Introduction and background

The 2006 release of the Hispanic Origin life table brought the existence of the Hispanic Paradox into the popular mindset.[1] The original Hispanic origin life table and every subsequent life table has shown that Hispanics show a higher life expectancy than non-Hispanic Whites and non-Hispanic Blacks.[1-3] These findings match with literature on the Hispanic Paradox.[4] In more recent publications on the Hispanic paradox, the findings indicate that the paradox may be more concentrated in the Mexican Origin populations.[5] In their analysis, Blue and Fenelon contributed these differences in mortality to smoking. Further, the authors contributed much of the change to differences in smoking related mortality to Hispanic immigrants.[6]

In their 1991 review, Bradshaw and Liese indicate that Hispanic males showed lower mortality than the non-Hispanic whites for heart disease and malignant neoplasms, but higher rates for infectious diseases like tuberculosis and pneumonias, accidents, and homicide. Hispanic females. Both Hispanic males and females showed higher rates of diabetes than non-Hispanic Whites. They also suggested that the gap was declining.[7] Hummer and colleagues found that the mortality advantage for Hispanics pertained primarily to chronic diseases such as cancer and circulatory diseases.[8] In a more recent analysis, Eschbach and colleagues reported that younger US-born Hispanic males had higher rates of mortality for social and behavioral contributors (homicide, alcohol use, HIV, and substance use) while chronic illness mortality was similar between the groups. US-born Hispanic females showed differing mortality against non-Hispanic whites for social and behavioral contributors, but chronic disease rates were similar [9] Conventional analyses have shown that cause-specific mortality is very dynamic. There is every reason to expect that the contributors to mortality identified in the traditional literature would change as mortality patterns evolve through time.

Eschbach and colleagues implore researchers to not consider mortality as stable and invariant across time and cohorts.[9] While research has examined mortality of Hispanics, no one has looked at the evolution of cause-specific mortality differences through time. This research acts as a preliminary analysis to compare to an eventual replication of life tables using nativity status to further understand how Hispanic mortality is influenced by country of birth. Of interest to this project is understanding how life expectancy has change related to shifts in causes of mortality such as heart disease, smoking, and diabetes. This research is a descriptive analysis which focuses on life expectancy and contributions to mortality between racial/ethnic groups at each time point. The differences in life expectancy and contributions to mortality are then compared across time.

Methodology

The states of analysis are restricted to five Southwestern US states: Arizona, California, Colorado, New Mexico, and Texas. These states contribute the largest number of Hispanics in the US (85%). In the remaining 45 states, only 45% of Hispanics are Mexican Origin. Denominator data come from the 1990 Modified Age, Race, and Sex (MARS) file for the year 1990 and the bridged race population estimates for the year 2000 (Bridged Race). The MARS and the Bridged Race are top coded at age 85. To allow for life table construction and decomposition of mortality to age 100, the proportion of deaths from ages 85 to 100 from the 1990 and 2000 Census populations were calculated and the proportions were then applied to the MARS and Bridged Race files to expand populations at age 85 and older out to age 100.

Numerator data are from the National Vital Statistics System Mortality Multiple Cause of Death files for the years 1989-1991 and 1999-2001. For the numerator data, missing values on age and ethnicity were imputed using the hotdeck procedure. For the imputation of age (NMISS=

738), most cases were imputed using race/ethnicity, sex, and cause of death. Missing values for Hispanic origin (NMISS= 6189) were hotdecked within sex, race, state of birth, state and county of residence, and age categories, with 732 cases imputed as Hispanic. Deaths for non-Hispanic Whites and Hispanics are also adjusted to correct for misclassification in death certificate reporting for Hispanics using the method provided in the 2006 Hispanic Origin Life Table. The application of the Arias correction adjusts population counts Non-Hispanic Blacks were not adjusted due to the small population size in the southwest United States.

Life table construction primarily follows the methods outlined in the Hispanic Origin life table.[1] My methodology diverges in that I estimate the probability of death (qx) for non-Hispanic Whites and the non-Hispanics Blacks as well as Hispanics using the Brass logit model. The standard population for the non-Hispanic White and Black estimates are derived from the US Decennial life tables for 1990 and 2000. Hispanic qx is then estimated based on the estimated non-Hispanic White qx.

The Arriaga methodology is used to decompose differences in mortality across populations. The Arriaga method takes the change in cause specific death rates and contributes it to the total change in mortality at each age. The total effect of the cause-specific rates is then distributed across the total mortality. The totals of these distributed values equals the difference in life expectancy between the populations being decomposed. For the ${}_nm_x$ for the Arriaga decomposition, values estimated for death and the number of person years at risk in the life table are used to calculate the values ($nmx = \frac{d}{L}$). Analyses were conducted primarily using Stata.

Table 1: Life Expectancy by Ethnicity and Sex for 1990 and 2000

1990		2000	
Hispanic Female	81.1	Hispanic Female	80.2
NH White Female	79.4	NH White Female	79.9
Hispanic Male	74.0	Hispanic Male	75.6
NH Black Female	74.0	NH White Male	75.0
NH White Male	72.7	NH Black Female	74.8
NH Black Male	65.2	NH Black Male	68.7

*NH = Non-Hispanic

Preliminary Results

Table 1 shows life expectancy for each racial/ethnic group in 1990 and 2000. Hispanics have higher life expectancy than their non-Hispanic counterparts at both times, with Hispanic females showing the highest life expectancy of all groups at 81.1 and 80.1 years, respectively.

Between 1990 and 2000, White males gained almost 2.5 years life expectancy while white females gained slightly over ½ year. Life expectancy decreased one year for Hispanic females from 1990 to 2000. Further investigation is needed to understand this pattern. Non-Hispanic Black males and females both made gains in life expectancy between 1990 and 2000, but they still fall far behind their counterparts by 5 years or more.

Also of interest is the change in life expectancy from 1990 to 2000. White males made considerable gains on Hispanic males, with non-Hispanic White males closing the gap between Hispanic males to only 1/2 a year. In the same time, White females essentially closed the gap with Hispanic females completely from 1990 and 2000 with a difference of .10 years due to a half year gain for non-Hispanic Whites females and a one year loss for Hispanics. For non-Hispanic Blacks, males made a gain of 3.5 years in life expectancy, females gained only 4/5 of a year.

Table 2: Top Contributors to Differentials in Life Expectancy for Males, 1990 and 2000

	Hispanic & NH Whites				Hispanic & NH Blacks			
	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)
1990	Assault	-0.54	Diabetes	-0.33	Transport Accidents	-0.09	Alcoholic Liver Disease	-0.16
	Alcoholic Liver Disease	-0.21	Assault	-0.28	Alcoholic Liver Disease	-0.09	Other Chronic Liver Disease	-0.08
	Diabetes	-0.21	Alcoholic Liver Disease	-0.19	Other Chronic Liver Disease	-0.04	Transport Accidents	-0.03
	MNP - Trachea, Bronchus, and Lung	0.52	MNP - Trachea, Bronchus, and	0.41	Assault	1.14	MNP - Trachea, Bronchus, and	0.79
	All Other Chronic Ischemic Heart Disease	0.44	Chronic Lower Respiratory Disease	0.33	MNP - Trachea, Bronchus, and Lung	0.98	Assault	0.56
	Chronic Lower Respiratory Disease	0.31	Intentional Self-harm	0.26	All Other Chronic Ischemic Heart Disease	0.59	Atherosclerotic Cardiovsacular Disease	0.45

*NH = Non-Hispanic; MNP = Malignant Neoplasm

Table 3: Top Contributors to Differentials in Life Expectancy for Females, 1990 and 2000

	Hispanics & NH Whites				Hispanic & NH Blacks			
	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)	Cause	Losses(-) /Gains(+)
1990	Diabetes	-0.37	Diabetes	-0.55	Other Chronic Liver Disease	-0.05	Other Chronic Liver Disease	-0.09
	Other Chronic Liver Disease	-0.07	Nephritis/ Nephritic Syndrome	-0.11	Non-Hodgkin Lymphoma	-0.01	MNP-Liver	-0.03
	MNP - Stomach	-0.07	Other Chronic Liver Disease	-0.10	MNP-Liver	-0.01	Parkinson's	-0.03
	MNP - Trachea, Bronchus, and Lung	-0.54	MNP - Trachea, Bronchus, and Lung	0.50	Cerebrovascular Disease	0.65	MNP - Trachea, Bronchus, and Lung	0.49
	Chronic Lower Respiratory Disease	0.35	Chronic Lower Respiratory Disease	0.44	All Other Chronic Ischemic Heart Disease	0.58	Ischemic Heart Disease	0.41
	All Other Chronic Ischemic Heart Disease	0.23	MNP Breast	0.12	Ischemic Heart Disease	0.52	Cerebrovascular Disease	0.38

*NH = Non-Hispanic; MNP = Malignant Neoplasm

The preliminary mortality decomposition for 1990 shows assault as the biggest contributor to differences in mortality for Hispanic compared to non-Hispanic White males with slightly over 1/2 of a year of life expectancy lost. By 2000, assault dropped to the second leading contributor to mortality at ¼ year of life expectancy lost, while diabetes increased from ⅕ of a year life expectancy lost to ⅓ of a year of life expectancy lost. For Hispanic females, diabetes was the largest contributor to mortality for 1990 and 2000, with an increase from 2/5 of a year life expectancy lost to over one half of a year life expectancy lost, respectively. For non-Hispanic Whites, smoking related illnesses the largest contributor of mortality for males and females in 1990 and 2000. Non-Hispanic Blacks showed similar patterns for smoking versus Hispanics. In 1990, assault was the highest contributor to mortality differences for non-hispanic Black males, but by 2000, it had dropped from over 1 year of life expectancy lost in 1990 to about one half a year lost in 2000. In this same time, smoking became the leading contributor of mortality, but the contribution to life expectancy lost decreased somewhat from 1990 to 2000. Non-Hispanic Black females experienced the greatest loss of mortality related to cerebrovascular disease in 1990, but by 2000, the contribution was cut to roughly ⅓ of a year. By 2000, smoking

increased to the leading contributor with ½ a year life expectancy lost. For non-Hispanic Black females, heart-related mortality did not decrease as a contributor as was seen in other populations. Further exploration is needed to understand differentials in mortality by cause and age.

These results show that mortality is not a stationary process and that the primary benefactors of life expectancy changes has been males. Females, while showing some change in life expectancy, have not made gains of the same magnitude as their male counterparts. Whites, especially White males, made the most significant gains, significantly closing the gap between Hispanics and non-Hispanics Whites. If these preliminary results bear out in future analyses, then there may be an indication that the Hispanic mortality advantage for Mexican origin Hispanics may be decreasing or may soon shift to a mortality disadvantage, especially if preventive measures continue in the greater population combined with fewer smokers in the White population.

The next step in this research is to expand the analysis to include data for the year 2010. Additionally, this project will be expanded to include the construction of life tables based on nativity to attempt to tease out the effects of country of birth on mortality. This will further elucidate the changes in life expectancy in the Southwest United States as populations change through time.

References

1. Arias, E. (2010). United States life tables by Hispanic origin. *Vital and health statistics. Series 2, Data evaluation and methods research*, (152), 1.
2. Arias, E. (2011). United States life tables, 2007.*National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, *59*(9), 1.
3. Arias, E. (2012). United States life tables, 2008.*National vital statistics reports: from the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, *61*(3).
4. Markides, K. S., & Coreil, J. (1986). The health of Hispanics in the southwestern United States: an epidemiologic paradox.*Public Health Reports*,*101*(3), 253–265.
5. Markides, K. S., & Eschbach, K. (2005). Aging, Migration, and Mortality: Current Status of Research on the Hispanic Paradox. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*,*60*(Special Issue 2), S68 –S75.
6. Blue, L., & Fenelon, A. (2011). Explaining low mortality among US immigrants relative to native-born Americans: the role of smoking. *International Journal of Epidemiology*,*40*(3), 786 – 793. doi:10.1093/ije/dyr011
7. Bradshaw, B. S., & Liese, K. A. (1991). Mortality of Mexican-Origin Persons in the Southwestern United States. In I. Rosenwaike (Ed.), *Mortality of Hispanic populations: Mexicans, Puerto Ricans, and Cubans in the United States and in the home countries* (pp. 81–93). Greenwood Pub Group.
8. Hummer, R. A., Rogers, R. G., Amir, S. H., Forbes, D., & Frisbie, W. P. (2000). Adult mortality differentials among Hispanic subgroups and non-Hispanic whites. *Social Science Quarterly*, *81*(1), 459–476.
9. Eschbach, K., Stimpson, J. P., Kuo, Y.-F., & Goodwin, J. S. (2007). Mortality of Foreign-Born and US-Born Hispanic Adults at Younger Ages: A Reexamination of Recent Patterns. *American Journal of Public Health*,*97*(7), 1297–1304. doi:10.2105/AJPH.2006.094193