	...	46.3***	46.1***
≥ 20	...	...	24.0***	25.4***
Education				
< 9 y	10.5***	7.2***	45.0***	45.9***
9–11 y	20.1***	20.2***	24.7***	21.1***
High school diploma or some college	57.0***	62.2***	27.6***	29.6***
≥ bachelor's degree	12.4***	10.3***	2.7***	3.5***
Health behaviors				
Rigorous exercise	5.1***	5.3***	4.4***	4.2***
Daily smoker	3.6***	2.4***	2.7***	3.9***
Heavy drinker	5.2***	5.4***	4.8***	6.2***
Control variables				
Age, y				
20–44	58.5***	59.6***	75.9***	70.4***
45–54	19.7***	17.2***	13.8***	16.7***
55–64	11.7***	10.9***	6.0***	7.3***
≥ 65	10.1***	12.2***	4.3***	5.7***
DSQ	8.5 ± 3.50***	8.4 ± 3.53***	8.5 ± 3.42***	8.6 ± 3.38***
Health insurance	57.3***	57.4***	54.9***	55.4***

Note. DSQ = Depression Screener Questionnaire. Comparisons are between men and women from same racial/ethnic group. Statistic represents column percentage. **P* ≤ .05; ***P* ≤ .01; ****P* ≤ .001.

26% lower for Mexican men (AOR = 0.73; CI = 0.73, 0.74) who had been in the United States less than 5 years and 39% lower for Mexican men (AOR = 0.61; CI = 0.61, 0.62) who had been in the United States 5 to 19 years compared with those who had been in the United States 20 years or more. We found that foreign-born (AOR = 5.10; CI = 4.97, 5.24) and US-born (AOR = 4.34; CI = 4.23, 4.45) Mexican men with 9 to 11 years of education had the highest rates of hypertension (model 2). In the next model, we added rigorous exercise, daily smoking, and heavy drinking (model 3). Education odds ratios did not change dramatically, suggesting that education is a good predictor of hypertension for Mexican men regardless of nativity.

Models for HWC show higher odds for married than unmarried foreign-born Mexicans (AOR = 1.26; CI = 1.25, 1.26) and US-born

Mexicans (AOR = 1.22; CI = 1.21, 1.23; Table 2, model 1). Mexicans with less than 5 years in the United States had better health profiles than those with more than 5 years in the United States. However, when educational attainment was entered into the model, having HWC was highest for foreign-born (AOR = 1.54; CI = 1.52, 1.56) and US-born (AOR = 1.40; CI = 1.38, 1.41) Mexican men with a diploma or some college (model 2). Although daily smoking and rigorous exercise were positively associated with HWC (model 3), the education odds ratios in model 2 became larger, indicating that education is a better predictor of HWC for US- and foreign-born Mexican men.

The results in Table 2 show that foreign-born Mexican men who spent less than 5 years in the United States had lower odds of having diabetes (AOR = 0.41; CI = 0.41, 0.42; model

1) than those who spent more than 5 years in the United States. The odds ratios remained unchanged once education was added (model 2), showing lower educational attainment to be a significant predictor of diabetes for foreign- and US-born Mexican men. Overall, time in the United States (model 2) and health behaviors (model 3) could not explain differences in diabetes by nativity because the odds ratios remained relatively the same from model 1 to model 3.

Traditional Risk Factors by Nativity for Women

Table 3 shows the weighted and adjusted odds ratios for CVD risk for Mexican women by nativity. Women had a different CVD risk profile than men. Model 1 shows that married foreign-born (AOR = 0.96; CI = 0.96, 0.97) and US-born (AOR = 0.96; CI = 0.95, 0.96) Mexican women were at lower risk for hypertension than were unmarried foreign- and US-born Mexican women. Moreover, the risk of hypertension was 1.09 times higher for foreign-born Mexican women with less than 5 years in the United States than for those who spent 20 or more years in the United States. When education was added (model 2), the risk of hypertension was lowest for women with less than 9 years of education. Health behaviors were significantly associated with hypertension for foreign- and US-born Mexican women, but the risk of hypertension was 2.15 times higher for US-born women who were daily smokers. Health behaviors were a better predictor of hypertension because the AORs for educational attainment did not change substantially in the full model for both foreign- and US-born women.

Marital status was a significant predictor of HWC for married compared with unmarried foreign-born (AOR = 1.05; CI = 1.05, 1.06) and US-born (AOR = 1.04; CI = 1.03, 1.04) women (model 1). Foreign-born women with less than 5 years in the United States had better risk profiles than women with 20 or more years in the United States. Similar to men, foreign-born (AOR = 1.38; CI = 1.37, 1.39) and US-born (AOR = 1.19; CI = 1.18, 1.20) women with a high school diploma or some college had the highest risk of HWC (model 2). When health behaviors were incorporated (model 3), foreign-born women who were daily smokers (AOR = 1.51; CI = 1.50, 1.52) and

TABLE 2—Weighted Adjusted Odds Ratios for Cardiovascular Risk Factors for Men: National Health and Nutrition Examination Survey, United States, 2001–2008

Variable	Model 1		Model 2		Model 3	
	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)
Hypertension						
Married	0.99 (0.98, 0.99)	0.96 (0.96, 0.97)	0.98 (0.97, 0.98)	0.95 (0.95, 0.96)	0.96 (0.96, 0.97)	0.94 (0.94, 0.95)
Time in the United States, y						
< 5	0.73 (0.73, 0.74)	...	0.74 (0.74, 0.75)	...	0.72 (0.72, 0.73)	...
5–19	0.61 (0.61, 0.62)	...	0.59 (0.59, 0.60)	...	0.58 (0.58, 0.57)	...
> 20 (Ref)	1.00	1.00	1.00		1.00	
Education						
< 9 y			3.11 (3.04, 3.19)	2.63 (2.56, 2.69)	3.12 (3.05, 3.21)	2.64 (2.57, 2.71)
9–11 y			5.10 (4.97, 5.24)	4.34 (4.23, 4.45)	5.07 (4.94, 5.20)	4.32 (4.21, 4.43)
High school diploma or some college			3.78 (3.69, 3.88)	3.41 (3.32, 3.49)	3.75 (3.66, 3.85)	3.37 (3.28, 3.46)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					2.13 (2.11, 2.17)	2.07 (2.04, 2.09)
Daily smoker					1.16 (1.14, 1.18)	1.13 (1.11, 1.15)
Heavy drinker					1.13 (1.12, 1.14)	1.11 (1.09, 1.12)
High waist circumference						
Married	1.26 (1.25, 1.26)	1.22 (1.21, 1.23)	1.26 (1.25, 1.26)	1.22 (1.22, 1.23)	1.26 (1.25, 1.26)	1.22 (1.22, 1.23)
Time in the United States, y						
< 5	0.60 (0.56, 0.61)	...	0.61 (0.60, 0.61)	...	0.59 (0.59, 0.59)	...
5–19	0.87 (0.87, 0.88)	...	0.89 (0.89, 0.89)	...	0.88 (0.88, 0.88)	...
> 20 (Ref)	1.00		1.00		1.00	
Education						
< 9 y			1.22 (1.21, 1.23)	1.12 (1.11, 1.13)	1.27 (1.26, 1.28)	1.16 (1.15, 1.17)
9–11 y			1.07 (1.06, 1.08)	0.98 (0.97, 0.99)	1.13 (1.12, 1.15)	1.03 (1.15, 1.17)
High school diploma or some college			1.54 (1.52, 1.56)	1.40 (1.38, 1.41)	1.61 (1.59, 1.63)	1.45 (1.44, 1.47)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					1.82 (1.80, 1.83)	1.75 (1.15, 1.17)
Daily smoker					1.58 (1.56, 1.59)	1.36 (1.34, 1.37)
Heavy drinker					0.72 (0.71, 0.72)	0.72 (0.71, 0.72)
Nativity × education					1.09 (1.18, 1.20)	
Diabetes						
Married	1.01 (1.00, 1.02)	1.00 (0.99, 1.01)	1.02 (1.01, 1.03)	1.01 (1.00, 1.02)	1.08 (1.07, 1.09)	1.07 (1.06, 1.08)
Time in the United States, y						
< 5	0.41 (0.41, 0.42)	...	0.39 (0.39, 0.40)	...	0.38 (0.38, 0.39)	...
5–19	0.84 (0.83, 0.85)	...	0.84 (0.83, 0.84)	...	0.87 (0.86, 0.88)	...
> 20 (Ref)	1.00		1.00		1.00	
Education						
< 9 y			1.22 (1.19, 1.25)	1.13 (1.11, 1.15)	1.22 (1.19, 1.25)	1.13 (1.11, 1.15)
9–11 y			0.99 (0.98, 1.02)	0.92 (0.90, 0.94)	0.97 (0.95, 0.99)	0.89 (0.88, 0.92)
High school diploma or some college			0.89 (0.88, 0.92)	0.84 (0.82, 0.86)	0.87 (0.85, 0.89)	0.82 (0.80, 0.84)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					0.62 (0.59, 0.66)	0.06 (0.06, 0.06)
Daily smoker					0.26 (0.25, 0.27)	0.25 (0.24, 0.25)
Heavy drinker					0.21 (0.20, 0.22)	0.21 (0.20, 0.22)

Note. AOR = adjusted odds ratio; CI = confidence interval. All models control for age, Depression Screener Questionnaire, and health insurance. Only significant interactions are reported in the table at $P < .001$.

TABLE 3—Weighted Adjusted Odds Ratios for Cardiovascular Risk Factors for Women: National Health and Nutrition Examination Survey, United States, 2001–2008

Variable	Model 1		Model 2		Model 3	
	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)	Foreign-Born, AOR (95% CI)	US-Born, AOR (95% CI)
Hypertension						
Married	0.96 (0.96, 0.97)	0.96 (0.95, 0.96)	0.97 (0.96, 0.98)	0.96 (0.96, 0.97)	0.95 (0.94, 0.96)	0.95 (0.94, 0.96)
Time in the United States, y						
< 5	1.09 (1.08, 1.09)	...	1.07 (1.06, 1.08)	...	1.09 (1.09, 1.11)	...
5–19	0.89 (0.89, 1.09)	...	0.94 (0.93, 0.95)	...	0.96 (0.96, 0.97)	...
> 20 (Ref)	1.00		1.00		1.00	
Education						
< 9 y			0.46 (0.45, 0.47)	0.46 (0.45, 0.46)	0.46 (0.45, 0.47)	0.45 (0.45, 0.46)
9–11 y			0.58 (0.56, 0.58)	0.58 (0.57, 0.59)	0.58 (0.57, 0.59)	0.58 (0.57, 0.59)
High school diploma or some college			0.75 (0.74, 0.76)	0.74 (0.73, 0.75)	0.76 (0.75, 0.77)	0.75 (0.73, 0.76)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					2.05 (2.02, 2.08)	1.913 (1.89, 1.94)
Daily smoker					1.94 (1.91, 1.97)	2.15 (2.08, 2.15)
Heavy drinker					1.61 (1.59, 1.63)	1.61 (1.59, 1.63)
High waist circumference						
Married	1.05 (1.05, 1.06)	1.04 (1.03, 1.04)	1.05 (1.05, 1.05)	1.03 (1.03, 1.04)	1.04 (1.04, 1.04)	1.03 (1.03, 1.03)
Time in the United States, y						
< 5	0.60 (0.59, 0.60)	...	0.61 (0.60, 0.61)	...	0.60 (0.60, 0.61)	...
5–19	0.75 (0.75, 0.75)	...	0.75 (0.75, 0.75)	...	0.75 (0.74, 0.75)	...
> 20 (Ref)	1.00		1.00		1.00	
Education						
< 9 y			1.21 (1.20, 1.22)	1.04 (1.03, 1.05)	1.22 (1.21, 1.23)	1.05 (1.04, 1.05)
9–11 y			1.25 (1.24, 1.26)	1.07 (1.06, 1.08)	1.26 (1.25, 1.27)	1.08 (1.07, 1.09)
High school diploma or some college			1.38 (1.37, 1.39)	1.20 (1.18, 1.20)	1.39 (1.38, 1.40)	1.19 (1.19, 1.21)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					1.51 (1.496, 1.52)	1.43 (1.41, 1.44)
Daily smoker					1.51 (1.50, 1.52)	1.37 (1.36, 1.38)
Heavy drinker					1.17 (1.16, 1.17)	1.16 (1.15, 1.17)
Nativity × education (significant)					1.69 (1.67, 1.70)	1.00
Diabetes						
Married	1.17 (1.15, 1.18)	0.89 (0.89, 0.91)	1.17 (1.16, 1.19)	0.89 (0.89, 0.91)	0.89 (0.89, 0.91)	0.89 (0.88, 0.90)
Time in the United States, y						
< 5	1.17 (1.09, 1.13)	...	1.17 (1.15, 1.19)	...	0.45 (0.44, 0.46)	...
5–19	3.12 (3.08, 3.17)	...	3.14 (3.09, 3.19)	...	3.13 (3.09, 3.17)	...
> 20 (Ref)	1.00		1.00		1.00	
Education						
< 9 y			0.901(0.90, 0.91)	0.32 (0.31, 0.33)	0.86 (0.86, 0.87)	0.33 (0.32, 0.34)
9–11 y			0.58 (0.57, 0.58)	0.38 (0.37, 0.39)	0.61 (0.61, 0.62)	0.38 (0.37, 0.38)
Diploma or some college			0.89 (0.89, 0.89)	0.40 (0.39, 0.41)	0.86 (0.86, 0.86)	0.39 (0.39, 0.41)
≥ bachelor's degree (Ref)			1.00	1.00	1.00	1.00
Health behaviors						
Rigorous exercises					0.63 (0.61, 0.65)	0.77 (0.73, 0.76)
Daily smoker					0.57 (0.24, 1.37)	1.21 (0.40, 3.70)
Heavy drinker					0.86 (0.86, 0.90)	1.06 (1.04, 1.08)
Nativity × education (significant)						1.04 (1.03, 1.04)

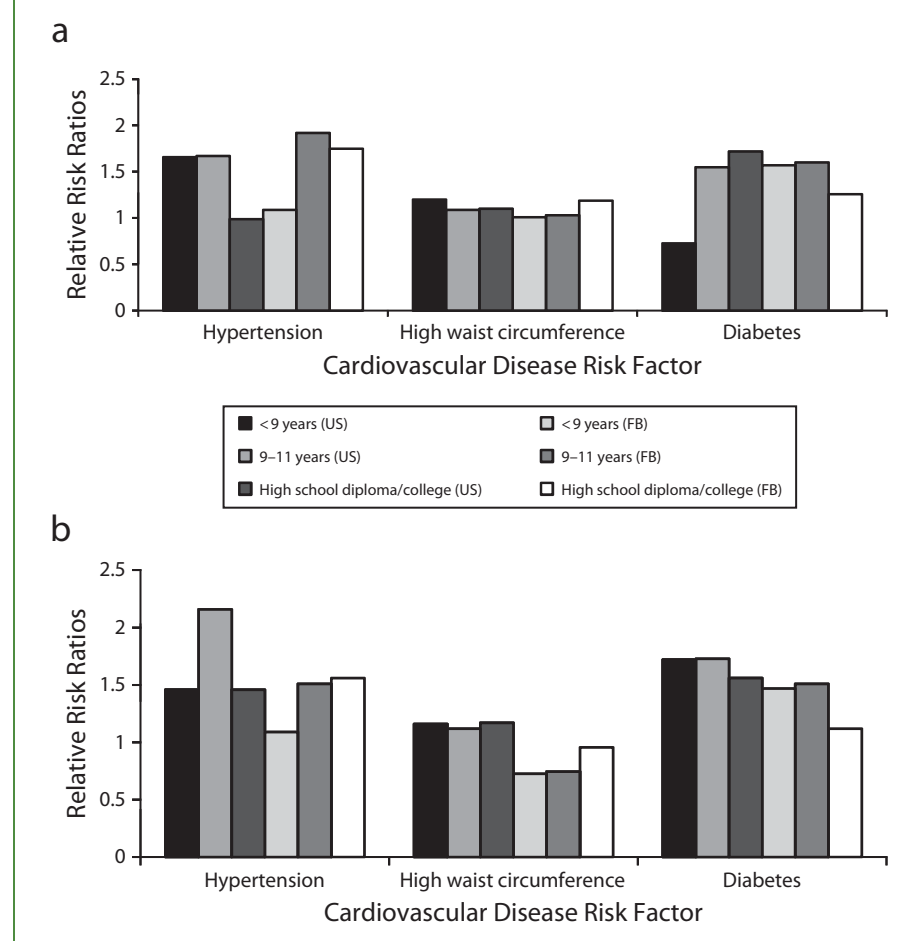
Note. AOR = adjusted odds ratio; CI = confidence interval. All models control for age, Depression Screener Questionnaire, and health insurance. Only significant interactions are reported in the table at $P < .001$.

US-born women who rigorously exercised (AOR = 1.43; CI = 1.41, 1.44) had HWC. In the full model, both higher educational attainment and health behaviors explained HWC for women.

The analysis for diabetes showed that married rather than unmarried foreign-born Mexican women were more likely to have been diagnosed with diabetes (AOR = 1.17; CI = 1.15, 1.18; model 1). Moreover, diabetes was 3 times higher for women who spent between 5 and 19 years in the United States (AOR = 3.13; CI = 3.08, 3.17) than for those who had spent 20 or more years in the United States. Diabetes was lowest in foreign-born women with 9 to 11 years of education. However for US-born women, it was lowest for those with less than 9 years of education (model 2). In our full model, heavy drinking was associated with diabetes for US-born women (AOR = 1.06; CI = 1.04, 1.08), but other health behaviors were not.

Gender Differences by Nativity and the Educational Gradient

To investigate whether an education gradient existed for CVD risk factors by gender and nativity, we estimated RRs controlling for age, Depression Screener Questionnaire, and health insurance (Figure 1a). Among US- and foreign-born Mexican women, having some education at the high school level was a critical benchmark associated with hypertension. The relative risk of having hypertension was highest for US-born Mexican women with 9 to 11 years of schooling (RR = 1.66; $P \leq .001$) and foreign-born Mexican women with similar education (RR = 1.09; $P \leq .001$) relative to those with no CVD risks. We found a significant education gradient associated with diabetes for US-born Mexican women, suggesting that as educational attainment increased, the relative risk of having diabetes also increased. Similar to women with hypertension, results showed the relative risk of having hypertension was highest for US-born Mexican men with 9 to 11 years of schooling (RR = 2.16; $P \leq .001$). Examining educational gradients in hypertension for foreign-born Mexican men showed a significant association between increases in educational attainment and hypertension (Figure 1b). For diabetes, RRs did not vary much between education categories for US-born Mexican men



Note. FB = foreign-born; US = US-born. Significance for all relative risk ratios are at the $P \leq .001$ level.

FIGURE 1—Relative risk ratios for cardiovascular disease risk factors by educational attainment and nativity for (a) Mexican women and (b) Mexican men: National Health and Nutrition Examination Survey, United States, 2001–2008.

(RR = 1.72; $P \leq .001$ and RR = 1.73; $P \leq .001$) and foreign-born Mexican men (RR = 1.47; $P \leq .001$ and RR = 1.12; $P \leq .001$) with less than 9 years and 9 to 11 years of education, respectively.

DISCUSSION

Our objective was to investigate whether the Hispanic Health Paradox exists by education, nativity, and gender for Mexican-origin groups for important CVD risk factors. In our relative risk analysis, we found evidence that contradicts health advantages, particularly for US-born Mexican women with diabetes. Our results showed that length of stay and education were better predictors of hypertension and HWC for men regardless of nativity. However,

both educational attainment and health behaviors were significant predictors of hypertension and HWC for both foreign- and US-born Mexican women. Moreover, time in the United States (i.e., < 5 years) does matter, and our results suggest that health conditions may be compromised by material and psychosocial stress experienced by foreign-born Mexicans. Transitions into new environments are associated with changes in both dietary and other lifestyle practices, producing psychosocial stress associated with adhering to new cultural mores, isolation, and breaks in social ties that may account for higher rates of hypertension.^{44–46} Hypertension and HWC have been shown to be good predictors of the physiological response to stress and strong predictors of incident CVD, atherosclerosis,

and future cardiac events.^{47,48} Our analysis further illuminates that foreign-born Mexicans may now experience more stress and be affected by unwelcoming and more dangerous contexts as they immigrate to the United States seeking community and employment opportunities.^{49,50} Viruell-Fuentes⁵¹ provided evidence that suggests that compared with first-generation Mexican Americans, second-generation Mexican Americans experience cumulative exposure to “othering” (essentialized differences through stereotyping) and discrimination that are potential pathways through which becoming American erodes immigrant health. In our analyses, the less time in the United States (< 20 years), the higher the odds of hypertension for both men and women and the higher the odds of diabetes for women. Evidence has suggested that exposure to multiple environmental and discriminatory processes among foreign-born Mexicans contribute to higher stress that may increase biological risk factors leading to subsequent atherosclerosis and heart disease. Of note, previous research has not found support for a Hispanic Health Paradox in biological risk profiles (e.g., blood pressure, blood glucose, and cholesterol). For example, foreign-born Hispanics and non-Hispanic Whites showed similar biological risk profiles, but US-born Mexicans had higher risk, reinforcing hypothesized effects of immigrant health advantages.²⁵ However, results from our analysis suggest that biomarkers such as hypertension and HWC must be examined separately from measures of education to deepen our knowledge of how social inequalities affect the health of foreign- and US-born Mexicans differently.

Although the data do not clearly show an educational gradient that may account for health disparities on all 3 CVD risk factors, they nonetheless suggest that education may operate differently for Mexicans by nativity and gender. Moreover, our analysis informs and extends the perspective that the Mexican population has a decreased ability at any given level of education to translate educational resources into good health.⁵² The health advantages of educational attainment are well documented for the US population, showing education’s protective effects on self-rated health, physical functioning, mortality, depression, and morbidity.^{53–56} However, our

findings showed an education gradient for US-born Mexican women in which higher levels of education were predictive of diabetes, contradicting findings for the general population in which lower education was associated with higher risk for disease.⁵⁷ For foreign-born Mexican men, the education gradient operated in a similar direction for hypertension and HWC. Higher educational attainment showed increased risk for HWC for foreign-born Mexican women. These findings affirm that the various mechanisms through which education operates to influence health are direct, mediated through social mechanisms, or both. For example, hypertension was associated with 9 to 11 years of schooling for Mexican men, regardless of nativity, which suggests that this group, who are the most likely to be employed in service sectors, underemployed, or unemployed, may experience chronic economic strain, which has an impact on CVD risks such as hypertension. In addition, education can influence exposure to both distal mechanisms (i.e., neighborhood context,⁵⁸ residential segregation,⁵⁹ and discriminatory experiences^{60,61}) and proximate mechanisms (i.e., general and health-related knowledge, literacy, and problem-solving skills; prestige; influence over others’ and one’s own life) that have a significant impact on health status throughout the life course.

An interesting finding was that health behaviors were modestly associated with CVD risk factors, which may suggest that psychosocial stress, conditioned by the returns on educational attainment, is a more powerful predictor of CVD risk factors in our study. For less-educated Mexican groups, economic stress and its associated pathways may result in more adverse health outcomes, especially HWC given the economic constraints on healthier food purchases, discriminatory experiences, and residential choices.^{62–65} These data challenge existing hypotheses of the health advantages for foreign-born Mexicans and suggest that future research investigate the returns of community-level educational gradients on health by gender.

Although the results of the study yielded interesting conclusions, several limitations warrant consideration. First, our conclusions are only directed to Mexican Americans without knowing whether social and behavioral

factors equally predict CVD risk factors in other Latino subgroups. Second, the cross-sectional nature of the data did not allow us to establish causality for the CVD risk factors under study. Third, we included only self-reported measures of diabetes, which can lead to underestimation because this population experiences barriers in access to health care.^{66,67} Despite these limitations, this study is, to our knowledge, one of the few to empirically examine educational gradients and CVD risk factors for Mexican-origin groups by nativity and gender.

In conclusion, our analyses reveal important findings by nativity, gender, and education. The results contest prevailing conventional paradigms of a Hispanic Health Paradox and suggest new hypotheses and theorizing. Mexican immigrants generally are healthier on arrival and experience a process of adaptation into the US racial/ethnic structure. Yet, foreign-born Mexican groups are different from other immigrant groups because they must negotiate this racial/ethnic system as immigrants with limited human and social capital. Less education, few economic assets, and overrepresentation in unskilled occupations shape their economic viability, which conditions their exposure to occupational work hazards, racial discrimination, and persistent surveillance as a result of immigration policies and xenophobia. These factors should be taken into account when examining the Hispanic Health Paradox and Healthy Immigrant Hypothesis for Latino subgroups. New questions for future research include, for example, how do racial discrimination, residential segregation, and limited social support networks affect the stress-related biological pathways leading to increased risk for CVD risk factors? Why are men and women in the 9- to 11-year educational category at higher risk for CVD risk factors? In what ways do higher educational attainment (college and beyond) compromise or protect health for US-born Mexican men and women? Do these patterns differ by educational level and gender within foreign-born Mexican groups? Why are US-born Mexican women with increased education exhibiting higher rates of diabetes? These data strongly support that educational inputs be considered in future research for understanding health disparities associated with Mexican-origin

populations. Moreover, the evidence-based literature is strongly redirecting and urging researchers to decontextualize culture as explanatory and examine structure and racialized policies as important factors that influence the health of US- and foreign-born Mexicans.^{8,37,51,68} ■

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Contributors

G. Y. Dinwiddie designed the overall study, performed the statistical analysis, and interpreted the findings. R. E. Zambrana contributed to the design of the study, literature review, and interpretation of the findings. M. A. Garza provided input on critical revision of the article for important intellectual content. All authors reviewed and revised all sections of the article for intellectual content.

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