Risk factors for cardiovascular disease among Mexican-American adults in the United States and Mexico: a comparative study

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Morales LS, Flores YN, Leng M, Sportiche N, Gallegos-Carrillo K, Salmerón J. Risk factors for cardiovascular disease among Mexican-American adults in the United States and Mexico: a comparative study. Salud Publica Mex 2014;56: xx-xx.

Abstract

Objective. To compare cardiovascular disease (CVD) risk factors in a cohort of Mexican health workers with representative samples of US- born and Mexican-born Mexican-Americans living in the US. **Materials and methods**. Data were obtained from the Mexican Health Worker Cohort Study (MHWCS) in Mexico and the National Health and Nutrition Examination Survey (NHANES) IV 1999-2006 in the US. Regression analyses were used to investigate CVD risk factors. **Results**. In adjusted analyses, NHANES participants were more likely than MHWCS participants to have hypertension, high total cholesterol, diabetes, obesity, and abdominal obesity, and were less likely to have low HDL cholesterol and smoke. Less-educated men and women were more likely to have low HDL cholesterol, obesity, and abdominal obesity. **Conclusions**. In this binational study, men and women enrolled in the MHWCS appear to have fewer CVD risk factors than US-born and Mexico-born Mexican-American men and women living in the US.

Key words: cardiovascular diseases; risk factors; Hispanic Americans; acculturation; Mexico

Morales LS, Flores YN, Leng M, Sportiche N, Gallegos-Carrillo K, Salmerón J. Factores de riesgo de enfermedad cardiovascular en adultos mexicano-estadunidenses en Estados Unidos y México: un estudio comparativo. Salud Publica Mex 2014;56: xx-xx.

Resumen

Objetivo. Comparar factores de riesgo de enfermedad cardiovascular (ECV) en una cohorte de trabajadores en México, con muestras representativas de Mexicano-Estadunidenses nacidos en EU y en México. **Material y métodos**. Los datos se obtuvieron del Estudio de Cohorte de Trabajadores de la Salud (ECTS) en México y de la Encuesta Nacional de Salud y Nutrición (NHANES) IV 1999-2006 en EU. Se realizaron análisis de regresión para determinar los factores de riesgo de ECV. **Resultados**. Los análisis ajustados muestran que los participantes del NHANES fueron más propensos a presentar hipertensión, colesterol total alto, diabetes, obesidad y obesidad abdominal, que los participantes del ECTS, y menos propensos a tener colesterol HDL bajo y a fumar. Los participantes con menor educación fueron más propensos a tener niveles bajos de colesterol HDL, obesidad, y obesidad abdominal. **Conclusiones**. En este estudio binacional, los participantes del ECTS tienen menos factores de riesgo de ECV que los Mexicano-Estadunidenses nacidos en EU y México que viven en Estados Unidos.

Palabras clave: enfermedades cardiovasculares; factores de riesgo; hispanoamericanos; aculturación; México

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Received on: July 19, 2013 • **Accepted on:** January 9, 2014
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Heart disease is the leading cause of death in the United States (US), accounting for 261 deaths per 100 000 men and 273 deaths per 100 000 women, and representing 33% of total mortality in 2007.[1] Among Hispanics, heart disease is also the leading cause of death, representing 29% of all mortality and accounting for 192.4 deaths per 100 000 men and 129.1 deaths per 100 000 women in 2007.[1] Heart disease mortality in the US has declined 66% from 1950 to 2000; down from 1 446 deaths per 100 000 in 1950 to 777 deaths per 100 000 in 2000.[2] This decline can be attributed in part to reductions in certain cardiovascular risk factors, including lower total cholesterol and smoking in the general population.[3] Conversely, other risk factors such as obesity and diabetes have increased during this time.[4,5]

In Mexico, coronary heart disease has increased 90% since 1970.[6,7] In 2008, heart disease was the second cause of death, accounting for 59.7 deaths per 100 000 men and 47.9 deaths per 100 000 women.[8,9] Deaths due to heart disease represented more than 17% of all deaths in Mexico in 2008.[10] At least one risk factor for cardiovascular disease (CVD) (smoking, obesity, hypertension, diabetes or hypercholesterolemia) has been observed in 60.5% of the adult population in Mexico.[11] At the Mexican Institute of Social Security (*Instituto Mexicano del Seguro Social*, IMSS), the prevalence of coronary artery disease has increased from the third most important disease in 1995 to the second in 2000.[12] A study of the IMSS population found that the most prevalent CVD risk factor in men was smoking (31.9%), whereas in women it was obesity (26.6%) and, within it, abdominal obesity (49.7%).[13]

The increasing rates of CVD in the US and Mexico have been attributed to the escalating prevalence of risk factors such as hypertension,[13-15] high cholesterol levels,[13,15,16] low HDL cholesterol,[15] obesity,[13,15] diabetes mellitus,[13,15,17] abdominal obesity,[13] and smoking.[13,15] Since 1993, the prevalence of type 2 diabetes among Mexican adults has risen from 6.7 to 14.4%, hypertension has increased from 24 to 30%, and hypercholesterolemia from 27 to 44%.[18] Studies have also found that acculturation is associated with increases in established cardiovascular risk factors[19-22] as well as with some indicators of pre-clinical CVD such as coronary calcifications.[23]

For this study, we compared the prevalence of CVD risk factors in a cohort of health workers in Mexico with representative US samples of Mexican-Americans born in the US and in Mexico. We hypothesized that US Mexican-Americans would be at greater risk for CVD than members of the Mexican health worker cohort. Our hypothesis is motivated by studies suggesting that less acculturated and immigrant Mexican-Americans have better health outcomes than their more acculturated and US-born counterparts.[24-27]

Materials and methods

Data sources

Data for Mexican residents was obtained from the Mexican Health Worker Cohort Study (MHWCS), a longitudinal study that began in 1998. The MHWCS is prospectively evaluating the effect of lifestyle factors on the incidence of chronic diseases, including heart disease, diabetes, and liver disease, among others. Participants in the MHWCS include employees of the IMSS and the National Institute of Public Health (*Instituto Nacional de Salud Pública*, INSP), both located in Cuernavaca, Morelos, as well as employees of the Universidad Autónoma del Estado de México, located in Toluca, Mexico. From 2004-2006, approximately 9 000 workers enrolled in the MHWCS. All participants provided informed consent prior to completing a series of self-reported questionnaires, physical examinations and laboratory tests. Additional details about the design and methods of the MHWCS are described elsewhere.[28-30] The anthropometric and clinical procedures are consistent with those used in the National Health and Nutrition Examination Survey (NHANES).[31] The MHWCS and this binational study were both approved by the IMSS Ethics Committee.

Data for US Mexican-Americans came from the NHANES, a continuous cross-sectional examination survey of the US population that provides national estimates of nutritional, infectious, environmental, and chronic health conditions. Health data were collected using standardized questionnaires administered in the participants' homes and by physical examinations and laboratory tests conducted at mobile examination centers. NHANES began in April 1999 and has been administered to approximately 5 000 individuals per year. This study uses data from the NHANES IV samples collected between 1999 and 2006. The design of NHANES is described in detail elsewhere.[32]

Mexican and US study samples

The MHWCS sample was limited to participants 20 years of age and older who were born in Mexico. Of the 8 890 participants in the MHWCS sample with questionnaire and laboratory data, 192 women were excluded because they were pregnant or breastfeeding at the time of the survey. An additional 48 individuals were excluded because they were not born in Mexico, and 271 were excluded because they did not report a place of birth. The final sample consisted of 8 379 men and women 20 years and older who were born in Mexico with complete questionnaire and laboratory data. All

MHWCS participants had medical insurance coverage at the time they enrolled in the study.

The 1999-2006 NHANES IV sample was limited to Mexican-American participants 20 years of age and older, who were born in the US or Mexico, and had medical insurance. Females who were pregnant at the time of data collection were excluded. Of the 2 459 individuals in our NHANES IV study sample who completed the home questionnaires, 2 336 also underwent physical examinations including laboratory studies. Of those individuals who had laboratory studies, only 1 004 had fasting samples.

Our final sample of 10 838 consisted of 8 379 Mexican subjects who currently reside in Mexico, 1 322 US-born Mexican-Americans who live in the US, and 1 137 Mexican-Americans who were born in Mexico and now live in the US.

Definitions of cardiovascular disease risk factors

Hypertension: Hypertension was identified by a report of taking medicine for hypertension and/or a systolic blood pressure result ≥140 and/or a diastolic blood pressure result ≥90 for males and females.[33]
High Total Cholesterol: Following NCEP/ATPIII recommendations, high total cholesterol was defined as ≥200 mg/dL for males and females.[34]
Low High Density Lipoprotein-Cholesterol (HDL-C): Following NCEP/ATPIII recommendations low HDL-C was defined by <40 mg/dL for males and females.[34]
Diabetes: Type 2 diabetes in men and women was defined as having one of the following: a medical history of diabetes (other than during pregnancy), currently taking medication for diabetes, a plasma glucose level >125 mg/dL after more than 8 hour of fasting, or a random glucose test >200 mg/dL.[35]
Obesity: Subjects were categorized according to body mass index (BMI) following the recommendations of the National Heart, Lung and Blood Institute: normal (BMI 18.5–24.9 kg/m^2), overweight (BMI 25.0–29.9 kg/m^2), and obese (BMI ≥30.0 kg/m^2).
Abdominal obesity: Abdominal obesity was defined as a waist circumference >102 cm for males and a waist circumference >88 cm for females.[36,37]
Current smoking: Current cigarette smoking was defined as having smoked at least 100 cigarettes during their lifetimes and currently smoking at least one cigarette.[37]

Definition of independent variables

The main independent variable in this study classified individuals by birthplace and country of residence. All individuals in the MHWCS represent Mexicans who were born and currently live in Mexico. Individuals from the NHANES IV sample were sub-classified according to birthplace (US-born versus Mexico-born).

Other independent variables included age (20 to 44 years, 45 to 60 years, and 61 years or more), sex (male versus female), marital status (single/never married, married/living with someone, and divorced/separated/widowed), and completed education level (less than high school, completed high school, and more than high school). Approximately 15% of the subjects in MHWCS sample had missing education data, which was imputed using a three step procedure. There was no missing data for the other independent variables.

Statistical analysis

Descriptive analyses of all study variables were performed. Age-adjusted prevalence rates and means were calculated for each CVD risk factor stratified by sex and country of birth/residence. Separate multiple logistic regression models were estimated for males and females, to evaluate the independent associations of each cardiovascular disease risk factor to country of birth/residence, age, marital status, and education. The data analysis for this paper was generated using SAS software, Version 9 for Windows, and STATA 10.

Results

Sample characteristics

Table I presents the sociodemographic characteristics of the study sample. Most of the MHWCS subjects are between the ages of 22-44 (51.5%) and 45-59 years (32.7%). A greater proportion of the NHANES IV subjects are age 60 or older (46.6% and 41.3% for US-born and Mexico-born subjects, respectively) as compared to 15.8% of the MHWCS. Approximately half of the NHANES IV subjects and nearly 70% of the MHWCS participants are female. The majority of both the US and Mexico subjects are currently married or were previously married. More than half of the MHWCS subjects have an education beyond high school, while 40.8% of the US-born and 72.6% of the Mexico-born NHANES IV subjects did not complete high school.

Cardiovascular disease risk factors

Table II shows the age-adjusted means and prevalence rates of cardiovascular disease risk factors for males and females. There is a higher prevalence of hypertension, high cholesterol, diabetes, obesity, and abdominal obe-

Table I

Sociodemographic characteristics of the study sample.

	Mexico cohort % *[n]*	*Mexico-born* % *[n]*	*US-born Mexican-Americans* % *[n]*
Total sample sizes	77.3 [8379]	10.5 [1137]	12.2 [1322]
Age (years)			
20-44	51.5 [4312]	40.6 [462]	35.0 [462]
45-59	32.7 [2740]	18.0 [205]	18.5 [244]
60+	15.8 [1327]	41.3 [470]	46.6 [616]
Gender			
Males	30.7 [2573]	52.6 [598]	46.6 [616]
Females	69.3 [5806]	47.4 [539]	53.4 [706]
Marital status			
Never married/single	6.3 [526]	7.8 [89]	11.9 [157]
Married/living together	61.6 [5161]	74.1 [843]	66.8 [883]
Divorced/separated/widowed	32.1 [2692]	18.0 [205]	21.3 [282]
Education			
Less than High School	35.2 [2921]	72.6 [825]	40.8 [539]
High School graduate	13.0 [1078]	11.9 [1078]	22.2 [293]
More than High School	51.9 [4297]	15.6 [177]	37.1 [490]

Table II

Age-adjusted means and prevalence of cardiovascular disease risk factors

	Males			*Females*		
Mexico cohort	*NHANES IV (REF)*	*NHANES IV Mexico-born*	*Mexico cohort US-born*	*NHANES IV (REF)*	*NHANES IV Mexico-born*	*Mexico cohort*
Hypertension,* %	23 (15,35)	27 (24,32)	32 (28,36)	17 (14,21)	30 (26,33)‡	34 (30,39)‡
Diastolic blood pressure (mm/Hg), mean	74.9 (68.8,81.1)	71.7 (70.4-,73.0)	73.2 (71.8,74.6)	70.9 (68.6,73.2)	69 (67.7,70.3)	70.5 (69.4,71.6)
Systolic blood pressure (mm/Hg), mean	125.0 (117.0,133.0)	124.9 (123.6,126.1)	126.2 (124.2,128.2)	116.3 (112.8,119.9)	124.3 (122.2,126.4)‡	124.7 (122.5,126.8)‡
High total cholesterol§ (mg/dL), %	43 (40,46)	55 (50,59)‡	45 (39,51)	40 (39,42)	47 (42,52)#	45 (41,49)#
Total cholesterol (mg/dL), mean	196.2 (193.3,199.1)	206.3 (202.2,210.4)‡	198.5 (193.9,203.0)	193.8 (192.1,195.6)	197.8 (193.8,201.8)	198 (195.2,200.8)#
Low HDL cholesterol& (HDL<40), %	66 (52,77)	34 (30,38)‡	28 (23,33)‡	84 (73,90)	43 (39,48)‡	42 (37,47)‡
HDL cholesterol (mg/dL), mean	37 (34.0,39.9)	45.7 (44.8,46.7)‡	46.6 (45.1,48.1)‡	39.8 (36.1,43.6)	53.3 (51.9,54.6)‡	55.3 (53.8,56.7)‡
LDL cholesterol (mg/dL), mean	159.4 (158.1,160.7)	160.6 (156.0,165.1)	151.8 (146.9,156.7)‡	154 (150.6,157.4)	144.6 (140.6,148.6)‡	142.7 (139.5,146.0)‡
Diabetic,ᵠ %	9 (8,10)	15 (10,21)#	19 (14,25)‡	9 (8,10)	14 (9,21)	15 (11,19)‡
Obesity (BMI ≥ 30),∞ %	18 (16,20)	26 (23,29)‡	38 (34,42)‡	21 (18,23)	35 (30,40)‡	41 (36,46)‡
BMI (kg/m2), mean	26.9 (26.7,27.1)	27.8 (27.4,28.1)‡	29.2 (28.6,29.7)‡	26.7 (26.6,26.9)	28.8 (28.2,29.4)‡	29.4 (28.7,30.0)‡
Abdominal obesity,ø %	17 (11,27)	32 (28,36)‡	46 (41,50)‡	54 (48,60)	67 (61,72)‡	67 (62,72)‡
Waist circumference (cm), mean	93.8 (90.8,96.8)	97.6 (96.6,98.5)#	101.6 (100.2,102.9)‡	91.1 (89.1,93.0)	94.6 (93.0,96.2)‡	95.3 (93.9,96.6)‡
Current smoker,◊ %	26 (25,27)	23 (19,27)	24 (20,29)	19 (17,20)	11 (8,14)‡	14 (11,18)#

* Hypertension was defined as taking medicine for hypertension, and/or a systolic blood pressure result ≥140 mm/Hg, and/or a diastolic blood pressure result ≥90 mm/Hg for men and women

‡ *p* value is significant at the 0.01 level

§ High total cholesterol was defined as >200 mg/dL for men and women

\# p value is significant at the 0.05 level

& Low High Density Lipoprotein-Cholesterol (HDL-C) was defined as < 40 mg/dL for males and females

ᵠ Diabetes was defined as having a plasma glucose level >125 mg/dL after a more than 8 hour fast, and/or a medical history of diabetes, and/or currently taking medication for diabetes, and/or a random glucose test >200 mg/dL

∞ Obesity was defined as having a body mass index (BMI) of ≥30.0 kg/m2

ø Abdominal obesity was defined as having a waist circumference >102 cm for males, and a waist circumference >88 cm for females

◊ Current cigarette smoking was defined as having smoked at least 100 cigarettes and being a current smoker

sity among the NHANES IV participants than among the MHWCS subjects. The prevalence of low HDL and smoking is lower among the US-born and Mexico-born NHANES IV subjects than among the MHWCS participants. These findings were confirmed by a gender and age-stratified analysis (data not shown).

Mexican males had lower rates of high cholesterol (43%) than Mexico-born Mexican-American males (55%), with mean total cholesterol levels of 196.2 mg/dL vs. 206.3 mg/dL, respectively. The prevalence of diabetes was 9% among Mexican males compared with 15 and 19% among the Mexico and US-born NHANES participants, respectively. The proportion of obesity among Mexican males is 18%, as compared to 26 and 38% among Mexican- and US-born NHANES subjects, respectively. Mexican males had a lower prevalence of abdominal obesity (17%) than Mexican- and US-born Mexican-American males (32 and 46%, respectively), with a mean waist circumferences of 93.8 cm vs. 97.6 cm and 101.6 cm, respectively. The prevalence of low HDL cholesterol was lower among Mexican- and US-born Mexican-American males than among Mexican males. The prevalence of hypertension was lower among females in Mexico than among Mexican- and US-born Mexican-American females. Mexican females also had a lower prevalence of high cholesterol than Mexican- and US-born Mexican-American females. The proportion of diabetes was 9% among Mexican females compared to 15% among US-born Mexican-American females. The prevalence of obesity among Mexican females was 21% compared to 35 and 41% among the Mexican- and US-born NHANES subjects, respectively. Abdominal obesity is less prevalent among females in Mexico, than among Mexican- and US-born Mexican-American females, with a mean waist circumference of 91.1 cm vs. 94.6 cm and 95.3 cm, respectively. The prevalence of low HDL cholesterol is lower among Mexico-born and US-born Mexican-American females, than among Mexican females. Mexico-born and US-born Mexican-American females are also less likely to smoke than Mexican females (table II).

Multivariate analysis

After controlling for age, marital status and education level, Mexican- and US-born Mexican American males were more likely to have hypertension, high cholesterol, diabetes, obesity, and abdominal obesity than Mexican males. Mexican- and US-born Mexican American males were less likely to have low HDL cholesterol and to smoke than Mexican males. Mexican males in the US and Mexico aged 60 and older were less likely to smoke, but had greater odds of having hypertension, high cholesterol, low HDL cholesterol, diabetes, and abdominal obesity than males between the ages of 20 and 44 years. Males who had never been married or were divorced/separated/widowed had lower odds of having hypertension. Males with less than a high school education had higher odds of low HDL cholesterol, obesity, abdominal obesity, and smoking than males with more than a high school education (table III).

After adjusting for the aforementioned covariates, Mexican- and US-born Mexican-American women were more likely to have hypertension, high cholesterol, diabetes, obesity, and abdominal obesity than their counterparts in Mexico. The odds of smoking and having low HDL cholesterol were lower among Mexican- and US-born Mexican American females than among females in Mexico. Women aged 60 and older in both Mexico and the US were less likely to smoke, but had higher odds of hypertension, high cholesterol, low HDL cholesterol, diabetes, obesity, and abdominal obesity than females between 20-44 years. Mexican females in both the US and Mexico who did not complete high school had greater odds of having hypertension, low HDL cholesterol, diabetes, obesity, and abdominal obesity (table IV).

Discussion

Our results suggest that the MHWCS participants have fewer CVD risk factors than their Mexican- and US-born counterparts living in the US. Mexican-born males living in the US had higher rates of high total cholesterol, diabetes, and obesity; and US-born Mexican-American men had higher rates of diabetes and obesity than their counterparts in Mexico. Among females we found similar trends, with higher rates of hypertension, high total cholesterol, and obesity among Mexican-born and US-born females living in the US, as compared to females in Mexico. The direction of these trends did not change significantly after adjusting by education and marital status, or in the gender and age stratified analyses.

Not all risk factors, however, were more favorable in the Mexico cohort. Rates of low HDL (<40 mg/dL) were higher in the Mexican cohort than among Mexican-born or US-born NHANES participants. Smoking rates were also higher among women in the Mexican cohort than in either group living in the US. The explanation for the high rates of low HDL in the Mexican cohort is unclear but warrants further exploration. Differences in dietary and/or physical activity habits between the US and Mexico may be important factors.[38] Lower smoking rates in the US may be attributable to the strong anti-smoking policies, particularly in California, where a large proportion of Mexican-Americans live.

Table III

Odds ratios and 95% confidence intervals for cardiovascular disease risk factors among males, by country of birth/residence, age, marital status and education

	*Hypertension**	*High cholesterol‡*	*Low HDL-C§*	*Diabetes#*	*Obesity&*	*Abdominal obesity≠*	*Current smoking∞*
Nationality/birthplace							
MHWCS (Mexico)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NHANES Mexico-born	1.6 [1.2-1.9]ø	1.8 [1.4-2.2]ø	0.2 [0.2-0.3]ø	3.2 [2.3-4.5]ø	1.4 [1.1-1.7]ø	1.4 [1.1-1.7]ø	0.7 [0.6-0.9]ø
NHANES US-born	2.1 [1.7-2.6]ø	1.1 [0.9-1.3]	0.2 [0.2-0.3]ø	3.7 [2.7-5.0]ø	2.7 [2.1-3.3]ø	2.7 [2.1-3.3]ø	0.9 [0.7-1.1]
Age							
20-44	1.00	1.00	1.00	1.00	1.00	1.00	1.00
45-59	2.5 [2.0-3.1]ø	1.6 [1.4-1.9]ø	1.1 [0.9-1.2]	5.6 [3.9-8.1]ø	1.2 [0.9-1.5]	1.4 [1.1-1.7]ø	0.9 [0.8-1.1]
60+	5.8 [4.7-7.2]ø	1.3 [1.1-1.5]ø	1.6 [1.3-1.9]ø	10.1 [7.0-14.6]ø	0.7 [0.6-0.9]	1.7 [1.4-2.2]ø	0.4 [0.4-0.6]ø
Marital status							
Married/living together	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Never married	0.6 [0.4-0.9]ø	0.7 [0.5-1.01]	0.9 [0.6-1.3]	0.7 [0.4-1.4]	0.8 [0.6-1.2]	0.7 [0.4-0.9]	1.2 [0.8-1.7]
Divorced/separated/widowed	0.7 [0.6- 0.9]ø	0.8 [0.6-0.9]ø	0.9 [0.8-1.2]	0.9 [0.7-1.3]	0.7 [0.6-0.9]	0.8 [0.7-1.1]	1.2 [1.0-1.4]
Education							
More than High School	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High School graduate	0.8 [0.6-1.1]	0.9 [0.7-1.1]	1.4 [1.1-1.8]ø	0.8 [0.6-1.3]	1.3 [1.0-1.7]ø	1.3 [0.9-1.6]	1.2 [0.9-1.5]
Less than High School	0.9 [0.8-1.2]	0.8 [0.7-0.9]ø	1.3 [1.1-1.5]ø	0.9 [0.7-1.2]	1.4 [1.2-1.7]ø	1.3 [1.1-1.6]ø	1.7 [1.5-2.1]ø

Notes. Regressions include country of birth/residence, age, marital status and education

* Hypertension was defined as taking medicine for hypertension, and/or a systolic blood pressure result ≥140 mm/Hg, and/or a diastolic blood pressure result of ≥90 mm/Hg for men and women

‡ High total cholesterol was defined as >200 mg/dL for men and women

§ Low High Density Lipoprotein-Cholesterol (HDL-C) was defined as < 40 mg/dL for males and females

Diabetes was defined as having a plasma glucose level >125 mg/dL after a more than 8 hour fast, and/or a medical history of diabetes, and/or currently taking medication for diabetes, and/or a random glucose test >200 mg/dL

& Obesity was defined as having a body mass index (BMI) of ≥30.0 kg/m2

≠ Abdominal obesity was defined as having a waist circumference >102 cm for males, and a waist circumference >88 cm for females

∞ Current cigarette smoking was defined as having smoked at least 100 cigarettes and being a current smoker

ø *P*< 0.05 for test of null hypothesis that rate is equal to rate in reference category

Our findings are consistent with the hypothesis that Mexicans are at lower risk for CVD than their more acculturated counterparts living in the US, and suggest that CVD risk factors may increase among Mexican immigrants and their descendants. Previous studies have linked acculturation to US society with higher rates of adverse behavioral risk factors, including the adoption of less heart-healthy diets[38,39] as well as with higher rates of psychological distress.[40] However, the effects of the acculturation processes on cardiovascular health among Mexican-Americans is still unclear and is an area of ongoing investigation.[41,42]

This study has some limitations. First, participants in the MHWCS are volunteer health workers, who are younger, more educated, and are mostly women who are not representative of the Mexican population. Additionally, the prevalence of diabetes reported in the 2006 ENSANUT was 14.4%,[43] while the prevalence of diabetes among the MHWCS was 9.8%. The prevalence of obesity was also higher among the ENSANUT population (29.4%)[44] as compared to the MHWCS participants (20.2%). However, the prevalence of high triglycerides (≥ 150 mg/dL) was greater among the MHWCS participants (44.0%) than in the ENSANUT population (31.5%).[45] The prevalence of high cholesterol (≥ 200 mg/dL) and low HDL cholesterol (< 40 mg/dL) was similar among both populations.[45] Because of the limited generalizability of our study's results, they should be viewed as exploratory and preliminary.

As in all observational studies, this study is also limited by our ability to control for confounding variables in the comparisons between the Mexico and US sam-

Table IV
Odds ratios and 95% confidence intervals for cardiovascular disease risk factors among females, by country of birth/residence, age, marital status and education

	*Hypertension**	*High cholesterol*‡	*Low HDL-C*§	*Diabetes*#	*Obesity*&	*Abdominal obesity*≠	*Current smoking*∞
Country of birth/residence							
MHWCS (Mexico)	1.00	1.00	1.00	1.00	1.00	1.00	1.00
NHANES Mexico-born	2.9 [1.3-3.6]º	1.4 [1.2-1.7]º	0.1 [0.1-0.2]º	3.9 [2.9-5.3]º	2.1 [1.7-2.6]º	1.5 [1.2-1.9]º	0.5 [0.3-0.6]º
NHANES US-born	3.6 [3.0-4.4]º	1.3 [1.1-1.6]º	0.1 [0.1-0.2]º	3.9 [2.9-5.0]º	2.6 [2.2-3.1]º	1.6 [1.3-1.9]º	0.7 [0.6-0.9]º
Age							
20-44	1.00	1.00	1.00	1.00	1.00	1.00	1.00
45-59	5.3 [4.4-6.4]º	3.3 [2.9-3.7]º	0.9 [0.7-0.9]º	5.3 [4.0-6.9]º	1.8 [1.6-2.1]º	2.4 [2.1-2.7]º	1.1 [0.9-1.2]
60+	12.1 [9.9-14.8]º	3.5 [3.0-4.1]º	0.9 [0.8-1.1]	9.5 [7.1-12.7]º	1.3 [1.1-1.5]º	4.9 [4.2-5.8]º	0.5 [0.4-0.6]º
Marital status							
Married/living together	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Never married	1.1 [0.9-1.4]	1.0 [0.8-1.2]	0.8 [0.7-1.0]	1.1 [0.8-1.4]	1.1 [0.9-1.3]	1.3 [1.1-1.7]º	1.0 [0.8-1.3]
Divorced/separated/widowed	1.2 [0.9-1.2]	0.9 [0.8-0.9]º	1.0 [0.9-1.2]	0.9 [0.8-1.2]	0.9 [0.8-0.9]	0.8 [0.7-0.9]º	1.1 [0.9-1.3]
Education							
More than High School	1.00	1.00	1.00	1.00	1.00	1.00	1.00
High School graduate	1.2 [0.9-1.5]	0.9 [0.8-1.0]	1.4 [1.2-1.7]º	1.0 [0.7-1.4]	0.9 [0.8-1.1]	1.1 [0.9-1.2]	1.2 [0.9-1.4]
Less than High School	1.2 [1.1-1.4]º	0.9 [0.9-1.1]	1.7 [1.4-1.9]º	1.4 [1.1-1.7]º	1.5 [1.3-1.7]º	1.7 [1.5-1.9]º	1.0 [0.9-1.2]

Notes. Regressions include country of birth/residence, age, marital status and education

* Hypertension was defined as taking medicine for hypertension, and/or a systolic blood pressure result ≥140 mm/Hg, and/or a diastolic blood pressure result of ≥90 mm/Hg for men and women
‡ High total cholesterol was defined as >200 mg/dL for men and women
§ Low High Density Lipoprotein-Cholesterol (HDL-C) was defined as < 40 mg/dL for males and females
# Diabetes was defined as having a plasma glucose level >125 mg/dL after a more than 8 hour fast, and/or a medical history of diabetes, and/or currently taking medication for diabetes, and/or a random glucose test >200 mg/dL
& Obesity was defined as having a body mass index (BMI) of ≥30.0 kg/m2
≠ Abdominal obesity was defined as having a waist circumference >102 cm for males, and a waist circumference >88 cm for females
∞ Current cigarette smoking was defined as having smoked at least 100 cigarettes and being a current smoker
º *P*< 0.05 for test of null hypothesis that rate is equal to rate in reference category

ples of Mexican-Americans. To address confounding, we stratified all analyses by gender and controlled for age, educational attainment, and marital status in the regression analyses. We also limited the US sample to individuals with health insurance since all the MHWCS participants have health insurance. Our ability to control for potential confounding was limited by the available data and there may be other unobserved differences between the two samples that confound our results.

This study adds to the relatively scarce literature on binational research in the US and Mexico. To further investigate the cardiovascular health of the Mexican population in both countries, new binational primary data collection projects with representative samples and comparable demographic, socioeconomic and health status measures are needed.

Acknowledgements

This research was supported by a grant from CONACYT (SALUD-2002-C01-7876), the Programa de Investigación en Migración y Salud [PIMSA], and a grant from IMSS' Coordinación de Investigación en Salud (CIS). The authors also thank Oyuki Liviett Rueda and Paula Ramírez for providing statistical support.

Declaration of conflict of interests: The author declares not to have conflict of interests.

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