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Cardiovascular diseases mortality in Cuba, Mexico, Puerto Rico and US Hispanic populations

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Summary
Background: The large scale migration currently taking place from Latin-America to the United States has created a new era in public health. A systematic examination of patterns of cardiovascular mortality (CVD) for the major US Hispanic populations was carried out and a direct comparison to their respective countries/regions of origin was conducted to evaluate possible transitions in health with migration.
Methods: Vital statistics records from the US, Mexico, Cuba and Puerto Rico compiled by governmental agencies in each country during 2000 were used to estimate CVD age-adjusted mortality.
Results: Total age-adjusted CVD mortality for Mexican Americans, Cuban Americans and mainland Puerto Ricans was similar to non-Hispanic whites, and lower than among blacks. CVD rates in Mexico and on the island of Puerto Rico were likewise similar in magnitude, while these mortality rates were 20% higher in Cuba. Death from ischemic heart disease, on the other hand, was higher in non-Hispanic whites than Mexican Americans, Mexicans, Cuban Americans, but lower than Puerto Ricans, Cubans and US blacks. Stroke rates tended to be lower in US whites and all Hispanics and higher in Mexico and Cuba.

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Conclusions: These data suggest at most a very modest Hispanic advantage in CVD within the US at the present time and a substantial burden of both heart disease and stroke in the countries from which these individuals have immigrated. Further surveillance efforts will be required to determine whether the long-term trends for these populations are following the downward course observed in the US.

Introduction

Both coronary heart disease (CHD) and stroke have followed a path of sharp decline in many industrialized countries in recent decades [1,2]. A number of major public health challenges must still be met, however, before an equally effective prevention strategy can be implemented for all social strata. Within the US well recognized disparities persist in the burden from cardiovascular diseases (CVD) among various racial/ethnic sub-populations and substantial heterogeneity has been observed in the trends across geographic regions [2]. It has also become apparent in recent years that the true burden of CVD in growing immigrant populations from Mexico and other Spanish-speaking countries has not been adequately defined [3–7]. Improved surveillance and prevention for these high-risk populations is thus an important priority.

Hispanic populations are now the largest minority group in the US [8,9]. These populations themselves are highly internally heterogeneous in terms of their country of origin, average level of education and wealth, and cultural background [8–11]. According to the 2000 census, 33 million Latinos resided in the United States, representing 12.0% of the total US population. Of these individuals 22 million were of Mexican origin, 3 million were Puerto Rican, and 1.3 million were Cuban [8,9]. In the published vital statistics data both CVD and all cause mortality are substantially lower for all Hispanic groups compared to white and black [2,11]. Characterized as the ''Hispanic paradox'', this outcome is contrary to what would be expected for a population with a moderately high frequency of CVD risk factors and low average levels of education and income. In fact, considerable controversy exists regarding the accuracy of the vital statistics data [3–7,10,12–20]. While some national longitudinal cohort studies show a much reduced advantage for Hispanics, community surveys in the Southwest document higher rates of CVD in Mexican Americans [3,5,7,12–15]. Although different in character, numerous biases plague all of the various surveillance mechanisms that are currently in place, making it impossible to resolve this controversy at the present time. A synthesis of information derived from multiple sources is therefore likely to be required to obtain reliable estimates.

Additional insight into the public health status of the Hispanic population in the US can be obtained by describing the health situation in the country of origin. This approach could help focus information on the burden of disease and risk factor prevalence to develop efficient and culturally acceptable public health interventions. Unfortunately almost all prior surveillance research on CVD has been restricted to developed countries and the magnitude of the health burden from these disorders is only now being recognized in middle-income and poor countries [21–25]. The vital records systems in these countries are often weak and the long-term data required to monitor trends are especially limited [26]. These issues have not been thoroughly evaluated in the countries on the US borders that are the principal source of Hispanic migrants. As a result, we are faced not only with uncertainty about the extent to which US vital systems are accurately recording the mortality experience of Hispanics in this country but we cannot yet say with confidence that the data from the countries that are sending immigrants to the US would support direct comparisons.

The primary purpose of this study was therefore to use the vital records data to characterize the pattern of CVD in each of the countries of origin of the major US Hispanic groups and to compare these data to what is currently being recorded among the respective immigrant groups. First, we attempted to determine whether adequate data resources existed to permit a detailed comparison of the patterns of CVD mortality in Mexico, Cuba, Puerto Rico and related population groups in the US. Second, we wanted to examine whether or not these patterns were consistent with risk factor profiles and other public health information as the first step to characterize the transition in CVD health currently taking place as a result of the on-going Hispanic migration.

Materials and methods

Data sources

Initial efforts were made to obtain standardized mortality data from a single source. The only available data repository was provided by the Pan-American Health Organization (e.g., *Health in the Americas*), however, the data were presented in insufficient detail or for different calendar years. As a consequence we obtained data from the institutions responsible for vital records in each country and created our own data base. For consistency we calculated mortality rates for each country for the year 2000. Although not strictly speaking a CVD cause, deaths coded to diabetes were examined given its increasing impact of vascular outcomes. Rates were generated for the following categories coded as underlying cause according to designations in the *10th International Classification of Diseases* (*ICD*), for all countries except Cuba; for Cuba the equivalent ICD-9 codes were used:

Cause	ICD-10 codes	ICD-9 codes
All causes		
Total CVD	(I00—I99)	390—459
Heart disease (HD)	(I05—I51)	390—398, 402, 404, 410—429
Ischemic heart disease (IHD)	(I20—I25)	410—414, 429.2
Acute myocardial infarction (MI)	(I21)	410
Stroke	(I60—I69)	430—434, 436—438
Diabetes	(E10—E14)	250
Ill defined and unknown causes	(R95—R99)	798.0, 798.1—799.9

Deaths from ''ill defined and unknown causes'' were also collected to assure that the registration systems were assigning cause for a comparable proportion of deaths. In all instances this number was low, viz., as a percent of all deaths: US = 7%; Puerto Rico = 4%; Mexico = 7%; Cuba = 4%. Mortality rates were compiled in a data base at the Department of Preventive Medicine and Epidemiology at Loyola and analyzed in a uniform manner. The country-specific sources are provided below. Because of concerns about small numbers of events in young individuals and potential mis-statement of age we confined the analysis to persons in the age range 20—84. Data from each country were age-adjusted to the total US population using the direct method. Supplemental analyses were conducted for the US data using ''any mention'' of diabetes on the death certificate.

United States

Data on the number of deaths by cause and 5-year age groups were obtained on CD from the NCHS (National Center for Health Statistics), men and women separately. Codes on the death certificate designated race/ethnicity as non-Hispanic white, non-Hispanic black, Mexican American, Cuban American, and Puerto Rican; all other race/ethnic groups were ignored. For comparisons of US ethnic groups to a reference group and to assess differences in diabetes rates between Mexico and the US, the total US resident population was used. Among Puerto Ricans further sub-codes designated those with a permanent residence on the mainland (''Mainland Puerto Ricans'') and those with a permanent residence on the island (''Island Puerto Ricans''). Since US deaths are coded on the basis of place of residence, rather than occurrence, we did not have information on the number of persons who, for example, might have maintained a mainland address but retired to Puerto Rico and subsequently died. Data on the inclusive grouping of ''all Hispanics'', which included ''other — Central — South Americans'' in addition to the groups described above, were also provided for comparison. Population data were obtained from the US Census Bureau for 2000 and divided into the same categories as the death counts.

Mexico

Five-year age—sex—cause specific mortality rates and population counts were obtained directly from the website of INEGI (Instituto Nacional de Estadistica Geografica y Informatica; National Institute of Geographic and Statistical Information) for the year 2000.

Cuba

Counts of deaths and the population were obtained from MINSAP (*Ministerio de Salud Publica*; Ministry of Public Health) by one of the investigators (AS). These data also included counts of deaths and population in each of the designated cells.

Statistical analysis

Because the available data represented the entire population of interest, inferential statistics were not required in the comparisons among groups. When examining the age—gender related patterns, however, the data were fitted to regression models and compared across countries. Briefly, mortality

Table 1 Mortality rates per 100,000 population from cardiovascular diseases, US population groups, Cuba, Mexico and Puerto Rico, by gender, ages 20–84, 2000

	Total CVD (I00–I99)			Heart disease (I05–I52)			Ischemic heart disease (I20–I25)			Stroke (I60–I69)		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
US population groups												
NH Whites	278	310	251	220	254	188	161	195	136	44	40	50
Blacks	472	531	430	368	422	329	235	277	204	85	88	83
All Hispanic	235	264	206	182	209	156	159	163	113	43	43	42
Mexican-American	266	291	237	203	228	175	153	178	126	53	53	53
Cuban-American	234	272	199	196	228	166	153	181	127	30	33	27
Puerto Rican (mainland)	288	332	252	235	271	205	176	209	149	43	49	38
Mexico, Cuba, Puerto Rico, US												
Mexico	250	244	255	174	174	174	116	126	105	68	62	72
Cuba	329	336	318	215	230	197	167	182	149	92	86	97
Puerto Rico (island)	246	277	216	193	224	165	126	151	103	46	46	46
US		348	262		283	197		212	133		49	53

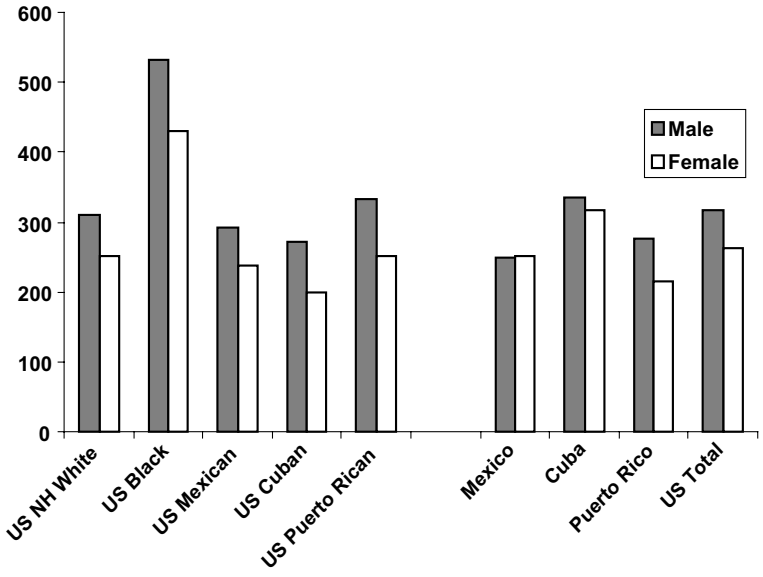

Figure 1 Mortality rates by gender from all cardiovascular diseases (ICD-10: I00–I99), among adults aged 20–84 in main US population groups, Cuba, Mexico and Puerto Rico.

rates were log transformed and regressed on a time period to assess how rapidly mortality was changing in each country. Parameter estimates were obtained using ordinary (unweighted) least squares (data not shown).

Results

Age-adjusted mortality rates for persons aged 20–84 for total CVD and the major sub-codes are presented in Table 1. Patterns of mortality for HD are determined primarily by IHD, and CVD is in turn weighted principally by HD, therefore the most informative contrasts among groups are provided by total CVD, HD and stroke; these data are presented graphically in Figs. 1–3. Total CVD and HD among US blacks exceed those of the reference total US population by 70–100%. Among the US groups, Puerto Ricans experienced the next highest rates, while Cuban Americans had the lowest. HD rates were higher in all Hispanic groups in the US relative to their country/region of origin, with the exception of Cubans; by contrast, death from

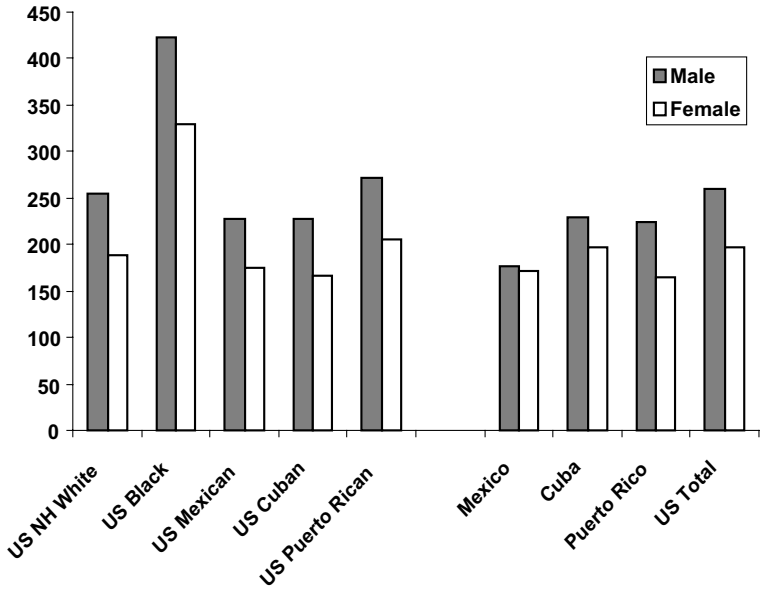

Figure 2 Mortality rates by gender from heart disease (ICD-10: I05—I52), among adults aged 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

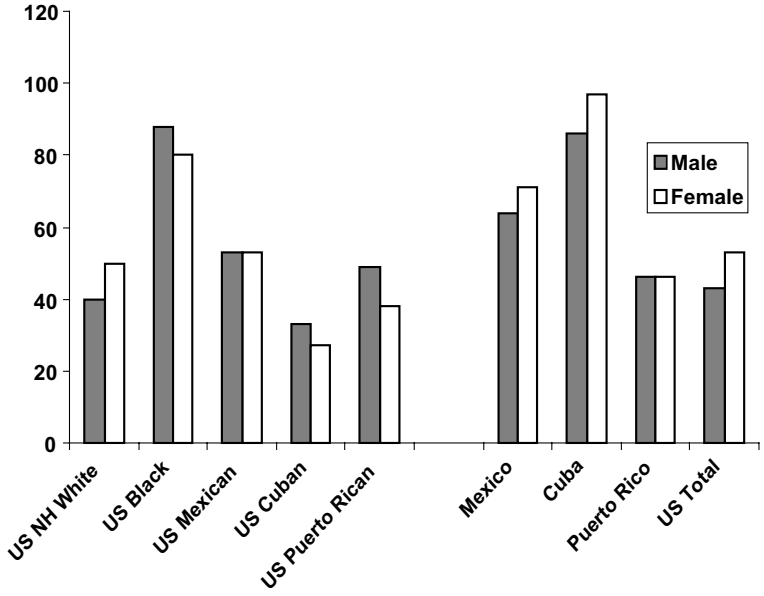

Figure 3 Mortality rates by gender from stroke (ICD-10: I60—I69), among adults aged 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

stroke was substantially more common in the country of origin. The population defined as ''All Hispanics'' had consistently lower rates of CVD and HD in comparison to other Hispanic sub-populations, as a result of much lower reported rates in persons whose origin was designated ''Central or South American'' (cf. Appendix Table 1). Only Cuban Americans had lower death rates from stroke than the grouping designated ''All Hispanics''. Blacks had high rates in all CVD categories; only stroke mortality among Cubans was comparable.

Total CVD mortality was higher in men than women in all groups, except Mexicans, where parity was observed. These gender differences were the result of higher rates of IHD, where the male disadvantage was apparent for all groups. Stroke rates were generally similar in the two genders, with a modest excess among women noted in US whites and Mexicans and Cubans (Fig. 3).

Age-specific patterns of CVD, HD and stroke were examined over the age range 30—64 for all groups, excepting Cuban Americans, where insufficient

Appendix Table 1 All-cause and cause-specific age-adjusted mortality rates by Hispanic subgroup in the US

	US other Hispanic-Central/South American		US Cuban		US Mexican		US Puerto Rican		US all Hispanic	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
All cause	567	401	728	511	842	665	1005	687	765	572
Diabetes (E10—E14)	23	20	24	22	54	63	52	22	41	43
All CVD (I00—I99)	193	139	272	199	291	237	332	252	264	206
Heart disease (I05—I52)	151	100	228	166	228	175	271	205	209	156
Ischemic heart disease (I20—I25)	115	71	181	127	178	126	209	149	163	113
Acute MI (I21)	40	25	65	44	69	54	67	47	60	43
Stroke (I60—I69)	30	32	33	27	53	53	49	38	43	42

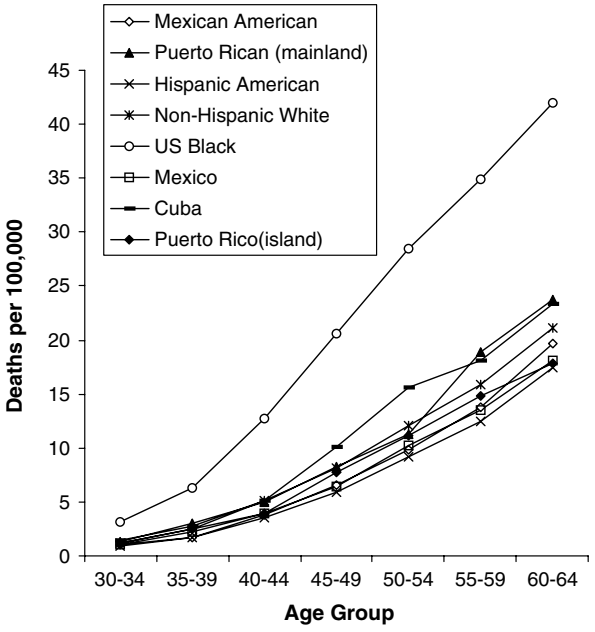

Figure 4 Age-specific death rates from all cardiovascular diseases (ICD-10: I00—I99), among adults age 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

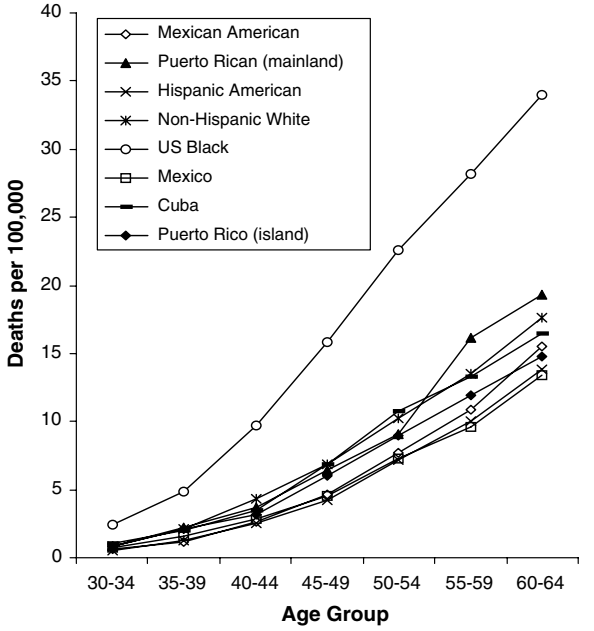

Figure 5 Age-specific death rates from heart disease (ICD-10: I05—I52), among adults age 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

events were present in the individual cells (Figs. 4—6). Relative homogeneity in the age-related patterns was observed for CVD and HD rates across population groups with the exception of US blacks (Figs. 4 and 5). For stroke, Mexicans, Mexican Americans and US whites clustered in a similar pattern while Cubans and US blacks had substantially steeper age-related increases in risk (Fig. 6).

As noted previously, the importance of diabetes as a contributing factor to CVD burden has increased rapidly in the last several years. While it is well recognized that death certificate data do not provide a robust measure of the burden from diabetes, the large overlap with other forms of vascular disease requires that some accounting must be made of the impact of this condition. To complement the analyses presented above we therefore examined the patterns of mortality from diabetes (Figs. 7 and 8). In the US, mortality rates from diabetes were 3-fold higher among both blacks and Mexican Americans, as was the case among Puerto Rican men compared to non-Hispanic Whites. Surprisingly, reported death rates were greatly elevated in Mexico, and also higher, although hardly to the same degree, on the island of Puerto Rico. Cubans and Cuban-Americans had

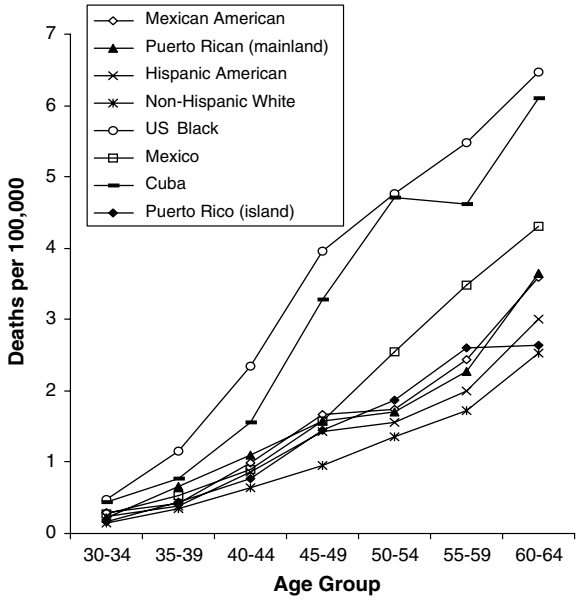

Figure 6 Age-specific death rates from stroke (ICD-10: I60—I69), among adults age 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

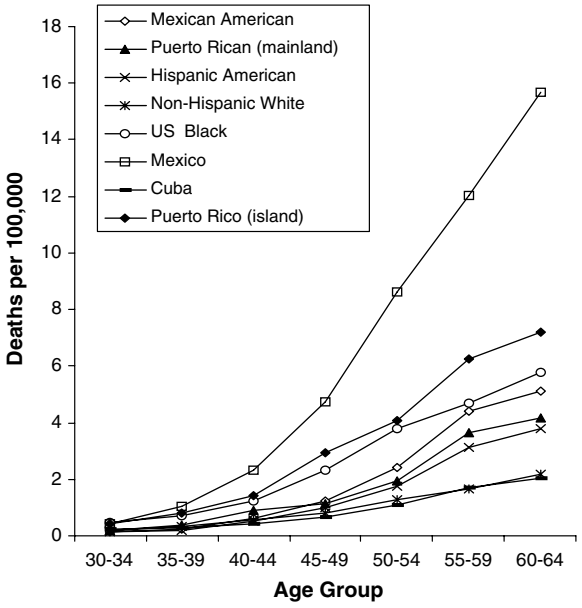

Figure 8 Age-specific death rates from diabetes (ICD-10: E10—E14), among adults age 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

similarly low rates, with the minimum being observed among Cuban men. On the other hand, when diabetes death rates were estimated in the total US population as ''any diabetes-related'' death (i.e., any mention of diabetes as an underlying or contributing cause of death), the apparent gap between Mexico and the US narrowed (138 versus 82 per 100,000 population). The corresponding difference between Mexican Americans and Mexicans was even smaller (153 versus 138 per 100,000 population). Thus, observed discrepancies among countries can be partially explained by coding and counting algorithms used.

Discussion

The data presented here document high rates of CVD and diabetes in the two principal countries of origin for US Hispanics, viz., Mexico and Cuba, and among Puerto Ricans on the mainland as well as

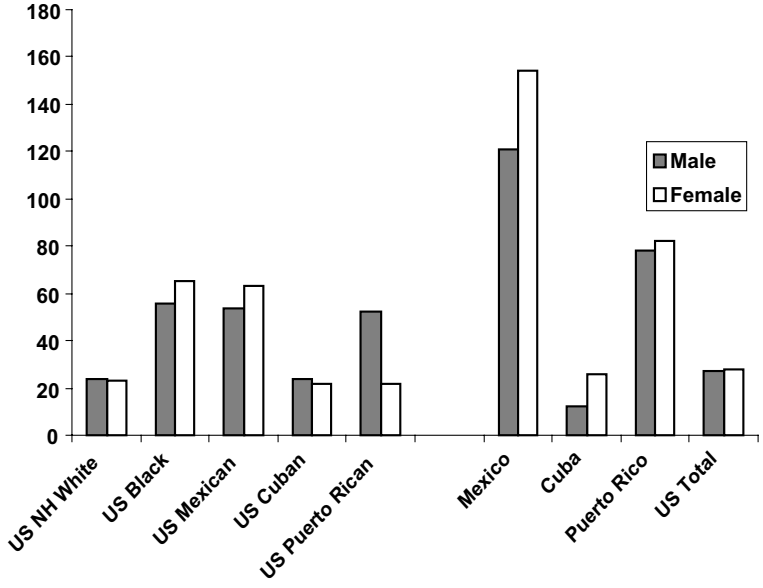

Figure 7 Mortality rates by gender from diabetes (ICD-10: E10—E14), among adults aged 20—84 in main US population groups, Cuba, Mexico and Puerto Rico.

on the island. Although we did not report deaths for the whole age range, we captured the majority of events. Modestly lower rates of HD were observed among Mexican Americans, compared to non-Hispanic whites, and rates were slightly higher for stroke. In Mexico, on the other hand, HD was substantially lower and stroke was 50% higher. Most notably, deaths from diabetes were 5-fold higher in Mexico than in the US (138 versus 28 per 100,000 population). In relation to Cuba the findings were more consistent, with similar rates of HD, 2-fold higher stroke rates, and modestly lower diabetes rates. The pattern of CVD among Puerto Ricans was similar to non-Hispanic whites, with higher HD rates on the mainland and lower HD rates on the island. In contrast to the other analyses provided by NCHS, therefore, these data do not suggest a large advantage for US Hispanic sub-populations [9] and suggest the absence of any significant paradox. As summarized elsewhere, there are numerous potential biases in the US data systems that could undermine the validity of analyses of the Hispanic population [10,12]. These biases include, among others, undercounting by the census, misreporting of age or ethnicity at the time of death, healthy people are more likely to immigrate (''healthy migrant'' effect), and selective return migration of sick or frail individuals (''salmon bias''). Demographic analyses, comparing Puerto Ricans and Cubans suggest the possibility of bias [4,20]. Other studies, using Medicaid and NUDIMENT files, further support the ''salmon bias'' [6,19,27]. It is unlikely that these biases would be equally influential for all groups. For example, Puerto Ricans are fully registered in the US vital records system and have official Social Security Numbers while Cuban Americans only infrequently return permanently to Cuba. In addition, for some groups, particularly Cubans, the number of events in a given age—gender—cause specific group may be small. In general, the data presented are consistent with expectations based on risk factor profiles.

Cardiovascular disease (CV) risk factors among Hispanics have been characterized in NHANES and other studies, such as the Puerto Rico Heart Study. For instance, Mexican Americans have similar levels of hypertension as white, with poorer levels of treatment; obesity and diabetes are 30—50% higher than among whites, but lower than among blacks; smoking and hypercholesterolemia are similar as among whites. Puerto Ricans have somewhat higher prevalences of diabetes, hypertension and asthma, while Cubans fare the best.

The vital records system in Cuba is described as virtually 100% inclusive of the population and has produced consistent national data since the early 1970s [28]. The findings reported here are consistent with a more detailed recent analysis of CVD and associated risk factors in Cuba [29]. The vital records system in Mexico is likely to be reasonably complete, given the modest number of deaths coded to ill-defined causes, however, coverage in rural areas, particularly in the South, may not be well documented. Long-term trend analyses of CVD in Mexico have not yet been published, to our knowledge.

International comparisons of mortality are subject to important biases from variation in either how physicians or other responsible parties complete the death certificate and the application of algorithms that lead to designation of the primary cause of death. While all countries use the ICD methods, there is obviously substantial room for variation in practice. In general the broadest categories are likely to be the most comparable, which is why we placed the emphasis on CVD. However, coding of diabetes is particularly problematic, since it contributes to many CVD outcomes but may not be designated as the primary cause of death. It seems likely that variation in coding practices at least in part explain the situation in relation to diabetes in Mexico. In the US data files we were able to count the number of deaths with any mention of diabetes as a contributing cause. Summing deaths ascribed to diabetes as a primary cause and those with any mention increased the rates among US Hispanic groups roughly 3-fold, greatly reducing the disparity with Mexico. It should also be noted that the prevalence of diabetes is lower in Mexico than among US groups other than non-Hispanic whites and the contrast in mortality is unlikely to represent underlying disease burden, although of course it is possible that case-fatality rates are higher [30—32]. It seems most likely, therefore, that the large number of deaths currently coded to diabetes in Mexico would be distributed among other related codes, most of which would be CVD-related, if similar coding algorithms were applied as in the US. If correct, this argument implies that CVD mortality in Mexico would be increased relative to the other countries once those diabetes deaths have been moved to more conventional codes. More detailed comparisons of the coding algorithms will be required to resolve this question. Beyond this specific concern with comparison between the US and Mexico, our analysis clearly demonstrates the need to make some accounting for the impact of diabetes in presenting vital statistics data since it is rapidly increasing in importance.

This study is the first attempt to systematically characterize the CVD epidemic in the countries of origin of US Hispanic populations. Subsequent studies will be needed to track the trends within these

countries, in particular in relation to diabetes mortality. To provide adequate information for public health policy these studies will likewise need to study the prevalence of established cardiovascular risk factors in these countries and assess the progress being made at reducing the risk factor burden.

References

[1] Levi F, Lucchini F, Negri E, La Vecchia C. Trends in mortality from cardiovascular and cerebrovascular diseases in Europe and other areas of the world. Heart 2002;88:119—24.

[2] Cooper R, Cutler J, Desvigne-Nickens P, et al. Trends and disparities in coronary heart disease, stroke, and other cardiovascular diseases in the United States: findings of the national conference on cardiovascular disease prevention. Circulation 2000;102:3137—47.

[3] Stern MP, Wei M. Do Mexican Americans really have low rates of cardiovascular disease? Prev Med 1999;29:S90—5.

[4] Palloni A, Arias E. Paradox lost: explaining the Hispanic adult mortality advantage. Demography 2004;41:385—415.

[5] Markides KS, Coreil J. The health of Hispanics in the southwestern United States: an epidemiologic paradox. Public Health Rep 1986;101:253—65.

[6] Lerman-Garber I, Villa AR, Caballero E. Diabetes and cardiovascular disease. Is there a true Hispanic paradox? Rev Invest Clin 2004;56:282—96.

[7] Hunt KJ, Resendez RG, Williams K, Haffner SM, Stern MP, Hazuda HP. All-cause and cardiovascular mortality among Mexican-American and non-Hispanic White older participants in the San Antonio Heart Study — evidence against the ''Hispanic paradox''. Am J Epidemiol 2003;158:1048—57.

[8] Ramirez RR, de la Cruz GP. The Hispanic population in the United States: March 2002. Curr Popul Rep Popul Charact 2003:P20—P545.

[9] Therrien MRR. The Hispanic population in the United States. Curr Popul Rep 2001:P20—P535.

[10] Palloni A, Morenoff JD. Interpreting the paradoxical in the Hispanic paradox: demographic and epidemiologic approaches. Ann N Y Acad Sci 2001;954:140—74.

[11] National Center for Health Statistics. Health, United States 2005. With chart book on trends in the health of Americans; 2005.

[12] Smith Ph DD, Bradshaw Ph DB. Rethinking the Hispanic paradox: death rates and life expectancy for US non-Hispanic White and Hispanic populations. Am J Public Health 2006;96:1686—92.

[13] Thomas AJ, Eberly LE, Neaton JD, Smith GD. Latino risk-adjusted mortality in the men screened for the Multiple Risk Factor Intervention Trial. Am J Epidemiol 2005;162:569—78.

[14] Sorlie PD, Backlund E, Keller JB. US mortality by economic, demographic, and social characteristics: the National Longitudinal Mortality Study. Am J Public Health 1995;85: 949—56.

[15] Sorlie PD, Backlund E, Johnson NJ, Rogot E. Mortality by Hispanic status in the United States. JAMA 1993;270:2464—8.

[16] Liao Y, McGee DL, Cooper RS. Mortality among US adult Asians and Pacific Islanders: findings from the National Health Interview Surveys and the National Longitudinal Mortality Study. Ethn Dis 1999;9:423—33.

[17] Liao Y, Cooper RS, Cao G, Kaufman JS, Long AE, McGee DL. Mortality from coronary heart disease and cardiovascular disease among adult US Hispanics: findings from the National Health Interview Survey (1986 to 1994). J Am Coll Cardiol 1997;30:1200—5.

[18] Liao Y, Cooper RS, Cao G, et al. Mortality patterns among adult Hispanics: findings from the NHIS, 1986 to 1990. Am J Public Health 1998;88:227—32.

[19] Elo IT, Turra CM, Kestenbaum B, Ferguson BR. Mortality among elderly Hispanics in the United States: past evidence and new results. Demography 2004;41:109—28.

[20] Abraido-Lanza AF, Dohrenwend BP, Ng-Mak DS, Turner JB. The Latino mortality paradox: a test of the ''salmon bias'' and healthy migrant hypotheses. Am J Public Health 1999;89:1543—8.

[21] Yusuf S, Reddy S, Ounpuu S, Anand S. Global burden of cardiovascular diseases. Part II. Variations in cardiovascular disease by specific ethnic groups and geographic regions and prevention strategies. Circulation 2001;104:2855—64.

[22] Yach D, Hawkes C, Gould CL, Hofman KJ. The global burden of chronic diseases: overcoming impediments to prevention and control. JAMA 2004;291:2616—22.

[23] Reddy KS. Cardiovascular disease in non-Western countries. N Engl J Med 2004;350:2438—40.

[24] Forrester T, Cooper RS, Weatherall D. Emergence of Western diseases in the tropical world: the experience with chronic cardiovascular diseases. Br Med Bull 1998;54:463—73.

[25] Beaglehole R, Yach D. Globalisation and the prevention and control of non-communicable disease: the neglected chronic diseases of adults. Lancet 2003;362:903—8.

[26] Cooper RS, Osotimehin B, Kaufman JS, Forrester T. Disease burden in sub-Saharan Africa: what should we conclude in the absence of data? Lancet 1998;351:208—10.

[27] Markides KS, Eschbach K. Aging, migration, and mortality: current status of research on the Hispanic paradox. J Gerontol B Psychol Sci Soc Sci 2005;60(Spec. No. 2):68—75.

[28] Gran Alvarez MA, Ramil JD, Peraza Peraza M, Perez ME. Statistical Information System of Cuban Public Health (Sistema de Informacion Estadistica de Salud Cubano). La Habana, Cuba: Ministerio de Salud Publica; 2006.

[29] Cooper RS, Ordunez P, Iraola Ferrer MD, Munoz JL, Espinosa-Brito A. Cardiovascular disease and associated risk factors in Cuba: prospects for prevention and control. Am J Public Health 2006;96:94—101.

[30] Stern MP, Gonzalez C, Mitchell BD, Villalpando E, Haffner SM, Hazuda HP. Genetic and environmental determinants of type II diabetes in Mexico City and San Antonio. Diabetes 1992;41:484—92.

[31] Hazuda HP. Hypertension in the San Antonio Heart Study and the Mexico City Diabetes Study: sociocultural correlates. Public Health Rep 1996;111(Suppl. 2):18—21.

[32] Gonzalez C, Stern MP, Gonzalez E, et al. The Mexico City Diabetes Study: a population-based approach to the study of genetic and environmental interactions in the pathogenesis of obesity and diabetes. Nutr Rev 1999;57:S71—6 [discussion S76—7].