Cardiovascular Risk Factors in Mexican American Adults: A Transcultural Analysis of NHANES III, 1988–1994

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ABSTRACT

Objectives. This study examined the extent to which cardiovascular disease risk factors differ among subgroups of Mexican Americans living in the United States.

Methods. Using data from a national sample (1988–1994) of 1387 Mexican American women and 1404 Mexican American men, aged 25 to 64 years, we examined an estimate of coronary heart disease mortality risk and 5 primary cardiovascular disease risk factors: systolic blood pressure, body mass index, cigarette smoking, non–high-density lipoprotein cholesterol, and type 2 diabetes mellitus. Differences in risk were evaluated by country of birth and primary language spoken.

Results. Estimated 10-year coronary heart disease mortality risk per 1000 persons, adjusted for age and education, was highest for US-born Spanish-speaking men and women (27.5 and 11.4, respectively), intermediate for US-born English-speaking men and women (22.5 and 7.0), and lowest for Mexican-born men and women (20.0 and 6.6). A similar pattern of higher risk among US-born Spanish-speaking men and women was demonstrated for each of the 5 cardiovascular disease risk factors.

Conclusions. These findings illustrate the heterogeneity of the Mexican American population and identify a new group at substantial risk for cardiovascular disease and in need of effective heart disease prevention programs. (*Am J Public Health.* 1999;89: 723–730)

Hispanic Americans constitute 11% of the US population and total 29 million people.[1] Hispanics are one of the fastest-growing ethnic minority groups in the United States, and they are expected to constitute 24% of the US population by 2050.[1] Hispanic groups are diverse; Mexican Americans make up 63% of the Hispanic population.[2] Mexican American groups are also diverse, as reflected by differences in educational attainment, country of birth, language spoken, and other indicators of migration and acculturation status.

As in most other ethnic groups in the United States, cardiovascular disease is the leading cause of death and disability among Mexican Americans.[3–6] Several studies have compared Mexican Americans with White (non-Hispanic) adults and found that cardiovascular disease risk factors, particularly physical inactivity,[7,8] unfavorable body fat distribution and obesity,[8–11] and type 2 diabetes mellitus,[8,12] are higher among Mexican Americans than among Whites. Furthermore, compared with Whites, Mexican Americans have a higher prevalence of hyperinsulinemia[13–15]; abnormalities in plasma lipoprotein lipids, especially higher levels of low-density lipoprotein and apolipoprotein B; and lower levels of high-density lipoprotein cholesterol.[16–19] Although blood pressure findings are somewhat inconsistent,[8,20–24] Mexican Americans have higher levels of uncontrolled and untreated hypertension than do Whites.[25,26] The prevalence of cigarette smoking, although similar for Mexican American and White men, is much lower for Mexican American women than for White women.[8,27]

The overall cardiovascular risk profile observed in Mexican American populations is supported by recent studies that document a greater incidence of hospitalized myocardial infarction among Mexican Americans than among Whites,[28] which suggests that higher cardiovascular disease risk factors in Mexican American populations are associated with manifestation of disease. A few studies have examined risk factor differences within Mexican American groups,[9,29–31] but they have been limited in scope by one or more of the following factors: dependence on small samples, confinement to selected geographic areas, and inclusion of only one cardiovascular disease risk factor.

Past research has established that cardiovascular disease risk factors are strongly influenced by behavioral, cultural, and societal factors.[32–35] This link has been established in part by migration and acculturation studies that have compared risk factors of migrant and nonmigrant populations[36,37] and that have examined change in risk factors after migration.[38–40] Such studies have documented poorer health status among populations that have migrated and have suggested that underlying mechanisms are associated with lifestyle change,[41] low social support,[41] lack of educational or occupational opportunities,[42] low access to medical care,[43,44] discrimination or injustice,[41,42] and other structural inequalities.[37,41]

In this study, we examined whether an estimate of coronary heart disease mortality risk and a set of primary cardiovascular disease risk factors differed among subgroups of a large national sample of Mexican American women and men living in the United States. The cardiovascular disease risk factors we examined were systolic blood pressure, body

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mass index (BMI), cigarette smoking, non-high-density lipoprotein (non-HDL) cholesterol, and type 2 diabetes mellitus[45] (chosen because of its relationship to lifestyle factors and its disproportionately high rates in ethnic minority groups). We examined these risk factors in 3 groups of Mexican Americans reflecting different levels of migration status (country of birth) and acculturation status (primary language spoken): those born in Mexico, those born in the United States whose primary language was Spanish, and those born in the United States whose primary language was English. We expected that women and men born in Mexico would have healthier cardiovascular profiles than those born in the United States, because of positive social and cultural influences from their country of birth. We also expected that US-born English-speaking women and men would have healthier cardiovascular profiles than US-born Spanish-speaking women and men because of higher levels of acculturation. These higher levels of acculturation may result in positive benefits from the dominant culture, including opportunities for higher education and income; access to preventive health services; and effective screening, diagnosis, and treatment of cardiovascular disease–related conditions. We expected that US-born Spanish-speaking women and men would have the least healthy profiles because of weakened ties with their traditional Mexican culture and poorly established ties with American culture, indicating a loss of protective influences of their native culture before a gain of protective influences of the English-speaking culture.

Methods

The National Health and Nutrition Examination Survey III (NHANES III), a large national survey, was conducted between 1988 and 1994 by the National Center for Health Statistics.[46] Designed to collect information to assess the health status of the US civilian noninstitutionalized population 2 months and older, NHANES III used the same stratified multistage probability design as in NHANES I and II.[47,48] NHANES III included an oversampling of both the Mexican American and the Black American populations, so that the sample could produce statistically reliable health estimates for the 2 largest ethnic minority groups in the United States.

NHANES III data were collected via standardized questionnaires administered by bilingual interviewers at participants' homes, standardized medical examinations conducted by health examiners at NHANES mobile examination centers, and laboratory tests on whole blood and sera. Of the 40 600 persons invited to participate, 86% completed the home questionnaire and 78% completed both the home questionnaire and the medical examination.

The sample for our analyses included women and men, aged 25 to 64 years, who completed both the home questionnaire and the medical examination. Twenty-five years was used as the lower age cutpoint because educational attainment (a covariate in our multivariate regression models) is often not completed before this age. Sixty-four years was used as the upper age cutpoint to avoid problems of selection effects due to noncardiovascular disease–caused morbidity and mortality.[49] We excluded data for pregnant women (n = 69) and surveys that were coded as unreliable (n = 3). Missing data were minimal for the outcome variables that we examined, ranging from 0% for smoking to 4.3% for systolic blood pressure.

Definition of Variables

Race/ethnicity was based on asking respondents to classify their ethnicity as Black; Mexican or Mexican American; White, non-Hispanic; Asian or Pacific Islander; Aleut, Eskimo, or American Indian; or other Latin American or other Spanish. Respondents who chose Mexican or Mexican American ethnicity were included in this analysis. We divided these respondents into 3 groups: those born in Mexico, those born in the United States whose primary language at home was Spanish, and those born in the United States whose primary language at home was English. Migration and acculturation status were indicated by country of birth and primary language spoken at home; both of these factors have shown high levels of validity and reliability.[50] These 2 individual attributes reflect strength of cultural beliefs and practices and influence health status and use of health care services.[51] Educational attainment, which was collected as a continuous variable and recorded as the highest number of years of schooling completed, was used in our models to control for potential confounding from socioeconomic status.

Outcome Variables

The first outcome variable was an estimate of overall 10-year mortality risk from coronary heart disease, calculated with gender-specific formulas and regression coefficients from a modified Framingham risk equation based on NHANES I data.[52] The formulas included age, systolic blood pressure, total cholesterol, and cigarette smoking; means used in the formulas were adjusted for age and educational attainment. For graphical presentation, the composite risk index was multiplied by 1000 to yield a projection of 10-year incident mortality from coronary heart disease per 1000 persons.

To further understand cardiovascular disease risk, we evaluated the following 5 cardiovascular disease risk factors and defined them as follows:

1. Systolic blood pressure (mm Hg) was measured 3 times during the medical examination by a health examiner while the participant was sitting after 5 minutes of rest. The mean of the second and third readings was reported.

2. BMI (weight in kg/height in m^2) was used as a measure of general overweight. Weight and standing height were obtained with a balance scale and metal rule, respectively, without shoes or heavy clothing. In addition to BMI, circumference of waist was used as a measure of central overweight.

3. Current cigarette smoking was based on whether respondents reported that they had smoked at least 100 cigarettes during their lifetime and whether they currently smoked. Serum cotinine levels (cutpoint >13 ng/mL)[53] were used to validate self-reported smoking.

4. Non-HDL cholesterol (mg/dL) was measured from serum specimens and calculated as the difference between total cholesterol and HDL cholesterol.[54] Non-HDL cholesterol was used rather than other measures of lipids because it is a better indicator of atherogenic lipoprotein particles than are indirectly estimated low-density lipoprotein cholesterol levels.[54] In addition, non-HDL cholesterol measurement does not require fasting blood samples and therefore allowed use of the entire NHANES III sample.

5. Type 2 diabetes mellitus was defined as an 8-hour or greater fasting plasma glucose level of ≥126 mg/dL.[55] Plasma glucose level, available for the entire sample, was measured by means of a microadaptation of the national glucose oxidase reference method.[56] Respondents who reported that a physician had ever told them that they had diabetes (other than during pregnancy) and who were older than 25 years at onset also were classified as diabetic. As a secondary measure of a risk factor associated with type 2 diabetes mellitus and overweight, serum insulin was used,[57,58] for which fasting blood specimens were obtained on all respondents and analyzed with radioimmunoassay (Insulin RIA Kit, Pharmacia Diagnostics, Columbia, Mo).[46]

Data Analysis

Primary analyses using linear models were carried out in SUDAAN (Research Triangle Institute, Research Triangle Park, NC)

Table 1—Sample Sizes and Weighted Sociodemographic Characteristics by Migration and Acculturation Status for Women and Men, Aged 25–64 Years: NHANES III, 1988–1994

	Women			Men		
	Mexican-Born	US-Born English-Speaking	US-Born Spanish-Speaking	Mexican-Born	US-Born English-Speaking	US-Born Spanish-Speaking
Estimated US population[a]	1 300 000	1 057 300	416 600	1 600 300	1 138 300	342 000
Sample size[b]	626	502	259	696	475	233
Mean age, y	38.6	39.6	44.4	36.5	38.4	45.6
Family size, mean no. of persons	5.1	3.7	3.8	5.0	3.5	4.1
Region of residence						
West (predominantly California, Arizona, and New Mexico), %	64.2	49.2	27.8	61.5	53.5	27.0
South (predominantly Texas), %	27.2	40.8	67.2	27.1	37.7	66.1
Northeast/Midwest, %	8.6	10.0	5.0	11.4	8.8	6.9
Living in rural area, %	32.3	42.8	64.1	30.6	40.4	64.1
Mean education level, y	7.0	11.9	8.9	7.3	12.2	8.7
Occupation[c]						
Skilled, %	24.2	65.4	45.8	9.5	37.1	17.4
Semi-skilled, %	47.5	26.7	40.6	39.3	36.0	49.0
Unskilled, %	28.3	7.9	13.6	51.2	26.9	33.6
Living below the poverty level, %	57.8	24.4	45.8	48.0	17.1	44.6
Reporting medical insurance, %	51.2	84.0	70.3	46.6	83.7	68.2
Percentage of lifetime spent in United States	34.4	100.0	100.0	37.3	100.0	100.0

Note. NHANES III = National Health and Nutrition Examination Survey III. Means and percentages were calculated with normalized sample weights.
Source. National Center for Health Statistics, NHANES III, 1988–1994.
[a]Projected estimates based on weighted percentages from NHANES III for the defined sample.
[b]Number who participated in both the home questionnaire and the medical examination, unweighted.
[c]Among those who were employed.

to adjust for the complex sample design of NHANES III.[59] All analyses incorporated sampling weights that adjusted for unequal probabilities of selection. Sample weights were also adjusted for nonrespondent characteristics. The analyses were run separately for men and women and used multiple linear regression models for continuous outcomes and logistic regression models for binary outcomes. The outcome variables were the estimate of overall cardiovascular disease risk and the cardiovascular disease risk factors defined earlier. The predictor variables were age (in years, centered at the sample mean to aid in the interpretation of the regression coefficients), education (in years, continuous and centered at 12 years), and migration and acculturation (3 groups—born in Mexico and used as the reference group, born in the United States and Spanish speaking, born in the United States and English-speaking). All first order interactions between predictor variables were included.

Results

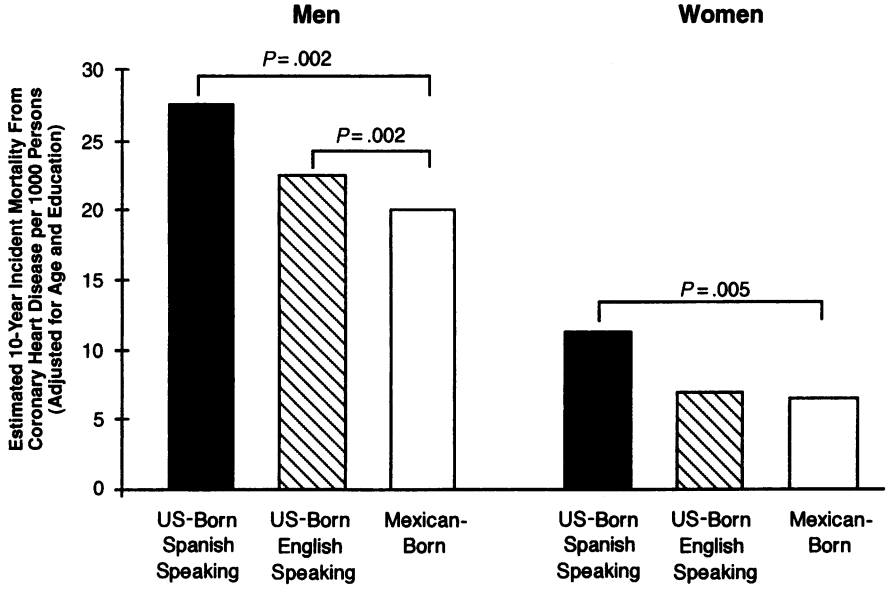
There were 1387 Mexican American women and 1404 Mexican American men, aged 25 to 64 years, who were selected for the NHANES III sample and who completed both the home questionnaire and the medical examination (Table 1). US-born Spanish-speaking respondents were older, more likely to live in the South (predominantly Texas), and more likely to live in rural areas than their counterparts. US-born English-speaking respondents had substantially higher levels of education and lower levels of poverty than their counterparts and were most likely to be employed in skilled occupations.

Estimated 10-year coronary heart disease mortality risk per 1000 persons, adjusted for age and education, was highest for US-born Spanish-speaking men and women (27.5 and 11.4, respectively), intermediate for US-born English-speaking men and women (22.5 and 7.0), and lowest for Mexican-born men and women (20.0 and 6.6) (Figure 1). In the linear regression model, the differences were significant between the Mexican-born and the US-born Spanish-speaking men and women, with adjustment for age and years of education ($P = .002$ and .005, respectively). Differences were also significant between the Mexican-born and the US-born English-speaking men ($P = .002$).

In general, each of the 5 cardiovascular disease risk factors showed similar patterns; risk factors were lowest for Mexican-born women and men, intermediate for US-born English-speaking women and men, and highest for US-born Spanish-speaking women and men (Table 2). When stratified by the 3 levels of education, these relationships persisted, showing a similar gradient effect within each level of education. Risk factor patterns for White, non-Hispanic women and men are presented for reference. Risk factors for Whites were higher than those for Mexican-born persons but lower than those for US-born Spanish-speaking persons, with the exception of type 2 diabetes mellitus for both women and men, smoking for women, and non-HDL cholesterol for men. Patterns for waist circumference and serum insulin paralleled those for BMI and type 2 diabetes mellitus, respectively.

Table 3 presents the coefficients from the regression models comparing US-born Spanish-speaking to Mexican-born persons and US-born English-speaking to Mexican-born persons. US-born Spanish-speaking women and men had significantly higher levels of blood pressure, BMI, and non-HDL cholesterol (women only) and a higher prevalence of smoking than did Mexican-born women and men of comparable age and education. US-born English-speaking women were significantly more likely to smoke, and US-born English-speaking men had higher levels of BMI than did their Mexican-born counterparts.

Educational attainment was not significantly associated with cardiovascular disease



Note. Formulas include age, systolic blood pressure, total cholesterol, and cigarette smoking. Means are adjusted for age and years of education. The composite risk was multiplied by 1000 to yield a projection of 10-year incident mortality from coronary heart disease per 1000 persons.

FIGURE 1—Estimated 10-year risk of mortality from coronary heart disease, according to gender-specific formulas based on National Health and Nutrition Examination Survey data.[50]

risk factors in the regression models, with the exception of smoking in men. Age was significantly associated with all of the risk factors, with the exception of smoking in women. Several modest interactions were found between the 3 groups and age for BMI and type 2 diabetes mellitus; however, these did not appear to be clinically significant.

Discussion

This study was one of the first to examine differences in cardiovascular disease risk factors among subgroups of a large national sample of Mexican American women and men. The results were consistent with our expectations: after accounting for age and educational attainment, we found that Mexican-born women and men had the healthiest cardiovascular profiles and that US-born Spanish-speaking women and men had the least healthy profiles. The latter group represents a newly identified group that is at substantial risk for cardiovascular disease and in need of effective health promotion and disease prevention programs.

Mexican-born women and men, despite having the lowest levels of educational attainment (mean 7 years) and the highest levels of poverty (>50% living below the poverty level), had the healthiest cardiovascular profiles, possibly influenced by positive social and cultural influences from their country of birth. Also, the Mexican-born women and men in this analysis may have had healthy cardiovascular profiles because of selection bias; that is, those who were able to immigrate had better health than those who were less able to immigrate.[36] Although this is a plausible explanation, past studies of Mexican women and men living in Mexico suggested that they have low levels of cardiovascular disease risk factors and heart healthy lifestyles, exemplified by diets rich in fruits and vegetables and low in fat, low smoking rates among women, and physical activity that is part of their daily work and leisure time.[60–64] A further study, in which Mexicans from low-income areas in Mexico City were compared with Mexican Americans from low-income barrio neighborhoods in San Antonio, Tex, found that the Mexican respondents had lower systolic blood pressure and lower BMI levels,[60,61] which was generally consistent with the blood pressure, BMI, and type 2 diabetes mellitus findings for Mexican-born vs US-born women and men in the present study.

US-born English-speaking women and men also had low levels of cardiovascular disease risk factors. They had the highest levels of educational attainment (mean 12 years), the lowest levels of poverty (<25% living below the poverty level), and the highest levels of medical insurance coverage (84% insured)—factors that previously have been associated with heart-healthy lifestyles, such as nonsmoking, low dietary fat intake, and leisure time physical activity, as well as with access to cardiovascular medical services.[33,35,65–68] Their cardiovascular profiles are consistent with findings from past research that established that Hispanic subgroups, whose educational levels most closely approximate those of the White majority, have greater access to and are thus more likely to use preventive and primary health care services.[69]

US-born Spanish-speaking women and men had higher levels of cardiovascular disease risk factors than the other 2 subgroups of Mexican Americans and higher levels than White Americans, a finding that has important implications for clinicians and public health policymakers. Despite being born in the United States, this group had exceptionally low educational levels (mean <9 years) and high poverty levels (45% living below the poverty level). Given the interrelationship of language with many other factors, one should not assume a causal relationship between Spanish language and higher levels of risk factors. In fact, those with higher levels of education within this Spanish-speaking subgroup had healthier cardiovascular profiles than those with lower levels of education (see Table 2).

One can speculate why the US-born Spanish-speaking group had the highest risk level. In contrast to those born in Mexico, this group of second generation Mexican Americans may face intergenerational conflicts. If they do not have opportunities to acquire adequate education or occupational or language skills to compete fully in the host society, they may become marginalized.[37,70,71] This marginalization may result in poorer medical insurance coverage; lower access to screening for cholesterol, blood pressure, and diabetes; and less effective treatment of chronic conditions such as hypertension and diabetes, leading to higher risk for cardiovascular disease. Preventive services and medical care also may be compromised by the lack of health education materials available in Spanish and the paucity of health professionals who understand the cultural and language needs of Spanish-speaking Americans.

The higher risk among US-born Spanish-speaking women and men who are less acculturated to the dominant culture is consistent with findings from migrant studies that showed that cardiovascular disease mortality and risk factors increased after immigration.[39,71] For example, Finnish and East European women immigrants, after living in

TABLE 2—Cardiovascular Risk Factors, by Migration and Acculturation Status and Education Level for Women and Men, Aged 25–64 Years: NHANES III, 1988–1994

	Systolic Blood Pressure, mm Hg, Means		Body Mass Index, kg/m^2, Means		Current Cigarette Smoker, %		Non-HDL Cholesterol, mg/dL, Means		Type 2 Diabetes Mellitus, %	
	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted
Women										
Migration and acculturation group										
Mexican-born	113.0	(113.6)	28.1	(27.8)	11.7	(11.6)	145.6	(146.6)	7.0	(6.9)
US-born English-speaking	113.8	(114.5)	28.5	(29.1)	18.2	(18.2)	147.7	(148.6)	6.1	(6.1)
US-born Spanish-speaking	123.5	(119.5)	30.2	(29.7)	20.4	(20.4)	160.0	(154.7)	14.6	(13.5)
White, non-Hispanic[a]	114.0	(113.9)	26.3	(26.3)	30.0	(30.1)	148.7	(149.0)	4.2	(4.2)
Education										
<9 years										
Mexican-born	115.2		28.8		13.0		149.3		8.8	
US-born English-speaking	121.7		28.7		22.7		153.8		13.9	
US-born Spanish-speaking	130.4		30.0		23.4		165.7		14.1	
9–11 years										
Mexican-born	109.9		28.1		4.4		141.4		5.5	
US-born English-speaking	112.7		29.1		28.0		149.6		4.9	
US-born Spanish-speaking	120.6		30.9		28.6		168.2		21.2	
≥12 years										
Mexican-born	108.5		26.1		12.3		137.5		2.8	
US-born English-speaking	113.0		28.3		14.9		146.3		6.8	
US-born Spanish-speaking	117.3		30.1		13.9		150.4		7.6	
Men										
Migration and acculturation group										
Mexican-born	117.9	(118.6)	26.7	(26.9)	33.0	(32.8)	157.2	(159.8)	5.0	(5.0)
US-born English-speaking	121.5	(121.5)	28.2	(28.1)	27.3	(27.5)	161.4	(159.8)	7.1	(7.0)
US-born Spanish-speaking	127.1	(123.9)	28.7	(28.0)	33.3	(33.6)	165.9	(158.8)	13.4	(12.8)
White, non-Hispanic[a]	120.5	(120.5)	27.0	(27.1)	33.2	(33.3)	161.3	(161.0)	4.8	(4.8)
Education										
<9 years										
Mexican-born	118.6		27.0		35.0		159.4		8.1	
US-born English-speaking	124.3		28.9		36.6		157.7		17.0	
US-born Spanish-speaking	129.7		28.9		39.3		164.6		18.9	
9–11 years										
Mexican-born	115.8		25.9		40.8		152.2		2.9	
US-born English-speaking	120.4		28.8		43.9		163.3		4.8	
US-born Spanish-speaking	133.2		29.7		32.7		181.5		15.7	
≥12 years										
Mexican-born	117.8		26.5		21.4		155.4		2.6	
US-born English-speaking	121.4		28.0		22.7		161.5		6.9	
US-born Spanish-speaking	121.4		28.1		25.7		162.0		5.5	

Note. NHANES III = National Health and Nutrition Examination Survey III. HDL = high-density lipoprotein. The first column for each risk factor presents means or percentages that are unadjusted, and the second column presents means or percentages that are adjusted for age and education.

Source. National Center for Health Statistics, NHANES III, 1988–1994.

[a]Data for white, non-Hispanic women and men are presented for reference.

Sweden for several years, had cardiovascular disease mortality rates 2 times higher than in their countries of birth.[71] Increases in cardiovascular disease risk factors also have been documented in South Asian immigrants[72] and Pacific Atoll men[39] after migration.

Limitations and Strengths

Our study had several limitations. First, the cross-sectional design of NHANES III makes it difficult to draw inferences about causal pathways. Second, there may have been genetic differences among the 3 groups we examined; however, no evidence indicates such a bias. For example, past studies have shown that Mexicans living in Mexico City and Mexican Americans living in San Antonio, Tex, had a similar percentage of Native American genetic admixture, estimated from skin reflectance measurements.[61] Third, self-reported smoking may have resulted in bias. However, we validated self-reported smoking by examining a biochemical measure, serum cotinine. Underreporting did not significantly differ between the groups for either women or men. Fourth, the regression coefficients for the 10-year mortality risk from coronary heart disease were based on the White adult population of the United States and may not be the most appropriate for Mexican American groups. However, the coefficients were used because of the lack of any comparable risk equations specific to Mexican American populations. Fifth, our measure of acculturation was indicated by primary language spoken at home; a static factor that does not measure core beliefs and practices in relation to specific cardiovascular disease risk factors or medical conditions and does not reflect the social context of health behavior.[51,73]

These limitations are countered by the strengths of the NHANES III—the most comprehensive national survey with data on cardiovascular disease risk factors for Mexican American women and men. Extensive and complete data, including socioeconomic indicators of health and standardized mea-

TABLE 3—Regression Model Coefficients and *P* Values for Cardiovascular Risk Factors in Mexican-born, US-Born English-Speaking, and US-Born Spanish-Speaking Women and Men, Aged 25–64 Years: NHANES III, 1988–1994[a]

Main Effects	Systolic Blood Pressure, mm Hg			Body Mass Index, kg/m^2			Current Cigarette Smoker[b]			Non-HDL Cholesterol, mg/dL			Type 2 Diabetes Mellitus[b]		
	β	± SE	*P*	β	± SE	*P*	β	± SE	*P*	β	± SE	*P*	β	± SE	*P*
Women															
Migration and acculturation group															
Mexican-born[c]	0			0			0			0			0		
US-born English-speaking	0.45	(1.63)	.78	0.58	(0.52)	.27	0.78	(0.33)	.02	1.24	(3.81)	.75	0.30	(3.22)	.93
US-born Spanish-speaking	5.84	(1.55)	<.001	2.18	(0.63)	<.001	0.60	(0.27)	.03	8.82	(3.83)	.03	0.93	(3.14)	.77
Education	−1.65	(0.91)	.07	−0.77	(0.40)	.06	−0.11	(0.19)	.54	−1.60	(3.14)	.61	−0.38	(3.19)	.91
Age	0.75	(0.08)	<.001	0.13	(0.03)	<.001	0.00	(0.02)	.77	1.22	(0.22)	<.001	0.10	(0.03)	.01
Men															
Migration and acculturation group															
Mexican-born[c]	0			0			0			0			0		
US-born English-speaking	2.14	(1.48)	.16	1.52	(0.42)	<.001	0.41	(0.26)	.12	−0.49	(4.15)	.91	0.60	(0.60)	.32
US-born Spanish-speaking	4.56	(1.65)	.01	1.52	(0.53)	.01	0.48	(0.23)	.04	3.29	(4.62)	.48	0.19	(0.76)	.80
Education	0.37	(0.66)	.57	0.08	(0.19)	.67	−0.27	(0.11)	.02	0.71	(1.67)	.67	−0.31	(0.41)	.45
Age	0.49	(0.08)	<.001	0.10	(0.02)	<.001	−0.04	(0.01)	.01	1.01	(0.19)	<.001	0.11	(0.02)	<.001

Note. NHANES III = National Health and Nutrition Examination Survey III.
[a]*Source*: National Center for Health Statistics, NHANES III, 1988-1994. Linear models incorporated sampling weights. Predictor variables were migration and acculturation group, education, age, and all first order interactions between predictor variables. Regression coefficients are unstandardized.
[b]Coefficients for binary outcomes are based on multiple logistic models. To calculate an odds ratio, exponentiate the beta coefficient.
[c]Mexican-born women and men were coded as the reference group for both US-born English-speaking and US-born Spanish-speaking groups.

sures of blood pressure, lipids, and diabetic status, are available from both the home questionnaire and the medical examination. This survey included an oversampling of Mexican American women and men and thus had adequate numbers to allow for comparisons within subgroups of the population. NHANES III also included large numbers of women and men at the upper and lower levels of educational attainment, so that the influence of socioeconomic status on observed differences in subgroups could be examined.

Public Health Implications

The findings of this study are especially relevant given the growth of the Hispanic population in the United States. Between 1980 and 1990, the Hispanic population increased by 39% compared with 7% for the overall US population.[74] Within the Hispanic population, the Mexican American population increased by 45%. These trends are expected to continue. It is estimated that the Hispanic population will account for 44% of the United States population growth from 2000 to 2020 and for 62% of the growth from 2020 to 2050.[75] In absolute numbers, the US Hispanic population is projected to increase from 31.4 million people in 2000 to 96.5 million people in 2050. Furthermore, the future growth of the Hispanic population will be decreasingly dependent on immigration and increasingly determined by birth and death rates in the resident population.[75] Thus, the subgroup identified in this study as being at highest risk for cardiovascular disease will likely experience large growth in the future.

Conclusions

These findings illustrate the heterogeneity of the Mexican American population and indicate that some groups are at substantially higher risk for cardiovascular disease than other groups. We found strong differences in cardiovascular disease risk factors among subgroups of Mexican American women and men, defined according to country of birth and primary language spoken. The distinct cardiovascular disease risk profile of US-born Spanish-speaking Mexican Americans suggests that they may have lost some of the advantages associated with the Mexican lifestyle without gaining the advantages associated with acculturation into the English-speaking culture. Further studies are needed to explore this hypothesis and hypotheses that examine how the process of acculturation, change in cultural norms, and societal factors may affect the cardiovascular health of Mexican Americans. Such work is critical to advance our knowledge of effective health promotion and disease prevention programs that can reduce the risk of heart disease in Mexican American populations. □

Contributors

J. Sundquist and M. A. Winkleby conceived and designed the study, analyzed and interpreted the data, and wrote the paper. Both authors guarantee the integrity of the research.

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