ACCULTURATION AND ITS ASSOCIATION WITH HEALTH-RISK BEHAVIORS IN A RURAL LATINA POPULATION

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Purpose: To evaluate the performance of proxy measures of acculturation and to examine the association between acculturation and selected health-risk behaviors.

Methods: Participants were 1062 Latina pregnant women who received prenatal care at clinics in San Joaquin County, California between 1999 and 2001. We used the receiver-operating characteristic (ROC) curve to characterize the sensitivity and specificity of proxy measures and regression analysis to examine health-risk behaviors.

Results: Using the ARSMA-II short version scale as a reference, age at immigration had the highest percentage of correctly classified individuals. Acculturation was significantly associated with a lifetime history of substance use, risky sexual behavior, low fruit consumption, and high fast-food meal consumption.

Conclusions: Acculturation is an important predictor of health-risk behavior among women. Further research is needed to better understand the phenomenon and to avert associated adverse health consequences. (*Ethn Dis*. 2005;15:733–739)

Key Words: Acculturation, Health-Risk Behaviors, Latinas

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INTRODUCTION

Acculturation is associated with higher rates of certain health-risk behaviors.[1–3] Regional and national data show lower rates of smoking,[4–9] alcohol consumption,[10–13] and substance abuse[14–18] among recent Latino immigrants compared to US-born Latinas and non-Hispanic Whites.

In the current study, we employed the short version of the ARSMA-II[14,19–21] and the receiver-operator characteristic (ROC) method to compare the performance of different proxy measures of acculturation (ie, nativity, age at immigration, and length of US residence) in a sample of 1062 Latinas attending prenatal clinics in rural northern California and sought to determine whether the performance improved when these measures were combined. We also examined the association between the level of acculturation and selected health-risk behaviors that affect reproductive outcomes.

METHODS

We analyzed data from interviews conducted as part of the Study for Hispanic Acculturation, Reproduction, and the Environment (SHARE) a longitudinal study of pregnant Hispanic women. Participants for the study were recruited from obstetrics and gynecology clinics affiliated with San Joaquin General Hospital, a regional center that serves a largely rural population of Latinos of Mexican descent. Women were contacted to inform them about the study, invite them to participate, and obtain informed consent. Fewer than 2% of the women contacted refused to participate. Women who agreed to participate in the study had a 45-minute personal interview with a trained bilingual/bicultural field worker. Interviews were offered in English or Spanish, depending on the participant's preference, between August 1999 and February 2001. Approximately 13% (n=166) of those who agreed to participate did not complete the required interview and were excluded from the study. All protocols were reviewed and approved by the University of California institutional review board. In the current analysis, we focused on information pertaining to acculturation and health-risk behaviors.

In addition to questions about demographic information, participants were asked to describe the occupation in which they had worked the longest. Responses were categorized into "farm work," "other work (not farm work)," or "never worked." Participants were also asked about their health habits and health-risk behaviors, including lifetime use of tobacco, alcohol, and illicit drugs; age at first sexual intercourse; lifetime number of sexual partners; and intake of fruits, vegetables, and fast-food meals in the previous month. Interviewers asked participants the total number of years they had lived in the United States. For women born in the United States, we set this variable equal to their age at interview. We estimated a woman's age at immigration to the United States as

the difference between her age at interview and the total number of years she had resided in the United States.

The ARSMA-II short version (SV) consists of 12 items, which were derived from the ARSMA-II by selecting the items from each culture orientation scale with the highest item-total correlations. ARSMA-II and ARSMA-II-SV are highly correlated in an adult sample (N=1547; concurrent validity: r= 0.93), and both subscales of the ARSMA-II-SV have adequate internal consistency (Cronbach α 0.83 and 0.87).[21] The ARSMA-II-SV assesses language use and preference. It uses a five-point Likert scale to score responses to questions about the use of English or Spanish in speaking, reading, writing, and other forms of communication. Response options are: 1 (not at all), 2 (very little/not very often), 3 (moderately), 4 (much or very often), and 5 (extremely often or almost always).

After approximately one third of the interviews had been completed, the questionnaire was reprinted, and options 2 and 4 were inadvertently omitted from each of the acculturation questions. Thus, approximately two thirds of the participants received a version with only options 1, 3, and 5, which altered the distribution of values and produced small but statistically significant differences in the mean values for the questions (data not shown) between the two versions. To adjust for the effects of this alteration,[22] we imputed new values for those who received the three-option version as follows:

1) We assumed that some individuals who selected 1 on the three-option questionnaire would have selected 1 anyway, but some would have selected option 2 if they had been given five options. Similarly, some individuals who selected 5 on the three-option questionnaire would have selected 5 anyway, but some would have selected option 4 if they had been given five options. Lastly, some individuals who selected 3 on the three-option questionnaire would have selected 3 if they had been given five options, but the remainder would have selected 2 or 4. We also assumed that the only difference between the two groups was the version of the questionnaire they received.
2) Next, using the group that received the five-option questionnaire, for each of the 12 questions, we calculated the proportion of participants that selected each option. We used this distribution to estimate expected proportions for those who received the three-option questionnaire and calculated weighted average values to replace participant-reported values for the three-option questionnaire. Thus the value 1 was replaced by a weighted average of 1 and 2. Similarly, 3 and 5 were also replaced by weighted averages.

After making these adjustments, we found that differences in the mean values for each question between the two versions were substantially reduced and became nonsignificant (P>.05) for eight of the 12 items. We then derived a raw acculturation score for each individual by calculating separate mean scores for the Mexican-oriented (MO) scale questions and the Anglo-oriented (AO) scale questions and then subtracting the mean score for the MO scale from the mean score for the AO scale. Using preset cutoff points,[14] we developed a five-level linear acculturation scale: level 1 represented Mexican orientation, and level 5 represented Anglo orientation. Because of the relative paucity of individuals in levels 2–5, we combined levels 2 and 3 to create a moderate acculturation category and levels 4 and 5 to create a high acculturation category.

We used ROC curve analysis to evaluate the sensitivity and specificity for each proxy acculturation measure, with the ARSMA-II-SV level of acculturation as the reference. For this analysis, we combined the moderate and high acculturation categories to dichotomize the scale. In this case, sensitivity of a proxy measure referred to the proportion of participants who were classified as moderate-to-high acculturation by both the ARSMA-II-SV (reference) and the proxy measure. Specificity referred to the proportion of participants who were classified as low acculturation on both the ARSMA-II-SV (reference) and the proxy measure. For the continuous variables (age came to United States and number of years in United States), the ROC curve was constructed by first calculating the sensitivity and specificity of each proxy measure at serial cutoff levels. The resulting sensitivities were plotted against corresponding values of the false-positive rate. According to cutoff points that provide the highest combination of sensitivity and specificity, individuals who came to the United States at or before 15 years of age were classified as moderate-to-highly acculturated, whereas those who immigrated later were classified as having low acculturation. Similarly, individuals who had lived in the United States for 10 or more years were classified as moderate-to-highly acculturated, whereas those who had lived in the United States for less time were classified as having low acculturation.

We used multiple logistic regression to analyze the association between acculturation and health-risk behaviors. We performed linear regression for age at first sexual intercourse. In each analysis, we adjusted for relevant sociodemographic factors. We excluded household income because a large percentage of subjects did not report their annual income.

RESULTS

A total of 1287 Latinas were enrolled in the study, and 1121 (87%)

completed the interview. We excluded 59 women from the study because their interview records had missing or incomplete information. Approximately two thirds (65%) of the individuals in the sample had low acculturation according to the ARSMA-II-SV (Table 1). Individuals in this category typically responded that they used Spanish "a lot or very often" in speaking, reading, thinking, and other forms of communication, and that they communicated "very little or not at all" in English. Conversely, highly acculturated individuals, who made up 15.2% of the sample, typically stated that they frequently used English (and did not often use Spanish) in their communication. The moderate acculturation group, which made up 19.8% of the sample, showed mixed results; whereas their responses on the MO scale were similar to those of the low acculturation group, their scores on the AO scale resembled those of the high acculturation group. The results support the notion that the moderately acculturated individuals are bi-cultural.

Individuals with low acculturation were older than those with moderate or high acculturation (mean ages 26.4 vs 23.2 and 22.6 years, respectively, $P<.05$). These individuals were also more likely than highly acculturated

Approximately two thirds (65%) of the individuals in the sample had low acculturation according to the ARSMA-II-SV.

Table 1. Demographic characteristics, proxy measures of acculturation, and behavioral characteristics by level of acculturation*

Characteristic	Level of Acculturation			
	Low (n=690)	Moderate (n=210)	High (n=162)	Overall (n=1062)
Demographic variables				
Age (years ± SD)	26.4 ± 6.1	23.2 ± 6.2	22.6 ± 5.7	25.2 ± 6.3
Nativity				
Born in US (%)	19 (2.8%)	103 (49.1%)	155 (95.7%)	277 (26.1%)
Foreign-born (%)	671 (97.3%)	107 (51.0%)	7 (4.3%)	785 (73.9%)
Age came to US (years ± SD)	20.7 ± 6.7	5.8 ± 8.0	0.3 ± 1.6	14.6 ± 10.6
Number of years in US (± SD)	5.6 ± 5.5	17.4 ± 7.6	22.3 ± 5.9	10.6 ± 9.1
Marital status:				
Married (%)	377 (54.6%)	71 (33.8%)	34 (21.0%)	482 (45.4%)
Living with a partner (%)	215 (31.2%)	62 (29.5%)	43 (26.5%)	320 (30.1%)
Never married (%)	86 (12.5%)	69 (32.9%)	81 (50.0%)	236 (22.2%)
Other† (%)	12 (1.7%)	8 (3.8%)	4 (2.4%)	24 (2.3%)
Years of education (± SD)	7.6 ± 3.0	10.5 ± 2.4	11.3 ± 1.6	8.8 ± 3.2
Longest occupation:				
Farm work (%)	249 (36.1%)	31 (14.8%)	6 (3.7%)	286 (26.9%)
Other service work (%)	207 (30.0%)	117 (55.7%)	121 (74.7%)	445 (41.9%)
Never worked (%)	234 (33.9%)	62 (29.5%)	35 (21.6%)	331 (31.2%)
Health behaviors				
Lifetime history of substance use:				
Cigarette smoking (%)	59 (8.6%)	57 (27.1%)	77 (47.5%)	193 (18.2%)
Alcohol use (%)	207 (30.0%)	106 (50.5%)	132 (81.5%)	445 (41.9%)
Illicit drug use (%)	7 (1.0%)	39 (18.6%)	77 (47.5%)	123 (11.6%)
Sexual behavior:				
Age at first intercourse (years ± SD)	19.0 ± 3.7	16.8 ± 3.2	15.9 ± 2.7	18.1 ± 3.7
Number of sex partners:				
One (%)	508 (73.6%)	96 (45.7%)	32 (19.6%)	636 (59.9%)
Two or more (%)	175 (25.4%)	99 (47.1%)	84 (51.9%)	353 (33.2%)
Dietary habits:				
3+ servings of fruits a day (%)	433 (62.8%)	133 (63.3%)	70 (43.2%)	636 (59.9%)
3+ servings of vegetables a day (%)‡	299 (43.3%)	82 (39.0%)	58 (35.8%)	438 (41.3%)
Fast-food more than two days a week (%)	38 (5.5%)	53 (25.2%)	49 (30.3%)	140 (13.2%)

US=United States.
* All differences were statistically significant at P=.05 except 'servings of vegetables.'
† Includes divorced, widowed, separated.
‡ P=.164.

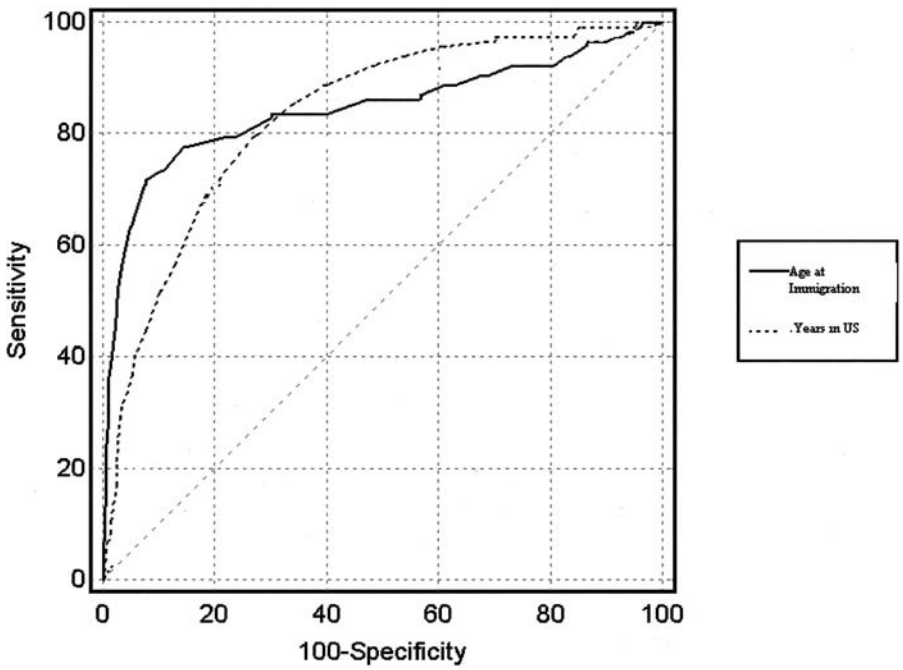

Fig 1. Receiver operator characteristic (ROC) curve for "Age at Immigration" and "Years in US." Foreign-born individuals

individuals to have worked on a farm (36.1% vs 3.7%, $P<.05$) or never worked (33.9% vs 21.6%, $P<.05$). Conversely, approximately three quarters of the women with high acculturation and more than half of those with moderate acculturation performed other types of work. Most (97.3%) of the women in the low acculturation category were born outside the United States. These women were more likely to be married (54.6%) and to have fewer years of formal education (mean 7.6) than those in the moderate and high acculturation categories.

Table 1 also summarizes the performance of the proxy measures of acculturation in our sample. Most individuals with low acculturation (97.3%) were foreign born, whereas 95.7% of highly acculturated individuals were US-born. Women with a low level of acculturation immigrated to the United States at a later age than women with a moderate or high level of acculturation (mean 20.7 vs 5.8 and 0.3 years, respectively, $P<.05$). They also lived in the United States for a shorter period of time relative to women in the moderate and high acculturation groups (mean 5.6 vs 17.4 and 22.3 years, respectively, $P<.05$).

The ROC curve analysis showed that age at immigration correlated better than years in the United States as a proxy measure of acculturation among foreign-born individuals (Figure 1), given specificity >70% (ie, 30% on the x-axis). Given a specificity of 80% (ie, 20% on the x-axis), for example, the sensitivity for age at immigration was approximately 80%, whereas the sensitivity for years in the United States was about 70%. Similar results (not shown) were obtained for foreign-born and US-born women combined. No significant difference was seen in the calculated AUCs (Table 2) because years in the United States performed better if a low specificity cutoff was used. The percentage of individuals with moderate-to-high acculturation who were born in the United States (sensitivity) was 69.0% (Table 2), indicating that 31% of those classified as moderate-to-highly acculturated individuals with the ARSMA-II-SV were misclassified by using nativity because they were born outside of the United States. Conversely, nativity had the highest specificity (97.2%), meaning that almost all the individuals who were classified as low acculturation on the ARSMA-II-SV were born outside the United States; and very few individuals (2.8%) were misclassified by using nativity because they were born in the United States. At the optimum cutoff of 15 years, age at immigration, with sensitivity of 91.8% and specificity of 86.9%, had the highest percentage of correctly classified individuals (88.7%) according to the ARMA-II-SV. In a logistic regression model including all three proxy measures (ie, nativity, age at immigration, and years in United States), the AUC was 94.1%.

Table 1 also describes the association of acculturation and selected health-risk behaviors. Highly acculturated women were more likely than women with low acculturation to report a lifetime history of tobacco (47.5% vs 8.6%, $P<.05$), alcohol (81.5% vs 30.0%, $P<.05$), and illicit drug use (47.5% vs 1.0%, $P<.05$). The former also had a younger age at first sexual intercourse (15.9 vs 19.0 years, $P<.05$) and were more likely to have had multiple sexual partners (51.9% vs 25.4%, $P<.05$). The questions regarding dietary habits (fruit, vegetable, and fast-food intake) produced mixed results; women with low acculturation had higher daily intakes of fruits than highly acculturated women (63% vs 43%, $P<.05$), but this pattern was not observed for daily vegetable intake. In addition, the percentage of individuals eating more than two fast-food meals a week increased from 6% in the low acculturation group to 30% in the high acculturation group.

In logistic regression analysis (Table 3), the lifetime odds of smoking adjusted for age were 4.6 (95% confidence interval [CI] 3.0–6.9) times greater in moderately acculturated women and 11.5 (95% CI 7.5–17.8) times greater in highly acculturated

Table 2. Proxy measures of acculturation: Area Under the Curve (AUC), sensitivity and specificity (with 95% CI) using ARSMA-II-SV Scale as "reference"

Measure	AUC	Cutoff Point	Sensitivity	Specificity	Correctly Classified
Born in US	–	–	69.0% (64.0–73.6)	97.2% (95.7–98.3)	87.2%
Age came to US	93.6% (91.9–94.9)	≤15 years	91.8% (90.1–93.5)	86.9% (85.2–88.6)	88.7%
No. years in US	92.5% (90.8–94.0)	≥10 years	80.3% (78.6–82.0)	80.4% (78.7–82.1)	83.8%

US=United States.

women relative to women with low acculturation. Even after adjusting for marital status, occupation, and education, which may actually be markers of acculturation, the odds of smoking remained statistically significant at 2.9 (95% CI 1.8–4.6) and 6.0 (95% CI 3.6–10.0), respectively. Similar patterns were observed for the lifetime odds of alcohol and illicit drug use; however, the adjusted association between acculturation and illicit drug use was particularly strong (odds ratio [OR] 11.2, 95% CI 6.2–37.5 for moderate acculturation and OR 50.9, 95% CI 20.1–128.6 for high acculturation). The adjusted odds of having multiple sex partners were also significantly higher among moderately and highly acculturated women than those in the low acculturation group.

Table 3. Odds ratios (OR) and 95% confidence intervals (CIs) of having a given behavioral characteristic

	OR (95% CI) Model 1*	OR (95% CI) Model 2†
History of smoking		
Low acculturation	1.0	1.0
Moderate acculturation	4.6 (3.0, 6.9)	2.9 (1.8, 4.6)
High acculturation	11.5 (7.5, 17.8)	6.0 (3.6, 10.0)
History of drinking		
Low acculturation	1.0	1.0
Moderate acculturation	2.4 (1.7, 3.3)	1.8 (1.3, 2.6)
High acculturation	10.3 (6.7, 15.8)	6.9 (4.2, 11.3)
History of drug use		
Low acculturation	1.0	1.0
Moderate acculturation	22.3 (9.8, 50.6)	11.2 (6.2, 37.5)
High acculturation	88.4 (39.5, 197.9)	50.9 (20.1, 128.6)
Multiple sexual partners‡		
Low acculturation	1.0	1.0
Moderate acculturation	3.5 (2.4, 5.0)	2.0 (1.3, 3.1)
High acculturation	11.4 (7.2, 18.2)	4.9 (2.8, 8.5)
More than three (3) daily servings of fruits		
Low acculturation	1.0	1.0
Moderate acculturation	1.0 (0.7, 1.4)	1.1 (0.8, 1.5)
High acculturation	0.4 (0.3, 0.6)	0.5 (0.3, 0.7)
More than three (3) daily servings of vegetables		
Low acculturation	1.0	1.0
Moderate acculturation	0.8 (0.6, 1.1)	0.9 (0.6, 1.3)
High acculturation	0.7 (0.5, 1.0)	0.8 (0.5, 1.2)
More than two (2) fast-food meals per week		
Low acculturation	1.0	1.0
Moderate acculturation	5.5 (3.5, 8.8)	4.3 (2.6, 7.3)
High acculturation	7.1 (4.4, 11.5)	4.9 (2.8, 8.6)

* Model 1: adjusted for age.
† Model 2: adjusted for age, marital status, occupation, and education.
‡ Also adjusted for age at first sexual intercourse.

The results for dietary habits were mixed; in the unadjusted analysis, no significant differences were seen in the daily intake of more than three servings of fruits or vegetables between the low and moderate acculturation groups. However, high acculturation was negatively associated with fruit intake. Intake of more than three servings of vegetables was not significantly associated with level of acculturation. Fast-food consumption was the dietary outcome showing the strongest association with acculturation. The odds of eating more than two fast-food meals a week were 5.5 (95% CI 3.5–8.8) times as high for moderately acculturated women and 7.1 times (95% CI 4.4–11.5) times as high for highly acculturated women compared to women in the low acculturation category. These odds ratios were reduced to 4.3 (95% CI 2.6–7.3) and 4.9 (95% CI 2.8–8.6), respectively, after adjusting for demographic variables. No significant effect modification was in any of the analyses. The analyses were repeated without imputation, and results were robust with and without the imputation.

DISCUSSION

Acculturation plays a significant role in health-risk behaviors and health outcomes.[18,19,21–28] However, because of the multifactorial nature and complexity of the phenomenon, various proxy measures are often used in public health studies to assess the level of acculturation. In general, the present

study demonstrates that nativity (place of birth), age at immigration, and the number of years living in the United States were strong predictors of acculturation in this sample of young, pregnant Latinas in rural northern California. Nonetheless, when used by itself to distinguish low levels of acculturation from moderate-to-high acculturation, nativity resulted in a high percentage of misclassification. By using nativity, individuals born outside of the United States are presumed to have low acculturation; our analysis showed that 31% of those with moderate-to-high acculturation were born outside of the United States, and would have been misclassified by using nativity alone. The group of foreign-born individuals includes those who immigrated at a young age and had therefore been in the United States for a long time. Our results indicate that immigration before the age of 15 years and presence in the United States for >10 years are important determinants of level of acculturation. As indicated by the high AUC (94.1%), combining these measures improves the overall ability to predict level of acculturation.

The demographic characteristics of the study participants are consistent with those in earlier studies[29] in that less acculturated individuals were older, more likely to be married, and had fewer years of formal education than more acculturated individuals. The change in estimates after adjusting for sociodemographic characteristics, such as marital status and education, suggests that these characteristics play an intervening role that partially explains the observed associations. The results for dietary habits demonstrate that fast-food consumption has the strongest association with acculturation and that a threshold effect exists for fruit consumption.

Our results indicate that immigration before the age of 15 years and presence in the United States for >10 years are important determinants of level of acculturation.

Some of the strengths of this study include the large sample size, rural setting, and the comparison between US-born and Mexican-born individuals. We also used ROC curve analysis to compare different proxy measures. Although the ROC curve method is most often used to evaluate the utility of clinical tests, it can also be used to evaluate other systems for classifying individuals. As far as we know, this is the first study that has used this method to examine acculturation measures.

Our analysis has several limitations, including its cross-sectional design, which make causal inferences difficult. Our study was limited to women because the SHARE study was designed to analyze the effects of acculturation on birth outcomes; thus our results cannot be generalized to the male population, which has a higher prevalence of illicit drug use and a different response to acculturation.[14] In addition, the selection of this clinic-based sample is potentially biased, not just in selecting women who are more health conscious, but also those who are more willing to use prenatal care and who have access to health services, both of which are also associated with level of acculturation. Health-conscious Latinas who score low on acculturation scales may not seek prenatal care services. Likewise, low acculturation Latinas may be reluctant to use prenatal care services, even when they perceive a need to do so, either because of their status as undocumented immigrants, or because they are unaware of the availability of prenatal care services to all pregnant women in California. We do not know what effect, if any, resulted from these factors. The very low refusal rate and consistency of our findings suggests that the results were reflective of the population of Latinas who receive prenatal care and possibly other immigrant Latina populations.

To keep the length of interviews to less than an hour, we were limited to use of the abbreviated version of the ARSMA-II, which is predominantly language-based. However, a recent study[21] showed high correlation between the ARSMA-II and ARSMA-II-SV, so use of the shortened version is valid. The results were further compromised by the need to impute five-point scores from a three-point scale on two thirds of our questionnaires. In spite of the imputation procedure, our results should still be valid, since we only adjusted for changes that could be explained by the reduced number of options, and we used weighted averages of adjacent option values. We also had limited information on nutritional evaluation, and data on income and country of education were not available in many cases.

Despite these limitations, our results have several notable public health implications. Acculturation needs to be taken into account when assessing the health risk of immigrant populations and in designing public health programs. Our findings also suggest a need to focus particular attention on health education for women who are moving from low to high levels of acculturation. Furthermore, national surveys, vital statistics records, and other secondary data sources, which are often used in studies examining health outcomes such as low birth weight,[30] depend on proxy measures of acculturation such as nativity or surname. Our results indicate that using nativity alone as a proxy measure of acculturation may lead to substantial misclassification, especially of foreign-born individuals.

Future studies can extend our findings by focusing on urban populations and including men. Investigators can

also consider conducting further sensitivity and specificity analyses with different combinations of acculturation measures. A more accurate measure of the number of years in the United States would take into account women who make frequent trips back and forth between the United States and Mexico. Finally, other measures could be explored to further characterize level of acculturation. The unabbreviated version of the ARSMA-II captures many of these additional measures, although with substantially higher respondent burden.

ACKNOWLEDGMENTS

This study was a part of a larger study, the Study of Hispanic Acculturation, Reproduction and the Environment (SHARE). This article was made possible by grant numbers 5RO1 ES09867-03 and P30 ES05707 from the National Institute of Environmental Health Sciences (NIEHS), and National Institute for Occupational Safety and Health (NIOSH), Cooperative Agreement # 1 U50 OH07550. Its contents are solely the responsibility of the authors and do not necessarily represent the official views of the NIEHS or NIOSH, NIH.

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