

Do Mexican Americans Really Have Low Rates of Cardiovascular Disease?¹

Michael P. Stern, M.D.*² and Ming Wei, M.D.†

*Department of Medicine, Division of Clinical Epidemiology, University of Texas Health Science Center at San Antonio, Texas 78284-7871; and †Cooper Institute for Aerobics Research, Preston Road, Dallas, Texas

In this article we challenge the conclusion made from vital statistics that Hispanic Americans have lower all-cause and cardiovascular disease (CVD) mortality than non-Hispanic whites. There is reason to believe that vital statistics underascertain minority, and in particular Hispanic, deaths. Cohort studies minimize many of these limitations. In the San Antonio Heart Study risk factor distributions predicted higher all-cause and CVD mortality among Mexican Americans than among non-Hispanic whites. Follow-up of the cohort confirmed a mortality ratio of 1.38 for all-cause and 1.30 for CVD mortality for Mexican Americans vs non-Hispanic whites. This excess risk was confined to U.S.-born Mexican Americans, since immigrants from Mexico had very low mortality despite low socioeconomic status. We attribute this latter finding to a "healthy migrant effect."

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Key Words: Hispanic-Americans; risk and acculturation; vital status; cohort study.

INTRODUCTION

The idea has been in the literature for many years that Mexican Americans, especially Mexican American men, have paradoxically low rates of cardiovascular disease, paradoxical because their high rates of diabetes and obesity suggest that the opposite should be true. This idea is based entirely on vital statistics data. Table 1 summarizes original studies, all of which showed lower rates of cardiovascular mortality among Mexican American men than among non-Hispanic men, although, interestingly, this tended not to be the case among Mexican American women [1-5]. The studies summarized in Table 1 reflect mainly the decade of the 1970s. More recently, our group reported secular trends

in cardiovascular mortality among Mexican Americans and non-Hispanic whites for the state of Texas from 1970 to 1980 [6], and Goff et al. extended these trends through 1989 [7]. Both studies were based on vital statistics data and both showed that Mexican Americans from Texas shared in the national secular decline in cardiovascular mortality. However, as shown in Fig. 1, the pattern of deficit in cardiovascular mortality persisted among Mexican American men, but not Mexican American women.

With respect to all-cause mortality, vital statistics data from the state of Texas suggest no difference between Mexican Americans and non-Hispanic whites of either sex above age 40 years [8]. More recently, the National Longitudinal Mortality Study [9] reported reduced all-cause mortality and reduced cardiovascular mortality relative to non-Hispanic whites in both sexes and in all three major Hispanic subgroups in the United States, namely, Mexican American, Puerto Rican, and Cuban American. Data were available for the years 1973 to 1985 on approximately 700,000 individuals, 40,000 of whom were Hispanic, and mortality was traced through the National Death Index. In this study the deficit for Hispanics in both all-cause and cardiovascular mortality was observed in both sexes. These findings were unexpected because Hispanics, for the most part, are a disadvantaged minority and it was anticipated that, like African Americans, they would display elevated mortality rates.

Vital statistics data are subject to a number of limitations. For example, it has been reported that the National Death Index underestimates the mortality of minorities [10]. Matching on social security number is problematic for Hispanics, since many are undocumented aliens who have either no social security number or a forged one. In the National Mortality Followback Survey, investigators identified a sample of death certificates and then interviewed informants who

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² To whom reprint requests should be addressed. Fax: (210) 567-6955. E-mail: stern@uthscsa.edu.



TABLE 1
Studies Comparing Cardiovascular Mortality between Mexican Americans and Non-Hispanic Whites

Geographic area	Period	Age-adjusted rate per 100,000 persons					
		Men			Women		
		MA	NHW	MA/NHW	MA	NHW	MA/NHW
Texas [1]	1969-1971	346.1	441.4	0.78	225.0	217.2	1.04
California [2]	1969-1971	—	—	0.82	—	—	1.00
New Mexico [3]	1969-1975	193.1	299.6	0.64	—	—	—
New Mexico [4]	1978-1982	159.8	231.4	0.69	91.6	109.8	0.83

Note. MA, Mexican Americans; NHW, non-Hispanic whites.

had provided the original information about the deceased. It was found that 20% of individuals identified as Hispanic on the followback interview were not so identified on their death certificates [11]. The explanation for this finding is uncertain, but the individual filling out the death certificate may not have asked this question and listed the decedent as non-Hispanic white by default. It is also claimed that an unknown number of ill Mexican Americans return to Mexico to die. The population pool from which these individuals are drawn, however, is to varying degrees represented in the U.S. census count. All of these problems would have the effect of spuriously lowering the estimates of Hispanic mortality, although it is not clear why they should affect men more than women. Prospective cohort data would obviate many of these difficulties. Unfortunately, few such data are available.

Prevalence data for myocardial infarction (MI) have been reported from the San Antonio Heart Study [12]. These data indicate that the age-adjusted prevalence

ratio of self-reported MI and/or definite MI by Minnesota-coded ECG among Mexican Americans compared with non-Hispanic whites is 0.65 for men and 1.24 for women. The low ratio among men was of borderline statistical significance ($P = 0.06$), whereas the high ratio among women, perhaps due to a relatively small number of events, was not statistically significant ($P = 0.49$). The low ratio among men could indicate a higher case fatality rate among Mexican American than among non-Hispanic white men with MI. Because, however, the sex-ethnic interaction in MI prevalence paralleled the pattern of mortality, these data have been interpreted as indicating a reduced incidence of MI among Mexican American men. As we shall see below, this interpretation may not be correct.

In 1993 Nichaman et al. reported data from the Corpus Christi Heart Project [13]. Their data unexpectedly showed that the age-adjusted rates of hospitalization for acute MI among Mexican American men and women

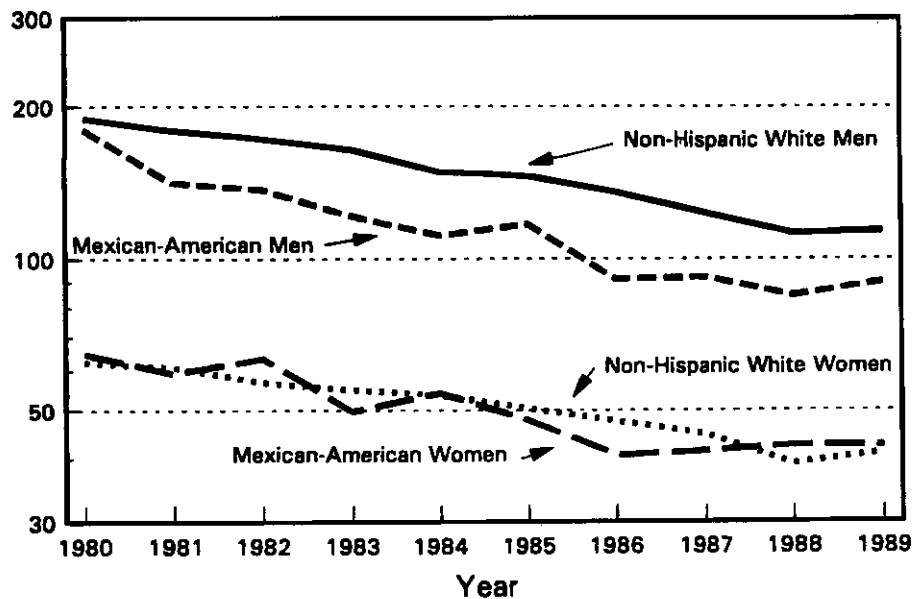


FIG. 1. Age-adjusted mortality due to acute myocardial infarction per 100,000 population, 1980 through 1989, for Mexican Americans and non-Hispanic white men and women in Texas.

were 606.1 and 427.4 per 100,000, respectively, compared with 502.6 and 276.9 per 100,000 among non-Hispanic white men and women. The higher rates among Mexican Americans were statistically significant for both sexes. These results can be reconciled with the mortality results only by postulating that out-of-hospital cardiac deaths are less frequent among Mexican Americans than among non-Hispanic whites.

In fact, there is evidence that out-of-hospital deaths occur less frequently among Hispanics than among non-Hispanics. Gillum reported national vital statistics data indicating that the rates of out-of-hospital deaths due to coronary heart disease for non-Hispanic and Hispanic men were 166 and 75 per 100,000, respectively [14]. The corresponding figures for in-hospital deaths were 99 and 73 per 100,000. Thus, the total deficit in coronary heart disease deaths among Hispanics was 117 per 100,000 ($(166 + 99) - (75 + 73) = 117$), of which 91 per 100,000 or 78% was due to the deficit in out-of-hospital deaths. A similar pattern was seen for women, among whom 85% of the deficit in coronary heart disease deaths was due to a lower rate of out-of-hospital death. It should be noted, however, that these analyses are based on vital statistics data and are therefore subject to the various caveats noted above.

The Corpus Christi Heart Study also found that, among subjects hospitalized for acute MI, the 28-day case fatality rate due to all causes and the 25-month coronary heart disease case fatality rate were both higher among Mexican Americans than among non-Hispanic whites [15]. The Mexican American excess was greater among men than among women. These findings, if generalizable, could explain the lower MI prevalence among Mexican American men, although not the higher prevalence among Mexican American women, observed in the San Antonio Heart Study (see above).

In the San Antonio Heart Study, we performed a 7- to 8-year mortality follow-up from 1987 to 1996 on 2,674 Mexican Americans and 1,132 non-Hispanic whites initially enrolled between 1978 and 1985 [16]. Vital status ascertainment was 98.1% complete. A total of 96 deaths were recorded among Mexican Americans and 40 among non-Hispanic whites. Selected baseline risk factors are shown in Table 2. Mexican Americans had more diabetes and gallbladder disease, but less self-reported heart disease and cancer. The two ethnic groups were equally likely to be cigarette smokers, but Mexican Americans, on average, smoked only about half as many cigarettes as non-Hispanic white smokers. Mexican Americans were also more obese and had higher blood pressures and triglycerides, but lower total and HDL cholesterol than non-Hispanic whites. Using a multiple logistic regression model derived from the Framingham data, which included age, body mass index, triglyceride, HDL cholesterol, systolic blood pressure,

presence or absence of diabetes, and cigarette smoking, cardiovascular risk scores were calculated for men and women of both ethnic groups [18]. For men, the cardiovascular risk scores were 0.074 for Mexican Americans and 0.066 for non-Hispanic whites ($P = 0.02$). The corresponding figures for Mexican American and non-Hispanic white women were 0.033 and 0.028, which was also statistically significant ($P = 0.02$). Thus, the prediction is that Mexican Americans of both sexes would have higher cardiovascular mortality than non-Hispanic whites.

The age- and sex-adjusted all-cause mortality per 1,000 person years was 5.26 for Mexican Americans and 3.80 for non-Hispanic whites (Table 2), giving a mortality ratio of 1.38, which just achieves statistical significance (95% confidence interval 1.0–2.0). Cardiovascular mortality, defined as ICDA-9 codes 390 to 459, was 1.78 per 1,000 person years for Mexican Americans and 1.37 for non-Hispanic whites (Table 2). Here, the mortality ratio of 1.30 was not statistically significant. These results from an intact cohort suggest that all-cause and cardiovascular mortality are actually higher among Mexican Americans than among non-Hispanic whites, so that the low mortality suggested by the vital statistics data could be an artifact resulting, at least in part, from underascertainment of Hispanic deaths.

The only published cohort data on incidence of cardiovascular disease among Hispanics comes from the San Luis Valley Diabetes Study [19]. In this study, incident cases of coronary heart disease (CHD) were defined as individuals who developed ECG Minnesota codes of 1.1–1.2, those who self-reported a heart attack, or, for fatal cases, those whose underlying cause of death was coded as ICDA-9 410–414 on the death certificate. Using these criteria, there were no statistically significant differences in age-adjusted 4-year incidence of CHD between Hispanics and non-Hispanics of either sex. However, the power of this study to detect ethnic differences in CHD incidence was low; only 54 nonfatal and 18 fatal cases were identified.

Table 3 shows the relative risk of cardiovascular mortality according to selected risk factors for Mexican Americans and non-Hispanic whites studied in the 7- to 8-year follow-up of the San Antonio Heart Study [16]. The relative risks were statistically significant for Mexican Americans (borderline in the case of cholesterol level), but not for non-Hispanic whites. However, for non-Hispanic whites, the estimates are based on only 40 deaths. Total cholesterol and current cigarette smoking appeared to be equally risky for both ethnic groups, whereas hypertension and diabetes appeared to be more risky for Mexican Americans. In view of the broad and overlapping confidence intervals for these ethnic-specific relative risks, however, this finding should be interpreted cautiously until larger numbers are available and this interaction can be tested formally.

TABLE 2

Baseline Risk Factors among Mexican Americans and Non-Hispanic Whites: San Antonio Heart Study [16]

	Mexican Americans (<i>n</i> = 2,674)	Non-Hispanic whites (<i>n</i> = 1,132)
Age (years)	43.1 ± 11.1	45.7 ± 12.0*
Percentage male	41.2	43.8
Years of education	9.8 ± 4.3	13.5 ± 2.7*
Percentage diabetic ^a	13.6	7.0*
Percentage with self-reported		
Heart attack	2.5	3.9*
Cancer	1.0	1.9*
Gallbladder disease	12.5	7.4*
Percentage current cigarette smokers	30.5	31.6
Cigarettes smoked/day among smokers	11.2 ± 3.2	20.2 ± 4.5*
Body mass index (kg/m ²)	28.6 ± 5.7	26.0 ± 5.3*
Cholesterol (mg/dl)	204 ± 42	210 ± 42*
Triglyceride (mg/dl)	155 ± 117	137 ± 97*
HDL cholesterol (mg/dl)	46.6 ± 13.2	50.9 ± 15.0*
Systolic blood pressure (mm Hg)	117 ± 16	114 ± 14*
Diastolic blood pressure (mm Hg)	73 ± 9	71 ± 9*
All-cause mortality/1,000 person years	5.26	3.80*
Cardiovascular mortality/1,000 person years ^b	1.78	1.37

^a WHO criteria [17].^b ICDA-9 codes 390-459.* *P* < 0.05.

Considerable variability in mortality exists within the Mexican American population according to migrant status and socioeconomic status. For example, the age- and sex-adjusted mortality for U.S.-born Mexican Americans in the San Antonio Heart Study was 5.7 per 1,000 person years, which was statistically greater than for non-Hispanic whites, whose mortality was only 3.8 per 1,000 person years (*P* < 0.05) (Table 4). However, the mortality rate for Mexican Americans born in Mexico was 3.6 per 1,000 person years, which is similar to the mortality of non-Hispanics [20]. This low mortality of Mexican immigrants is observed despite the fact that they had the lowest socioeconomic status of all three groups (Table 4). Also shown in Table 4 is the fact that Mexico-born Mexican Americans had a higher prevalence of diabetes than non-Hispanic whites, although

it was still lower than in U.S.-born Mexican Americans. The rates of self-reported cancer and gallbladder disease among Mexico-born Mexican Americans were also intermediate between the other two groups, whereas immigrants had the lowest rates of heart attack and stroke. Smoking rates were similar in all three groups, but immigrant smokers smoked the fewest number of cigarettes per day. Immigrants used less alcohol than the other two groups, but this difference was not statistically significant. Obesity, as assessed by body mass index, was similar among foreign-born and U.S.-born Mexican Americans and, in both groups, significantly higher than among non-Hispanic whites.

Overall, the patterns of risk factors and health-related behaviors do not provide a definitive explanation for the low total mortality among Mexican American immigrants in our studies. One possible explanation is that there is a "healthy migrant" effect, analogous to the "healthy worker" effect, whereby individuals who elect to migrate to another country tend to be, on average, healthier than the overall population from which they are drawn. Alternatively, immigrants may have been exposed to relatively "protective" environments for variable periods of time prior to immigrating.

Few studies of Hispanic mortality based on vital statistics have distinguished between immigrants and U.S.-born. Thus, in addition to underascertainment of Hispanic deaths, the low mortality reported among Hispanics may also reflect the relatively favorable mortality experience of an unknown proportion of immigrants

TABLE 3

Effect of Risk Factors on Cardiovascular Mortality in Mexican Americans and Non-Hispanic Whites [16]

	Relative risk ^a (95% confidence interval)	
	Mexican American	non-Hispanic white
Total cholesterol >240 mg/dl	2.0 (0.9-4.4)	2.0 (0.7-5.7)
Hypertension	2.7 (1.3-5.6)	1.0 (0.3-3.1)
Current smoking	2.2 (1.1-4.4)	2.2 (0.8-6.0)
Diabetes	4.4 (2.1-9.2)	1.8 (0.5-6.5)
One or more of the above	3.5 (1.2-10.1)	2.1 (0.6-7.3)

^a Adjusted for age and sex.

TABLE 4

Baseline Risk Factors among U.S.-Born and Mexico-Born Mexican Americans and Non-Hispanic Whites: San Antonio Heart Study [20]

	Mexican Americans		Non-Hispanic whites
	U.S.-born	Mexico-born	
Age (years)	43.2 ± 11.5	42.8 ± 10.7	45.8 ± 12.0**.*
Monthly income (\$)	1125	875*	1750**.*
Years of education	10.3 ± 4.1	7.5 ± 4.5*	13.5 ± 2.7**.*
Percentage diabetic ^a	14.3	10.3*	7.1**
Percentage with self-reported			
Heart attack	2.8	1.2	3.9**.*
Stroke	1.7	1.0	1.8
Cancer	1.6	2.3	7.2**.*
Gallbladder disease	13.6	8.0*	7.3**
Percentage current cigarette smokers	30.8	30.4	31.6
Cigarettes smoked/day among smokers	12.0 ± 10.6	9.5 ± 7.5*	23.3 ± 13.2**.*
Alcohol use (g/day)	56.7 ± 138.3	46.5 ± 115.2	56.4 ± 103.9
Body mass index (kg/m ²)	28.7 ± 5.8	28.3 ± 5.4	26.0 ± 5.4**.*
Cholesterol (mg/dl)	205 ± 42	201 ± 39	210 ± 42**.*
Triglyceride (mg/dl)	157 ± 120	146 ± 101*	138 ± 98**
Systolic blood pressure (mm Hg)	118 ± 16	116 ± 15	114 ± 14**.*
Diastolic blood pressure (mm Hg)	73 ± 10	72 ± 9*	71 ± 9**
All cause mortality/1,000 person years	5.7	3.6	3.8**

^a WHO criteria [17].* Difference between foreign-born and U.S.-born Mexican Americans statistically significant, $P < 0.05$.** Difference between U.S.-born Mexican Americans and non-Hispanic whites statistically significant, $P < 0.05$.*** Difference between foreign-born Mexican Americans and non-Hispanic whites statistically significant, $P < 0.05$.

included within the overall Hispanic mortality statistics. One study based on vital statistics data that did distinguish between foreign-born and U.S.-born Hispanics was the National Longitudinal Mortality Study [9]. This study also found a lower mortality among immigrants.

Using the Cox proportional hazards model, the age- and sex-adjusted relative risk of death among U.S.-born Mexican Americans compared with non-Hispanic whites was 1.5 (95% confidence interval 1.0–2.2) [20]. This excess risk disappeared when the model was further adjusted for socioeconomic status as measured by the Duncan Socioeconomic Index [21] (relative risk 1.0; 95% confidence interval 0.7–1.6). In contrast, socioeconomic status did not explain the mortality difference between U.S.-born and foreign-born Mexican Americans [20]. The age- and sex-adjusted relative risk of 1.6 (95% confidence interval 0.8–3.0) increased to 1.9 (95% confidence interval 1.0–3.5) after adjustment for Duncan Socioeconomic Index.

In summary, the supposed low all-cause and cardiovascular mortality among Mexican Americans and other Hispanic groups reported in the literature is based entirely on vital statistics data that may be flawed by underascertainment of Hispanic deaths. Cohort data, admittedly limited at the present time, suggest the opposite, namely, higher all-cause and cardiovascular mortality among Mexican Americans. There is also evidence that Mexican Americans have higher rates of hospitalization for acute myocardial infarction

and higher case fatality rates for this condition. It is also important to distinguish between U.S.-born Mexican Americans and immigrants. The latter have lower mortality despite being of lower socioeconomic status than U.S.-born Mexican Americans, which may be due to a "healthy migrant" effect and/or a residual protective effect from early exposure to traditional lifestyles.

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