Clashing paradigms: An empirical examination of cultural proxies and socioeconomic condition shaping Latino health

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Abstract:

Objective: Much debate exists regarding the role of culture versus socioeconomic position in shaping the health of Latino populations. We propose that *both* may matter for health and explicitly test their independent and joint effects on smoking and physical activity. **Methods:** We used the 2010 National Health Interview Survey, a population-based survey of the U.S. population, to estimate the prevalence of smoking and physical activity by language use (cultural proxy) and education among Latino adults (n = 4929). We fit log binomial regression models to estimate prevalence ratios and test for interaction. **Results:** English-language use and educational attainment were each independently associated with smoking and physical activity. Joint effect models showed that individuals with both greater use of the English language and low levels of education were nearly three times more likely to smoke (prevalence ratio, 2.59; 95% confidence interval, 1.83-3.65) than those with low English language use and high education (referent group); high acculturation and high education were jointly associated with increased activity (prevalence ratio 2.24, 95% confidence interval, 1.79-2.81). **Conclusions:** Cultural proxies such as language use and educational attainment are both important determinants of health among Latinos. Their joint effect suggests the need to simultaneously consider Latinos' socioeconomic position and their increased risk of adopting health-damaging behaviors while addressing culturally-specific factors that may mitigate risk.

Keywords: Hispanic Americans | Acculturation | Education | Smoking | Physical activity

Article:

Introduction

Previous research suggests that for some health outcomes, Latino populations appear to have a health advantage relative to non-Latino white individuals born in the United States [1], [2], [3], despite Latinos' overall lower socioeconomic position (SEP). One of the central explanations proposed for these findings has been the potential role of greater retention of cultural factors presumed to be health protective. Specifically, acculturation has gained much attention in the literature as one of the processes explaining the health patterns observed among Latinos. Acculturation is generally defined as the process by which immigrants adopt the attitudes, values, customs, beliefs, and behaviors of a new culture [4], [5], [6] and has been associated with a wide range of health outcomes [7], [8], [9], [10], [11], [12], [13], [14].

In recent years, however, the role of acculturation in explaining Latino health patterns has increasingly come into question. Broadly construed, the debates can be characterized into two broad perspectives, one highly critical of acculturation measures and the other supporting this construct. Some scholars argue that the widespread popularity and focus on acculturation has failed to consider how socioeconomic condition, racialization processes, neighborhood deprivation, residential segregation, or other axes of social location in the United States shape the lives of Latino populations [15], [16], [17], [18], [19]. In fact, it has been suggested that the concept of acculturation is so flawed that it should be abandoned altogether [20]. Moreover, the expansive literature documenting the association between social inequalities and health suggests that acculturation/cultural factors alone are unlikely to explain the profound role of social disadvantage on health [21], [22], [23].

A second perspective is that, although imperfectly measured, acculturation remains crucial for understanding the health of racially and ethnically diverse populations. These scholars argue that to move the field forward what is needed is a better articulation of the theory/concept being tested, consideration of the dynamic process of acculturation over the life course, explicitly measuring "culture" as the underlying phenomenon suggested by acculturation measures and how this relates to health, and modeling the complex interplay of how social conditions produce and reinforce the adoption of particular forms of cultural norms, values, and practices [4], [15], [16], [24], [25]. Moreover, in some social science disciplines there has been a revival of cultural frameworks that articulate the intersection of poverty and culture and suggest that both can shape group identity formation and lead to the adoption of health behaviors, and ultimately health outcomes [26].

The issue that has received less attention in the public health literature is the extent to which these seemingly opposing areas of scholarship can be conceptually and empirically integrated. We suggest that both of these factors matter for Latino health and propose that one approach to addressing this debate is to test for interaction or joint effects, where culture and SEP jointly operate to increase risk of disease. Using a population-based sample of U.S. Latinos, we examined how language use, a commonly applied proxy measure of acculturation, and education, as a marker of SEP, are associated with two pressing public health problems: smoking and leisure-time physical activity. The prevalence of obesity has reached a crisis in the United States; Latino are disproportionately overweight/obese compared with white individuals [27], [28] and have low levels of physical activity. Similarly, although the prevalence of smoking has significantly decreased in recent years, several studies have shown increased smoking among Latinos [29]. These health behaviors also allow us to examine diverging associations between

acculturation and health since lower acculturation generally has been associated with lower smoking (i.e., health-enhancing), but lower acculturation has generally been associated with lower physical activity (i.e., health-damaging). On the basis of previous findings, we hypothesized that more frequent English language use and greater levels of education would be significantly and independently associated with physical activity, whereas the prevalence of smoking would be greater among those with more frequent use of English language and low levels of education. Further, we hypothesized that their joint effects would be significant, demonstrating the need to consider both of these factors as determinants of health in Latino populations.

Methods

We used cross-sectional data from the 2010 National Health Interview Survey (NHIS) to answer our study questions. The 2010 NHIS interview sample consisted of 34,329 interviewed households designed to be a nationally representative sample of the civilian, noninstitutionalized U.S. population. In all, 27,157 adults and 11,277 children were interviewed with a total household response rate close to 80%. The sample for this analysis was restricted to adults, 18 years and older who self-identified as Hispanic/Latino (herein Latino). We did not include non-Latino white or black populations in the analysis because our main interest was in exploring the role of acculturation, as measured by language use, on health, and very few white or black subjects in the sample had limited English proficiency.

Our main independent and dependent variables were dichotomized to ease subsequent testing of interaction. Our main independent variables are language use (herein interchangeably labeled "acculturation") and educational attainment. Participants were asked to rate the "language they most often use," and we classified those as having high levels of acculturation if they spoke English only or most of the time and the rest as having low levels of acculturation. Educational attainment was our marker of SEP, and subjects were classified as having high levels of education if they had some college education or more and were otherwise classified as having low education. The dependent variables in the present study are smoking and leisure-time physical activity. Participants were coded as current smokers if they said yes to ever smoking at least 100 cigarettes in their lifetime and were currently smoking and otherwise classified as nonsmokers.

Participation in leisure-time physical activity was based on intensity, duration, and frequency of activity per week. As suggested in the NHIS documentation, we used the 2008 physical activity guidelines for adults to classify individuals as meeting physical activity guidelines for both aerobic and strengthening, either one, or neither. We classified people as physically active if they met criteria for both aerobic and strengthening activities, and inactive if they only met one or neither criterion. We adjusted for age (18 to <25 years, 25 to <45 years, 45 to <65 years, and 65 or greater), family income as a percent of the federal poverty level (up to 200% vs. 200% or greater) and gender in all analyses.

Statistical analyses

The Latino sample in the 2010 NHIS included a total of 5158 participants, of whom 4929 were included in our final analytic sample. Individuals were excluded if they were missing data on smoking (n = 39), physical activity (n = 49), education (n = 32), and language use (n = 109). Percent distributions and means were estimated for the total population and by acculturation status and educational level. We fit a series of sequential regression models that examined the independent association between acculturation and education and smoking and physical activity (Models 1-2) and then adjusted for both acculturation and education as well as age, gender, family income, and nativity/length of stay in the United States (Models 3-7). The number of records retained in these models varied depending on the covariates included. Furthermore, we estimated prevalence ratios as functions of average marginal predictions within a complex survey design setting [30] in an effort to reduce the potential of overestimating associations with odds ratios [31] and to more accurately detect the presence (or absence) of interaction, as described below.

To test for interaction between acculturation and education on smoking and physical activity, we applied the research methods illustrated by Knol and VanderWeele [32] and VanderWeele [33]. These authors suggest the use of categories with the lowest risk as the referent [34]. Thus, we created two coding schemes for educational attainment wherein for smoking models the high education group was assigned the referent category to reflect the lowest risk of smoking, whereas low education was the referent category in physical activity models because the probability of meeting recommended levels of physical activity was found to be the lowest in this group. For the acculturation variable, the low acculturation category served as the referent for both smoking and physical activity models because low-acculturated individuals were the least likely to smoke or meet guidelines for physical activity. We then created a four-level combined acculturation and education variable to model the joint effects of these exposures, where the combined group with the lowest risk was used as the referent. These models were adjusted for age, gender, family income, and nativity/length of stay in the United States. Data management was conducted in SAS version 9.2 (SAS Institute, Cary, NC), and statistical analyses were performed in SAS-callable SUDAAN to generate weighted prevalence estimates, and weighted crude and model-adjusted prevalence ratios.

Results

The characteristics of the study population are presented in Table 1. Sixty-percent of the study population was younger than 45 years of age, and slightly more than half was female. Most participants only achieved a high school education or less, 38% spoke English all or most of the time, and most were of Mexican origin. Thirteen percent of study participants were current smokers, with a greater percentage (17.3%) found among those who mostly spoke English. A total of 16% of the population met current guidelines for engaging in both leisure-time strengthening and aerobic physical activity, increasing to 25% among individuals with high English language use.

Table 1. Characteristics of Latino study population (weighted) by acculturation and education, National Health Interview Survey, 2010

	Total population (N = 4929)	Acculturation status/language use*		Educational attainment*	
		High acculturation	Low acculturation	High education	Low education
Age, y, %					
18-24	13.4	17.5	10.9	14.5	12.7
25-44	47.9	475	48.1	50.6	46.1
45-64	26.6	25.6	27.3	27.0	26.4
65 and older	12.1	9.4	13.7	7.9	14.8
Sex, %					
Male	47.9	46.3	48.9	46.6	48.8
Female	52.1	53.7	51.1	53.4	51.2
Educational attainment, %					
Less than high school	39.3	18.2	51.9	N/A	64.2
High school	21.9	22.1	21.8	N/A	35.8
Some college	24.2	36.5	16.9	62.4	N/A
College or more	14.6	23.2	9.4	437.6	N/A
FPL, %†					
Up to 199% FPL	49.8	33.8	59.5	30.5	62.1
200% and above FPL	41.0	57.4	31.1	60.8	28.4
Use English language only/mostly, %					
Yes	37.5	100.0	N/A	57.7	24.7
No	62.5	N/A	100.0	42.3	75.3
Nativity/length of stay, %†					
U.S. born	39.8	75.2	18.5	54.9	30.1
Foreign-born 10 or more years in United States	46.9	22.4	61.6	35.2	54.3
Foreign-born less than 10 years in United States	12.6	2.1	18.9	9.3	14.6
Latino origin, %					
Cuban	4.7	4.03	5.0	5.7	4.0
Central/South American (non-Mexican)	17.2	11.5	20.6	21.3	14.5
Mexican	58.7	58.1	59.1	48.0	65.5
Puerto Rican	11.2	15.6	8.6	13.7	9.6
Other	8.3	10.8	6.7	11.3	6.3
Smoking status, %					
Current smoker	12.9	17.0	10.5	11.3	14.0
Currently not smoking	87.1	83.0	89.5	88.8	86.0
Physical activity, %					
Meets both aerobic and strengthening criteria	16.1	24.9	10.9	25.1	10.4
Does not meet either or both aerobic and strengthening criteria	83.9	75.1	89.1	74.9	89.6

FPL = federal poverty level; N/A = not available.

* High acculturation represents those who speak English only or mostly; high education represents those with some college or higher education.

† Percentages may not total 100% because of missing data.

Both language use and educational attainment were independently associated with smoking and physical activity (Table 2). Individuals with high English-language use (acculturation) use had a significantly greater probability of smoking (prevalence ratio [PR], 1.63; 95% confidence interval [95% CI], 1.38-1.93) compared with those with low English-language use, after we adjusted for age and sex (Table 2, Model 3). This association remained after adjusting for all covariates, including education (PR, 1.76; 95% CI, 1.42-2.18, Table 2, Model 7). Educational attainment was marginally associated with smoking, after adjusting for age and sex (PR, 1.27;

95% CI, 1.05-1.53, Table 2, Model 4), but was significantly associated with smoking in fully adjusted models (Table 2, Model 7). For physical activity models, age and sex-adjusted models individuals with high English-language use were significantly more likely to meet current physical activity guidelines than those with low English-language use (PR 2.29; 95% CI, 1.98-2.66). A similar association was observed for educational attainment (PR, 2.41; 95% CI, 2.09-2.77). Each of these measures remained significantly associated with leisure-time physical activity in fully adjusted models, although estimates were substantially reduced (Model 7).

Table 2. Crude and adjusted PR for current smoking and being physically active among Latino adults, National Health Interview Survey, 2010

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)	PR (95% CI)
Smoking status							
High acculturation vs. low acculturation*	1.63 (1.38-1.93)		1.64 (1.39-1.94)		1.90 (1.59-2.26)	2.17 (1.81-2.61)	1.76 (1.42-2.18)
Low education vs. high education*		1.25 (1.03-1.51)		1.27 (1.05-1.53)	1.58 (1.29-1.92)	1.46 (1.17-1.82)	1.48 (1.19-1.85)
Age 25-44 vs. age 18-24			1.13 (0.88-1.45)	1.06 (0.82-1.36)	1.15 (0.89-1.48)	1.15 (0.88-1.51)	1.25 (0.95-1.65)
Age 45-64 vs. age 18-24			1.48 (1.14-1.92)	1.38 (1.06-1.79)	1.49 (1.15-1.94)	1.57 (1.18-2.08)	1.72 (1.29-2.31)
Age 65 or more vs. age 18-24			0.71 (0.48-1.04)	0.61 (0.42-0.89)	0.69 (0.47-1.01)	0.71 (0.47-1.08)	0.78 (0.51-1.19)
Female vs. male			0.57 (0.49-0.67)	0.59 (0.50-0.69)	0.58 (0.49-0.68)	0.57 (0.48-0.68)	0.57 (0.48-0.67)
FPL 200% or greater vs. FPL <200%						0.70 (0.58-0.85)	0.69 (0.57-0.84)
FB <10 y in United States vs. born in the United States							0.74 (0.54-1.00)
FB 10+ y in United States vs. born in the United States							0.65 (0.53-0.81)
Physical activity							
High acculturation vs. low acculturation	2.29 (1.98-2.66)		2.24 (1.93-2.59)		1.80 (1.54-2.10)	1.62 (1.38-1.91)	1.32 (1.10-1.60)
High education vs. low education		2.41 (2.09-2.77)		2.34 (2.03-2.69)	1.92 (1.65-2.25)	1.73 (1.47-2.04)	1.68 (1.43-1.98)
Age 25-44 vs. age 18-24			0.92 (0.77-1.10)	0.85 (0.71-1.01)	0.90 (0.76-1.07)	0.86 (0.71-1.04)	0.91 (0.74-1.12)
Age 45-64 vs. age 18-24			0.68 (0.55-0.85)	0.63 (0.51-0.78)	0.67 (0.54-0.83)	0.61 (0.48-0.77)	0.65 (0.50-0.68)
Age 65 or more vs. age 18-24			0.34 (0.22-0.53)	0.34 (0.22-0.52)	0.37 (0.24-0.56)	0.37 (0.23-0.59)	0.39 (0.24-0.63)
Female vs. male			0.56 (0.48-0.64)	0.55 (0.48-0.64)	0.55 (0.48-0.63)	0.59 (0.51-0.68)	0.58 (0.50-0.68)
FPL 200% or higher vs. FPL<200%						1.56 (1.32-1.85)	1.54 (1.29-1.82)
FB <10 y in United States vs. born in the United States							0.64 (0.47-0.88)
FB 10+ y in United States vs. born in the United States							0.71 (0.58-0.87)

CI = confidence interval; FPL = federal poverty level; FB = foreign-born; PR = prevalence ratio.

* High acculturation represents those who speak English only or mostly; high education represents those with some college or higher education.

Tables 3 and 4 show interaction results of language use and education on smoking status and physical activity. The joint effect model showed that the independent association between acculturation and education was comparable with the regression model results presented in Table 2. When both high acculturation and low education were present, the probability of smoking was 2.59 times (95% CI, 1.83-3.65) that of the referent category group (low acculturation and high education). Individuals who both had high levels of acculturation and high educational attainment were 2.24 times more likely (PR, 2.24; 95% CI, 1.79-2.81) to meet physical activity guidelines than those in the referent category.

Table 3. Joint effect of acculturation and educational attainment on smoking prevalence* among Latino adults, National Health Interview Survey, 2010

Acculturation Status†	**Educational attainment†**		**PRs (95% CI) for educational attainment within acculturation strata (ref: high education)**
	Low (1)	**High (0)**	
	PR (95% CI)	**PR (95% CI)**	
High (1)	2.59 (1.83-3.65)	1.73 (1.23-2.43)	1.43 (1.09-1.88)
	$P \leq .0001$	$P = .0017$	$P = .0100$
Low (0)	1.45 (1.06-1.99)	1.00 (referent)	1.53 (1.10-2.13)
	$P = .0187$		$P = .0111$
PRs (95% CI) for acculturation within educational attainment strata (ref: Low acculturation)	1.70 (1.34-2.17)	1.89 (1.28-2.79)	
	$P \leq .0001$	$P = .0014$	

CI = confidence interval; PR = prevalence ratio.

* PRs are adjusted for age, gender, income, and nativity status/length of time in the United States.

† High acculturation represents those who speak English only or mostly; high education represents those with some college or higher education.

Table 4. Joint effect of acculturation and educational attainment on prevalence* of physical activity among Latino adults, National Health Interview Survey, 2010

Acculturation Status†	**Educational attainment†**		**PRs (95% CI) for educational attainment within acculturation strata (ref: low education)**
	High (1)	**Low (0)**	
	PR (95% CI)	**PR (95% CI)**	
High (1)	2.24 (1.79-2.81)	1.30 (0.97-1.76)	1.70 (1.34-2.14)
	$P \leq .0001$	$P = .0844$	$P \leq .0001$
Low (0)	1.67 (1.34-2.07)	1.00 (referent)	1.62 (1.27-2.07)
	$P \leq .0001$		$P \leq .0001$
PRs (95% CI) for acculturation within educational attainment strata (ref: Low Acculturation)	1.35 (1.12-1.63)	1.18 (0.81-1.72)	
	$P = .0016$	$P = .3849$	

CI = confidence interval; PR = prevalence ratio.

* Prevalence ratios (PR) are adjusted for age, gender, income and nativity status/length of time in the US.

† High acculturation represents those who speak English only or mostly; high education represents those with some college or higher education.

Discussion

Our study contributes in three ways to the study of Latino health. First, we linked current conceptual debates surrounding language use (a commonly used acculturation measure and proxy for "culture") and SEP with an empirical approach to determine the extent to which these factors contribute to population-level health patterns among Latinos. Second, we empirically demonstrated that language use and education were independently associated with smoking and physical activity and remained so after adjustment for relevant confounders. Third, these

measures also jointly increased the probability of smoking and physical inactivity beyond their independent association.

Few studies have examined the potential interaction between acculturation and education on health. Acevedo-Garcia et al [35] found significant interaction between various social factors (e.g., education, household income, occupation, home ownership) and immigrant generation or duration in the United State, showing steeper gradients for second and third generations compared with the foreign-born or those with shorter duration spent in the United States. However, this study examined associations with self-rated health only and was interested in examining immigration-health differences across race/ethnicity, showing that foreign-born black individuals also appeared to have a health advantage. Our study focused exclusively on Latino populations to directly address debates regarding acculturation and SEP for this group and examined how acculturation and SEP influence smoking and physical activity- health behaviors with broad public health implications and significance to racial/ethnic minority groups.

Our study explored interaction/joint effects between acculturation and SEP on leisure-time physical activity among Latinos. Although other studies have shown that increasing acculturation and education each are associated with increased leisure-time physical activity [7], [36], [37], [38], and indeed some studies have suggested the role of interaction shaping Latino health more generally [39], [40], little empirical evidence exists documenting the extent to which education modifies associations between acculturation and physical activity (or vice versa). The joint effects we observed may be attributable to fundamental resources [21], where individuals with greater SEP and greater English-language use may be able to avail themselves of the benefits of being physically active. Those with lower educational attainment and low English-language use, for example, may face substantial barriers in being physically active, including having limited disposable income to enroll in private gyms or other types of facilities, lacking access to facilities or parks in their neighborhoods to be active, living in unsafe neighborhoods or areas that hamper active living, and working in occupations with long and strenuous work hours that limit time for leisure-time physical activity [41], [42], [43]. Given the high prevalence of obesity in Latino populations, our findings suggest the need to develop interventions that simultaneously address cultural as well as structural barriers, such as low educational achievement, in the adoption of health-enhancing forms of physical activity.

The results we present on the independent association between acculturation (language use) and education on smoking behaviors are consistent with prior evidence [44], [45], [46]. Less work exists, however, investigating whether smoking patterns are modified by acculturation or educational attainment. In a study by Goldman et al [47], the authors also used NHIS data (1997-2001) and tested for interaction between Latinos and Whites and educational attainment on smoking. The authors found generally weak education gradients in smoking for Mexicans compared with the sharp educational gradients observed among U.S.-born white subjects. This weaker education gradient held among both foreign and U.S.-born Mexican-origin Latinos, leading the authors to conclude that one explanation for this difference may be caused by acculturation or assimilation processes. Our work directly examines the role of acculturation and thus adds new evidence on the strong and significant association of acculturation and education on smoking among Latinos.

Our study also supports current paradigms proposing an "intersectional" approach to health. Intersectionality theory considers the simultaneous positions individuals occupy in society and how these distinct social locations in combination may increase social vulnerability, or in the case of health, increase risk of disease [25], [48]. We used this intersectional lens as a backdrop to our study questions and translated intersectionality frameworks to an empirical approach specific to Latino health. Future work should demonstrate how simultaneously addressing educational attainment and culturally-based approaches are associated with improved physical activity behaviors, rather than addressing each of these determinants separately.

There are several limitations to consider with our study findings. We used English-language use as a proxy for underlying specific cultural constructs. Clearly, language use is a crude measure of concepts that are inherently complex, multifaceted, and potentially changing over time [4], [24]. However, we do not believe this measurement challenge to be exclusive to acculturation research. As an example, neighborhood socioeconomic condition has been consistently associated with health despite its obvious crude approximation to the underlying mechanisms implicated in neighborhood-health associations [49], yet this area of research has become a cornerstone of research on the social determinants of health. Although improving the measurement of acculturation is essential, we believe there is a merit to this concept and hope researchers will continue to try and identify what Broesch and Hadley [50] define as the cultural 'scripts" or frames that are embedded in human populations and how these scripts may differ (if at all) in reference to other groups and within and across specific social contexts.

A further limitation of our study is that we were not able to examine whether results held across different subgroups of Latinos or if other potential causal processes may be taking place. For example, Latino subgroups (i.e., Mexicans, Puerto Ricans, Dominicans, South/Central Americans) have varied social, economic, and political histories that can shape health patterns in distinct ways [51], [52]. We thus caution that results may not apply to all Latino subgroups because the NHIS sample is largely restricted to individuals of Mexican origin. Similarly, we only considered joint effects between acculturation and education on health and adjusted for important confounders of this association. However, an equally plausible mechanism may be that the social and political minority status of Latinos in the United States structures the educational opportunities they receive and thus education may actually serve as a mediator in the relationship between Latino ethnicity and smoking or physical activity, or simultaneously act as a mediator and effect modifier. Further, other analytic approaches may provide yet another way to capture the dynamic nature of cultural identity and social conditions and their expression(s) across time and settings [53], [54], [55]. Research is also needed to determine whether the interaction results we observed hold across varied measures of acculturation and for distinct health outcomes, over time and across the life course. Finally, we are not aware of well-established systematic differences in self-reported physical activity by acculturation or education status, and thus it is not clear in what direction any misclassification of physical activity might have biased the reported associations. Nonetheless, self-report of physical activity remains the most efficient way to collect this type of data in large population-based surveys.

Despite these potential limitations, a particular strength of our study is the use of a population-based sample to test how acculturation and SEP shape smoking and physical activity behaviors in Latinos. The large sample size allowed us to demonstrate the presence of interaction that could

have been missed in smaller scale studies. We also used current epidemiologic methods to test for interaction. Further, our translation of conceptual debates/frameworks into an applied epidemiologic approach provides an alternative way to 'unpack' the complex process(es) potentially implicated in the generation of health disparities among Latinos.

In summary, our study supports the notion that acculturation and socioeconomic condition are both important to consider in the study of Latino health, with substantial joint effects observed. These findings suggest that culturally meaningful interventions may be relevant for increasing physical activity and combating smoking, but equally important are the broader structural determinants that pattern the health of racial/ethnic minority populations in the United States.

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