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Health Status and Behavioral Risk Factors in Older Adult Mexicans and Mexican Immigrants to the U.S

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Abstract

Objectives—Investigate the “salmon-bias” hypothesis, which posits that Mexicans in the U.S. return to Mexico due to poor health, as an explanation for the Hispanic health paradox in which Hispanics in the United States are healthier than might be expected from their socioeconomic status.

Method—Sample includes Mexicans age 50 or above living in the U.S. and Mexico from the 2003 Mexican Health and Aging Study and the 2004 Health and Retirement Study. Logistic regressions examine whether non-migrants or return migrants have different odds than immigrants of reporting a health outcome.

Results—The “salmon-bias” hypothesis holds for select health outcomes. However, non-migrants and return migrants have better health outcomes than immigrants on a variety of indicators.

Discussion—Overall, the results of this study do not support the salmon bias hypothesis; other explanations for the paradox could be explored.

Keywords

Mexican Immigrants; Hispanic Health Paradox; Salmon Bias Effect; Migration Selection Hypothesis

Introduction

The “Hispanic health paradox” refers to a finding in the research literature that Hispanics in the U.S. seem healthier by various measures, including chronic disease prevalence and mortality, than non-Hispanic whites (for example, Markides & Coreil, 1986; Singh & Siahpush, 2001; Sorlie, Backlund, Johnson, & Rogot, 1993).⁵ This finding is considered paradoxical because Hispanics in the U.S. have on average a much lower socioeconomic

⁵The term “Hispanic paradox” was first used by Markides and Coreil (1986). This finding is also known as the epidemiological paradox.

status (SES) than whites (see Williams & Collins, 1995), and a large body of research has shown an association between SES and health (for example, Chandola, Ferrie, Sacker, & Marmot, 2007; Feinstein, 1993; House, Kessler, & Herzog, 1990; Lafortune & Balestat, 2007; Marmot, 2002; Marmot, Shipley, & Rose, 1984; Meara, Richards, & Cutler, 2008; Minkler, Fuller-Thomson, & Guralnik, 2006; Smith, 2004). The paradox manifests strongly among Mexican immigrants to the U.S. (Abraído-Lanza, Dohrenwend, Ng-Mak, & Turner, 1999; Hummer, 2000; Palloni & Arias, 2004).

Using data on Mexicans living in the U.S. and in Mexico, this study examines selective out-migration from the U.S., or the “salmon-bias” effect, which posits that Mexicans in the U.S. have a propensity to return to Mexico following periods of poor health.⁶ We analyze health outcomes and behavioral risk factors of return migrants compared with immigrants that stayed in the U.S. The data used - the Health and Retirement Survey (HRS) and Mexican Health and Aging Study (MHAS) - are comparable and provide information for persons aged 50 and above.

The data are less suitable for examining selective in-migration or the healthy-migrant effect, which hypothesizes that immigrants self-select from their native populations by having better physical and mental health. The age of first migration to the U.S. typically occurs when individuals are in their twenties and thirties (Aguila & Zissimopoulos, 2010). The ideal healthy-migrant test would include non-migrants and immigrants at the time of migration, prior to any return migration. In our data, we only observe the net emigration effects (i.e., those that stay in the US).⁷ The main focus of the paper is the salmon bias effect for males and females, though we present results that may indicate whether the healthy-migrant effect holds for older immigrants.

The health status variables of interest in this study are incidence of major chronic diseases (diabetes, hypertension, lung diseases, stroke, arthritis, and obesity), difficulties with activities of daily living (ADLs), and health behaviors (smoking and heavy alcohol use). We examine the health outcomes and behaviors of three groups: Mexicans in the U.S. (immigrants), return migrants living in Mexico (return migrants), and Mexicans who never emigrated (non-migrants).

Background

Three explanations have been proposed for the Hispanic health paradox: data artifacts, protective social and cultural characteristics differentiating Hispanics from whites, and selective migration in and out of the U.S. First, data artifacts threaten the validity of mortality rates calculated from aggregate data. As described in Palloni and Arias (2004), a lack of correct ethnic identification on death certificates, a tendency in certain Hispanic subgroups in the U.S. to overstate age, and mismatching of records can lead to downward-biased measures of mortality rates for Hispanics in comparison to non-Hispanic whites. Second, protective social and cultural characteristics, including family structure and social supports, may benefit Hispanics by positively influencing individual health behaviors (see Abraído-Lanza, et al., 1999). These characteristics may apply to Hispanics in their countries of origin and the U.S. An extension of this is the acculturation effect: after spending time in the U.S., foreign-born Hispanics assimilate and lose their health advantage (see Antecol & Bedard, 2006; Lara, Gamboa, Kahramanian, Morales, & Bautista, 2005).

⁶The term “salmon bias” was coined by Pablos-Mendez (1994).

⁷Another option would be pooling migrants and return migrants as one group. However, as the return migrants have spent varying lengths of time in Mexico upon their return from the U.S., we do not consider it an accurate test.

Third, the focus of this study, selective migration, refers to the salmon-bias and healthy-migrant effects. Selective out-migration to the country of origin, or the salmon-bias effect, proposes that unhealthy migrants return to their country of origin after experiencing illness or poor health, as they may prefer to be in poor health in their country of origin, while healthier immigrants stay in the U.S. (for example, Shai & Rosenwaike, 1987; Turra & Elo, 2008). Selective in-migration - the healthy-migrant effect - proposes that migrants may be healthier than individuals who stay in their country of origin (see Abraído-Lanza, et al., 1999; Sorlie, et al., 1993).

Most studies that have found evidence of the health paradox have compared mortality rates, health outcomes and behaviors, and biomarkers between Hispanics in the U.S. and non-Hispanic whites using only U.S. data (for a review, Markides and Eschbach, (2011). However, using Mexican data, as in the present study, allows for the comparison of Mexicans living in the U.S. with return migrants and non-migrants living in Mexico and for the examination of the selective migration mechanisms.

This is not the first study to examine the health paradox, nor the first to do so with data from both countries. Crimmins et al. (2005) used the MHAS and the NHANES IV to examine anthropometric measures of immigrants, non-migrants, return migrants and U.S.-born Hispanics. They found support for the salmon-bias and healthy-migrant hypotheses on height, as immigrants were taller than non-migrants and return migrants were shorter than immigrants. However, the wording of questions on NHANES and MHAS is different, making the surveys less plausibly comparable. Rubalcava et al. (2008) used panel data from the Mexican Family Life Survey (MxFLS), comparing pre-migration health of respondents who immigrated to the U.S. with that of respondents who remained in Mexico. They used height, body mass index (BMI), blood pressure, and hemoglobin measurements as well as self-assessed health status to examine whether healthier Mexicans were more likely to move to the U.S. The authors found that the likelihood of moving to the U.S. was not related to height or hemoglobin but was related in rural males to lower BMI, normal (as opposed to high) blood pressure, and poorer health status for rural males. No statistically significant relationships were found for urban males. Rural women with high hemoglobin (iron-replete) and with poor self-reported health status were more likely to migrate; for urban women, likelihood of moving was positively associated with height and better health status. Overall, they found only weak evidence to support the healthy-migrant hypothesis.

Borges et al. (2011), using the Mexican National Comorbidity Survey and the U.S. Collaborative Psychiatric Epidemiology Surveys, found that Mexican immigrants in the U.S. had a higher risk of drug use and drug disorders than Mexicans in Mexico but did not find evidence of an effect for alcohol use. They also found that return migrants have an increased risk of alcohol and drug use; their findings thus support the salmon-bias hypothesis for substance use disorders. Ullmann, Goldman & Massey (2011) used data from the Mexican Migration Project to compare male return migrants to non-migrants. They found that return migrants had better early-life health than non-migrants, providing some evidence for the healthy-migrant hypothesis. They found that return migrants were disadvantaged in some areas of adult health (heart disease, emotional or psychiatric disorders, obesity, and ever having smoked) and did not find a relationship between return migration and self-reported adult health, diabetes, or hypertension. Their study provide mixed evidence for the salmon-bias hypothesis.

Turra and Elo (2008) tested the salmon bias using U.S. Social Security data on persons aged 65 and above, comparing mortality among foreign- and U.S.-born Hispanic and non-Hispanic white emigrants with the same groups residing in the U.S. They found evidence of the salmon bias but the effect was small. They concluded it was unlikely to explain most of

the Hispanic mortality advantage. Riosmena et al. (forthcoming), using the MHAS and the U.S. National Health Interview Survey (NHIS), found evidence of the salmon bias effect in height (return migrants were shorter than immigrants) and self-reported health (return migrants were more likely to report poor health) but not in hypertension, obesity, or diabetes. They found a small return migrant advantage in hypertension. For the healthy-migrant effect, they found evidence in height and self-reported health; they also found limited evidence of this effect for hypertension in those with less than 15 years of experience in the U.S. Barquera et al. (2008) examined hypertension using the 2000 Mexican National Health Survey and the 1999–2004 NHANES and found higher prevalence of hypertension among Mexicans than among Mexican-born U.S. residents.

The contributions of this study to the literature in the Hispanic health paradox are using comparable U.S. and Mexican data sources (HRS and MHAS), providing estimates for males and females, and additional evidence for health outcomes and health behaviors, some of which have not been studied in the context of the salmon-bias hypothesis. Limitations of this study are that some health outcomes might be influenced by differences in undiagnosed conditions between the U.S. and Mexico; for example, there may be a higher proportion of individuals in Mexico with undiagnosed hypertension or diabetes. Another limitation is that we do not observe the health outcomes of immigrants when they first arrived in the U.S. We also do not observe the health outcomes of return migrants immediately after their return to Mexico.

Methods

Data Sources

In this study we use data from the MHAS and the HRS. The MHAS is a nationally representative panel study of individuals born and residing in Mexico before 1951, together with their spouses, and has two waves of data from 2001 and 2003. The data set contains information on demographic characteristics, indicators of current health, health behaviors, use of health care services, income, wealth, and migration history. The MHAS oversamples states with higher numbers of migrants to the U.S. (Durango, Guanajuato, Jalisco, Michoacán, Nayarit, and Zacatecas). In this study, we use the 2003 MHAS wave, which had a 94.2% response rate.

The HRS is a nationally representative biennial panel survey of individuals aged 50 years and older living in the U.S.; the first wave is from 1992. The survey elicits information similar to that in the MHAS. It oversamples Hispanics, blacks, and Florida residents, and includes data on country of origin for Hispanics, making it possible to identify Mexican immigrants. The HRS follows a similar sampling strategy to other surveys in the U.S. and oversample Hispanics in geographic areas with a higher concentration of Hispanics but also includes other areas with a lower concentration, where Hispanic households are chosen to guarantee representation of this population group. The core interview is offered in English or Spanish (Ofstedal & Weir, 2011). In this study, we use the 2004 HRS wave, which had a 75.3% response rate. The design of the MHAS questionnaire was based on the HRS, so the phrasing of questions in the HRS and MHAS are comparable (Soldo, Wong, & Palloni, 2002).

Sample

We identified three groups of analysis in this study based on birthplace and place of residence: (1) individuals born in Mexico who have never migrated to the US (non-migrants), (2) individuals born in Mexico and living in the US (immigrants), and (3) individuals born in Mexico that migrated to the US and returned to Mexico (return

migrants). This study does not include second- or higher-generation Mexican-Americans (individuals born in the U.S. to Mexican or Mexican-American parents). The MHAS includes 1,482 Mexican-born individuals who at some point migrated to the U.S. (return migrants) and 11,054 without a migration history living in Mexico (non-migrants). The HRS includes 505 Mexican-born individuals living in the U.S. (immigrants).

The weighted sample sizes are 1,441,854 return migrants, 12,464,942 non-migrants, and 1,528,577 immigrants. The HRS individual weights are computed to match the Current Population Survey (CPS) for a given year, stratifying by birth cohorts, gender, and race of respondents and adjusting for sample attrition and mortality. The weights are zero for those not age-eligible, living outside the U.S., or living in a nursing home, as the CPS does not include individuals living outside the U.S. or institutionalized respondents. By comparing different demographic characteristics of the HRS sample with the CPS, Ofstedal and Weir (2011) find that the subgroup of Hispanics in the HRS well represents Hispanics aged 50 and above in the U.S. They also show that the response rate of Hispanics in the 2004 HRS is similar to that of whites. Mexicans represent the largest group within Hispanics. Among Hispanic households, 58 percent have Mexican ancestry (HRS, 2011).

In the MHAS, the weights are computed at the individual and household level to match the 2000 Mexican Census and provide a nationally representative sample of the population aged 50 and above for urban and rural areas. An MHAS methodological document (2004) shows that the MHAS sample's demographic characteristics are similar to those for the 2000 Mexican Census and the 2000 Mexican National Health Survey. The MHAS methodological document (2004) also compares other health and socioeconomic indicators, and the authors conclude that the MHAS sample matches other nationally representative surveys in Mexico.

We included non-Hispanic whites as a comparison group in the first part of the analysis to confirm the paradox from our data, and then proceeded to analyze the selection hypotheses using the three comparison groups of persons born in Mexico and living in the U.S. or Mexico.

Outcome Variables

Self-reported health status—Self-reported health status was measured on a five-point scale: excellent, very good, good, fair, and poor. We collapsed responses to create a binary variable with two categories: excellent, very good, or good (0) and fair or poor (1).

Health conditions—We defined a variable indicating the number of chronic health conditions (0, 1, or 2 or more) of the following self-reported and provider-diagnosed health conditions: hypertension, diabetes, lung disease, stroke, and arthritis. Although additional chronic conditions were asked about in the MHAS and HRS, we only included health conditions for which the phrasing of the questions in both surveys was identical.

ADLs—We defined a binary variable indicating a limitation with one or more ADLs including dressing, eating, bathing, walking across a room, getting out of bed, or using the toilet. A value of 0 represented no limitations and 1 for one or more limitations.

Obesity—Participants with a BMI of 30 or more were classified as obese, with 1 signifying obese and 0 not obese.

Smoking—We defined a binary variable indicating current self-reported smoking status with 0 denoting a non-smoker and 1 a current smoker.

Alcohol consumption—The heavy drinking variable was based on the frequency and quantity of alcohol consumption reported. Heavy drinking was defined as two or more drinks per day for women and three or more for men, with 0 representing no drinking or a moderate drinker and 1 a heavy drinker (Flores et al., 2008).

Independent Variables

The independent variables included indicator variables for the three groups identified for analysis: non-migrant, immigrant, and return migrant. Additional independent variables were age brackets (classified as 50–59, 60–69, or 70 or more), gender (male or female), years of education (categorized as 0–3, 4–6, 7–9, or 10 or more), and marital status (single or couple). Individuals that were widowed, divorced or never married were considered single. Individuals living with a partner were classified in the couple category. We also included a variable that indicates whether the individual has access to a health insurance plan (including social security) and a duration variable denoting the number of years the immigrant or return migrant spent in the U.S. For non-migrants, this variable takes a value of zero.

Statistical Analysis

First, we computed prevalence of the health measures for each Mexican group and non-Hispanic whites. Next, we estimated a series of logit models of the probability of having a health outcome (as described above) as a function of belonging to an immigration group, controlling for other covariates. Binary logit models were used for binary health outcome measures and ordered logit models were used for polytomous measures. All models were estimated by gender. The results of these models are presented in odds ratios (ORs) and are interpreted as the odds (comparing across groups) that an event happens, relative to that in the reference group (immigrants). All analyses were conducted using version 11 of STATA statistical software (StataCorp, 2007).

The comparisons between the return migrant and immigrant groups provided tests of the salmon-bias hypothesis: that immigrants with poor health are more likely to return to their home country, which would imply that return migrants would have poorer health than immigrants who stayed in the host country. We would see evidence of this effect through coefficients or ORs greater than one in our models for the return migrant group as compared to the immigrant group, indicating that return migrants are more likely to have poorer health than immigrants.

The comparisons between the non-migrant and immigrant groups test whether the healthy-migrant hypothesis holds for older immigrants. Immigrants who leave their countries of origin and emigrate to another country may be healthier than those who stay. We would expect coefficients or odds ratios greater than one in our analysis for the non-immigrant group as compared to the immigrant group. This would indicate that non-immigrants are more likely to be in the poor state of that particular health outcome and therefore less healthy than the immigrant group.

Results

Demographics

Table 1 shows the demographic characteristics of immigrant, return migrant, and non-migrant adults compared with non-Hispanic whites. The age distribution of the immigrants in this 50-and-older sample is skewed toward 50–59 years old. Return migrants have a higher proportion of individuals aged 70 or above and most of them are men. Comparing educational attainment, 58.4 percent of non-migrants and 59.8 percent of return migrants

have between 0 and 3 years of school. In contrast, over 60 percent of immigrants have completed four or more years of school and over 90 percent of non-Hispanic whites have 10 or more years of education. Immigrants have higher education levels than other Mexican groups but less education than non-Hispanic whites.

Health Outcomes

We compared health status and various health outcomes by gender and age for immigrants, return migrants, and non-migrants, as well as for non-Hispanic whites. Tables 2 and 3 show the prevalence of health outcomes for males and females, respectively. All results are weighted.

Regarding self-reported health status, Tables 2 and 3 show that the distribution of responses is similar across categories of Mexican males and females in all age groups. For men aged 50–59, immigrants have lower prevalence of hypertension, lung diseases, arthritis, and smoking than non-migrants, return migrants, and non-Hispanic whites. Return migrants show higher prevalence of lung diseases and smoking than non-migrants, immigrants, and non-Hispanic whites. In general, older age groups show smaller differences between all groups. Non-Hispanic white males have higher prevalence of hypertension, lung diseases, and arthritis than Mexican males. We show the difference between non-Hispanic whites and immigrants in order to examine the paradox in these data. We find evidence of the paradox for males, particularly for health conditions, lung disease, and arthritis.

Females tend to report a higher prevalence of health conditions (except smoking and heavy drinking) than males for Mexican groups (Table 3). For immigrants, females in all age groups show a lower prevalence of lung diseases but a higher propensity to report a difficulty with an ADL than non-migrants, return migrants, and non-Hispanic whites. Immigrant females report no heavy drinking. Non-Hispanic white females present a higher prevalence of stroke, arthritis, and heavy drinking than for any of the Mexican-born groups. The fifth column shows some evidence of the paradox for females for certain indicators (lung disease) and suggests that the paradox may not be as prevalent at older ages for women. We find evidence of the paradox for males and females only on select indicators, which may indicate a weaker paradox effect than has been posited in the literature.

Salmon Bias Effects

Tables 4 and 5 present the results of the ordered and binary logit models with the coefficients expressed as ORs for health outcomes. In table 4, we see that the odds of a male return migrant having poor or fair self-reported health are less than one compared to that for immigrants, a difference that is statistically significant at 0.41 (95% CI: 0.19–0.89); this is evidence against the salmon bias, as it indicates that return migrants are likely to report better health than immigrants. Self-reported health is not significant for females. Female return migrants have higher odds of presenting one or more health conditions compared to immigrants, although this result is significant only to the 90% level, providing weak evidence for the salmon bias on this indicator.

We see strong evidence against the salmon bias in difficulty with ADLs for both genders. Return migrant men have an odds ratio of 0.30 (95% CI: 0.12–0.80) and return migrant women have an odds ratio of 0.14 (95% CI: 0.05–0.36), meaning they are less likely than immigrant males and females, respectively, to have difficulties with ADLs. We see only weak evidence against the salmon bias in obesity for female return migrants. There is strong evidence for the salmon bias in smoking, with return migrant males having higher odds (2.34, 95% CI: 0.98–5.58) of smoking compared to immigrant males. Results for heavy drinking are not statistically significant for either males or females. Table 5 shows no

statistically significant results for diabetes, hypertension, stroke, or arthritis for return migrants. Both male and female return migrants have high odds of lung disease compared to immigrants, providing strong evidence for the salmon bias on this indicator.

Previous literature has documented higher rates of heavy drinking for both men and women (Borges, et al., 2011), obesity (males), and smoking (males) among return migrants compared to non-migrants and no relationship for self-reported adult health, diabetes, or hypertension for males (Ullmann, et al., 2011); Riosmena et al. (forthcoming) find higher rates of hypertension, poorer self-reported health, and no effect for obesity for males. Overall, we have found evidence for the hypothesis for lung disease for males and females, smoking for males, and health conditions for females. We found evidence against the hypothesis for self-reported health for males, difficulties with ADLs for both genders, and obesity for females. Many of the health outcomes used in this study have not been examined in prior studies and thus we are not able to compare to the results of other studies.

Other Findings

Examining the estimate in Table 4 that compares non-migrants with immigrants, we see that self-reported health provides weak evidence against the healthy-migrant hypothesis in persons aged 50 and over, as non-migrant males have lower odds of reporting poor or fair health than immigrant males (statistically significant at the 90% level). Female non-migrants are more likely than immigrants to report health conditions, providing weak evidence (statistically significant at the 90% level) for the healthy-migrant hypothesis. Difficulty with ADLs provides strong evidence against the healthy-migrant hypothesis for both genders. Male non-migrants have odds of 0.20 (95% CI: 0.07–0.56) and female non-migrants of 0.23 (95% CI: 0.10–0.51) for difficulties with ADLs compared to immigrants. Female non-migrants provide strong evidence against the hypothesis for both obesity and smoking, with non-migrant women less likely to report either of these conditions than immigrant women (statistically significant at the 95% level). In Table 5, both male and female non-migrants are more likely to report lung disease than immigrants, providing fairly strong evidence for the healthy-migrant hypothesis on this indicator.

Overall, we found evidence that may support the healthy-migrant hypothesis at older ages for lung disease in both genders and for health conditions in females. We found evidence against the healthy-migrant effect at older ages for difficulties with ADLs in both genders, for self-reported health in males, and for obesity and smoking in females. Previous findings by Rubalcava et al. (2008), Borges et al. (2011), Riosmena et al. (forthcoming) and Barquera et al. (2008) find a small effect (rural males only) or no effect (in both men and women generally) for obesity, poor general self-reported health status (rural males and females only), and no effect on heavy drinking (both men and women), but lower incidence of hypertension (both men and women), among immigrants compared to non-migrants. Our results provide mainly evidence against the healthy migrant hypothesis for population 50 years old or above.

Furthermore, if the selection hypotheses explain the paradox, we would expect to see significant results in tables 4 and 5 for the indicators on which we note significant differences between non-Hispanic whites and Mexican immigrants (see tables 2 and 3); however, we do not, which is puzzling. For men, this does not appear to be true for the number of health conditions or arthritis, though it seems to be the case for salmon bias for smoking and for both salmon bias and healthy migrant for lung diseases. For women, it also holds for lung diseases and a number of health conditions for both hypotheses, but not for smoking, or heavy drinking. In addition, the estimates for return migrants and non-migrants with respect to immigrants are similar in magnitude on nearly all health indicators and behaviors supporting the lack of evidence for the salmon bias or healthy migrant hypotheses.

We also found (not shown) that the ORs of the age dummies are in the expected direction, as there are higher odds of reporting worse health status, experiencing more health conditions, and having difficulties with ADLs as the respondents age. The age dummies also show that as age increases, both men and women are less likely to be smokers and to use alcohol. The directions of the ORs for educational attainment and our dependent health outcomes are also mostly as expected: the higher the number of years of education, the lower the odds that both males and females will report health conditions, difficulties in ADLs, and obesity. In contrast, the higher the education level, the higher the odds of being a smoker or a heavy drinker for males and females. On balance, though, higher socio-economic status (as measured by education) and lower age are associated with better health outcomes. Having health insurance increases the odds of having more health conditions and obesity for both genders. The higher the number of years in the U.S., the higher the odds of reporting poor health status for males and experiencing more health conditions for females.

An issue to consider is mortality selection, which may arise if mortality occurred differentially in the compared Mexican population groups. To our knowledge, there are no studies comparing mortality differentials between Mexican immigrants and non-migrants. If the selection hypotheses are true, we would expect different mortality rates between groups. Mortality selection could introduce a downward bias, underestimating the effect of the salmon bias and healthy-migrant hypotheses. Unfortunately, we cannot link the survey data used in this study to administrative records of mortality. We conducted the same analysis as in Table 4 but for the 50-to-59 age group, i.e., the youngest group.⁸ We found similar results in terms of magnitude and significance of the ORs with the exception of health conditions and obesity, which are not statistically significant for these younger females. This may imply that if mortality selection is present, it is not large enough to bias the estimates. In the case of health conditions and obesity, the difference in the estimates could be explained by a higher number of health conditions and obesity becoming more prevalent in older cohorts. Mortality selection does not seem to be driving the main results in this study.

Conclusion

Overall, the findings indicate the salmon-bias hypothesis may not hold and does not seem to explain the health paradox in this population. We also do not find evidence that supports the healthy-migrant hypothesis for middle-aged and older Mexicans. Perhaps, instead, a sociocultural protection process is at work among Mexicans living in areas with other Hispanics (Lara et al., 2005). In this study, we do not analyze the process that produces health outcomes. Our scope is only to document differences in health outcomes for Mexicans living in the U.S. and Mexico.

The largest cohorts in Mexico, born between 1980 and 2005, will be of working age in the next three decades and will start retiring by 2040. Currently, 65.5 percent of the population in Mexico is of working age (ages 15–64). The older population in Mexico is expected to increase 232 percent by 2040. In comparison, for the United States is expected to increase 107 percent over the same period (Aguila, Diaz, Fu, Kapteyn, & Pierson, 2011). Given that the Mexican population is aging, it is becoming even more important to understand migration dynamics and health at older ages, i.e. to what extent migration into and out of the United States involves those who are either healthier or less healthy than the general population. Further research is needed to understand whether and on what indicators, if any, the salmon-bias hypothesis holds at older ages. These results could indicate that the opposite is happening; those individuals in poorer health on many indicators stay in the U.S. and

⁸Results available upon request to the authors.

those in better health return to Mexico at older ages. Further research is needed to understand the mechanisms by which Hispanics in the U.S. have a mortality advantage.

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Table 1

Main characteristics of the sample

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites
Total number of observations (weighted)	1,528,577	1,441,854	12,464,942	66,808,452
Groups of age (%)				
50–59 years old	54.46	26.83	36.71	38.67
60–69 years old	26.59	35.56	35.05	28.13
70 years old or above	18.95	37.61	28.24	33.20
Male (%)	49.18	76.68	42.35	46.45
Female (%)	50.82	23.32	57.65	53.55
Years of education (%)				
0–3	35.74	59.83	58.40	0.31
4–6	29.79	23.74	23.60	0.81
7–9	10.60	7.01	10.86	6.59
More than 10	23.86	9.42	7.15	92.29
Marital Status (%)				
Single	29.10	26.82	34.57	30.81
Married	70.90	73.18	65.43	69.19
Health Insurance (%)	63.73	78.19	76.80	94.79
Duration of Stay in the U.S. (mean) in years	35.81 (15.04)	4.81 (7.68)	0 (0.00)	0 (0.00)
Number of observations (unweighted)	505	1,482	11,054	14,241

Note: The sample includes people 50 years old or above. For observations missing data in 2003, we used data from the 2001 wave when appropriate. Standard deviation in parentheses.

Source: Author's calculation using the 2003 Mexican Health and Aging Study (MHAS) and the 2004 Health and Retirement Study (HRS).

Table 2

Prevalence of self-reported health status, health conditions, ADL, obese, smoking, and drinking, males (%)

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
50–59 years old					
Self-reported health (%)					
Excellent or Very good or Good	57.42	43.54	46.30	82.05	24.63***
Fair or Poor	42.58	56.46	53.70	17.95	–24.63***
Health Conditions (%)					
0	59.16	55.40	54.46	43.73	–15.43**
1	29.78	27.71	29.89	33.60	3.82
2 or more	11.06	16.88	15.65	22.68	11.62***
Diabetes (%)	15.65	11.55	13.00	10.95	–4.70
Hypertension (%)	23.70	25.88	31.17	37.26	13.56***
Lung diseases (%)	0.00	7.22	5.42	4.51	4.51***
Stroke (%)	1.21	0.97	1.62	2.67	1.46
Arthritis (%)	11.33	20.94	15.34	30.96	19.63***
ADL (%)					
None	92.39	95.15	95.67	92.55	0.16
Difficulty with at least one	7.61	4.85	4.33	7.45	–0.16
Obese (%)	32.35	17.96	20.09	30.14	–2.21
Smoking (%)	20.67	41.65	28.88	22.55	1.88
Heavy drinking (%)	22.01	21.85	21.85	22.03	0.02
Number of observations (weighted)	428, 659	268, 904	1,873,939	12,457,146	
60–69 years old					
Self-reported health (%)					
Excellent or Very good or Good	32.87	39.07	33.91	78.84	45.97***
Fair or Poor	67.13	60.93	66.09	21.16	–45.97***
Health Conditions (%)					
0	36.27	40.40	45.55	22.97	–13.3*

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
1	26.69	33.04	33.58	36.91	10.22 [*]
2 or more	37.04	26.56	20.87	40.12	3.08
Diabetes (%)	33.68	14.70	16.40	17.38	-16.3 ^{***}
Hypertension (%)	39.35	41.95	33.47	49.65	10.3
Lung diseases (%)	1.72	9.58	5.96	8.61	6.89 ^{***}
Stroke (%)	3.76	2.65	2.29	5.89	2.13
Arthritis (%)	35.49	26.12	22.60	51.05	15.56 ^{***}
ADL (%)					
None	86.54	88.57	94.23	90.85	4.31
Difficulty with at least one	13.46	11.43	5.77	9.15	-4.31
Obese (%)	39.26	21.74	20.19	30.13	-9.13
Smoking (%)	20.08	30.11	20.81	17.08	-3.00
Heavy drinking (%)	13.49	12.62	16.41	14.39	0.90
Number of observations (weighted)	180,740	410,584	1,895,241	8,948,770	
70 years old or above					
Self-reported health (%)					
Excellent or Very good or Good	37.76	29.46	23.56	69.53	31.77 ^{***}
Fair or Poor	62.24	70.54	76.44	30.47	-31.77 ^{***}
Health Conditions (%)					
0	34.26	35.79	29.28	15.22	-19.04 ^{***}
1	24.43	34.27	43.64	33.17	8.74
2 or more	41.31	29.94	27.08	51.62	10.31
Diabetes (%)	24.75	13.79	18.92	20.20	-4.55
Hypertension (%)	51.77	42.30	42.11	55.76	3.99
Lung diseases (%)	4.27	11.43	9.64	12.49	8.22 ^{***}
Stroke (%)	7.73	3.56	5.09	12.49	4.76
Arthritis (%)	36.17	33.04	28.94	59.87	23.7 ^{***}
ADL (%)					
None	72.48	83.23	84.75	81.35	8.87

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
Difficulty with at least one	27.52	16.77	15.25	18.65	-8.87
Obese (%)	20.53	12.43	11.02	17.27	-3.26
Smoking (%)	3.19	23.39	16.07	7.15	3.96**
Heavy drinking (%)	9.03	9.39	10.00	7.76	-1.27
Number of observations (weighted)	142,345	426,132	1,509,533	9,164,183	

Note: Estimates are weighted.

*
p<0.1,

**
p<.05,

p<0.01.

Source: Author's calculation using the 2003 Mexican Health and Aging Study (MHAS) and the 2004 Health and Retirement Study (HRS).

Table 3
Prevalence of self-reported health status, health conditions, ADL, obese, currently smoking, and drinking, females (%)

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
50-59 years old					
Self-reported health (%)					
Excellent or Very good or Good	43.44	40.71	31.97	82.31	38.87***
Fair or Poor	56.56	59.29	68.03	17.69	-38.87***
Health Conditions (%)					
0	36.11	35.44	31.09	39.86	3.75
1	36.33	41.77	37.68	36.73	0.40
2 or more	27.56	22.79	31.23	23.41	-4.15
Diabetes (%)	17.50	15.73	19.87	8.64	-8.86*
Hypertension (%)	40.12	56.13	49.81	31.83	-8.29
Lung diseases (%)	1.12	7.38	8.37	6.17	5.05***
Stroke (%)	3.93	0.99	3.91	1.90	-2.03
Arthritis (%)	36.32	11.84	26.87	41.72	5.40
ADL (%)					
None	79.87	98.55	94.51	90.59	10.72**
Difficulty with at least one	20.13	1.45	5.49	9.41	-10.72**
Obese (%)	36.74	41.81	27.37	30.75	-5.99
Smoking (%)	9.55	12.88	8.74	19.95	10.40***
Heavy drinking (%)	2.05	3.75	3.58	21.16	19.11***
Number of observations (weighted)	403,731	117,918	2,701,569	12,993,839	
60-69 years old					
Self-reported health (%)					
Excellent or Very good or Good	34.03	37.10	27.81	78.62	44.59***
Fair or Poor	65.97	62.90	72.19	21.38	-44.59***
Health Conditions (%)					
0	28.56	17.94	24.54	19.59	-8.97

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
1	21.31	41.17	36.39	36.70	15.39 ***
2 or more	50.13	40.89	39.07	43.71	-6.42
Diabetes (%)	34.78	23.01	21.81	13.81	-20.97 ***
Hypertension (%)	50.09	51.57	57.38	47.80	-2.29
Lung diseases (%)	1.82	12.33	10.50	10.86	9.04 ***
Stroke (%)	5.50	0.94	2.22	5.20	-0.3
Arthritis (%)	56.80	50.58	34.75	64.35	5.50
ADL (%)					
None	71.65	95.80	90.78	86.54	14.89 **
Difficulty with at least one	28.35	4.20	9.22	13.46	-14.89 **
Obese (%)	40.74	15.56	30.44	28.87	-11.87 **
Smoking (%)	12.65	12.20	6.34	16.82	3.87
Heavy drinking (%)	1.30	5.93	2.35	13.69	12.39 ***
Number of observations (weighted)	225,758	102,150	2,473,672	9,561,104	
70 years old or above					
Self-reported health (%)					
Excellent or Very good or Good	21.40	25.80	23.14	69.83	48.43 ***
Fair or Poor	78.60	74.20	76.86	30.17	-48.43 ***
Health Conditions (%)					
0	14.45	20.13	22.80	11.47	-2.98
1	15.17	27.01	37.41	31.59	16.42 ***
2 or more	70.38	52.85	39.79	56.94	-13.84 **
Diabetes (%)	34.11	26.38	21.64	14.03	-20.08 ***
Hypertension (%)	70.66	64.21	59.27	60.94	-9.72
Lung diseases (%)	8.44	12.44	9.79	10.51	2.07
Stroke (%)	8.42	10.53	3.51	11.79	3.37
Arthritis (%)	70.40	40.15	39.74	71.77	1.37
ADL (%)					

	Mexican immigrants in the U.S. born in Mexico (Immigrants)	Return Mexican migrants in Mexico (Return migrants)	Mexicans without a history of migration to the U.S. (Non-migrants)	Non-Hispanic whites	Difference between non- Hispanic whites and immigrants
None	58.57	79.56	74.95	77.44	18.87***
Difficulty with at least one	41.43	20.44	25.05	22.56	-18.87***
Obese (%)	23.89	13.51	18.97	17.02	-6.87
Smoking (%)	5.73	8.07	5.00	7.40	1.67
Heavy drinking (%)	0.00	4.28	2.34	7.56	7.56
Number of observations (weighted)	147,344	116,166	2,010,988	12,683,410	

Note: Estimates are weighted.

*
p<0.1,

**
p<.05,

p<0.01.

Source: Author's calculation using the 2003 Mexican Health and Aging Study (MHAS) and the 2004 Health and Retirement Study (HRS).

Table 4

Binary and ordered logit models including as a reference group Mexican immigrants living in the U.S. born in Mexico (immigrants), odds ratios

	Self-reported health	Health conditions	Difficulty with at least one ADL	Obese	Smoking	Heavy drinking
<i>Males</i>						
Return Mexican migrants in Mexico (Return migrants)	0.411 ^{**} [0.16] (0.19, 0.89)	0.84 [0.27] (0.45, 1.57)	0.30 ^{**} [0.15] (0.12, 0.80)	0.53 [0.23] (0.23, 1.24)	2.34 [*] [1.04] (0.98, 5.58)	1.46 [0.72] (0.56, 3.85)
Mexicans without a history of migration to the U.S. (Non-migrants)	0.45 [*] [0.19] (0.20, 1.03)	0.08 [0.27] (0.41, 1.53)	0.20 ^{***} [0.11] (0.07, 0.56)	0.55 [0.25] (0.23, 1.33)	1.35 [0.63] (0.54, 3.37)	1.67 [0.88] (0.59, 4.69)
Number of observations	5,157	5,748	5,735	4,509	5,741	5,663
<i>Females</i>						
Return Mexican migrants in Mexico (Return migrants)	0.88 [0.34] (0.41, 1.89)	1.80 [*] [0.62] (0.91, 3.55)	0.14 ^{***} [0.07] (0.05, 0.36)	0.46 [*] [0.20] (0.20, 1.06)	0.61 [0.31] (0.22, 1.67)	2.81 [2.31] (0.56, 14.10)
Mexicans without a history of migration to the U.S. (Non-migrants)	0.97 [0.37] (0.46, 2.05)	1.80 [*] [0.63] (0.90, 3.58)	0.23 ^{***} [0.09] (0.10, 0.51)	0.42 ^{**} [0.18] (0.19, 0.95)	0.37 ^{**} [0.19] (0.13, 0.99)	1.68 [1.49] (0.29, 9.55)
Number of observations	6,287	6,751	6,739	4,191	6,745	6,737

Notes: Additional variables included in the models were marital status, years of education, age, enrolled in a health insurance plan, and duration of stay in the U.S. The observations are weighted. Standard error in brackets; 95% CI in parentheses.

* p<0.1,

** p<0.05,

*** p<0.01.

Source: Author's calculation using the 2003 Mexican Health and Aging Study (MHAS) and the 2004 Health and Retirement Study (HRS).

Table 5

Binary logit models for specific health conditions including as a reference group Mexican immigrants living in the U.S. born in Mexico (immigrants), odds ratios

	Diabetes	Hypertension	Lung diseases	Stroke	Arthritis
<i>Males</i>					
Return Mexican migrants in Mexico (Return migrants)	0.59 [0.24] (0.26, 1.33)	1.14 [0.38] (0.60, 2.17)	4.24** [2.42] (1.38, 12.99)	0.35 [0.28] (0.07, 1.68)	0.77 [0.31] (0.35, 1.70)
Mexicans without a history of migration to the U.S. (Non-migrants)	0.75 [0.34] (0.31, 1.80)	1.07 [0.38] (0.54, 2.13)	2.97* [1.87] (.86, 10.22)	0.40 [0.35] (0.07, 2.19)	0.62 [0.27] (0.27, 1.43)
Number of observations	5,741	5,745	5,745	5,747	5,746
<i>Females</i>					
Return Mexican migrants in Mexico (Return migrants)	0.87 [0.34] (0.40, 1.85)	1.44 [0.51] (0.72, 2.87)	5.94*** [3.78] (1.71, 20.65)	2.58 [2.30] (0.45, 14.83)	0.86 [0.33] (0.41, 1.81)
Mexicans without a history of migration to the U.S. (Non-migrants)	0.85 [0.30] (0.42, 1.71)	1.31 [0.45] (0.66, 2.58)	5.46** [3.66] (1.47, 20.31)	2.23 [1.87] (0.43, 11.50)	0.97 [0.36] (0.47, 2.01)
Number of observations	6,745	6,751	6,748	6,750	6,750

Note: Additional variables included in the models were marital status, years of education, age, enrolled in a health insurance plan, and duration of stay in the U.S. The observations are weighted. Standard error in brackets; 95% CI in parentheses.

* p<0.1,

** p<.05,

*** p<0.01.

Source: Author's calculation using the 2003 Mexican Health and Aging Study (MHAS) and the 2004 Health and Retirement Study (HRS).