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The association of smoking with English and Spanish language use as a proxy of acculturation among Mexican Americans

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Introduction

Hispanics have now surpassed Blacks to become the largest ethnic group in the United States (US) (1). In the US Hispanic population, those of Mexican origin experienced the greatest population growth over the last decade, accounting for nearly three-quarters of the 15.2 million person increase (1). Given the size and continued growth of this group, an understanding of the factors that influence health behaviors among Mexican-Americans (MA) is integral to developing effective health interventions in the US.

Along with the shift in US demographics has come an increasing interest in the experiences unique to immigrants and how these experiences may shape health and well-being. One factor that has been found to relate to numerous health behaviors is acculturation. Acculturation has been defined as “a process of cultural and psychological change that results following meeting between cultures” (2). Current acculturation theory suggests that this process is dynamic and that adoption of a new culture does not necessarily occur at the expense of the culture of origin; people can acculturate while still retaining a strong cultural identity of their home culture (3-5). More recent research has attempted to capture this more complex view of acculturation. For example, the assessment of language use, which has been used as a proxy measure for acculturation in several studies (6-9) has moved away from unidimensional scales (10,11) to mor dinamic scales which assess both maintenance of the culture of origin and adoption of the host culture(12-14).

Smoking rates are lower among Hispanic adults (12.9%) than non-Hispanic White adults (19%) in the US (15). However, smoking rates increase as Hispanics become more integrated into the American culture (7,16-19). For example, in a study examining data from

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Mexican-Americans in Texas, New Mexico, Arizona, Colorado, and California, those who were more proficient in English and had greater contact with Anglo-Americans were found to be more likely to smoke (20). Although these studies provide initial support that greater acculturation may be a risk factor for smoking among Mexican-Americans, examining only contact with or adoption of the host culture fails to capture the full acculturation experience. More recent models of acculturation suggest that maintenance of the culture of origin is a unique and distinct factor in the acculturation process, and should be considered, along with adoption of the host culture, when examining acculturation. Drawing from these recent models of acculturation, we expand on previous work by using a bi-dimensional measurement of acculturation, which assesses both maintenance of the culture of origin and adoption of the host culture, in this study of acculturation and smoking.

Roughly 19% of the Hispanic population in the US resides in Texas (21) and 84% of the Hispanic population in Texas is of Mexican ancestry (22). Moreover, Hispanics comprise 44% of Houston's population (1) making this an ideal setting for examining health behaviors in this population. Given that Mexican-Americans represent almost two-thirds of the US Hispanic population (1) and are one of the fastest growing minority groups in the US, increasing smoking rates in this group are likely to have a significant impact on public health not only in Texas, but the rest of the country. The objective of this study is to more fully identify the relationship between acculturation and smoking behaviors among Mexican-Americans using a bi-dimensional assessment approach.

Methods

Study population

This study is a secondary analysis of data collected from the Mexican-American Cohort (MAC) in Houston, Texas (23). The MAC is an ongoing population-based cohort approved by the MD Anderson IRB of households initiated in 2001. The population includes 11,674 adult Mexican or Mexican American descendants that reside in Harris or surrounding counties for at least 1 year. More details about this cohort can be found in previous publications (24).

Primary dependent variable: Current cigarette smoking

The sample of Mexican and Mexican American descendants was stratified into cigarette smokers (CS) and non-cigarette smokers (NCS). All participants who responded “Yes, currently smoke” to the question “Have you smoked at least 100 cigarettes (5 packs) in your lifetime?” and “Do you currently smoke every day or some days?” were classified as CS, while NCS were those participants who responded either “Yes, but quit smoking” or “No, never smoked”.

Acculturation measurements—Three proxies for acculturation (years in the US, comfort level with English language, comfort level with Spanish language) were predictors in analyses of cigarette smoking.

Years in the US

This self-report measure was obtained from the question “How many years have you lived in the United States?”

Linguistic measurements

English language: The following five items on a 4-point Likert scale guided our assessment of domain of English language:

“How well do you read in English?”, “How often do you read English language newspapers or magazines?”, “How often do you speak English?”, “How often do you watch TV programs in English?”, and “How often do you listen to radio programs in English?” These questions are similar to the 2007 Detjen, et al study, which used a 4-level acculturation measure derived by accumulating scores on well-validated questions on language preference and birthplace (25).

Answers range from 1= very poorly to 4= very well for the first question, and from 1=almost never to 4=almost always for the other four questions. The Cronbach's Alpha for this subscale was 0.89. Fifty-eight respondents were excluded because of missing data on at least 1 item. High scores in the English oriented subscale indicate an affinity for English language.

Spanish language: Similar questions (and scores) were used to compute the Spanish oriented subscale: “How well do you read in Spanish?”, “How often do you read Spanish language newspapers or magazines?”, “How often do you speak Spanish?”, “How often do you watch TV programs in Spanish?”, “How often do you listen to radio programs in Spanish?” (25). The Cronbach's Alpha for this subscale was 0.71 (73 respondents were excluded because of missing data on at least 1 item), with higher scores indicating more comfort with the use of the Spanish language.

The bilingual categories—Cross tabulations of the English and Spanish subscales were conducted and analyzed to create a bilingual classification. The rationale supporting this exploratory analysis is the fact that acculturation (in this case, its proxy, language use preference) is a process in which individuals from a minority group react on four different dimensions when they are immersed in a cultural and social environment where a different language is spoken. This rationale parallels Berry's Four-fold model of acculturation which accounts for different levels of acculturation (14).

For this purpose, participants who responded “very poorly” or “poorly” as well as “almost never” or “sometimes” to the English and Spanish subscales were re-classified as “Low”. Conversely, participants who responded “well” or “very well” and “often” or “almost always” were re-classified as “High”. This procedure allowed us to create four bilingual groups, according to their level of comfort with either the English or Spanish language:

- Low use of Spanish/Low use of English
- Low use of Spanish/High use of English
- High use of Spanish/Low use of English

- High use of Spanish/High use of English

Statistical Analyses

Cigarette use prevalence was defined as the proportion of *Mexican or Mexican American descendants* who reported currently smoking cigarettes. In order to identify statistical differences between CS and NCS, categorical variables were compared using the χ^2 test or Fisher's exact test, when appropriate. Continuous data were compared using 2-sided *t* tests.

Pearson correlation coefficients (*R*) were calculated between age, years in the US, and the English and Spanish subscales we used for computing the bilingual categories. Since high correlation coefficients do not necessarily imply multicollinearity, we also assessed the Tolerance and Variance Inflation Factor (VIF). Variables with a Tolerance value less than 0.2 were not included in the regression equation and were investigated further. Values of VIF exceeding 5.0 were regarded as an indication of multicollinearity.

A conditional logistic regression analysis was performed with backward stepwise procedures based on the maximum partial likelihood estimates to construct a final best fit logistic regression model to identify the risk factors (age, gender, education, marital status, religion, alcohol consumption, years in the US, and bilingual categories) associated with cigarette smoking. In the backward stepwise method, the significance level was set at $p<0.05$ for entering an explanatory variable into the models. We estimated odds ratios (ORs) and 95% confidence intervals (CIs). Finally, we assessed model calibration using the Hosmer-Lemeshow goodness-of-fit test. All statistical tests were considered to be significant at an alpha level of 0.05 on a two-tailed test. Statistical Package for Social Sciences Software (SPSS 18 for Windows; SPSS Inc., IL, USA) was used to conduct all statistical analyses.

Theory

Current theory of acculturation suggests that the process of acculturation is dynamic and that adoption of a new culture does not necessarily occur at the expense of the culture of origin; people can acculturate while still retaining a strong cultural identity of their home culture (3-5). Drawing from research models of acculturation, we expand on previous work by using a bi-dimensional measurement of acculturation which assesses both maintenance of the culture of origin and adoption of the host culture.

Results

Demographics and behavioral characteristics

The study sample consisted primarily of women (80.3%) with a mean age of 39 ± 13.1(SD) years. Respondents born in Mexico represented more than three quarters of the sample (76.3%). More than half of the study population (58.1%) had less than a high school degree, while 77.9% were unmarried or single, 70.1% never consumed alcohol, and 73.7% self-identified as Catholic.

Cigarette smoking among *Mexican and Mexican American descendants*

The overall prevalence of cigarette smoking was 11.4%. While females represented 80.3% of the total sample, males were more highly represented than females when comparing smokers to nonsmokers. Most of cigarette smokers (84.2%) had their first cigarette more than 30 minutes after waking up and smoke an average of 9 cigarettes per day (± 21).

Acculturation and its association with cigarette smoking among *Mexican and Mexican American descendants*

The overall mean score on the English subscale was significantly higher among cigarette smokers (2.6±0.99) compared to non-cigarette smokers (2.24±0.96), indicating higher comfort levels in the use of English language among smokers. In contrast, the mean score on the Spanish subscale was significantly lower among cigarette smokers (3.01±0.79) compared to non-cigarette smokers (3.20±0.66), implying lower comfort levels in the use of Spanish among smokers (Table 1).

In addition, a statistically significant difference in smoking prevalence was observed among the 4 bilingual groups, with those participants who reported high scores for the use of English language but low scores for the use of Spanish language, having the highest smoking prevalence (20.1%) (Table 2).

Acculturation as predictor for cigarette smoking among *Mexican and Mexican American descendants*

The Pearson coefficient indicated moderate correlations between age and years in the US, years in the US and the English subscale, years in the US and the Spanish subscale, and between the English and the Spanish subscale, with *Rs* of 0.4, 0.5, -0.4 and 0.5 respectively. However, the tolerance value and VIF did not indicate multicollinearity in the final model. Therefore age, years in the US and the bilingual categories were included in in the multivariable logistic regression analysis.

From the initial full logistic regression model for current cigarette smoking, a reduced model was developed retaining only the significant predictor variables: gender, education, marital status, religion, alcohol consumption, and the acculturation proxy, bilingual categories. Of note, age and years in the US were not retained by the model. In this analysis, the Hosmer-Lemeshow goodness-of-fit test was significant, suggesting it does not fit the data. However, as we have a sample size of over 11,000, even very small divergences of the model from the data would be flagged and be significant. Therefore, with large samples it is difficult to find models that are parsimonious and fit the data. In order to circumvent the limitation of using the Hosmer-Lemeshow goodness-of-fit test with large datasets, we selected a random subsample (10% of our original sample) and assessed model fit (26). For this additional multivariate analysis, the *p*-value for the Hosmer and Lemeshow goodness-of-fit test was greater than 0.05, which indicates a subjective assessment that the model fit the data at an acceptable level.

In our study, Mexican or Mexican Americans who smoke were more likely than those who are non-smokers to be male (adjOR 3.74, 95% CI=1.975-2.636), have education level less

than high school (adjOR 1.35, 95% CI=1.095-1.659), be married or live with someone (adjOR 1.75, 95% CI=1.516-2.022), self-identify as Catholic (adjOR 1.36, 95% CI=1.174-1.585), currently consume alcohol (adjOR 3.98, 95% CI=3.440-4.599) or had consumed alcohol but quit (adjOR 1.75, 95% CI=1.419-2.165), and to report both low use of Spanish and high use of English (adjOR 3.13, 95% CI=1.850-5.310) or high use of Spanish and high use of English (adjOR 2.12, 95% CI=1.255-3.569) (Table 3).

Discussion

The purpose of the present study was to examine the relation of acculturation to smoking status among Mexican-Americans. This study was conducted among a large sample of Mexican-Americans in Houston, Texas, which has one of the largest concentrations of Mexican-Americans in the US. Half of the sample reported living in the US longer than 15 years and the majority of respondents displayed low levels of acculturation (high levels of Spanish use and low levels of English use). Over three-fourths of participants reported sharing the same ethnic background as their spouse/partner. With regards to cultural attitudes, three-fourths identified all or most of their closest friends as Mexican-American and 77.1% reported conducting the interview in Spanish.

Several demographic differences were observed between smokers and non-smokers. Overall, men were more likely to be smokers than women, which are consistent with research that shows Hispanic men reporting smoking at higher rates than Hispanic women (24,27,28). The majority of women in the study reported being non-smokers (91.88%), while a smaller percentage of men identified as non-smokers (75.17%).

Participants who had lived in the US for more than 15 years had higher smoking rates than those who had lived in the US less than 15 years. The majority of non-smokers reported their parent's place of birth as Mexico (78%), while lower percentages of smokers reported having parents born in Mexico (61%). Taken together, this supports previous research showing that as Hispanics acculturate in US, behaviors associated with tobacco use begin to mirror that of non-Hispanic Whites (16).

We also examined the relation of language use, a proxy measure of acculturation used in other studies, to smoking status. We divided participants into four groups based on use of English and Spanish: High English/ High Spanish, High English/Low Spanish, Low English High Spanish, and Low English/Low Spanish. The most highly acculturated individuals (high English use and low Spanish use) had the highest smoking rates, followed by those with high use of both languages. Those with lower levels of acculturation (low use of English and high use of Spanish) were less likely to smoke than the High English/Low Spanish and High English/High Spanish groups. Relationships remained even after controlling for several socio-demographic factors, including age, gender, education, and marital status, among others.

Categorizing language use in this way allowed us to better examine different dimensions of acculturation and how these relate to smoking. High use of Spanish language, indicative of low acculturation, appeared to be a protective factor against smoking. Interestingly, using

High levels of Spanish along with high levels of English seemed to confer an advantage, when compared to those who used high levels of English, but low levels of Spanish. This suggests that even as one becomes more acculturated to the US culture, maintaining aspects of one's home culture could possibly provide protective factors against certain risky health behaviors associated with greater acculturation in the US, such as smoking.

Strengths of the present study include the large sample size (n=11,684) of Mexican-Americans adults. Also, respondents included people from varying socio-demographic backgrounds. For example, respondents with less than high school education were well represented in the sample. As an additional strength, several demographic and lifestyle variables were collected in this study, allowing researchers to control for potential confounding variables. Lastly, data collected on language use allowed us to examine different levels of use for both English and Spanish.

The present study has some limitations. Over 80% of the respondents in this study were female. Given the observed gender differences in smoking among Mexican-Americans, the results of the study should be interpreted cautiously for men. Secondly, this study utilized an abbreviated self-report measure of tobacco use, which may result in less accurate classification of tobacco use.

Existing batteries for assessing tobacco use are highly rigorous and typically assess multiple domains of tobacco use (15). Several studies have demonstrated the drawbacks of abbreviated self-reported tobacco assessments, such as the one used in this study, in Hispanic populations. For example, these measures can produce misclassification of tobacco use among Hispanic men, given that some Hispanic men believe that infrequent tobacco use does not qualify one as a current user (29). Additionally, the perception of smoking as less acceptable for women may present a barrier to accurate self-report among Hispanic women (29).

Conclusion

Overall, this study provides further support for the link between greater acculturation, based on language use, and higher smoking prevalence among Mexican-American adults. An understanding of how acculturation contributes to cigarette smoking among this fast growing population is important in the development of effective and innovative tobacco cessation interventions. Results suggest that examining Spanish or English language use in isolation does not adequately capture acculturation. Rather, accounting for each individual's use of *both* languages, as conceptualized in models such as Berry's Four-fold model (23), appears to provide unique information about acculturation. Individuals can differ both in their maintenance of the home culture and adoption of a new culture and both dimensions are important in predicting tobacco use. Future research is needed to better explore the mechanisms that underlie this relationship. Moreover, future research should have as a goal designing interventions to reduce smoking behaviors in Mexican-American adults that are appropriately tailored to different language use preferences and levels of acculturation.

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All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. The University of Texas MD Anderson Cancer Center Protocol # PA13-0582.

Appendix

1. Irene Tamí-Maury, DMD, MSc, DrPH. Assistant Professor in the Department of Behavioral Science at The University of Texas MD Anderson Cancer Center. Dr.declares that she has no conflict of intere Tamí-Maury conducts research on four specific areas: a) tobacco prevention and control in vulnerable populations (e.g., people living with HIV/AIDS, individuals infected with tuberculosis, cancer patients, immigrants, LGBT individuals); b) non-cigarette tobacco product use; c) dentistry's role in cancer prevention, specifically tobacco control; and d) web-based research and e-learning/training – itami@mdanderson.org ; phone number: 713-563-1264. Author Irene Tamí-Maury declares that she has no conflict of interest.
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7. Ellen R. Gritz, PhD, Professor in the Department of Behavioral Science at The University of Texas MD Anderson Cancer Center. She has published extensively on cigarette smoking behavior, including prevention, cessation, pharmacologic mechanisms, effects on weight and special issues of concern to women and high-risk groups, including ethnic minorities, youth, cancer patients and people living with HIV/AIDS – egritz@mdanderson.org; phone number: 713-745-3187. Author Ellen R. Gritz declares that she has no conflict of interest.

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Table 1
Means and Standard Deviations of linguistic proxies of acculturation by smoking status

Items for measuring acculturation	Total Mean (SD[c])	Non-smoker Mean (SD[c])	Smoker Mean(SD[c])	*p*-value
Overall English oriented subscale Internal consistency reliability: English, 0.89	2.28 (0.968)	2.24 (0.958)	2.58(0.989)	0.000
How well do you read English?[a]	2.42 (1.121)	2.38 (1.115)	2.72(1.119)	0.000
How often do you read English language newspapers or magazines?[b]	2.01 (1.122)	2.02 (1.114)	2.22(1.165)	0.000
How often do you speak English?[b]	2.26 (1.234)	2.20 (1.219)	2.68(1.263)	0.000
How often do you watch television program in English?[b]	2.57 (1.133)	2.53 (1.124)	2.87(1.150)	0.000
How often do you listen to radio programs in English?[b]	2.10 (1.215)	2.05 (1.199)	2.43(1.275)	0.000
Overall Spanish oriented subscale Internal consistency reliability: Spanish, 0.71	3.17 (3.400)	3.20 (0.662)	3.01(0.785)	0.000
How well do you read Spanish?[a]	3.27 (0.828)	3.29 (0.802)	3.09(0.980)	0.000
How often do you read Spanish language newspapers or magazines?[b]	2.57 (1.176)	2.60 (1.169)	2.34(1.197)	0.000
How often do you speak Spanish?[b]	3.68 (0.743)	3.71 (0.712)	3.48(0.904)	0.000
How often do you watch television program in Spanish?[b]	3.24 (1.041)	3.28 (1.026)	3.02(1.116)	0.000
How often do you listen to radio programs in Spanish?[b]	3.10 (1.146)	3.11 (1.148)	3.09(1.128)	0.612

[a](1= very poorly, 2= poorly, 3=well, 4= very well).

[b](1=almost never, 2=sometimes, 3=often, 4=almost always)

[c]Standard deviation.

Table 2

Bilingual groups by smoking status

	Total Sample (%) 11532 (100.0)	Low English/Low Spanish (%) 267 (2.3)	High English/LowSpanish (%) 1605 (13.9)	Low English/ High Spanish(%) 6912 (59.9)	High English/ High Spanish(%)2748 (23.8)	*p*-value
Current cigarette smoker						
No	10216 (88.6)	250 (93.6)	1282 (79.9)	6311 (91.3)	2373 (86.4)	0.000
Yes	1316 (11.4)	17 (6.4)	323 (20.1)	601 (8.7)	375 (13.6)	

Table 3

Socio-demographic and acculturation proxies (years in the US and bilingual categories) as predictors of smoking status among Mexican-Americans[a]

	Bivariate analyses	Multivariate analyses		
Independent variable	**Crude OR[b]**	**Adj OR[b]**	**95% CI[c]**	***p*-value**
Gender				
Male	3.74	2.28	1.975-2.636	0.000
Female (ref)	1.00	1.00		
Education				
Less than high school Graduated from high school More than high school	0.99	1.35	1.095-1.659	0.005
Graduated from high school	1.01	1.16	0.934-1.437	0.180
More than high school	1.00	1.00		
Marital status				
Married/living with someone	1.73	1.75	1.516-2.022	0.000
Unmarried/Single (ref)	1.00	1.00		
Religion				
Catholic	1.33	1.36	1.174-1.585	0.000
Non-Catholic (ref)	1.00	1.00		
Do you now or did you ever drink alcoholic beverages, at least 1×/month for 1 year or more?				
Yes, currently	6.11	3.98	3.440-4.599	0.000
Yes, but I quit	2.67	1.75	1.419-2.165	0.000
No, never (ref)	1.00	1.00		
Bilingual oriented				
Low Spanish/Low	1.00	1.00		
Low Spanish/High English	3.71	3.13	1.850-5.310	0.000
High Spanish/Low English	1.40	1.55	0.927-2.593	0.095
High Spanish/High English	2.32	2.12	1.255-3.569	0.005

[a]MODEL: Smoking *vs.* Non-smoking. The following variables are also adjusted for in this multivariate model: age, gender, education, marital status, religion, alcohol consumption, years in the US, and bilingual categories.

[b]Odd ratios, significant association ($p<0.05$),

[c]Confidence Interval