

**Healthier before they migrate, less healthy when they return? The health of returned migrants in Mexico**

## **Abstract**

Over the course of the 20<sup>th</sup> century, Mexico-U.S. migration has emerged as an important facet of both countries, with far reaching economic and social impacts. The health of Mexican immigrants in the U.S. has been well studied, but relatively less is known about the health of returned migrants to Mexico. The objectives of this paper are twofold. Relying on health information pertaining to two stages of the life course, early life health (pre-migration) and adult health (post-migration) from the Mexican Migration Project, we aim to assess disparities in adult health status between returned migrants and non-migrants, accounting for their potentially different early life health profiles. While we find evidence that returned migrants had more favorable early life health, the results for adult health are more complex. Returned migrants have a higher prevalence of heart disease, emotional/psychiatric disorders, obesity, and smoking than non-migrants but no differences are found in self-rated health, diabetes, or hypertension.

## **Introduction**

Over the course of the 20<sup>th</sup> century, Mexico-U.S. migration has emerged as an important facet of both countries, with wide ranging economic and social impacts. By 2003 it was estimated that over ten million Mexicans, representing close to nine percent of the Mexican population, had migrated to the U.S. From the perspective of the U.S., Mexican immigrants comprise the largest group of all foreign-born persons and just under four percent of the total U.S. population (Borjas, 2007). Although return migration is an important component of the migration process, it is often neglected. For example, the health of Mexican immigrants residing in the U.S. has been well studied, but relatively less is known about the health of migrants when they return to Mexico.

The objectives of this paper are twofold. Relying on health information pertaining to two stages of the life course, early life health (pre-migration) and adult health (post-migration), we aim to assess disparities in adult health between returned migrants and non-migrants, accounting for their potentially different early life health.

## **Theoretical Framework and Hypotheses**

Much of the research on immigrant health in the U.S. focuses on Mexican migrants. This is due in part to the fact that they are numerically the largest immigrant group, but it also stems from interest in the “Hispanic paradox” which refers to the unexplained mortality advantage that foreign-born Hispanics exhibit relative to non-Hispanic Whites, despite low levels of socioeconomic status (SES) and limited access to health care (Hummer et al., 2000; Hummer et al., 2007; Turra & Goldman, 2007). Investigations have further refined the paradox by demonstrating that the mortality advantage is concentrated among foreign-born Mexicans and foreign-born South Americans (Palloni & Arias, 2004).

A number of hypotheses have been offered to explain the Hispanic paradox including data inaccuracies, cultural factors, selective return migration (the salmon bias) and selective migration to the U.S (the healthy migrant theory). The healthy migrant theory is premised on the notion that migration is not random, and that a selection process occurs whereby migrants are positively selected on health traits, so that those who migrate to the U.S. are in better health than those who do not migrate. The decision to migrate is typically conceptualized as a

balance between the benefits and costs of migration (Stark & Bloom, 1985; Todaro, 1969). Health status can enter into this decision by influencing these perceived costs and benefits. For example, an unhealthy individual may have less success in crossing the heavily militarized Mexico-U.S. border (higher costs). Should he succeed in crossing, he may not be able to secure a job in the U.S. (lower benefits). Although the possible health selectivity of migrants is frequently mentioned, there has been little formal theoretical investigation of this relationship, and the few empirical studies find only partial or weak support for it (Rubalcava et al., 2008). The other side of health-related migration is the salmon bias, which posits that migrants return to their place of origin when their health deteriorates – i.e., that migrants who return to the country of origin are negatively selected for health traits. The salmon bias receives some, though not unequivocal, support in the literature (see, for example, Abraído Lanza et al., 1999).

In this paper our purpose is to gain insight into Mexican migrant health selection so that we can address the possibility that differences in adult health between returned migrants and non-migrants are attributable to differences in pre-migration, early life health. In the absence of such evidence, differences in adult health between returned migrants and non-migrants are likely due to the salmon bias or to health consequences of living in the U.S.

Mexican migrants to the U.S. often live in precarious conditions where they risk exposure to infectious diseases, such as TB (Cantwell et al., 1998). They may also experience high levels of psychosocial stress, resulting from their marginalized (and often undocumented) position in American society, discrimination, and hostile relationships with host communities (Hovey, 2000a). Because males frequently migrate alone, in their quest for companionship they may engage in unsafe sexual behavior, increasing their likelihood of exposure to STIs, including HIV (Muñoz-Laboy et al., 2009).

Yet, despite these health hazards, it is possible that returned migrants have better health than non-migrants. Migrants frequently originate from rural and impoverished communities and migrating to the U.S. may represent movement away from an unhealthy environment. Moreover, insofar as migration is associated with earned wages in the U.S., and higher earning potential following a return to Mexico (Zahniser & Greenwood,

1998), returned migrants may have a higher standard of living relative to those who never migrated. Evidence suggests that the effects of U.S. migration for returned migrants is consistently positive with respect to accumulated personal wealth in the long-term (Wong et al., 2007), which can, in turn, translate into improved health into middle and late adulthood. Finally, if migrants are selected on health traits and are generally more robust than non-migrants, then the adult health of returned migrants may also reflect this advantage.

In the face of arguments for both improved and worse health status among returned migrants, we hypothesize that the experience of migration will have a negative impact on two health conditions, emotional/psychiatric disorders and obesity. Relative to U.S. born Mexicans, Mexican-origin migrants in the U.S. have a lower prevalence of obesity, but obesity prevalence appears to increase with length of residence in the U.S. (Barcenas et al., 2006; Kaplan et al., 2004). This pattern is attributed to environmental factors in American society that promote weight gain, such as the increased consumption of high caloric foods. We hypothesize that returned migrants will be more obese than their non-migrating counterparts because, while living in America, they may have adopted American dietary habits, such as the consumption of sugary beverages and unhealthy snack foods. Subsequently, because they have higher accumulated personal wealth, they can afford the continued consumption of these goods when they return to Mexico.

Acculturative stress may result in poorer mental health among returned migrants vis-à-vis non-migrants. This concept captures the stressful process of adjusting to and integrating a new system of beliefs, routines, and social roles (Rogler et al., 1991; Salgado de Snyder et al., 1990). Acculturative stress is found to significantly affect the physical and mental health of Hispanic immigrants. Hovey and Magaña find that elevated levels of acculturative stress, low self-esteem, and weak social support are related to anxiety among Mexican farm workers (Hovey & Magaña, 2002). In addition to separation from family and lack of social support, Hispanic immigrants are also adversely affected by discrimination (Caplan, 2007). Thus, although Mexican non-migrants face many stressors, including marginalization, poverty, and substandard housing, the additional stress experienced by migrants who reside in an unfamiliar environment, perhaps most acutely for those who are undocumented, may lead to worse mental health among returned migrants.

## **Data**

### Sample

The Mexican Migration Project (MMP) is well-suited to explore issues pertaining to returned migrant health. MMP is a collaborative research project based at Princeton University and the University of Guadalajara. MMP incorporates techniques of ethnographic fieldwork with representative survey sampling to collect cross-sectional data in Mexican communities and migrant-receiving communities in the U.S. (MMP, 2010). It is based on a purposive, representative sample of communities in the main migrant sending regions. Comparisons between MMP and a representative national survey, the National Survey of Population Dynamics, reveal that MMP provides an accurate profile of the characteristics and experiences of Mexican migrants to the U.S. (Massey & Zenteno, 2000).

Community samples consist of 150-200 households selected randomly from a census of each community (INEGI, 2000). Data are collected via interview on social, economic, and demographic characteristics of the head of household and other household members. Information is also gathered on whether the head of household has migration experience to the U.S. Community-level information in MMP is drawn from the Mexican National Statistics and Geography Institute (INEGI) decennial census (INEGI, 2000).

MMP contains information on 138,711 individuals from 128 communities in the U.S. and Mexico collected between 1982 and 2009. Health data began to be collected in 2007, so observations that were gathered before 2007 are excluded, leaving 13,581 observations from 14 Mexican communities. Because we focus on the health data gathered on the head of household, we exclude observations belonging to non-heads of household. The resulting sample consists of 2,471 heads of household between the ages of 19 and 102 who were interviewed between 2007 and 2009. Females are excluded from the analysis because there are few female heads of household with migration experience. Of the 2,207 male heads of household, 86 observations are excluded for missing values on health measures, or household or community characteristics. The final analytic sample comprises 2,121 male heads of household from 14 communities in Mexico.

## Measures

### *Migration*

A variable in MMP counts how many migration trips a head of household made to the U.S. MMP defines a migration trip as a visit to the U.S. that involves work, an active job search, or a reasonably stable residency. Short visits to family or friends and vacations to the U.S. are not considered trips. Migration experience is coded as a binary variable, defined as having made a migration trip to the U.S. after the age of 14 to exclude individuals who were brought to the U.S. by their parents as children. Thus “returned migrants” are those in the sample that have previous migration experience to the U.S. but are in Mexico at the time of survey. Another measure of migration in MMP is the number of months that a respondent resided in the U.S. This variable is used to test the robustness of the findings.

### *Health*

All health measures in MMP, including anthropometric measures, are self-reported. Respondents are asked about current and ever smoking, height, weight, and whether they have suffered from the following diseases and conditions: hypertension, diabetes/elevated blood sugar, heart attack or other heart problems, and emotional/psychiatric disorders. Using the anthropometric data we calculate BMI as weight in kilograms divided by height in meters squared in order to assess the prevalence of obesity in the sample. Obesity is defined as BMI  $\geq 30$ .

Respondents are also asked to rate their health at the time of survey, their health the year prior to survey, and their health at the age of 14. These four-point scales comprise poor, “regular” (fair), good, and excellent. The second category “regular” is a direct translation from the Spanish as it appears in the questionnaire. In Spanish “*regular*” has a slightly negative undertone (Real Academia Española, 2001), unlike in English where it is more neutral, so we use the English “fair” as a more faithful translation of the Spanish word “*regular*.” Because very few respondents rate their health at age 14 as poor (n=4), these respondents are grouped with those who responded fair to this question.

Early life health is operationalized as adult height and self-rated health (SRH) at the age of 14. Adult height is at least partially determined by early life nutritional and health environments (Case & Paxson, 2010), so it approximates a measure of pre-migration health. Adult health status is operationalized as the presence of diseases or health conditions and SRH at the time of survey. Given the similarity of results and conclusions that emerge from using ordered logistic regression to model SRH in four categories compared to logistic regression for a binary outcome (Manor et al., 2000), we create a dichotomous variable to reflect whether a respondent rates his health at the time of survey as excellent or good.

### *Demographic and SES characteristics*

Age and marital status are included in the analyses as demographic controls. Age is analyzed as a linear variable (but including a quadratic term to test for non-linearities) and marital status as a binary variable based on whether the respondent is married or in a consensual union at the time of survey. Because additional early life SES variables are not available in MMP, we follow Crimmins et al. (2005) and use the respondent's education to reflect early life SES. Current SES is measured by household assets (Filmer & Pritchett, 2001). An index of household assets is constructed using factor analysis based on the ownership of 10 items: stove, refrigerator, washing machine, sewing machine, radio, television, phone, internet, computer, and cellular phone (Cronbach's alpha = 0.70). The scale ranges from 0 to 1 with higher values reflecting more asset ownership. Although head of household income is generally available in the MMP dataset, it was not collected during the years examined here. Years of completed schooling is also included in the models as a control for current SES. Community SES characteristics, denoted by the percentage of households in the *municipio* (roughly equivalent to a U.S. county) with dirt floors, the percentage of households in the *municipio* with running water, the percentage of households in the *municipio* with no sewage, and rural/urban status, are also included in the models. Metropolitan and small urban areas are categorized as urban, while towns and villages are classified as rural.

### **Analytic Strategy**



Subsequent to describing the characteristics of the sample, we model the relationship between (1) early life health and migration experience and (2) migration experience and adult health. We employ random intercept logistic regression models to account for the hierarchical nature of the data using the *xtnlogit* command in Stata 11 (StataCorp, 2009). We then re-estimate these models by rural/urban residence to determine whether the relationships of interest differ according to place of residence. This step is necessary because research finds significant variation in the relationship between health and migration between urban and rural dwellers (Rubalcava et al., 2008) and the determinants of migration also differ by area of residence (Fussell & Massey, 2004).

## **Results**

### Descriptive statistics: migration and socioeconomic characteristics of the heads of household in MMP

Table 1 presents the weighted migration, socioeconomic, and community descriptive statistics for the sample by urban/rural residence. Twenty-one percent of the sample has migration experience to the U.S. and migration is more common among rural residents ( $p < 0.001$ ). The mean number of trips among those with migration experience is two (range 1-30) and the mean length of stay in the U.S. is 68 months (range 1-564). During their last migration to the U.S., close to 79% of migrants in the sample were undocumented. On average the first migration occurred at the age of 26 and the mean duration in years since the last migration is 16. Urban residents are of higher SES than their rural counterparts with respect to both educational attainment and asset ownership ( $p < 0.001$  for both). The communities in the sample are very heterogeneous, and they differ by urban/rural status on every dimension examined.

### Descriptive statistics: characterizing the health of heads of household in MMP

The weighted demographic and health characteristics of the sample are presented in Table 2. The mean age of the population is 48 years (range 20-102), and about 40% of the sample resides in urban locales. Over one-third of respondents smoked at some point in their lives, and almost one-quarter currently smokes. The average

height in the sample is 1.66m (SD 0.08) and the average weight is 75.3kg (SD 11.9). Respondents tend to rate their health at age 14 in favorable terms, with 23.6% and 73.9% rating their early life health as excellent and good, respectively. The most prevalent health conditions are obesity and hypertension.

As a first approximation to the questions we will be addressing, we disaggregate the descriptive analyses on health by migration status. Returned migrants are more likely to rate their health as excellent as compared with fair/poor at all three time points relative to non-migrants ( $p < 0.01$  for all, Table 2). However, they appear more likely to report health conditions, specifically hypertension ( $p < 0.05$ ), heart disease ( $p < 0.05$ ), and emotional/psychiatric disorders ( $p < 0.001$ ). Returned migrants are also more likely to be obese and to have diabetes, but these differences are not statistically significant. Figure 1, which shows the distribution of height by urban/rural residence and migration experience, suggests that rural non-migrants are the shortest of the groups.

#### Do returned migrants and non-migrants differ in early life health? A look at migrant health selection

Table 3 reports the estimated odds ratios and test statistics from multilevel logistic regression models predicting migration experience. The results support the descriptive analyses on most dimensions. The two proxies for early life health, adult height and SRH at 14, are predictive of having migration experience (Model 1): every centimeter increase in height is associated with 1.02 times the odds of having migration experience ( $p < 0.01$ ), and reporting excellent relative to fair or poor health at age 14 is associated with 2.12 times the odds of having migration experience ( $p < 0.05$ ). Model 2 builds on the previous model by incorporating demographic and early life SES controls. The relationship between height and migration is unchanged with the inclusion of the control variables, although the odds ratio is now significant at the 0.05 level. Respondents who report excellent health at age 14 still have over two times the odds of migration experience of those who report fair or poor health ( $p < 0.05$ ). When Model 2 is stratified by urban/rural residence (Models 3 and 4, respectively), height is no longer a significant predictor of migration experience. SRH at 14 is associated with having migration experience in rural settings, where individuals who reported excellent health at 14 have 2.36 times the odds of migration as individuals who reported fair or poor health at 14 ( $p < 0.05$ ). Although health at

younger ages also appears to be related to migration experience in urban locales, the odds ratio is not statistically significant.

These models were re-estimated using alternative specifications of the dependent variable: migration as a continuous measure, based on the number of months that respondents spent in the U.S., and as a categorical measure, based on the distribution of the number of trips (results are not shown). The main findings persist irrespective of the specification of the dependent variable: height is positively associated with migration experience, and reporting excellent health at 14 is positively associated with migration experience, relative to those reporting fair or poor health at 14.

#### Differences in adult health status: do returned migrants have better or worse health than non-migrants?

Table 4 presents results from multilevel logistic regression models that predict several measures of adult health. There appears to be no association between having migration experience and reporting good or excellent adult health (first column). The results from the models for diseases and health conditions reveal some interesting patterns. In the presence of controls for demographic, health (including early life health), and SES characteristics, migration experience is positively and significantly associated with the presence of heart disease, emotional/psychiatric disorders, obesity, and ever smoking. Those with migration experience have 2.11 times the odds of heart disease ( $p < 0.01$ ), 2.19 times the odds of emotional/psychiatric disorders ( $p < 0.01$ ), 1.38 times the odds of obesity ( $p < 0.05$ ), and 1.32 times the odds of ever smoking ( $p < 0.05$ ) of non-migrants, *ceteris paribus*.

In light of the important differences between rural and urban areas, the analyses of adult health were stratified by place of residence. These analyses revealed no significant differences in the correlates of adult health between rural and urban residents (results are not shown).

## **Discussion**

Our understanding of the dynamic and complex relationship between health and migration can be enhanced by investigations that take into account the health of migrants in both origin and destination locations.

Returned migrants constitute a unique subset of all migrants. Just as the reasons that motivate a migration are multifaceted, involving individual- and household-level decision making (Massey & Espinosa, 1997), the reasons that motivate a return migration are equally complicated. A combination of “push” (e.g. unemployment) and “pull” (e.g. family ties in the country of origin) factors are thought to influence the decision to return (Gmlech, 1980). To what extent health factors into this equation is unclear as there is little in the literature pertaining to the health of returned migrants. Our study makes a contribution in this regard by evaluating disparities in adult health between returned migrants to Mexico and Mexican non-migrants, accounting for potential differences in early life health.

We demonstrate that two proxies for early life health, adult height and SRH at age 14, are associated with migration. Although by no means conclusive or indicative of causality, these results provide modest support for a process of migrant health selection. These findings are consistent with Crimmins and colleagues who utilize data from the National Health and Nutrition Examination Survey IV (NHANES IV 1999-2002) and the Mexican National Health and Aging Survey (MHAS) to investigate the association between height, education, migration, and health in later life (Crimmins et al., 2005). As in the present analysis, these authors report that Mexican immigrants to the U.S. are positively selected for height. The findings of the present study also concur to some extent with Rubalcava et al.’s analysis of the Mexican Family Life Survey (MxFLS) (Rubalcava et al., 2008). Although these authors do not find a significant relationship between height and subsequent migration experience, their findings indicate that positive health traits are predictive of subsequent migration among rural men. Here we confirm an association between health status and migration among rural dwellers. In rural areas, where health status is generally poorer and greater obstacles to migration may exist, health status may play an especially important role in influencing the decision to migrate.

The findings pertaining to the links between migration and adult health are complex. The results on adult SRH reveal no differences by migration experience, but returned migrants report more health conditions than non-migrants. Specifically, returned migrants are significantly more likely to report heart conditions, emotional and psychiatric disorders, and they are more likely to be obese and to smoke. Conversely, they are not significantly

more likely to report diabetes or hypertension than non-migrants. The discrepancy between the results for SRH and those for health conditions may reflect that, among Latin American populations, including Mexicans, self-reports of general health status appear to encompass a wide range of assessments, including life satisfaction, perception of memory, functional limitations, and socioeconomic status (Wong et al., 2005). Although returned migrants appear to experience at least some health conditions more frequently than non-migrants, they may not evaluate these conditions as seriously as other dimensions of well-being, and they may employ a different reference group than non-migrants when making their assessments.

There are two plausible interpretations of the results for adult health conditions. The first is that the experience of migration may account for the higher frequency of these conditions among returned migrants. A second interpretation is that the migrants return *because* of their health problems, i.e., the salmon bias. Both of these interpretations are explored below. It is important to keep in mind that these interpretations need not be mutually exclusive. Rather, it is likely that both processes contribute to the observed differentials.

The results reveal that returned migrants are more obese than non-migrants. This finding may be due at least in part to differences in wealth. In a recent study Wong and Gonzalez-Gonzalez show that accumulated wealth is higher for male returned migrants than for non-migrants (Wong & Gonzalez-Gonzalez, 2010), confirming earlier work by Wong et al. (2007). Since adult obesity among men appears to be linked to higher wealth in Mexico (Buttenheim et al., 2010), it is possible that returned migrants are more obese than their non-migrant counterparts because of their increased ability to purchase high caloric foods and beverages.

But, higher SES cannot entirely explain the association, since a proxy for household wealth is included in the models. There are likely to be behavioral explanations as well. For example, Creighton and colleagues demonstrate that Mexican children embedded in migrant networks are at a greater risk of becoming overweight or obese relative to children with no migrant ties to the U.S (Creighton et al., 2010). These authors posit that migrant networks are pathways by which health behaviors are transmitted. Other researchers have also pointed to the role of migrant networks in disseminating ideas, norms, and behaviors (Conway & Cohen, 1998; Levitt, 1998). Thus, returned migrants may play an important role in importing and transmitting health behaviors adopted in the U.S.

and perpetuating these behaviors in their households. We speculate that, while residing in the U.S., migrants both adopt unhealthy behaviors, such as consuming processed foods and larger food portions, and discontinue their potentially healthier traditional dietary practices. Indeed, there is some evidence for this. For instance, higher levels of acculturation are linked to higher fat intake, specifically the consumption of butter and margarine, and lower fruit and vegetable consumption among Mexican immigrants (Neuhouser et al., 2004).

As with obesity, the increased prevalence of smoking among returned migrants is likely to be the result of increased purchasing power and behavioral modifications that occurred while living abroad. Although the literature generally supports a positive relationship between household wealth and smoking in Mexico (Stevens et al., 2008; Arillo-Santillan et al., 2005; Buttenheim et al., 2010), investigations on the relationship between acculturation and smoking frequently arrive at contradictory conclusions (see for example Lara et al., 2005; Caraballo & Lee, 2004). One relatively consistent finding among Mexican populations is the link between mental health pathologies and smoking (Rodríguez Esquivel et al., 2004), including depression (Benjet et al., 2004) and anxiety disorders (Zvolensky et al., 2007). In this analysis, returned migrants are more likely to both smoke and report emotional/psychiatric problems.

Situating the present study in the literature on mental health among Mexican migrants is difficult for two reasons. First, previous research on migrant mental health considers a wide range of conditions, and presumably, the “emotional/psychiatric” category in MMP includes many types of mental health pathologies. Second, most of the literature in this area compares the mental health of Mexicans born in the U.S. to that of Mexican immigrants in the U.S., with few studies focusing on Mexicans residing in Mexico. One study that uses a bi-national sample finds that, compared with the Mexican general population, English-speaking Mexican immigrants in the United States are at increased risk for first onset of an anxiety or mood disorder (Breslau et al., 2007). While the finding that migrants are more likely to have mental health disorders is replicated here, one important difference is that the Breslau finding applies to English-speaking Mexican immigrants, who likely spent many years in the U.S. Nonetheless, together these findings suggest that stressors associated with life in the U.S. may increase the risk for psychopathology among Mexican migrants.

Factors such as separation from family, pessimistic expectations for the future, and low income appear to be significantly related to elevated levels of stress for Mexican immigrants residing in the U.S. (Hovey, 2000a). There is also considerable evidence that stress is associated with increases in depressive mood symptoms (for a review see Thoits, 1983) and that adult Mexican immigrants who experience elevated levels of stress may be at risk for experiencing depression and suicidal ideation (Hovey, 2000b). Discrimination is another factor that may predispose Mexican migrants in the U.S. to emotional and psychiatric disorders (Finch et al., 2000).

The findings on emotional/psychiatric disorders among returned Mexican migrants are not entirely surprising given the increasingly hostile political climate toward Mexican immigrants in the U.S. The rise in anti-immigrant sentiment over the course of the preceding decades has been accompanied by a proliferation of anti-immigrant legislation, an increase in hate crimes against Hispanics, and an increase in the number of border patrol agents (Massey, 2010). Although more research is needed in this area, it seems reasonable to posit that exposure to such a hostile political environment has brought about an increase in the prevalence of emotional/psychiatric disorders, smoking, and heart disease among returned migrants.

An alternative explanation for the excess of health conditions is that migrants may return to Mexico because their physical or mental health deteriorates, the so-called salmon bias. For example, immigrants who develop heart conditions in the US may seek treatment in Mexico in light of their limited access to health care services in the U.S. (Nigenda et al., 2009), and those who are especially susceptible to the stresses of American life may return for the emotional support of family members in Mexico. Turra and Elo conclude that, while there may be evidence of a salmon bias in mortality, the magnitude of this effect is not large enough to account for the mortality advantage among foreign born Hispanics in the U.S. (Turra & Elo, 2008). Palloni and Arias use data from the Mexican Health and Aging Study (MHAS) and various National Health Interview Survey-Multiple Cause of Death (NHIS-MCD) samples to compare SRH status among older individuals in Mexico and a similarly aged group of Mexican migrants residing in the U.S. (Palloni & Arias, 2004). They report that those in the MHAS sample have worse health status than those the NHIS-MCD samples. However the MHAS sample is comprised of

non-migrants and returned migrants, and it appears that the subsample of returned migrants have marginally better health than the non-migrants in the sample, a pattern that is inconsistent with our findings.

Although this study expands our knowledge of a poorly understood piece of the health-migration relationship, the health of returned migrants in their country of origin, it suffers from several limitations. First, our findings are generalizable to only the populations of selected migrant-sending communities in Mexico. Another limitation is that we rely on self-reported measures of health. We cannot exclude the possibility that reporting of diseases and health conditions is higher among those who receive regular medical care. If returned migrants are more likely than non-migrants to have the means to visit a doctor, then they might be more cognizant of their health conditions rather than suffer from these conditions more than non-migrants. Likewise, there may be differences in the ways in which returned migrants and non-migrants perceive their health. Self-reported height and weight appear to be less subject to these variations and are relatively accurate reflections of actual height and weight in Mexican adult populations (Osuna-Ramirez et al., 2006).

A final limitation concerns the selectivity of the study population – returned migrants. Research has demonstrated that returned migrants differ in social and economic characteristics from Mexican migrants who settle permanently in the U.S. (Reyes, 1997; Riosmena, 2004). Here we document disparities in adult health between returned migrants and Mexican non-migrants, but we cannot distinguish whether the results are attributable to the health impacts of migrating to and living in the U.S. or to selective return migration. As MMP begins to collect health data on Mexican immigrants residing in the U.S., this and other avenues of inquiry will become possible.

This study highlights differences in adult health between returned migrants and Mexican non-migrants, pointing to the unique health needs of the returned migrant population. We underscore the need for further research to refine the nature of these differences and the need to develop binational approaches to preserve and protect the health of migrant populations. Public health programs in Mexico such as “Vete sano, regresa sano” (“Go healthy, return healthy”), aimed at improving the health of migrant populations at all stages of the migration



process, are an encouraging start (Vete Sano, Regresa Sano, 2007), but the full potential of such programs cannot be realized until similar programs are in place in migrant receiving communities in the U.S.

**Table 1. Weighted descriptive statistics: Migration, socioeconomic, and community characteristics by urban/rural residence**

	Sample	Urban	Rural	p-Value
<b>Migration characteristics [N=2,121]</b>				
Percent with migration experience	21.4%	18.4%	24.8%	<0.001
<i>Among those with migration experience</i>				
Mean number of trips to the U.S.	2.05	2.13	1.98	–
Mean length of time spent in the U.S. (months)	67.8	67.2	68.4	–
Mean age at first migration	25.9	25.2	26.5	–
Mean duration since last migration (years)	16.04	16.63	15.53	–
Percent undocumented during last migration	78.7%	76.7%	80.5%	–
<b>Socioeconomic characteristics</b>				
Mean years of education	7.4	8.3	6.4	<0.001
Mean asset ownership index score (range 0-1)	0.63	0.68	0.56	<0.001
<b>Community characteristics [N=14]</b>				
Population	133,477	240,492	10,002	<0.001
Percent earning < minimum wage	42.8%	31.2%	56.3%	<0.001
Percent illiterate	13.6%	12.5%	14.9%	<0.001
Migration prevalence among males	15.3%	13.4%	17.4%	<0.001
Percent HH in municipio with dirt floors	8.7%	7.7%	9.6%	<0.001
Percent HH in municipio with running water	86.7%	93.8%	78.5%	<0.001
Percent HH in municipio with no sewage	18.8%	9.4%	29.8%	<0.001

Source: Mexican Migration Project (MMP128) and INEGI 2000.

**Table 2. Weighted descriptive statistics: Demographic and health characteristics by migration experience [N=2,121]**

	Sample	With migration experience	Without migration experience	p-Value
<b>Demographic characteristics</b>				
Age	48.4	46.4	48.9	<0.01
Urban	40.5%	30.7%	43.4%	<0.001
Married	96.8%	95.9%	97.1%	–
<b>Anthropometric characteristics</b>				
Height (m)	1.66	1.67	1.65	<0.05
Weight (kg)	75.3	77.1	74.8	<0.001
<b>Health behaviors</b>				
Ever smoking	34.5%	41.2%	32.7%	<0.01
Current smoking	23.6%	28.5%	22.2%	<0.05
<b>Self-rated health status</b>				
<i>Health at age 14</i>				
Excellent	23.6%	37.6%	19.7	<0.001
Good	73.9%	60.1%	77.6%	<0.001
Fair/Poor	2.5%	2.2%	2.6%	–
<i>Health year prior to survey</i>				
Excellent	6.4%	10.4%	5.4%	<0.01
Good	67.1%	65.0%	67.8%	–
Fair	23.8%	20.2%	24.9%	<0.05
Poor	2.5%	4.4%	1.9%	<0.05
<i>Health at the time of survey</i>				
Excellent	5.9%	9.6%	4.8%	<0.01
Good	60.2%	56.4%	61.2%	–
Fair	30.1%	28.8%	30.4%	–
Poor	3.8%	5.1%	3.5%	–
<b>Health conditions and diseases</b>				
Obesity	19.8%	22.8%	19.0%	–
Hypertension	14.0%	17.3%	13.1%	<0.05
Diabetes/high blood sugar	10.4%	12.0%	9.9%	–
Emotional or psychiatric disorders	7.4%	13.1%	5.9%	<0.001
Heart attack or heart problems	4.3%	6.9%	3.6%	<0.05

Source: Mexican Migration Project (MMP128).

**Table 3. Odds ratios from random intercept logistic regression models predicting migration experience**

	<b>Model 1</b>	<b>Model 2</b>	<b>Model 3 Urban</b>	<b>Model 4 Rural</b>
Height (cm)	1.02** [1.01-1.03]	1.02* [1.01-1.03]	1.01 [0.99-1.04]	1.02 [0.99-1.03]
Health at 14 (Ref = Fair/Poor)				
Good	1.02 [0.52-1.97]	1.05 [0.54-2.04]	1.46 [0.17-12.8]	1.00 [0.49-2.04]
Excellent	2.12* [1.08-4.15]	2.27* [1.15-4.47]	2.89 [0.32-25.4]	2.36* [1.13-4.90]
Age		0.98** [0.97-0.99]	0.99 [0.98-1.01]	0.97** [0.96-0.98]
Education (years)		0.98 [0.95-1.01]	0.96 [0.92-1.01]	0.98 [0.94-1.02]
Urban		0.46 [0.21-1.01]		
N	2,121	2,121	858	1,263

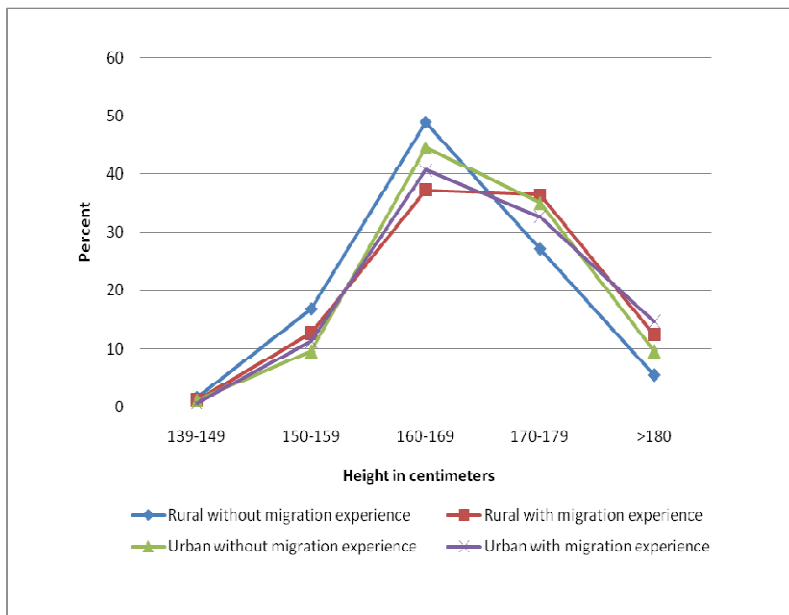
Source: Mexican Migration Project (MMP128). 95% Confidence Intervals are reported in brackets. The individual odds ratio is statistically significant at the \*\*1% significance level and at the \*5% significance level.

**Table 4. Odds ratios from random intercept logistic regression models predicting adult health**

<b>Dependent variable →</b>	<b>G/E SRH</b>	<b>HTN</b>	<b>Diabetes/ elevated blood sugar</b>	<b>Heart attack/ heart problems</b>	<b>Emotional/ psychiatric disorders</b>	<b>Obesity</b>	<b>Ever smoking</b>
Migration experience	0.84 [0.65-1.08]	1.34 [0.97-1.85]	1.30 [0.91-1.87]	2.11** [1.27-3.51]	2.19** [1.51-3.17]	1.38* [1.06-1.79]	1.32* [1.05-1.65]
Age	0.89** [0.85-0.93]	1.17** [1.09-1.26]	1.38** [1.24-1.52]	1.18* [1.04-1.33]	1.11** [1.03-1.19]	1.11** [1.05-1.16]	0.98 [0.94-1.01]
Age squared	1.00* [1.00-1.01]	0.99** [0.99-0.99]	0.99** [0.99-0.99]	0.99 [0.99-1.00]	0.99* [0.99-0.99]	0.99** [0.99-0.99]	1.00 [0.99-1.00]
Urban	0.94 [0.55-1.62]	1.01 [0.63-1.61]	1.32 [0.83-2.08]	1.82 [0.91-3.61]	1.50 [0.95-2.37]	1.35* [1.00-1.80]	1.05 [0.68-1.59]
Married	0.70 [0.41-1.19]	1.37 [0.71-2.67]	1.10 [0.54-2.27]	1.20 [0.46-3.11]	0.44* [0.22-0.87]	1.05 [0.54-1.99]	0.49** [0.30-0.82]
Education (years)	1.03* [1.00-1.06]	1.03 [0.99-1.06]	0.98 [0.94-1.02]	0.99 [0.93-1.05]	0.98 [0.93-1.03]	1.01 [0.98-1.05]	0.99 [0.96-1.02]
Household assets (Ref=Low)							
Assets: Medium	1.03 [0.79-1.32]	1.11 [0.80-1.53]	1.56* [1.10-2.22]	1.51 [0.88-2.56]	1.03 [0.68-1.55]	1.15 [0.87-1.51]	0.93 [0.73-1.18]
Assets: High	1.44* [1.08-1.92]	0.66* [0.44-0.97]	0.98 [0.63-1.52]	1.01 [0.51-1.98]	0.74 [0.45-1.24]	1.06 [0.77-1.44]	0.82 [0.63-1.07]
Currently smokes	0.82 [0.64-1.04]	1.36 [0.99-1.85]	1.24 [0.87-1.75]	1.03 [0.59-1.80]	1.14 [0.77-1.68]	1.22 [0.95-1.58]	
Health at 14 (Ref =Fair/Poor)							
Good	6.03** [3.21-11.3]	0.45* [0.22-0.94]	1.00 [0.38-2.65]	1.69 [0.21-13.4]	0.37* [0.16-0.87]	0.56 [0.31-1.02]	
Excellent	6.99** [3.64-13.4]	0.62 [0.29-1.32]	1.25 [0.46-3.39]	3.10 [0.39-24.6]	0.77 [0.32-1.82]	0.50* [0.26-0.94]	
Height (cm)	1.02* [1.00-1.03]	0.98 [0.96-1.01]	0.98 [0.96-1.01]	1.00 [0.96-1.03]	1.03* [1.00-1.05]		
Weight (kgs)	0.98** [0.97-0.99]	1.04** [1.02-1.05]	1.02** [1.01-1.03]	1.02* [1.01-1.04]	0.98* [0.96-0.99]		
Dirt floors	1.00 [0.98-1.03]	1.00 [0.98-1.03]	1.00 [0.98-1.02]	1.02 [0.98-1.05]	1.02 [0.99-1.04]	1.01 [0.99-1.02]	0.99 [0.97-1.02]
Running water	1.00 [0.99-1.02]	1.00 [0.99-1.01]	0.99 [0.98-1.00]	0.99 [0.97-1.01]	1.00 [0.98-1.01]	1.00 [0.99-1.01]	0.99 [0.98-1.01]
No sewer	1.01 [0.99-1.01]	0.99 [0.98-1.00]	1.01 [0.99-1.02]	0.99 [0.97-1.01]	1.01* [1.00-1.02]	1.00 [0.99-1.01]	0.98 [0.97-0.99]
F-statistic for joint significance of community variables	3.74	2.41	5.16	3.00	9.04*	3.63	8.59*

Source: Mexican Migration Project (MMP128). 95% Confidence Intervals are reported in brackets. The individual odds ratio is statistically significant at the \*\*1% significance level and at the \*5% significance level.

**Figure 1. Distribution of height by urban/rural residence and migration experience**



Source: Mexican Migration Project (MMP128).

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