

# Effects of Nativity, Age at Migration, and Acculturation on Smoking Among Adult Houston Residents of Mexican Descent

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Tobacco continues to be the number one cause of preventable death in the United States despite decreases in overall smoking rates.<sup>1</sup> Although there has been considerable research on tobacco use among people of different ethnicities, little is known about tobacco use among homogeneous subgroups of Hispanics.<sup>2</sup> Even less is known about tobacco use among diverse immigrant populations.<sup>3</sup>

Studies suggest that individuals who have immigrated to the United States tend to adopt the lifestyle and health patterns of their host country.<sup>4</sup> Among immigrant Hispanics, for example, use of tobacco has been shown to increase after migration to the United States.<sup>5</sup> Data indicate that such changing patterns in tobacco use among Hispanics may be related to acculturation.<sup>6</sup>

People of Mexican descent represent the most rapidly growing segment of the US population and account for almost 60% of the Hispanic population.<sup>7</sup> In addition, Mexicans and Central Americans account for two thirds of the foreign-born Hispanics residing in the United States.<sup>8</sup> Yet, little is known about the factors that influence smoking behavior among homogeneous groups of Hispanics such as people of Mexican descent, irrespective of where they were born. Therefore, a close examination of the effects of nativity status, age at migration, and acculturation on smoking behavior in a large, well-characterized population of Mexican descent is timely and warranted.

In the current study, we examined smoking behaviors among adult men and women of Mexican descent from a population-based cohort of households in the Houston, Tex, metropolitan area. Our goals were to analyze smoking rates among men and women by age, educational attainment, level of acculturation, and country of birth; to investigate differences in smoking behavior among US- and Mexican-born smokers; and to examine the role of exposure to US culture in smoking be-

**Objectives.** We investigated differences in smoking behaviors between US- and Mexican-born ever smokers and examined the influence of US culture on smoking initiation.

**Methods.** Participants were 5030 adults of Mexican descent enrolled in an ongoing population-based cohort in Houston, Tex.

**Results.** More men than women reported current smoking; rates among US-born women were higher than those among Mexican-born women. Smoking rates among US-born men were higher than earlier published rates among Hispanics and non-Hispanic Whites but similar to rates among African Americans. Current smoking rates among Mexican-born women were lower than published rates for Hispanics, non-Hispanic Whites, and African Americans. Older age, male gender, a higher level of acculturation, more than a high school education, and residing in a census tract with a higher median age predicted history of smoking among US-born participants. Among Mexican-born participants, older age, male gender, a higher level of acculturation, and younger age at migration predicted history of smoking.

**Conclusions.** Smoking interventions for people of Mexican descent should be tailored according to gender, nativity, and acculturation level and should target all ages, not just young people. (*Am J Public Health*. 2005;95:1043–1049. doi: 10.2105/AJPH.2004.055319)

havior. We hope that the knowledge generated from this study will be useful in the design of culturally sensitive smoking prevention and cessation programs.

## METHODS

### Participant Recruitment

Participants included in this study were drawn from an ongoing population-based cohort of households initiated in July 2001 by the Department of Epidemiology at The University of Texas M. D. Anderson Cancer Center. Participants resided in predominantly Mexican American neighborhoods in Houston and were recruited between July 2001 and April 2004. Families were recruited into the cohort through random-digit dialing, “block walking” (i.e., recruiting door to door in selected neighborhoods), “intercept” (i.e., recruiting individuals from such locations as community centers and local health clinics), and networking via already-enrolled participants.

Once a household member agreed to participate, a pair of bilingual interviewers visited the home and recruited up to 3 additional household members above the age of 5 years. All participants 18 years or older provided written consent and completed an interview in either English or Spanish. Data were collected on demographic characteristics, medical history, level of acculturation, social habits, and occupational and residential history.

Smoking status was grouped into 3 categories: current, former, and never. Current and former (“ever”) smokers reported having smoked at least 100 cigarettes in their lifetime. Former smokers were defined as those who had quit at least 1 year before the interview. Participants also provided data on age at smoking initiation, age at cessation, and number of cigarettes smoked per day.

Level of acculturation was assessed with 4 items from the Bidimensional Acculturation Scale for Hispanics, a validated instrument that has very good reliability ( $\alpha=0.87$ ) and is designed for use with Mexican Americans.<sup>9</sup>

Scores ranged from 1 to 4, with higher scores reflecting a preference for and fluency in English and higher levels of acculturation.

Because acculturation is a process through which individuals' values and behaviors change as a result of interactions with people in their social environment, we explored the role of several contextual factors that influence acculturation. These factors, assessed at the census-tract level, included percentage of individuals who speak Spanish fluently, percentage of owner-occupied housing units, percentage of individuals born in the United States, percentage of adults aged 25 years with at least a high school education, and median age.

In terms of sociodemographic characteristics, age was calculated on the basis of participants' reported birth dates and was used as a continuous variable. Education level was categorized as (1) less than 8 years, (2) 9 to 11 years, or (3) high school or more. Nativity status was divided into US born and Mexican born. Age at migration was grouped into 3 categories: less than 16 years, 16 to 25 years, and more than 25 years. These cutoffs were selected to reflect periods of heightened susceptibility to smoking experimentation and initiation.<sup>10</sup> Among Mexican immigrants, length of residence in the United States was divided into 2 categories (12 years or less and more than 12 years) on the basis of the median split.

### Statistical Analyses

We conducted Student *t* tests, one-way analyses of variance, and Pearson  $\chi^2$  analyses, as appropriate, to evaluate smoking behavior according to birthplace, age at migration, duration of residence in the United States, acculturation level, and gender. Because our observations were not completely independent (68% of the observations were derived from households with 1 participant; 27%, from households with 2 participants; and 5%, from households with 3 or more participants), we conducted these analyses using generalized estimating equation (GEE) techniques to account for the correlated data.<sup>11</sup> However, because the results obtained from the GEE analyses were comparable to those obtained from the descriptive bivariate statistical tests, we chose to report the *P* values from the bivariate tests.

To determine the relative influence of individual- and contextual-level variables on history of smoking, we performed 3 multiple regression analyses using GEE techniques, stratifying the sample according to nativity status. We specified an exchangeable working correlation matrix assuming that, in each household unit, correlations among the observations were the same for any pair of household members. Odds ratios (ORs) and their 95% confidence intervals (CIs) were calculated via the GENMOD procedure in SAS.<sup>12</sup> The initial analysis, based on the US-born cohort, included age (continuous), gender (female), educational attainment (high school or above), acculturation level (continuous), and the contextual-level variables (home ownership, Spanish speaking, more than a high school education, US born, and median age).

We estimated 2 models for the Mexican-born cohort: one for those who initiated smoking in the United States and one for those who initiated smoking in Mexico. In the analysis based on Mexican-born participants who initiated smoking in the United States, we included age, gender, educational attainment, acculturation level, age at migration, and the contextual-level variables. However, in the analysis based on participants who were born in and initiated smoking in Mexico, we examined only variables that could have influenced their decision to begin smoking: age, gender, and educational attainment. All of the variables were simultaneously entered into the 3 GEE models. All statistical tests were 2 sided and were conducted with SAS software.

## RESULTS

### Study Participants

As of April 2004, data from 5512 participants 18 years or older were available for analysis. Of these individuals, 14 were excluded from the study because of missing data on smoking information (*n*=10) or educational attainment (*n*=4). Because the present analysis incorporated contextual effects measured at the census-tract level, participants were also excluded if fewer than 20 people resided in their census tract or census tract information was missing (or both). This

resulted in the exclusion of 45 census tracts (*n*=468 participants). Thus, the final sample size for the analysis was 5030.

Among the 5030 participants, 1392 were men and 3638 were women; 70% had been born in Mexico. At entry into the study, the US-born participants were older (44.2 vs 41.5 years; *P*<.001) and more educated (57.7% vs 29.4% had completed high school or some college; *P*<.001) than the Mexican-born participants. Most of the Mexican-born participants completed the interview in Spanish (93.1% vs 23.5%; *P*<.001). This significant difference in regard to language was also reflected in the language-based measure of acculturation (Bidimensional Acculturation Scale); scores on this scale showed that US-born participants were more acculturated than their Mexican-born counterparts (US-born mean = 3.3, Mexican-born mean = 1.8; *P*<.001).

Table 1 shows the distribution of never, former, and current smokers according to sociodemographic characteristics. Among the men, 43.8% had never smoked, 27.5% were former smokers, and 28.7% were current smokers; the corresponding percentages among women were 79.9%, 10.6%, and 9.5%. Former smokers, regardless of gender, were older on average than never or current smokers (50.9, 41.4, and 40.1 years, respectively, among men and 47.8, 41.1, and 41.2 years, respectively, among women).

Men who had never smoked were more likely to have completed high school (43.0%) than either former smokers (35.0%) or current smokers (37.1%). The pattern was opposite among women. Women who were current smokers were more likely to have completed the interview in English and were more acculturated. As expected, regardless of gender and country of origin, higher levels of acculturation were associated with higher levels of education (data not shown). Smoking status among men exhibited significantly less variance by country of birth than smoking status among women; a higher percentage of never smokers of both genders were Mexican born (68.0% of men and 75.4% of women), and higher proportions of US-born than Mexican-born women were former or current smokers.

We next analyzed smoking initiation according to nativity status (Table 2). US-born

**TABLE 1—Distribution of Sociodemographic Characteristics, by Gender and Smoking Status: Mexican American Residents of Houston, Tex**

	Men			Women		
	Never, No. (%) (n = 610)	Former, No. (%) (n = 383)	Current, No. (%) (n = 399)	Never, No. (%) (n = 2907)	Former, No. (%) (n = 387)	Current, No. (%) (n = 344)
Age, y <sup>a</sup>						
Mean (SD)	41.4 (15.8)	50.9 (16.5)	40.1 (13.7)*	41.1 (15.0)	47.8 (16.8)	41.2 (13.7)*
Range	18–86	19–86	19–79	18–90	18–87	18–82
Educational attainment						
≤8 y	216 (35.4)	170 (44.4)	143 (35.8)	1252 (43.1)	153 (39.5)	123 (35.8)
9 to 11 y	132 (21.6)	79 (20.6)	108 (27.1)	607 (20.9)	61 (15.8)	80 (23.3)
High school or more	262 (43.0)	134 (35.0)	148 (37.1)**	1048 (36.0)	173 (44.7)	141 (40.9)**
Language of interview						
English	181 (29.8)	104 (27.2)	129 (32.3)	605 (20.8)	132 (34.1)	145 (42.3)
Spanish	417 (68.4)	270 (70.5)	258 (64.7)	2250 (77.4)	249 (64.3)	187 (54.5)
Both	11 (1.8)	9 (2.3)	12 (3.0)	50 (1.8)	6 (1.6)	11 (3.2)**
Mean acculturation scale score <sup>a,b</sup> (SD)	2.5 (1.0)	2.4 (1.0)	2.6 (1.0)	2.1 (1.0)	2.4 (1.0)	2.6 (1.1)**
Nativity status						
US born	195 (32.0)	138 (36.0)	152 (38.1)	715 (24.6)	153 (39.5)	156 (45.3)
Mexican born	415 (68.0)*	245 (64.0)	247 (61.9)	2192 (75.4)**	234 (60.5)**	188 (54.7)**

<sup>a</sup>Significance test based on one-way analysis of variance; all other significance tests based on Pearson  $\chi^2$  analysis (2-sided).

<sup>b</sup>Range = 1 to 4, with higher values reflecting higher levels of acculturation.

\* $P < .05$ ; \*\* $P < .01$ .

men and women had smoked for significantly more years than Mexican-born participants who initiated smoking in the United States (men: mean = 23.1 vs 15.7 years; women: mean = 19.8 vs 11.9 years). Similarly, US-born men and women reported smoking more cigarettes per day than their Mexican-born counterparts (men: mean = 12.5 vs 8.1; women: mean = 11.1 vs 7.3) and thus had smoked for significantly more pack-years. There was little difference in age at initiation between (1) Mexican-born participants who had migrated before the age of 15 years and initiated smoking in the United States, (2) US-born participants, and (3) Mexican-born participants who had initiated smoking in Mexico. However, smoking initiation was delayed among Mexican-born participants who had migrated after the age of 16 years and initiated smoking in the United States. The majority of Mexican-born participants had initiated smoking in Mexico (75.8% of men and 65.2% of women—data not shown).

US-born men and women were older than Mexican-born participants when they quit

smoking, but the differences were not statistically significant. US-born ever smokers of both genders were more educated than their Mexican-born counterparts; immigrant women who had initiated smoking in the United States were significantly more likely to be high school graduates than those who had initiated smoking in Mexico (42.2% vs 32.0%) (Table 2). Mexican-born ever smokers who had initiated smoking in the United States had migrated at a younger age and hence had resided in the United States for more years than Mexican-born never smokers (Table 3).

### Multivariate Analyses

All of the individual-level predictors and one of the contextual-level predictors were significantly related to current smoking status among the US-born participants (Table 4). Specifically, significant predictors of ever smoking included older age (OR = 1.01; 95% CI = 1.01, 1.02), male gender (OR = 3.40; 95% CI = 2.68, 4.17), having less than a high school education (OR = 1.41; 95% CI = 1.10,

1.82), having a higher level of acculturation (OR = 1.28; 95% CI = 1.09, 1.51), and residing in a census tract with an older median age (OR = 1.11; 95% CI = 1.02, 1.21).

Among Mexican-born participants who had initiated smoking in the United States, 4 of the individual-level predictors, but none of the contextual-level predictors, were significant predictors of ever smoking: older age (OR = 1.03; 95% CI = 1.01, 1.04), male gender (OR = 3.24; 95% CI = 2.44, 4.31), a higher level of acculturation (OR = 1.31; 95% CI = 1.09, 1.58), and migrating at a younger age (OR = 0.93; 95% CI = 0.91, 0.94). Among Mexican-born participants who had initiated smoking in Mexico, 2 variables, both assessed at the individual level, were significant predictors: older age (OR = 1.02; 95% CI = 1.02, 1.03) and male gender (OR = 7.02; 95% CI = 5.82, 8.44) (Table 4).

### DISCUSSION

Our study is one of the first to investigate differences in smoking behaviors and related social correlates between US- and Mexican-born individuals. As a result of sample size limitations, previous regional and national studies<sup>6,13</sup> focused on differences based on gender or nativity status rather than the interaction between these 2 important determinants of smoking behavior. The large sample size of the present study allowed us to assess the influence of exposure to US culture on smoking among both immigrants and native-born individuals.

National and regional studies have shown that smoking rates are lower among Hispanics than among non-Hispanic Whites and African Americans.<sup>13,14</sup> In 2002, for example, 18.9% (95% CI = 16.3%, 21.4%) of Hispanic, 25.1% (95% CI = 23.3%, 26.8%) of non-Hispanic White, and 21.4% (95% CI = 17.2%, 25.5%) of African American Texas residents reported that they smoked.<sup>13</sup> The lower rate observed among Hispanics has been attributed to very low rates among Hispanic women.<sup>14</sup>

In our study, there were more US-born (31.3%; 95% CI = 27.2%, 35.4%) than Mexican-born (27.2%; 95% CI = 24.3%, 30.1%) current smokers. The rate of 31.3% among US-born Mexican Americans was higher than previously reported rates

**TABLE 2—Smoking Behaviors and Sociodemographic Characteristics of Ever Smokers, by Gender and Nativity Status: Mexican American Residents of Houston, Tex**

Characteristic	Men				Women			
	US Born (n = 290)	Mexican Born, Country of Smoking Initiation		P	US Born (n = 309)	Mexican Born, Country of Smoking Initiation		P
		US (n = 119)	Mexico (n = 373)			US (n = 147)	Mexico (n = 275)	
Mean no. of years smoking (SD)	23.1 (15.9)	15.7 (13.4)	22.1 (13.6)	<.001	19.8 (14.2)	11.9 (10.7)	19.3 (13.7)	<.001
Mean no. of cigarettes/d (SD)	12.5 (13.2)	8.1 (8.0)	10.1 (9.9)	.001	11.1 (14.3)	7.3 (7.8)	8.1 (8.8)	<.001
Mean no. of pack-years <sup>a</sup> (SD)	17.0 (23.8)	7.1 (10.8)	12.4 (18.2)	<.001	12.1 (17.6)	5.3 (8.1)	9.3 (16.0)	<.001
Mean age of initiation, y (SD)	17.0 (5.4)	21.6 (8.4)	16.4 (4.0)	<.001	19.8 (8.1)	25.8 (10.7)	18.6 (5.7)	<.001
Mean age at migration								
≤15		17.3 (4.8)				19.7 (7.2)		
16–25		24.3 (7.3)				25.8 (7.2)		
≥26		37.3 (11.7)		<.001		39.5 (9.6)		<.001
Mean age at cessation, y <sup>b</sup>	39.9 (16.3)	35.2 (13.6)	36.4 (14.4)	.065	37.6 (15.2)	36.6 (13.9)	34.8 (13.7)	.239
Mean level of acculturation (SD)	3.3 (0.7)	2.5 (0.9)	1.9 (0.7)	<.001	3.3 (0.7)	2.3 (1.0)	1.6 (0.7)	<.001
Education level, no. (%) <sup>c</sup>								
Less than high school	136 (46.9)	88 (73.9)	276 (74.0)		145 (46.9)	85 (57.8)	187 (68.0)	
High school or more	154 (53.1)	31 (26.1)	97 (26.0)	<.001	164 (53.1)	62 (42.2)	88 (32.0)	<.001

<sup>a</sup>Pack-years = (number cigarettes per day/20) × (years smoked).

<sup>b</sup>n = 138, n = 44, n = 196, n = 150, n = 64, and n = 167, respectively.

<sup>c</sup>Significance tests based on Pearson  $\chi^2$  analyses (2-sided); all other significance tests based on one-way analysis of variance.

**TABLE 3—Distribution of Age at Migration and Years of Residence in the United States, by Gender, Among Mexican-Born Never Smokers and Mexican-Born Ever Smokers Who Initiated Smoking in the United States**

Characteristic	Men			Women		
	Never (n = 415)	Ever (n = 119)	P	Never (n = 2192)	Ever (n = 147)	P
Age at migration, y						
≤15, no. (%)	70 (16.9)	61 (51.3)		306 (14.0)	68 (46.3)	
16–25, no. (%)	195 (47.0)	50 (42.0)		995 (45.4)	49 (33.3)	
≥26, no. (%)	150 (36.1)	8 (6.7)		891 (40.6)	30 (20.4)	
Mean (SD)	23.4 (11.0)	14.6 (7.5)	<.001	25.1 (11.3)	17.5 (10.8)	<.001
Residence in US, y						
≤12, no. (%)	176 (42.4)	28 (23.5)		1139 (52.0)	35 (23.8)	
≥13, no. (%)	239 (57.6)	91 (76.5)		1054 (48.0)	112 (76.2)	
Mean (SD)	18.0 (12.9)	26.1 (15.7)	.05	15.4 (12.0)	24.0 (13.5)	<.001

among Hispanic men (24.1%; 95% CI=21.9%, 26.3%) and non-Hispanic White men (25.5%; 95% CI=24.4%, 26.6%) but similar to the rate observed among African American men (28.7%; 95% CI=25.9%, 31.5%).<sup>14</sup> Although the rate among Mexican-born men was similar to previously reported rates for Hispanic

men, it was not significantly lower than rates reported among non-Hispanic Whites and African Americans.<sup>14</sup>

Among women, 15.2% (95% CI=14.0%, 17.4%) of those who were US born and 7.2% (95% CI=6.2%, 8.2%) of those who were Mexican born were current smokers. While these rates were lower than those that have

been observed among non-Hispanic Whites (23.1%; 95% CI=22.2%, 24.0%) and African Americans (20.8%; 95% CI=18.9%, 22.7%), the rate among US-born women was higher than that previously reported for Hispanic women (12.3%; 95% CI=10.9%, 13.7%), while the rate for Mexican-born women was lower.<sup>14</sup>

Consistent with previous studies,<sup>5,6</sup> never smokers were significantly more likely to be Mexican born. It seems possible that the lower smoking rates previously reported in Hispanic populations were attributable to large percentages of immigrants, because national statistics do not differentiate between US- and foreign-born individuals. Acculturation appears to influence the behavior of immigrant populations such that it approaches the behavior of their US-born peers, and thus Mexican-born men may be at increased risk for smoking the longer they live in the United States.

Data compiled by the American Cancer Society<sup>15</sup> reveal that although the overall percentage of Hispanic smokers decreased steadily from 1978 to 2000, smoking rates among men increased slightly, from 22.9% in



**TABLE 4—Predictors of Ever Smoking, by Nativity Status, Based on Generalized Estimating Equation Analysis**

Individual-level variable	Mexican Born, Country of Smoking Initiation		
	US Born, <sup>a</sup> OR (95% CI)	US, <sup>b</sup> OR (95% CI)	Mexico, <sup>c</sup> OR (95% CI)
Age	1.01 (1.01, 1.02)	1.03 (1.01, 1.04)	1.02 (1.02, 1.03)
Gender (female)	3.40 (2.68, 4.17)	3.24 (2.44, 4.31)	7.02 (5.82, 8.44)
Education (more than high school)	1.41 (1.10, 1.82)	1.06 (0.76, 1.48)	0.90 (0.72, 1.12)
Acculturation scale score <sup>d</sup>	1.28 (1.09, 1.51)	1.31 (1.09, 1.58)	...
Age at migration <sup>e</sup>	...	0.93 (0.91, 0.94)	...
Census variable			
Median age	1.11 (1.02, 1.21)	1.02 (0.90, 1.16)	...
Percentage Spanish speaking	1.01 (0.99, 1.03)	1.02 (0.99, 1.05)	...
Percentage born in US	0.98 (0.96, 1.01)	1.02 (0.99, 1.05)	...
Percentage homeowners	1.00 (0.98, 1.01)	0.99 (0.98, 1.01)	...
Percentage more than high school education	1.01 (0.99, 1.03)	1.00 (0.97, 1.02)	...

Note. OR = odds ratio; CI = confidence interval.

<sup>a</sup>Number of participants: 1509; number of clusters (households): 1156.

<sup>b</sup>Number of participants: 2873; number of clusters (households): 2306.

<sup>c</sup>Number of participants: 3255; number of clusters (households): 2423.

<sup>d</sup>Range = 1 to 4, with higher values reflecting higher levels of acculturation.

<sup>e</sup>Range: 0–60 years.

1994–1995 to 24.0% in 2000. The overall smoking rate of 28.7% we observed among male participants may have represented a continuation of this upward trend.

This study provides new data on intensity of smoking according to nativity status and gender. US-born ever smokers of both genders smoked more cigarettes per day and had smoked for a longer number of pack-years than their Mexican-born counterparts, regardless of where they initiated smoking. This pattern is consistent with the results of previous studies.<sup>6</sup> Mexican-born men and women who initiated smoking in the United States had smoked for fewer years and smoked fewer cigarettes per day than those who initiated smoking in Mexico.

Among Mexican-born participants who migrated to the United States between 16 and 25 years of age and then began smoking, average ages of smoking initiation were 24.3 years among men and 25.8 years among women, and these initiation ages were higher still among those who migrated after they were 26 years old. In addition, a surprisingly high percentage of ever-smoking women who initiated smoking in the United States mi-

grated after the age of 26 years. Most studies report that smoking initiation is largely a youth behavior,<sup>16</sup> but this finding highlights the need for programs designed to prevent smoking initiation among older immigrants.

In terms of the results of the multivariate analyses assessing predictors of history of smoking, older age and male gender were associated with such a history in all 3 models. Mexican-born men who had initiated smoking in Mexico were 7 times more likely to be ever smokers than women, whereas US- and Mexican-born men who initiated smoking in the United States were roughly 3 times more likely to be ever smokers than women. This twofold difference in odds ratios probably reflects differences in gender roles between Mexico and the United States and speaks to the process of acculturation. Smoking in Mexico continues to be socially acceptable among men and unacceptable among women, while in the US culture smoking is equally and increasingly unacceptable among both men and women.<sup>17</sup> Thus, when the women lived in Mexico, they encountered stronger social pressure against smoking than they did after migrating to the United States. As Mexican

immigrant women become more acculturated, acquiring greater equality with men, the cultural sanctions against smoking wane, which may partly explain why higher levels of acculturation are associated with smoking among women but not men.

Educational attainment was predictive of history of smoking only among participants born in the United States. Consistent with previous research, we found that smoking rates were lower among participants at higher educational levels.<sup>1</sup> Previous studies have revealed the opposite relationship in Central and Latin American countries: smoking rates increase as educational attainment increases.<sup>18,19</sup> Yet, educational attainment was not a significant predictor among the Mexican-born participants in our study, regardless of where they began smoking.

Among all of the participants, regardless of birthplace, those who were more acculturated were more likely to have a history of smoking. However, bivariate analyses showed that while ever-smoking women were more acculturated than never-smoking women, there was no relationship between male acculturation and smoking status. Previous studies have produced mixed results on the acculturation–smoking relationship. One study revealed no relationship<sup>20</sup>; others showed that less acculturated men smoked more than more acculturated men but revealed the reverse pattern among women<sup>6,21</sup>; and still others showed an association among women but not men.<sup>22,23</sup> Our results indicate that smoking prevention programs need to account for differences in levels of acculturation among women as well as differences in nativity status among both women and men.

Age at migration also affects acculturation; the longer one resides in the United States, the greater one's exposure to American culture and the stronger the influence of this new culture on one's behavior. Younger age at migration was a significant predictor of ever smoking, suggesting that there are certain periods of exposure during which young people are more susceptible to smoking initiation and underscoring the need for primary prevention programs aimed at Mexican immigrant youth.

Although a number of studies have shown that contextual variables predict smoking

status, only one of the variables included in our analysis—median age of census-tract population—successfully predicted history of smoking. There were probably several reasons for this discrepancy in findings. First, the census data used here provided no information on aspects of the social environment that might deter or promote smoking. This information is important because recent studies indicate that, in promoting tobacco use, the big tobacco companies are focusing on minority populations. In future studies, we will compare the number of pro-tobacco and antitobacco messages in different census tracts by assessing the numbers of billboards, promotions, and other forms of advertising for or against tobacco use. Second, although our participants resided in 31 different census tracts, these areas were relatively homogeneous in terms of residents' sociodemographic characteristics. It might be that we were unable to detect social environment influences because of a lack of variance.

This study involved some important limitations. First, the data were cross-sectional, hindering assessments of causality. However, because the participants are enrolled in a cohort that will be involved in future studies, we intend to gather longitudinal data on smoking and its correlates among both adults and adolescents. Second, because we did not obtain smoking information on all members of households, we were unable to assess the influence of family contexts on smoking. Family norms and cohesion are known to play a major role in Hispanic smoking behavior, and thus we intend to include family-level variables in future studies to assess their relationship to smoking status.

Third, our smoking rates were self-reported and unverified by biological samples, and hence smoking prevalence may have been underreported. Although the half-life of cotinine, a byproduct of nicotine, would have enabled us to detect smoking only during the previous 24 hours, studies indicate that the validity of self-reported data increases if participants believe they may be asked to provide a biological sample.<sup>24</sup> Certain culturally related concepts, such as *respeto* (respect) and *simpatia* (niceness/sympathy), also need to be considered given that they probably increase participation rates and data quality. However, *simpatia* is also likely to increase socially de-

sirable responses, possibly resulting in underreporting of smoking, especially among Mexican-born women.<sup>25</sup>

Fourth, other key variables used in our analyses, specifically age at migration and country where the Mexican-born participants initiated smoking, were calculated on the basis of self-reported data. Although there could have been categorization errors based on the calculated variables, such errors probably would have been randomly distributed. In future studies, we will ask participants for this information directly rather than imputing it from other self-reported data.

In conclusion, given that this is one of the largest community-based surveys to investigate the roles of nativity status, age at migration, acculturation, and other social factors related to smoking behavior among Mexican- and US-born Hispanics, our results have several clear implications for the design of future smoking prevention programs. These programs should be separately designed for and disseminated to men and women in both Spanish and English. Multiple messages are needed, especially in the case of women. Also, preventive interventions need to take into account the influence of acculturation by separately targeting native-born and Mexican-born immigrants. Finally, in the case of female immigrants, programs need to focus not only on young women but on women of all ages. ■

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### Contributors

A. V. Wilkinson assisted in the data analysis, interpreted the data, and led the writing. M. R. Spitz and M. L. Bondy conceived and coauthored the article and provided critical revisions. S. S. Strom and A. V. Prokhorov provided critical revisions and interpreted the data. C. H. Barcenas completed the data preparation and assisted with the data analysis and interpretation. Y. Cao analyzed the data. K. C. Saunders assisted in collecting, analyzing, and interpreting the data.

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### Human Participant Protection

This study was approved by the institutional review board of The University of Texas M.D. Anderson Cancer Center. Informed consent was obtained before initiation of the interview process.

### References

- Mokhad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *JAMA*. 2004;291:1238–1245.
- Tobacco Use Among U.S. Racial/Ethnic Minority Groups—African Americans, American Indians and Alaska Natives, Asian Americans and Pacific Islanders, and Hispanics: A Report of the Surgeon General*. Atlanta, Ga: Centers for Disease Control and Prevention; 1998.
- Baluja KF, Park J, Myers D. Inclusion of immigrant status in smoking prevalence statistics. *Am J Public Health*. 2003;93:642–646.
- Singh GK, Miller BA. Health, life expectancy, and mortality patterns among immigrant populations in the United States. *Can J Public Health*. 2004;95:114–121.
- Singh GK, Siahpush M. Ethnic-immigrant differentials in health behaviors, morbidity and cause-specific mortality in the United States: an analysis of two national databases. *Hum Biol*. 2002;74:83–109.
- Perez-Stable EJ, Ramirez A, Villareal R, et al. Cigarette smoking behavior among US Latino men and women from different countries of origin. *Am J Public Health*. 2001;91:1424–1430.
- Guzman B. *The Hispanic Population: Census Brief*. Washington, DC: U.S. Bureau of the Census; 2000.
- Schmidley D. *The Foreign-Born Population in the United States: March 2002*. Washington, DC: US Bureau of the Census; 2003. Current Population Reports, P20-539.
- Marin G, Gamba RJ. A new measurement of acculturation for Hispanics: the Bidimensional Acculturation Scale for Hispanics (BAS). *Hispanic J Behav Sci*. 1996;18:297–316.
- Coombs RH, Fawzy FI, Gerber BE. Patterns of cigarette, alcohol, and other drug use among children and adolescents: a longitudinal study. *Int J Addict*. 1986;21:897–913.
- Stokes ME, Davis CS, Koch GG. Generalized estimating equations. In: Stokes ME, Davis CS, Koch GG, eds. *Categorical Data Analysis Using the SAS System*. 2nd ed. New York, NY: John Wiley & Sons Inc; 2000: 469–548.
- SAS, Version 8e. Cary, NC: SAS Institute Inc; 2001.
- Behavioral Risk Factor Surveillance System Smoking*

*Prevalence Data, 2002*. Atlanta, Ga: Centers for Disease Control and Prevention; 2002.

14. Centers for Disease Control and Prevention. Cigarette smoking among adults—United States, 1999. *MMWR Morb Mortal Wkly Rep*. 2001;50:869–873.

15. *Cancer Facts and Figures for Hispanic/Latinos 2003–2005*. Atlanta, Ga: American Cancer Society; 2004.

16. Giovino GA. Epidemiology of tobacco use among U.S. adolescents. *Nicotine Tob Res*. 1999;1:S31–S40.

17. Marin BV, Marin G, Perez-Stable EJ, et al. Cultural differences in attitudes toward smoking: developing messages using the theory of reasoned action. *J Appl Soc Psychol*. 1990;20:478–493.

18. *Smoking and Health in the Americas*. Atlanta, Ga: Centers for Disease Control and Prevention; 1992. DHHS publication CDC 92-5419.

19. Vazquez-Segovia L, Sesma-Vasquez S, Hernandez-Avila M. Tobacco consumption in Mexican households: results from the National Household Income and Expenditure Survey, 1984–2000 [in Spanish]. *Salud Publica Mex*. 2002;44:S76–S81.

20. Markides KS, Coreil J, Ray LA. Smoking among Mexican Americans: a three-generation study. *Am J Public Health*. 1987;77:708–711.

21. Marin G, Perez-Stable EJ, Vanoss Marin B. Cigarette smoking among San Francisco Hispanics: the role of acculturation and gender. *Am J Public Health*. 1989;79:196–198.

22. Coreil J, Ray LA, Markides KS. Predictors of smoking among Mexican-Americans: findings from the Hispanic HANES. *Prev Med*. 1991;20:508–517.

23. Palinkas LA, Pierce J, Rosbrook BP, Pickwell S, Johnson M, Bal DG. Cigarette smoking behavior and beliefs of Hispanics in California. *Am J Prev Med*. 1993;9:331–337.

24. Cohen S, Lichtenstein E. Perceived stress, quitting smoking, and smoking relapse. *Health Psychol*. 1990;9:466–478.

25. Marin G, Marin VB. *Research With Hispanic Populations*. Newbury Park, Calif: Sage Publications; 1991.



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